GIS Strategic Plan and Staffing

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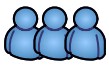
Guide to this Document

This GIS Needs Assessment and Five-Year Implementation Plan is an exhaustive look at everything that needs to be considered for further implementing geographic technologies in the City of Champaign. It is understood that most people do not have the time to read the entirety of this document. Therefore, this guide has been created as a quick reference for the various people that will need to read this document. Find the category or categories into which you fit and turn directly to those sections to get optimal impact from the document.

Guide to the Icons in the Document
Interspersed throughout this document are icons used to designate specific information and draw attention to key topics or points.

	Included in the needs assessments to designate a section about Personnel and Duties.
	Included in the needs assessments to designate a section about Hardware and Software.
	Included in the needs assessments to designate a section about GIS Needs and Duties.
	Designates a recommendation or key concept specific to a GIS need
	Included in the needs assessments to designate a Case Study
	Designates GIS Data Layers or data that can be converted to GIS Data
	Designates a section about GIS Applications to meet specific GIS goals
	Designates a specific GIS Application to meet specific GIS goals
	Identifies or designates Multi-tier GIS Users

Management (Elected Officials, City Manager)

Step 1 – Read the executive summary beginning on page i

Step 2 – Read Chapter 2 beginning on page 2-1 for a detailed look at the needs of each department
Step 3 – Read Chapter 5 for information on priorities and costs
Step 4 – Review the Table of Contents and read sections of interest

Department Heads

Step 1 – Read the executive summary beginning on page i

Step 2 – Read your department's section of Chapter 2 - Refer to the Table of Contents to find the page number for your department
Step 3 – Read Chapter 5
Step 4 – Read Chapter 4 detailing the recommended organizational structure
Step 5 – Review the Table of Contents and read sections of interest

Departmental Staff

Step 1 – Read the executive summary beginning on page i

Step 2 – Read your department's section of Chapter 2 – Refer to the Table of Contents to find the page number for your department
Step 3 – Review the Table of Contents and read sections of interest

Technical Staff (Future GIS Coordinator and IT Director)

Step 1 – Read the executive summary beginning on page i

Step 2 – Read the entire document and highlight areas that require action
Step 3 – Refer to the document throughout the life of the project and update annually

Executive Summary

Introduction

Geographic Technologies Group, Inc. (GTG) was retained by the City of Champaign to perform a City-wide Geographic Information System (GIS) Strategic and Staffing Plan. A summary of the key recommendations and conclusions made by GTG for the City of Champaign is provided. GTG is recommending a five-year phased implementation of GIS. A "Five-Year Phased GIS Implementation Plan" was developed through information gathering, questionnaires and interviews conducted with the departments of the City of Champaign. After extensive on-site interviews, meetings, and telephone conversations, the following results were determined:

Conclusions:

- The City of Champaign has been utilizing GIS in a moderate capacity for several years in various departments; it now needs to move to a more integrated, scalable, enterprise-wide implementation

- Some of the critical elements needed for a successful GIS are:
    - Enabling existing databases (TRAKiT, OneRoof, Firehouse, Crime data) using an easy-to-use GIS front-end
    - Creation of new GIS data layers and updates to existing GIS data layers
    - Conversion of existing GIS data to a standard citywide format
    - Consolidation, centralization, and management of GIS data layers for use by all departments
    - Creation of user-friendly tools to access GIS efficiently and effectively
    - Coordination of GIS efforts across the enterprise to improve effectiveness, reduce duplicate efforts, and realize optimal return on investment
    - Make GIS accessible to all City employees and the public

- Current GIS efforts are diverse, not unified, and include: creation of map products, spatial analyses, database queries, records management, and ad hoc information retrieval.

- The City of Champaign has invested in software and associated databases (ArcGIS, TRAKiT, GEMS, Firehouse, OneRoof, Police Records Management, etc.). Utilizing GIS as a window into these databases will improve City of Champaign operations and allow a much more significant return on investments from these existing products.

- A survey of all networking, hardware and software resources throughout the City of Champaign indicates that computer resources and network infrastructure are good. Some personal computers may need to be upgraded to accommodate high-end GIS applications and additional software installations and updates will be required.

Summary of Recommendations:
The following is a list of key implementation issues and recommendations:

- This document should be relied on to direct the implementation of the technology over a five year period. However, this document should be looked upon as a living document that will evolve to incorporate the invariable changes that occur in local government. Additionally, new and emerging technologies will need to be considered as the phases of implementation progress. It is therefore imperative to regularly update the master implementation plan. It is recommended that the City of Champaign update the plan on an annual basis.

- The technology will give council members access to GIS data that will allow for:
    - Viewing the potential impact of annexation, re-zoning, and other property issues
    - Viewing residences within council districts
    - Conducting on-the-fly analysis such as; cell tower ordinance distance requirements and location of dog grooming facilities
    - Use GIS to view predictive modelling such as infill analysis, population trends, and neighborhood wellness.
    - Use GIS to improve economic development efforts

- The City of Champaign should utilize a hybrid GIS organizational structure. A recommended GIS Coordinator in the Information Technologies Department will serve as the primary GIS resource for the City. The GIS Coordinator will coordinate many of the City's GIS implementation efforts, with support and assistance from the Information Technologies Director and other department/division heads. Key GIS staff for data creation, collection, and analysis are distributed throughout certain City of Champaign departments; though these staff members are not directly responsible for the City's GIS, they play a key role in the City's implementation of GIS and its complementary technologies. For the present and near future, the GIS Coordinator should assist departments until demand outpaces his or her ability to adequately meet their needs.

- It is recommended that the City of Champaign continue to utilize Environmental Systems Research Institute (ESRI) products for its GIS.

- Train key staff in each department to serve as their department's GIS liaison.

- Hire GIS Technicians in Public Works to create and maintain the various infrastructure data layers.

- Schedule and adhere to monthly (or quarterly) technical meetings of the GIS Users Group and Executive Management Team (EMT).

- Based on the implementation plan, develop rules/protocols to decide administrative issues such as:
  - Data development priorities
  - Application development priorities
  - Data standards and documentation
  - Maintenance responsibilities
  - Public data access
  - Cost recovery or data sales

- Maintain a dynamically updated repository for all GIS data that is accessible to all users with appropriate security.

- Work in conjunction with the GIS Consortium and METCAD to continue data development and data sharing efforts.

- Create, consolidate, and convert needed data layers; this process is critical and should be a focus in the first year of this initiative (address points, utility features, etc.).

- Implement data maintenance applications within appropriate departments.

- Acquire and utilize an easy-to-use data browser that will enable all necessary staff to utilize GIS to answer daily questions.

- Implement mobile GIS technologies that will provide field staff with access to both static and dynamic data layers.

- Conduct annual reviews of GIS activities and user satisfaction survey (modify implementation based on review and survey results).

- Develop training and educational mechanisms to involve all levels of employees.

- Develop educational programs for citizens of the community. These can be used to demonstrate the utility of the GIS.

- Distribute a City of Champaign GIS newsletter (hardcopy and/or Intranet) as a means of sharing successes and educating the organization about the uses of GIS.

- Share data with the public through Internet based GIS applications.

A successful GIS is measured not by the amount of money spent, the volume of data, or the GIS software utilized, but by the applications made available and the usage of these applications by staff and the public. Key applications have been identified and prioritized and are as follows:

- Intranet Data Browser – ArcServer-based; most commonly used GIS functionality made available to entire organization

- ArcGIS 9 for advanced spatial analysis, data editing, and data maintenance

- Police and Fire Incident Analysis – Allows mapping of all incidents for crime analysis, arson investigations, balancing districts, and optimal facility location

- Internet GIS – Public access of GIS data via the Internet

- Work Order Processing – GIS based work orders. Maps assist field crews and insure needed information is returned from the field

- Touch Screen Public Access – Extremely easy to use touch screen GIS application for use by the public

- Automated Neighborhood Wellness Plan – Digital version of the Neighborhood Wellness Plan with embedded live mapping

- Mobile Data Browsers for use in Neighborhood Service, Public Works, and Police Department. The Fire Department is implementing a solution now.

- Emergency Notification – Emergency and public service applications that will place calls to phone numbers based on a spatial query

- Automated mapping application for creation of vicinity maps, exhibit maps, and other publicly distributed maps

- Planning Support System – Allows for "What If?" planning modeling and analysis

- Crime Analysis – a two tiered solution for distributing crime mapping to all officers with a high-level crime analysis tool for a core crime analyst

Summary of Implementation Costs

The following cost estimate includes costs associated with a five-year phased implementation, based on baseline budgetary projections. This five-year phased implementation plan, if implemented, will provide the City of Champaign with a thorough and sophisticated enterprise-wide GIS, on par with enterprise-wide GIS implementations in mid-sized cities in the United States. These costs can be viewed in the detailed cost schedules in *Chapter 5: Recommended GIS Initiatives and Five Year Strategic Plan*.

The Five-Year GIS implementation costs are as follows:

Year One – Initial Enterprise-Wide Deployment, Data Creation, Software Implementation, and Initial Database Development

Year One will be focused on development and acquisition of several enterprise-wide GIS applications as well as data development efforts. The City will also begin to develop the

foundation for a geodatabase by conducting a logical and physical database design, which will be used for an enterprise geodatabase. The primary goal for the Year One is to gain several "quick successes" in terms of application implementation, data development and integration, data maintenance procedures, and training. Year One will be pivotal in terms of providing GIS access across the enterprise through an Intranet GIS data browser. Tasks and procedures for Year One are summarized below.

At the end of Year One the City of Champaign will have accomplished the following goals:

- Upgraded hardware and software to support City-wide GIS usage
- Implemented an Intranet GIS data browser for data access throughout the City
- Upgraded to a standardized GIS platform across City departments, based primarily on ESRI software tools
- Completed monthly/quartely meetings to continue prioritization of GIS data design and development objectives
- Implemented data automation tools that geographically enable existing IT investments (TRAKiT, OneRoof, Firehouse, Tiburon, and Police Records)
- Completed a logical and physical database design
- Created new GIS layers to serve a variety of City of Champaign departments
- Implemented an address maintenance application that will insure optimal use of investments in current appliations such as TRAKiT
- Provided training to key staff throughout the City
- Hired key staff to maintain the GIS
- Enabled GIS for the enterprise across all departments

Year One Resources: $200,000

Year Two – Enterprise Integration Phase

Year Two will be focused on continuing development/acquisition of GIS applications, database development and integration of recently developed (and acquired) geo-spatial data. By Year Two, most, if not all, relevant City personnel will have access to base map data through an easy-to-use application. Year Two will also include ongoing software and hardware installation and configuration, as well as training and education for both technical and non-technical staff.

At the end of Year Two the City of Champaign will have accomplished the following goals:

- Continued the creation/update of additional departmental GIS layers
- Implement a GIS based automated Neighborhood Wellness Plan
- Implemented a GIS-based emergency notification system
- Further implemented data automation tools that geographically enable existing IT investments (T-2 Parking System, GEMS, and Questica)
- Implement targeted GIS Internet portals for the public to include a Neighborhood Services and Planning portal
- Expand the implemention of the Intranet GIS data browser for data access throughout the City to include the Finance, Human Resources, and Legal Departments

- Implemented Public Works field tools and work order synchronization (separate recommendation)
- Provided additional training to key staff throughout the City

Year Two Resources: $232,780

Year Three – Mobile Deployment and Public Access

The third year of the project will revolve around data sharing and expansion of the advanced GIS services. Year Three will continue the expansion of GIS applications and access to geodatabases both internally and externally. Additionally, mobile access to GIS will be established.

In addition to the Intranet, Internet users (e.g. Citizens) will have access to more accurate and timely data. Additional Internet GIS portals will be developed so that Citizens can take advantage of the City's investment in GIS. At this point in the project, departments should be utilizing the GIS for analysis. It should become another resource that employees rely on, much like a word processor or spreadsheet program.

This phase focuses on the implementation of advanced applications that facilitate data acquisition, sharing, and updating between the City and external entities. By the completion of this implementation phase the enterprise GIS should be considered a comprehensive source for spatial data and information for the City of Champaign.

At the end of Year Three, the City of Champaign will have accomplished the following goals:

- Centralized all data into an enterprise-wide data store
- Enabled GIS for use by all City departments
- Enhanced its Internet GIS portal presence with more complex functionality including Public Safety and Public Works web portals
- Implemented automated vehicle location(AVL) tools within Public Works
- Implmented mobile data browsers for Police, Public Works, and Neighborhood Services
- Implemented a crime analysis tool for sophisticated crime analysis
- Implemeted touch screen GIS solutions for walk in traffic in the City's atrium and in Planning
- Established a solid foundation for additional development and refinement of the City of Champaign GIS

Year Three Resources: $219,300

Year Four and Year Five – Maintenance Phase

The fourth and fifth year of the project will revolve around maintenance of existing systems and some additional data development. The system will now be mature and should be focused on maintaining existing data sets and software tools.

At the end of Year Three, the City of Champaign will have accomplished the following goals:

- Implementation of a planning support system that allows planners to do "what if" scenarios
- Implementation of an economic development web portal
- Continued creation of key data sets
- Established maintenance producures and protocols

Year Four Resources: $145,500
Year Five Resources: $113,500

Public Works Data Collection and Maintenance Initiative

Public Works will be one of the biggest users of GIS. The above five year plan includes the editing and viewing GIS-software for Public Works. However, Public Works data creation and maintenance tasks are much larger than the rest of the organization as a whole. They need to map and verify the City's infrastructure. Therefore, the costs for the infrastructure collection and maintenance have been documented separately. The City will need to decide whether to outsource the data collection or hire GIS Technicians to collect this data. Additionally, a robust work order management and asset tracking application should be acquired. Additional information on this can be found on the final page of Chapter Five.

Chapter One - Introduction

Overview

The City of Champaign retained Geographic Technologies Group to develop a Five-Year GIS Strategic Plan. The goal of this initiative was to expand and formalize the City's GIS services. The Five-Year GIS Strategic Plan assesses, evaluates, and makes recommendations for many strategic, tactical, technical, and logistical issues facing the City of Champaign. The Five-Year GIS Strategic Plan addresses the following key issues:

A. STRATEGIC ISSUES

What is the goal for GIS technology?
What are the short-term and long-term objectives?
How do we define the City's goals and objectives?
How will GIS enhance City functions?
What are the priorities for services and functions?
What pitfalls might the City encounter?
How can the City best use the GIS Consortium and any other intergovernmental agreements? What obligations does the Consortium have to the City of Champaign?

B. TACTICAL ISSUES

How will the City of Champaign manage GIS?
What type of governance should be used?
What type of GIS users should exist in the City?
What general policies and procedures are needed?

C. TECHNICAL ISSUES

What type of GIS architecture is required?
What type of data and databases exist? Which are recommended?
What skills might a potential staff member need?
What options are there for maintaining and managing the GIS?

D. LOGISTICAL ISSUES

Who should perform certain GIS functions?
Who manages all the components of a GIS?
What staff support and contractual services are needed?
Is it possible for existing staff to perform some of the work?
What are the costs of the recommended plan?
Could City resources better support GIS?

History

The City of Champaign is a vibrant midwestern city that has seen increased growth from business and industry. The City continues to grow, and some additional resources will be needed to continue to serve the citizens and to build and maintain Champaign's

infrastructure. The City began using GIS in 2001 with the help of the Champaign County GIS Consortium, established to help its members capitalize on the benefits of the emerging technology. Consortium members include the cities of Champaign and Urbana, the University of Illinois, the villages of Mahomet, Rantoul and Savoy, and Champaign County. The Consortium was established to:

1. Lead development efforts for the acquisition of data;
2. Act as a data repository/custodian;
3. Establish standards for content, quality, and structure of repository data;
4. Host data on servers accessible to all members;
5. Provide all members access to data;
6. Establish and maintain metadata for data held in the repository;
7. Provide computer system administration and ongoing system support, upgrades, and maintenance for Consortium-controlled assets;
8. Provide services to members in accord with a work plan approved by the Policy Committee;
9. Promote use of the GIS countywide by distributing data and using GIS;
10. Establish operational, administrative, and procedural policies for GIS system operations, data standards, and data distribution.

The City of Champaign and its departments are starting to rely heavily on GIS technology. It is estimated that the Planning Department prepares 100-150 maps and graphics annually for its own use, and another 10-20 annually for other departments. The IT Department coordinates GIS functions with City departments and continues to assist in the development of a shared countywide GIS. Because GIS is fast becoming an integral part of the City of Champaign, it is important to understand the key issues that will make the City successful. The "governance" of GIS is one of the most pressing issues facing the City today. The GIS Strategic Plan should consider all pitfalls that can be avoided by implementing an effective GIS strategy.

The following table is a simplified illustration of the GIS roles and responsibilities of the Consortium and of the City of Champaign. This table highlights what the City must govern, verses what the City should expect from the Consortium.

Summary of GIS Responsibilities Consortium vs. City	
Champaign County GIS Consortium Responsibilities	**City of Champaign GIS Responsibilities**

• Regional Data Acquisition
• Regional Data Custodian
• Establish Standards for Data Contents
• Host Data
• Make Data Accessible
• Meta-data for Regional Data
• System Support & Administration
• Provide GIS Services to the City of Champaign
• Promote Use of GIS
• Provide Management for GIS Operations
	• City-Wide Vision and Departmental Goals & Objectives
	• Coordination of City GIS Activities:
	  • Infrastructure
	  • Hardware
	  • Software
	  • People
	• Implementing Enterprise Solutions (5 Year Strategic Plan)
	• Departmental GIS Support
	• Departmental Data Creation and Maintenance
	• Customer Relations
	• Documenting the Benefits and Costs of GIS and Quantify the ROI

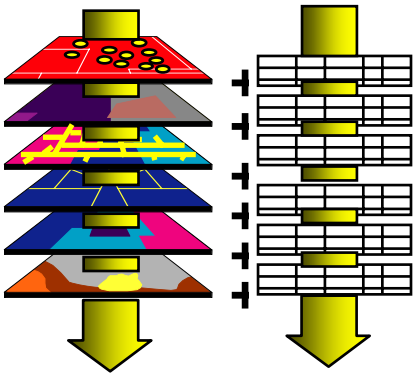
What Is GIS?

The use of geographic information tools has received rapid, overwhelming acceptance by local, state, and federal government organizations and in the private sector. This technology enables organizations to find more effective ways of doing business. Towns, cities, and counties are embracing GIS and the Global Positioning System (GPS) as mechanisms to improve efficiency, reduce costs, and increase productivity.

GIS has emerged as a powerful and sophisticated means to manage vast amounts of geographic data. This growth of GIS over the past 30 years can clearly be linked to technological advancements in the computer, digitizers and plotters, coupled with an increasing demand for geographic information. GIS provides the capability to collect, manage, manipulate, analyze, and distribute data in map-based layers which provide a better visual image of location, patterns and relationships.

Because of the very nature of GIS, and the rapid growth of associated disciplines, many definitions of this technology exist. The following is a useful definition because it addresses functionality as well as components:

> "GIS is an organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information." –ESRI



Others have attempted to use the name itself to better understand the functions and components of GIS. GIS can be viewed in this way:

Geographic: The system is concerned with data relating to geography and geographic scales of measurement. This is referenced by some coordinate system to locations on the surface of the earth.

Information: The system allows for the storage and extraction of specific and meaningful attribute information. These data are connected to some geography, and are organized around a model of the real world. Spatial and aspatial queries are made possible.

System: An automated system should include an integrated set of procedures for the input, storage, manipulation, and output of geographic information.

GIS relies on the integration of three areas of computer technology: 1) relational database management systems to store graphic and non-graphic data; 2) cartographic capabilities to depict, graph, and plot geographic information; and 3) spatial analytical capabilities to facilitate manipulation and spatial analysis. Three distinct areas are:

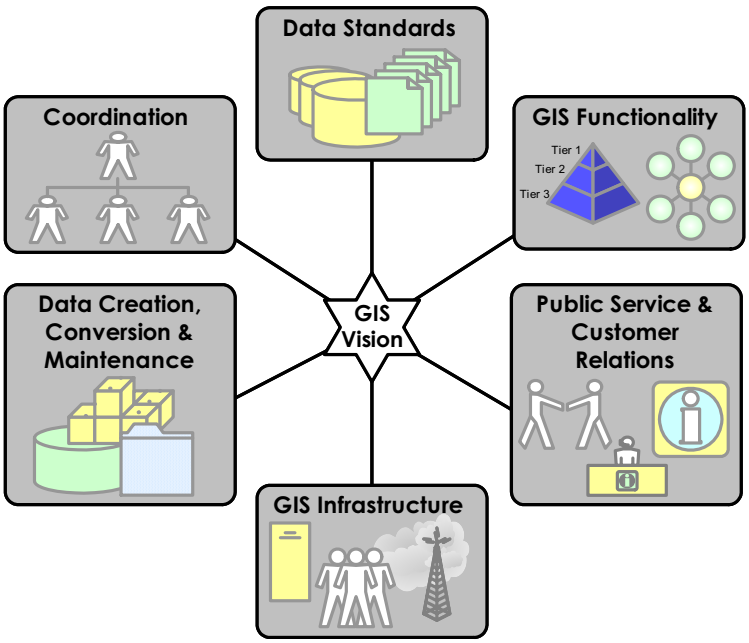
1. Graphic capabilities
2. Relational database
3. Spatial analysis

With GIS, one can:

- Map where things are
- Identify what exists at a certain location
- Determine if certain conditions are satisfied
- Map changes over time
- Discern spatial patterns and relationships
- Conduct 'what if?' scenarios and model future conditions

Components of GIS

The GIS vision for the City is to provide a high quality system to empower users to manage and quickly obtain geographic data on demand. It is important to realize the enterprise GIS project is not just a deployment of technology. It involves an interdependent set of components that through careful orchestration will lead to a successful enterprise system. These components include the following:



Each of these components contains specific elements themselves and only through a coordinated effort will the vision be achieved. These components include:

Coordination

1. Enterprise-wide GIS management
2. Leadership & management support
3. Identification, development, and maintenance of knowledge skills for spatial data handling
4. Public service needs analysis and assessment
5. Strategic and tactical support for projects and programs

Data Standards/Procedures

1. Accurate, reliable, and consistent geospatial data standards
2. Implementation of enterprise-wide metadata standards, procedures, and protocols
3. Documentation, archiving, and indexing of geospatial data

GIS Functionality

1. Effective use of GIS
2. Defined tiers of GIS functionality

a. Tier 1 GIS Administration
b. Tier 2 GIS Analyst/Data maintenance
c. Tier 3 GIS Viewers, browsers

3. Inter-governmental access & public access

Public Service and Customer Relations

1. Improve efficiency and productivity and enhance public service related to information containing geospatial data
2. Expand and improve public access to GIS

GIS Infrastructure

1. Technology: hardware/software/infrastructure
2. People: Skilled personnel, knowledge base
3. Data: geospatial information

Data Creation, Conversion, Maintenance

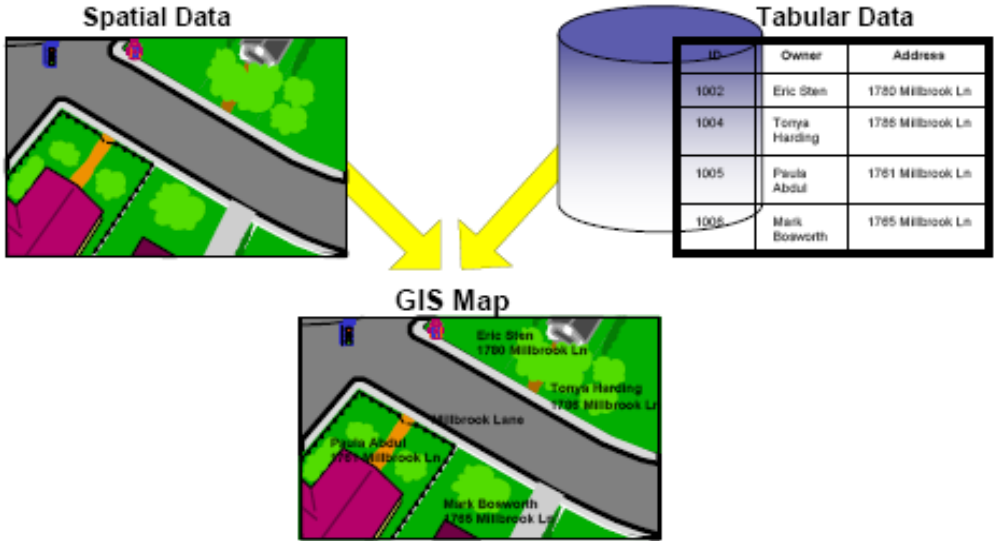
1. Geographic data handling procedures to acquire, process, store, and distribute GIS data
2. Conversion, integration, and standardization of disparate data from multiple sources and applications

Spatial and Attribute Data

The spatial organization, manipulation, and analysis of geographic data are extending the analytical reach of organizations around the world. The use of geographic information tools has received overwhelming acceptance. This technology enables organizations to consider more effective ways of doing business. Spatial data is the representation of the geography in our environment by modeling abstract forms, most often in the form of features on maps.

Most of us probably take for granted our intuitive understanding of spatial data. For example, when we unfold a road map, we know streets will probably be red or black lines, that rivers will be blue lines or polygons, and that a dot represents the location of something. In a GIS environment, formal models govern the representation of these features and allow for a highly sophisticated environment to store, display, analyze, and maintain that information. This modeling is not limited to mapping discrete features such as streets or rivers, but encompasses other representations of geography through such models of surfaces (e.g., slope), networks (such as a power system), images (an aerial photo), and three-dimensional (3D) models.

This technology, therefore, consists of computer software and hardware designed to organize spatial data for analysis, assessment, and cartographic depiction. It provides a mechanism by which information on a feature's location, spatial interaction, and geographic relationship can be assessed and viewed in moments. It provides an opportunity to efficiently view and access geographic data to improve the decision-making process.



The City of Champaign's Return on Investment (ROI)

Information from a GIS reveals patterns and relationships in geographic data not usually seen in tables and lists. GIS provides insight to a place, helps you focus actions, and helps you choose the best options. The benefits of a GIS are countless. Following are examples of the benefits and the return on investment of a GIS.

Financial Savings

GIS helps agencies control spending through direct cost savings and cost avoidance. Direct cost savings arise from improved decision-making and increased productivity. Cost avoidance becomes apparent over time, as costs are reduced or eliminated due to GIS applications that save staff time.

The Needs Assessment identified the **Fire Department and the Public Works Department as two agencies that would quickly realize significant savings**. The **IT, Neighborhood Services, METCAD, Finance, Human Resources, Planning, and Police departments** would all see important savings.

Saved Time

Having the information when you need and want it saves time, staff resources and ultimately money. General information can be made available to the public through a Web site or touch screen kiosks located in City offices. Both reduce demands on Champaign's staff and free them to do what they do best.

The Needs Assessment identified the following departments that would recognize

a significant time savings: **Neighborhood Services, Fire, METCAD, Legal, the Planning, Public Works, Finance and Police.** Other departments will also benefit from time savings, including the **IT and Human Resources departments and the City Manager's Office**.

Increased Productivity

Champaign's staff won't waste time searching for lost data or trying correct inaccurate data. Accurate digital and electronic GIS mapping can be easily accessed by all departments. Access is essential, as management constantly weighs new approaches to increase productivity. And because information can be accessed so quickly and accurately, productivity will improve in all departments. The Needs Assessment identified the following departments that would recognize the biggest increases productivity: **Neighborhood Services, Planning, Finance and Public Works.** The **IT, Fire, METCAD, Human Resources, and Police departments** will also benefit from increased productivity.

Improved Efficiency

Efficiency can be improved vastly using GIS in the City of Champaign by reducing or eliminating redundant or outdated steps in work processes. The Needs Assessment identified the following departments that would see a high degree of improved efficiency: **Neighborhood Services, Planning, and Public Works.** The **IT, Fire, METCAD, Finance, Human Resources, Legal and Police departments and the City Manager's Office** will also see significant increases in efficiency.

More Accurate Data

GIS creates maps from data pulled from databases. Existing paper maps can be digitized and translated into the GIS as well. Maps can then be created on any location, at any scale, showing selected information symbolized effectively to highlight specific characteristics. Working with precise GIS data will enable the City to generate accurate reports and produce quality maps instantly. The Needs Assessment identified the following departments that would recognize a high return in improved data accuracy: **IT, Neighborhood Services, Planning and Public Works**. Improved data accuracy will also benefit the **Fire, METCAD, Human Resources and Police departments, and the City Manager's Office.**

Better Decisions
A GIS is not just an automated decision-making tool to query, analyze, and map data. GIS can be used to help choose the location of a development that minimizes environmental impact, is in a low risk area, and is close to a population center. The Needs Assessment identified the following departments that would benefit from GIS' decision support capabilities: **IT, Neighborhood Services, Planning, and Public Works. The Fire, Police, METCAD, Finance, and Human Resources departments and the City Manager's Office** will all benefit from enhanced decision-making capabilities.

Saved Lives
When emergencies are reported, GIS can help responders reach the scene more quickly than ever before, and the time saved in locating a citizen in distress can be the difference between life and death. The Fire, Police and METCAD department would clearly see enhanced abilities to respond to emergencies and save lives. The **IT, Neighborhood Services, Human Resources, the Planning, and the Public Works departments will also be able to better respond to citizen emergencies.**

Automated Workflows
GIS offers the City of Champaign the opportunity to automate a variety of tasks that expedite work flows and enhance the city's ability to react during a crisis. GIS can be used to automate routine analysis, map production, data creation and maintenance, reporting, and statistical analysis. The Needs Assessment saw that the **IT Department** would recognize a high improvement in effective automated workflow procedures. The **Neighborhood Services, Fire, METCAD, Human Resources, Planning, Public Works and Police departments and the City Manager's Office,** will all receive visible benefits to automated workflow procedures.

Improve Information Processing
Enterprise-wide GIS improves operational effectiveness by improving access to accurate and reliable data. By processing information quickly and accurately, you can improve efficiency. The Needs Assessment identified that the **IT Department** would recognize a high improvement in improved information processing. The **Neighborhood Services, Fire, Police, Planning, Public Works, METCAD, and Human Resources**

departments and the City Manager's Office will all benefit from improved information processing.

Easier Compliance with State and Federal Mandates

Digital GIS-based inventories of water, sewer and storm water infrastructure are becoming increasingly important in local governments. A total GIS supports asset management, inventory control and depreciation that requires accurate and timely data on age, size and construction materials. GIS helps organizations anticipate and set priorities for the repair and replacement of infrastructure. The Needs Assessment identified the following departments that would recognize a high improvement in their ability to comply with state and federal mandates as **Public Works**. **IT, Neighborhood Services, Fire, Human Resources, Planning and Police**

Better Protection for the Community

Intelligent emergency response, emergency planning and homeland security require timely access to data that help the City monitor conditions, recognize threats, predict consequences, and respond effectively and efficiently to man-made or natural disasters. GIS can pinpoint precise locations affected by adverse conditions and allow information to immediately flow to City agencies responsible for public safety. The Needs Assessment identified the following departments that would recognize a high improvement in their ability to protect of the citizens of Champaign: **Fire, METCAD and Police**. The **IT, Neighborhood Services, Human Resources, Planning and Public Works departments will also enjoy enhance capabilities in community protection.**

Improved Communication, Coordination, and Collaboration

Good communication is the key to running an effective organization. GIS helps City leader's present complicated statistical information clearly and graphically. Maps are inherently easy to understand and help assimilate vast amounts of data and illustrate complex ideas without overwhelming the audience. The Needs Assessment identified the following departments that would recognize a high improvement in improved communication, coordination, and collaboration: **METCAD and the City Manager's Office**. Other departments that would receive visible benefits

include the **IT, Neighborhood Services, Fire, Finance, Human Resources, the Legal, Planning, Public Works and Police departments.**

Improved Ability to Provide Data to Regulators, Developers, and Others

A total GIS solution will help ensure that the City of Champaign will have accurate, reliable and repeatable digital information for complex political and regulatory requirements. GIS allows regulators and developers to consider all pertinent data involved in a project, which results in better decisions and better results. The Needs Assessment identified the following departments that would recognize a high improvement in providing data to regulators, developers, and others: **Neighborhood Services, Planning and Public Works.** The **IT, Fire, METCAD**, and Police departments should also see marked improvements in their ability to provide data requested.

Respond More Quickly to Citizen Requests

Responding to citizen information requests and explaining complex data are among the most time-consuming responsibilities of government agencies. Maps are instantly understandable and help even the most complicated information seem self-explanatory. With GIS, the City of Champaign will have an enormous opportunity to use maps as a communication tool. GIS allows for questions to be answered simply, quickly, and effectively. The Needs Assessment identified the following departments that would recognize a high improvement in responding more quickly to citizen requests: **Neighborhood Services, Fire, Finance, METCAD, Police, Planning and Public Works departments, and the City Manager's Office and the Library** the **IT Department** will also see visible improvements in their ability to respond to citizen requests more quickly.

Improved Citizen Access to Government

GIS on the Internet allows citizens to get geographical information themselves, at their convenience, without involving City staff members. Web access to GIS information gives citizens an interactive link to the government, and enhances the government's ability to serve citizens, improve education, and compete globally. The Needs Assessment identified the following departments that would recognize a high improvement in improved access to the government for Champaign's citizens: **the IT,**

Neighborhood Services and Planning departments, and the City Manager's Office and the Library. The Needs Assessment also identified **the Fire, METCAD, Public Works and Police departments** as seeing significant increases in citizen access to government through various forms such as kiosks and interactive Web browsers.

More Effective Management of Assets and Resources

Effective resource and asset management requires GIS systems to operate with peak user efficiency and under proper management. Effective management starts with analyzing, tracking, managing, allocating and conserving assets. Enterprise resource planning technology makes production and delivery quick and efficient. The Needs Assessment identified the **Public Works Department** likely to recognize a high improvement in effective management of assets and resources: The Needs Assessment also identified the **IT, Neighborhood Services, Fire, METCAD, Planning and Police departments** as receiving a visible return on investment due to effective management of assets and resources.

The following table indicates the Return On Investment (ROI) opportunities for each department in the City of Champaign. The ROI ranges from low to high.

Table #1: Departmental Overview of the Benefits of GIS

City of Champaign
The Benefits of GIS

Return on Investment (ROI) Opportunities	City Departments											
	IT Department	Neighborhood Services	Fire Department	METCAD	Finance Department	Human Resources Department	Legal Department	City Manager's Office	Planning Department	Library	Public Works Department	Police Department
Save Money	•	•	●	•	•	•			•		●	•
Save Time	•	●	●	●	•	•	●	•	●		●	●
Increase Productivity	•	●	•	•	•	•			●		●	•
Improve Efficiency	•	●	•	•	•	•	•	•	●		●	•
Improve Data Accuracy	●	●	•	•		•		•	●		●	•
Make Better Quality, and More Effective Decisions	●	●	•	•	•	•		•	●		●	•
Save Lives	•	•	●	●		•			•		•	●
Automate Workflow Processing	●	•	•	•		•		•	•		•	•
Improve Information Processing	●	•	•	•		•		•	•		•	•
Comply with State and Federal Mandates	•	•	•	•		•			•		●	•
Protect your Community	•	•	●	●		•			•		•	●
Improve Communication, Coordination and Collaboration	•	•	•	●	•	•	•	●	•		•	•
Provide Data to Regulators, Developers, and Other Interested Parties	•	●	•	•					●		●	•
Respond More Quickly to Citizen Requests	•	●	●	●	●			●	●	●	●	●
Improve Citizen Access to Government	●	●	•	•				●	●	●	•	•
Effective Management of Assets and Resources	•	•	•	•					•		●	•

Indicates:
• = low return
● = med. return
● = high return

This section provides details about GIS applications that will be used City-wide by personnel in various departments, by the public, or by both City personnel and the public. GIS applications are on of the key building blocks for the City's enterprise-wide GIS implementation. GIS application use is based on a multi-tiered model based on three types of users: power users, analytical users, and browser users. Please refer to specific department/division sections to determine the types of users within each department/division.

Desktop GIS Applications

ArcGIS 9

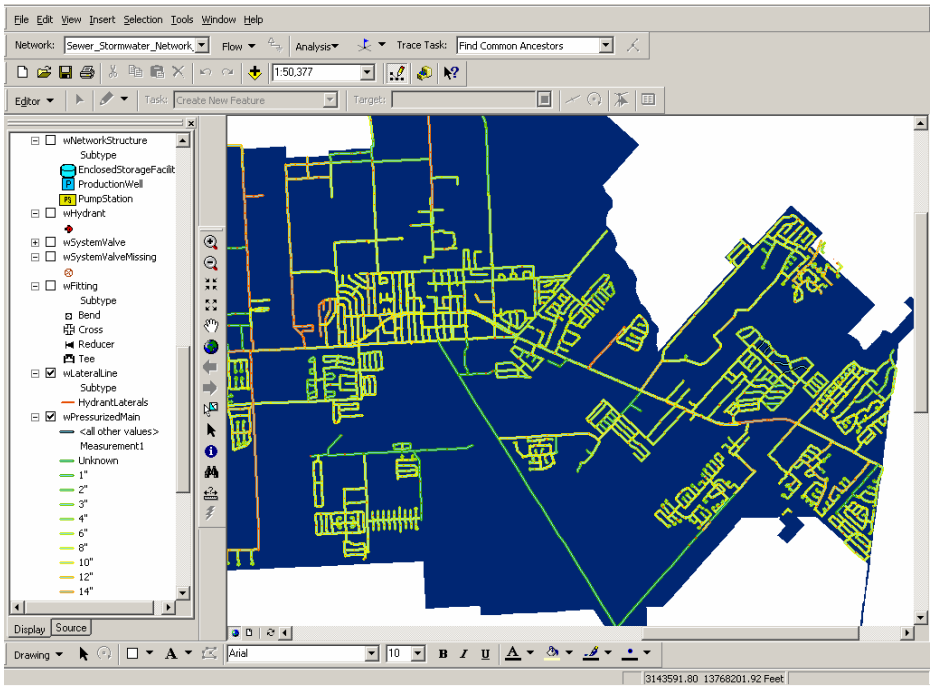
ArcGIS is a scalable system of software designed to meet all Tier 1 and Tier 2 needs. Three different levels of ArcGIS are available: 1) ArcInfo, 2) ArcEditor, and 3) ArcView. Although licensed separately, ArcGIS is a scalable set of software with the same underlying executables and user interface. ArcInfo, ArcEditor, and ArcView can all be customized using VB, C, and many other popular programming languages within the ArcObjects object model.

Individual recommendations for utilization of ArcGIS are included in each department/division section in this chapter.

Tier 1—Flagship GIS

ArcEditor 9 for ArcGIS is the recommended Tier 1 application for the City of Champaign. ArcEditor 9 (Figure below) includes all the functionality of ArcView 9 and allows users to access the power of ESRI's Spatial Data Engine (ArcSDE). The geodatabase is the primary data format used in ArcGIS. Two types of geodatabases are offered: 1) personal geodatabases, which store data within MS Access MDB files (regardless of whether the user has MS Access on their computer), and 2) enterprise geodatabases, which store data in a wide variety of commercial relational database management systems (RDBMS), including Oracle, SQL Server, Informix, and DB2. ArcSDE is required as a gateway between ArcGIS and the enterprise geodatabase stored in an RDBMS. ArcEditor can store and edit data in enterprise-wide geodatabases and personal geodatabases. ArcView can only store data in personal geodatabases. The primary advantage of using ArcSDE and enterprise-wide geodatabases is simultaneous, multi-user editing of geodatabases.

ArcEditor 9 costs approximately $4,000 per license. Most users will not need access to the full functionality of ArcEditor 9.



Tier 1 – ArcEditor

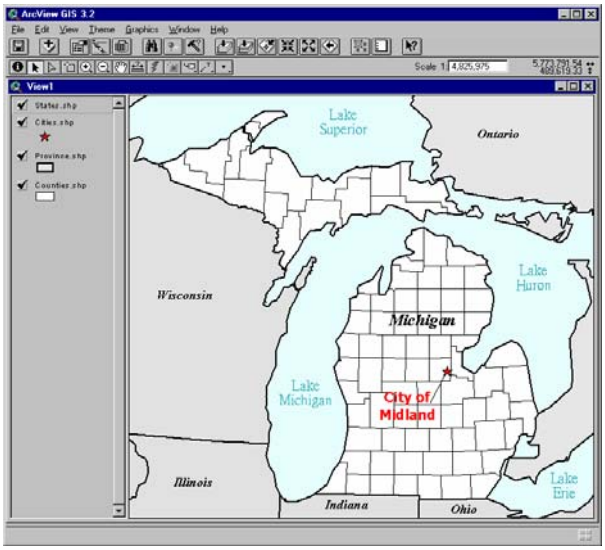
Tier 2—Desktop GIS

Over the past few years the use of desktop GIS has increased dramatically, facilitated by advancements in computing power and improvements in operating systems. Desktop GIS includes many of the more popular functions of the flagship GIS products but omits some of the lesser-used functions. Desktop GIS is much less expensive than the flagship product. Desktop GIS can be purchased for an average price of $1,500 per license. Products such as ArcView have proliferated throughout local government and have allowed a new, larger group of employees to use the GIS. If 5 people are using the flagship package, perhaps 30 will be using the desktop version.

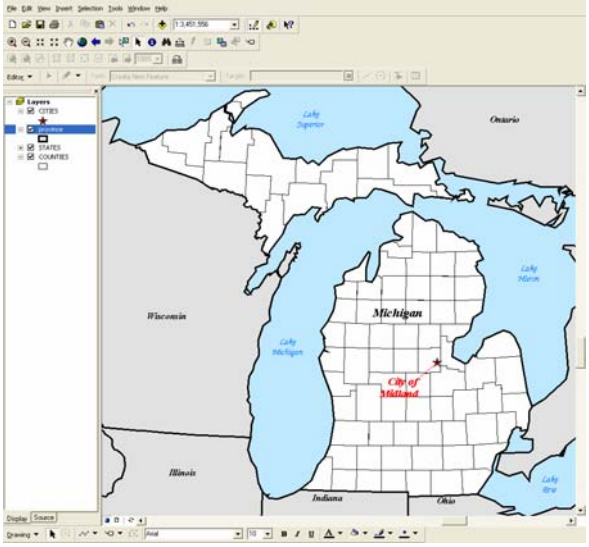
ESRI's Tier 2 software application has recently migrated from ArcView 3 to ArcView 9, although ArcView 3 is still supported. ArcView 9 is the least robust and least expensive of the ArcGIS suite. As an ArcGIS product, it uses the same interface as the Tier 1 one products, ArcInfo and ArcEditor. The primary differences (beside cost) between ArcView 9 and the Tier 1 products is that ArcView: 1) cannot edit coverage's, 2) can only use personal geodatabases, 3) has less geoprocessing tools, 4) and lacks many database schema customization tools.

Tier 2 desktop applications still offer more functionality than many users need, and their robust functionality often cause them to run slowly on machines not intended to operate memory intensive applications.

Tier 2 – ArcView 3x



Tier 2 – ArcView 9x



Tier 3—Customized/Open GIS

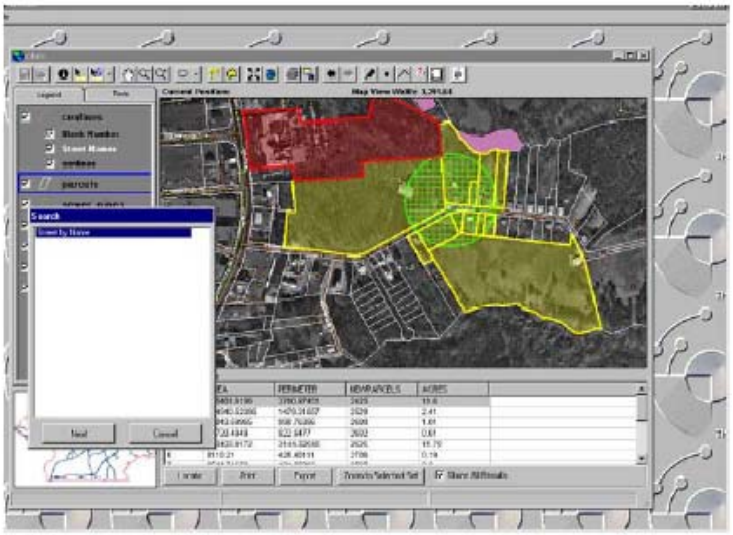
The majority of potential GIS users need easy-to-use, intuitive interfaces that perform well-defined tasks. Thus, the third tier of GIS software was born: customizable/open GIS. GIS software companies have moved GIS functionality to common, widely used programming languages such as C++ and Microsoft Visual Basic. The result is that application developers can create very user-friendly interfaces that have the look and feel of other personal computer applications. Only the GIS functionality needed for a specific program is used. Thus the overhead of non-used functionality is not slowing down the applications. Custom applications can be created and distributed throughout the organization. The Tier 3 product has a price tag of $3,000 to $4,000, which includes all the necessary programming software and 10 deployment licenses. For each additional deployment, a $500 fee is paid to the software company.

A data browser

Counties like Calvert County, Maryland, are deploying a GIS using all three tiers and concentrating on custom applications. Calvert County will be deploying a "generic data browser" that will allow citizens, elected officials, and anyone with a personal computer to access a wealth of information.

The open programming interface opens the GIS door for any application developer in any industry. No longer is GIS development the domain of an elite few GIS gurus. Now any programmer adept at a standard programming language can embed GIS functionality in applications to be used by anyone throughout the organization.

More information can be found at: http://www.esri.com



Example of a GIS Data Browser

Internet/Intranet Departmental GIS Data Browsers

The ability to view data in a quick and easy format is important for local governments and is needed throughout an enterprise. Web-based data browsers allow quick viewing and printing of map data. Web-based data browsers can be configured either for use solely within City of Champaign departments or as a web site available to the public. A potential application for a GIS browser would be for the visualization and query of property information, economic development, zoning, and other pertinent layers; additionally, this application could serve as a tool for creating mailing labels for targeted areas.

Intranet

Departmental Intranet GIS Data Browser Solutions are ArcServer-based applications for data dissemination by departmental function across an Intranet. Intranet browser's represent a step forward in enterprise-wide GIS technology as it offers just enough spatial analysis, geographical viewing and map production, as well as external database links. The browser should include: 1) Advance Search Criteria, 2) Automated Mailing Labels, 3) Customized Departmental Query Control, 3) On-Line Help and Tutorial, 4) Advanced Graphic Design, 5) Enhanced Text Placement, 6) Link to external web Databases, 7) Easy-to-Use interface

Each department is presented with pertinent GIS data and custom defined queries for easy end-user interaction and module development allows for the configuration or addition of module departments or functions to the browser based interface.

Intranet GIS Data Browser

The City currently has an existing platform that can serve as the backbone for Internet and Intranet GIS Data Browsers. Existing software from ESRI will need to be upgraded to the latest technology, ArcServer. ArcServer software from ESRI will serve as the underlying GIS component.

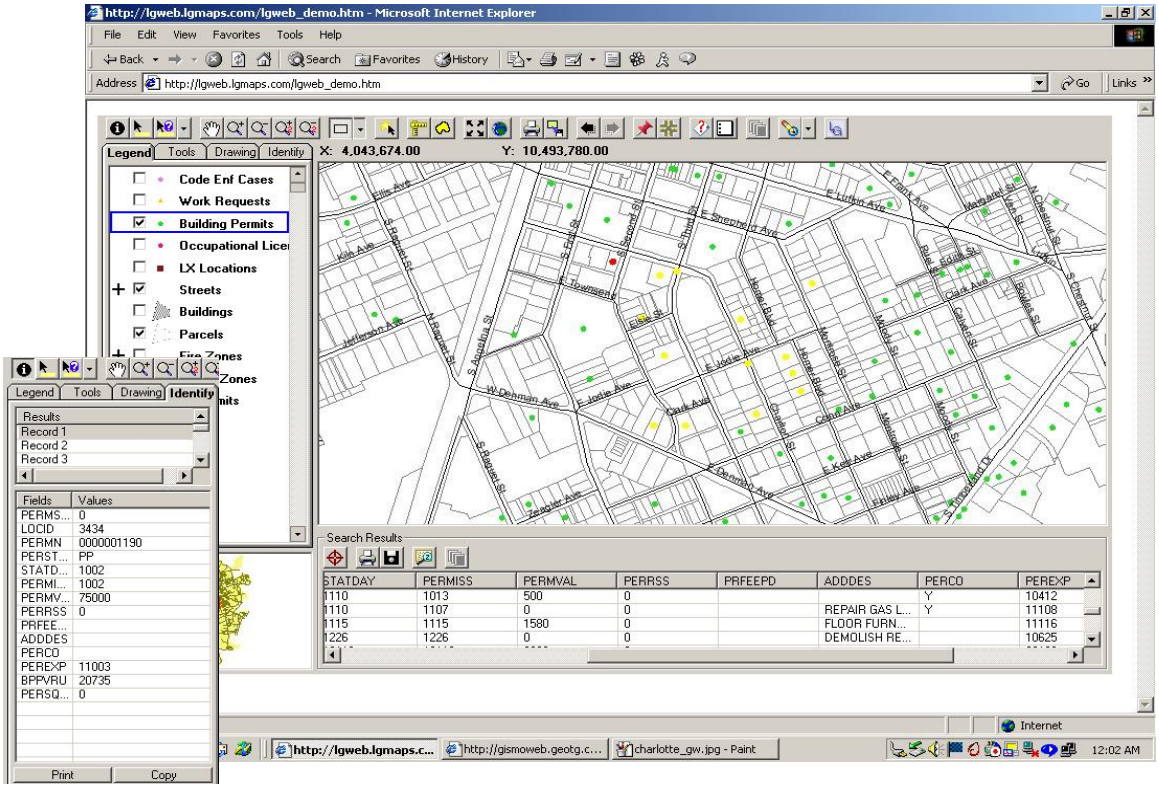
Upon consolidation, centralization and standardization of GIS data, the Intranet GIS data browser should be modified to provide department-specific data and functionality. Additional functionality should include the ability to view all base map data, department-specific queries, and standardized mapping templates. Additional departmental/divisional requirements are provided in specific department/division sections in this chapter.

The ArcServer platform utilized for the Intranet GIS data browser can also be leveraged to implement other Intranet GIS applications in the future as well as an Internet GIS data browser.

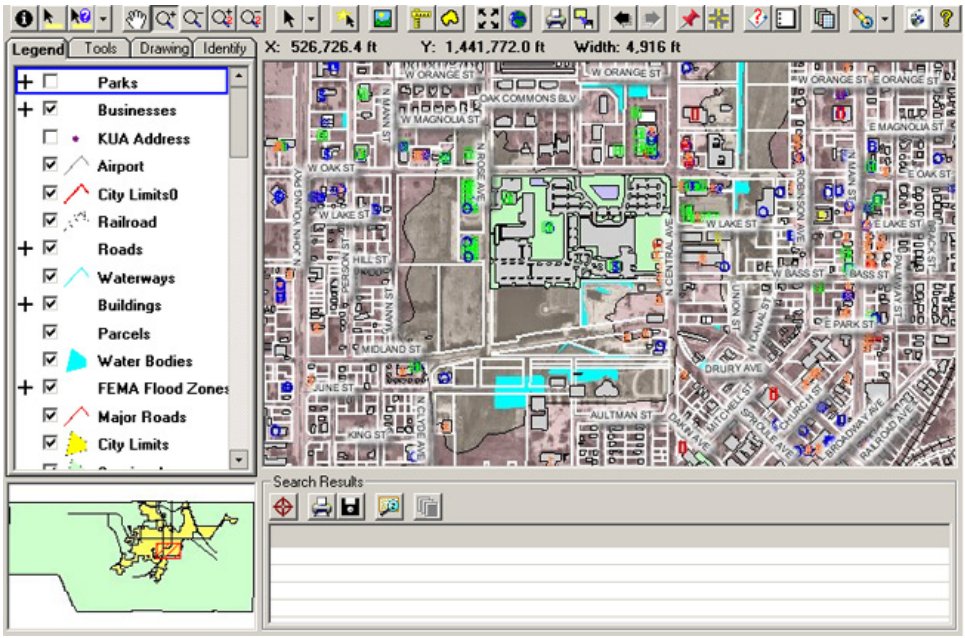
Benefits and Concepts of Intranet Application

The Intranet solution brings the targeted tool set for local governments and utilities while leveraging all of the data residing in existing data sets. Users can:

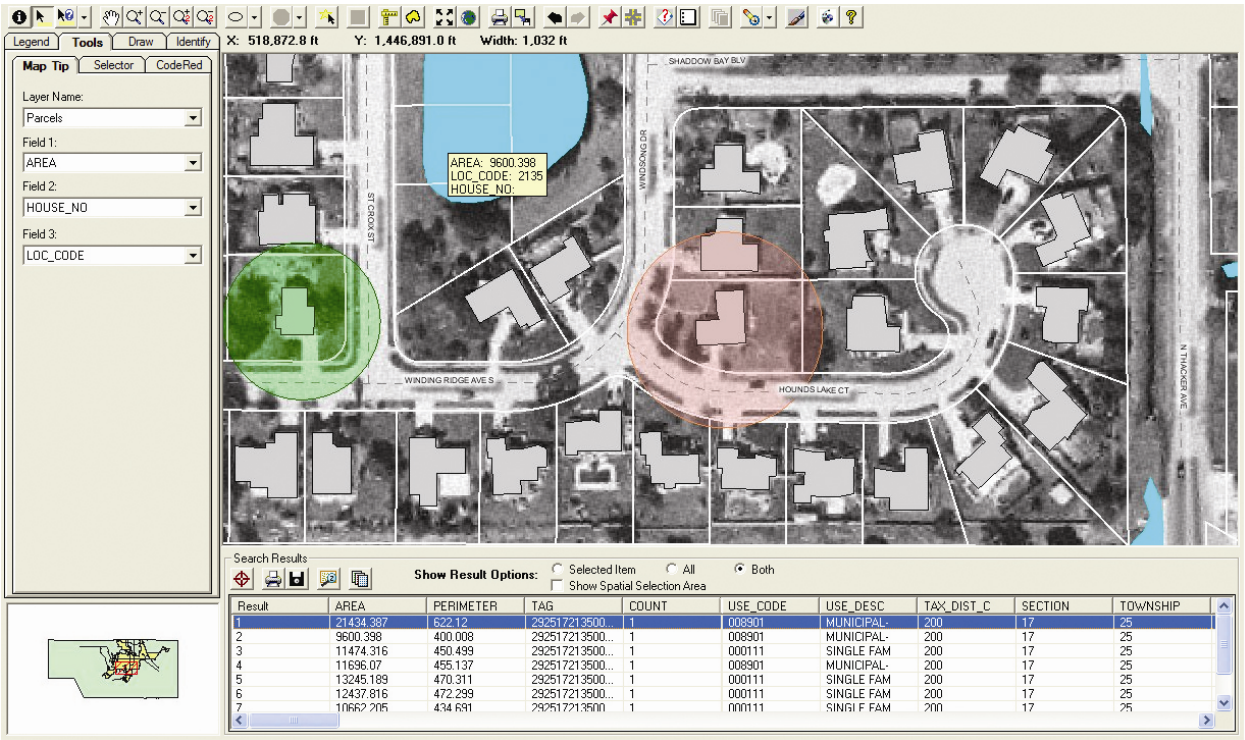
- Geographically query land base data. For instance, show me all work orders in my service area or show me all certificates of occupancy in the downtown area. Users can now geographically query their existing data.
- Utilize maptips – users can now hover over a GIS record and have tabular data displayed. As the cursor is moved over the map, any combination of data is automatically shown to the user.
- Find addresses easily – The tool should provide a smart intersection finder and advanced address finding capabilities.
- Produce advanced reports – An infinite amount of pre-defined reports can be made available to the end users. Gone are the days of having to try to create a cumbersome report via a report writer. A well written Intranet tool will make this a task which is accomplished in seconds. This includes mailing labels, letters to customers, or any report needed.
- Quickly measure distance and area – In local government the size of a lot, the distance from a house to a utility, or the dimensions of a building footprint, etc. are often needed. This has traditionally been a cumbersome task. The Intranet tool should allow the user to do this in a few seconds and see results in acres, square feet, and square miles automatically.
- Notify citizens – with a reverse dialing extension (TeleWorks, CodeRed) users can quickly select a geographic area and have their citizens phoned automatically. This is used for emergency and non-emergency events.
- Print quality maps – Maps of any size and scale can be printed by the user.



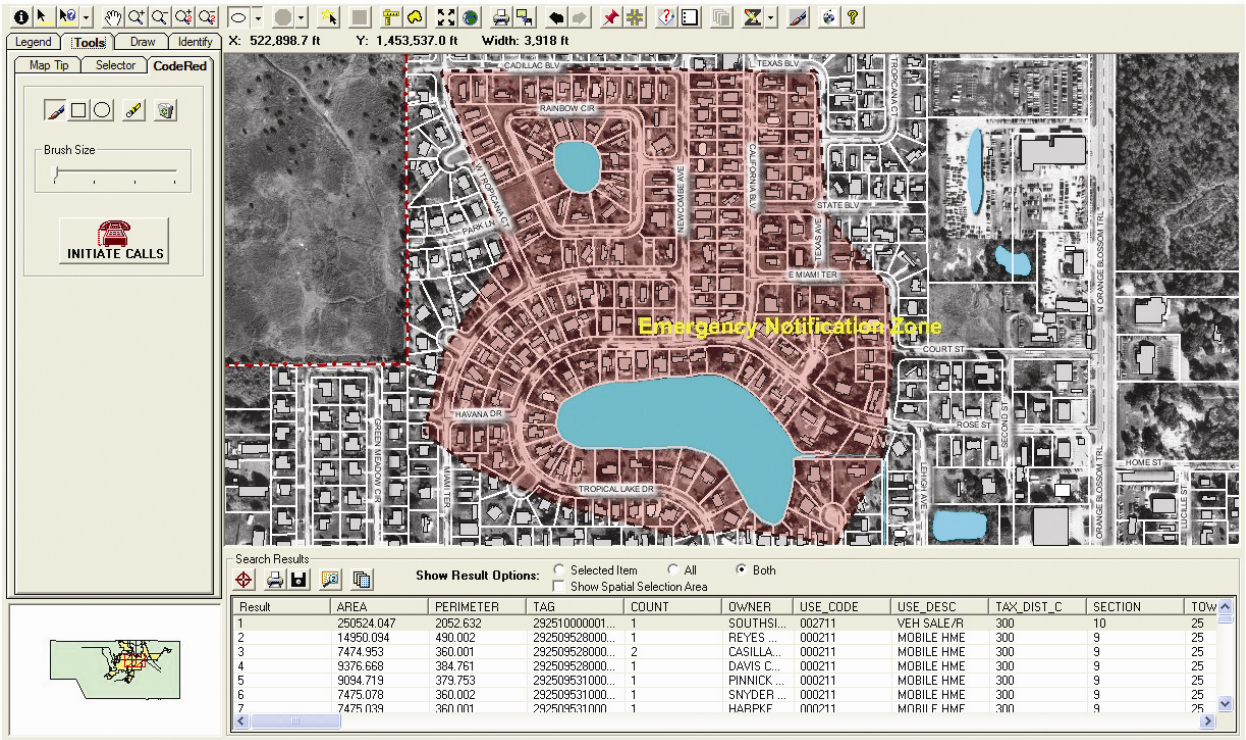
Example Intranet application with an easy-to-use browser interface



Simple yet Powerful



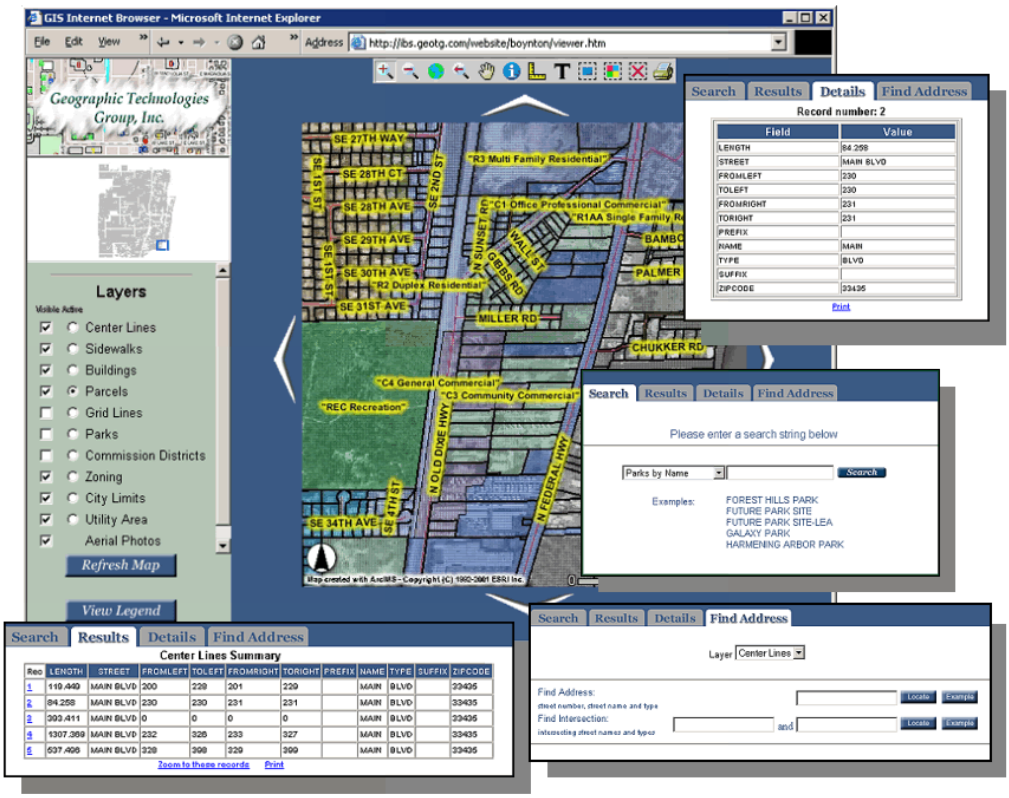
Easy selection tools for the user should be included



Integration of notification software is possible

Internet GIS Data Browser

The City of Champaign expressed an interest in providing its citizens with access to online maps and geo-spatial information via a web-based solution. An enterprise Internet GIS Browser application, based on ArcServer, will need to be implemented to provide such a solution. The Internet browser application should include an intuitive interface, and should incorporate the use of a graphic outline. The interface should be developed to match the current City of Champaign Web Site in color scheme, layout, logo etc.



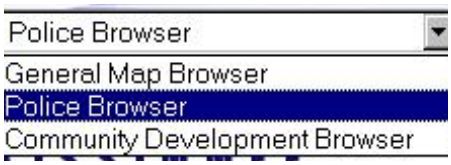
Departmental Internet Browser

Multiple Interfaces or Services by Department or Function

The browsers should have a selection box for every major department or function in the organization. Once the department is selected then the interface, layers available, search mechanisms, and available reporting change to focus on the needs of that department. These associated layers and stored queries should be definable by staff and not require the use of outside consultants to edit or update.

Data Search Methods and Stored Queries

Various methods of finding information should be available. Each departmental interface will have a definable list of data search methods. These methods will be editable and storable by an administrative user and the shared out to the end user community. The following graphic depicts some more popular ways of searching for data in local government.



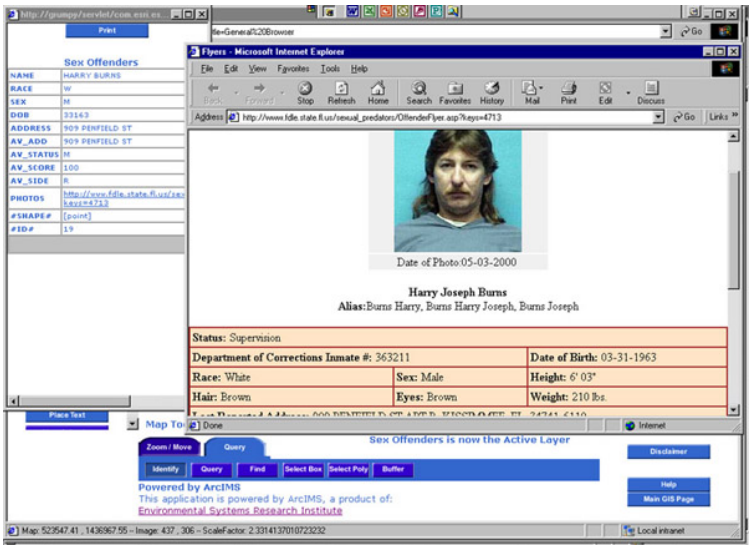
Departmental or Function List of map Interface

Standard Neighborhood Search or Stored Configurable Search list

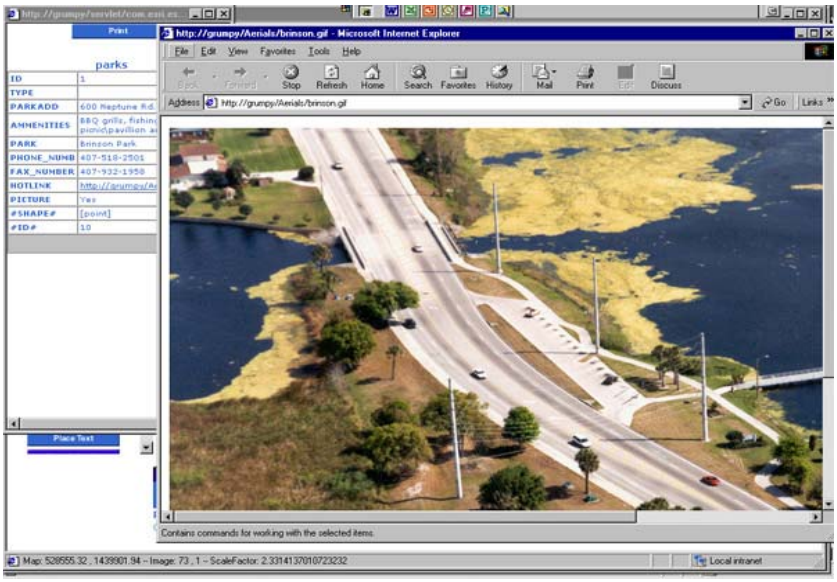
<u>Data Display and Hyper-linking</u>

The browser solutions should support hyper linking to web supportable file formats. Following are excellent examples of hyper-linking opportunities from the application datasets:

- Images within TRAKiT
- Sexual Offenders link to the State
- Imagery of Community Facilities
- Pictures of individual structures
- Maps to community facilities



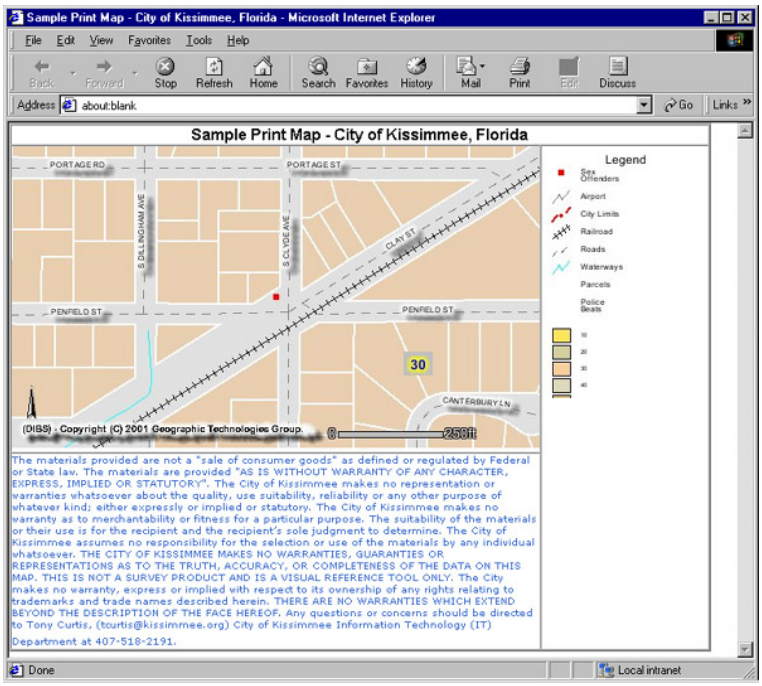
Sample of Sexual Offender link



Sample of Linked Photo

<u>Printing and Reporting</u>

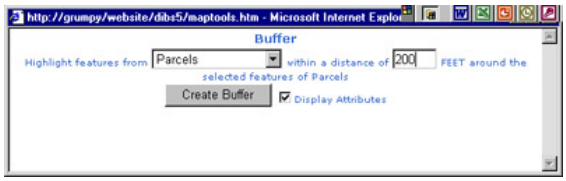
The browser solutions should provide the ability to generate quality prints to a local printer. The print should include the map, legend, title and scale bar for quick reference.

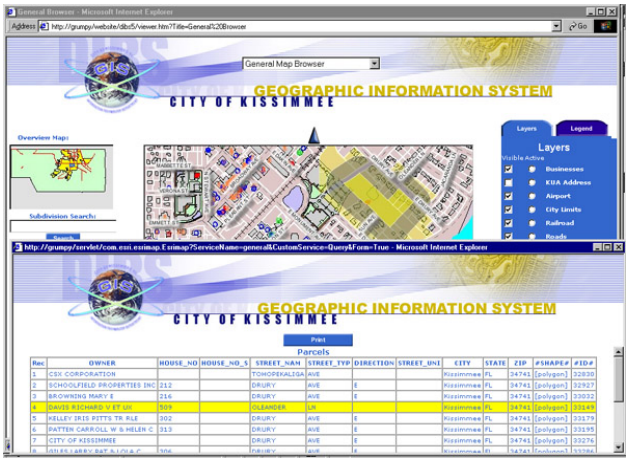


Sample of Print Page

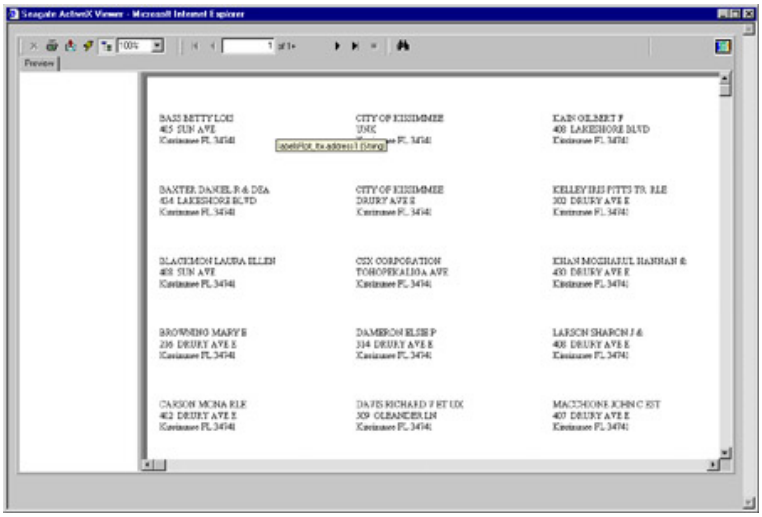
Buffering for Notification or Mailing Label Generation

The browser solutions should provide a method for staff to generate mailing labels for notification purposes. This should be accomplished by the server automatically producing a standard list using Crystal Reports or a similar reporting application.





A buffer interface (above) should provide the user with a simple method to produce buffers and select features based on that buffer. The resulting buffer and selected set should be displayed for the user (right). Generation of mailing labels should be supported by the application (below).

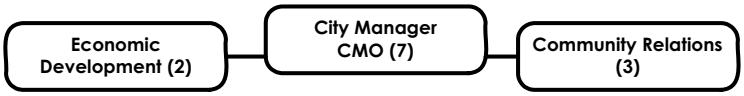


Sample Buffering and Mailing Label Generation

Existing Personnel and Duties

The City Manager's Office (CMO) employs 12 full-time staff to support the City Council and carry out Council policy. The main office houses seven employees with the remaining in the following two divisions:

- Community Relations (3)
- Economic Development (2)



The CMO provides professional management and leadership for all City activities and ensures City policies and programs are implemented consistently with the organization's philosophy, while serving as a liaison with outside agencies.

The CMO is responsible for:

- Implementing and administering City Council policy within the parameters of the City Charter
- The effective and efficient provision of City services
- Enforcing all laws pursuant to the City Charter, including human resources and financial management
- Preparing an annual operating budget and five-year Capital Improvements Program (CIP)
- Keeping the City Council abreast of the financial condition and future needs of the City
- Economic development initiatives and support
- Community relations

Recent interviews with CMO personnel identified important issues of GIS implementation, including:

- The strategic plan must create a GIS governance model that involves the City Manager in the development and management of GIS
- The Strategic Plan must consider carefully how GIS impacts the following:
    - Emergency management
    - Collaboration and relationship with the University
    - Citizen complaints and complaint tracking
      (History of city-wide inquiries and complaints)
    - Economic development and growth
    - Effective use of GIS at Council meetings
    - Relationships with other organizations (inter-governmental agreements)
    - Champaign County Consortium
    - Disseminating public information

- The strategic plan should consider carefully the existing council goals and City policy
- The strategic plan should evaluate how GIS can improve economic growth including:
    - Smart growth
    - Sustainable growth
    - Economic stimulation

- The strategic plan should evaluate how GIS can help manage liquor licensing issues

- The strategic plan must address the role of the Champaign County GIS Consortium and issues that will come up in the future, including:
    - GIS growth in the region
    - Cost recovery for GIS data
    - Funding GIS services
    - Availability and accessibility of GIS data
    - Policies and procedures

- The strategic plan should also demonstrate the following tangible results from GIS technology, including:
    - Improved efficiency
    - Increased productivity
    - Saved time
    - Saved money
    - Better decisions
    - Improved data accuracy
    - Automated workflow procedures
    - Saved lives
    - Improved information processing
    - Easier compliance with state and federal mandates
    - Improved community protection within the departments and with for the public
    - Improved communication, coordination, and collaboration
    - Improved ability to provide data to regulators, developers, and others
    - Ability to respond more quickly to citizen requests
    - Improved citizen access to government
    - More effective management of assets and resources

It is expected that the City Manager and City Council members will continue to support enterprise-wide GIS implementation. The City of Champaign is poised to leverage existing investments in technology and personnel to improve citywide decision making, services, and products through GIS. Continued leadership and strategic guidance will be necessary to ensure the City's GIS implementation is successful in the long term.

There are two divisions in the CMO. Both the Economic Development (ED) and Community Relations (CR) divisions will benefit from the effective use of GIS.

Economic Development Division

The ED division provides communication and staff support on a broad range of development activities, including communication with private developers, existing and prospective local industries and businesses, and other agencies. ED performs the following duties:

- Implements the City's Economic Development Plan
- Provides funds to encourage the community's commercial and industrial development, particularly for public improvements or engineering services which can result in major economic development achievements.
- Provides assistance to major industrial, high-tech, and commercial developments which meet the goals and objectives of the City's economic development policy. The main ED programs include:
  - Industrial Development Program
  - University Research Park Incentive Program
  - High Technology Incentive Program
  - Infill Redevelopment Policy
- Provides financial support for the Champaign County Economic Development Corporation (EDC) and participates in the following EDC activities:
- Provides financial support for the Champaign County Convention and Visitors Bureau and participates in the following CVB activities:
  - Attracting IHSA and other sports events, in collaboration with the Champaign County Sports Commission
  - Attracting meetings, conventions, and group tours
  - Supporting 40 North/88 West arts activities and events

- Continuously seeks ways to improve and evaluate communications with the development community consistent with the recommendations made by the Development Services Task Force, including monthly meetings of the Developer's Forum group to share information, and discuss development issues.

Community Relations Division

The Community Relations (CR) division performs the following duties:

- Addresses complaints of violations of the City's Human Rights Ordinance.
- Monitors results of the City's Affirmative Action Plan, assists the Personnel Services Department in employee recruitment and conducts training in Equal Employment Opportunity and Affirmative Action
- Monitors compliance with the Equal Opportunity in Purchasing Ordinance by contractors and vendors and helps contractors fulfill prequalification requirements (completing Affirmative Action Report Forms, writing Affirmative Action plans).

- Conducts on-going training for City employees and businesses on sexual harassment, multicultural diversity and other civil and human rights issues.
- Serves as the liaison between the CMO and community-based organizations, and responds to citizen complaints.
- Supports the Human Relations Commission by serving as secretary and handling related administrative duties.
- Works with the Police-Community Relations Committee to increase trust between the minority community and the Police Department.
- Through the C-U Diversity Network, the Latino Partnership, and other groups, promotes the exchange of ideas and partners with community groups to promote community events and projects.

Existing Hardware and Software

The City Manager's Office has 14 PCs, all running Windows operating software. All CMO employees have a workstation at their desk; the Deputy City Manager has both a desktop and a laptop.

The City Manager's Office uses the following software applications:

1. MS Office
2. GroupWise- email, calendaring, and scheduling
3. Mr. SID (used on a limited basis)
4. Payroll/ accounts payable
5. TrakIt

Recommended GIS Needs and Duties

The CMO does not have the capability to produce GIS maps in the department, and the CMO finds it difficult to rely upon other departments to create maps when needed. Additionally, the CMO cannot confirm that data provided are complete and error-free and needs better access to required data and data layers.

It is recommended that the CMO use tier-three GIS solutions that will allow CMO, ED, and CR to produce all maps and perform some spatial analysis in-house. It is anticipated that CR will use GIS for public communication, and mapping and evaluating citizen complaints. GIS mapping products may include:

- Land use maps
- City limits maps
- Street mapping
- Address and parcel mapping
- Geographic boundary maps
- Proposed development site maps

It is anticipated that spatial or analytical tasks will include the following:

- Proximity analysis
- Suitability analysis
- Statistical and acreage calculations

- Overlay analysis
    - Flood zones
    - Easement calculations
    - Property ownership
    - Construction activity
- Financial forecasting
- Economic impact studies
- Environmental impacts
- Analysis of vacant land and vacant buildings (abandoned or under-utilized)

Existing GIS Data Layer Inventory and Future Recommendations

It is recommended that the CMO, including Economic Development and Community Relations, have access to all GIS digital layers. The table in *Chapter 2 IT Department* documents city-wide data layers that the CMO can use.

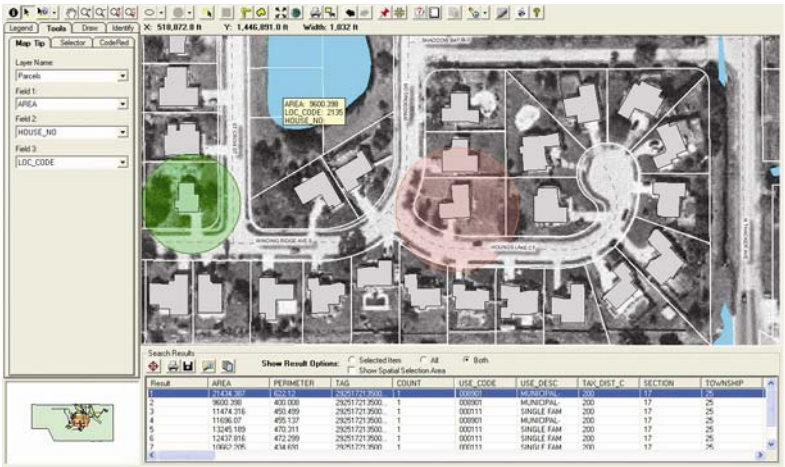
Recommended GIS Applications

It is recommended that the CMO (including ED and CR) use an intranet-based GIS application that offers all required functionality. The ED divison will also use a custom Web-based Internet solution (Economic Web Portal) customized for economic development. The following sections describe the two recommended solutions.

Intranet GIS Data Browser

An ArcGIS Server-based intranet GIS data browser has been recommended to provide all CMO staff the ability to view and analyze GIS data.

The City of Champaign expressed an interest in providing City staff with intranet access to online maps and geo-spatial information. An enterprise intranet GIS Browser application, based on ArcIMS, will be needed. The intranet browser should have an intuitive interface and should incorporate the use of a graphic outline.



City-wide Intranet Solution

Internet Economic Web Portal

The Economic Web Portal will be a unique and effective tool for the City of Champaign's ED. There will be several tabs users can click to find information or query specific data layers. These tabs will be outlined in the next paragraphs and a complete description on the functionality included in each tab will be presented.

Available Land

Land and property is a precious commodity, and finding suitable land for development is time consuming. Developers need access to maps and analysis of land data to make an informed decision. This tab should also have available buildings. Also, a link to recently approved and pending development review projects is recommended. In the available land tab, users will be able to:

- Search by property type (retail, office, industrial, commercial, vacant)
- Search by zoning
- Search by property size (square feet or acres)
- Choose properties for lease or properties for sale
- Search by parcel number
- Search by address to get
    - Current information on properties selected
    - A picture of the building (not for vacant land)
    - Building information
    - Parking information
    - Amenities
    - Infrastructure information
    - Parcel information

Demographic Profile

Demographics play a huge role in economic development. Demographics include population, age, gender, income, education level, race, business information and other data. In the Demographic Profile tab, users will have the ability to:

- Search by demographic type
- View thematic maps
- Choose number of groups and type of distribution
- View demographic reports and charts on screen or export to Word or PDF

Education

Education at the regional level will have an impact on future economic development. Users may want to know which schools and universities and the size and demographic profile of the schools. This tab allows users to search schools by name or address. In the Education tab, users will have the ability to:

- Search Pre-K-12 schools in a drop-down box
- Search universities and colleges in a drop-down box
- Access work force training program offerings at Parkland Community College
- Link to school Web sites
- See schools' average SAT scores
- Zoom to schools on the map by clicking on the name of the school

Infrastructure

Infrastructure includes transportation and utilities. The GIS layers will be on a list and can be turned on and off. Additional functionality available through this tab includes links to information on the utilities and types of infrastructure available in a pre-defined search area, such as around the parcel currently being viewed on the map.

- Water (Public Works, UCSD, ILAM)
- Sewer (Public Works, UCSD, ILAM)
- Wireless Internet
- Gas (not city)
- Electric (not city)
- Fiber
- Interstate and highways
- Regional roads and airports
- Telecommunications
- Utilities and infrastructure in a specified buffer zone around the selected site
- Utility companies in the area and links to their Web sites

Incentives & Programs

Incentives and programs available in the Champaign area may have an impact on whether businesses choose to relocate to the City. This tab will have the following functionality:

- Local programs search
- Links to local programs and maps of the location
- Links to local chamber of commerce, Economic Development County (EDC), and the Champaign Visitors Bureau (CVB)
- Links to regional development agencies
- Links to state and federal agencies

Housing Market

The area housing market helps encourage and promote economic growth for the City, making Champaign an optimum site for businesses. This tab will allow users to:

- Link to County real estate
- Link to regional Realtor association
- View pricing data and reports

- Get information on cost of living and relocating

Culture & Recreation

An important factor in economic development is the availability of recreation and cultural activities. CVB data and involvement is important for this data. This tab will allow users to:

- Search parks, museums, or other types of recreation by selecting from a list of information about the following:
  - Museums
  - Professional sports
  - Attractions
  - Clubs and organizations
  - Outdoor life
- The ability to zoom on the map to these locations by clicking on the name

Workforce

This tab lets users view demographic information related specifically to the employment labor force. Users can select from a pull-down menu types of employees in various industries to see on a map where most of the employment and industry is taking place. Also, a button can be added to view various business reports for the surrounding areas. When the report is generated, the businesses in a specific radius will be color-coded on the map based on business type. The EDC will need to play a major role in the development and maintenance of much of this data. Users can:

- Select from drop-down menu type of employee demographics
- View workforce data on the map
- View business reports for selected site
- View color-coded business types for selected radius
- Link to major employers Web sites

Business Parks

The types of business parks in the area are important to businesses considering Champaign. This tab will allow users to:

- View top companies
- View local tax information
- Get information on commercial building permits
- Search by business type or name
- Research consumer expenditures
- Get business counts
- Get a detailed business report of the local area within a specified radius of a potential site.

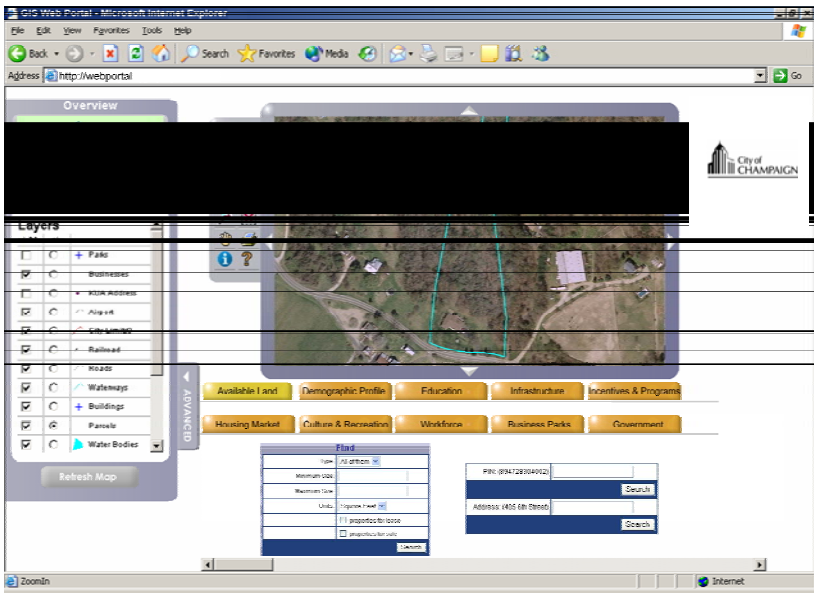
Government

Seeing where government agencies are located and having information on government leaders will be important for businesses considering moving to the area. The government tab will allow users to:

- Locate City and other government offices in the area
- Click on government name and zoom to the location on the map
- Get legislator names, contact information, and Web sites
- Obtain information about local elected and appointed positions

Look and Feel of the Economic Web Portal Application

The look and feel of an economic development application is illustrated in the graphic below:



The following case study illustrates how one community uses GIS as an economic development tool:

Case Study: Relocate Here -- An Economic Development GIS

Mecklenburg County, N.C., has a population of approximately 773,299, with Charlotte as its largest city, consisting of 527 square miles and approximately 280,000 tax parcels. Charlotte is a banking center, home to Bank of America and Wachovia, and also is the largest US Airways hub.

Using ESRI and open-source software, Mecklenburg County has more than 30 GIS applications, many of which are available to the public via the Internet. The new Economic Development GIS (gischamber.co.mecklenburg.nc.us/website/chamber) is dedicated to attracting new businesses and industries to the Charlotte region.

The system's primary goal is to provide businesses considering Charlotte more powerful, geographic-analysis tools than are typically available elsewhere. As a bonus, local businesses, contractors and developers frequently use the application for business-development research.

Development Framework

The Economic Development GIS uses existing staff in Mecklenburg County's GIS department. The project-development team consisted of a project manager, a GIS data manager, a systems architect, a Charlotte Chamber Economic Development research analyst, and two senior application developers, providing approximately 1,600 development hours. No outside contractual services or extra expenditures were necessary. Internal and external data sources were used in the application, and all spatial datasets were compiled in the Mapping and Project Services division of Mecklenburg County's GIS department, or by the city of Charlotte. Census data with current and 2010 projections were purchased from Applied Geographic Solutions, the Charlotte Chamber of Commerce supplied the business data, and Carolina's Real Data provided the available properties data. The spatial datasets included the following:

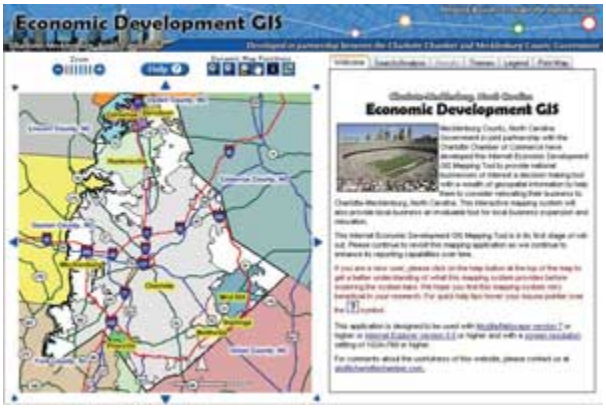


Figure 1. A Parcel Search displays current CAMA property information.

- Aerial photography (2005, 2004, 2002, 2001, 1999, 1997)
- Census block groups; real estate industrial, office and retail submarkets; county, municipal and ZIP Code boundaries
- Business location points with North American Industry Classification System (NAICS) labels
- Retail, office and industrial buildings for sale or lease
- Colleges and universities, private and public schools
- Tax parcels, Charlotte/Mecklenburg and small-town municipal zoning
- Parcel boundaries, dimensions and labeling; building outlines
- Fire stations, hospitals, police stations
- Golf courses, greenways, libraries, parks, points of interest
- 10-foot contours (topo), preliminary residential and commercial development plans
- Road-network infrastructure, interstate and highway designations, NCDOT traffic counts
- FEMA floodplains, regulated watersheds, swim buffers, streams and water bodies
- Proposed bus stops, light-rail stops and stations, and park-and-ride lot locations; traffic counts
- Building-permit location points by build type

The system's interface design was created to deliver the following: ease of use; avoidance of overly technical terms; options for simple lookups on addresses, parcel numbers, ZIP Codes, points of interest and facility names; full map-display functionality and navigation; organized map output into simple categories such as business, education, land use, parcel information, site selection, transportation and aerial photography; and detailed queries on locations of interest.

Previously, such information was dispersed, making research difficult. The Economic Development GIS puts all necessary information in one centralized location.
The application was developed using the Rapid Application Development protocol, which is useful in complex GIS application development. Because many people aren't aware of what GIS can do, prototyping sessions throughout the development process provide a communication medium for feedback and keep customers involved in system design.

Initial system requirements were laid out, and the subsequent prototyping sessions ensured that the requirements were implemented in a satisfactory manner. The sessions weren't an excuse to constantly change requirements, but they ensured customer satisfaction with the end result.

Technical Design
The Economic Development GIS uses a distributed system architecture comprised of application and database servers. Each HP DL380r server is configured with dual Xeon 2.8GHz processors and 4GB of memory.

The database server features an array of 72.8GB Ultra SCSI 10,000 rpm hard drives, providing 291GB of storage with an online spare hard drive. The application server features an array of 36.4GB Ultra SCSI 15,000 rpm hard drives, providing 110GB of storage with an online spare hard drive. The systems provide a high level of fault tolerance through RAID 5 disk arrays, redundant power supplies, teamed network cards and 2GB of online backup memory per server.

Figure 2. A Sample Properties report is created by clicking on a map location.

The application server is built on the Microsoft Windows Server 2003 platform with ESRI's ArcIMS 9.1 and IIS 6.0 software. The database server is built on the Microsoft Windows Server 2000 platform with ArcSDE 8.3 and Microsoft SQL Server 2000.

The application was developed using ArcIMS within a Microsoft .NET framework using JavaScript, and a Web service is used to process XML requests and responses from

ArcIMS. JavaScript is used for client-side features such as the zoom box and dynamic map panning.

Microsoft's ASP.NET was chosen due to its enriched development environment and the ability to purchase third-party Web controls for tabs and PDF file generation. Mapping functionality was developed using ArcIMS features and XML.

Central Functionality

Because the application's primary purpose is to attract new businesses to the Charlotte region, the main functionality was centered around searching on existing businesses, demographics and available property. Mapping features were designed with two types of users in mind: experienced GIS users and beginners.

For experienced users, traditional mapping tools are available for zooming and panning. For beginners, "MapQuest-type" directional pan arrows and zoom scales are available. A tabular design for data display was chosen for its ease of use. The tabs are broken down into six main categories: Welcome, Search/Analysis, Results, Themes, Legend and Print Map.

The Search/Analysis tab coordinates with the Results tab to display information, and it includes a drop-down list of 17 search options (see the accompanying table). In addition, the results of all search options can be printed or saved to PDF format.

Search/Analysis Tab Functionality

A Parcel Search report displays current Computer-Assisted Mass Appraisal (CAMA) property information, and users can search by a specific street address or parcel number as well as identify a parcel on a map using the identify tool (see Figure 1). A Sample Properties report allows users to obtain information about surrounding properties in any given location (see Figure 2).

Figure 3. A Business Summary report provides business information broken down by NAICS code.

The Business Summary report is a radius search tool that provides business information, broken down by NAICS code, based on a specified radius distance of one, five or 10 miles. To select a centroid for a search, users click on a map or complete a ZIP Code or street-intersection search. In addition, there are shortcut links available on the parcel, point-of-interest and street-intersection search results (see Figure 3).

The Available Space for Lease report displays all available properties based on data from Carolina's Real Data. With this search, users can select among industrial, office or retail

space in addition to a minimum and maximum square footage within Mecklenburg County. Only information containing the available property's address, year built, square footage and number of floors is available. If users want additional information, they must contact Carolina's Real Data.

Implementation

According to Frank Warren, a Charlotte real estate consultant, the Economic Development GIS application is "a valuable interactive tool for relocating companies and their site-selection consultants." Others have commented on how the application reduces research time due to its all-encompassing features.

The main technical problem that surfaced during implementation was the enormous "viewstate" size that was generated from Microsoft's .NET Web controls. A large viewstate creates an application that's slow to process on the client side, and it also can be blocked on the server side by firewalls. Major culprits to an enlarged viewstate are data grids and dynamically filled, large drop-down lists.

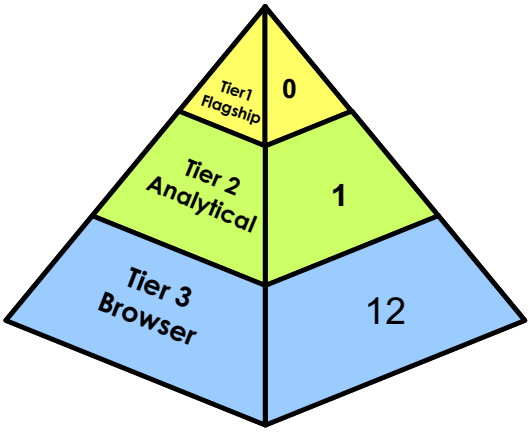
Although the viewstate is a benefit of using a .NET development environment, due to its ability to save the client's state, it must be utilized sparingly. Mecklenburg County's application firewall, for example, blocked repeated server requests from the Economic Development GIS, causing users to get a "page cannot be displayed" error. To solve this problem, the viewstate was turned off for many of the .NET controls, and the system manually regenerates the client's state at each page refresh.

The Economic Development GIS met its primary goal of providing an easy-to-use analysis tool for prospective Charlotte-area businesses. The site is constantly evolving as new data sources and technologies surface, including new data from the city of Charlotte and new search/analysis features.

***Case Study – courtesy of ArcUser magazine

Multi-Tier GIS Application Use within the City Manger's Office

The CMO should be primarily a tier 3 GIS user. One copy of Tier 2 tool should be available to the City Manager's Office. The emphasis should be on using GIS technology rather than being a custodian of data and databases.

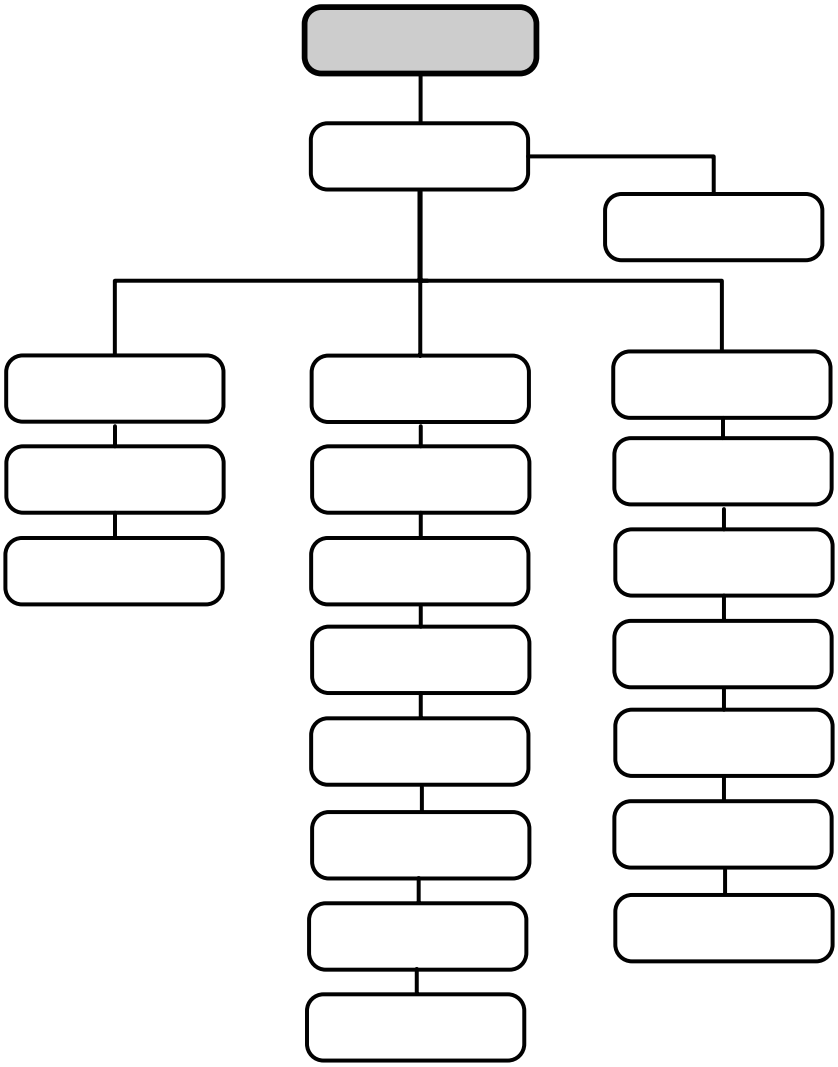


Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Economic Development (2

Existing Personnel and Duties

The mission of the Finance Department is to help citizens, the City Council, and staff wisely uses resources to improve the quality of life in Champaign. The Finance Department's organizational chart is below:



The Finance Department's management advises City Council, staff, and boards on financial matters, invests City funds, supports economic development activities, and manages the following divisions:

The Accounting Division

The Accounting Division is responsible for financial reporting, payroll, revenue collections, invoicing, and licensing.

The Financial Services Division

This Division serves internal customers by budget development and administration, establishing purchasing policies, coordinating purchasing functions, processing vendor payments, and maintaining fixed asset records. This division is also responsible for preparing the annual tax levy.

The Records Management Division

This division provides records management services and performs the statutory responsibilities of the City Clerk.

Existing Hardware and Software

Each staff person in the Finance Department has at least one desktop or laptop that is used daily. The computers are running the Windows operating system and use the following software s:

1. MS Office
2. GEMS (financial and billing application)
3. GroupWise- email, calendaring, and scheduling
4. TrakIt (business licenses and permits)
5. Team Budget Questica for CIP (budget application)

GEMS

GEMS is used for financials and personnel management. Data from GEMS should be extracted for mapping purposes.

TrakIt

TrakIt is available from CRW. The TrakIt system includes a series of modules linked with a GIS-centered database to allow users to create, issue and tracking planning activities. TrakIt stores information on zoning, ownership, sign applications, annexation agreements, historic property and other pertinent data. Data from TrakIt will need to be GIS enabled.

Questica

TeamBudget Capital includes features that improve the budget process.

Recommended GIS Needs and Duties

The Finance Department uses GIS technology on a limited basis, and relies on other departments for mapping and database information. The Department only uses maps for the NorthWest inteceptor fee recovery, and to attach maps to the Capital Improvement Plan (CIP) document. Current mapping and GIS activities include:

A. Generating maps for fee recovery:
The Finance Department is responsible for generating maps, (which they receive from the Engineering Department) that indicate interceptor fee recovery for NorthWest. However, since the areas are not subdivided, the only way the Finance Department can identify the appropriate properties is to update the information after the final plat is approved; this technique is inefficient and costly. The Finance Department needs an application that allows key staff to browse, analyze, report, and map information about the City's infrastructure. The Department should not have to be rely on any other department for adhoc mapping.

B. Attaching maps to the Capital Improvement Plan (CIP) document:
The Finance Department attaches paper maps showing scheduled projects to the Capital Improvement Plan document. They also attach maps that feature projects in the CIP tour, but these maps cannot be generated by the Finance Department and the Department must again rely on the Engineering Department to produce them. The Finance Department needs an application that can be used by key staff to browse, analyse, report, and map information about the CIP and all city data layers. The Department should not have to be rely on any other departments for adhoc and CIP mapping.

C. The Finanace Department uses three main software applications that do not have a geo-spatial link (a link to digital maps). **GEMS, TrakIT,** and **Questica** store an abundance of information about financials, billing, business licenses and permits, and general CIP budget information The Finance Department needs an application that can be used by key staff to browse, analyse, report, and map information that is contained in each of these software packages. An integrated GIS application should be able to use the following geo-links for LINKING DATA TO THE EARTH'S SURFACE:

- **GEMS** - This application uses an ADDRESS or LEGAL DESCRIPTION to reference data to the earth's surface
- **TRAKiT** - This application uses A PIN # to reference data to the earth's surface
- **QUESTICA** – This application has addresses and custom fields CIP for use in determing the geographic location

It is recommended that the Finance Department extract data from GEMS, and Questica GIS for use in the city-wide intranet solution. Attribute data will be used to create digital GIS layers.

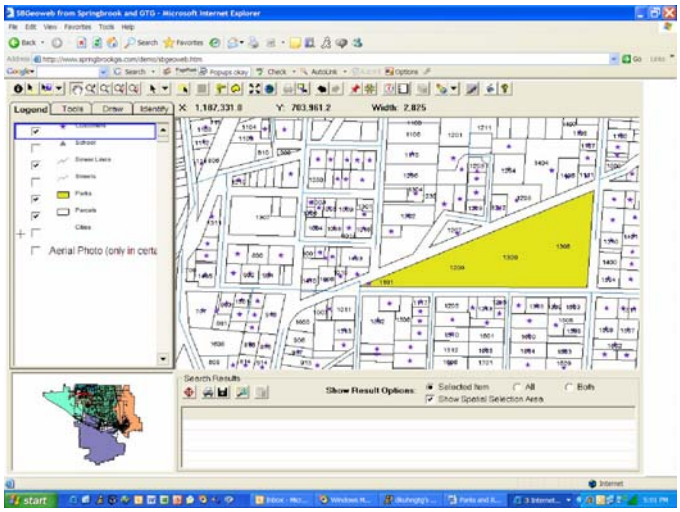
To produce maps and conduct spatial queries, the Finance Department needs an intranet application that can access the City's base map layers and specific data layers. An intranet GIS data browser can be installed on any computer. It is a tier 3 application with access to pre-defined GIS data layers determined by the user's business processes and workflow. User's will need to be able to respond to citizen's request, e.g. is my property within an SSA?; what is my tax rate?; can I operate a

business here (zoning restrictions)? These types of questions will be able to be answered via the Intranet application.

The table below illustrates recommended application functionality:

GIS Mapping Layers:

- Parcels
- CIP
- Business Licenses
- Billing Information
- Permits
- Property tax rates from other overlapping taxing districts (County Data)
- Zoning information
- Council Districts
- Financials
- Districts
  - Enterprise Zone
  - TIF
  - Special Service Area



Tier 3
Intranet GIS Data Browser

D. The Finance Department relies on Public Works to supply spreadsheets for GASB34 reporting. Information that is supplied to the Finance Department that allows a complete reporting of City assets includes:

- Pavement
- Curb
- Transportation
- Sewer
- Lighting
- Bridges

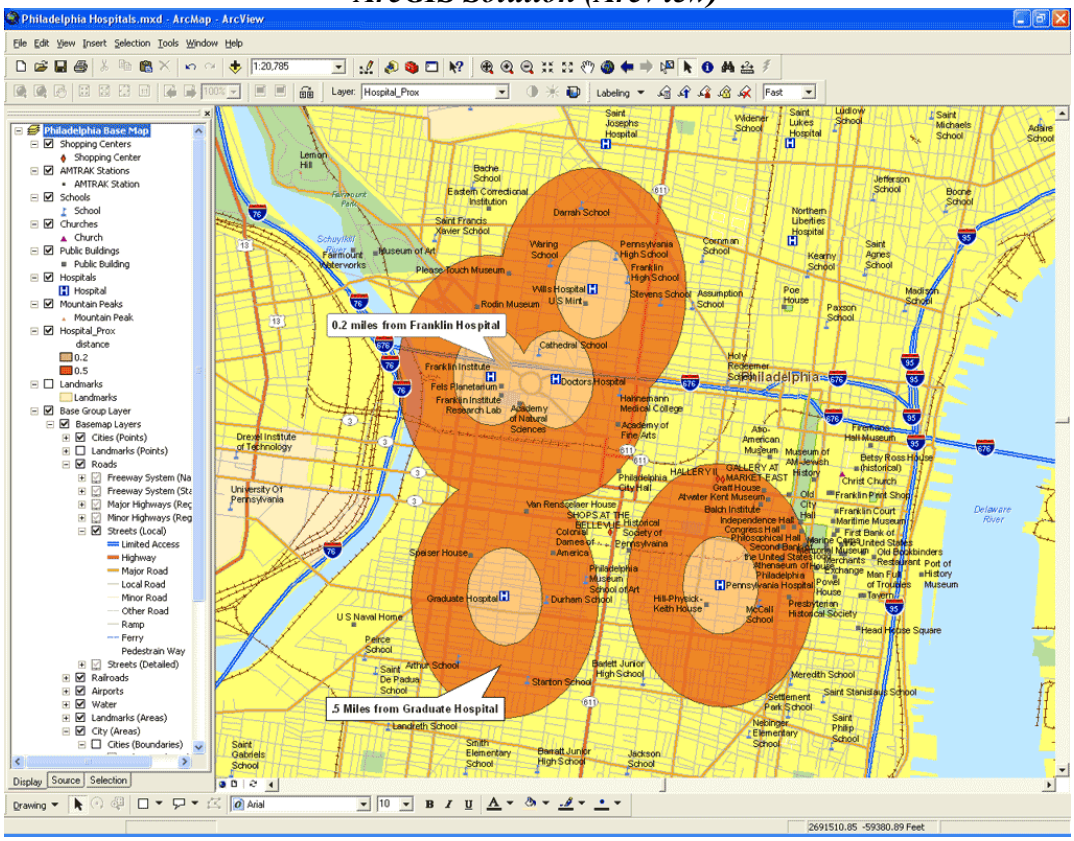
As the City's GIS intiative is implemented, the approach to reporting City assets will change. GIS will improve the management and maintenance and reporting of assets. The Finance Department does not need any changes to its existing GASB34 operations. GIS will replace spreadsheet reporting.

E. The Finance Department also needs Tier 2 analytical and mapping capabilities. The Department needs the following analytical tools:

GIS to Assess Property:

The Finance Department will rely on GIS technology to calculate average and median property values in specific areas or zones and trends over time. The Department needs to evaluate the tax revenues to include: **hotel-motel taxes, food and beverage taxes, sales taxes and property taxes and other miscellaneous revenues that can be identified by geographic info. Additionally, users will need to view building permit revenues over a defined period of time to predict building value currently under construction in an area.** Data for certain areas will need to be viewed to be able to predict property trends, map the number and distributions of licenses and alarms, and evaluate current trends.

ArcGIS Solution (ArcView)



Using a GIS application for spatial analysis, the Finance Department can produce reports and maps that:

Facilitate Special District Administration (SDA)

The Finance Department must consider SDA including Enterprise Zones (EZ), Tax Incentive Finance (TIF) and Special Service Areas. The Department can achieve quick success by using GIS to conduct a parcel validation analysis based on the Champaign county consortium parcel layer. This analysis can be performed utilizing the City's parcel layer in conjunction with the tax database.

☑ Mapping Businesses

Staff desire to be able to map licensed businesses to see the concentration and distance between the same types of businesses.

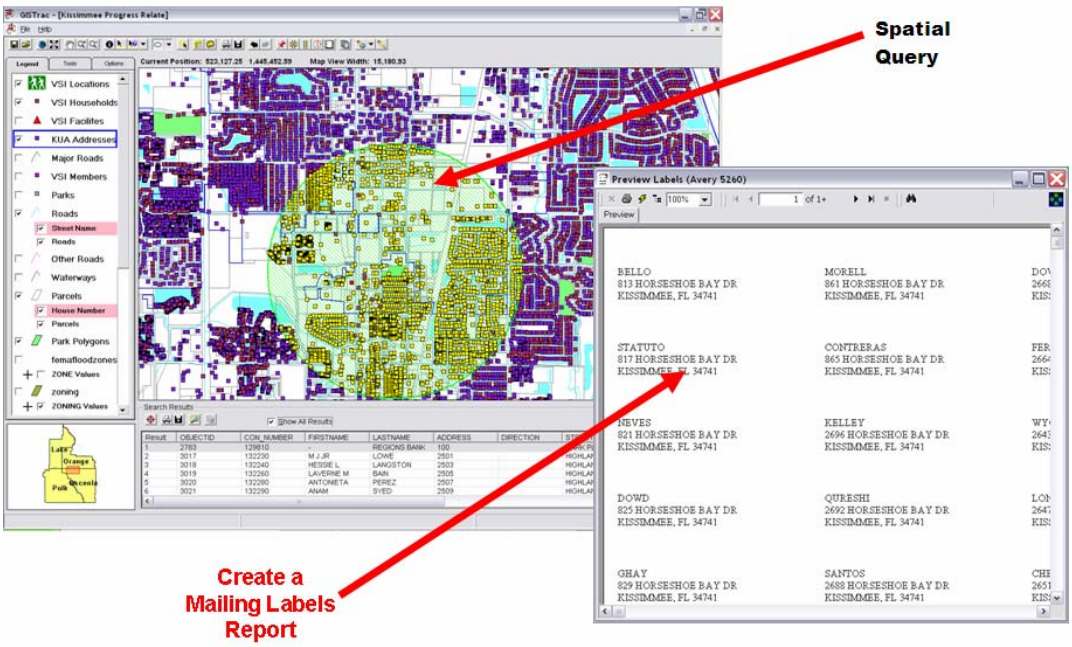
☑ Access Files From Other Departments:

The Finance Department relies heavily on files from other departments, which can be time-consuming and inefficient. The Finance Department needs access to Legal Department documents, including court and municipal fines, open cases and deeds. The Department relies on the Planning Department for all property and area information. The Champaign County GIS Consortium has property assessments and tax rate mapping, which the Finance Department needs to make decisions. The Finance Department needs:

- Legal files
- NSD Nuisance Abatements
- Planning documents
- County property assessments and tax rates

☑ Perform GIS Spatial Tabular Reporting:

The ability to query land, infrastructure, asset, and financial data layers by attribute values or proximity to specific sites will provide the Finance Department with powerful reporting capability. The following table illustrates how a GIS data browser can be used to query financial data:



Example of list development based on spatial query

Serve as Custodians of District Layers:

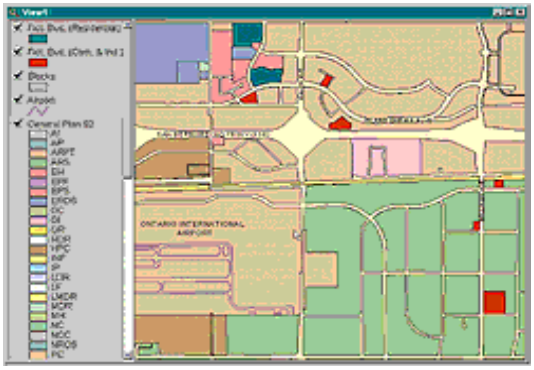
The Finance Department needs to continue to work with Planning and Economic Development staff who are in charge of creating, maintaining, and being custodian of the following districts:

- Enterprise Zones (1)
- Tax Incentive Finance (TIF) Districts (3)
- Special Service Areas (2)

The following case study is not directly applicable to the Champaign Finance Department but is illustrative as to how GIS can be utilized and might serve to give ideas for further utilization in Champaign.

Case Study: The City of Ontario, CA Collects Revenue More Efficiently

Faced with the uncertain economic climate in Southern California in 1993, many cities realized they needed to collect existing revenues more vigorously. Noncompliance with local business licensing laws was costing them thousands of dollars in lost license fees and sales tax, and uncollected penalties.



Instead of simply spending more staff time using the same old collection methods, the City of Ontario "*built a better mousetrap*" using the City's GIS. The resulting application was less labor intensive and produced far more revenue than more traditional methods.

Ontario, located in Southern California, has 6,000 businesses in its 36.8-square-mile jurisdiction. The potential revenues to be gained were enticing but the task of physically inspecting all businesses in the City was formidable. The traditional method of finding illegally-operating businesses required employees of the Revenue Division to canvass each neighborhood block by block on foot and then manually cross-reference licenses and inspections.

The revenue application began as a request from the Revenue Division for a map showing the commercial and industrial locations in the City. Revenue Division staff would be sent out to do a physical inventory based on this map that would focus their efforts and eliminate areas where businesses were very unlikely to be found. This original plan would have increased the efficiency of the physical inventory, but GIS staff realized that this audit could be more effectively done without ever leaving City Hall.

A pilot program was devised to test the GIS audit concept. Using ArcView GIS, staff searched the land use database for all parcels containing two or more commercial or industrial uses such as high rises, shopping centers, or industrial parks. The data associated with the assessor's parcel number (APN) were extracted and cross-referenced to the privilege license data file.

All parcels lacking a sufficient number of licenses for the reported uses were matched to the property owners and property management firms. Five hundred and seventy parcels were found that fit this profile. Mailing labels were generated from the privilege license database and generic letters sent to all property owners or manage

ment firms requesting a list of tenants.

The tenant list created from the responses obtained was run against the privilege license file. Tenants without privilege licenses were identified and notified by mail. Funds, not only for delinquent licenses but also for sales tax, were collected without staff having to walk a single City block.

The $114,972 collected by the pilot program was just the beginning. Privilege license recovery is the gift that keeps on giving. Once businesses have been identified and entered into the city database, they become an ongoing source of revenue. This revenue was realized using just two hours of staff time from the GIS department to perform the property searches and analysis, generate files, and create labels, all at a cost of just $30. This contrasts sharply with the 117 hours and $13,062 that would have been needed to perform a traditional field inventory.

GIS is effective because it taps into the geographic component--whether it is an address or a parcel number--that ties city database files to locations in the real world. This makes "invisible" businesses magically appear. Businesses present in the parcel layer are conspicuous by their absence from the privilege license database.

Not only does GIS allow efficient analysis of city databases for revenue auditing, but it is a project management tool for conducting and monitoring audits. The area to be audited can be divided into manageable chunks so that staff is not overburdened. Map-driven audits allow for a systematic inventory of the entire city in a timely fashion. Areas of noncompliance can be targeted. These project management benefits of GIS audits are intrinsic. No extra project management program requiring staff training time and maintenance is required.

The ease of use of ArcView GIS coupled with the ability to customize the interface and functionality for users meant the system could move into the department with a minimum of training and resistance. The application has been popular with Revenue Division staff who appreciate that it makes them much more effective. "By using the GIS technology, it

has certainly made my job easier, faster, more accurate, and efficient. I am able to audit for unlicensed businesses by computer and maps rather than complete field work. GIS is great!" says Pansy Welton, auditor/collector for the City of Ontario.

Because ArcView GIS is able to easily integrate data from many sources, city license files can be run against commercially available data sets such as MetroScan and TRW. These data sets are a cost-effective way to get data that are updated much more frequently than assessor's data. Geocoding verifies data from city files by forcing data back into the database that would otherwise drop out if selections were made by areas such as ZIP Codes or census blocks.

A natural progression from the Privilege license Audit was the Commercial Property Audit, which identifies owners of commercial land who lease out their properties but do not pay privilege license or sales taxes to the City as required. While the traditional Commercial Property Audit found $27,000 worth of license income, the GIS implementation of the same audit generated $200,000.

The success of the privilege license and commercial property audits quickly led to revenue audits for other fees and licenses. The City of Ontario currently performs GIS audits on industrial parks, commercial properties, warehouse properties, and on the downtown assessment area, as well as creating maps for outside consultants to use in field audits.

The newest auditing application is the Fictitious Business Name Audit. It is not uncommon for businesses to file a "Doing Business As" statement with county, state, and federal agencies, but to then fail to obtain a current local privilege license. Ontario purchased the "Doing Business As" county database file for a mere $5, ran the file against City records, and uncovered illegally operating businesses that were not previously found.

Chris Thomas, former GIS Specialist for the City of Ontario and now local government industry manager at ESRI, originated and refined revenue auditing for Ontario. He strongly believes starting a GIS program with revenue auditing may be the best route for many cities currently without GIS capabilities. "Revenue auditing with GIS allows a city to grow their GIS by quickly producing revenue and enlisting the support of city officials," says Thomas.

**Case Study Courtesy of ESRI ArcNews Magazine*

Existing GIS Data Layer Inventory and Future Recommendations

The Finance Department must have access to all City GIS data. The table in *Chapter 2 IT Department* documents city-wide data layers. We recommend that the Finance Department also use the following layers:

- Track-It (permit fees, licenses, and court and municipal fines)
- Sales Tax Database (by business)
- Food and Beverage Tax (by business)

- Hotel/ Motel Tax (by business)
- Fixed Assets/ City Owned Properties (City Clerk has existing responsibilities)

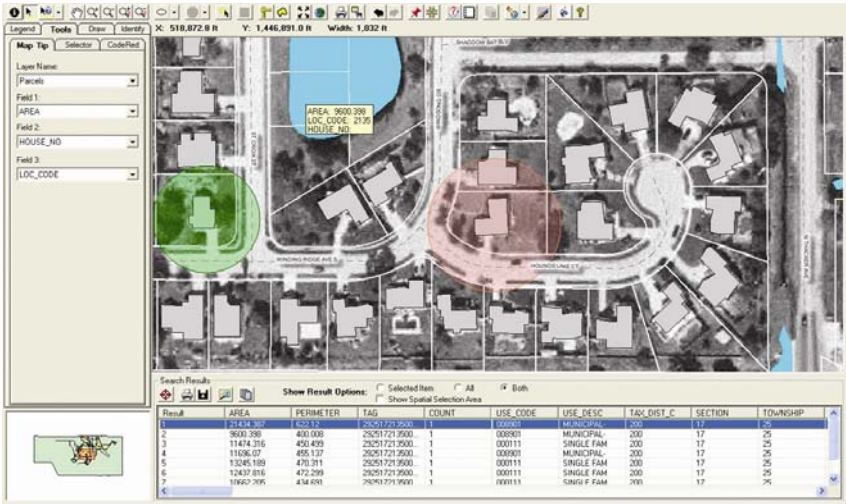
Recommended GIS Applications

It is recommended that the Finance Department use Tier 3 (Browser) and Tier 2 (Analytical) GIS Solutions. The following describes the four recommended solutions:

#1 Intranet GIS Data Browser

An ArcGIS server-based intranet GIS data browser is recommended to give Finance Department staff the ability to view and analyze GIS data.

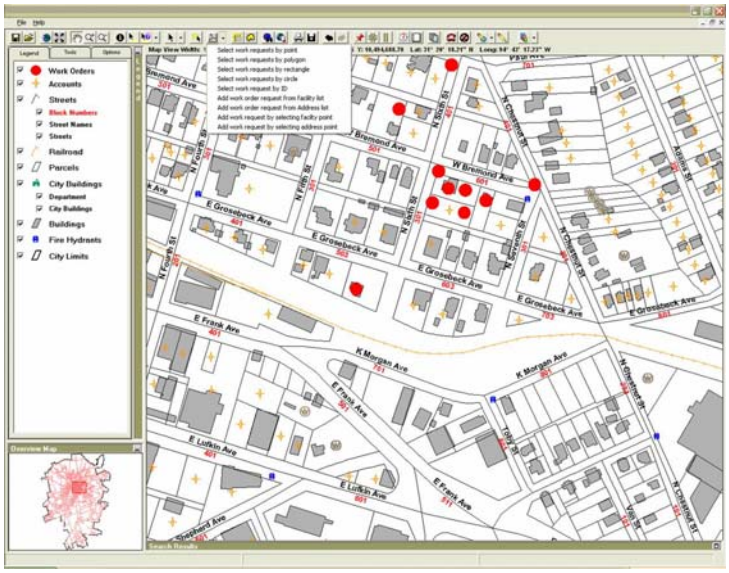
The City of Champaign expressed an interest in providing city staff with access to online maps and geo-spatial information via intranet. An enterprise intranet GIS Browser application, based on ArcIMS, will be needed to provide such a solution. The intranet browser should have an intuitive interface, and should incorporate the use of a graphic outline.



Intranet Solution

#2 GEMS GIS Interface

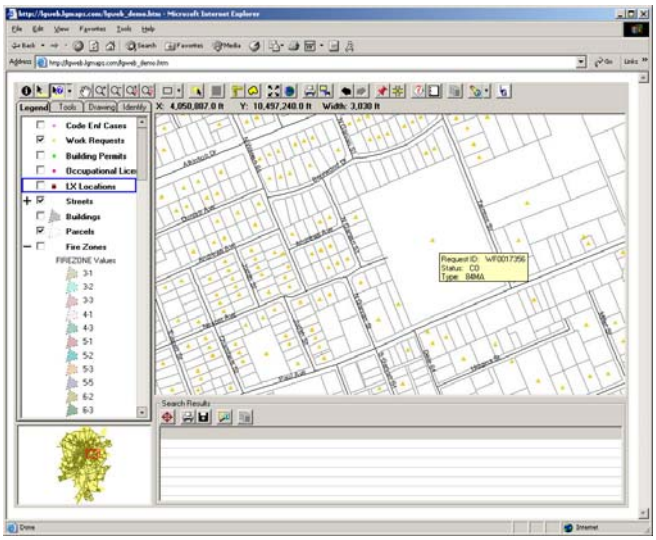
GEMS is used by Champaign for financials and personnel management. Data from GEMS should be extracted for mapping purposes.



GEMS Data Access Via a Map Interface

#3 TrakIt GIS Interface

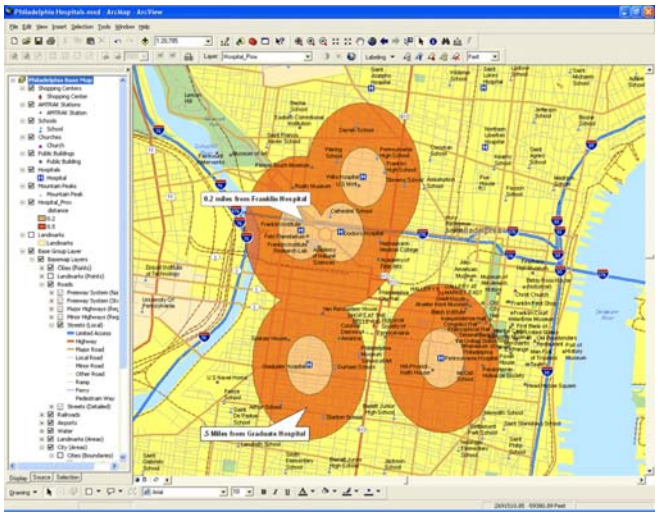
A key need identified by Finance personnel is better access to shared City GIS data. This includes the most recent parcel, address and street centerline data as well as high-resolution ortho-photography. Also, staff need to be able to visualize all historic and current data in the TrakIt application. Information such as zoning violations, zoning changes, sign applications, sign violations, etc., is housed in TrakIt. Using a back-end geocoding application will make these data available as discreet GIS data layers. Data should be available via the GIS once entered into TrakIt. Staff will use an intranet GIS data browser to access it.



The Finance Department will be Able to Quickly Visualize all TrakIt Records

#4 ArcView

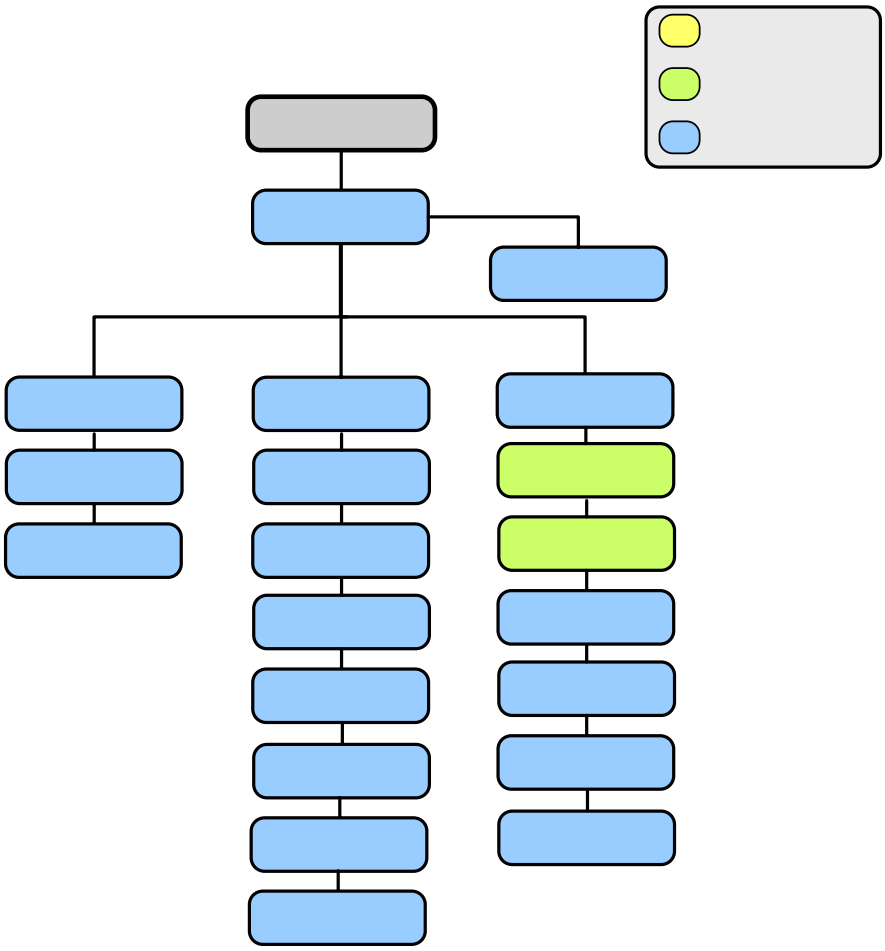
The Finance Department requires some analytical functionality that can be offered by ESRI's ArcView .



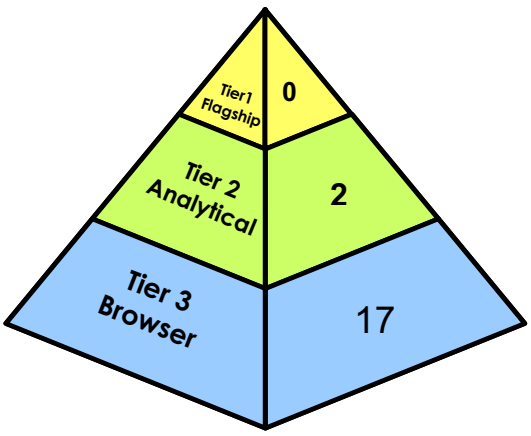
ArcView

Multi-Tier GIS Application Use within the Finance Department

The following graphic describes the recommended departmental GIS user roles for the Finance Department based on the three tiers of GIS.



There are two users in the Finance Department considered a Tier 2 user; all others are Tier 3.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The mission of the City of Champaign Fire Department is "To protect life and property by providing our community and customers with quality services through emergency response, code administration, fire prevention, and education in a professional, courteous, and ethical manner."

The Department consists of six divisions is responsible for the following:

- *Administrative Division*
  - Leadership, management direction, supervision, coordination, and general support for all Fire Department operations.
- *Fire Suppression Division*
  - Responds to fire, emergency medical, hazardous materials, and technical rescue situations
  - Responds to mutual aid calls
  - Strives to ensure a fire-safe environment for citizens and employees
  - Complies with state and federal regulations in regards to hazardous materials
  - Provides public fire education programs
- *Building Safety Division*
  - Provides enforcement of City codes relating to new building construction including
    - Building permit applications
    - Reviewing code compliance
    - Inspection of all new construction
- *Fire Prevention Division*
  - Informs citizens of fire and life safety hazards
  - Conducts inspections of commercial and state-owned properties
  - Responds to complaints in regards to non-commercial and state-owned properties
  - Conducts fire investigations
  - Serves as Public Information Officer for the Department
- *Training and Emergency Medical Services Division*
  - Provides fireground, emergency medical, hazardous material response, technical rescue, and leadership training.
  - Manages the emergency medical services of the department
  - Monitors performance of ambulance companies
- *Emergency Management Division*
  - Coordinates the emergency management and disaster preparedness program for the City
  - Revises and exercises the Emergency Operations Plan
  - Provides public education

The Fire Department employs approximately 125 staff members. Fire fighters work 24 hours on duty and then 48 hours off. Approximately 5,600 calls for service are logged annually. Six stations serve Champaign with a desired response time of less than four and one-half

minutes at least ninety percent of the time. Dispatch is handled by MetCAD. During an emergency situation the Fire Chief becomes the Emergency Operations Center (EOC) Coordinator.

At present, the Department does utilize GIS tools via software from Deccan International. This software utilizes MapInfo for various GIS tasks. The majority of GIS users in the Fire Department will be Tier 3 GIS Users; however, some GIS use within the Department will involve more complex GIS data analysis, mapping, and some geospatial data creation, such as that of Tier 2 GIS Users (see Chapter 4: Governance Model for more information on Tier 2 & Tier 3 GIS Users). The recommended GIS Coordinator should be utilized to assist with any of the more complex tasks.

Existing Hardware and Software

The Fire Department has approximately forty personal computers running Windows 2000 or Windows XP operating systems.

The Fire Department uses the following software applications:

1. Firehouse – used for incident tracking, fire code violations, Knox Box tracking, MSDS tracking, hazardous materials location tracking, and pre-fire planning
2. Visio – Used for pre-fire planning and then attached to FireHouse
3. TRAKiT – new construction, permitting
4. Deccan – defining run orders, station location analysis, response time analysis, historic performance analysis
5. MapInfo – Used in conjunction with Deccan
6. ArcGIS – have access but not using extensively
7. Group 1 – Remote Access (mobile data computers in the fire apparatus)
8. GroupWise – email, calendaring, and scheduling
9. Microsoft Office – used for office productivity

Firehouse

Firehouse is utilized by the Department for incident tracking, tracking fire code violations, Knox Box tracking, hazardous materials tracking. The software is being utilized extensively by the department.

NFIRS 5.0 Incident Report

Incident Investigation Report

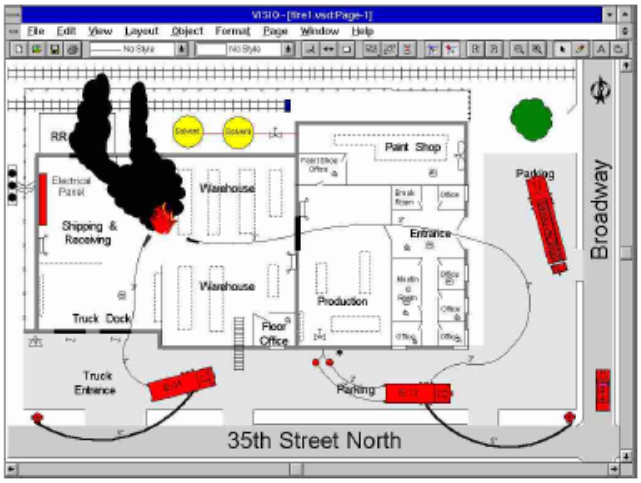
Hydrant Management

Occupancy

Firehouse Modules

Visio

Microsoft Visio is utilized for creating fire pre-plans. These pre-plans can then be stored in Firehouse. Each of these pre-plans should be linked to the GIS for viewing by pertinent departments.



Building Pre-Plans in Visio

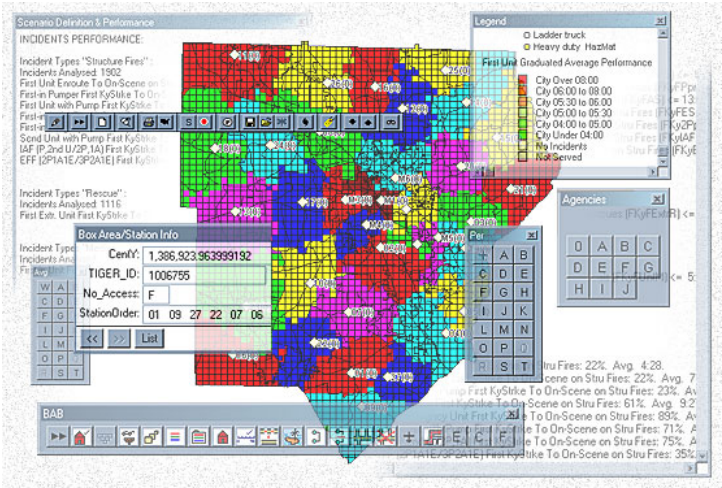
TRAKiT

TRAKiT is available from CRW. The TRAKiT system is comprised of a series of interrelated modules that are linked with a GIS-centered database to provide a system for creating, issuing, and tracking any type of Community Development activity. A single screen interface allows users rapid access to all the modules and interfaces within the system. Building Safety and Inspections utilizes TRAKiT for permitting and certificates of occupancy.

TRAKiT

Deccan

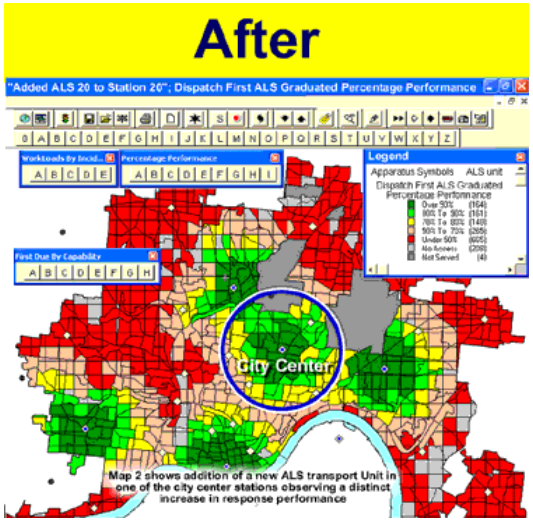
Deccan software is utilized for defining run orders, station location analysis, and response time analysis based on historical performance. Improved GIS data will add accuracy to the projects for which Deccan is utilized.



Deccan Software

MapInfo

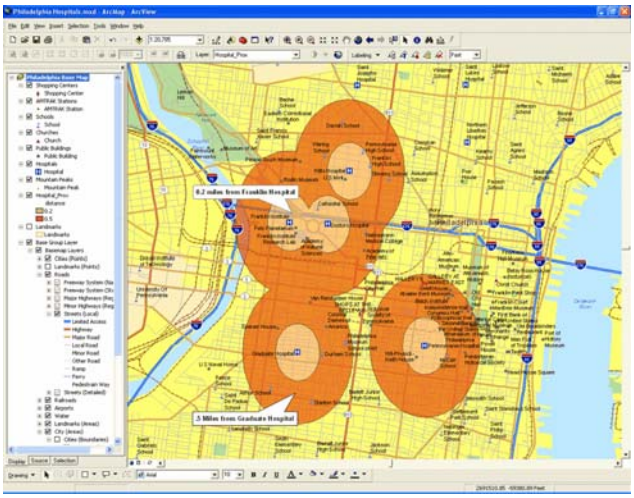
MapInfo is utilized in the Fire Department because the Deccan software utilizes it as the GIS engine for their software.



Fire Response Optimization Using MapInfo

ArcGIS

ArcGIS is currently used in a limited capacity. Limited licenses for the City often make the software inaccessible.



ESRI's ArcView

Group 1 - Remote Access

Group 1 Solutions, Inc. aides in force and property protection by giving fire, police, and EMS fast and easy access to critical emergency response data en-route to an incident and during planning.

Group 1 – Remote Access

Recommended GIS Needs and Duties

GIS will be crucial in the Department's need to integrate technology in support of incident response, fire safety, building permitting and inspections. The Fire Department will be able to utilize GIS in day-to-day tasks, such as incident analysis, integration of building safety and inspections records, and public outreach. In addition, the Department will also be able to utilize GIS for strategic objectives, using sophisticated analyses to improve decision-making as well as reducing response times.

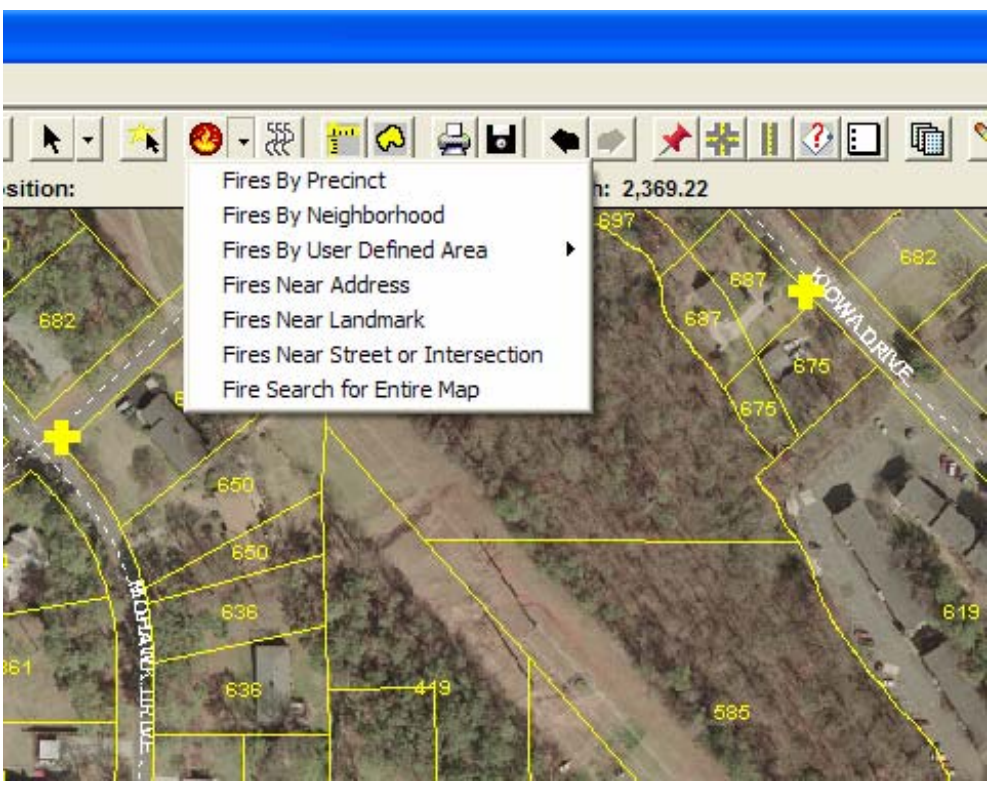
Based on this needs assessment, the Fire Department has several GIS needs, including:

- Spatial analysis of fire incidents
- Spatial analysis of inspections, building permits, and certificates of occupancy for Building Safety

- GIS for ISO rating
- Field access to geospatial data (MDCs currently in-house)
- Emergency Operations disaster response and recovery
- Enterprise access to digital pre-plans and hazardous material data
- Mass Notification
- Public access to building safety and inspections data

Spatial analysis of fire incidents

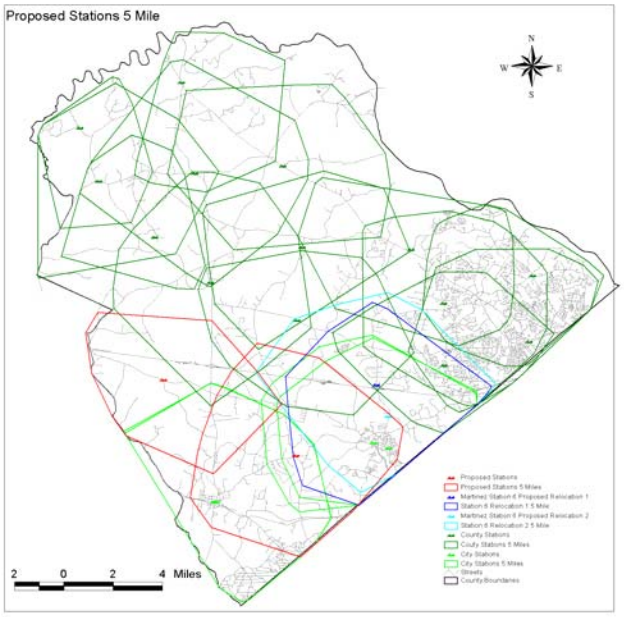
E-911 calls are handled by METCAD, who then dispatches the call to the appropriate agency. Call information is then downloaded into Firehouse software. Firehouse then houses this incident information for reporting and analysis. It is being recommended that the City implement an ArcServer based Intranet browser. This browser will allow each department to view pertinent data in a geographic context. Firehouse data will be address matched to the recommended address point layer. Each record will then be given a fixed x, y coordinate and will be available on the map for analysis, query, and reporting. Other data tied to these records such as pre-plans and hazardous materials information will be accessible via the Intranet. This application will allow staff to access incident information; as well as; do routing and quickly determine areas affected by a spill or fire.



Quick Viewing of Incident Data Residing in Firehouse

Fire Department staff should utilize the Intranet GIS data browser to conduct basic spatial analysis and to produce maps and to assist in day-to-day activities. This Intranet browser will serve the entire City but will have a specific link for the Fire Department. For more advanced analysis and other tasks such as data creation, determining drive times, or finding

the optimal location of a new Fire Station, the Fire Department currently utilizes Deccan software. This type of analysis can still be done with the Deccan software.

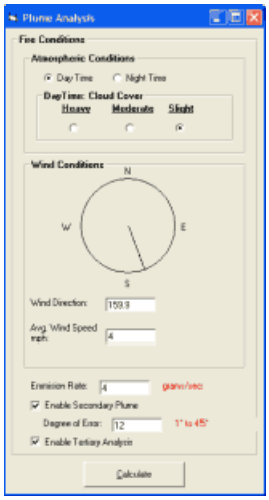


Fire Station Location Analysis Using GIS

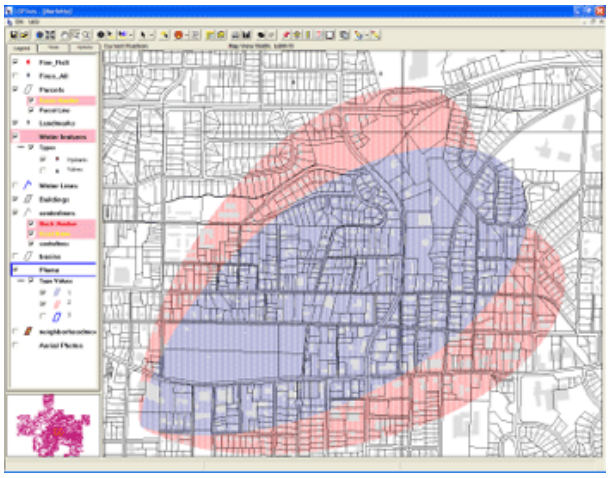
The Fire Department can utilize GIS to assist in several tasks, including:

- Evaluating the Insurance Services Office (ISO) rating
- New station location analysis
- Tracking hazardous materials
- Optimizing and reducing response times
- Disaster response and recovery
- Hydrant Locations
- Emergency Operations Center activities
- Optimal routing
- Code Violations
- Optimal districting
- Resident information
- Incident Pin mapping (Fire)
- Arson Fire mapping
- Drive-time studies
- Viewing alternate street routes
- Showing inspected businesses and location of code violations
- Statistical analysis for budgetary preparations
- Optimal spill response – downstream and upstream tracing
- Evacuation route planning
- Using maps for training personnel
- Homeland Security activities

GIS can also be used to conduct hazardous material release/contamination modeling. GIS offers a means for deriving time-critical information, such as plume analyses for gas releases, water and sewer contamination modeling (contaminants in water/sewer systems), and risk/catastrophe modeling.



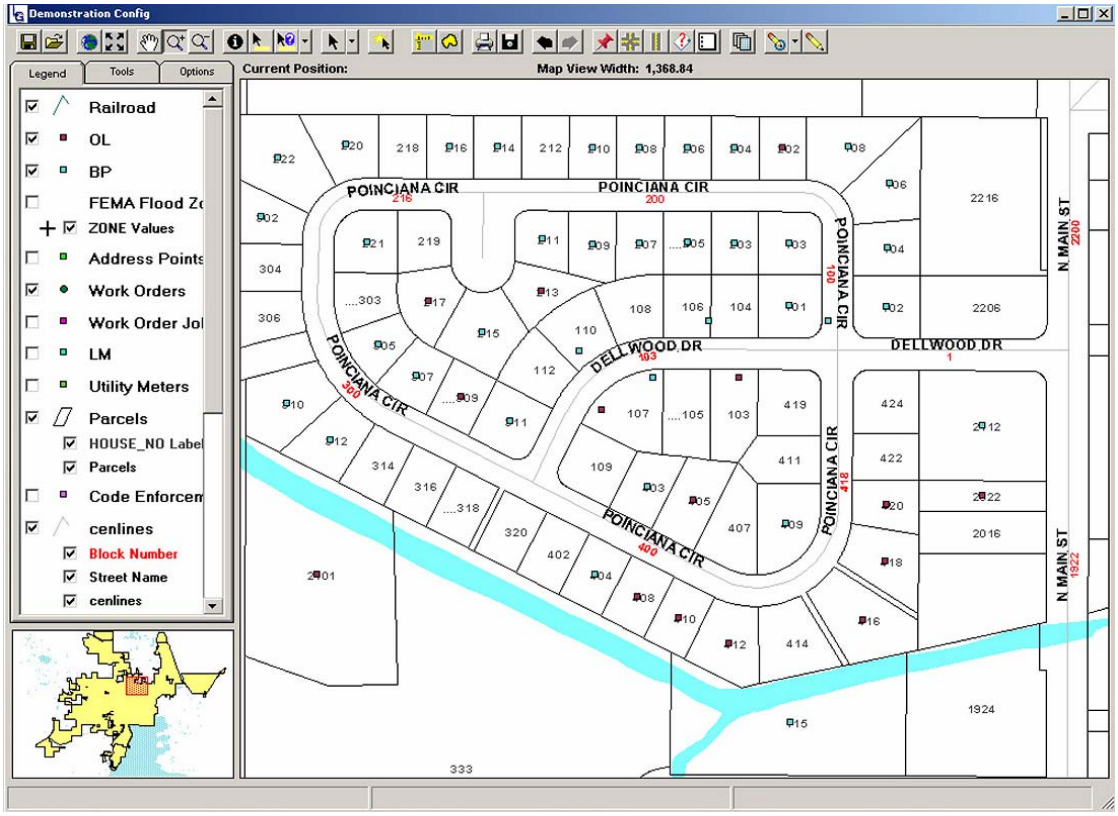
Example of Plume Analysis Modeling Interface



A Plume Analysis Map Can Provide Valuable Information for Determining Contamination Paths, Rates of Dispersion, and Identification of Affected Populations

Spatial analysis of inspections, building permits, and certificates of occupancy for Building Safety

A key need identified by Building Safety personnel is access to GIS data within the City. This includes the most recent parcel, address and street centerline data as well as high-resolution ortho-photography. Using the most recent, accurate GIS layers provides staff members with an invaluable tool for everyday tasks. It is recommended that an enterprise-wide ArcServer based Intranet GIS data browser tool be utilized to access pertinent data for Building Safety. This application will not only allow users to view GIS data but data entered into TRAKiT as well. For instance, users will be able to view building permits and certificates of occupancy as soon as they are entered into TRAKiT. Additionally, users will be able to see pending inspections and use the ArcServer Intranet application to create and optimal route and route manifest for each staff person. Both data from Firehouse and TRAKiT will be GIS enabled and viewed within the ArcServer application.



Easy Query and Analysis of data

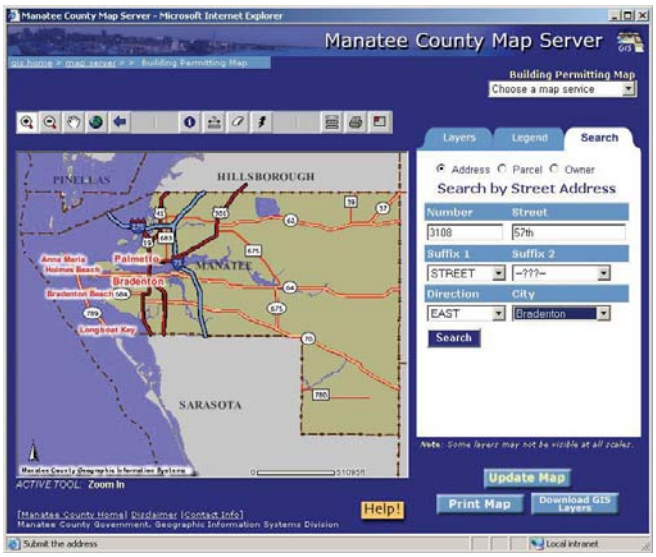
Case Study: Manatee County Building Department Uses GIS for Permitting Work Flow

Located on the central Gulf Coast of Florida, Manatee County government in Bradenton, Florida, serves a population of roughly 290,000 citizens. Like much of south and central Florida, the population in Manatee County has been steadily increasing. Since the 2000 census, an estimated 23,000 people have relocated to the county. Along with this increase in population comes an increase in construction of new buildings and infrastructure. The Manatee County Building Department is responsible for issuing the permits for this construction.

In the past, the Building Department's daily procedures involved tedious parcel-level research using multiple data sources. A good example is the use of cumbersome sets of static paper maps to delineate property boundaries, future land use, zoning, and flood prone areas. The data on these maps is only as current as the day it was produced. Reviewing a permit application using outdated data can lead to a whole host of problems, including legal issues.

Background

Well before the groundbreaking of any new construction, an extensive building permit application review is done. During this review, the location of the property, zoning, future land use, flood zones, overlay districts, impact fees, and watersheds are all considered before the issuance of a building permit. The application process can be straightforward if applicants have done their research. On the other hand, if applicants have not done research on the property on which they would like to build, the process can be drawn out and frustrating to both the applicant and the Building Department.



Manatee County staff are presented with an initial map extent of the entire county and the ability to search for a more specific piece of property.

Project Start-Up

The Manatee County GIS section, housed within the Information Services Department, was started in 1990 with a few workstations and ArcInfo licenses. The main responsibility of the section was to generate basemapping data and create a digital representation of the parcel fabric. As time went on and the true power of GIS was realized, the GIS section's responsibilities grew. In its current form, the GIS section supports any county department needing GIS services. This includes the Planning, Environmental Management, Agriculture and Natural Resources, Utilities, Transportation, and Building Departments.

The range of responsibilities of the GIS section made its goal explicitly clear: an enterprise GIS flexible enough to support the differing needs and skill levels of each department. The first enterprise-minded project tackled was to create a Web-based GIS tailored to the specific needs of the Building Department. The GIS would deliver fast, accurate, and current data within a single user-friendly application, which in turn would streamline the cumbersome permitting work flow. Staff from the GIS section met with staff from the Building Department to determine the users' needs and a scope of work. After several meetings, the scope became clear, and it was time for the GIS section to decide on the method of delivery.

Since the Building Department had a varying number of users with varying skill levels, the GIS section wanted to deploy a thin client application that was easy-to-use and accessible anywhere. After considering many options, ArcIMS was chosen because of its ability to serve browser-based GIS applications, relative ease of customization, and user friendliness. To handle the high volume of traffic anticipated, ArcIMS was installed on a Sunfire 280 server.

In Phase I of application development, the layout and functionality of the interface were created with many user testing and acceptance periods. Once the interface was accepted, Phase II began, which entailed map creation and symbology selection.

Project Scope

The initial two phases of the project consisted of providing the following items agreed upon during the user needs assessment:

- A linking of the ArcIMS map service to the building permitting database at the parcel level.
- Property appraiser information with the ability to query by parcel number, owner, secondary owner, business name, address, and secondary address. It was also imperative that queries would include condominiums and apartment complexes.
- Planning information with the ability to view parcel-level information on zoning, land use, future land use, overlay districts, and impact fee districts.
- Federal Emergency Management Agency Flood Insurance Rate Map information with the ability to view parcel-level information on flood zone designations.
- Environmental information with the ability to view parcel-level information on watersheds.
- Base map information including water features, streets, annotation, and aerial photography.
- Printable map with accompanying property data to attach to applications.

Project Implementation

The GIS section at Manatee County used a number of different tools in the creation of this application. The application uses ArcIMS 4.0.1, ArcSDE 8.3, Apache 2.0.48, Oracle9i, and Tomcat 4.0.12.

Making all this data available and searchable via a single application has made a previously tedious and time-consuming research effort quick and easy. As a result, the number of applications that can be researched and processed by the Building Department has increased dramatically.

By also making this application available to the public via the Internet, applicants are better prepared beforehand. This not only makes the application process move more efficiently, it in turn cuts down on public foot traffic in the Building Department as well.

**Case Study Courtesy of ESRI ArcNews Magazine*

GIS for ISO Rating

At this time, the City of Champaign Fire Department ISO rating of two. This is very difficult to improve upon. However, there are components of the ISO rating that relate to mapping and should be discussed. Less expensive fire insurance premiums are the result of a lower ISO rating. The ISO rating process requires fire departments to have the following resource documents and mapping capabilities:

1. Community Street Map – To Scale

   Plotted information Base

   - Named streets
   - Community boundary lines
   - Areas NOT built upon
   - Fire Station locations
   - Street Address - Numericals

2. Community Water Map – To Scale

   Plotted Information Base

   - Named streets
   - Water mains by size
   - Fire hydrants – numbered
   - Water tanks / Storage – capacity
   - Water pumping stations
   - Pressure zone(s)
   - Static water suction points
   - Dry hydrants and out-of-service hydrants

3. Map – Drawings of Water Supply Works

   Plotted Information Base

   - Intake supply line – size
   - Filtration-Purification Arrangement – capacity gpm
   - Pump Arrangement – capacity vs. head
   - Clear well(s): arrangement/capacity
   - Primary feeders: size arrangement

4. Fire District Map – To Scale

   Plotted Information Base

   - Fire Protection Response Boundary – served by community – currently done within Deccan
   - Five mile response boundary
   - Boundary of areas served by hydrants
   - Static water suction points
   - Dry hydrants
   - Bridge capacities
   - Schools
   - Shopping Centers
   - Commercial Centers

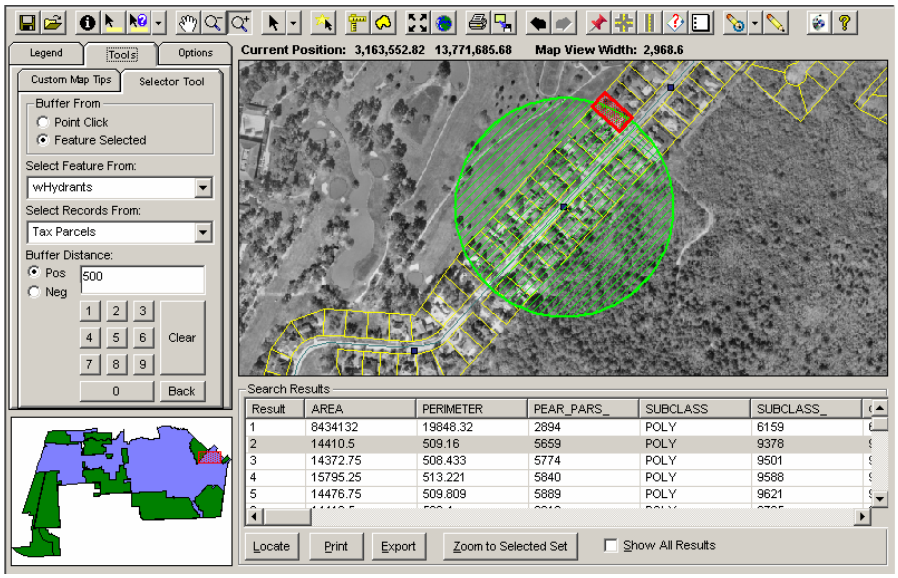
5. Regional Fire Protection Map – To Scale

   Plotted Information Base

   - Location of automatic aid companies – accomplished with Deccan – Barb software
   - Location of outside aid companies

With the implementation of GIS, each of the above tasks can be accomplished and can result in a cost savings to the residents of Champaign.

The Fire Department should work with the recommended GIS Coordinator on the creation of the GIS data layers need to generate these maps, as well as the generation of the maps.



Using GIS for ISO Ratings. A Query Based on 500 Foot Buffer around a Fire Hydrant Shows Which Properties Can Be Reached

Field Access to Geospatial Data

Another identified need by Champaign Fire and Building Safety personnel is to have field access to mapping data. Inspectors stated the desire to have GPS enabled mapping in their vehicles to assist in finding jobsites. There are two methods for personnel to access map information in the field:

1. Map Books
2. Mobile Computers

1. Map Books

The most cost effective solution for access to spatial information in the field is via map books. Map books can be generated for all personnel. Each page can display a different section of the City. The location of all pertinent features, such as critical facilities and schools can be displayed on top of base map information, such as labeled streets, tax parcels, building footprints with addresses, and even aerial photography. Map books represent an effective means of referencing the location of all pertinent features. As features are changed or added, new map books can be generated to reflect these changes.

It is recommended that Fire Department work with the GIS Coordinator for the production of custom map books until mobile mapping becomes available (Implementation of mobile mapping is currently underway). A free extension is available for ArcGIS software that can

be used for this purpose. These map books should contain up-to-date information and a variety of reference data.

2. Mobile Computers

A more advanced method for accessing spatial data in the field is through the use of laptops. A mobile data browser can be loaded on mobile computers, allowing the same capabilities offered by map books, but also the ability to conduct address searches; query attributes of all information, such as schools, types of hazardous material stored at a location; link to digital building pre-plan drawings, and optimal routing. The Fire Department relies on METCAD for 911 dispatch. As aforementioned, inspectors stated the desire to have GPS enabled mapping in their vehicles to assist in finding jobsites. Mobile data computers (MDCs) are currently being installed in fire vehicles.

Emergency Operations – disaster response and recovery

During an emergency the Fire Chief becomes the Emergency Operations Center (EOC) Coordinator. During and emergency staff are required to manage disaster response and recovery; as well as; be in the field after a disaster, such as a tornado or snow event. They are required to manage damage assessment and report this information back to the City for reporting to the state and federal government and for recovery operations. It is recommended that Champaign implement a disaster recovery tool that will enable staff with pen top computers to quickly assess and report the extent of a disaster. This application will allow users to enter the damage done on a site by site basis. Also, the computers will be GPS enabled so that the location of each field representative and the path they have already traveled can be easily ascertained. This application should be tested annually to insure that each of the components is in an operational state. Various GIS tools exist for disaster management. MaxResponder is utilized by some organizations.

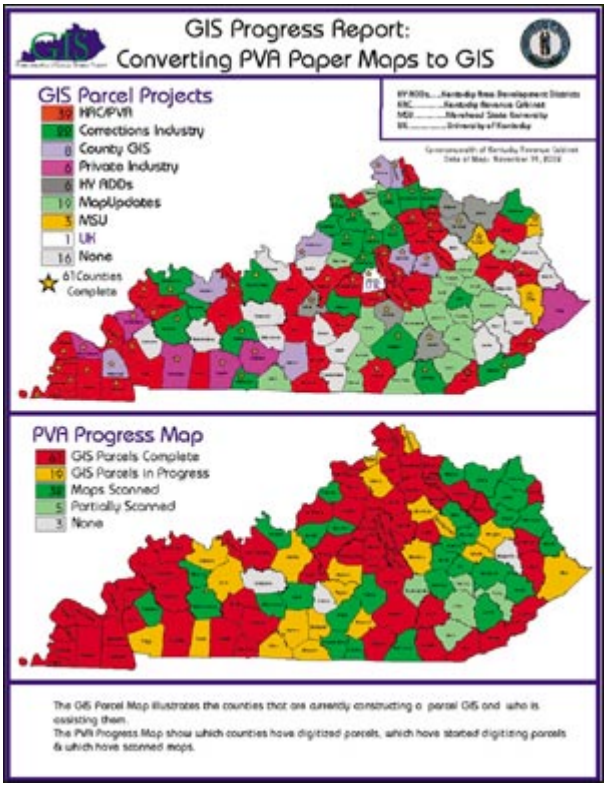
MaxResponder

MaxResponder brings geospatial tools to the aid of Fire, EMS, Police, HAZMAT Spill Response, Emergency Management and other agencies responding to everything from small house fires to large-scale terrorist incidents. MaxResponder includes an Administration Module which allows organizations to create and manage their own first responder databases including strategic pre-plans and floor plans geo-linked to their own custom GIS layers. In order to allow remote data entry of pre-plan data into the database, MaxResponder includes a Data Collection Module. Finally, to distribute this geospatial database in the field, the MaxResponder Mobile Module gives responders a user-friendly in-vehicle geospatial solution. This Fire Department utilizes Group 1 for some of these functions. MaxResponder should be considered as further functionality is needed.

Case Study: Providence, Kentucky, Digs Out From Tornado Damage with the Help of GIS

On Sunday, April 28, 2002, at 3:00 a.m., an F3 (on a scale of F0-F5 with F5 being the most violent) tornado hit the small town of Providence, Kentucky, damaging 378 structures in a town of approximately 2,500 parcels. More than 150 houses were destroyed in this natural disaster.

On Monday morning, the Webster County Property Valuation Administrator's (PVA) Office contacted the Kentucky Revenue Cabinet (KRC) to inform it of the disaster and request assistance.



Background

The PVA uses GIS to maintain maps of parcel lines to identify property ownership with tables of information and characteristics of each parcel and road centerlines to assist 911 in addressing, and it uses customized printouts to show price per square foot of residential housing or price per acre for farmland to assist in assessment of properties geographically.

In 2000, Webster County received a technology grant under Commissioner of Revenue Vince Lang and purchased computer equipment and ArcView software under a state bid procurement to begin digitizing parcels.

Old maps were scanned in by the Technical Support staff and registered to MrSID aerial photos using the ArcView Image Analysis extension. This was a relatively simple task that required a project be set up in ArcView with the base layer being the desired output data; then the scanned images were moved and resized by clicking on two points that should be identical. The software yielded a distortion factor to allow the user to see what level of distortion may be occurring between registered control points.

Technical Support then trained the Webster County staff on digitizing parcels from the overlay and other information tables on parcels. Digitizing parcels is done by registering old map information, then digitizing the lines as they appear on the registered image. When that image is removed, the lines should fit on the newer image. This required learning how to set up projects, add image layers, add feature layers, set properties for points and lines such as color and size, and use draw functions.

Webster County PVA was also assisted by Bill Smith and Philip Meyer of the Green River Area Development District who GPS located road centerlines and provided shapefiles of county, city, and other data that they had digitized or acquired from other sources.

Taking the Bull by the Horns

With this wealth of information available, Commissioner Lang sent KRC GIS Coordinator Mike Tackett to ground zero to begin the assessment of damage. Tackett obtained the most current shapefiles from PVA to begin this project. Entering an area that had been secured by National Guardsmen, Tackett received assistance from the nearby Crittenden County Road Department. In a little more than one day, they were able to GPS locate each damaged structure; enter information into a table, and hyperlink a photograph. This enabled PVA to locate each damaged structure for reassessment and estimate the damage that had occurred.

More than 150 houses were destroyed in this natural disaster

"GIS is essential for disaster projects such as the Webster County tornado project," says Tackett. "Instead of the damage assessment work taking months, with GPS and GIS the damage can be assessed in days or weeks. The GPS data was collected and photographs were taken in less than two days with all the processing and hot linking of photographs done at night in Webster County. And with just a little extra work, PVA assessment data was attached to show an estimated amount of property damage."

The Technical Support staff took this information and printed maps for Webster County PVA, Municipal Office, and county officials. The Municipal Office used these maps to track turnoffs and turn-ons of electric, gas, and water and debris removal.

"ArcView helped us assemble the data and print maps for the Providence Fire Department," says Tackett. "These maps were used to mark any property missed in the initial survey and keep track of gas valve or electricity turnoff for the Fire Department."

The maps and data were provided to the U.S. Federal Emergency Management Agency (FEMA), which then declared the area a federal disaster eligible for federal assistance for cleanup and rebuilding. Since then, many individuals are either in new homes or at some stage of repair or rebuilding of their damaged homes.

Although GIS has been used by other agencies in Kentucky over the past 15 to 20 years, GIS is relatively new to the Commonwealth of Kentucky Revenue Cabinet, which has made great strides in digitizing parcels in many Kentucky counties with the assistance of State Valuation's Technical Support Branch--Ron Johnson, cartography branch manager; Patti Royster, program coordinator; Mike Tackett, GIS coordinator; and Patti Hall, David Thornton, and B. David Wilson, geoprocessing specialists.

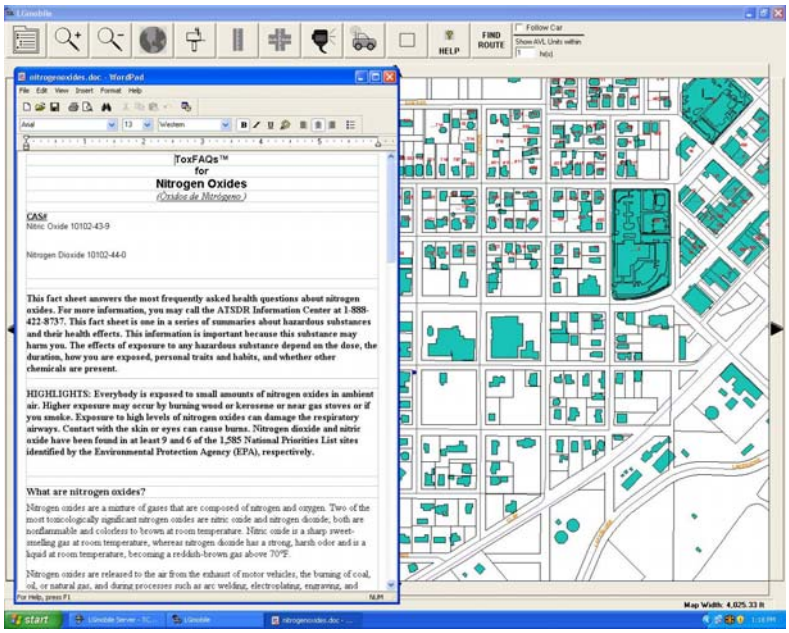
To see the path of the tornado with damaged structure points, visit www.webstercountypva.com and click on Property Maps. A map of this county has been set up by Kent Anness of the Kentucky Infrastructure Authority, which has provided support and

assisted with the Webster County GIS. For more information on Kentucky GIS, visit. www.kygeonet.state.ky.us.

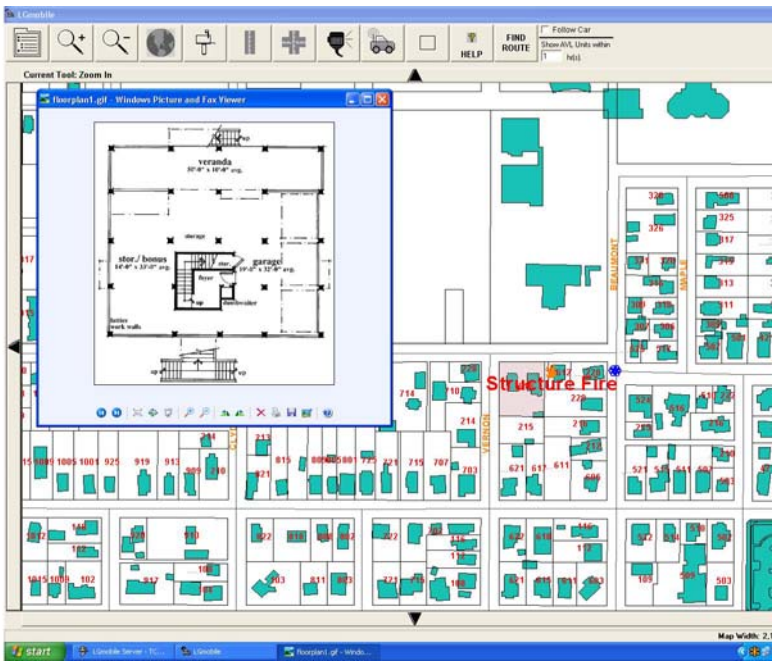
**Case Study Courtesy of ESRI ArcNews Magazine*

Enterprise access to digital pre-plans and hazardous material data

The Fire Department is creating and maintaining many pre-plans in Firehouse. Linking plans to GIS can add additional information and analysis capabilities. Pre-plans of critical facilities should be linked to the GIS Intranet application and a mobile data browser application. These pre-plans should be attached to a Firehouse record and then the images retrieved via the GIS interface. An icon will show up in the application if a pre-plan is available for a structure. Additionally, hazardous material information is being entered into Firehouse and should be accessible via the existing Group 1 – Remote Access application via the MDCs.



GIS Accessing Pre-Plans and Hazardous Materials Information



GIS Accessing Pre-Plans and Hazardous Materials Information

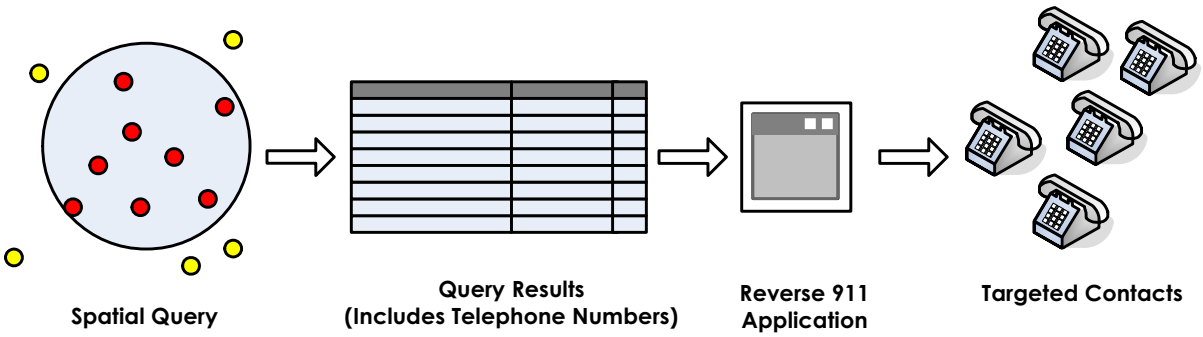
Mass Notification System

GIS has proven to be a valuable technology for community alerting mechanisms, such as a Mass Notification System. It is recommended that the city implement a GIS-based Mass Notification System solution. The Fire Department should have the opportunity to participate in this recommended city-wide application.

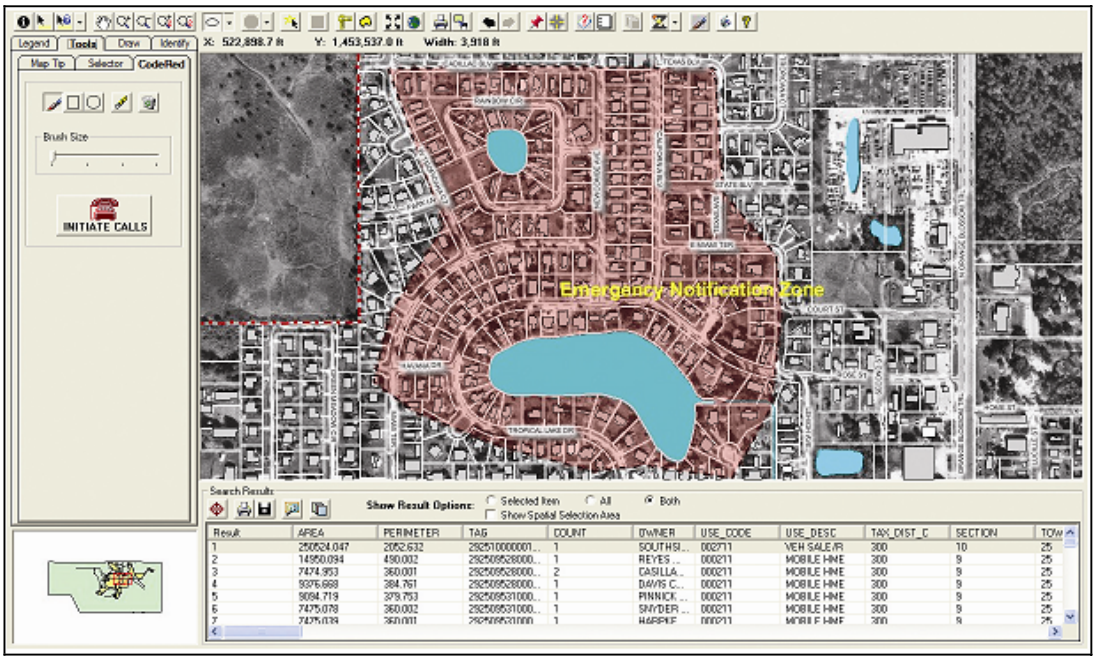
The uses of a GIS-based Mass Notification System application include:

- Emergency Evacuations
- Missing Person Alerts
- HAZMAT Emergency
- Public Service Announcements
- Investigation Assistance
- Search and Rescue Operations

GIS-based Mass Notification System applications include functionality to select target audiences for distribution of messages based on spatial queries, tabular queries, user-defined areas, buffers, and existing data layers. Using a GIS-based Mass Notification System application, the Fire Department could use spatial analyses to determine appropriate areas to contact in an emergency. The Department could utilize a Mass Notification System application that can be easily and effectively integrated with the City's GIS.



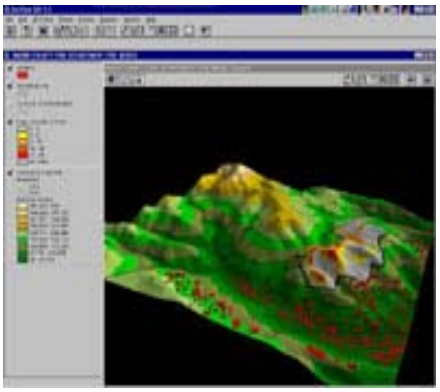
GIS Based Mass Notification Workflow



Mass Notification GIS Interface

Case Study: Fire Agencies Improve Response Time with GIS

Fire agencies on all levels strive to preserve lives, property, and natural resources. Many agencies have embraced GIS as a tool that helps them balance needs, uses, and hazards to promote sustainability of the environment while identifying and limiting vulnerability.



Effectively handling fires, whether structural fires in densely populated areas or wildfires raging over thousands of acres of forested land, involves planning strategic response on a regional scale, developing a tactical response for a specific event, formulating and carrying out a mitigation program, and analyzing incident data to improve policies and training programs-all activities enhanced by GIS. GIS-based fire tools range from Internet applications using Internet Map Server (IMS) technology to desktop applications developed using

ArcView GIS and its extensions to sophisticated real-time enterprise-wide applications using ArcInfo.

Developing Regional Strategies

Strategic planning answers three location-based questions: Where are the hazards? Where are the areas at highest risk? Where are the most valuable resources located? GIS is especially suited to answer these queries. Typically, strategic plans are made on a regional level with all agencies that have jurisdiction in the region involved in planning or at least agreeing to basic strategies.

Overlaying vegetation data with topography and transportation networks shows where fuel is present and identifies areas that may be hard to reach. Mapping historical data on fires, lightning strikes, arson activity, and other related events available from databases and paper records showing where fires occurred in the past can be used to gauge the likelihood of future fires. Finally, resources that are required to manage and recover from a fire such as water sources or transportation networks or resources that represent an unacceptable loss such as a hospital must be located. Aggregating data representing hazard, risk, and value factors for a region identifies areas with the highest priority.

Geography can provide a framework for organizing data from many sources that relate to fire strategy development. GIS, with its data integration and visualization capabilities that foster collaboration, is the natural vehicle for an intra-organizational and interagency development of strategic plans. GIS improves fire response by centralizing data in many formats and from many sources and integrating it with other technologies such as GPS. This means current information is quickly delivered in an easy-to-grasp format. In addition, powerful modeling capabilities, available from the desktop as well as on workstations, let planners model what-if scenarios to test the soundness of strategies. Fire agencies have exploited the power of GIS to their advantage in all types of settings.

The Cedar City Interagency Fire Center (CCIFC) in Cedar City, Utah, dispatches fire personnel for a number of agencies including the Bureau of Land Management, the National Park Service, the Bureau of Indian Affairs, and the State of Utah. When responding to a fire, CCIFC dispatchers plot real-time GPS positions and reference them against the GIS, which contains data on ownership; roads; wildlife habitats; slope classification; fire fuels; zones of moderated suppression; and other related themes that consolidate text, tabular, and other data previously available only from wall maps, manuals, and separate databases. Now dispatchers need only query an area to obtain concise instructions on the constraints and objectives for the area in question.

Making a Tactical Fire Plan

With a strategic plan in place, a more effective tactical plan can be developed. By having information on the risk to an area coupled with an idea of the location of the most valuable resources in the area, fire management can determine how and where to allocate resources when a fire does occur. Prior to an event, management can organize fire prevention activities and position suppression resources where they will be most effective. This means fire prevention budgets are spent in the most beneficial manner and resources can be used in ways that maximize protection to fire personnel as well as lives, property, and natural resources. In a typical scenario involving multiple fires, the agency managing the event has to allocate resources between competing areas. However, by developing both strategic analysis and a tactical plan, prioritizing areas and allocating resources will be optimized.

Improving Response

Responding to a specific incident requires more information than strategic planning. The analysis of hazard, risk, and value is revisited in much more detail. In the case of wildfires, data on topography such as slope and aspect as well as vegetation, weather, transportation, and other factors are used to further assess the risk for an area. Data on previous fire occurrences coupled with land use patterns and management goals give a more refined view of risk for this area. Value is determined by standard inventory types such as inhabited places or timberlands.

The Mapping Services Section for the Ventura County Fire Protection Agency, managed by Jim Kniss, has integrated GPS data with GIS to rapidly get crucial information into the hands of incident commanders. The agency has created a series of custom ArcView GIS extensions that import GPS data gathered by flying the perimeter of the fire and use standard Incident Command System symbology. These standard extensions can generate an initial attack map within 30 minutes of acquiring the incident data. The Mapping Services Section, which is responsible for all mapping products and services, also generates emergency response map books for all fire companies and cooperating agencies, wall maps for each fire station, and special tactical maps.

Tactical response planning in an urban setting requires street network data, information on hazardous materials locations, and pre-fire survey information such as floor plans or hydrant location and capacity data. The Winston–Salem Fire Department in North Carolina implemented a system that uses ruggedized PCs mounted on emergency vehicles that run a custom GIS application built using MapObjects and NetEngine. The application displays a map showing the optimal route to the emergency. This route can be instantly modified to take into account streets that are blocked. The application also provides information on all available fire hydrants, any known hazardous materials in the area, the locations of special needs populations, and other pertinent information. A touch screen lets firefighters pan and zoom on the map and use icons that link the GIS application to additional information such as floor plans, diagrams, or other pre-fire survey information.

Developing Mitigation Procedures

Determining where and how much vegetation must be cleared around structures and developing appropriate construction material standards are just two methods for mitigating

the effects of fires. The City of Laguna Beach, California, has used GIS to pursue both policies. In 1993, a fire driven by high wind conditions caused extensive damage to the City and resulted in the loss of 286 homes. The City has used GIS to help rebuild the portions of the community that were destroyed in the fire. GIS proved so useful that it has been adopted as a tool to improve City operations. As a result of the 1993 fire, Laguna Beach extensively updated the safety element in the General Plan. The availability of mapping, aerial photographs, and analysis tools in GIS helped speed and improve the revision process. The new safety element includes an emergency routing program and fuel modification specifications and requires an emergency preparedness plan that is updated on an annual basis. Zoning Analyst, a custom ArcView GIS extension developed by ESRI business partner Geographic Information Services, Inc., assists planners in providing public information, processing cases, generating public notification letters, and producing maps.

Better Policies

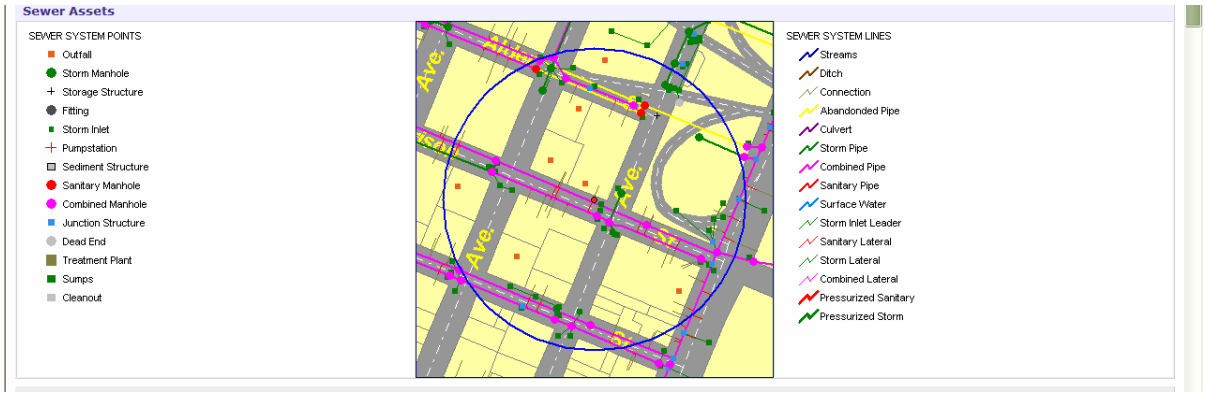
Not only is GIS used to develop and implement fire mitigation policies for local governments, but it can also help improve the policies and practices of fire agencies. Using GIS to model the terrain, path of the fire, weather conditions, and personnel movements during a fire incident illustrates the interaction of these factors in a way that is impossible with written reports.

Modeling data from the South Canyon fire that led to the deaths of 14 firefighters near Glenwood Springs, Colorado, in 1994 vividly demonstrated how the weather and terrain affected the path taken by fire. DEM data was modeled using the ArcView 3D Analyst extension, and attribute data created from scanned maps and aerial photos from the official report was incorporated into the model. Studying incidents such as the South Canyon fire using GIS can help improve fire response policies and training to minimize danger to firefighting personnel.

**Case Study Courtesy of ESRI ArcUser Magazine*

☑ Public access to building safety and inspections data (with commenting options available)

An important theme stressed by city management and reinforced by Building Safety is the need to share data with the public and to improve public service. It is being recommended that the city implement GIS based web portals for public consumption. One such portal, should allow users to quickly view building safety and inspections data and status. The users would be able to see where in the process any given permit is and submit comments via the web. More information on Internet GIS solutions can be found at the end of this chapter in the Enterprise-Solutions section.



Quick access to GIS data and projects via an online GIS application

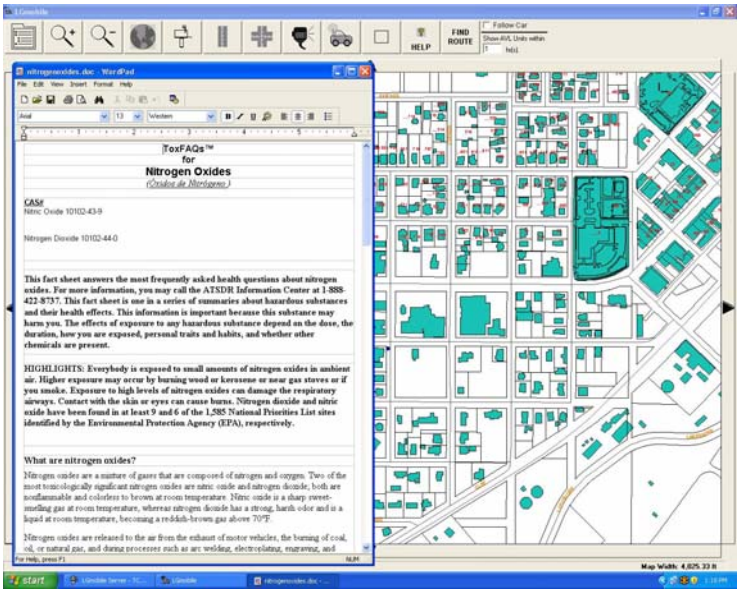
Existing GIS Data Layer Inventory and Future Recommendations

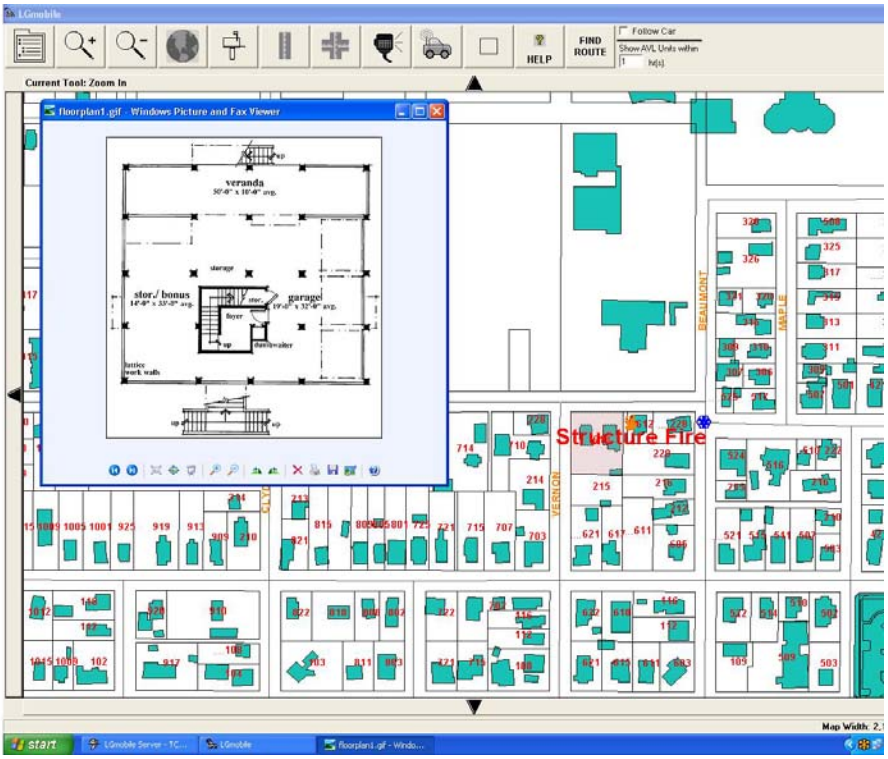
The Fire Department will benefit from access to several other departmental GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other City departments.

One of the most dangerous situations for fire fighters and citizens is a fire at a site that has hazardous materials. Fire departments are required by the Superfund Amendment and Reauthorization Act to track the location of known hazardous materials. This is commonly referred to as SARA Title III hazardous materials tracking. It is highly recommended that this information continue to be entered into the Firehouse system and then made available in a GIS format. This data should be tied to the address or parcel GIS layer and accessible via each PC at the fire stations and in the future through laptop computers mounted on apparatus. In the long term, it is also recommended that this data be accessible from each fire truck. This is being accomplished by utilized Group 1 – Remote Access software on laptop computers.

Building Pre-Plans

The Fire Department is creating in Visio and maintaining some pre-plans in Firehouse. Pre-plans of critical facilities is being linked to the Group One Remote Access application. An icon will show up in the application if a pre-plan is available for a structure.





GIS Accessing Pre-Plans and Hazardous Materials Information

Fire Department personnel expressed that access to the following GIS data layers would be beneficial:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Address Points	Extract, cleanse, geocode, and map from various existing data sources; georeference based on aerial photography and GPS field work	Automated; GIS Coordinator; Public Works	Recommended
Aerial Photography	GIS Consortium	GIS Consortium	Existing
Building Permits, Certificates of Occupancy	Housed in TRAKiT	Automated integration	Recommended
Building Pre-plans	Housed in Firehouse software	Fire Department	Recommended
Commercial Addresses	Extract, cleanse, geocode, and map from existing data sources	Automated	Recommended
Critical Facilities	Manually digitize points from aerial photography and address sources	GIS Coordinator	Recommended
Fire Hydrants	Are in AutoCAD	Illinois American Water	Recommended
Fire Incidents	Extract, cleanse, geocode, and map from Firehouse	Automated	Recommended
Fire Inspections	Extract, cleanse, geocode, and map from Firehouse	Automated	Recommended
Fire Investigations	Extract, cleanse, geocode, and map from Firehouse	Automated	Recommended
Fire Response Zones	Created in DECCAN and will need to be integrated into enterprise GIS efforts.	Fire Department; GIS Coordinator	Existing
Flood Zones	Acquire from FEMA	GIS Consortium	Recommended
Hazardous Materials	Extract from data within Firehouse; needs to be completed	Fire Department	In Progress
Hydrology	GIS Consortium	GIS Consortium	Existing
Knox Box Locations	Digitized on Screen	Fire Department	Existing
Municipal Boundaries	GIS Consortium	GIS Consortium	Existing
Parcels	GIS Consortium	GIS Consortium	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Water Base Map	Are in AutoCAD	Illinois American Water	Recommended
Streets	Derived from aerial photography; GPS	GIS Consortium but should be maintained in Public Works	Existing
Tornado Siren Locations	Derived from aerial photography; GPS	Fire Department	Recommended

Recommended GIS Applications

To meet the Fire Department GIS goals the following GIS software is recommended.

Intranet GIS Browser

An Intranet GIS data browser has been recommended for use by department personnel. The Intranet GIS data browser should provide incident mapping functionality for the all department personnel. This application will provide the ability to map and analyze all data extracted from the Firehouse incident reporting software and TRAKiT. This application will serve as the primary enterprise-wide GIS application for the Fire Department, and should be made available to all personnel throughout the Department. A full description of recommended GIS data browser solutions is provided in the Enterprise-wide Applications section of this chapter. This application will also have the ability to do mass notification.

Disaster Recovery and Damage Assessment

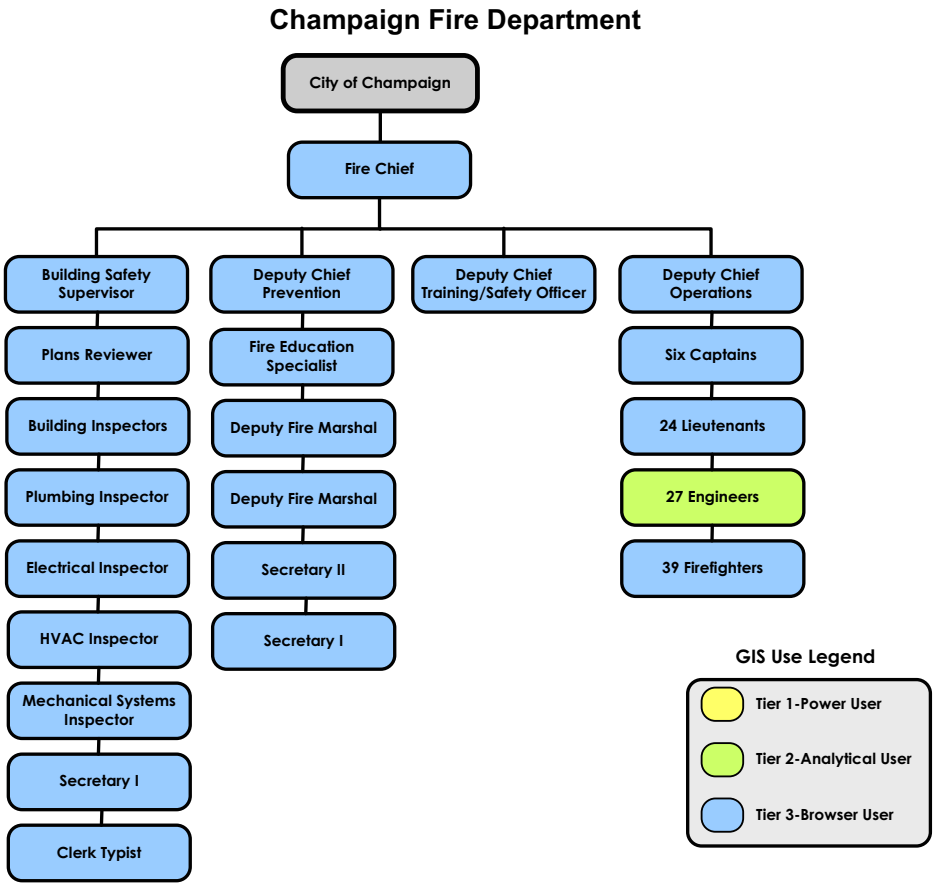
This application will allow users to enter the damage done on a site by site basis. Also, the computers will be GPS enabled so that the location of each field representative and the path they have already traveled can be easily ascertained. This application should be tested annually to insure that each of the components is in an operational state.

Internet GIS Data Browser

An ArcGIS Server-based Internet GIS data browser has been recommended to provide citizen's with access to the City's development review and permitting data. A description of recommended GIS data browser solutions is provided at the end of this chapter in the enterprise-wide applications section.

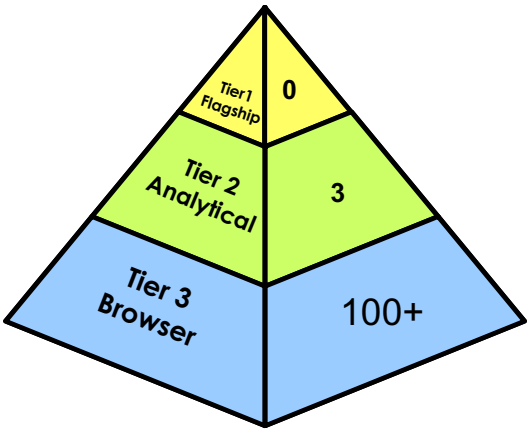
Multi-Tier GIS Application Use within the Fire Department

The following graphic describes the recommended departmental GIS user roles based on the three tiers of GIS. For more information on the three tiers of GIS refer to Chapter 4: Governance Model.



Fire Department Multi-Tier GIS Application Use

There are three users within the Fire Department that is considered a Tier 2 user; all other staff members are Tier 3 users.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The Champaign County GIS Consortium, a program of the Champaign County Regional Planning Commission, was formed in September of 2002 in order to secure the benefits of data collection and analysis at the county-wide scale and to share the cost of implementation, maintenance, and data acquisition. Currently, there are seven members of the Champaign County GIS Consortium:

- Champaign County
- City of Champaign
- City of Urbana
- Village of Rantoul
- Village of Mahomet
- Village of Savoy
- University of Illinois

The following four other entities within Champaign County are participating as Principal Data Clients:

- The CU-MTD
- CU-Public Health District
- Urbana-Champaign Sanitary District
- Champaign County Economic Development Corp

The mission statement of the Consortium is: "To implement, maintain, facilitate the use of, and distribute a quality Geographic Information System to GIS consortium member agencies and the greater Champaign County Community." Participation is open to both public and private sector organizations. Champaign County was designated as the Lead Member of the GIS Consortium and the County subsequently appointed the Champaign County Regional Planning Commission as the Agency to house and administrate the GIS Program. A formal intergovernmental agreement exists between the Consortium and member agencies. The Consortium plans to offer some basic GIS training including the Basics of ArcView.

The Consortium provides GIS services at the following rates:

CCRPC GIS Department Staff Billing Rates: Jan 2007

Staff Member:	Staff Level:	Billing Rate / hour:
Mark Toalson	Manager	$70.62
Leanne Brehob-Riley	Programmer / Analyst	$46.14
Tom Reed	Technician	$32.68
Becky Seaman	Technician	$29.68
Tom Laue	Technician	$29.26
Andrew Levy	Intern	$21.95
Jerod McCleland	Intern	$21.95

* this list does not include temporary employee Janet Thornhill as her permanent salary has not yet been determined.

The following are current or imminent projects that are being conducted by the Consortium:

- Completion of all taxing district boundaries
- Completion of parcel annotation
- Address Point Pilot Project
- UCSD sanitary sewer feature maintenance
- Scanning, rectification, and loading in SDE of historic aerial photography, (1988 and 1973)
- Pilot project - Scanning of property record cards (including all associated documents) within the County Assessor's Office and linking to parcels in GIS
- Mapping of County zoning boundaries
- Continued development and distribution of published map files for ArcReader
- IMS application development
- Migration and updating of Piatt County GDB with boundary adjustment

The following are anticipated projects that may be conducted by the Consortium:

- Creation of Address Point database for Entire County
- Historic Annexation Mapping (pre 2004)
- Completion of property record card scanning with the County Assessor's Office
- Server cycling –
    - Conversion of current 500GB SDE server to potential replacement of current 80GB IMS server or other use as complimentary server
    - Conversion of current 2TB backup server to active SDE server
    - Purchase and implementation of new backup server
- Implementation of standard training courses
- Sewer feature maintenance assistance to the City of Champaign and the Village of Savoy

Existing GIS Data Layer Inventory and Future Recommendations

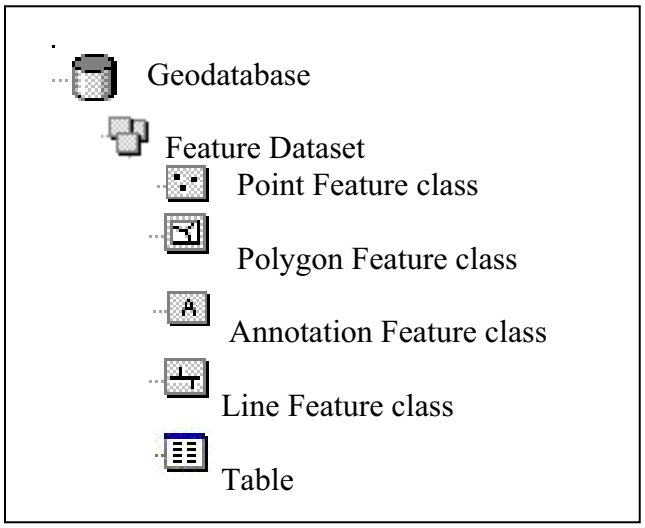
The Consortium maintains various data layers that are valuable to the City of Champaign. Of utmost importance are the following base layers:

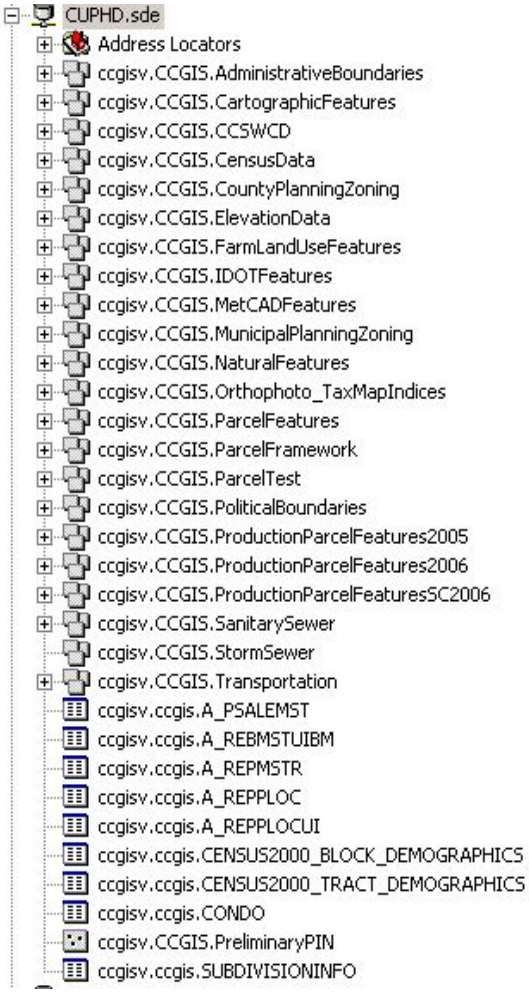
- Tax parcels – the approximately 70,000 parcels were converted from paper maps over the past few years. These were done via coordinate geometry (COGO) and non-COGO methods. Section corners have been located and a best fit method has been utilized for some parcels. Rights-of-way in urban areas were created first and parcels were built out from there. Assessment data is downloaded as it is updated by the Tax Assessor Department. Traditionally Assessor's have been focused on insuring that tax bills get sent out on time. Therefore, having an up-to-date assessment file was only needed once or twice a year. However, with the advent of GIS this information is needed daily by staff at the County and at other agencies. There is an effort underway to get the assessment data updated more expediently to meet this need. A download from the computer aided mass appraisal system (CAMA) is done nightly.
- Aerial photography – the Consortium has the County flown every three years. The next flight is due in the Spring of 2008. Color photography exists for 2005 and black and white exists for 2002.
- Street centerlines – the centerlines of all streets in the county are maintained by the consortium. Full attribution of street names and address ranges are maintained. The roads are updated once a month.

The following information is taken from an email sent by Mark Toalson, GIS Manager for the Consortium on 1/19/2007. Below is a list of data layers or feature classes that are currently distributed to Consortium members and Principle Data Clients (PDCs) with access to SDE.

The construction of metadata or information describing each of the feature classes is also currently in production. As metadata is completed it will be made available. The names of each of the feature classes should provide a general explanation of the contents. On the following page a brief description is provided for those feature classes that do not contain descriptive names. Below is a description of the commonly used icons in an ESRI Geodatabase. Please direct any questions regarding data contents to either Mark Toalson, GIS Manager or Leanne Brehob-Riley, GIS Database Administrator at 323-3313.

ESRI Geodatabase Icon Description





Administrative Boundaries

This feature dataset contains information regarding the boundaries of various administrative areas within the County.

- ccgisv.CCGIS.Annexation_Topology
- ccgisv.CCGIS.CivilTownships
- ccgisv.CCGIS.CivilTownships_Line
- ccgisv.CCGIS.CivilTownships_Topology
- ccgisv.CCGIS.Errors
- ccgisv.CCGIS.ForestPreserveBoundary
- ccgisv.CCGIS.Municipal_Lines
- ccgisv.CCGIS.MunicipalAnnex_Lines
- ccgisv.CCGIS.MunicipalAnnexations
- ccgisv.CCGIS.MunicipalBoundary
- ccgisv.CCGIS.MunicipalBoundary_Topology
- ccgisv.CCGIS.UCSanitary_Lines
- ccgisv.CCGIS.UCSanitary_Points
- ccgisv.CCGIS.UCSanitary_Topology
- ccgisv.CCGIS.UCSanitaryBoundary

Feature Classes of Interest:

Polygons - Civil Townships, ForestPreserveBoundary,Municipal Annexations, MunicipalBoundary, UCSanitaryBoundary

Points - UCSanitary_Points

> ***Note:*** *The remaining feature classes in the dataset our used for boundary construction purposes.*

Cartographic Features

This feature dataset mainly contains generalized information from the various SDE feature dataset. This data was created to assist with Cartographic production.

The names of the feature classes found within this feature dataset should provide a general explanation of the content.

- ccgisv.CCGIS.CountyHwys
- ccgisv.CCGIS.EducationalFacilities
- ccgisv.CCGIS.FedHwys
- ccgisv.CCGIS.HealthFacilities
- ccgisv.CCGIS.Interstates
- ccgisv.CCGIS.MunicipalFacilities
- ccgisv.CCGIS.Parks
- ccgisv.CCGIS.RailroadLines
- ccgisv.CCGIS.RailroadSpur
- ccgisv.CCGIS.RailroadYard
- ccgisv.CCGIS.Ramps
- ccgisv.CCGIS.RoadsMajor
- ccgisv.CCGIS.RoadsMinor
- ccgisv.CCGIS.RoadsNamed
- ccgisv.CCGIS.SectionPoints
- ccgisv.CCGIS.StateHwys
- ccgisv.CCGIS.StreamPols
- ccgisv.CCGIS.Streams
- ccgisv.CCGIS.StreamsIntermittent

CCSWCD

This dataset contains information that was obtained from the Champaign County Soil and Water Conservation District (CCSWCD). The CCSWCD is responsible for maintaining these feature classes.

- ccgisv.CCGIS.ConservationReserveProgram
- ccgisv.CCGIS.DrainageDistricts

Census Data

This feature dataset contains Blocks, Block Groups, and Tract geographic divisions. These data can be joined to the 2000 census demographics tables found in SDE *(CENSUS2000_BLOCK_DEMOGRAPHICS, CENSUS200_BLKGRP_DEMOGRAPHICS, and CENSUS2000_TRACT_DEMOGRAPHICS)* using the STFID field. The Census data was obtained from ***www.census.gov.***

- ccgisv.CCGIS.Census2000_BlockGroups
- ccgisv.CCGIS.Census2000_Blocks
- ccgisv.CCGIS.Census2000_Tracts

Elevation Data

This feature dataset contains 2 foot contour lines and spot elevation points for several of the urbanized areas in Champaign County. The feature class, *Index_100scale*, found in the Orthophoto_TaxMapIndicies feature dataset contains a field called *ContourCoverage.* When the value of 2005 appears in that field, contours and spot elevations exist for the area the index encompasses.

MunicipalPlanningZoning

This dataset includes boundary information for the municipalities with in Champaign County. These include, Extra-Territorial Jurisdiction, Boundary Agreements, and Subdivision Jurisdiction Boundaries.

NaturalFeatures

This dataset includes both natural and man-made water features and delineated soil data. The ***Hydrology*** and ***Lake*** feature classes were originally created by delineating visible features from 2002 orthophotography, many of the larger features contain both stream centerline and stream edges. The ***HydrologyCL*** is an edited version of the Hydrology feature class. This edited version contains only stream centerlines and in addition, streams were added that were found on USGS 7.5' quadrangle maps. The ***Soils*** layer was obtained from the Champaign County Soil and Water Conservation District (CCSWCD).

- ccgisv.CCGIS.Hydrology
- ccgisv.CCGIS.HydrologyCL
- ccgisv.CCGIS.Lake
- ccgisv.CCGIS.NaturalFeatures_Topology
- ccgisv.CCGIS.Soils

Orthophoto_TaxMapIndices

This dataset contains the index pages used for orthophotograhy and elevation data (contours and spot elevation points) and Champaign County tax map pages.

Feature Classes of Interest:

ccgisv.CCGIS.Index_100scale
ccgisv.CCGIS.Index_400scale
ccgisv.CCGIS.TaxMapIndex

ParcelFeatures

This dataset conveys information associated with a tax parcel management system.

Feature Classes of Interest:

TaxParcelDissolve – *polygon outlines of the tax parcels including the portion of the tax parcel that falls within the road right-of-way. This feature class contains the Parcel Identification Number (PIN) associated to each of the tax parcels.*

TaxParcel – *polygon outlines of the tax parcels, this feature class does not contain the PIN.*

Parcel – *point features that fall within the bounds of the Tax parcel polygons, PINs are specified for each Parcel point.*

Subdivision – polygon outlines of current Subdivision boundaries, a variety of attributes exist in this feature class including subdivision names, record date, Recorder's office document number, etc.

Anno100 - tax parcel map related annotation for pages printed at scales of 1:1200 or 1:2400.

Anno400 – tax parcel map related annotation for pages printed at scales of 1:4800 or 1:9600.

Related Condo Table (***CONDO)*** – table containing condominium information. This table is related through a relationship class to the Parcel (points) feature class.

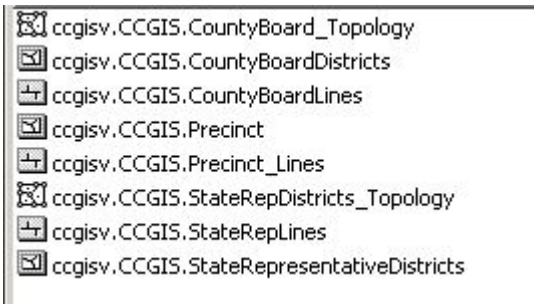
ParcelFramework

This feature dataset conveys the Public Land System Survey (PLSS) grid system.

ccgisv.CCGIS.County
ccgisv.CCGIS.PLSSQuarterSections
ccgisv.CCGIS.PLSSSections
ccgisv.CCGIS.PLSSTownship

PoliticalBoundaries

This feature includes boundaries for county board divisions, precinct, and state representative districts.



Feature Classes of Interest:
CountyBoardDistricts
Precinct
StateRepresentativeDistricts

Note: *The remaining feature classes in the dataset our used for boundary construction purposes.*

SanitarySewer
This feature contains SanitarySewer information for all the entities that fall within the Urbana Champaign Sanitary District (UCSD) boundary.

Transportation
This feature includes Street Centerlines, Railroads, Intersection Nodes, EdgeOf Pavement lines, and Bridges. The StreetCL feature class contains address ranges, these address ranges can be used to geocode street address information. The StreetCL and IntersectionNode feature classes are maintained by CCGISC however the EdgeOfPavement and Bridge feature classes have not been updated since they were created using the 2002 Orthophotography.

Champaign County Property Information Tables

The PIN field is used to join these tables to the TaxParcelDissolve polygons or Parcel points feature classes.

A_REPMSTR
County Master database contains information such as tax assesment, tax billing address, PIN, etc.

A_PSALEMST
County Property Sales Table

A_REPPLOC
Property Location Address Table

Existing Personnel and Duties

The mission of the Human Resources Department is to support neighborhood based service delivery programs by assisting City Departments in effectively managing their human resources.

Human Resources duties include:

- Worker's compensation
- Property and casualty insurance
- Claims management
- Benefits
- Compensation
- Labor relations
- Unemployment compensation
- Regulatory compliance
- Safety and Illinois Department of Labor compliance
- Equal Opportunity compliance
- Employee recruitment and hiring
- Employee training

At present, the Department does not utilize GIS. GIS users in the Human Resources Department will be data browser or Tier 3 GIS Users (see Chapter 4: Governance Model for more information on Tier 3 GIS Users). The recommended GIS Coordinator should be utilized to assist with any of the more complex tasks.

Existing Hardware and Software

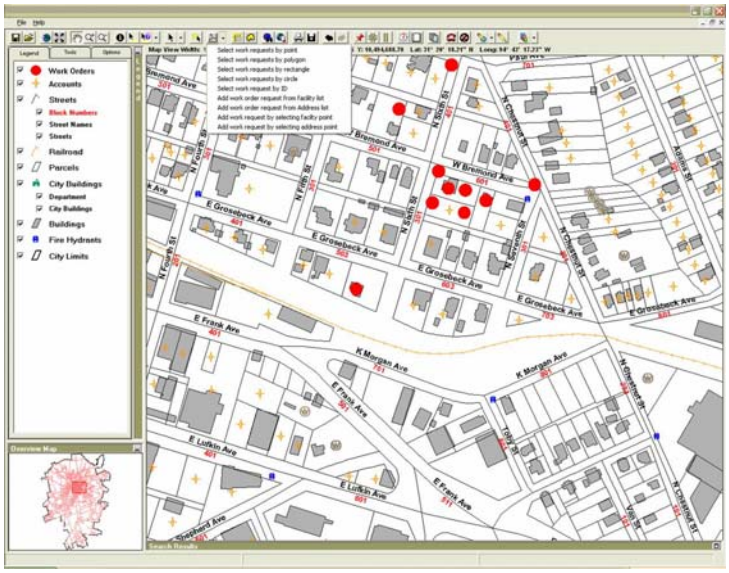
The Human Resources Department utilizes personal computers running the Windows XP operating systems.

Human Resources uses the following software applications:

1. GEMS – used for personnel data
2. Microsoft Office – used for office productivity
3. GroupWise- email, calendaring, and scheduling

GEMS

GEMS is utilized by Champaign for financials and personnel management. Data from GEMS should be extracted for mapping purposes.



GEMS Data Access Via a Map Interface

Recommended GIS Needs and Duties

GIS will be peripheral technology for the Human Resource Department. However, people are an integral part of any successful enterprise-wide GIS implementation. Information on needed personnel will be discussed below. One other need is the creation of various data layers to assist the department with its duties.

This section provides information on three issues important to the Human Resources Department:

- Recommended GIS Positions
- Recommended Job Descriptions
- GIS Staffing Issues

Access to Pertinent Data Layers

Based on interviews with personnel from the Human Resources (HR) Department, there are a few data layers that would be beneficial for viewing by the department. Viewing the location of all employees would be beneficial during emergency situations. This could be done by extracting the address, name, position, etc. of all staff from the GEMS system and then map their location. This would be automated and made available via the recommended Intranet GIS data browser. HR employees could then view employee residence by position type, name, and other pertinent methods. During an emergency or storm event this information would be available when making decisions on which personnel would be of help and where best to deploy them.

Additionally, risk management would like to view the location of all sewer backups, other complaint items, sidewalk inspections, last sidewalk repair dates, and be able to quickly find a claimant's location via their address. This information will be collected and maintained by

Public Works and will be made available to Risk Management via a GIS Intranet data browser.

Recommended GIS Positions

This section provides information on three issues important to the Human Resources Department:

- Recommended GIS Positions
- Recommended Job Descriptions
- GIS Staffing Issues

Recommended GIS Positions

Two new GIS-specific positions are recommended within the City of Champaign:

1. GIS Coordinator; suggested reporting to the Information Technology Director or to the City Manager (see Chapter 4: Governance Model for more on organizational recommendations). The GIS Coordinator is recommended for year one of this project.
2. GIS Technician; reporting to the Public Works Department – The hiring of a GIS Technician has been recommended for year two of this project.
3. GIS Intern; reporting to the Information Technologies Department – As needed to assist with project needs.
4. GIS Analyst; reporting to the Information Technologies Department – recommended for year three of this project.

As GIS grows in Champaign a GIS Technician II position can be introduced that has requires a Bachelor's Degree and more GIS experience.

Recommended Job Description

GIS Coordinator; reporting to the Information Technology Director or City Manager
Department: Information Technology Department or City Manager's Office
Supervisor's Title: Information Technology Director or City Manager

Nature of Position: This position requires a broad range of management, business, and technical skills to guide the successful implementation of an enterprise-wide GIS within the City of Champaign. The GIS Coordinator has overall responsibility for ensuring that key GIS work elements – hardware, software, networks, databases, and staff resources – are managed, maintained, and enhanced to meet agreed-upon city requirements.

Oversee all enterprise GIS operations including database management and administration, data structure and metadata development, system administration, GIS software selection, implementation and user support, GIS project management, budgeting, marketing, and training.

Education: Bachelor's Degree in Geography, Computer Science, Earth Science, Engineering, Planning, or related discipline and 5 years experience in GIS project management for local governments, or an equivalent combination of education and experience.

Skills: Experience with government GIS applications, especially in such business areas such as planning, public utilities, transportation, police, fire, EMS, and tax parcel creation and maintenance. Experience developing schedules and managing complex information technology projects. Familiarity with business process analysis as it relates to GIS. Active participation in professional GIS, mapping, and/or surveying organizations and activities. Verbal, written, and interpersonal communication skills. Ability to communicate technical information in a non-technical manner. Ability to lead and motivate work teams.

Computer Skills: Experience with ESRI's ArcGIS suite of products in a Windows environment. Experience in database administration, relational database design, development, and implementation. Working knowledge of ArcSDE, ArcIMS, ArcServer, ArcObjects, and ArcGIS data model design.

Nature of Contact with Other People: The GIS Coordinator will act as the geographic information expert for the City of Champaign. The GIS Coordinator provides oral and written progress reports and updates to superiors and oversight committees. The position requires an extensive amount of communication at all levels of the City.

Salary: $50K - $75K, commensurate with experience.

GIS Technician
Department: Public Works
Supervisor's Title: City Engineer

Nature of Position: GPS data collection, spatial data layer creation and conversion data analysis, map production, and specific GIS project management.

Education: Bachelors or Associates Degree in Geography, GIS, Engineering, Earth Sciences, or related discipline.

Skills: This position is highly technical in nature and requires a candidate with existing GIS and GPS knowledge and skills in order to perform tasks efficiently. Familiarity with geographic projections and cartographic principles, as demonstrated through coursework or work experience. Working knowledge of how to edit geodatabases, coverage's, and shapefiles, and how to perform logical queries of the database. Proficiency with spreadsheets and tabular data desirable. Understanding of utility and transportation infrastructure highly desirable.

Computer Skills: Proficiency with ESRI software, particularly ArcGIS, is essential, as well as GIS data conversion and GPS data collection skills.

Relevant Experience: One year of experience with GIS and GPS concepts and applications. (Coursework and special projects which emphasize GIS and GPS may be counted towards this experience requirement).

Personnel Supervised: None

Salary: $35K - $45K

GIS Enterprise Staffing

Staffing issues will be critical to the success of the City of Champaign'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 often difficult to attain. Nonetheless, there are fundamental steps that the City of Champaign 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.

The size of a local government organization plays a significant role in staffing issues. The needs of a large city 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 cities, such as Champaign, whenever possible.

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. Individual job descriptions are provided later in this document. The City of Champaign already has its own job classification structure in place, so careful consideration will be needed when assigning employees of particular functional area to the proper job classification.

Coordination: It is vital to the success of the City of Champaign's GIS effort to have a GIS Coordinator. The GIS Coordinator 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 cross-functional management of GIS resources. A GIS Coordinator 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 the City of Champaign will be provided primarily by the GIS Coordinator and staff from the IT 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 cities. Primarily developed with ESRI's ArcGIS Server, these GIS-based web applications require staff for its creation and maintenance. It is recommended that the City of Champaign utilize off-the-shelf GIS applications and not do any application development internally.

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 city is already using a specific RDBMS citywide, it makes sense to use that same RDBMS for its GIS, as it ensures compatibility and easier enterprise-wide data management. 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 the City of Champaign. Database support tasks can be conducted by the GIS Coordinator and staff in Information Technology.

User Support: This is a very broad category, and encompasses both GIS-core staff and GIS-departmental staff, depending on 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 Coordinator provide User Support for those departments that the GIS Coordinator deems appropriate. It is also recommended that the GIS Coordinator provide additional User Support, based on quantity, frequency, and complexity of support requests. As GIS usage grows throughout the City, those departments/divisions/offices that require a great deal of user support should consider hiring a department-specific GIS Analyst in the future.

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. This is primarily the role of GIS Technicians and GIS Coordinator. 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 Coordinator. It is recommended that the existing staff within Planning and the recommended GIS Technician in Public Works, with additional assistance from the GIS Coordinator, collect, produce, and

maintain GIS datasets for their own departments and 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 (outlined in the previous section).

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 Technician" can be differentiated into "Senior GIS Technician" and "GIS Technician."

The reason for creating position classes is two-fold. First, it allows for greater flexibility. As GIS technology grows, and use within the City 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 the City of Champaign'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 the City of Champaign 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 the City of Champaign an attractive place to work.

Salaries primarily depend on two factors: market conditions and skill sets. Although every organization is unique, the City of Champaign 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 the City of Champaign expects to hire and retain qualified GIS staff.

Different functional areas require positions with varying skill sets. The GIS Coordinator is the most important position to the success of the City of Champaign'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 Coordinators, as well as professionals with GIS skills. Full-time GIS Analysts and GIS Coordinators 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.

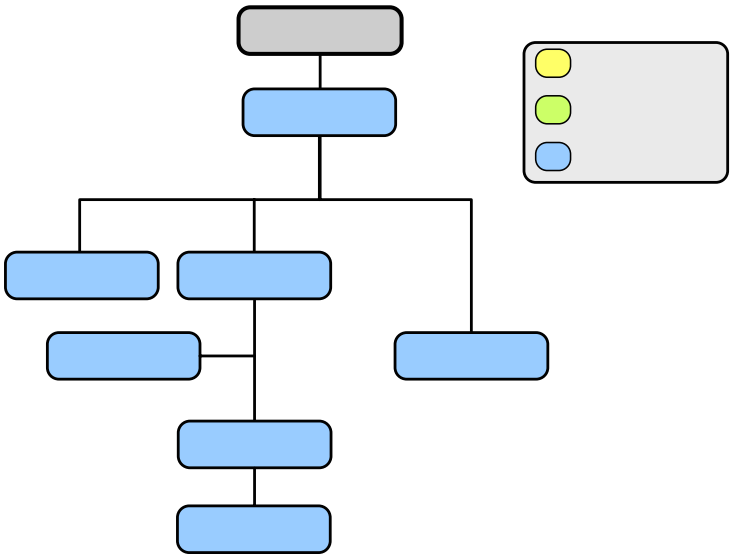
Department-specific professional staff positions that require GIS usage need to be addressed separately. Once GIS has been effectively integrated into the business processes of individual departments, employees with GIS skills become more valuable. Applicants with GIS skills should receive higher compensation 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

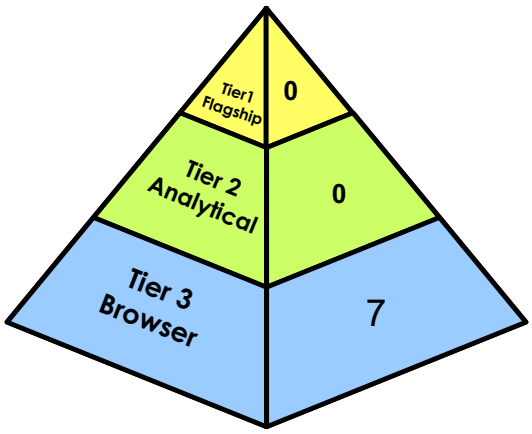
compensated. Existing employees may be hesitant to take the time to learn these skills, as it will detract from their job responsibilities in the short-term. However, if GIS is effectively integrated into business processes, the amount of time spent training will be recouped by more efficient work facilitated 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. The City of Champaign should consider utilizing university students as interns or in co-op positions to supplement the work performed by the GIS Coordinator. This can be 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.

Multi-Tier GIS Application Use within the Human Resources Department

The following graphic describes the recommended departmental GIS user roles based on the three tiers of GIS. For more information on the three tiers of GIS refer to Chapter 4: GIS Governance Model.

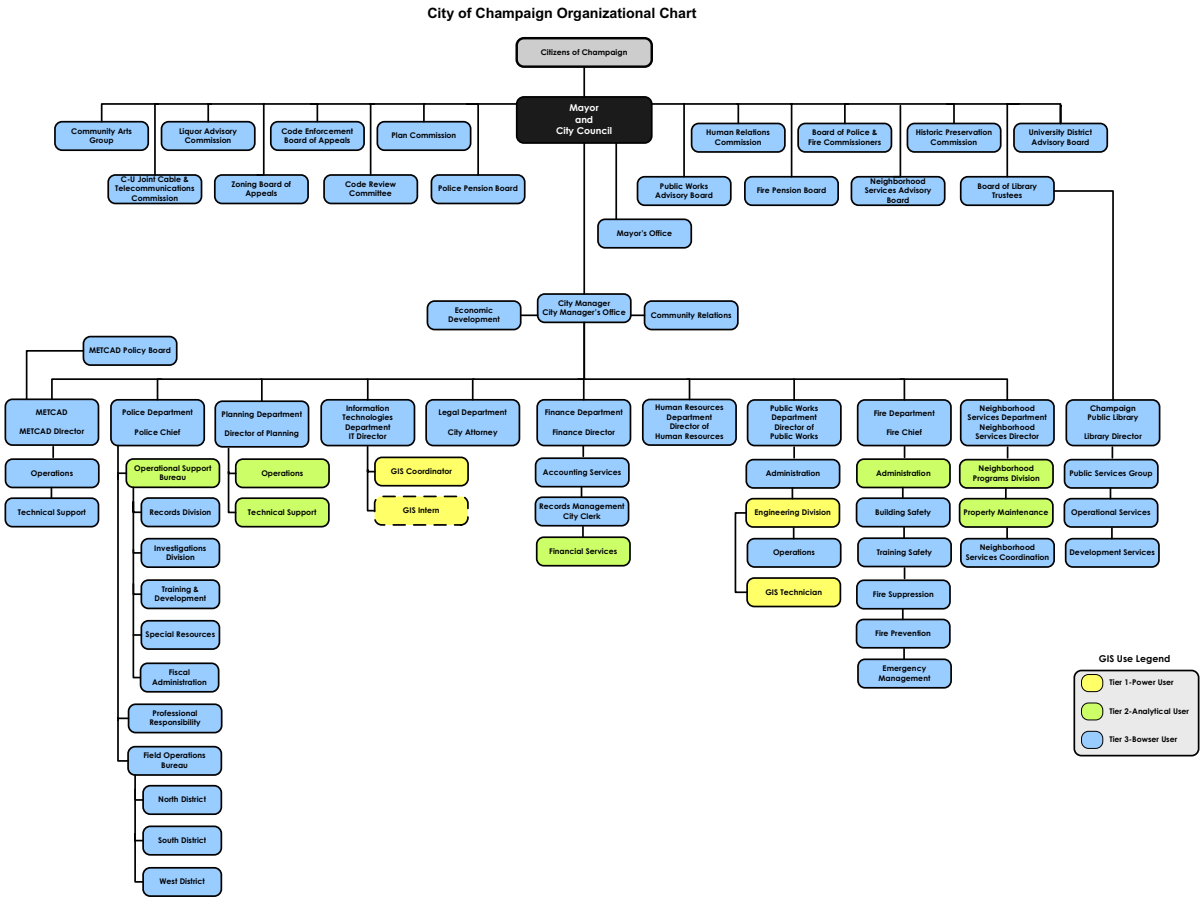




Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

The City of Champaign's Overall Organizational Chart

The following chart describes the overall department usage for the City of Champaign.



City of Champaign
Proposed GIS Organizational Structure and Staffing
GIS Coordinator Position in Information Technology Division
or in the City Manager's Office and GIS Technician in Public Works

Existing Personnel and Duties

The purpose of the Information Technology Department (ITD) is to develop and use technology resources to provide quality services to Champaign citizens and staff. The Information Technology Department has many duties including:

- Advises City Council, staff, and boards on technological matters
- Develops long-range strategic plans regarding technology
- Designs and implements systems based on adopted plans
- Provides support services for the technologies used by the City
- Responsible for networking, telephone systems, presentation systems including Channel 5, and the City's web site
- Supports the C-U Cable and Telecommunications Commission
- Creates City standards and policies related to the City's computing and communication environment
- Involved in disaster recovery planning and support

The Information Technology Department maintains the City's information technology and communication systems throughout the City. The Department assists all City-Departments with their automated information processing needs, including computer and telecommunication equipment purchases and maintenance.

The Information Technology Department plays a key role in assisting the City in achieving its information technology vision. The Department provides reliable and quality information management services as well as ongoing information technology leadership and direction for the organization.

The department employs eight full-time and one part-time staff persons, including:

- Director (1)
- Department Secretary (1)
- Network Engineers (2)
- Network Administrator (1)
- Network Technician (1)
- Telecommunications/AV Technician (1)
- Webmaster (1)
- Student Intern (1)

The Information Technology Department will play a key role in the development and implementation of the City's enterprise GIS.

Organizational GIS Support

It is recommended that the City hire a GIS Coordinator. The Coordinator should be in the Information Technology Department and answer directly to the IT Director. Alternatively, the GIS Coordinator could be housed directly in the City Manager's Office. However, it is critical that the Coordinator not be within a GIS using department. If this were to happen, the Coordinator would

tend to serve that department more than other departments. This would cause discontent within the organization and lead to the failure of enterprise-wide adoption of the technology. Housing the Coordinator in ITD makes sense because ITD is a service department, whose main goal is assisting other departments in achieving their goals. Additionally, the Coordinator can rely on the expertise of other ITD staff to assist with technical implementation issues. More information on the GIS Coordinator position can be found in the Human Resources section of this needs assessment and in Chapter 4 – Governance Model. The GIS Coordinator, in conjunction with the Information Technology Department should implement three levels of departmental support, depending upon the current level of GIS use and internal capabilities per department. They include:

Level 1 – GIS Coordinator provides minimal support for department/division/office GIS activities, system and application support. The GIS Coordinator is used primarily for strategic and procedural support. The City of Champaign currently does have departments/divisions almost at Level 1; personnel in the Public Works and Planning departments perform some Level 1 tasks and will quickly become full-fledged Level 1 users.

Level 2 – GIS Coordinator 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 Coordinator will provide advanced support; the GIS Coordinator will also be responsible for advanced spatial analysis as well as application development. Fire, Police, and Neighborhood Services are examples of Level 2 departments.

Level 3 – GIS Coordinator provides all support for department/division/office GIS activities. The GIS Coordinator is responsible for data maintenance, complex data analysis, and some cartographic products. Most of the non-technical departments will require continued support from the GIS Coordinator. The City Manager's Office, Finance, Human Resources, Legal, and the Library are examples of level 3 users.

The GIS Coordinator should provide training and technical support for all enterprise-wide GIS applications. All GIS software training should be coordinated through the GIS Coordinator to ensure maximum efficiency and effectiveness at a minimum cost.

Not every department/division/office at the City of Champaign 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 Coordinator will assist these departments/divisions/offices with their GIS needs. However, as usage of GIS in the aforementioned entities grows, the GIS Coordinator must encourage and facilitate the acquisition of appropriate resources to handle data maintenance responsibilities for these departments/divisions/offices.

Existing Hardware & Software

The ITD has ten personal computers for staff use. Four of the desktop computers adhere to technical workstations specifications and have the capacity to run GIS software. Three laptops and one tablet PC also reside with the department. Windows XP Pro is the operating system utilized on the personal computers. The City has a computer replacement program by which

technical workstations are replace every three years and office productivity PCs are replaced every five years.

The Information Technology Department currently manages all personal computers organization-wide. All personal computers have the Windows XP operating system or are planning to upgrade within the near future.

The Information Technology Department manages, maintains, and provides support for various applications used by the City's various departments, including this partial list:

1. MS Office including Visio
2. GroupWise- email, calendaring, and scheduling
3. Network tools
4. Web browsers
5. EIOBoard
6. ArcGIS – ArcView
7. ArcIMS
8. Freeance
9. ArcSDE
10. Roxio
11. SnagIt
12. Backup Exec
13. TRAKiT
14. FireHouse
15. PowerPark by T2
16. Adobe Photoshop, Illustrator, Acrobat
17. MrSid Viewer

Of particular importance are various existing applications that will need to have their data GIS enabled. A few of these follow:

- TRAKiT
  TRAKiT is available from CRW. The TRAKiT system is comprised of a series of modules to provide a system for creating, issuing, and tracking any type of Planning activity. TRAKiT is utilized to track various information about properties including zoning, ownership, sign applications, annexation agreements, historic property information and other pertinent data. Data from TRAKiT will need to be GIS enabled.

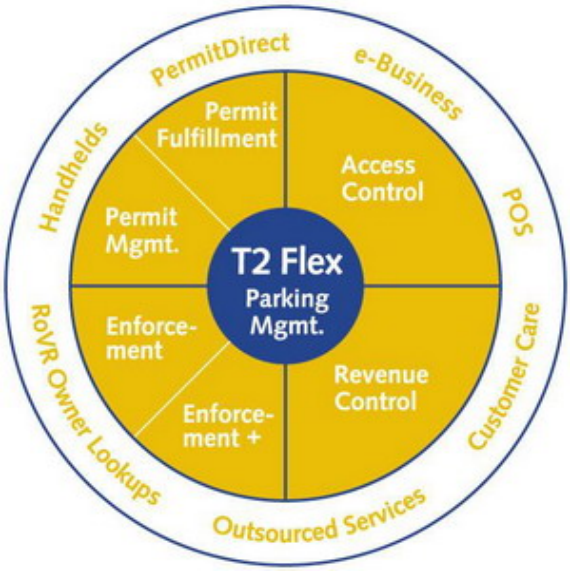
TRAKiT

OneRoof

OneRoof is utilized as a housing rehabilitation program. Information such as; affordable housing, new construction, community development block grant, and liens is tracked within OneRoof. Of critical importance is linking all data from OneRoof to the GIS.

Travis Systems OneRoof Workflow

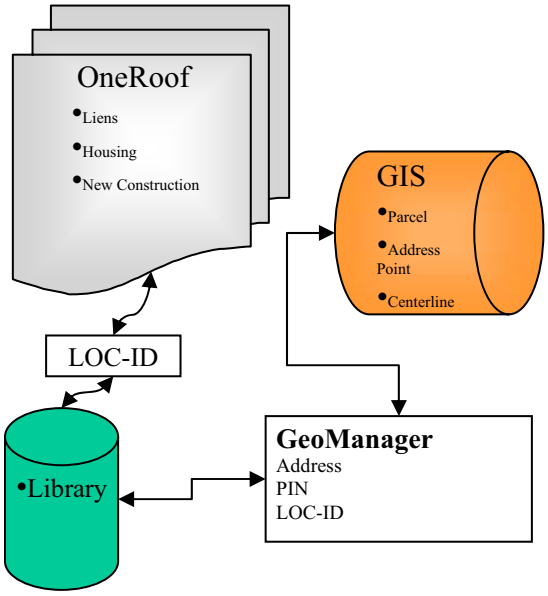
T-2 Systems - T2 Flex™ manages multiple parking tasks including: accounts receivable, residential and other permits, access cards, transient parking, citations, towing, monthly contract parking, and much more. Data from T2 will need to be integrated to GIS. The 2,100 metered and 1,800 permit spaces will need to be mapped and tied to their T2 records.



T2 Systems

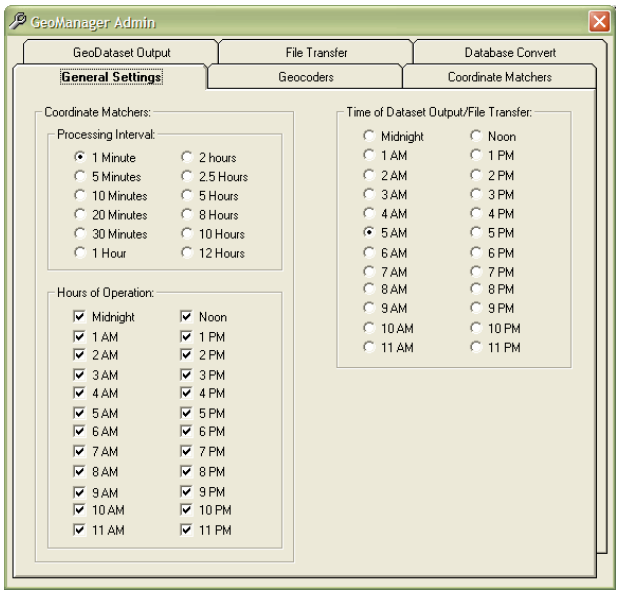
These systems along with others in Fire and Police will need to be GIS enabled. This is accomplished by geocoding records within these applications to parcels or preferably address points. Various applications exist that perform this task. Once such application, GeoManager, has been used successfully by many other organizations. The GeoManager application is an automated geo-coding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (DB2, Oracle and SQL Server). The automated process is based completely on standard SQL statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (shapefiles or SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user

specifications. X, Y coordinates will be utilized to display features in a GIS layer. The graphic below shows the process of using GeoManager to extract data from the OneRoof application.



Practical Example – OneRoof

All OneRoof records related to a specific location can be mapped by linking each record to a spatial feature such as an address point. The GeoManager can generate and export the resulting GIS layer on a regularly scheduled basis.



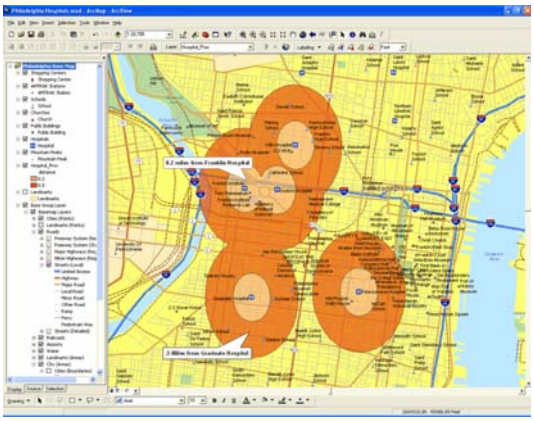
GeoManager Service Settings

Optimally, as each record is assigned an X, Y coordinate, the coordinate pair is stored in a field within the primary application (OneRoof, TRAKiT). That way each record has a validated x, y coordinate and can be mapped at any time. Additionally, those that do not have a valid x, y coordinate can be researched and assigned the appropriate geographic reference.

The new GIS Coordinator will be responsible for management and maintenance of all GIS software, with support from other staff from the IT Department. ArcGIS is recommended as the primary GIS application to be used by the City; Internet and Intranet applications will require ArcGIS Server, which the GIS Coordinator will be responsible for configuring, updating, and upgrading.

ArcGIS - ArcView

ArcView will be used extensively to view and map the City's GIS data; ArcView can also be used to perform spatial analyses. The GIS Coordinator can use ArcView to generate cartographic products for use by administrative and field staff.



ESRI's ArcView

ArcGIS Server

ArcGIS Server will be used as the map server platform for the City's Intranet GIS data browser. This application will serve as the platform to serve enterprise Intranet applications as well as targeted public access Internet applications.

ESRI's ArcGIS Server

Recommended GIS Needs and Duties

The Information Technology Department, primarily the GIS Coordinator, will be working to provide GIS support to the City's departments. As aforementioned, the GIS Coordinator will be a focal point for general technical support as the City expands and increases its utilization of GIS across the enterprise. Information Technology staff will need to work with the GIS Coordinator to establish, configure, and support various types of information technology infrastructure, including software, hardware, databases, networks, user accounts, and documentation.

The GIS Coordinator will continue to serve as the in-house GIS expert, putting into action many of the recommendations of the City's GIS Implementation Plan. One of the key issues that the GIS Coordinator will need to address is the short and long-term impact of enterprise-wide GIS implementation—support needs for each of the City's departments will quickly increase and continue to increase as personnel become exposed to the technology and its benefits. The GIS Coordinator will need to identify and devise strategies for ensuring that support is adequate in all

aspects of the City's GIS effort; these strategies may entail procurement of new software, outsourcing of projects, additional staffing (primarily interns), and protocols and standards.

This needs assessment provides general recommendations for GIS efforts within the Information Technology Department. Comprehensive recommendations for each department/division are provided in other sections of this chapter; the GIS Coordinator will need to work based on the recommendations provided, as a whole, throughout this chapter.

Based on this needs assessment, the Information Technology Department can contribute to the City enterprise-wide GIS Implementation by contributing to the following efforts:

- Enterprise GIS coordination
- GIS user support
- GIS software support
- Training
- Network administration

Enterprise GIS Coordination

As aforementioned, the GIS Coordinator will provide consistent guidance and coordination in support of GIS and its related components. In general terms, the Department will be responsible for providing technical support and guidance with the GIS Coordinator. Enterprise GIS coordination encompasses a variety of tasks, processes, and procedures, all of which have a cross-functional context within the scope of GIS implementation planning—the GIS Coordinator will have frequent contact with staff from other departments as well as external entities.

The following are GIS coordination needs to be provided both internally and externally:

City of Champaign

- Installation, maintenance, and upgrade of hardware and its operating systems
- Provision of training for users in the organization
- Establishment of database standards
- Plans and procedures for effective integration or transfer of GIS data from various sources into usable databases
- Establishment of mapping standards
- Maintenance of data security and integrity
- Primary contact for user problems and vendor support
- Complex spatial analysis
- High-level cartography
- Project management
- Inter-departmental collaboration on GIS projects and initiatives

External

- Collaboration with other local agencies; specifically the GIS Consortium
- Frequent attendance and participation in local and regional GIS groups
- Distribution and acquisition of geospatial data
- Participation with state and federal agencies on GIS initiatives

☑ GIS User Support

The Information Technology Department should provide ad hoc GIS user support as needed. The GIS Coordinator should work with Department staff to determine optimal strategies for the long-term implementation of GIS. In addition, the GIS Coordinator should implement and administer formal GIS support protocols to ensure that GIS user support is properly documented and administered.

☑ GIS Software Support

The Information Technology Department will provide GIS software support. It is recommended that the GIS Coordinator work in conjunction with IT staff on GIS software installation and support. The GIS Coordinator will be responsible for identifying, evaluating, and acquiring new GIS applications that may be beneficial for the City's GIS implementation. Additional staff members from the IT may need to be trained on some GIS software, in order to provide redundancy in technical knowledge as well as backup support should circumstances require support beyond that which can be provided solely by the GIS Coordinator. It is recommended that one of the Network Engineers receive training on ArcGIS Server and tuning the Server technology with SQL Server. These concepts are of a highly technical nature and will require support from not only the GIS Coordinator but from a Network Engineer.

☑ Training

City employees will require training on new GIS applications as they are implemented. The GIS Coordinator should setup and administer training. The GIS Coordinator will be responsible for identifying appropriate classes and education materials for departmental staff. Preliminary recommendations are provided in the following table:

GIS Applications Training Matrix

Class	Site	Trainer	Days	Year of Training	Participants	Cost
Introduction to ArcGIS I	On	ESRI Authorized Trainer	2	1,2,3,4,5	Various	$5,000
Introduction to ArcGIS II	On	ESRI Authorized Trainer	3	1,2	GIS Coordinator, Tier one GIS Users	$7,500
Building Geodatabases I	Off	ESRI	3	1	GIS Coordinator (if needed)	$1,350
Building Geodatabases II	Off	ESRI	2	1	GIS Coordinator (if needed)	$900
Introduction to ArcGIS Server	Off	ESRI	2	1,2	GIS Coordinator and Network Engineer (if needed)	$900
ArcGIS Server Enterprise and Tuning for SQL	Off	ESRI	2	2	GIS Coordinator (if needed) and Network	$900

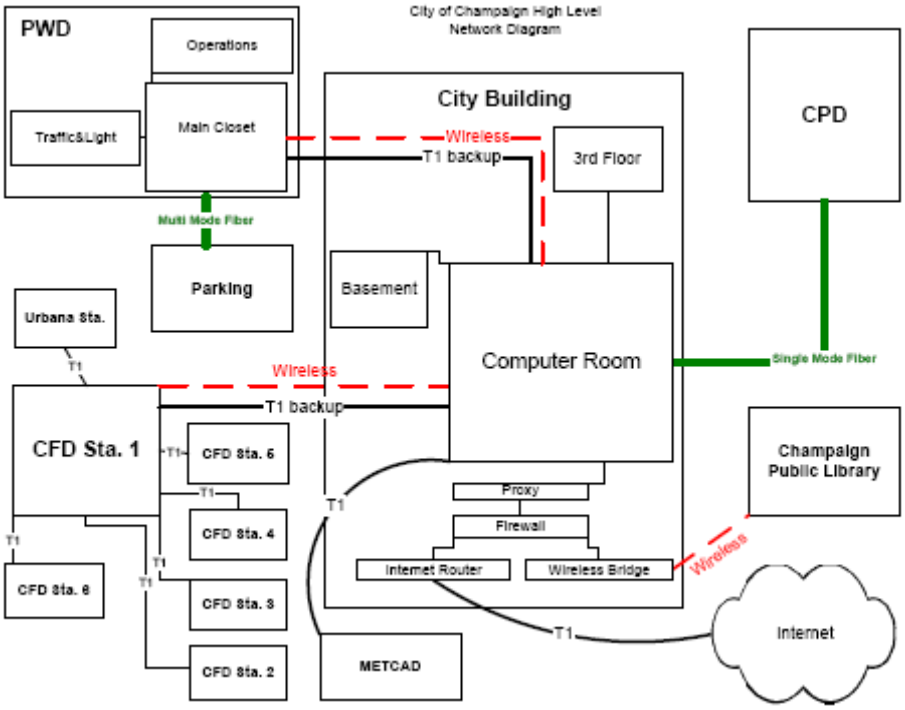
Class	Site	Trainer	Days	Year of Training	Participants	Cost
Server					Engineer, Information Technology	
Tier 3 Applications	On	Internal	1	1,2,3,4,5	Various	N/A

Recommended Number of Personnel (by Department) for ArcGIS I and II Training

Department/Division	ArcGIS I	ArcGIS II
IT Department	2	2
Neighborhood Services	3	0
Fire Department	3	0
Finance Department	3	0
Human Resources	0	0
METCAD	0	0
City Manager's Office	1	0
Planning Department	8	1
Public Library	0	0
Public Works Department	17	10
Police Department	2	0
Total	**39**	**13**

Network Administration

The Information Technology Department will continue to administer the City's network in support of GIS and its related components (see figure below). The GIS Coordinator will need to continually evaluate network infrastructure and configuration to facilitate data transfer and systems integration. The City has existing capacity to serve GIS data via the intranet and internet. The network consists of fiber with some point-to-point T1 and wireless connections to remote sites. The GIS Coordinator will also need to administer GIS user permissions for each GIS user—users must have different levels of read or write access to GIS data, depending on their responsibilities.



City of Champaign Network Infrastructure

Existing GIS Data Layer Inventory and Future Recommendations

Many GIS and CAD layers have been created and are maintained in the Planning and Public Works Departments; as well as, the GIS Consortium. The GIS Coordinator will need to work with these departments to determine what layers will be migrated to a geospatial format, such as shapefile and/or geodatabase. Detailed descriptions are available from existing staff but will need to be built into a metadata document for long-term information keeping.

The GIS Coordinator will be responsible for establishing and maintaining the corporate GIS database. As new data layers are created, the GIS Coordinator will need to ensure that each layer is at an acceptable accuracy level and that a data update methodology has been established. The GIS Coordinator will work closely with each department to ensure that they have the appropriate training and skills to maintain their own GIS layers where appropriate. These datasets will be stored on the existing corporate GIS server.

The table below lists all of the layers, both existing and recommended, identified during the needs assessment process:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Address Points	Extract, cleanse, geocode, and map from TRAKit and other sources; georeference based on aerial photography and GPS field work	Public Works and GIS Coordinator	Recommended
Aerial Photography	GIS Consortium	GIS Consortium	Existing
ATM, Banks, Branches	Heads up digitizing on the screen	Police	Recommended
Beats and Response Zones	Digitize from exiting maps and/or heads up digitizing using aerial photography	Police Department; GIS Coordinator	Recommended
Building Permits, Certificates of Occupancy	Housed in TRAKiT	Automated integration	Recommended
Building Pre-plans	Housed in Firehouse software	Fire Department	Recommended
Census Data	Download from Census Bureau	GIS Consortium	Existing
City Limits	Official City Limit Map	Planning	Existing
City Owned Property	Digitize on screen	Public Works	Recommended
Commercial Addresses	Extract, cleanse, geocode, and map from existing data sources	Automated	Recommended
Comprehensive Plan, Land Development Code, Development Agreements	Scan into database and link to parcel information.	Planning	Recommended
Council Districts	Creation in an initial data conversion	GIS Coordinator	Recommended
Crime Data	Extract, cleanse, and automatically map from Police database	Automated	Recommended
Critical Facilities	Manually digitize points from aerial photography and address sources	GIS Coordinator	Recommended
Delinquent Tax Properties	Extract from financial data	Automated	Recommended
Drug Free Zones Around Schools	Buffer created around schools	Crime Analyst	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Easements	Digitize from base map data; aggregate layers as needed	Public Works / GIS Coordinator	Partial Existing
Environmentally Sensitive Areas	GIS Consortium	GIS Consortium	Recommended
Evacuation Routes	Use street centerlines layer as source, and save evacuation routes as separate layer	Fire/Emergency Management	Recommended
Fire Hydrants	Are in AutoCAD	Illinois American Water	Recommended
Fire Incidents	Extract, cleanse, geocode, and map from Firehouse	Automated	Recommended
Fire Inspections	Extract, cleanse, geocode, and map from Firehouse	Automated	Recommended
Fire Investigations	Extract, cleanse, geocode, and map from Firehouse	Automated	Recommended
Fire response times	Created via DECCAN fire software	Fire	Recommended
Fire Response Zones	Created in DECCAN and will need to be integrated into enterprise GIS efforts.	Fire Department; GIS Coordinator	Existing
Flood Zones	Acquire from Illinois Water Survey	GIS Consortium	Existing
Hazardous Materials	Extract from data within Firehouse; needs to be completed	Fire Department	In Progress
Historic Properties	Field collection and documentation	Planning	Existing
Hot Spots	Automatically created by crime analysis software	Crime Analyst	Recommended
Hydrology	GIS Consortium	GIS Consortium	Existing
Impervious Surfaces	Digitize polygons from aerial photographs; derive polygons by raster analysis of remotely-sensed data	Public Works; GIS Coordinator	Recommended
Knox Box Locations	Digitized on Screen	Fire Department	Existing
Land Use (Existing and Future)	Digitize polygons from aerial photographs and existing maps	Planning	Recommended
Liquor License Locations	Derived from TRAKiT. Automatic download and creation	Licensing	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Lot survey	1/3 of the City complete. All of this data should be interfaced to the GIS	Planning	Recommended
Mosquito Breeding Areas	Digitized heads-up on screen	Consortium and Public Works	Recommended
Mowing Zones	Digitized heads-up on screen	Public Works	Partial
Municipal Boundaries	GIS Consortium	GIS Consortium	Existing
Neighborhood Watch Groups	Derived from neighborhood layer	Police	Recommended
Neighborhoods	Needs to be created from paper maps and local knowledge	Neighborhood Services	Partial
Newly Developed Areas	Digitized heads-up on screen	Public Works	Recommended
Northwest Interceptor Fee Boundary	Digitized heads-up on screen	Public Works	Partial
Nuisance Abatement Records	Extracted and mapped from TRAKiT. Process will be automated.	Neighborhood Services	Recommended
Parcels	GIS Consortium	GIS Consortium	Existing
Parking Features **Handicap** **Loading Zones** **Metered** **Lots** **Space markings** **Permit parking** **Towing zones**	GPS and heads-up digitizing	Public Works	Existing
Parolees	Extracted from data housed on the AS/400. Should be automated	Police	Recommended
Persons on Probation	Address matched from county probation records	County Probation	Recommended
Planning Areas	Neighborhood Services	Neighborhood Services	Recommended
Pre Plan Data (Buildings)	Scanned hardcopy and data at fire department	Fire; GIS Coordinator	Recommended
Public Works Routes (Snow Removal and Sweeping)	Digitized heads-up on screen and optimized using GIS software	Public Works	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Rights-of-Way	Site plans and other documents	Public Works	Partial Existing
School Crisis Plans	Scanned and linked to the school GIS layers for easy viewing on Intranet and mobile applications	Police	Recommended
Schools	Digitize from base map data.	GIS Coordinator	Recommended
Sewer Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Sex Offenders	Registered and housed on the AS/400. Download and mapping should be automated.	Police	Recommended
Sidewalks	GPS and digitizing from aerials	Public Works	Partial Existing
Sign Violations	Extracted and linked from TRAKiT	Automated	Recommended
Signs	GPS field work	Public Works	Recommended
Signs (Private)	GPS field work; aggregate layers as needed. Extracted from TRAKiT	Planning	Recommended
Special Needs Residents	Extract and map from CAD data	METCAD	Recommended
Speed Zones	GPS field work; derive from aerial photography; aggregate layers as needed	Public Works	Recommended
Storm Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Streetlights	GPS data capture	Public Works	Existing
Streets	Derived from aerial photography; GPS	GIS Consortium but should be maintained in Public Works	Existing
Striping & Pavement Markings	GPS field work; derive from aerial photography	Public Works	Recommended
Topography	Derived from LIDAR	GIS Consortium	Existing
Tornado Siren Locations	Derived from aerial photography; GPS	Fire Department	Recommended
Traffic Accidents	Extract and automatically map from RMS and IDOT	Automated	Recommended
Traffic Counts	Extract, cleanse, geocode and map from Access database	GIS Coordinator	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Traffic Service Requests	Scan into database and link	Public Works	Recommended
Traffic Signals	GPS field work	Public Works	Recommended
Transportation **Alleys** **Pavement Management** **Bridges** **Markings** **Streets** **Traffic Counts**	GPS and heads-up digitizing	Public Works	Partial
Tree Inventory	GPS	Public Works	Recommended
Underground Parking	Heads up digitizing on screen	Police	Recommended
Underground Storage Tanks	GPS and heads-up digitizing	Public Works	Existing
Utility Customers	Sanitary District	Sanitary District	Recommended
Vacant Properties	Query from parcel layer; other sources as needed	GIS Coordinator (eventually automated)	Recommended
Variances	Scanned and linked to the GIS	Planning and GIS Coordinator	Recommended
Water Base Map	Are in AutoCAD	Illinois American Water	Recommended
Water Sampling Station Data	GPS and field collection	Public Works	Existing
Waterways	USGS Data	GIS Consortium	Recommended
Well Head Protection Zones	GPS Field Work	Planning	Recommended
Wetlands	National Wetland Inventory	GIS Consortium	Recommended
Zoning	Digitized on screen	Planning	Complete
Zoning Violations	Extracted from TRAKiT	Automated	Recommended

Recommended GIS Applications

To meet the City's GIS goals the following GIS software is recommended within IT:

ArcView 9.2

ArcView 9.2 is recommended for use by Information Technology personnel. A description of this application is provided in the Enterprise-Wide Applications section of this chapter. One (1)

license of ArcGIS is recommended for use by the GIS Coordinator. The City may wish to utilize a license server in order for this license to be shared with users from other departments.

ArcGIS Server

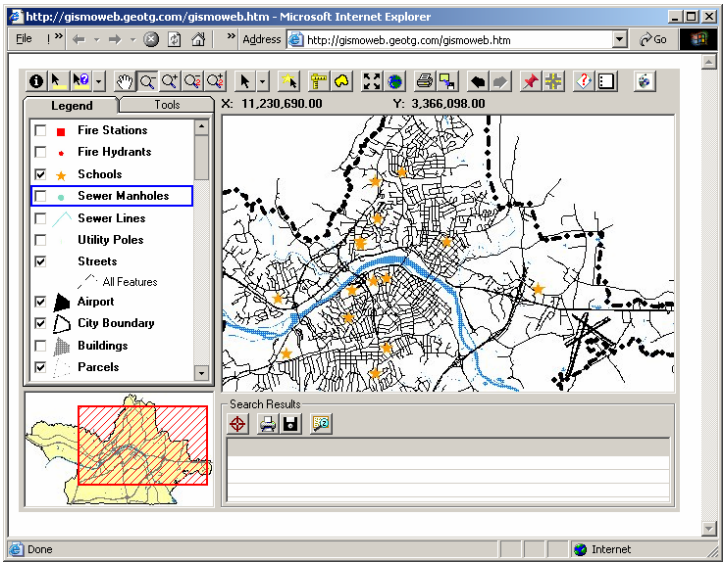
ArcGIS Server is a server-based product that provides a scalable framework for distributing GIS services and data over the Web. ArcGIS Server will be used as a platform to serve data for the City's LGweb data browser.

ArcGIS Server provides Web publishing of GIS maps, data, and metadata for access by many users both inside the organization and outside on the World Wide Web. ArcGIS Server enables Web sites to serve GIS data, interactive maps, metadata catalogs, and focused GIS applications. ArcGIS Server users access these services through their Web browsers using HTML or Java applications that are included with ArcGIS Server.
In addition, ArcGIS Server services can be accessed using many different clients including ArcGIS Desktop, custom applications created using ArcGIS Engine, ArcReader, ArcPad, ArcGIS Server, ArcObjects—Java Edition, and a wide variety of mobile and wireless devices.

ArcGIS Server will serve as the foundation for the City's Intranet and Internet GIS Data Browser, which will provide public access to the City's geospatial data.

Intranet GIS Data Browser

An Intranet GIS Data Browser is recommended for implementation City-wide, on all networked City government computers. An Intranet GIS Data Browser is an easy-to-learn and easy-to-use web-based GIS application. It provides easy access to all City employees to display, query, and analyze spatial information about many aspects of the City. In contrast to an Internet GIS Data Browser, the Intranet GIS Data Browser may contain spatial layers or connect to databases that the City may not wish to share with the public. For more information on the recommended Intranet GIS Data Browser, please refer to the Enterprise-Wide Applications section at the end of this needs assessment chapter.



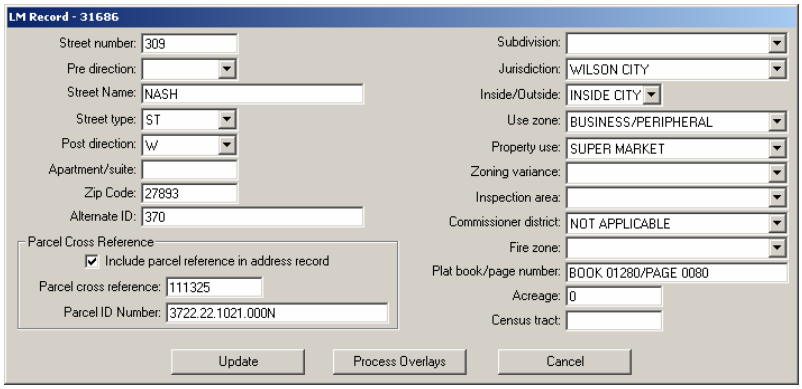
Example of an Intranet GIS Data Browser

Internet GIS Data Browser

An ArcGIS Server-based Internet GIS data browser has been recommended to provide citizen's with access to the City's geospatial data. This application will allow for different configurations and different skins. Targeted applications such as one for Economic Development will be deployed as well as a more generic public query portal. A description of recommended GIS data browser solutions is provided at the end of this chapter.

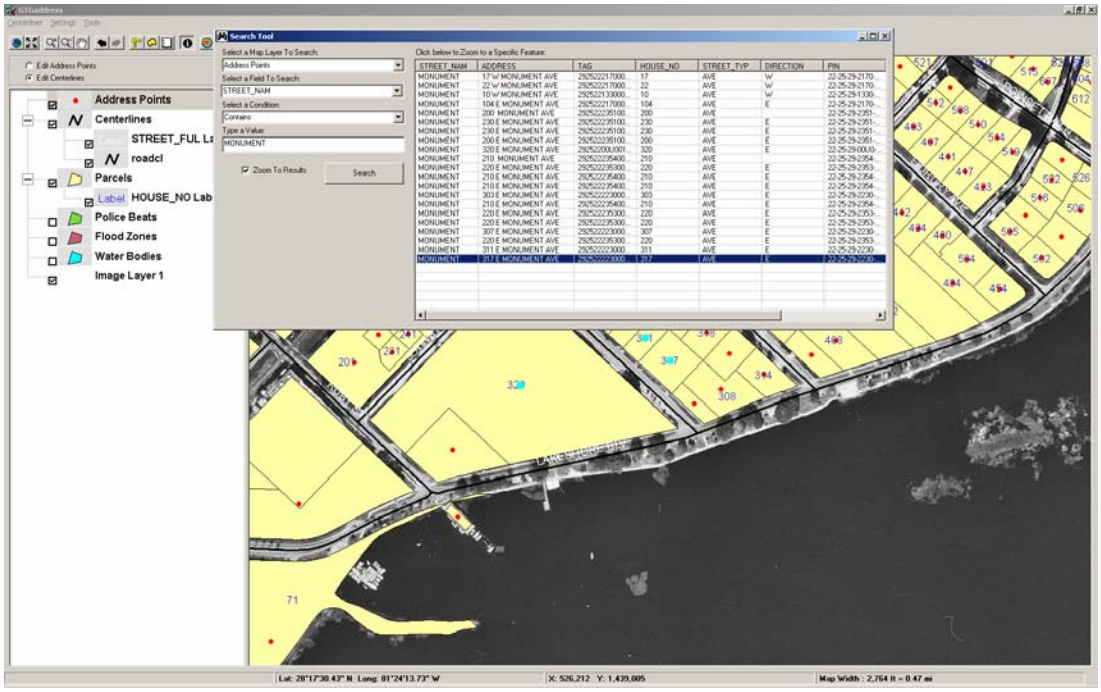
Addressing Application

After an initial address point creation task, a GIS based addressing application should be utilized to maintain addresses for the City. The application should be used for maintaining accurate addresses and address points. It is recommended that the Public Works Department, in conjunction with the GIS Coordinator, utilize this tool to manage and maintain address information. One license of the application is recommended for Planning and one for the GIS Coordinator.



Addressing Application Setup Interface

Using an Addressing Tool to Edit Address Data

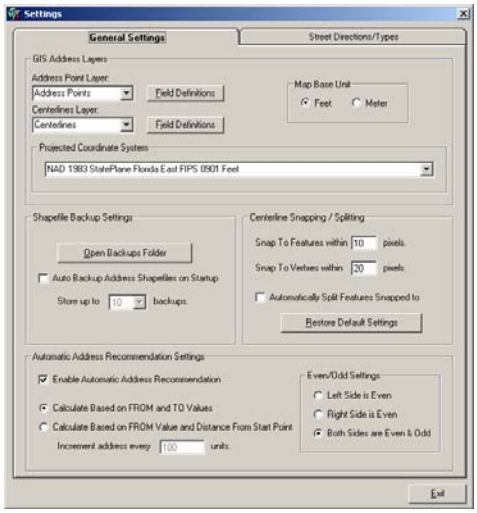


Example of Addressing Application's GIS Search Tool

The application should also allow users to carry out custom queries to search for specific information stored in various GIS layers such as streets and parcels. Users will be able to search for specific street names or addresses within the address point layer or street centerline layer. Also, users can find specific locations on the map by entering a latitude and longitude.

This application will also allow users to customize settings such as the following:

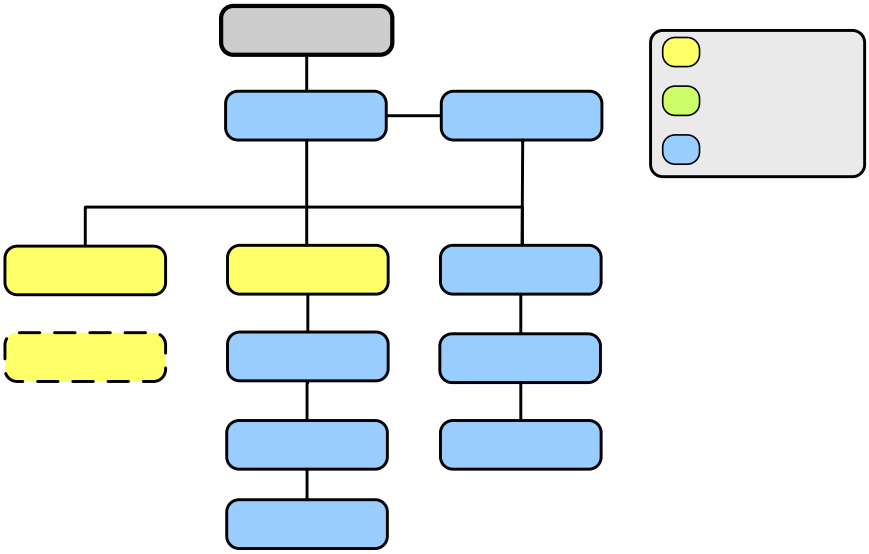
- Change the Projected Coordinate System
- Set Custom Snapping Tolerance (for use when moving address points)
- Enable Automatic Address Recommendation
- Calculate Based on From and To Values



Screen Shot of General Settings Tab in the Addressing Application

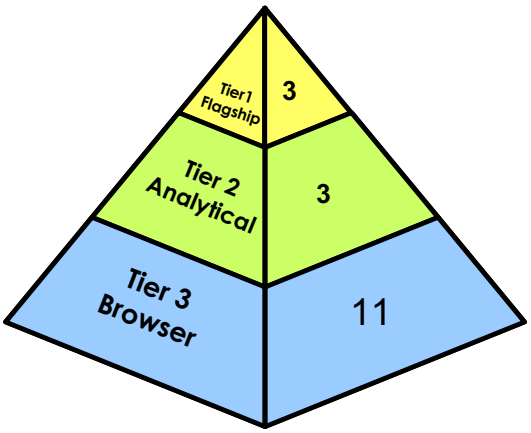
Multi-Tier GIS Application Use within the Information Technology Department

The following chart describes the recommended GIS application use by the Information Technology Department. A Tier 1 user is a power GIS user who should have access to a fully functioning GIS toolset. A Tier 2 users focus is data analysis in addition to general browsing capabilities. A Tier 3 user requires only general browsing GIS data functions. The Information Technology Department will consist primarily of Tier 3 users, although some staff have technical knowledge and understanding of GIS such that they can be considered Tier 2 users; the GIS Coordinator is a Tier 1 user.



Information Technology Department Multi-Tier GIS Application Use

There are three users within the Information Technology Department that are considered Tier 1 users; all other staff members are Tier 3 users.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The Legal Department is responsible for all legal matters affecting the City of Champaign. The office provides day-to-day advice and consultation, document drafting, legal research and provides legal representation to the City Council, the City Manager, the City's boards, commissions and committees, departments and staff, and the City of Champaign Township. The office also provides information and assistance to the general public and other local, state and federal government entities and municipal government associations and organizations.

The City Attorney, Deputy City Attorney, and each Assistant City Attorney work with City departments and officials as assigned. Two legal secretaries work with two attorneys and carry out independent administrative assignments. One additional legal secretary assisted by a part-time legal secretary coordinate the City's ordinance prosecution system. A paralegal assists all of the lawyers and three law clerks provide research assistance.

Existing Hardware and Software

All City employees have access to their own personal computers running Windows XP and Windows 2000 operating systems. The Department also has a laptop for departmental use.

The Legal Department uses the following software applications:

1. GEMS
2. Microsoft Office for office productivity
3. GroupWise- email, calendaring, and scheduling
4. TrakIt for preparation/review of property maintenance
5. Adobe Suite for office productivity
6. T-2 for small claims cases
7. Docushare for office productivity
8. City Court software for assistance with the prosecution of cases
9. Mr. SID for aerial image viewing
10. Team Budget Questica for CIP

Recommended GIS Needs and Duties

The Legal Department will work closely with the GIS custodian in all legal issues pertaining to GIS data and data accessibility.
Key issues facing the Legal Department include:

- Establishing access policies consistent with the Freedom of Information Act (FOIA);
- Setting the fee structure for GIS data;
- Writing the disclaimer notice for all Internet sites;
- Determining how the City will recover the costs of preparing and delivering GIS data and databases.

- Establishing interactivity with files from police, finance, public works, and other departments

Existing GIS Data Layer Inventory and Recommendations

The City's digital data layer repository will be used by the Legal Department via the Internet. The table in Chapter 2 IT Department shows city-wide data layers that will be available for use by the Legal Department.

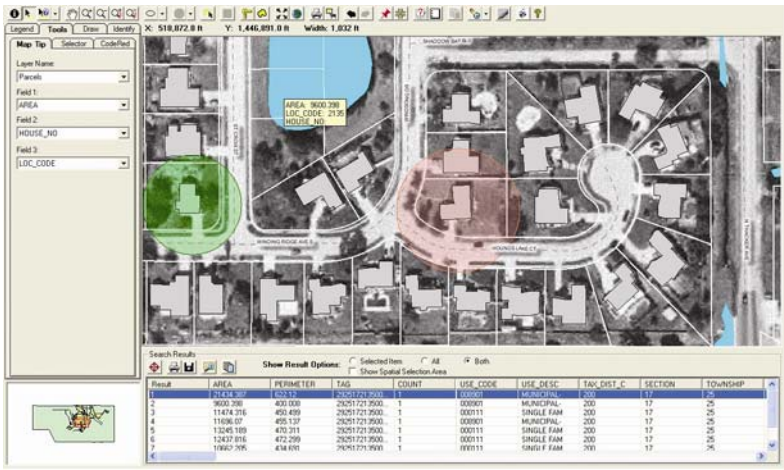
Recommended GIS Applications

We recommend all Legal Department staff have access to GIS via a citywide intranet GIS Data Browser.

Intranet GIS Data Browser

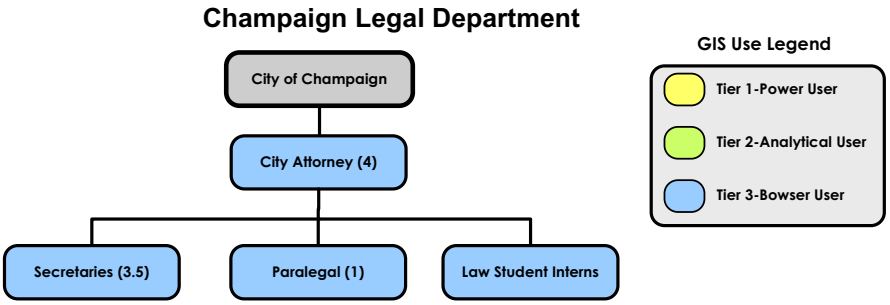
An ArcGIS server-based Intranet GIS data browser has been recommended to give Legal Department staff the ability to view and analyze GIS data.

The City of Champaign expressed an interest in providing city staff with access to online maps and geo-spatial information via the intranet. An enterprise Intranet GIS Browser application, based on ArcIMS, will be needed to provide such a solution. The intranet browser should have an intuitive interface, and should incorporate the use of a graphic outline.

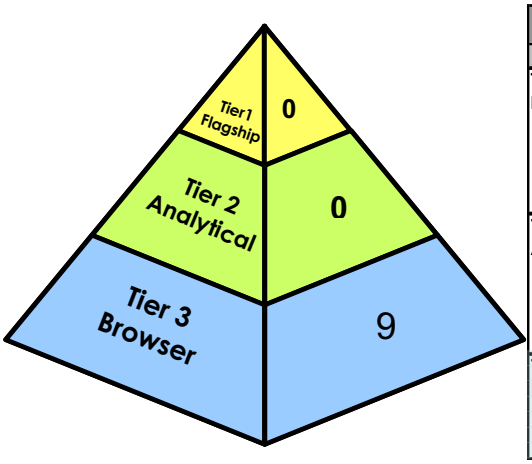


Multi-Tier GIS Application Use within the Legal Department

The following graphic describes the recommended departmental GIS user roles for the Legal Department based on the three tiers of GIS.



The Legal Department is comprised of Tier 3 GIS users whose emphasis should be on using GIS technology rather than being a custodian of data and databases.



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Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The mission of the METCAD is "To provide the highest quality, and most efficient, emergency communications service for the citizens and public safety agencies within Champaign County."

METCAD is a public safety answering point (PSAP) that serves a majority of the County including thirty separate agencies. A ten person policy board is responsible for the oversight and strategic direction of METCAD. METCAD staff are paid through the City of Champaign payroll but funding comes from member agencies and telephone surcharges. METCAD handles in excess of 280,000 calls per year.

METCAD takes responsibility for its own mapping needs and currently utilizes GIS products. Most often these products are acquired as part of a larger initiative such as Tiburon software for CAD calls. METCAD will not require GIS support or services from the City of Champaign.

Existing Hardware and Software

METCAD utilizes approximately 25 personal computers – ten of which are assigned to a specific user, six are used by IT staff, and four are on standby for disaster deployment. All computers utilize Windows XP Pro or SUSE Linux 10.0 as their operating systems. The primary software applications are from Tiburon. METCAD is Phase II compliant and therefore can display cell calls in conjunction with land-line calls.

Tiburon CAD/Ti

Firehouse is utilized by the Department for incident tracking, tracking fire code violations, Knox Box tracking, hazardous materials tracking. The software is being utilized extensively by the department. Tiburon's CAD/Ti operates as a fully distributed system on Intel-based processors using Microsoft Windows. At the core of Tiburon's CAD/Ti solution provides distributed, workstation-based processing of all dispatch functions operating under Microsoft Windows. The CAD/Ti solution places a complete desktop CAD system in front of every user and provides automatic, synchronization of each workstation. If any component fails, CAD continues to function. Each workstation is synchronized in real time with one or more CAD file servers and with all other workstations. Mapping for Tiburon is provided by their business partner Maverick Maps.

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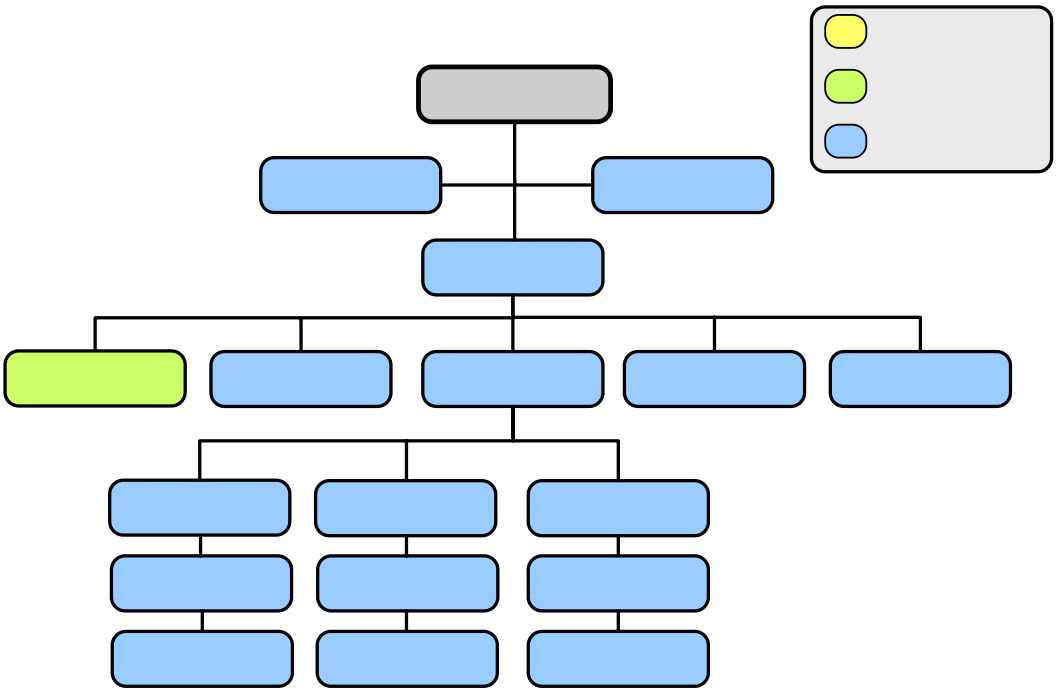
Recommended GIS Needs and Duties

GIS is an integral part of METCAD's daily operations. The following issues are important to this project:

- METCAD currently maintains its own GIS software and data layers. They maintain their own street centerline layers because their centerlines need to be broken at various boundary layers such as response zones. Therefore, they will need to continue to maintain their own independent centerline layer.
- METCAD stores their GIS data on the same SDE server as the GIS consortium. The consortium provides other needed GIS layers.
- Address points are desired by METCAD and will utilize this layer as it is provided by the Consortium.
- METCAD will provide calls for service data to the City as needed for mapping and analysis.
- METCAD has no plans to implement automated vehicle location (AVL) technology for the participating agencies in the near or foreseeable future.
- Reverse 911 technology is not being pursued at this time due to the inherent issues with the technology relating to the inability to access a reliable phone database.
- Mobile mapping is the responsibility of the member agency and is not being planned for implementation by METCAD.
- METCAD currently maintains GIS layers for the Champaign Police Department
- METCAD is currently implementing an 800MHz communication network from Motorola. This will provide coverage for the entire county.

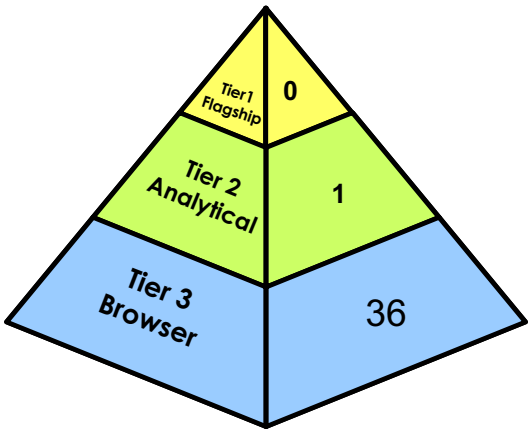
Multi-Tier GIS Application Use within the METCAD

The following chart describes the recommended GIS application use by the METCAD Department. A Tier 1 user is a power GIS user who should have access to a fully functioning GIS toolset. A Tier 2 users focus is data analysis in addition to general browsing capabilities. A Tier 3 user requires only general browsing GIS data functions.



METCAD Department Multi-Tier GIS Application Use

There is one user within the METCAD Department that is considered a Tier 2 user; all other staff members are Tier 3 users.



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Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The Neighborhood services Department employs sixteen full-time staff members and up to six interns per year. The mission of the Neighborhood services Department is; "to ensure a comprehensive and effective response to neighborhood needs through implementation of the City's Neighborhood Wellness Action Plan, coordination of neighborhood-based City services, and leadership on public information and citizen participation activities."

The Neighborhood services Department has three divisions as follows:

- Neighborhood Coordination Division – responsible for citizen education and outreach; organization and training of neighborhood watch groups, neighborhood organizations, homeowners associations, and lake associations; coordinating interdepartmental efforts to solve neighborhood problems; and promoting neighborhood self-help programs to address community priorities.
- Property Maintenance Division – responsible for the maintenance and preservation of existing maintenance and fire prevention codes. The Division coordinates City efforts to promote compliance with the City's nuisance and vegetation ordinances through public education, enforcement, and programs to eliminate blight and nuisance conditions.
- Neighborhood Programs Division – responsible for developing and managing programs to address neighborhood needs, including housing rehabilitation and home ownership programs, neighborhood plan implementation, and community service activities. The Division administers a variety of Federal, State, and local funds to support these programs and activities.

The Department uses GIS for mapping and some spatial analysis. However, due to the lack of data GIS is of limited use. The Community Development Specialist is the primary user of GIS. It is anticipated that the use of GIS will pervade the entire department once data and appropriate software tools become available. The majority of GIS use in Neighborhood services will be at the data retrieval level (level 3 GIS users); however, some GIS use within the Department will involve more complex mapping and analysis, such as that of a Level 2 GIS Users (see Chapter 4: Governance Model for more information on tiered GIS users).

Existing Hardware and Software

All staff in the Neighborhood Services Department have personal computers running the Windows XP or Windows 2000 operating system (citywide standard). Two laptops are shared by office staff.

The Neighborhood Services Department uses the following software applications:

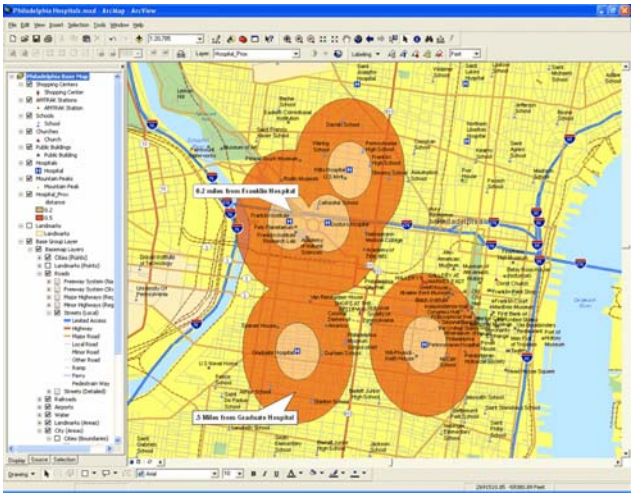
1. MS Office – office productivity
2. ArcGIS – ArcView seats (1) with no extensions
3. TRAKiT – neighborhood services and development
4. OneRoof – Housing rehabilitation tracking program
5. GEMS – for financials

6. GroupWise –email, calendaring, and scheduling

The Department utilizes the aforementioned software in varying capacities. ArcView is used for mapping and spatial analysis. An E-sized plotter will need to be acquired for Neighborhood Services.

ArcView

ArcView is used to view data and produce some maps. However, due to lack of significant data the product is of very limited use at this time. Eventually multiple staff will have access to ArcView and will receive training on how best to apply it to the issues faced by Neighborhood Services.



ESRI's ArcView

TRAKiT

TRAKiT is available from CRW. The TRAKiT system is a system for creating, issuing, and tracking issues related to properties and property owners. TRAKiT is utilized to track various information about properties including zoning, ownership, sign applications, annexation agreements, historic property information and other pertinent data. Data from TRAKiT will need to be GIS enabled.

TRAKiT

OneRoof

OneRoof is utilized as a housing rehabilitation program. Information such as; affordable housing, new construction, community development block grant, and liens is tracked within OneRoof. Of critical importance is linking all data from OneRoof to the GIS.

Travis Systems OneRoof Workflow

Recommended GIS Needs and Duties

Everything that is required of the Neighborhood Services Department has a geographic component. Therefore, everything done by the department should be GIS enabled and tracked via a GIS data layer. In addition, the City has made a concerted effort to focus on neighborhoods as a means of delivering government services and providing optimal customer interaction. Therefore, data collected by Neighborhood Services should drive decisions made by all departments. GIS is the tool that will enable all staff to gain a holistic view of any neighborhood. Neighborhood services should work closely with the recommended GIS Coordinator to integrate GIS within all its workflows.

Based on this needs assessment, the Neighborhood Services Department has several GIS needs:

- Mapping and Spatial Analysis of Neighborhood, Wellness, Community Development and Other Key Data – Including automatic dialing and mailings
- Public forum neighborhood and vicinity mapping
- Creation of a GIS enabled Neighborhood Wellness Action Plan
- Mapping and Spatial Analysis for Support of Community Investment Programs and Projects
- Cartographic Products for Grant Proposals
- Public access to geospatial Neighborhood Services data
- Formal GIS training for Neighborhood Services staff
- Neighborhood wellness plan managed as an ESRI data model
- Interfacing TRAKiT and OneRoof data with GIS
- Field access to GIS data

It is expected that Neighborhood Services personnel will begin to create and maintain data specific to their department. It is recommended that department personnel begin to do all of their own mapping and analysis as more data becomes available. For advanced GIS support, staff should work with the GIS Coordinator, who can use robust GIS software such as ArcEditor or ArcInfo to conduct additional mapping and analysis tasks; the GIS Coordinator may also be called upon to help create additional cartographic/analysis products for the

Neighborhood Services Department. This does not mean that the Neighborhood Services Department will not have trained analytical users; it simply means the GIS Coordinator will act as a senior technical advisor on GIS projects within each department.

It is also recommended that Neighborhood Services implement an Intranet GIS data browser to provide staff with access to mapping, imaging, and spatial analysis functionality. This GIS data browser should include the ability for staff to view updated Department-specific information as well as the City's base GIS data layers.

Mapping and Spatial Analysis of Neighborhood, Wellness, Community Development and Other Key Data – including automatic dialing and mailings

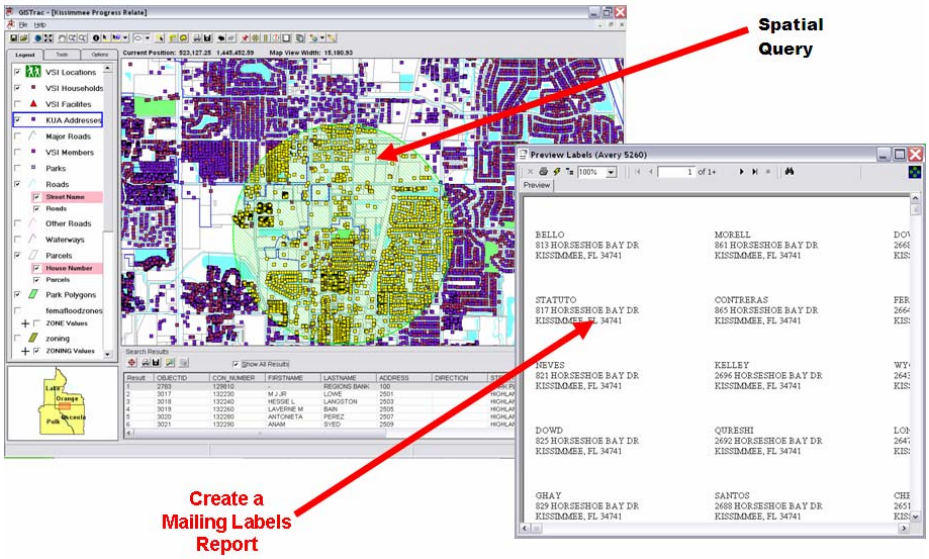
A key need identified by Neighborhood Services Department personnel is increased and improved use of GIS to map and analyze land neighborhood based data. All of Neighborhood Services projects and tasks require the ability to produce maps and derive information from spatial analyses, including updates to the Neighborhood Wellness Action Plan, infill issues, and community development issues. In reality, Neighborhood Services staff need access to all the information about an area as is available. Staff make decisions based on data that they can obtain. Often, this data is lacking and best judgment has to be utilized. However, each data layer that is created will empower staff with more detail and accurate data from which to make decisions. Data from every department has a bearing on the decisions made within Neighborhood Services. Therefore, quick and easy access to all City data is imperative for Neighborhood Services.

The Neighborhood Services Department identified that it could utilize GIS to assist in several tasks, including:

- Proposed development location analysis
- Neighborhood wellness and infill analysis
- Land use and land development mapping and analysis
- Census/Demographic analysis
- Creation of mailing labels based on geography
- Project activity mapping
- Production of public meeting and exhibition maps
- Access to nuisance abatement issues
- Access to land use information
- Access to information on properties – owner occupied, rental, homeowner, liens, affordable housing, etc.

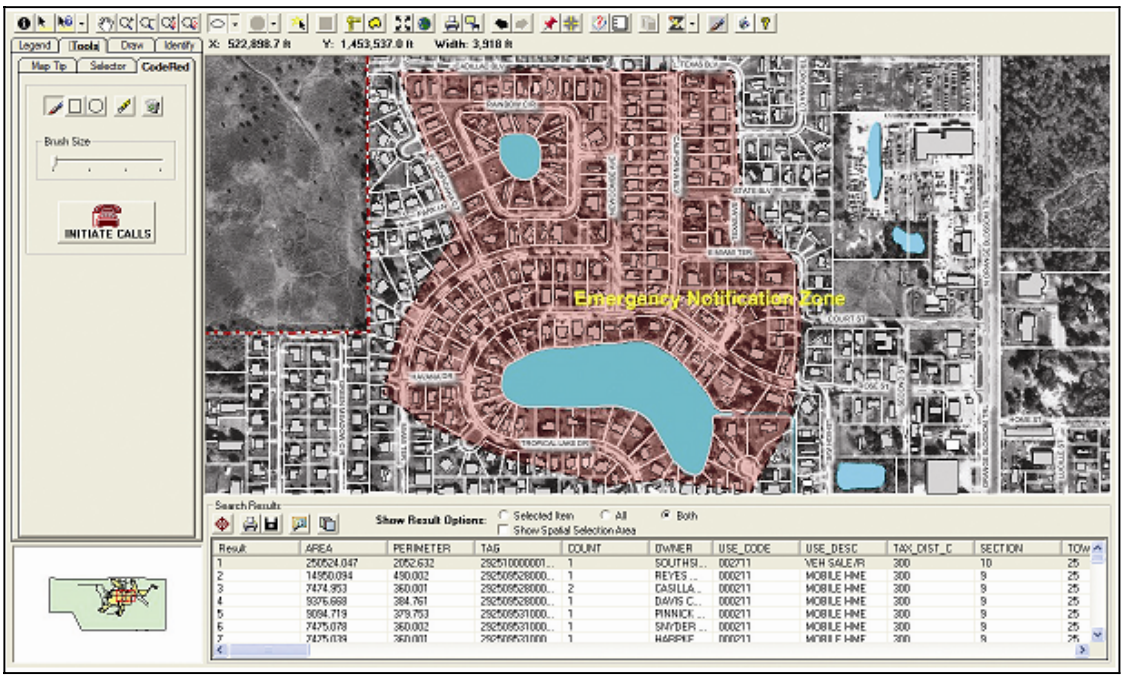
Various data layers are needed to accomplish the above tasks. These data layers will be detailed further below.

Neighborhood Services is responsible for notifying citizens about a variety of neighborhood related issues. In some cases the ability to notify the public in mass may be required. In these instances Department personnel need to be able to quickly identify citizens affected by these changes using heads up spatial query capability, with output generating mailing labels or call lists.



Mailing List Generation

Additionally, notification can be handled via the GIS data browser through remote dialing software solutions. In this case, the user selects an area and a pre-defined message is sent to everyone within the selected area. Detail on these solutions is provided in the applications section further below.

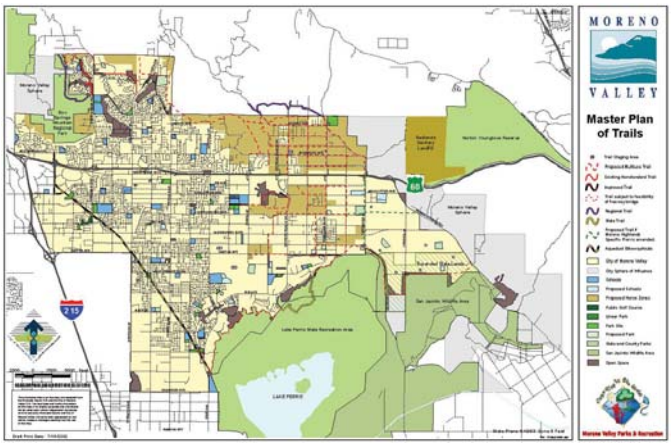


Using GIS for Citizen Notification

The following case study details the use of GIS for growth issues in Moreno Valley, California.

Case Study: Moreno Valley, California, Manages Explosive Growth with GIS

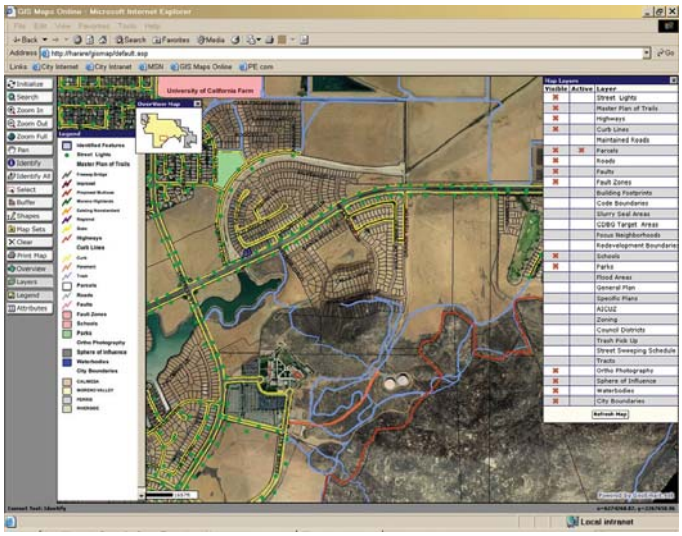
Cities with explosive growth need to optimize their resources. This is a truism regardless of their size, shape, or location. Case in point: Based on preliminary Census 2000 data, Moreno Valley in Riverside County is the sixth fastest growing city in California and 26th in the nation. Once an infant among California cities, Moreno Valley, situated 70 miles east of Los Angeles, now has 150,000 residents—a 450 percent increase over its 1980 population of 28,000.



The GIS mapping of vacant or underdeveloped parcels by the Planning Department helps show development opportunities within close proximity to existing infrastructure.

Like many other cities across the United States, Moreno Valley first acquired GIS to help manage its growth. The city began its GIS journey with desktop mapping software that was used by various departments. For the most part, the software was used for mapping, visualization, and query, with its users working independently.

The city eventually realized it needed a more strategic plan to deploy its GIS and turned to its newly hired GIS coordinator Michael Heslin for help. Heslin conducted interviews with various city agencies and performed an extensive GIS needs assessment. He also investigated how other local government agencies managed information; in the process he studied other enterprise implementations and instantly recognized the many benefits that were possible.



What resulted was a clear understanding that an enterprise GIS implementation was needed to streamline Moreno Valley's GIS processes and leverage the true analysis capabilities a GIS would provide. In addition, Heslin recognized the need for leveraging data managed independently within separate departments. An enterprise approach would allow various departments to use data managed outside their own department. Plus, the city wanted more powerful functionality.

Moreno Valley's GIS includes the ability to look up a property by the assessor parcel number, address, or property owner as well as generate notification mailings, view buffer maps, and print full property records.

Using his prior knowledge and experience, bolstered with the information resulting from the interviews and investigation, and taking into consideration the city had 32 seats of ArcView, Heslin made his decision. He realized that migrating to ArcInfo would add advanced geoprocessing and data conversion capabilities including tools for data creation, update, query, mapping, and analysis. In addition, ArcGIS Server could provide an intuitive, Web-based platform for sharing data and applications easily throughout the city. Thus, in 2001, the city selected and successfully made the move to ArcGIS software and then had a true enterprise GIS in place. The city uses ArcInfo 8.3, ArcView 9.2.3, ArcView 3.2, and ArcGIS Server 4.0.1 and is now deploying GIS for virtually all city departments including Planning, public works, fire, law enforcement, Recreation and Parks, and economic development. Today, the city is doing more with fewer resources and doing it in less time.

With a Little Help from Their Friends

The city quickly began capturing data and performing a wide range of GIS applications. In addition, several other municipal, county, and state agencies already using ESRI GIS software were contacted, and information sharing began to take place. Now Moreno Valley has a vast array of existing, up-to-date data sets to work with as part of its own GIS work.

"Prior to GIS, many of the analysis capabilities available today were simply not available," adds Heslin. "By moving to an enterprise GIS, you can better share and distribute information. And you have the whole analysis capability. It has real, lasting value in numerous ways.

"City staff had used the databases in the past to store their departmental information," continues Heslin. "We moved to an enterprise GIS system, meaning information is deposited in a central location and can be shared from department to department using a common data standard. Users can retrieve any available information from their desktop rather than knocking on doors or calling people to request information."

ArcGIS Applications

Moreno Valley's GIS includes the ability to look up a property by the assessor parcel number, address, or property owner as well as generate notification mailings, view buffer maps, and print full property records.

An important GIS application involved an impact study for a proposed hiking trail project. The city needed to decide whether the proposed multiuse trails project was a worthy endeavor. The GIS Department collected data from different sources including paper maps, on-the-fly digitizing of aerial photos, GPS mapping, input from a trails committee, and other public sources. GIS analysis was performed by evaluating a number of different variables including impact on funding, integration into existing trails, and more. Trails were mapped using aerial images, some were mapped in the field, and some were already stored in digital format and input into ArcGIS.

"Once the data was in GIS, calculations became a snap," says Heslin. "We could calculate linear feet for any type of trail, calculate how much a trail would cost, determine which properties it would cross, and more. It essentially saved several hundred hours of manually mapping trails and performing analysis."

Collaborative efforts were made with other municipalities. The cities of Riverside and Corona, both also within Riverside County, got together with Moreno Valley and shared land use, Planning, zoning, parks, and other information for a California Department of Transportation (CalTRANS) project to get a better understanding of trails and their interconnection between these cities.

"We've learned a lot from other government agencies, both larger and smaller than we are that have done similar things and have important lessons to share," says Heslin. "There's a great user community out there to learn from, and Moreno Valley is certainly taking advantage of this simple fact."

The GIS Department shares its database with the Fire Department so it can have a better understanding of roads, access ways, and other data crucial in an emergency response and for emergency mitigation Planning.

"There's a huge benefit for how decisions are being made because there's more accurate, detailed information available to more people," says Heslin. "Our enterprise GIS provides a jump-start to City Hall and other professionals who need to do a vast array of diverse research. It also helps us work with other cities in joint projects."

Users accessing the database have a large number of tools for performing queries and analysis. For instance, a search can be performed by street location, ZIP Code, parcel

number, zone identification, or any number of spatial and asset identifiers. The automated links between spatial and tabular data provide a sophisticated integration method for greater analysis.

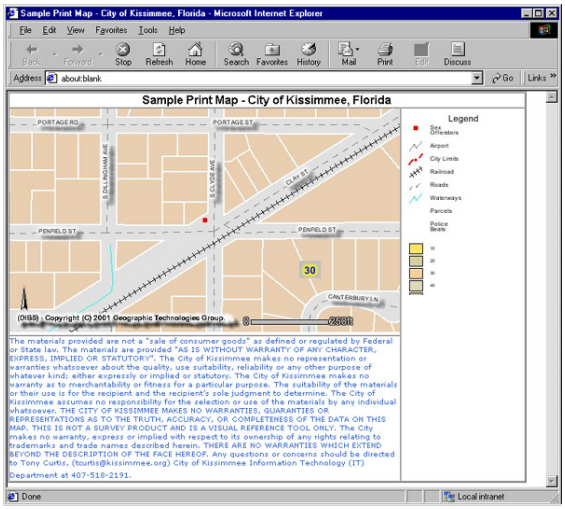
"Government employees can look at a map and drill down to view related map data or look at a database record and then access a map," adds Heslin. "People may not even know exactly what they're looking for but, geographically, they know it's around a general area. They can then drill down and pull up other layers of information. They couldn't do this before. If they're researching a project in the city, they may want to see what impact it will have on school systems, parks, traffic, or other entities. They can make better decisions and, ultimately, save money by making sure budget dollars are spent in the best manner possible."

The city also recently finalized the development of an ArcGIS Server software-based Intranet site. "With an Intranet-based interface to our information, we can serve a greater number of government employees more efficiently," concludes Heslin.

Future applications include integrating GIS with Moreno Valley's permitting system. The city is also in the process of developing an economic development Internet site.

**Case Study Courtesy of ESRI ArcNews Magazine*

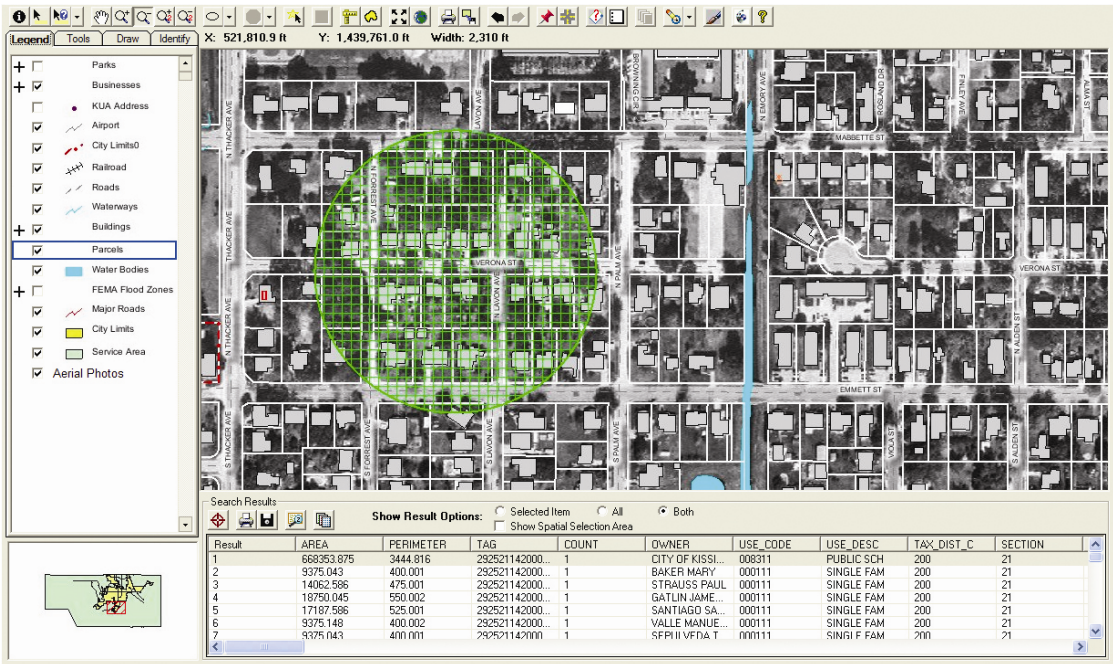
Public Forum Neighborhood and Vicinity Mapping



Neighborhood Services conducts many public forums and neighborhood meetings that would greatly benefit from mapping products. This should be accomplished in two different ways depending on the nature of the meeting. If the meeting is addressing a specific topic then a static map can be created to depict the issue at hand for the area of concern (Figure to the left). This can be accomplished by utilizing ArcView and/or the Intranet Browser Solution (discussed in the applications section later in this chapter).

This process can be automated to where a user can quickly selected needed data layers and a print template for the quick production of maps for the public forum.

Alternatively, if the issue being discussed requires analyzing various neighborhood factors in various areas a live GIS viewing tool should be utilized. This tool would allow the presenter to zoom into areas of concern and display key data layers and do quick analysis such as show me all properties within 500 feet of the area of concern. An easy-to-use data browser should be deployed for this task. With a short learning curve this application would allow a user to display and analyze GIS data on-the-fly.

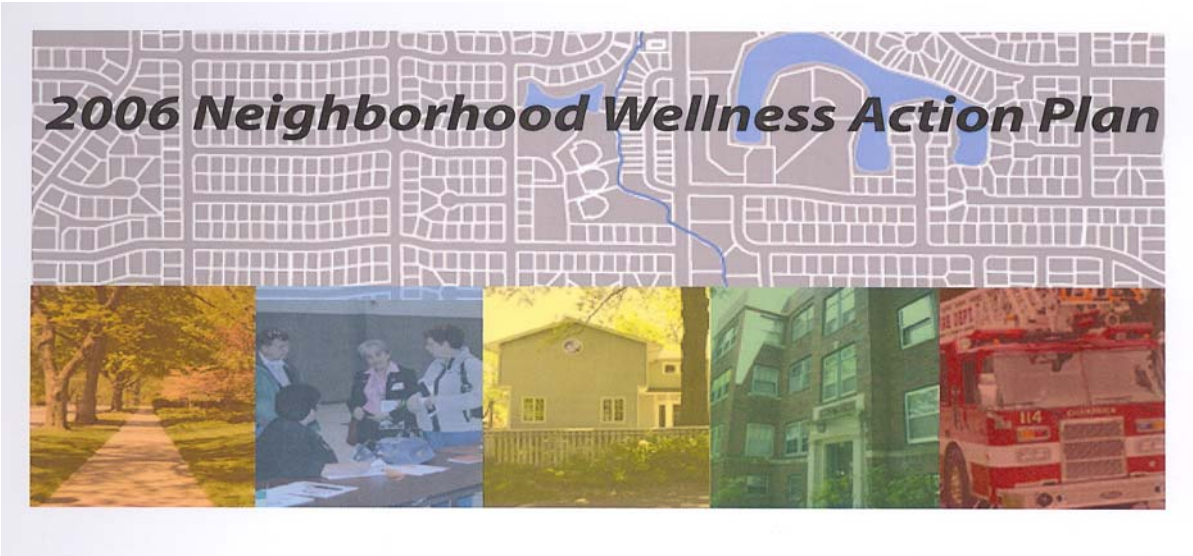


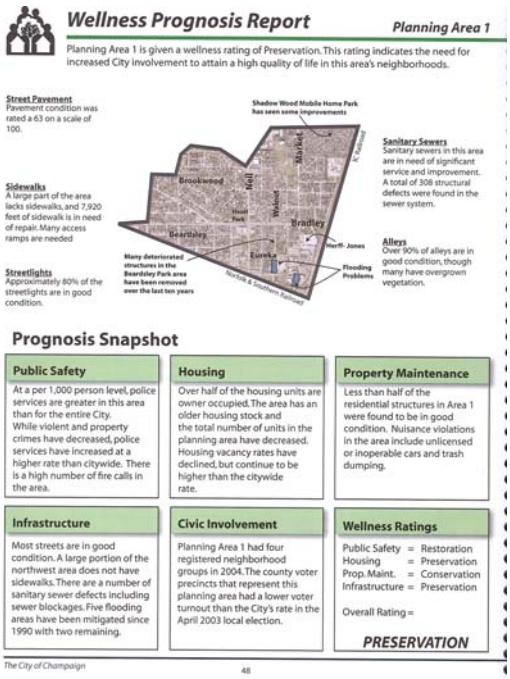
Easy-to-use GIS Viewing Tool

Public Forum Meeting Using GIS Viewing Application

☑ Creation of a GIS enabled Neighborhood Wellness Action Plan

Neighborhood wellness is the centerpiece of the City of Champaign's government. Staff in each department are focused on delivering services to the neighborhoods. Neighborhood Services maintains a Neighborhood Wellness Action Plan. The document looks at many





Wellness Prognosis Report — *Planning Area 1*

Planning Area 1 is given a wellness rating of Preservation. This rating indicates the need for increased City involvement to attain a high quality of life in this area's neighborhoods.

Street Pavement
Pavement condition was rated a 63 on a scale of 100.

Sidewalks
A large part of the area lacks sidewalks, and 7,920 feet of sidewalk is in need of repair. Many access ramps are needed

Streetlights
Approximately 80% of the streetlights are in good condition.

Shadow Wood Mobile Home Park has seen some improvements

Sanitary Sewers
Sanitary sewers in this area are in need of significant service and improvement. A total of 308 structural defects were found in the sewer system.

Alleys
Over 90% of alleys are in good condition, though many have overgrown vegetation.

Many deteriorated structures in the Beardsley Park area have been removed over the last ten years

Flooding Problems

Brookwood, Bell, Market, Hoal Park, Walnut, Bradley, Beardsley, Eureka, North Jones

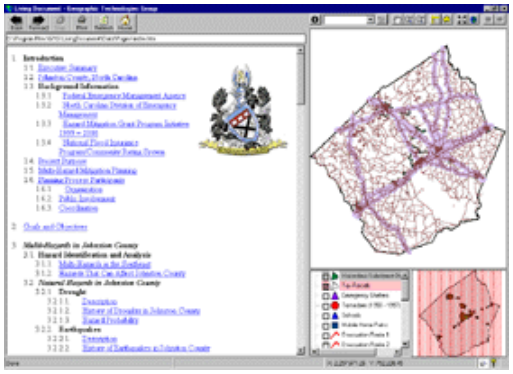
Prognosis Snapshot

Public Safety	Housing	Property Maintenance
At a per 1,000 person level, police services are greater in this area than for the entire City. While violent and property crimes have decreased, police services have increased at a higher rate than citywide. There is a high number of fire calls in the area.	Over half of the housing units are owner occupied. The area has an older housing stock and the total number of units in the planning area have decreased. Housing vacancy rates have declined, but continue to be higher than the citywide rate.	Less than half of the residential structures in Area 1 were found to be in good condition. Nuisance violations in the area include unlicensed or inoperable cars and trash dumping.
Infrastructure	**Civic Involvement**	**Wellness Ratings**
Most streets are in good condition. A large portion of the northwest area does not have sidewalks. There are a number of sanitary sewer defects including sewer blockages. Five flooding areas have been mitigated since 1990 with two remaining.	Planning Area 1 had four registered neighborhood groups in 2004. The county voter precincts that represent this planning area had a lower voter turnout than the City's rate in the April 2003 local election.	Public Safety = Restoration Housing = Preservation Prop. Maint. = Conservation Infrastructure = Preservation Overall Rating = **PRESERVATION**

The City of Champaign 48

variables that factor into the quality of life for a neighborhood. Much of the data that goes into making neighborhood decisions is geographic in nature. It is recommended that the Action Plan move from its hardcopy format to a digital "living document". This digital "living document" will be available via the Intranet and contain live data as sections are updated. Additionally, hyper-links to other pertinent documents would be imbedded into the digital document. Also, all references to map graphics would be clickable links that would bring up a GIS viewing tool depicting the area of concern and the appropriate data layers.

Each page of the plan would come to life and be interactive.



Dynamic Plan Manager – LivingDocument

This application will allow for the visualization and update of standard hard copy plans through intuitive interface using standard web formats. Traditionally, hard copy documents are the final product of plans such as; neighborhood plans, hazard mitigation, land-use plan, and comprehensive plans. Much

money is spent on these documents and they are static in nature. By moving these plans to a living document they become dynamic. These digital documents provide state of the art tools such as: web hyperlinks to references in the document, high quality digital maps and photographs, and a live map interface that zooms to areas discussed in the body of the document. This application could then be deployed to any desktop via a browser or distributed to the public.

☑ Mapping and Spatial Analysis for Support of Community Investment Programs and Projects

One of the significant benefits that the Neighborhood Services Department will realize from the implementation of GIS and complementary technologies is increased and improved access to information. The Department will be able to understand relationships between different types of data in a spatial context, thereby improving decision-making; maps will be used to provide the public with valuable housing and neighborhood information in a geographic context; grant applications and materials will include maps and quantitative information from spatial analyses that will give emphasis to areas in need of assistance.

The Neighborhood Services Department will be able to utilize GIS in several tasks, including:

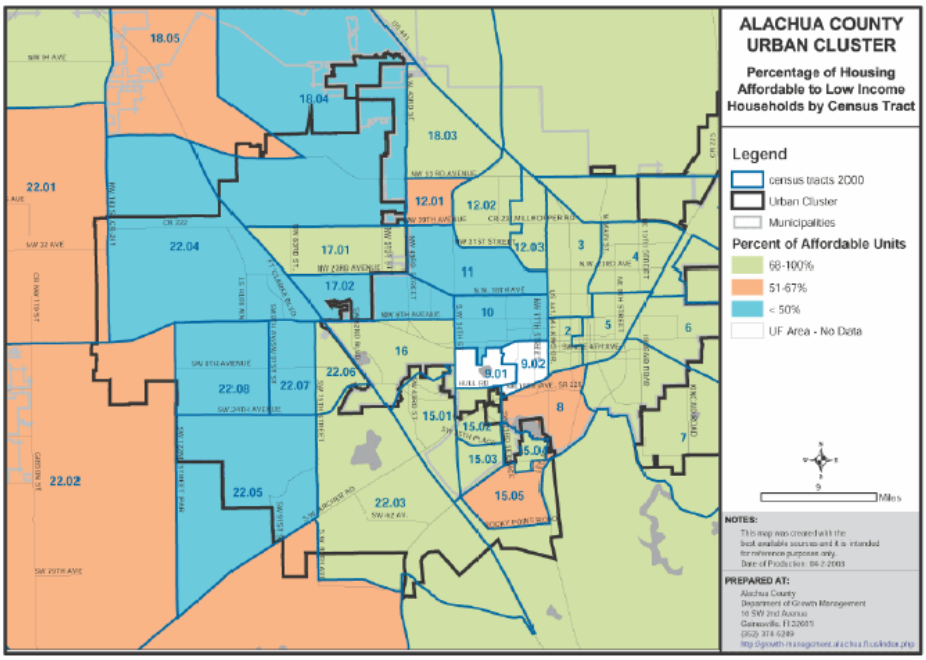
- Viewing and analyzing City demographic information
- Proposed real estate project location analysis
- Identifying vacant and underutilized land
- Community Development Block Grant (CDBG) administration and analysis
- Environmental Assessment (EA) and Cost Benefit Analysis (CBA) for projects, programs, and CDBGs
- Affordable housing monitoring and site location analysis
- School route modeling and analysis
- Focus area identification and evaluation
- General land use and infrastructure mapping and analysis
- Citizen education and advocacy
- Statistical analysis for budgetary preparations
- Using maps to train personnel

Working in conjunction with the GIS Coordinator, Neighborhood Services will be able to derive valuable, spatially-driven information on key issues. It is recommended that the Department work with the GIS Coordinator to identify and prioritize GIS-based analyses that can be performed on a project or program basis. Among these analyses, the GIS Coordinator can provide support for demographics, real estate sales, inclusionary/affordable housing, parcel-specific environmental assessments, housing/property condition, and vacant land.

Some of the information that the Neighborhood Services will be able to visualize and analyze via a GIS interface includes:

- Real Estate Sales: See all data for a period of time and calculate a median sales price. Affordable housing is an issue – therefore staff must see median household prices.
- Housing Element: Vacant and Underutilized Land Survey.

- Zoning: Determine how zoning impacts housing and property values.
- Affordable Housing (Figure Below): Monitor units multi-family units (e.g. crime stats are good)
- Environmental Assessment: Work with Planning and utilize to conduct cost/benefit analysis.
- Code Enforcement: Find any type of units that qualify for other programs (e.g., house that has lots of infractions, violations, or deemed unsafe). Use information along with census socio-economic data to target areas for rehabilitation programs.
- Mapping organized neighborhood groups and planning areas.
- Parcel by Parcel Analysis: Track owners, age and configuration of parcel.
- Safe Routes to School: Find different ways to make the most traveled routes to school safer (e.g. paving, parking, etc.)
- Neighborhood Enhancement Programs: Identify City resources and areas in need of improvement.



Alachua County, FL Affordable Housing GIS Analysis

Case Studies:

The following case studies are included to provide the Neighborhood Services Department with examples of how GIS is being used to address some of the issues for which the Department is responsible, including housing, neighborhood revitalization, environmental assessment, and grant administration.

<u>GIS Helps Laguna Niguel Use Federal Money More Effectively</u>

One of the goals of local governments is not just obtaining sufficient funds, but being able to use those funds in the most beneficial way. The City of Laguna Niguel used the spatial analysis capabilities of ArcView GIS to decide how to administer funds from the Housing

and Urban Development Department (HUD) in a way that maximized the number of areas that could qualify to receive funding.

Areas that qualify for CDBG funds with county administration.

Much larger area that would qualify for CDBG funds if the city administered the program.

Laguna Niguel is a study in doing a lot with a little and in little time.

Located in Southern California's Orange County, Laguna Niguel has a population of 56,000. City staffing is lean. Wade Kloos, an associate planner for Laguna Niguel for the past six years, and an intern, ARE the GIS Department. Kloos actually spends only about 20 percent of his time working on GIS projects. Though the City's parcel map was produced by a consultant using ArcInfo, Kloos uses ArcView GIS for all the City's GIS projects.

HUD's Community Development Block Grant (CDBG) programs promote sound community development through awarding grants to qualifying communities. Grants help cities provide public services, carry out neighborhood revitalization, and administer economic development programs.

Entitlement grant amounts are determined by a statutory formula that uses several objective measures of community need including poverty, population, housing overcrowding, age of housing, and growth lag. When Laguna Niguel's population passed 50,000, the City qualified as an entitlement city under HUD guidelines that allowed it to choose whether to continue to allow the County to administer the City's CDBG grants or to administer those monies itself.

What's the difference, you say? It hinges on the effect of HUD's qualifying threshold for the number of low to moderate households in any census block. If the County administered Laguna Niguel's CDBG program, HUD would use the County's median household income, and 36.4 percent of households within any census block would be required to be low to moderate income for that block to qualify. Under City administration using the City's median household income, only 16.8 percent of households in a census block would have to be categorized as low to moderate for that block to be eligible for funds. The City had to decide if the benefit to the community of expanding qualifying areas sufficiently offset the additional staff resources needed to administer the program.

In about two hours, Kloos created the census block themes, analyzed census blocks by income level, and generated thematic maps showing which areas would qualify under the County's threshold and under the City's threshold. Only two census blocks qualified under the County administration option, while seven census blocks qualified under the City administration option. Armed with these maps it was easy to demonstrate to the City Council that the City could significantly increase the benefit from the $335,000 in CDBG funds through City administration of the program. City Manager Tim Casey opted to devote all CDBG funds to project work rather than charge staff time against CDBG funds.

After providing the spatial analysis information that supported the City's decision to administer the CDBG program, Kloos became the CDBG coordinator. Other projects Kloos has completed using ArcView GIS include a real property inventory that gave the City a record of all its real estate holdings. Kloos also used ArcView GIS to produce conceptual designs for proposed MetroLink stations, saving the City from hiring an engineering firm to complete the designs. "We are low tech and low budget. I like to think we are a model of what a small City can do," says Kloos.

**Case Study Courtesy of ESRI ArcUser Magazine*

City of Tucson Leverages GIS to Assist with Grant Applications

The Planning Department at the City of Tuscon, Arizona has utilized GIS to overlay crime information on base maps for analysis and added census information to those same maps to apply for grants targeting special populations such as at-risk youth. In addition, the library is planning to work with Community Services to disseminate information about housing programs. For example, customers could do their own checking to see if a certain address is in a "low/mod" area which qualifies for certain grants. Future TPPL applications include periodic comprehensive demographic analysis of all library branch and Main service areas, as well as areas not currently within three-miles of a library.

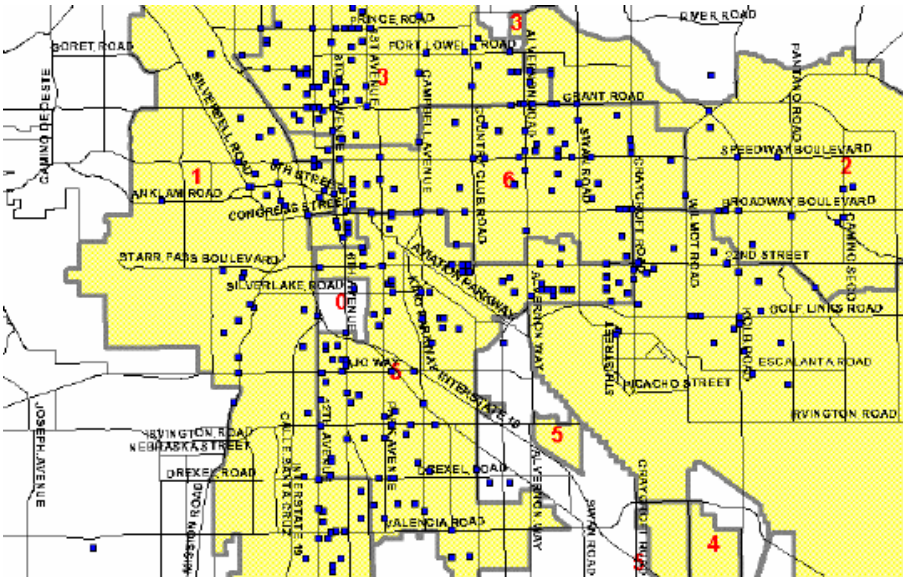


Figure GCI-1.2: GIS-Based Analysis of Burglaries in City of Tucson, AZ

EPA Brownfields Grants in the Southeast

Anniston, AL Brownfields Assessment Demonstration Pilot $200,000
Anniston's objective is to support the transfer of the targeted brownfields properties to public or private entities capable of returning them to economically or socially productive use compatible with the community. Activities planned as part of the pilot include: establishing a Brownfields Task Force Committee to conduct outreach activities within the community regarding appropriate reuse of the sites; conducting assessments of targeted properties and developing cost analyses and remediation plans for cleanup; and developing a Geographic Information System (GIS) with information about the targeted sites.

Montgomery, AL Brownfields Assessment Demonstration Pilot $200,000/Greenspace $50,000
Montgonery's goal is to obtain an economically viable and sustainable mixed use development along its riverfront. The city intends to accomplish this objective through a planned redevelopment that emphasizes a limited number of isolated projects. Activities planned as part of the pilot and greenspace funding include: reviewing riverfront land use history and incorporating the results into a Geographic Information Systems (GIS) database; conducting Phase I and Phase II environmental site assessments on brownfields sites within the planned riverfront trail area; developing guidance for land use planning; and implementing the redevelopment plan community participation program.

Selma, AL Brownfields Assessment Demonstration Pilot $200,000
Selma's objectives are to target three city-owned properties; the 50-acre All-Lock Plant, the Waterfront district, and the Selma East Area Pond, for assessment and redevelopment planning to help reverse the city's 30-year economic decline. Actions planned as part of the pilot include: completing environmental audits of city-owned properties; conducting Phase I and Phase II environmental site assessments at three priority sites; incorporating brownfields properties into a database inventory and linking the inventory to a Geographic Information Systems (GIS); and conducting outreach and public participation.

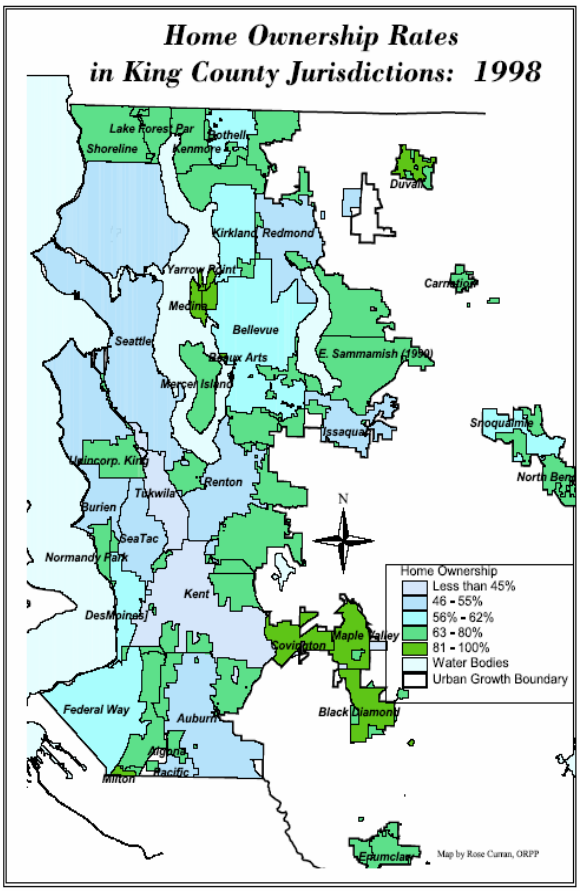
Charleston, SC Brownfield Supplemental Assistance $150,000
Charleston's goal is to targets additional brownfields in the Charleston Enterprise Community (EC) for development into a light industrial park for manufacturing and distribution. Charleston's plans for the Supplemental Assistance include: reviewing historical records for all EC properties, developing a Geographic Information System (GIS) and incorporating it into the city planning department's GIS; conducting Phase I and Phase II assessments of at least three additional sites; prepare redevelopment plans for four brownfields in the federal EC; and expand public involvement by creating a brownfields web site, hosting a brownfields conference.

Cartographic Products for Grant Proposals

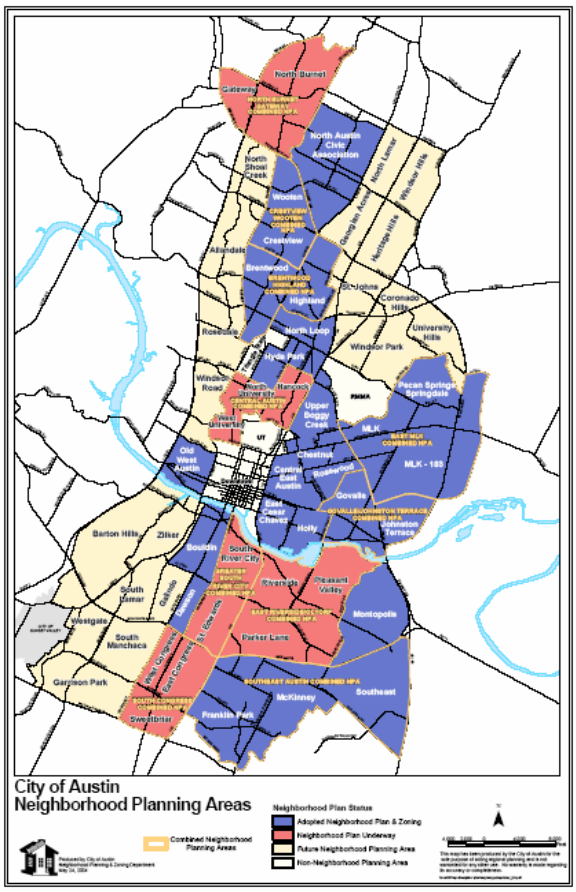
The Neighborhood Services Department will benefit from the generation of cartographic products for use in grant proposals. Several different products, such as base and thematic maps as well as 3D landscape renderings, can be used to enhance grant proposals. In addition, these products can be utilized to provide status updates to funding organizations. Maps can also be used to educate the public at meetings and to provide training for personnel.

Many of the needed maps can be created by utilizing the recommended GIS data browser. For more complex maps, it is recommended that department personnel work with the GIS Coordinator to generate several map and visualization templates that can b used to quickly produce maps. An ideal long-term goal is to develop automated mapping applications (or macros) that can be used by staff to quickly produce maps for various interest areas.

Cartographic products should incorporate other media, including CADD drawings for proposed infrastructure, digital images and photographs, and reports.



GIS-Based Analysis of Ownership Rates in King County, WA



Reference Map Shows City of Austin, TX Neighborhood Planning Areas

☑ Public Access to Geospatial Neighborhood Services Data

The Neighborhood Services Department expressed the need to disseminate spatial information to the public by providing a mapping application that will enable citizens to view neighborhood wellness issues.

As part of the City's objective to provide an Internet GIS data browser, the department should coordinate with the GIS Coordinator to integrate departmental GIS data into the Internet-based application. In addition the department should identify additional functionality that may be required in addition to the City's base enterprise offering.

More information on Internet GIS data browsers can be found in GIS Applications section at the end of this chapter.

Public access to geospatial neighborhood services data will increase productivity by reducing the need for staff to personally respond to questions from citizens. In addition to providing public access to mapping via an Internet GIS data browser, it is recommended that the City purchase and maintain a public access kiosk in the atrium area of City Hall. The kiosk will allow citizens that come into the office to view and query neighborhood services related information without disturbing or disrupting staff productivity. The kiosk should provide an intuitive, user-friendly mapping interface that provides users the ability to view, query, and print relevant land use information. Staff members field numerous questions on a daily basis related to Neighborhood Services such as:

- What is the housing condition and availability in my area?
- What are the public safety issues in my neighborhood?
- Where is the infrastructure in my neighborhood?
- Where are the neighborhoods and when is our next public meeting?

Many of these questions can be answered via a public access kiosk or the Internet. The savings in staff time will equate to hundreds of hours a year. Information on touch screen GIS solutions is detailed in the applications section further in this section.

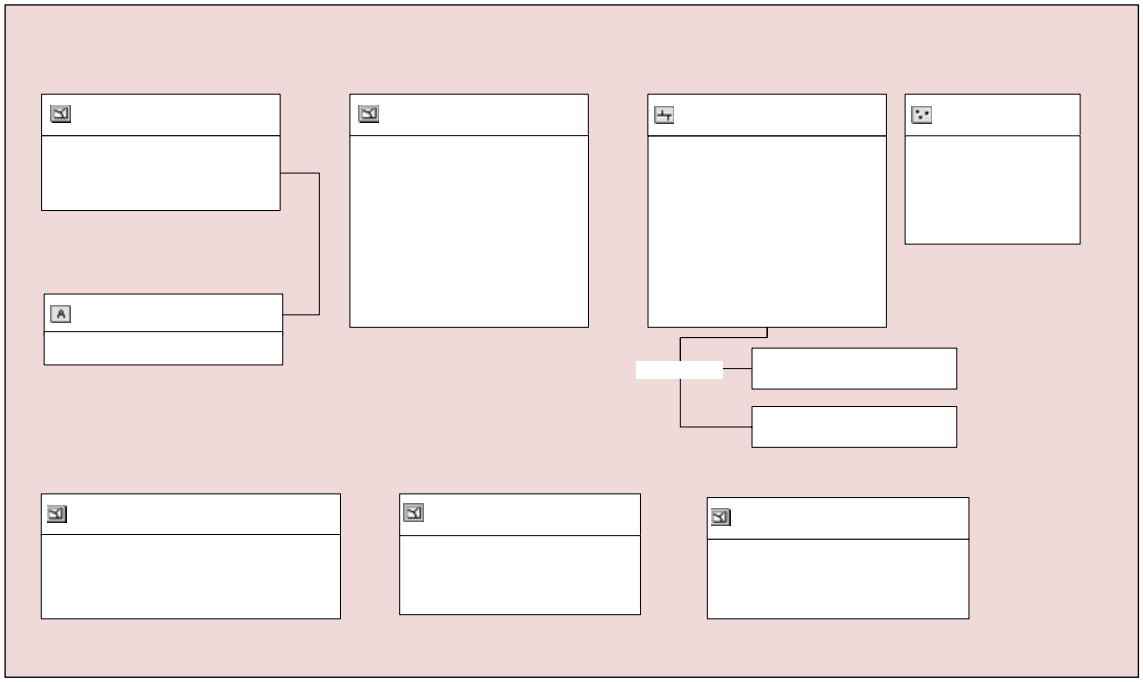
☑ Formal GIS Training for Neighborhood Services Staff

Neighborhood Services staff will benefit from formal training in GIS. It is recommended that the Neighborhood Services Department and the recommended GIS Coordinator identify key department staff to receive formal training. All staff will need training on the Intranet data browser and a few staff will need training on ArcView. More information on training opportunities can be found in Chapter 5: Five Year Strategic Plan.

☑ Neighborhood wellness plan managed as an ESRI data model

Neighborhood wellness is a big priority for Champaign. Various departments collect and maintain data about neighborhoods. This data is stored in various places and in different formats. Various forms are filled out based on the variables within the neighborhoods and properties. This data can be modeled and tracked within GIS. It is recommended that a GIS data model is created that allows for the input of these various neighborhood variables for tracking and historical reference. This would incorporate the lot by lot survey data conducted by Planning including the photographs of each property and the disparate

neighborhood data managed within Neighborhood Services. Various data input forms would be incorporated for entry of data from the various hard copy forms currently in use. This could then be taken into the field on handheld computers for automation of the data entry.



Sample Data Model

Interfacing TRAKiT and OneRoof data with GIS

A key need identified by Neighborhood Services personnel is increased and improved access to shared GIS data within the City. This includes the most recent parcel, address and street centerline data as well as high-resolution ortho-photography. Also, it is key for staff to be able to visualize all of their historic and current data within the TRAKiT and OneRoof software. Information such as zoning violations, zoning changes, affordable housing, new construction, property liens etc. is housed within these applications. Utilizing a backend geocoding application this data should be interfaced to the GIS as GIS data layers. Data should be available via the GIS once it is entered into TRAKiT and OneRoof. Staff will utilize an Intranet GIS data browser for access to this data. An application, GeoManager that can automate this interaction is described below.

TaxParcel

TaxPIN

TaxParcelType

ExemptStatus

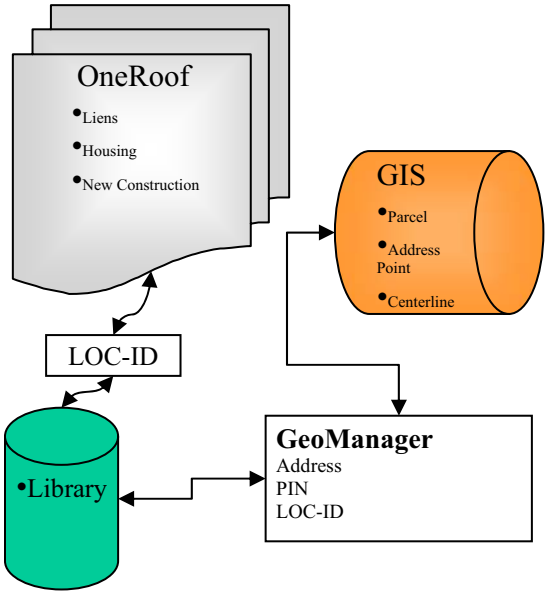
1

The GeoManager application is an automated geo-coding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (DB2, Oracle, SQL Server, and Access). The automated process is based completely on standard SQL statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (shapefiles) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer.

ParcelAnno

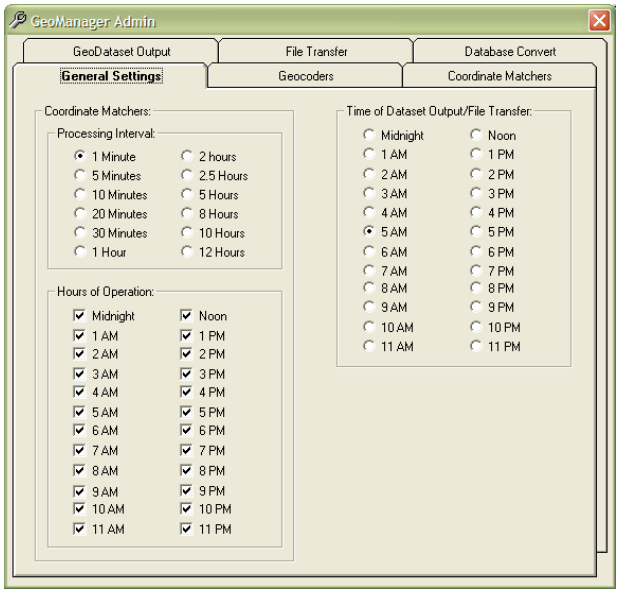
(TaxPIN from parcel)

1



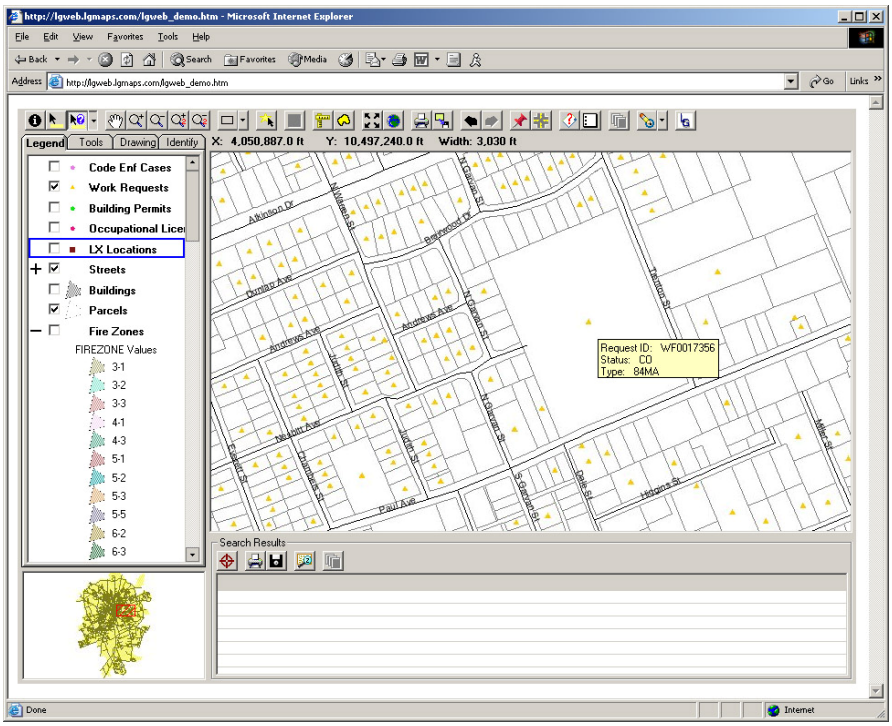
Practical Example – OneRoof

All OneRoof records related to a specific location can be mapped by linking each record to a spatial feature such as an address point. The GeoManager can generate and export the resulting GIS layer on a regularly scheduled basis.



GeoManager Service Settings

Quick and Easy Access of Data from TRAKiT



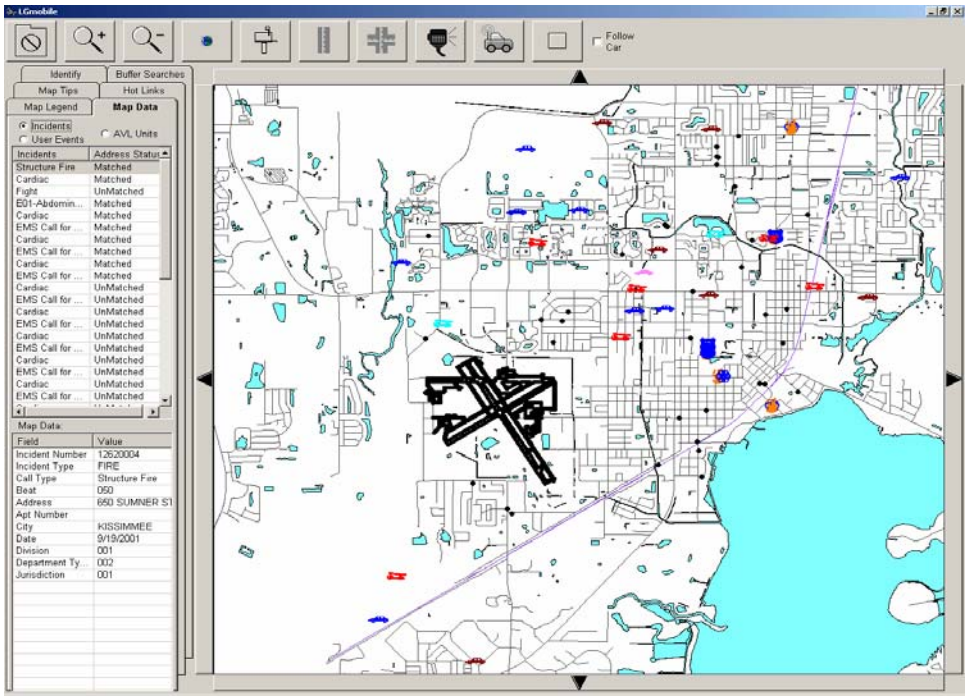
Neighborhood Services Will be Able to Quickly Visualize all TRAKiT and OneRoof Records

Field Access to GIS Data

Neighborhood Services staff should have GIS data mobile on their laptops. This mobile GIS data browser must be easy-to-learn and easy-to-use for all Department personnel. Personnel should have the ability to take pictures and have it automatically connect to the data field. GPS ability in the field is also desired. Information about the neighborhoods and properties

can be managed and entered while in the field. The mobile GIS data browser should be developed using ESRI's ArcObjects technology. Functionality should include:

- Zoom Tools
- Extent History
- Pan Map
- Identify Features
- Pan Map
- Spatial Selection
- Tabular Searches
- Measure Tools
- Geocoding
- Intersection Finder
- Buffer Tool
- Map Tips
- Hot Linking
- Integrated Legend



Mobile GIS Application for Neighborhood Services Staff

Existing GIS Data Layer Inventory and Future Recommendations

The Neighborhood Services Department will benefit from access to almost all data layers created and obtained for the City. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to **all** non-classified GIS data layers from other City departments.

Department personnel expressed that access to the following GIS data layers would be beneficial:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Address Points	Extract, cleanse, geocode, and map from TRAKit and other sources; georeference based on aerial photography and GPS field work	Public Works and GIS Coordinator	Recommended
Aerial Photography	GIS Consortium	GIS Consortium	Existing
Building Permits	Extracted from TRAKiT	Automated through geocoding software	Recommended
Census Data	Download from Census Bureau	GIS Consortium	Existing
City Limits	Official City Limit Map	Planning	Existing
Comprehensive Plan, Land Development Code, Development Agreements	Scan into database and link to parcel information.	Planning	Recommended
Council Districts	Creation in an initial data conversion	GIS Coordinator	Recommended
Crime Data	Extract, cleanse, and automatically map from Police database	Automated	Recommended
Delinquent Tax Properties	Extract from financial data	Automated	Recommended
Easements	Digitize from base map data; aggregate layers as needed	Public Works / GIS Coordinator	Partial Existing
Environmentally Sensitive Areas	GIS Consortium	GIS Consortium	Recommended
Fire response times	Created via DECCAN fire software	Fire	Recommended
Flood Zones	Acquire from FEMA	GIS Consortium	Existing
Historic Properties	Field collection and documentation	Planning	Recommended
Hydrology (Natural Water Features)	USGS	GIS Consortium	Existing
Land Use (Existing and Future)	Digitize polygons from aerial photographs and existing maps	Planning	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Lot survey	1/3 of the City complete. All of this data should be interfaced to the GIS	Planning	Recommended
Neighborhoods	Needs to be created from paper maps and local knowledge	Neighborhood Services	Recommended
Nuisance Abatement Records	Extracted and mapped from TRAKiT. Process will be automated.	Neighborhood Services	Recommended
Parcels	GIS Consortium	GIS Consortium	Existing
Planning Areas	Neighborhood Services	Neighborhood Services	Recommended
Sidewalks	GPS and digitizing from aerials	Public Works	Partial Existing
Rights-of-Way	Site plans and other documents	Public Works	Partial Existing
Sewer Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Signs (Private)	GPS field work; aggregate layers as needed. Extracted from TRAKiT	Planning	Recommended
Sign Violations	Extracted and linked from TRAKiT	Automated	Recommended
Storm Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Streets (Public and Private)	Derived from aerial photography; GIS existing data from Consortium	Public Works and GIS Coordinator	Existing
Vacant Properties	Query from parcel layer; other sources as needed	GIS Coordinator (eventually automated)	Recommended
Variances	Scanned and linked to the GIS	Planning and GIS Coordinator	Recommended
Water Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Well Head Protection Zones	GPS Field Work	Planning	Recommended
Wetlands	National Wetland Inventory	GIS Consortium	Recommended
Zoning	Digitized on screen	Planning	Existing but should make it a polygon layer
Zoning Violations	Extracted from TRAKiT	Automated	Recommended

Additional layers may be required as the Department increases its GIS utilization and incorporates additional field data.

Recommended GIS Applications

Internet GIS Data Browser

An ArcGIS Server-based Internet GIS data browser has been recommended to provide citizen's with access to the City's geospatial data. A description of recommended GIS data browser solutions is provided at the end of this chapter in the Enterprise-wide Applications section.

Intranet GIS Data Browser

An Intranet GIS data browser has been recommended for use by Neighborhood Services personnel. The Intranet GIS data browser should provide mapping and analysis capabilities for all personnel. This application will serve as the primary GIS application for the Neighborhood Services Department. This application will enable staff to accomplish about 90% of their GIS tasks. These tasks will include the quick query and search of data; as well as, more intricate uses such as citizen notification.

A description of recommended GIS data browser solutions is provided at the end of this chapter in the Enterprise-wide Applications section.

ArcView 9.2

ArcView 9.2 is recommended for use by Neighborhood Services personnel. A description of this application is provided in the Enterprise-Wide Applications section of this chapter. One licenses of ArcView is currently utilized by the Department. Four staff will need access to ArcView.

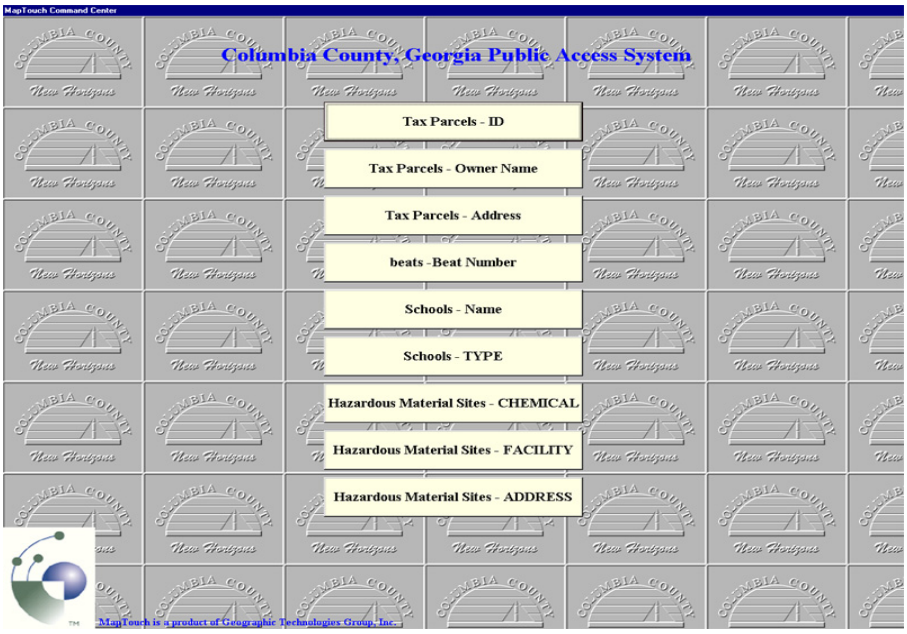
Mobile Data Browser

Neighborhood Services staff should have GIS data mobile on their laptops. This mobile GIS data browser must be easy-to-learn and easy-to-use for all Department personnel. Personnel should have the ability to take pictures and have it automatically connect to the data field. GPS ability in the field is also desired. Information about the neighborhoods and properties can be managed and entered while in the field. The mobile GIS data browser should be developed using ESRI's ArcObjects technology.

Public Access Kiosk Application

Many public access attempts required the user to use a mouse and keyboard and have an understanding of how to use a Windows based application. These expectations eliminate 70% of potential users. The Internet has become one medium of disseminating data to the public. However, there is still a need to have public access to data physically at an organization's buildings. Many people come to a facility, such as City Hall, with specific questions about the area and services provided. A well-written public access application will allow a user to find the answers for themselves. One public access kiosk should be acquired and location in the atrium of City Hall.

To be effective, a public access application must be easy to use. For many users, this means an application that does not require use of a mouse or keyboard. Touch screen monitors have enabled applications that do not require a mouse and keyboard to become a reality. A touch screen kiosk application should be implemented utilizing Tier 3 GIS software. Buttons and slider bars must be large so that they are easily selected by touching the screen.



Sample Introduction Screen for Touch Screen Kiosk

This application should be flexible so that it can be used at other facilities/sites to provide public access with other data sets. Once the public access application is written it should allow for quick changes and customization. A printer should be available at the kiosk and a recovery cost should be charged for each print.

The public access application should target the following goals:

- Configurable for at least 10 preset queries
- Extremely user friendly — no keyboard, no mouse
- Must have an administration package for complete control of layers, colors, and data
- Network ready for automatic update of configuration and setup files
- Easy to customize data setup and query configuration
- Supports imagery and ortho-photography
- Easy and quick setup

The kiosk application should be very streamlined, offering only the essential GIS functionality such as; printing, pan, zoom in, zoom out, identify, and turning layers on and off.

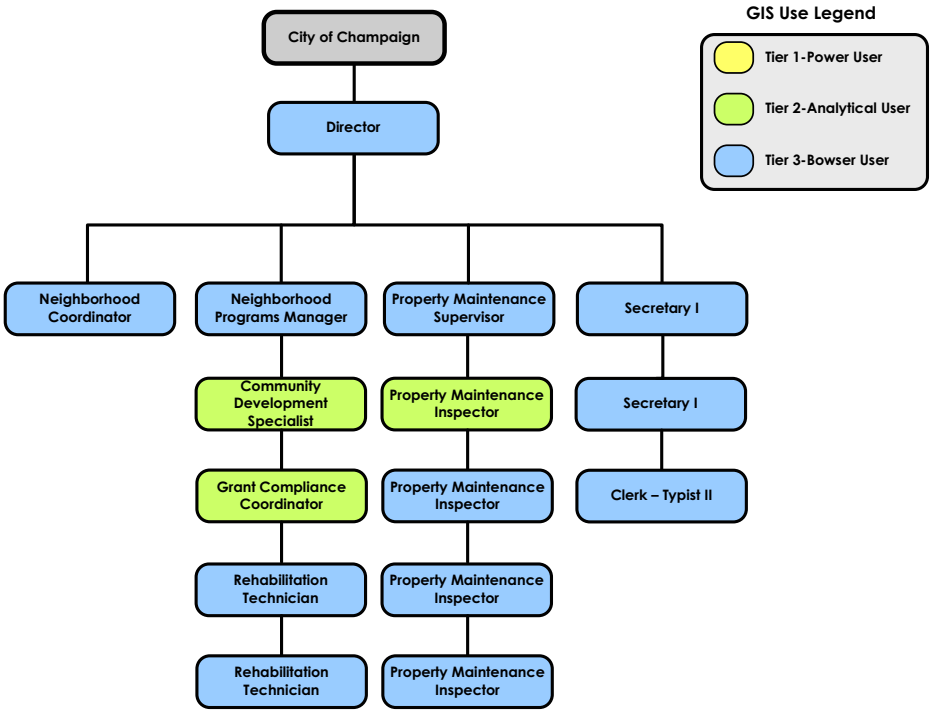
Kiosk Application with Key GIS Functions

Easy-to-Use Touch Screen Interface

Multi-Tier GIS Application Use within the Neighborhood Services Department

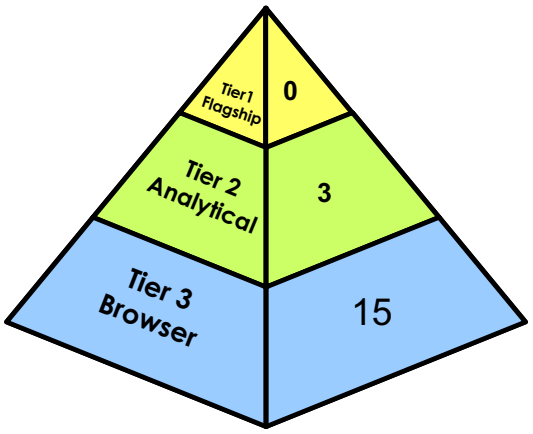
The following chart describes the recommended GIS application use by the Neighborhood Services Department. A Tier 1 user is a power GIS user who should have access to a fully functioning GIS toolset. A Tier 2 users focus is data analysis in addition to general browsing capabilities. A Tier 3 user requires only general browsing GIS data functions. The Neighborhood Services Department will consist of both Tier 1 and Tier 2 users.

Champaign Neighborhood Services Department



Neighborhood Services Multi-Tier GIS Application Use

There are three users within the Neighborhood Services Department that is considered a Tier 2 user; all other staff members are Tier 3 users.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The Planning Department employs ten full-time staff members, one contract employee, and varying numbers of interns. The Department's staff includes:

- Director (1)
- Assistant Director (1)
- Zoning Administrator (1)
- Planners (5)
- Secretaries (2)
- Interns (3)

The mission of the Planning Department is to engage in responsible and responsive planning to enhance the quality of life in the community by promoting the wellness of existing neighborhoods, protecting property values by encouraging compatible development, and providing for the future growth and stability of the City of Champaign.

The Planning Department has two divisions. The Current Planning Division is responsible for development management, zoning administration, annexation coordination, tracking historic properties, and mapping and graphics. The Advance Planning Division is responsible for administration of the Comprehensive Plan, neighborhood planning, capital improvement planning, promotion of economic development, plan implementation, and dissemination of demographic information.

The Department uses GIS for mapping and some spatial analysis. Planners utilize four licenses of ArcGIS ArcView to conduct mapping and analysis. The majority of GIS use in Planning will be at the data retrieval level (level 3 GIS users); however, some GIS use within the Department will involve more complex mapping and analysis, such as that of Level 1 and Level 2 GIS Users (see Chapter 4: Governance Model for more information on tiered GIS users).

Existing Hardware and Software

All staff in the Planning Department have personal computers running the Windows XP or Windows 2000 operating system (citywide standard).

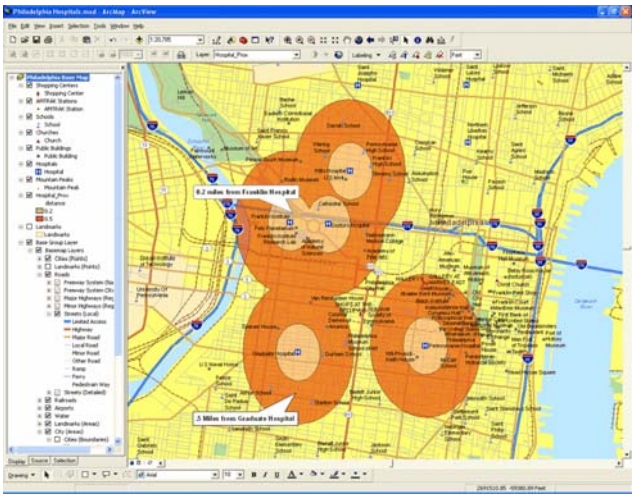
The Planning Department uses the following software applications:

1. MS Office – office productivity
2. ArcGIS – ArcView seats (4) with no extensions
3. TRAKiT – planning and development
4. ArcReader (2) – GIS data viewing
5. AutoCAD – Computer Aided Drafting and Design
6. Questica – for budgeting
7. Mr.SID – for aerial image viewing
8. Adobe Suite – for document publishing and creation
9. GroupWise- email, calendaring, and scheduling

The Department utilizes the aforementioned software in varying capacities. ArcView is used for mapping and spatial analysis.

ArcView

ArcView is used extensively to produce zoning and planning maps. The Department also uses ArcView to generate other cartographic products for use by administrative, Neighborhood Services, and field staff.



ESRI's ArcView

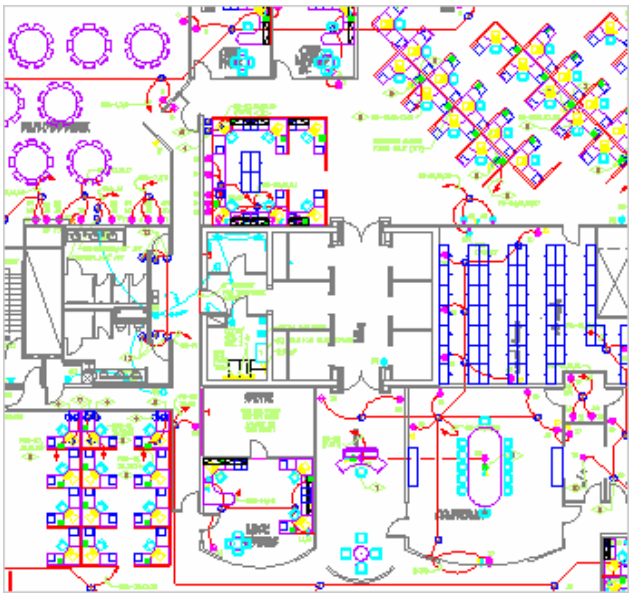
TRAKiT

TRAKiT is available from CRW. The TRAKiT system is comprised of a series of interrelated modules that are linked with a GIS-centered database to provide a system for creating, issuing, and tracking any type of Planning activity. TRAKiT is utilized to track various information about properties including zoning, ownership, sign applications, annexation agreements, historic property information and other pertinent data. Data from TRAKiT will need to be GIS enabled.

TRAKiT

AutoCAD

AutoCAD can be utilized to view, map, maintain, and modify computer aided drafting and design data. At this time the Planning Department is occasionally using AutoCAD.



AutoDesk AutoCAD

Recommended GIS Needs and Duties

There is great potential for increasing the utilization of GIS in the Planning Department. Planning manages and maintains a variety of data that has a spatial component. In addition, the Department's objectives require comprehensive knowledge of various types of spatial data, including neighborhood wellness, infill, zoning, and environmental data. Planning should work closely with the recommended GIS Coordinator to integrate GIS as much as possible within its workflows.

Based on this needs assessment, the Planning Department have several GIS needs:

- Mapping and spatial analysis of land use, zoning, environmental and other key data
- Automated neighborhood and vicinity mapping
- Planning support systems
- Public access to geospatial planning data
- Formal GIS training for Planning staff
- Integration and utilization of imaging data in conjunction with GIS
- Neighborhood wellness plan managed as an ESRI data model
- Interfacing TRAKiT data with GIS
- GIS management of the addressing process

It is expected that Planning personnel will gradually garner greater involvement in planning-specific GIS data production, maintenance, and management, as technical knowledge and resources within the Department increase.

It is recommended that the Department continue to use software such as ArcView to produce maps and conduct basic spatial analyses. For advanced GIS support, the Department should work with the GIS Coordinator, who can use robust GIS software such as ArcEditor or ArcInfo to conduct additional mapping and analysis tasks; the GIS Coordinator may also be

called upon to help create additional cartographic/analysis products for the Planning Department. This does not mean that the Planning Department will not have trained analytical users; it simply means the GIS Coordinator will act as a senior technical advisor on GIS projects within each department.

It is also recommended that Planning implement an Intranet GIS data browser to provide staff with access to mapping, imaging, and spatial analysis functionality. This GIS data browser should include the ability for staff to view updated Department-specific information as well as the City's base GIS data layers.

Mapping and Spatial Analysis of Land Use, Zoning, Environmental and Other Key Data

A key need identified by Planning Department personnel is increased and improved use of GIS to map and analyze land use, zoning, environmental and other key data. A variety of Planning projects and tasks require the ability to produce maps and derive information from spatial analyses, including updates to the master plan, neighborhood wellness planning, and development/updates to the City's various plans. In reality, Planners need access to all the information about an area as is available. Planners make decisions based on data that they can obtain. Often, this data is lacking and best judgment has to be utilized. However, each data layer that is created will empower the planners with more detail and accurate data from which to make decisions. Data from every department has a bearing on the decisions made within Planning. Therefore, quick and easy access to all City data is imperative for Planning.

The Planning Department identified that it could utilize GIS to assist in several tasks, including:

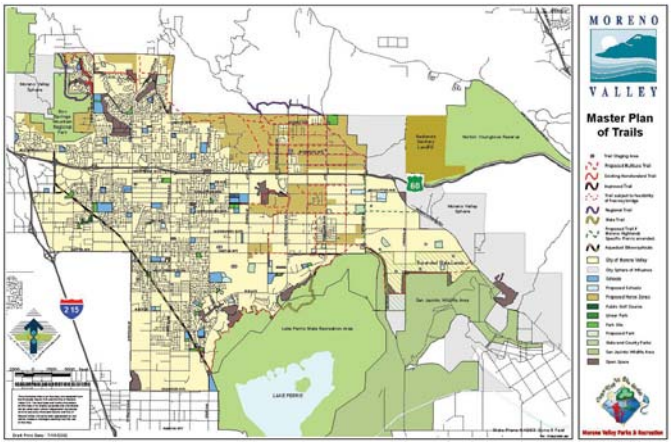
- Proposed development location analysis
- Neighborhood wellness and infill analysis
- Land use and land development mapping and analysis
- Zoning data mapping and analysis
- Environmental inventories mapping and analysis
- Project activity mapping
- Traffic modeling
- Production of public meeting and exhibition maps
- Statistical analysis for budgetary preparations
- Spatial and quantitative analysis of long-range planning issues: demographics and growth, housing, economic development, environmental protection, and infrastructure
- Annexation studies
- Tracking who has sign applications and violations
- Ascertaining assessed values for various time frames
- Historical property tracking and analysis

Various data layers are needed to accomplish the above tasks. These data layers will be detailed further below in the Planning Department section.

The following case study details the use of GIS for planning in Moreno Valley, California.

Case Study: Moreno Valley, California, Manages Explosive Growth with GIS

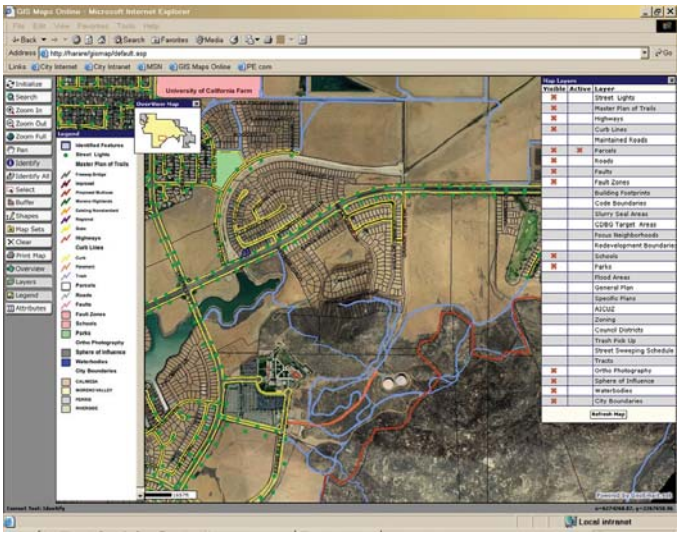
Cities with explosive growth need to optimize their resources. This is a truism regardless of their size, shape, or location. Case in point: Based on preliminary Census 2000 data, Moreno Valley in Riverside County is the sixth fastest growing city in California and 26th in the nation. Once an infant among California cities, Moreno Valley, situated 70 miles east of Los Angeles, now has 150,000 residents—a 450 percent increase over its 1980 population of 28,000.



The GIS mapping of vacant or underdeveloped parcels by the Planning Department helps show development opportunities within close proximity to existing infrastructure.

Like many other cities across the United States, Moreno Valley first acquired GIS to help manage its growth. The city began its GIS journey with desktop mapping software that was used by various departments. For the most part, the software was used for mapping, visualization, and query, with its users working independently.

The city eventually realized it needed a more strategic plan to deploy its GIS and turned to its newly hired GIS coordinator Michael Heslin for help. Heslin conducted interviews with various city agencies and performed an extensive GIS needs assessment. He also investigated how other local government agencies managed information; in the process he studied other enterprise implementations and instantly recognized the many benefits that were possible.



Moreno Valley's GIS includes the ability to look up a property by the assessor parcel number, address, or property owner as well as generate notification mailings, view buffer maps, and print full property records.

What resulted was a clear understanding that an enterprise GIS implementation was needed to streamline Moreno Valley's GIS processes and leverage the true analysis capabilities a GIS would provide. In addition, Heslin recognized the need for leveraging data managed independently within separate departments. An enterprise approach would allow various departments to use data managed outside their own department. Plus, the city wanted more powerful functionality.

Using his prior knowledge and experience, bolstered with the information resulting from the interviews and investigation, and taking into consideration the city had 32 seats of ArcView, Heslin made his decision. He realized that migrating to ArcInfo would add advanced geoprocessing and data conversion capabilities including tools for data creation, update, query, mapping, and analysis. In addition, ArcGIS Server could provide an intuitive, Web-based platform for sharing data and applications easily throughout the city. Thus, in 2001, the city selected and successfully made the move to ArcGIS software and then had a true enterprise GIS in place. The city uses ArcInfo 8.3, ArcView 9.2.3, ArcView 3.2, and ArcGIS Server 4.0.1 and is now deploying GIS for virtually all city departments including planning, public works, fire, law enforcement, Recreation and Parks, and economic development. Today, the city is doing more with fewer resources and doing it in less time.

<u>With a Little Help from Their Friends</u>

The city quickly began capturing data and performing a wide range of GIS applications. In addition, several other municipal, county, and state agencies already using ESRI GIS software were contacted, and information sharing began to take place. Now Moreno Valley has a vast array of existing, up-to-date data sets to work with as part of its own GIS work.

"Prior to GIS, many of the analysis capabilities available today were simply not available," adds Heslin. "By moving to an enterprise GIS, you can better share and distribute information. And you have the whole analysis capability. It has real, lasting value in numerous ways.

"City staff had used the databases in the past to store their departmental information," continues Heslin. "We moved to an enterprise GIS system, meaning information is deposited in a central location and can be shared from department to department using a common data

standard. Users can retrieve any available information from their desktop rather than knocking on doors or calling people to request information."

ArcGIS Applications

Moreno Valley's GIS includes the ability to look up a property by the assessor parcel number, address, or property owner as well as generate notification mailings, view buffer maps, and print full property records.

An important GIS application involved an impact study for a proposed hiking trail project. The city needed to decide whether the proposed multiuse trails project was a worthy endeavor. The GIS Department collected data from different sources including paper maps, on-the-fly digitizing of aerial photos, GPS mapping, input from a trails committee, and other public sources. GIS analysis was performed by evaluating a number of different variables including impact on funding, integration into existing trails, and more. Trails were mapped using aerial images, some were mapped in the field, and some were already stored in digital format and input into ArcGIS.

"Once the data was in GIS, calculations became a snap," says Heslin. "We could calculate linear feet for any type of trail, calculate how much a trail would cost, determine which properties it would cross, and more. It essentially saved several hundred hours of manually mapping trails and performing analysis."

Collaborative efforts were made with other municipalities. The cities of Riverside and Corona, both also within Riverside County, got together with Moreno Valley and shared land use, planning, zoning, parks, and other information for a California Department of Transportation (CalTRANS) project to get a better understanding of trails and their interconnection between these cities.

"We've learned a lot from other government agencies, both larger and smaller than we are that have done similar things and have important lessons to share," says Heslin. "There's a great user community out there to learn from, and Moreno Valley is certainly taking advantage of this simple fact."

The GIS Department shares its database with the Fire Department so it can have a better understanding of roads, access ways, and other data crucial in an emergency response and for emergency mitigation planning.

"There's a huge benefit for how decisions are being made because there's more accurate, detailed information available to more people," says Heslin. "Our enterprise GIS provides a jump-start to City Hall and other professionals who need to do a vast array of diverse research. It also helps us work with other cities in joint projects."

Users accessing the database have a large number of tools for performing queries and analysis. For instance, a search can be performed by street location, ZIP Code, parcel number, zone identification, or any number of spatial and asset identifiers. The automated links between spatial and tabular data provide a sophisticated integration method for greater analysis.

"Government employees can look at a map and drill down to view related map data or look at a database record and then access a map," adds Heslin. "People may not even know exactly what they're looking for but, geographically, they know it's around a general area. They can then drill down and pull up other layers of information. They couldn't do this before. If they're researching a project in the city, they may want to see what impact it will have on school systems, parks, traffic, or other entities. They can make better decisions and, ultimately, save money by making sure budget dollars are spent in the best manner possible."

The city also recently finalized the development of an ArcGIS Server software-based Intranet site. "With an Intranet-based interface to our information, we can serve a greater number of government employees more efficiently," concludes Heslin.

Future applications include integrating GIS with Moreno Valley's permitting system. The city is also in the process of developing an economic development Internet site.

**Case Study Courtesy of ESRI ArcNews Magazine*

☑ Automated Neighborhood and Vicinity Mapping

Planning Departments across the country are turning to GIS for automation of several tasks, including the production of neighborhood and vicinity maps for public meetings and public distribution. Planning will be able to better serve its public duties by utilizing an automated mapping application that enables staff members to quickly and efficiently create neighborhood and vicinity maps. At present, there is no automated means for generation of these maps.

It is recommended that an Intranet GIS application be utilized to address these mapping needs. The application should be based on ESRI technology to facilitate integration with the City's existing/proposed platform and to enable streamlined access to the City's geospatial data.

The Intranet GIS data browser is a resource that can be used by Planning staff to view and map GIS data. Additionally, this application can be utilized for zoning notification and other citizen notification tasks. It is recommended that the Department utilize an Intranet GIS data browser to provide mapping and spatial analysis capabilities for non-technical staff (more information on this application is provided in the Enterprise-Wide Applications section at the end of this chapter).

☑ Planning Support Systems

Another potential utilization of GIS within Planning is the analysis of proposed development scenarios, neighborhood wellness, and infill issues. It is recommended that Planning procure a third party extension for ArcGIS that will enable departmental staff to leverage existing GIS infrastructure to perform these types of analysis. The solution should provide the ability to version temporary scenario data, as this will facilitate the reconciliation of approved data changes to master data sources (more information on these applications is provided in the GIS Application section below).

☑ Public Access to Geospatial Planning Data

The Planning Department expressed the need to disseminate spatial information to the public by providing a mapping application that will enable citizens to view development, land use, zoning, neighborhood, and other planning information.

As part of the City's objective to provide an Internet GIS data browser, the department should coordinate with the GIS Coordinator to integrate departmental GIS data into the Internet-based application. In addition the department should identify additional functionality that may be required in addition to the City's base enterprise offering.

More information on Internet GIS data browsers can be found in GIS Applications section at the end of this chapter.

Public access to geospatial planning data will increase productivity by reducing the need for staff to personally respond to questions from citizens. In addition to providing public access to mapping via an Internet GIS data browser, it is recommended that the City purchase and maintain a public access kiosk in the atrium area of City Hall. The kiosk will allow citizens that come into the office to view and query planning related information without disturbing or disrupting staff productivity. The kiosk should provide an intuitive, user-friendly mapping interface that provides users the ability to view, query, and print relevant land use information. Staff members field numerous questions on a daily basis related to planning such as:

- What is the future land use of certain property?
- What is the zoning of certain property?
- What is allowed in the zoning?
- What is the maximum density or intensity?
- Request for vacant land with certain land use designation and zoning classification that is a certain size in terms of acreage.

Many of these questions can be answered via a public access kiosk or the Internet. The savings in staff time will equate to hundreds of hours a year. Information on touch screen GIS solutions is detailed in the applications section further in this section.

☑ Formal GIS Training for Planning Staff

Planning staff will benefit from formal training in GIS. It is recommended that the Planning Department and the recommended GIS Coordinator identify key department staff to receive formal training. More information on training opportunities can be found in Chapter 5: Five Year Strategic Plan.

☑ Integration and Utilization of Imaging Data in Conjunction with GIS

A big need for Planning and other departments is to integrate image based documents and photos for easy access via a GIS interface. Currently the City does not have an imaging system to store these files. Three options exist for linking images and photos as follows:

- Images files can be linked within TRAKiT and then accessed via GIS
- Images can be stored in logical directories on the server
- An imaging system can be acquired to house all imaging data

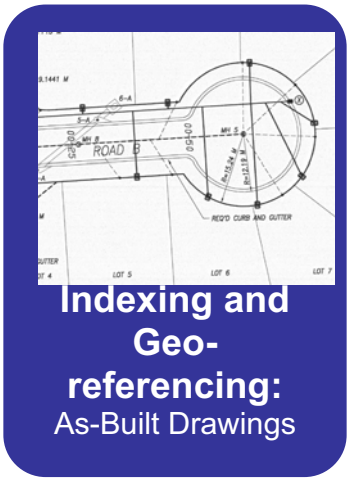
It is recommended that further analysis be done to determine the best method for housing imaging data at the City. Image files can be linked within TRAKiT but may prove to be too cumbersome for a large volume of images. Alternatively, images can be stored in logical directories on a server for viewing and linking to GIS. Another option is to acquire an imaging system that houses all images that need to be linked to GIS and other records that are non-geography related. It is out of the scope of this project to recommend the optimal imaging solution for the City. Many cities conduct an imaging study to determine the best way to handle the enterprise imaging needs. Alternatively, the recommended GIS Coordinator should test the first two options above to determine which is the best for housing images that need to be linked to the GIS.

The Planning Department handles volumes of paper and digital data that is important for daily decision making. This data can be found in filing cabinets, digitally on computer, or as submitted plans. Using GIS as a portal for all of this information would be a huge advantage for Planning staff. The following are just a sample of records that should be scanned and linked to the GIS for quick retrieval and viewing:

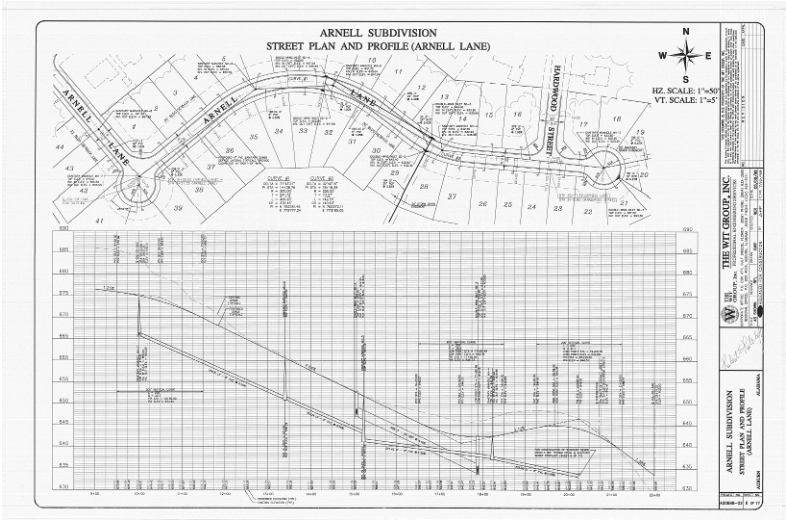
- Variances – currently on paper
- PDFs about various property issues
- Photos digital and hardcopy dealing with property issues
- Historical property documents and photographs
- Development plans – hardcopy
- Zoning regulations
- Sign and billboard photos

These records are stored in various places in hard copy and digital format. A logical storage and archiving system should be developed. Recently, the Town of Blacksburg, Virginia needed the same kind of central storage and conducted a detailed study on how to optimally implement an imaging system and how to interface the data with the GIS. The city will need to take similar steps to implement this solution effectively.

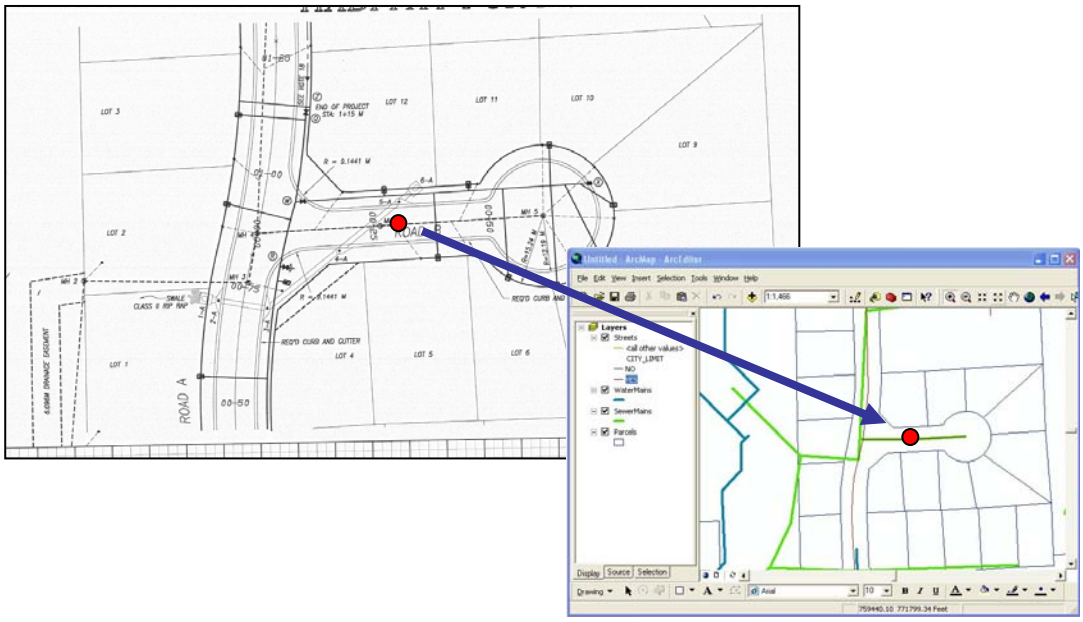
Scanning these documents and maintaining them in a document management system is the first step. However, each of these documents will need to be spatially referenced for access via the GIS. The following steps need to take place when tying images to the GIS.



Linking Documents to a GIS



Documents will be scanned and geo-referenced



Each document will have a geographic link

There following example details how Richardson, TX integrated imaging and GIS.

Integrated GIS/Document Management System - City of Richardson, TX

Implementation Services Based on ESRI Technology

Redlands, California--The city of Richardson, Texas, is deploying an integrated ArcGIS/document management system as its enterprise geographic information system (GIS) environment, automating and streamlining how it manages, disseminates, and uses information. GIS Technology, Inc. (GTI) is providing software and implementation services based on ESRI technology. GTI was initially contracted to install a FileNET-based integrated document management system and link it to the city's GIS in September of 2001. The city has now entered the implementation phase of the system.

"The city has recognized the advantages of integrating GIS with document management," says Jeff Hecht, chief executive officer, GTI. "It will be able to spatially enable documents that, up until now, have resided in a manual storage system with limited access and consuming valuable floor space. The city is going to have a unique capability here that few cities can match."

"Our city hall is limited in space, and we were faced with the prospect of losing even more space to document storage," says Sylvia Kendra, GIS project manager, city of Richardson. "We needed to solve the space problem, but more importantly we wanted to change the way we do business. The ArcGIS/integrated document management (IDM) integration enabled us to accomplish both goals."

"The city of Richardson showed tremendous leadership and vision in outlining the solution it wanted," says Amy Thorson, corporate alliance representative, ESRI. "GTI is a leader in providing integrated ESRI and FileNET solutions. ESRI's relationships with best-of-breed

solution providers like GTI help us focus on providing the best technology possible while leveraging the industry expertise of other organizations."

GTI supplied the city with FileNET's Panagon software solution as the preferred document management system as well as provided IDM for ArcGIS and IDM for ArcIMS middleware solutions. IDM for ArcGIS includes powerful tools for creating and manipulating connections between the two information sources. IDM for ArcIMS extends integrated access to GIS and document information to remote locations via the Web. In addition, the city of Richardson has retained GTI to design the document repository, recommend adjustments to the existing GIS database, train staff, and design and implement the integration of the GIS/document management system.

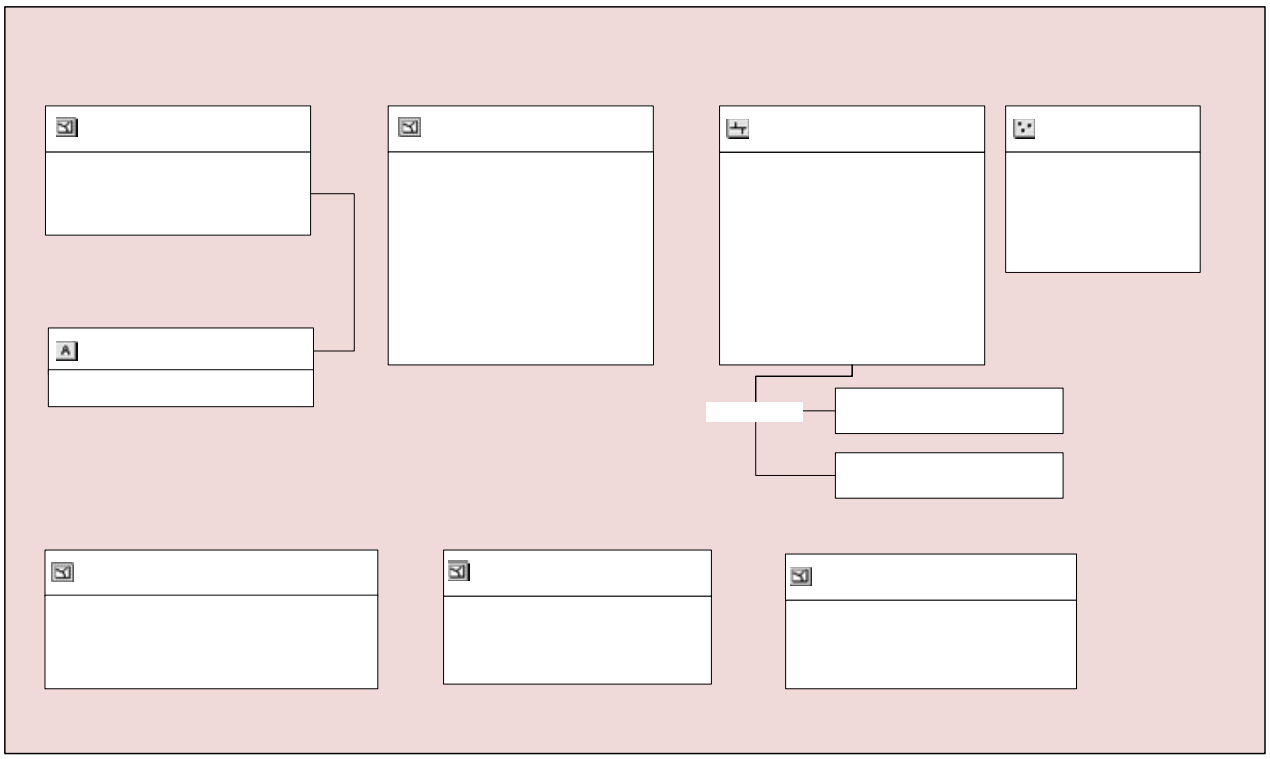
The integrated ArcGIS-FileNET solution will replace paper and manual document management and indexing methods including hanging file folders and microfiche machines. Faster, more efficient data management will significantly reduce the number of hours spent retrieving information, whether for planning and zoning, economic development, property assessment, or a myriad of other government application areas. The new solution also provides remote data access, meaning users from various offices can digitally retrieve information rather than having to physically visit one site for submitting information requests.

The city of Richardson has completed the pilot stage of the project and is currently loading documents. Planning documents, as-built drawings, plats, building inspection records, and ordinances are being incorporated into the document repository and linked to the city's existing GIS. With completion of the database design, the city of Richardson will be undertaking a pilot test of the system that will involve three of the city's departments. Use of the integrated GIS/document management system will then be extended throughout the city. The city will be integrating both thick and thin clients in this Internet-enabled solution. A large number of users will access the system via the Internet and a thin client, while a smaller number of users will be utilizing thick clients on a limited number of desktops.

Case Study Provided By: ESRI
Press Information: Jesse Theodore, ESRI
Tel.: 909-793-2853, extension 1-1419
E-mail (press only): press@esri.com
General Information: info@esri.com

☑ Neighborhood wellness plan managed as an ESRI data model

Neighborhood wellness is a big priority for Champaign. Various departments collect and maintain data about neighborhoods. This data is stored in various places and in different formats. Various forms are filled out based on the variables within the neighborhoods and properties. This data can be modeled and tracked within GIS. It is recommended that a GIS data model is created that allows for the input of these various neighborhood variables for tracking and historical reference. This would incorporate the lot by lot survey data conducted by Planning including the photographs of each property. Various data input forms would be incorporated for entry of data from the various hard copy forms currently utilized. This could then be taken into the field on handheld computers for automation of the data entry.



Sample Data Model

TaxParcel

TaxPIN

TaxParcelType

ExemptStatus

1

ParcelAnno

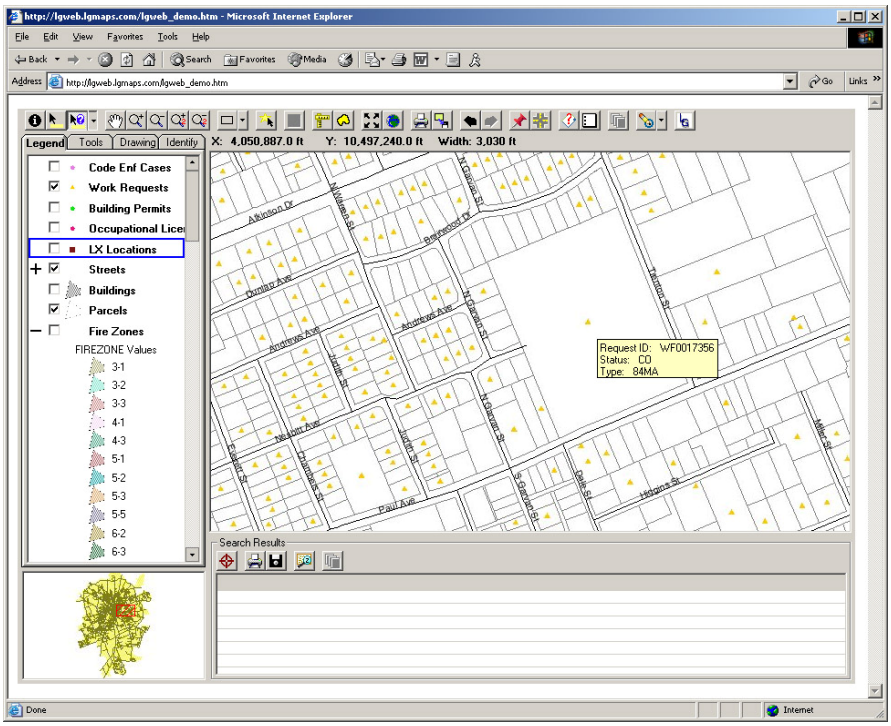
(TaxPIN from parcel)

1

☑ Interfacing TRAKiT data with GIS

A key need identified by Planning personnel is increased and improved access to shared GIS data within the City. This includes the most recent parcel, address and street centerline data as well as high-resolution ortho-photography. Also, this key for staff to be able to visualize all of their historic and current data within the TRAKiT software. Information such as zoning violations, zoning changes, sign applications, sign violations, etc. is housed within TRAKiT. Utilizing a backend geocoding application this data should be interfaced to the GIS as discreet GIS data layers. Data should be available via the GIS once it is entered into TRAKiT. Staff will utilize an Intranet GIS data browser for access to this data.

Quick and Easy Access to Data for Planners



Planning Will be Able to Quickly Visualize all TRAKiT Records

Existing GIS Data Layer Inventory and Future Recommendations

The Planning Department will benefit from access to almost all data layers created and obtained for the city. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to **all** non-classified GIS data layers from other City departments.

Department personnel expressed that access to the following GIS data layers would be beneficial:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Address Points	Extract, cleanse, geocode, and map from TRAKit and other sources; georeference based on aerial photography and GPS field work	Public Works and GIS Coordinator	Existing in a form but needs verification and completion
Aerial Photography	GIS Consortium	GIS Consortium	Existing
Building Permits	Extracted from TRAKiT	Automated through geocoding software	Recommended
Census Data	Download from Census Bureau	GIS Consortium	Existing
City Limits	Official City Limit Map	Planning	Existing
Comprehensive Plan, Land Development Code, Development Agreements	Scan into database and link to parcel information.	Planning	Recommended
Crime Data	Extract, cleanse, and automatically map from Police database	Automated	Recommended
Easements	Digitize from base map data; aggregate layers as needed	Public Works / GIS Coordinator	Partial Existing
Environmentally Sensitive Areas	GIS Consortium	GIS Consortium	Recommended
Fire response times	Created via DECCAN fire software	Fire	Recommended
Flood Zones	Acquire from FEMA	GIS Consortium	Existing
Historic Properties	Field collection and documentation	Planning	Existing
Hydrology (Natural Water Features)	USGS	GIS Consortium	Existing
Land Use (Existing and Future)	Digitize polygons from aerial photographs and existing maps	Planning	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Lot survey	1/3 of the City complete. All of this data should be interfaced to the GIS	Planning	Recommended
Neighborhoods and Subdivisions	Needs to be created from paper maps and local knowledge	Neighborhood Services	Partial
Parcels	GIS Consortium	GIS Consortium	Existing
Sidewalks	GPS and digitizing from aerials	Public Works	Partial Existing
Rights-of-Way	Site plans and other documents	Public Works	Partial Existing
Sewer Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Signs (Private)	GPS field work; aggregate layers as needed. Extracted from TRAKiT	Planning	Billboards complete Others Recommended
Sign Violations	Extracted and linked from TRAKiT	Automated	Recommended
Storm Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Streets (Public and Private)	Derived from aerial photography; GIS existing data from Consortium	Public Works and GIS Coordinator	Existing
Vacant Properties	Query from parcel layer; other sources as needed	GIS Coordinator (eventually automated)	Recommended
Variances	Scanned and linked to the GIS	Planning and GIS Coordinator	Recommended
Water Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Well Head Protection Zones	GPS Field Work	Planning	Recommended
Wetlands	National Wetland Inventory	GIS Consortium	Recommended
Zoning	Digitized on screen	Planning	Complete
Zoning Violations	Extracted from TRAKiT	Automated	Recommended

Additional layers may be required as the Department increases its GIS utilization and incorporates additional field data.

Recommended GIS Applications

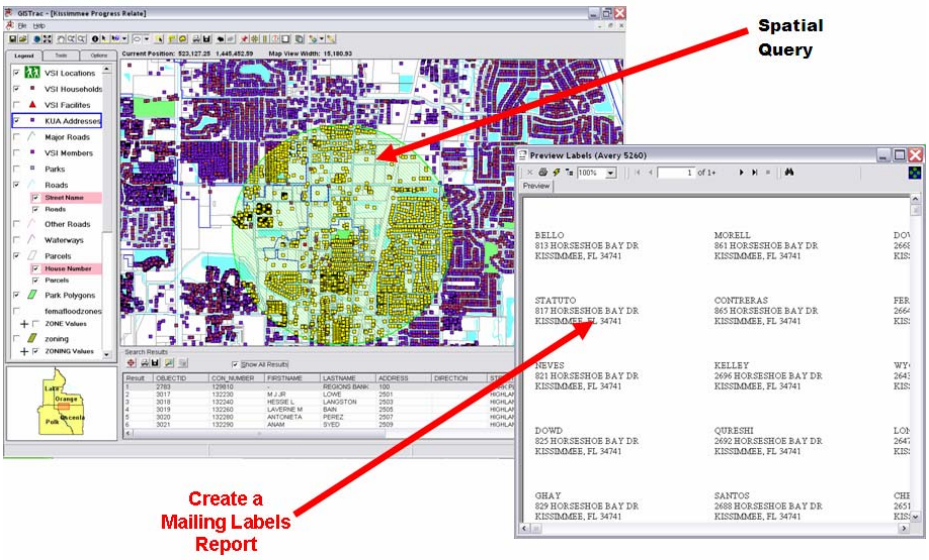
Internet GIS Data Browser

An ArcGIS Server-based Internet GIS data browser has been recommended to provide citizen's with access to the City's geospatial data. A description of recommended GIS data browser solutions is provided at the end of this chapter in the Enterprise-wide Applications section.

Intranet GIS Data Browser

An Intranet GIS data browser has been recommended for use by Planning personnel. The Intranet GIS data browser should provide mapping and analysis capabilities for all personnel. This application will serve as the primary GIS application for the Planning Department. This application will enable staff to accomplish about 90% of their GIS tasks. These tasks will include the quick query and search of data; as well as, more intricate uses such as citizen notification.

Planning is responsible for notifying citizens impacted by zoning changes, ordinances, and variances. In some cases the ability to notify the public in mass may be required. In these instances Department personnel need to be able to quickly identify citizens affected by these changes using heads up spatial query capability, with output generating mailing labels or call lists.



Mailing List Generation

A description of recommended GIS data browser solutions is provided at the end of this chapter in the Enterprise-wide Applications section.

ArcView 9.2

ArcView 9.2 is recommended for use by Planning personnel. A description of this application is provided in the Enterprise-Wide Applications section of this chapter. Four (4) licenses of

ArcView currently exist and should suffice. These planners should continue to utilize ArcGIS to produce maps and conduct spatial analyses.

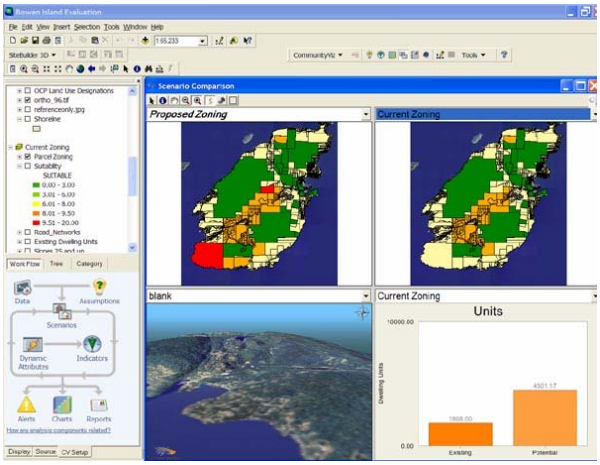
Planning Support Systems

A planning support extension for ArcGIS has been recommended for use by the department. A planning support application will enable the department to analyze proposed development scenarios and improve decision-making. In addition, integrated GIS applications that provide access to a geodatabase will maximize efficiency through versioning and redundant data production. Included below are three options for ArcGIS-based planning support systems that the department should consider and assess.

Scenario 360

Scenario 360 is GIS-based decision support software for planners and resource managers. Scenario 360 is an ArcGIS extension that adds interactive analysis tools and a decision-making framework to the ArcGIS platform. Scenario 360 is a valuable tool that enables viewing, analyzing, and understanding of land-use alternatives and impacts.

More details are available at http://www.communityviz.com

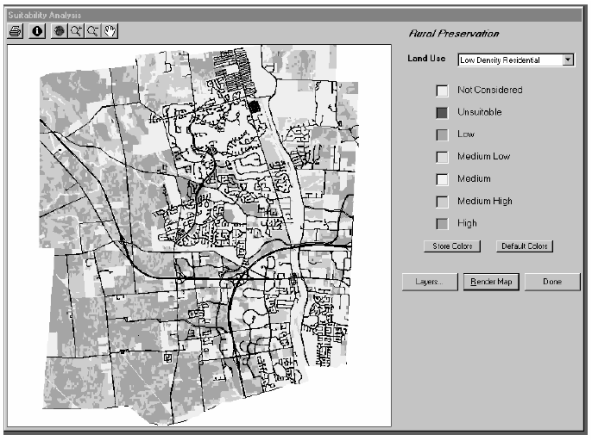


Scenario 360 by CommunityViz

What If?

What if? is an interactive GIS-based system which supports all aspects of the land use planning process: conducting a land suitability analysis, projecting future land use demand, allocating this demand to suitable locations, and evaluating the likely impacts of alternative policy choices and assumptions.

More details are available at http://www.what-if-pss.com

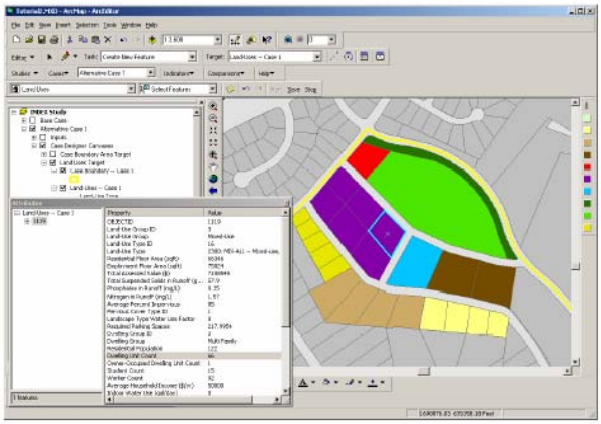


What If? Planning Support System

INDEX Software

INDEX is an integrated suite of tools designed to support the entire process of community planning and development. INDEX is used to design and visualize alternative planning scenarios, analyze and score their performance, and compare and rank alternatives. Once plans are adopted, INDEX supports implementation by evaluating development proposals against plan goals.

More details are available at http://www.crit.com

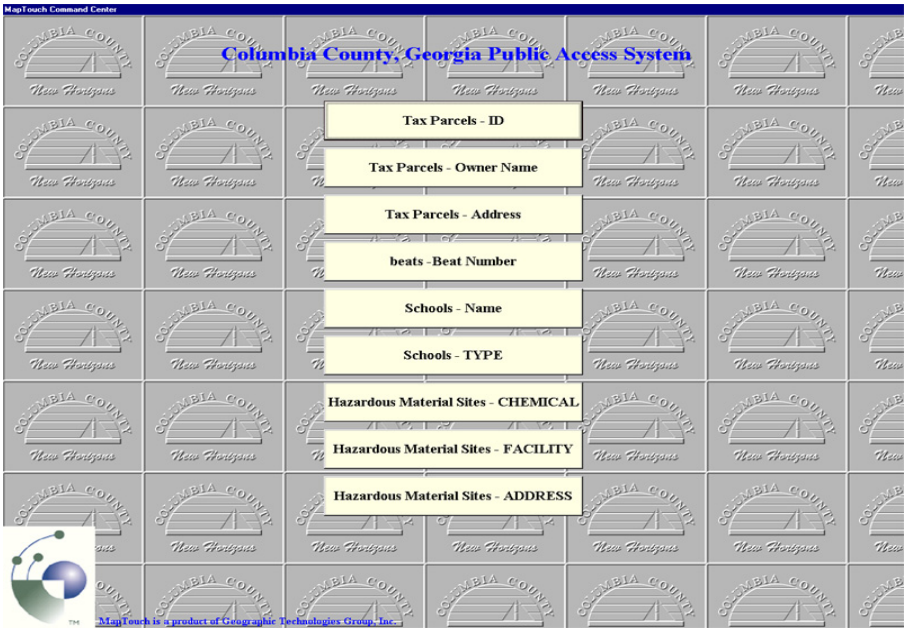


Index Software

Public Access Kiosk Application

Many public access attempts required the user to use a mouse and keyboard and have an understanding of how to use a Windows based application. These expectations eliminate 70% of potential users. The Internet has become one medium of disseminating data to the public. However, there is still a need to have public access to data physically at an organization's buildings. Many people come to a facility, such as City Hall, with specific questions about the area and services provided. A well-written public access application will allow a user to find the answers for themselves. One public access kiosk should be acquired and location in the atrium of City Hall.

To be effective, a public access application must be easy to use. For many users, this means an application that does not require use of a mouse or keyboard. Touch screen monitors have enabled applications that do not require a mouse and keyboard to become a reality. A touch screen kiosk application should be implemented utilizing Tier 3 GIS software. Buttons and slider bars must be large so that they are easily selected by touching the screen.



Sample Introduction Screen for Touch Screen Kiosk

This application should be flexible so that it can be used at other facilities/sites to provide public access with other data sets. Once the public access application is written it should allow for quick changes and customization. A printer should be available at the kiosk and a recovery cost should be charged for each print.

The public access application should target the following goals:

- Configurable for at least 10 preset queries
- Extremely user friendly — no keyboard, no mouse
- Must have an administration package for complete control of layers, colors, and data
- Network ready for automatic update of configuration and setup files
- Easy to customize data setup and query configuration
- Supports imagery and ortho-photography
- Easy and quick setup

The kiosk application should be very streamlined, offering only the essential GIS functionality such as; printing, pan, zoom in, zoom out, identify, and turning layers on and off.

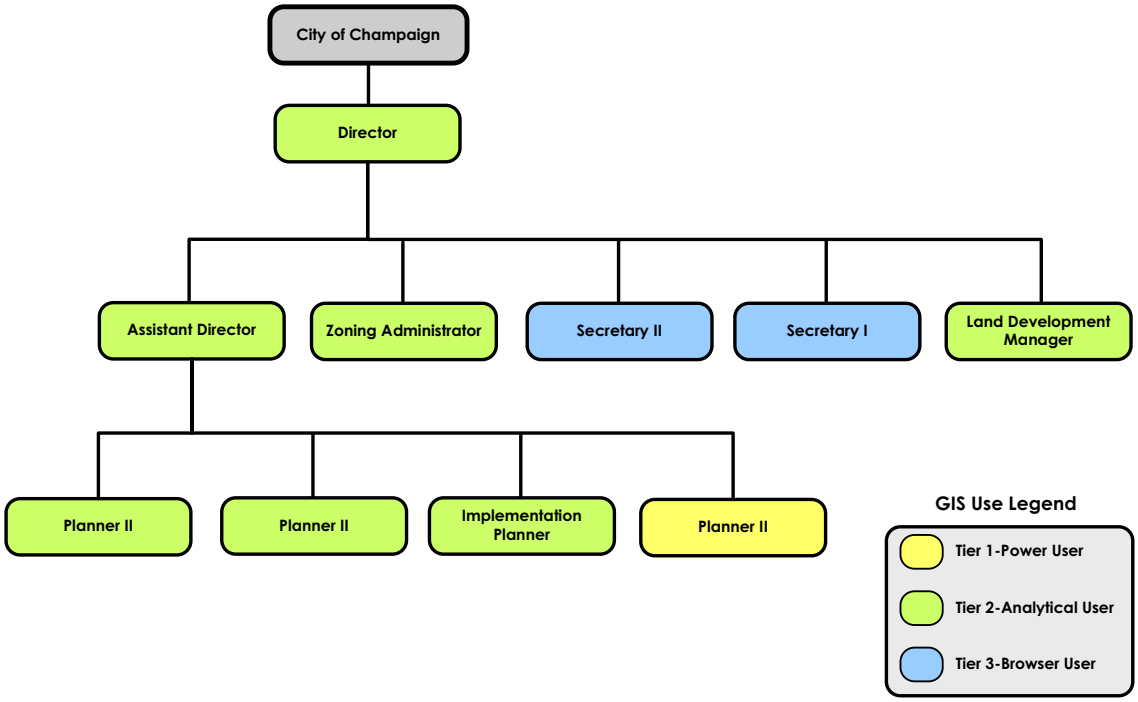
Kiosk Application with Key GIS Functions

Easy-to-Use Touch Screen Interface

Multi-Tier GIS Application Use within the Planning Department

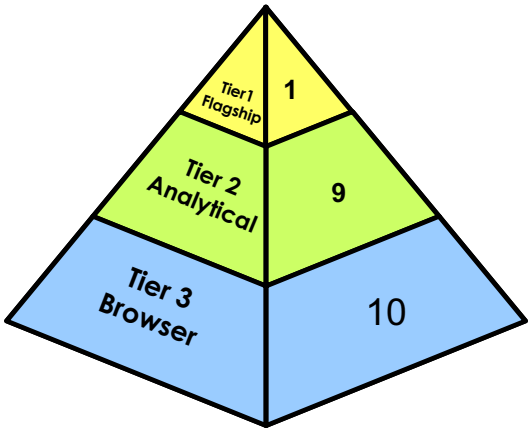
The following chart describes the recommended GIS application use by the Planning Department. A Tier 1 user is a power GIS user who should have access to a fully functioning GIS toolset. A Tier 2 users focus is data analysis in addition to general browsing capabilities. A Tier 3 user requires only general browsing GIS data functions. The Planning Department will consist of all 3 Tier users.

Champaign Planning Department



Planning Department Multi-Tier GIS Application Use

There are 7 users within the Planning Department that is considered a Tier 2 user, and 1 user considered a Tier 1 user; all other staff members are Tier 3 users.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The City of Champaign Police Department's mission is to…"preserve peace and order within the City through a cooperative effort with its citizens. To that end, the Police Department will seek citizen involvement in identifying problems and solutions to those problems within each neighborhood throughout the City. The Police Department and neighborhood citizens will combine resources to address those problems."

The Police Department is comprised of the following divisions/sections:

- Field Operations
- Operational Support
- Professional Standards
- Assistant to the Chief of Police for Community Services.

The Police Department consists of approximately 123 sworn and 37 civilian employees. Staff operate out of a central police station and 3 substations. Approximately 80,000 police calls for service are received annually with 16,000 of those being reportable incidents. The City is divided into three districts and eight beats.

Existing Hardware and Software

The Police Department has personal computers for office personnel which are all networked. The Police Department PCs utilize Windows XP or Windows 2000 operating system (city-wide standard). Currently, there 45 vehicles operate with mobile or laptop computers. Currently CMA cellular technology is utilized for communications. Wireless hotspots for mobile computers will be available in the next few months

METCAD uses a Computer Aided Dispatch System (CAD) to dispatch and communicate with patrol officers. The dispatch center currently uses a Tiburon Phase II Compliant 9-1-1 system with integrated GIS mapping. The Police Department utilizes an in-house AS/400 records management system (RMS). Office staff enter incident information into the RMS for reporting to the state and federal government. Weekly reports are derived from the RMS data. MapInfo is currently utilized for creating GIS maps and beat by beat reports. A copy of ArcView has been acquired but is not currently utilized for crime mapping. The METCAD system assigns x, y coordinates to each incident as the calls are received.

The Police department utilizes:

1. Tiburon – dispatch by METCAD
2. AS/400 in-house application for records management
3. MapInfo – crime analysis
4. ArcGIS 9.1 – ArcView for Crime Analysis
5. Mr. Sid viewer – aerial photo visualization
6. Microsoft Office – Office productivity
7. GroupWise- email, calendaring, and scheduling

Recommended GIS Needs and Duties

The Police Department should continue to implement GIS and complementary technologies throughout the Department. From crime/incident analysis to special project mapping, the Department can leverage and integrate existing investments in its technology infrastructure to develop an effective solution for crime mapping and community protection.

Police departments throughout the country have implemented GIS in varying capacities—the City of Champaign Police Department is well positioned to continue to implement GIS effectively. Key to this effort will be the implementation of mapping and spatial analysis applications throughout the department as well as dynamic, real-time access to data for field personnel. Access to information should be provided by several user-friendly applications which will be discussed in detail in the following sections.

Since the department already has a savvy GIS user, many of the initial learning curves will be shortened dramatically. With formal training and access to cutting edge applications and accurate data, the Crime Analyst position will be able to contribute positively from the start. The Crime Analyst will need to transition solely to ArcView for crime mapping. This is because the City will be implementing over 100 layers of GIS data that will reside in an ESRI compatible format (ArcView). Specific training on ArcView for crime analysis should be provided for the Crime Analyst.

Based on this needs assessment, the Police Department has several GIS needs, including:

- Mapping and spatial analysis of criminal activity, incidents, and accidents
- Field access to geo-spatial data
- Mass Notification System
- Public Access to Geo-Spatial Police Data
- Formal GIS training for Police staff

<u>Mapping and Spatial Analysis of Criminal Activity, Incidents and Accidents</u>

Crime analysis is already taking place by the City's Crime Analyst. Data is downloaded to the AS/400 from METCAD as calls are received. This information can then be extracted for mapping purposes. Currently, the Analyst is constrained by the lack of city data. As more data becomes available, crime analysis activities will be enhanced and officers will have easy access to the data. A key need for the Police is to provide organization-wide access to GIS-based mapping and spatial analysis. Users in every section will benefit from access to the City's base data as well as department-specific information. Upon implementation of an

enterprise GIS, the Police Department will be able to conduct the following types of mapping and analysis:

- Incident analysis
- Crisis management for schools
- Mapping home bound citizens
- Mapping sex offenders
    - Megan's Law and Jessica Lunsford Act databases stored on the AS/400 – these can be spatially enabled and shown as GIS layers
- Reverse 911
- View and query existing infrastructure – water, sewer, gas, storm water, and facilities
- View and query utility customers
- Intranet Site for quick PIN mapping
- Weekly PIN map
- Hot spot analysis
- Court case support for Detectives
- Logistical support
- Tracking drug free zones around schools
- Creation of new response areas
- Staffing analyses – what is happening when
- View aerial imagery for drug raids and traffic accident analysis
- Assisting in evacuation during storm events
- Laptop access with an easy-to-use data browser
- Traffic collision intersection studies
- Know location of speed zones, survey zones, etc.
- Regional crime analysis
- Ability to create a three minute drive and walking distance from an incident

Staff members in various sections should be able to conduct some mapping and analysis tasks utilizing an Intranet GIS application. Various tiers of GIS applications are recommended for the Department to meet its GIS needs. An Intranet GIS data browser should be made available to all staff—this application will enable staff to perform basic PIN mapping.

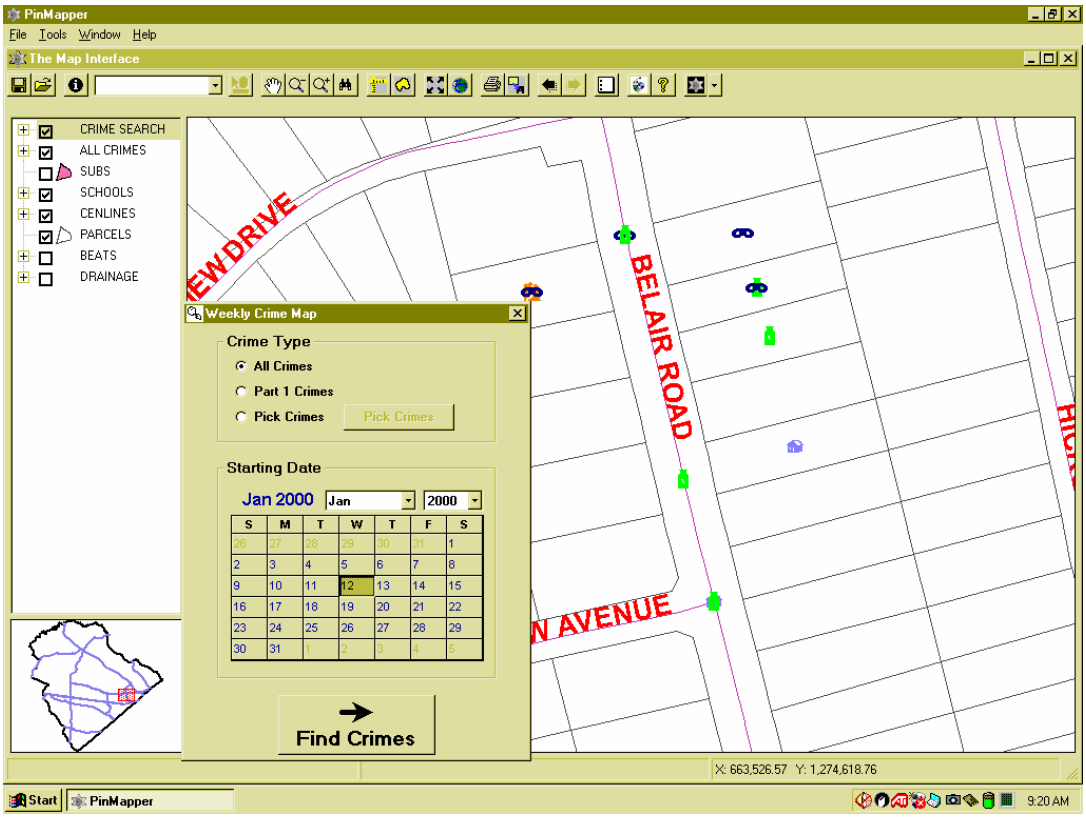
A desktop GIS data browser is recommended for use by personnel that wish to conduct more complex PIN mapping and analysis (for the most part this will be the Crime Analyst); this application will provide access to data extracts from the RMS and CAD databases, as well as base map information such as streets, parcels, and aerial photography.

It is recommended that the Crime Analyst begin to utilize ArcGIS for crime analysis. Various tools will be provided that automate the mapping of incidents. Therefore, the Crime Analyst will have more time for advanced analysis.

The following are some examples of the type of advanced GIS analysis that can be conducted for the Police Department:

Incident Analysis Application

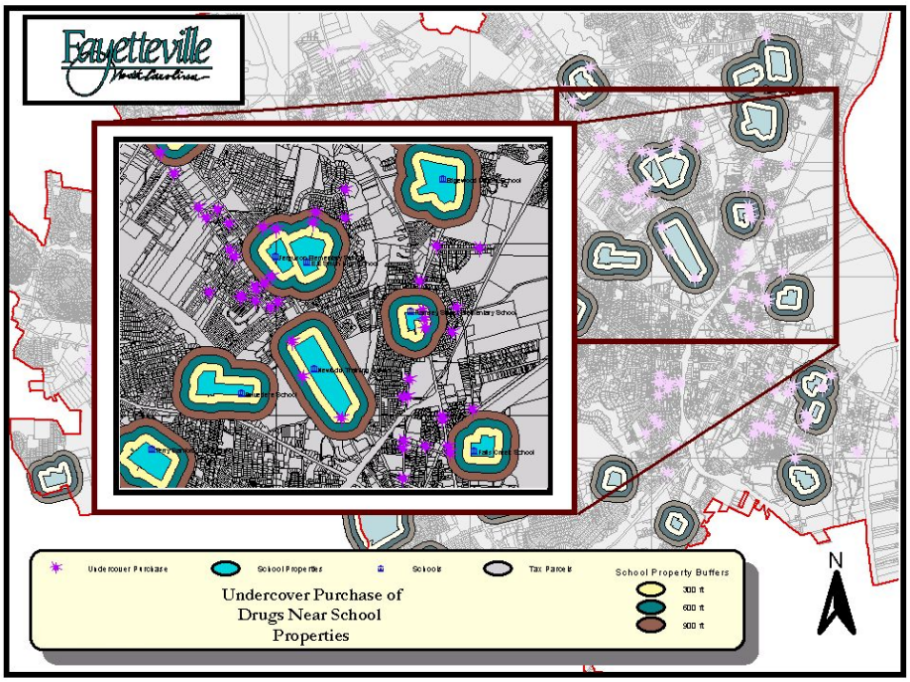
A crime analysis package should be utilized to view information that is input into the RMS software. This program will create an up-to-date GIS layer depicting the location of all incidents reported. Officers can then view the data in a variety of ways. For example, an officer can view the data by time of day, incident type, specific UCR code, officer responding, case status, alcohol involvement, etc. Any data that is entered into the RMS crime-reporting package can be accessed and queried from this GIS interface. Various GIS based crime mapping applications are on the market. The key thing to look for is that the application is written in an open programming language and that it utilizes ESRI GIS technology at its core. An Intranet interface to the RMS data is recommended. This data would be automatically mapped via a nightly download and upload program from the RMS. Each staff person would then have quick and easy access to crime data in a map format.



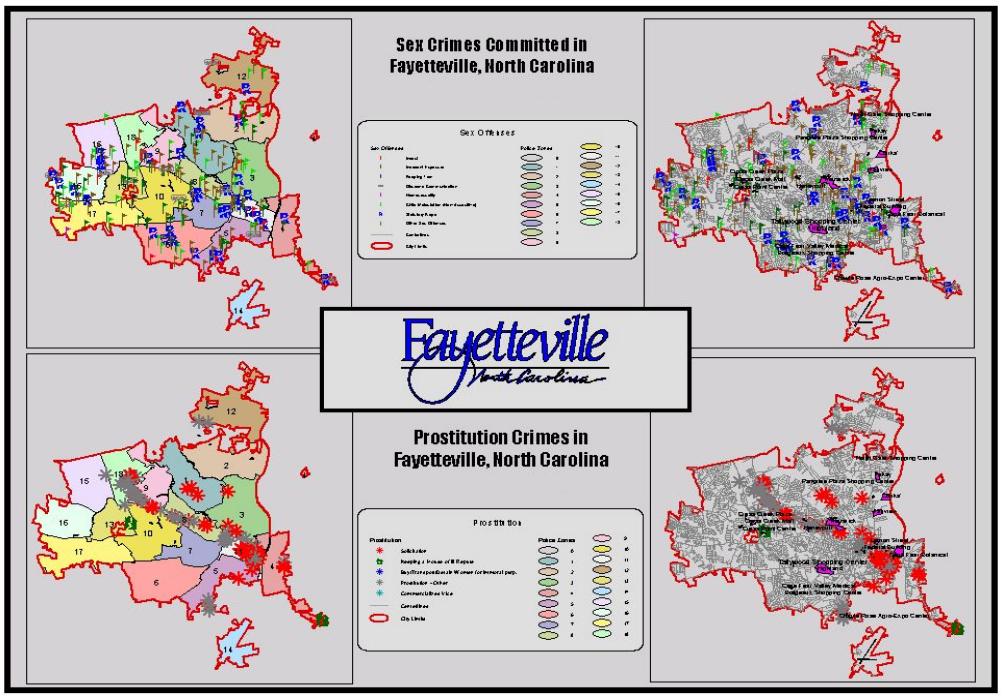
Crime Incident Analysis

Optimal Response Area Creation

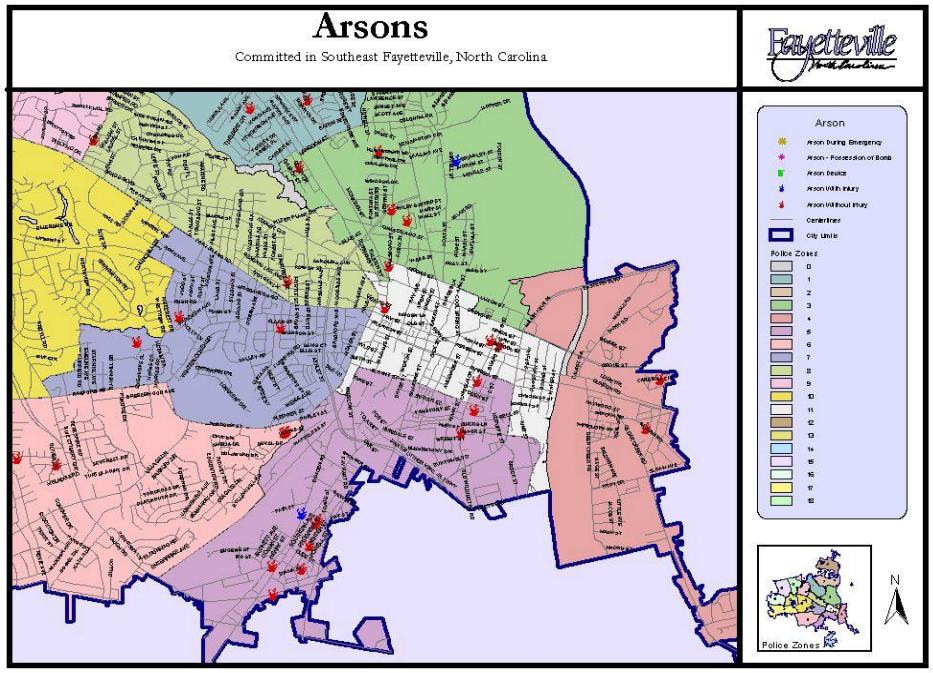
GIS should be utilized to analyze Police response areas or beats. Calls for service can be mapped and then GIS can be utilized to optimize beat configuration. Once mapped, incidents can be equally distributed between beats. Police staff can quickly change a zone boundary and recalculate total calls for the new zones. The Crime Analyst can accomplish this process in-house. Additionally, the Crime Analyst will be able to create of zones of concern such as drug free zones around schools and search buffers around sex offender's residences.



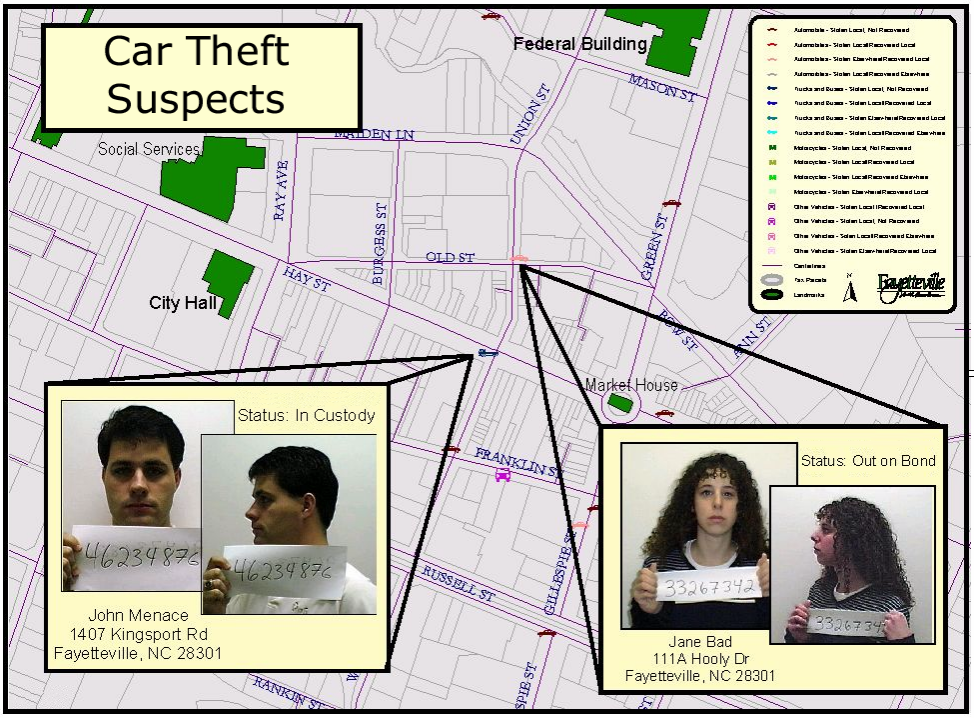
Drug Free Zones Around Schools



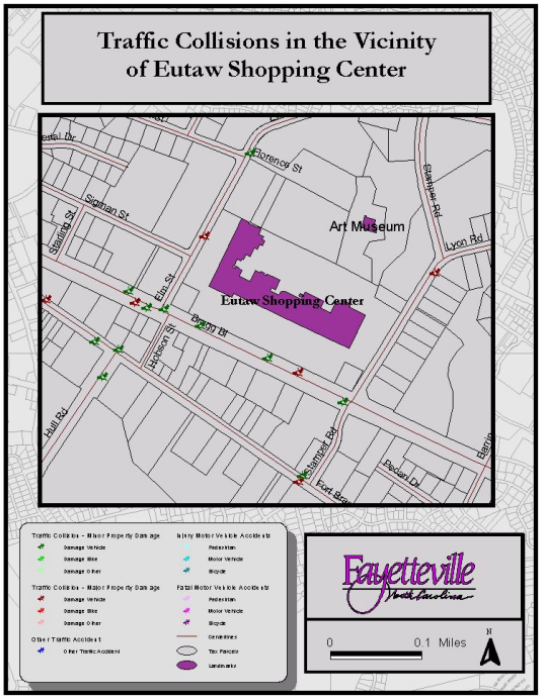
GIS Allows for Viewing Specific Crime Types



GIS Can Assist in Visualizing Crime Patterns such as Arson



Tying Mug Shots to Crimes is Possible with GIS



GIS Assists in Traffic Accident Studies

- Case Study: Jacksonville, North Carolina, City Police Track Crime with Computer Program

City police track crime with computer program
November 22, 2004
ROSELEE PAPANDREA
DAILY NEWS STAFF

The dots pop up in several places on a map of Jacksonville. Some are even lined up on the same street. Based on the information that Jacksonville police detective Scott Smith plugged into his computer, the dots indicate that there is a pattern of car break-ins in a neighborhood in Jacksonville.

The names and addresses of all the victims are at the bottom of the computer screen along with other information, such as the names of potential suspects and when the crimes occurred. If Smith needs more details about the crimes, most of it can be found just by a click of his computer's' mouse. Smith and other Jacksonville police officers now have access to LG (Looking Glass) Crimes - – computer program designed to make solving crimes easier.

The city purchased the program about two months ago for $15,000. Investigators who use the program were then trained by Jennifer Hughes, who works for the city as a geographic

information systems program analyst. Most of the information included in LG Crimes was already available to police officers. The difference is they now can find it all in one spot. "I cleans it all up and puts all the important information in one bundle," Smith said. "The information was always there. It compiles it into one easy tool." now, Smith doesn't' have to flip through all the reports of car break-ins to compare details. All he has to do is look at the bottom of his computer screen.

Investigators can define their searches by neighborhoods, by specific streets, by landmarks and by crimes. They can quickly measure the distance between homes. They can do overhead views of an area. They can analyze crime hot spots. They can compare data on a monthly basis. They can even use it to predict where the next break-in might occur, said Jacksonville police Capt. Gary Dixon.

"I help with trends and patterns," Dixon said. "We can see if larcenies are up this month. We can see where they are located." sometimes the information is helpful after a suspect is caught. "A lot of times, criminals who do one break-in will do other weeks later," Smith said. "I you can solve one crime, you can usually solve many more." That kind of match game is important to investigators, Smith said. Just looking at it visually helps us out sometimes," Smith said. Sometimes we don't connect the dots until we see it. Sometimes another investigator is working on a crime, and you don't know it."

"All crime reports that are typed into the Police Department's computer system can be accessed through LG Crimes. The information is updated about every 10 minutes, Hughes said.

Smith probably uses LG Crimes about three times a week to assist with investigations. The program also allows the Police Department to organize drug raids with visual aids. The overhead view of the city allows officers to see where the house to be raided is located. They can identify what's around the house. If it is located near a wooded area, the program can even illustrate a break in the woods or the distance a house is from a school, Smith said.

"We can see it from every angle," Smith said. "We know what buildings surround the house. We know who owns the house."

"*Case Study Courtesy of Jacksonville Daily News

Field access to Geospatial Data

Another identified need by Champaign Police personnel is to have field access to mapping data. Champaign currently has 45 mobile units. A mobile data browser can be loaded on the mobile computers, allowing the same capabilities offered by map books, but also the ability to conduct address searches; query attributes of all information, such as schools, types of hazardous material stored at a location; link to digital building pre-plan drawings, and optimal routing.

All relevant layers, including base map layers and aerial photography should be available for display in the GIS data browser. It should be noted that highly accurate geospatial data is

required for the successful implementation of such a solution, given that patrol personnel will rely on this information to make tactical decisions. Officers currently have DeLorme GPS and mapping software in their vehicles to determine driving directions. However, this software does not allow for the incorporation of the extensive data sets that will be created for the City during this project.

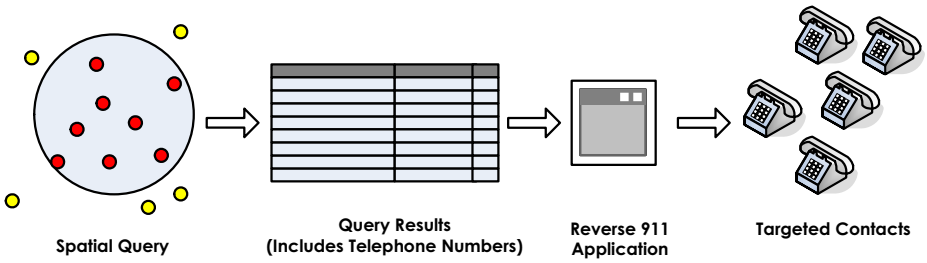
Mass Notification System

GIS has proven to be a valuable technology for community alerting mechanisms, such as a Mass Notification System. It is recommended that the city implement a GIS-based Mass Notification System solution. The Police Department should have the opportunity to participate in this recommended city-wide application.

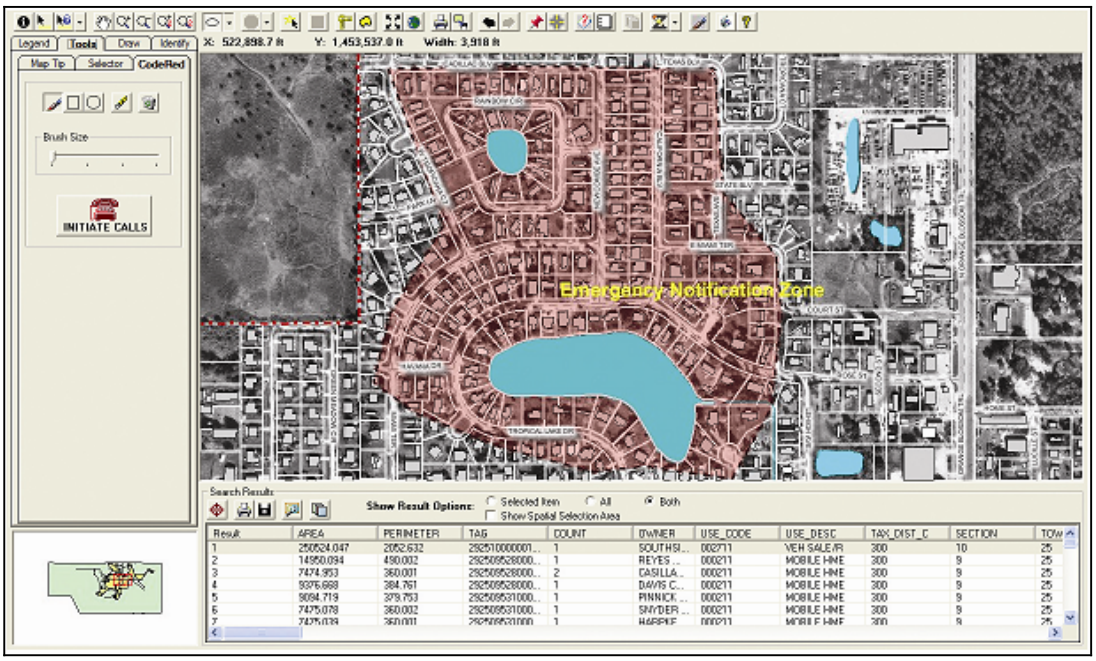
The uses of a GIS-based Mass Notification System application include:

- Emergency Evacuations
- Missing Person Alerts
- HAZMAT Emergency
- Crime Prevention Safety Tips
- Public Service Announcements
- Citizen Surveys
- Business Crime Alerts
- Investigation Assistance
- Prison Escape Alerts
- Sexual Offender and Predator Notices
- Parolee and Juvenile Check-ups
- Search and Rescue Operations
- Neighborhood Watch Meeting Notices

GIS-based Mass Notification System applications include functionality to select target audiences for distribution of messages based on spatial queries, tabular queries, user-defined areas, buffers, and existing data layers. A possible need for the department is notification of incidents/events to neighborhood watch groups. Using a GIS-based Mass Notification System application, the Police Department could use spatial analyses to determine appropriate contact information for selected neighborhood watch groups in the vicinity of an incident or event. The Department could utilize a Mass Notification System application that can be easily and effectively integrated with the City's GIS.



GIS Based Mass Notification Workflow



Mass Notification GIS Interface

Public Access to Geo-Spatial Police Data

The Police Department expressed the need to disseminate spatial information to the public by providing a mapping application that will enable the city's citizens to view and analyze criminal and incident information. The mapping application should incorporate the ability for the public to view criminal and incident data generalized by blocks, including crime hotspots and sexual offender locations.

As part of the City's objective to provide an Internet GIS data browser, the department should coordinate with the GIS Coordinator to integrate departmental GIS data into the Internet-based application. In addition the Department should identify additional functionality that may be required in addition to the City's base enterprise offering.

More information on Internet GIS data browsers can be found in the Enterprise-Wide Applications section of this chapter.

Formal GIS training for Police staff

It is recommended that the Police Department and the recommended GIS Coordinator identify key division staff to receive formal training. The Crime Analyst will need training in ArcView and each officer will need training on the Intranet crime mapping application. The ArcView training should be specific for crime analysis and not the more generalized basic course. More information on training opportunities can be found in Chapter 5: Five-Year Strategic Plan.

Existing GIS Data Layer Inventory and Future Recommendations

The Police Department will benefit from access to several other departmental GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other City departments.

Police Department personnel expressed that access to the following GIS data layers would be beneficial:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Address Points	Integrate various sources to create address point layer	Public Works and GIS Coordinator	Recommended
Aerial Photography	GIS Consortium	GIS Consortium	Existing
ATM, Banks, Branches	Heads up digitizing on the screen	Police	Recommended
Beats and Response Zones	Digitize from exiting maps and/or heads up digitizing using aerial photography	Police Department; GIS Coordinator	Recommended
Building Pre-Plans	Scanned and linked from Fire Records	Fire Department	Recommended
Census Data	Bureau of the Census	GIS Consortium	Existing
Crime Data	Extract, cleanse, and automatically map from RMS. Needs to be done via a nightly script	Police	Recommended
Drug Free Zones Around Schools	Buffer created around schools	Crime Analyst	Recommended
Evacuation Routes	Use street centerlines layer as source, and save evacuation routes as separate layer	Fire/Emergency Management	Recommended
Hazardous Materials	Fire Department MSDS Sheets Scanned and Linked to Site	GIS Coordinator; Fire Department	Recommended
Hot Spots	Automatically created by crime analysis software	Crime Analyst	Recommended
Liquor License Locations	Derived from TRAKiT. Automatic download and creation	Licensing	Recommended
Neighborhood Watch Groups	Derived from neighborhood layer	Police	Recommended
Parcels	GIS Consortium	GIS Consortium	Existing
Parolees	Extracted from data housed on the AS/400. Should be automated	Police	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Persons on Probation	Address matched from county probation records	County Probation	Recommended
Pre Plan Data (Buildings)	Scanned hardcopy and data at fire department	Fire; GIS Coordinator	Recommended
Schools	Digitize from base map data.	GIS Coordinator	Recommended
School Crisis Plans	Scanned and linked to the school GIS layers for easy viewing on Intranet and mobile applications	Police	Recommended
Sex Offenders	Registered and housed on the AS/400. Download and mapping should be automated.	Police	Recommended
Special Needs Residents	Extract and map from CAD data	METCAD	Recommended
Speed Zones	GPS field work; derive from aerial photography; aggregate layers as needed	Public Works	Recommended
Streets	GIS Consortium	Public Works and GIS Coordinator	Recommended
Traffic Accidents	Extract and automatically map from RMS and IDOT	Automated	Recommended
Underground Parking	Heads up digitizing on screen	Police	Recommended
Utility Customers	Extract, cleanse, geocode, and map from billing software or in-house database	Automated	Recommended
Waterways	USGS Data	GIS Consortium	Recommended

Recommended GIS Applications

To meet the Police Department GIS goals the following GIS software is recommended.

ArcView 9.2

ArcView 9.2 is recommended for use by select Police personnel. A description of this application is provided in the Enterprise-Wide Applications section of this chapter. One (1) license of ArcView 9.2 is recommended for use by the Crime Analyst. The software already exists within the department.

Internet GIS Data Browser

An Internet GIS data browser has been recommended to provide citizens with access to the City's geo-spatial data. Leveraging the City's existing GIS platform, the City will need to develop an enterprise-wide Internet GIS data browser to provide the public with access to

geo-spatial property data. A description of recommended GIS data browser solutions is provided in the Enterprise-wide Applications section of this chapter.

Intranet GIS Browser

An Intranet GIS data browser has been recommended for use by Department personnel. The Intranet GIS data browser should provide PIN mapping functionality for the all Police personnel. This application will provide the ability to map and analyze all data extracted from the RMS. This application will serve as the primary enterprise-wide GIS application for the Police Department, and should be made available to all personnel throughout the Department. A full description of recommended GIS data browser solutions is provided in the Enterprise-wide Applications section of this chapter. This application will also display calls for service from 911. This will require the acquisition of a dump of data from the 911 system at appropriate intervals and mapping this data against GIS layers such as address points to show their locations. This application should allow for automated weekly and daily pin maps to be made available in Roll Call.

Crime Analysis (including PIN Mapping)

A standalone (desktop) crime analysis application is recommended for the Crime Analyst who will engage in mid-level crime analysis. This package should include much of the same functionality as that provided by the Intranet GIS data browser, but it should include additional functionality including more detailed reporting, additional crime mapping tools (including crime trend analyses) and the ability to read data files on a local drive (for mobile computers, such as those in patrol vehicles).

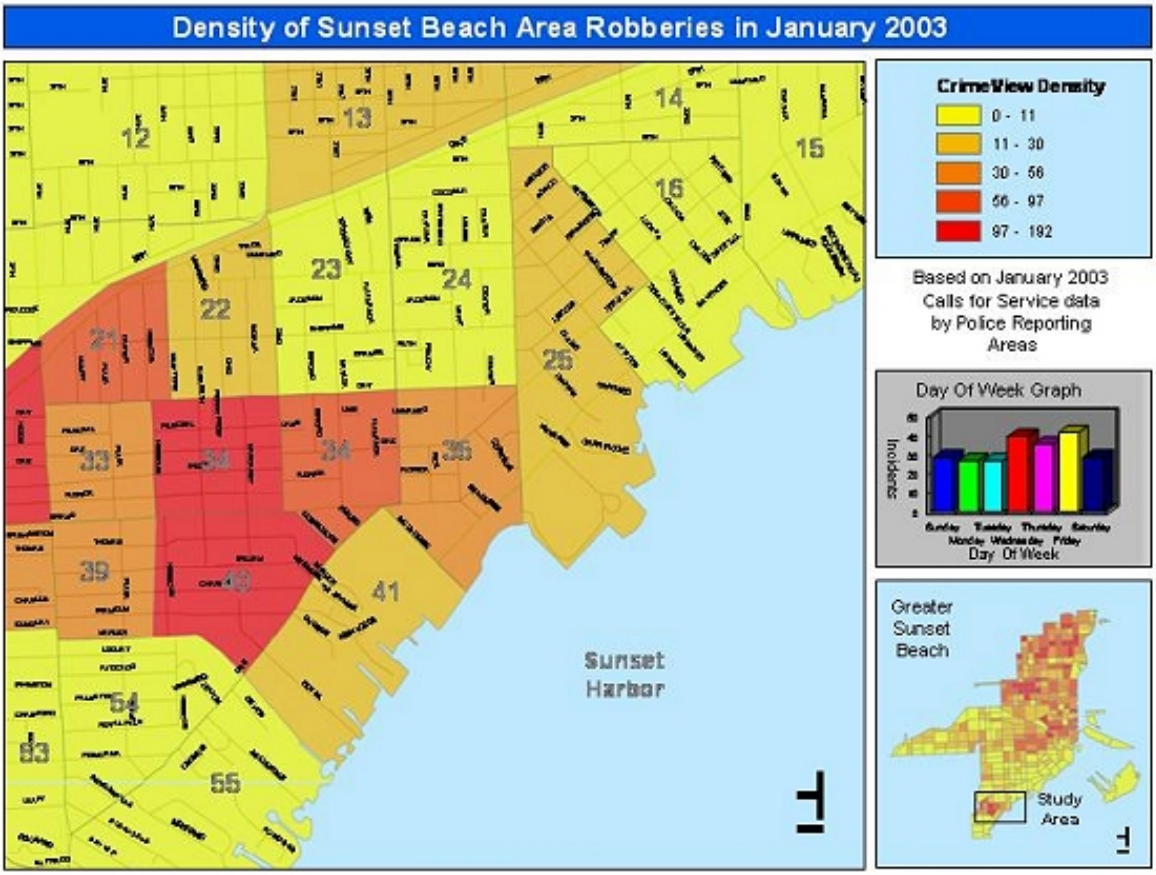
CrimeView

CrimeView® from the Omega Group is the next generation of crime analysis software, based on ESRI's new ArcGIS 9.0 platform. CrimeView is an advanced interface to existing CAD and RMS databases. This application specifically addresses the integration of data in order to effectively query and analyze data in a mapping environment.

CrimeView® includes a number of query, reporting, analyses, and mapping features to help expand user capabilities and simplify current crime analysis procedures.

Features:

- Queries - by any attribute, geographic boundary, or proximity to a landmark
- Density Maps - standardized density, hot spot maps, repeat calls
- Cyclical Reports - combine and save queries, reports, and graphs to run anytime
- Exception Reporting – create COMPSTAT style comparison reports
- Threshold Alert – be alerted by email when activity thresholds have been reached
- Analyses - crime rate generator, spatial trends

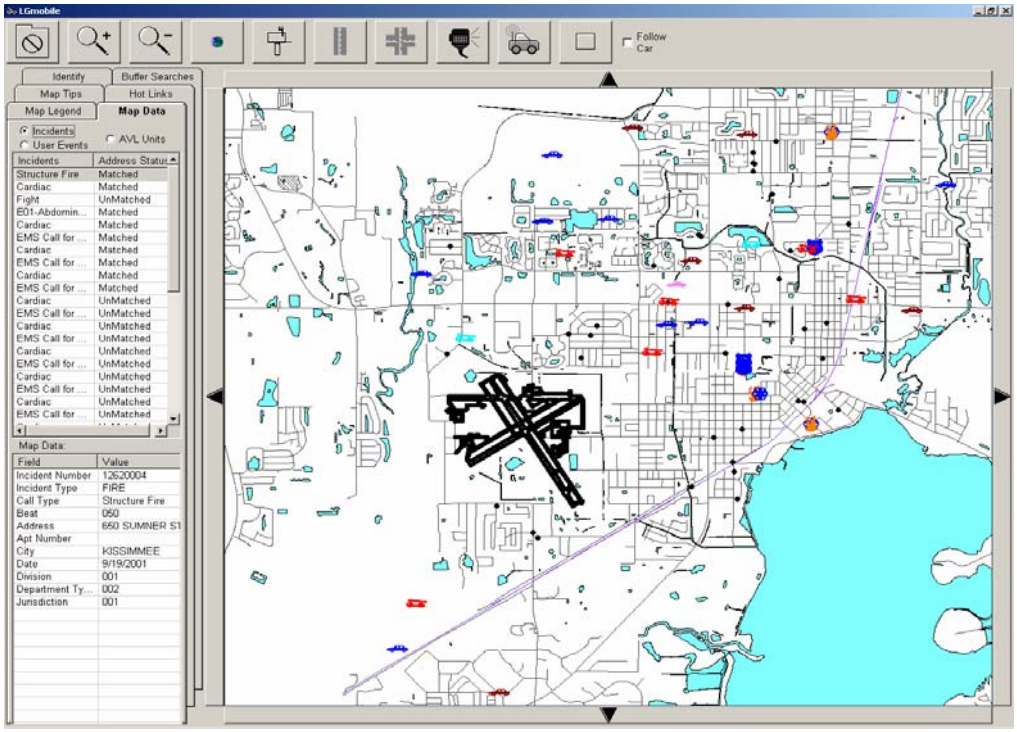


Sample Crime View Mapping Interface

Mobile GIS Data Browser

A Mobile GIS Data Browser must be easy-to-learn and easy-to-use for all Police Department personnel. It should be a data browser only – and not allow editing of source data. This application should include the following functionality:

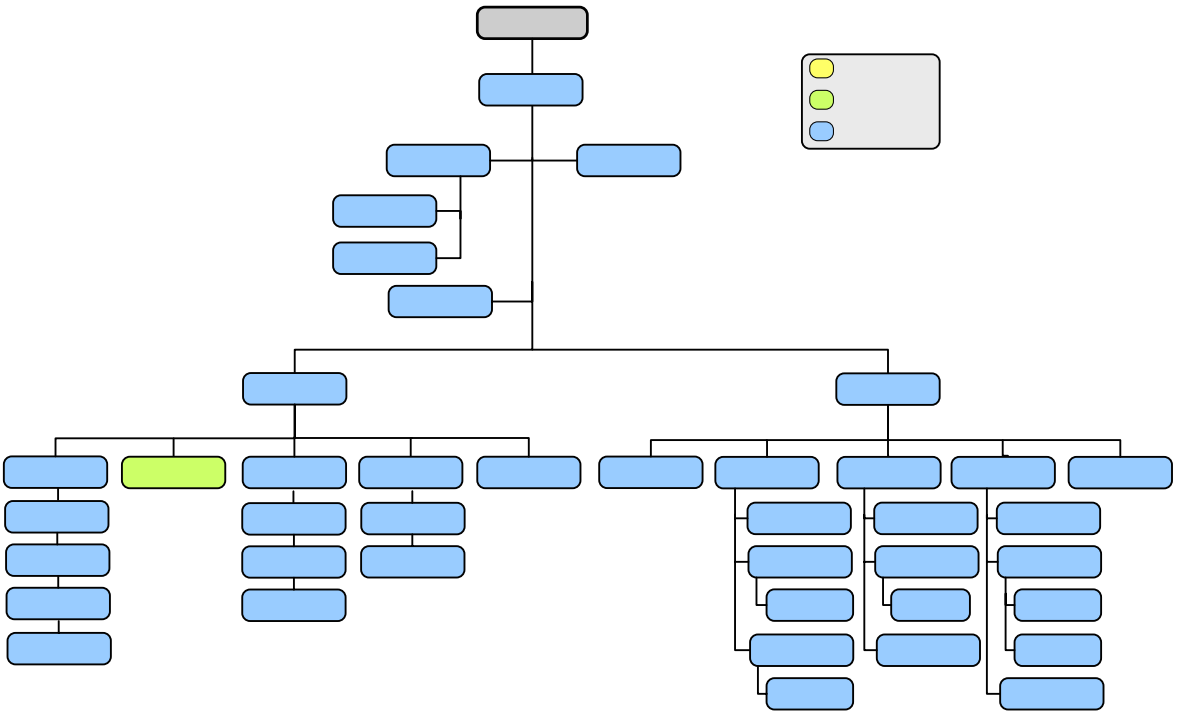
- Zoom Tools
- Extent History
- Pan Map
- Identify Features
- Pan Map
- Spatial Selection
- Tabular Searches
- Measure Tools
- Geocoding
- Intersection Finder
- Buffer Tool
- Map Tips
- Hot Linking
- Integrated Legend



Example of a Mobile Data Browser

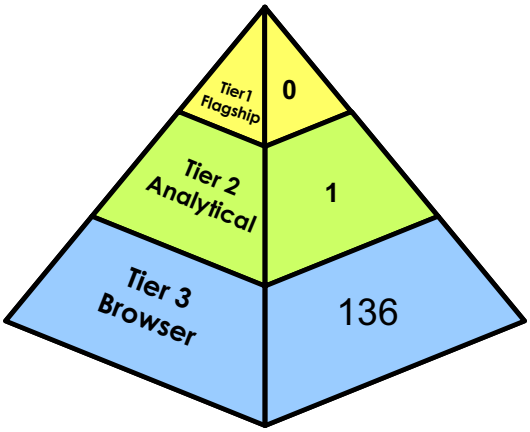
Recommended Departmental GIS Users

The following graphic describes the recommended departmental GIS user roles for the Police Department based on the three tiers of GIS. For more information on the three tiers of GIS refer to Chapter 4: Governance Model.



Police Department Multi-Tier GIS Application Use

There is one user within the Police Department that is considered a Tier 2 user; all other staff members are Tier 3 users.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Existing Personnel and Duties

The Public Library employs 40 full-time staff, 80 part-time staff, and has 70 volunteers who contribute a total of 670 hours.

The Library:

- Provides resources and programs for everyday information, enjoyment, and enlightenment.
- Provides accurate, thorough answers to patron reference questions.
- Provides resources to support schoolwork and independent learning at every age.
- Provides an environment for Champaign‘s children that is rich in stories and literature, where reading is valued and encouraged.
- Provides a welcoming, safe environment that reflects the community’s changing needs.

Adult Services Department

Adult Services provides references, information, and reader’s advisory services, programming (primarily for teens and adults), interlibrary loan and computer assistance to customers of all ages.

In 2005, the City of Champaign voted to approve the building of a new 122,600 square foot main library. The new library is expected to exceed the record of 640,321 total visits and to help attract new businesses, encourage business development and growth, and increase revenues.

Existing Hardware and Software

The Public Library has approximately 95 computers for staff use. The computers use Windows XP or Windows 2000, or the Macintosh operating systems.

The Library uses the following software:

1. MS Office
2. MS Visio
3. GroupWise - email, calendaring, and scheduling
4. Trillian
5. QuestionPoint
6. LivePerson
7. PmWiki
8. Basecamp
9. Hot Ticket
10. MRBS
11. OverDrive Media Console (e-audiobook reader)
12. Adobe
13. Streets and Trips (reference computer)

14. Adobe Photoshop
15. QuarkXpress
16. Sirsi/Dynix Horizon 7.3.2

Recommended GIS Needs and Duties

Interviews with the Library Director and key staff and a review of the Champaign Public Library Technology Plan 2006- 2009 indicate that the only GIS needs of the library are an Internet solution that can be accessed by any computer in the library with no licensing fees. It was explicitly stated that no PC-based solutions should be used. The ultimate goal is to make all GIS data accessible to citizens without burdening library staff. It was determined that no link to the patron database was required.

Existing GIS Data Layer Inventory and Future Recommendations

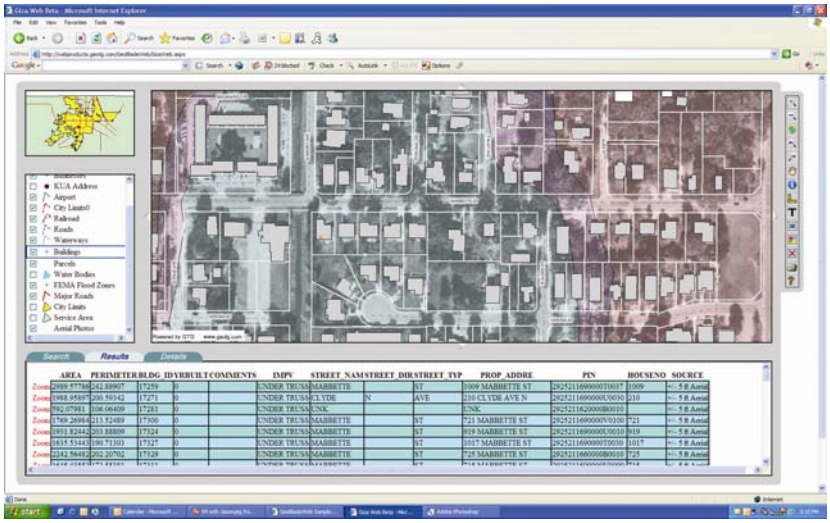
All data layers available on a Web-based solution will be used by library staff and patrons. The City's digital data layer repository will be used by patrons of the library. The table in *Chapter 2 IT Department* documents city-wide data layers that will be made avialable for the library.

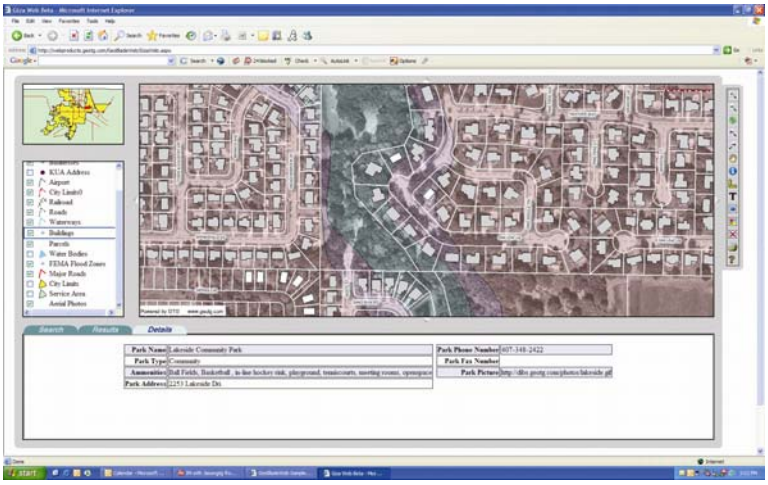
Recommended GIS Applications

Internet GIS Data Browser

The City of Champaign and the Public Library would like to provide citizens with Web access to online maps and geo-spatial information. An enterprise Internet GIS browser application, based on ArcIMS, will be needed. It should have an intuitive interface, and should incorporate the use of a graphic outline. The interface should be developed to match the current City of Champaign's Web site in color scheme, and layout.

The following graphics illustrates the "look and feel" of a proposed Internet solution.





Case Study: ESRI Grants for Libraries

ESRI Livable Communities Grant Series
Libraries
Grant Program

The goal of this program is to foster and support the integration of geographic information system (GIS) software in public libraries. Software and training grants totaling $150,000 will be awarded to public libraries within the United States.

The Public Libraries Grant Program is one in a series of Grant Programs designed to promote the development of Sustainable Communities. Grants also are available for many other types of community. Contact ESRI for more information on the Sustainable Communities Grant Series.

Program Description
The Public Libraries Grant Program has been established to provide assistance to public libraries for the establishment of GIS projects that facilitate the sharing and use of community information. The grant program consists of a $150,000 GIS investment program. ESRI has provided software and training to a total of 50 public libraries meeting the requirements.
Grant recipients will receive the following:

GIS Software and Data Needs

1. One copy of the ArcView GIS for Schools and Libraries bundle
2. One copy of ArcView Streetmap extension
3. ArcExplorer
4. Links to ArcData Online Program

GIS Books

1. One copy of Getting to Know ArcView GIS
2. One copy of Zeroing In: GIS at Work in the Community
3. One copy of ArcView GIS Means Business

4. One copy of Serving Maps on the Internet
5. One copy of GIS for Managing Natural Resources

Eligibility
The grant program is open to all public libraries in the United States.

Priority is given to:
- Organizations demonstrating collaborative efforts with other community organizations (city or county government, law enforcement, health and human services, schools, community development, etc.)
- Projects that promote public access to GIS databases

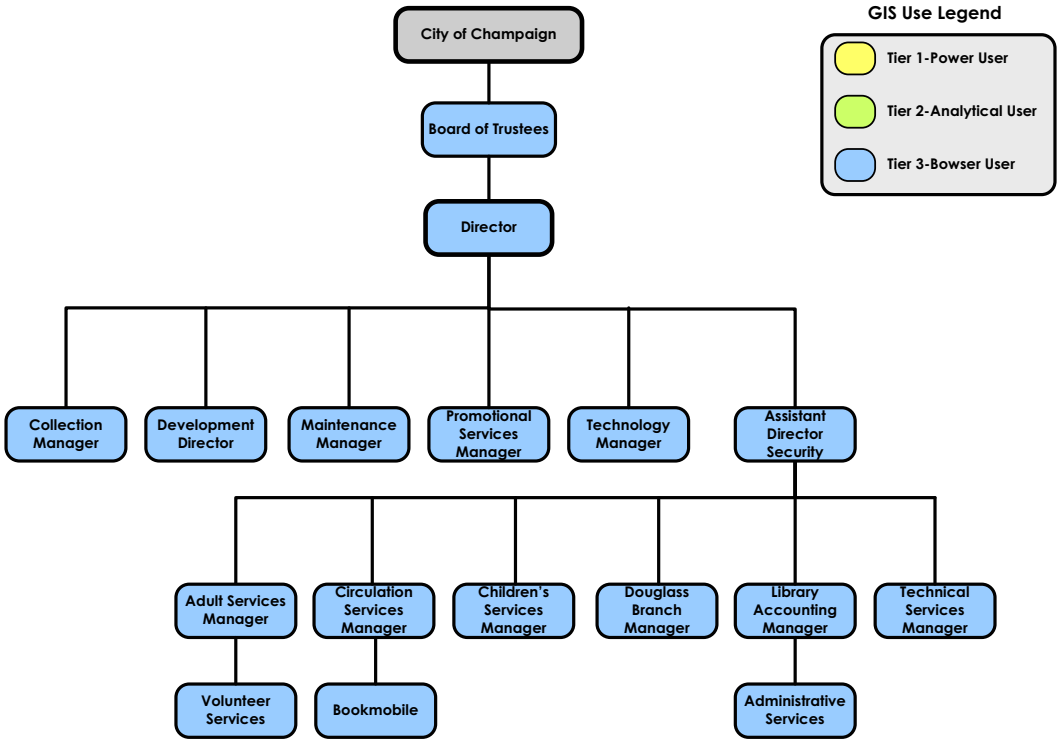
Provisions
To meet the goals of the Sustainable Communities Grant, recipients must agree to establish a public-access GIS workstation on which any citizen can access the GIS software and data. Grant recipients also must agree to add the GIS books to their collection for citizen use.

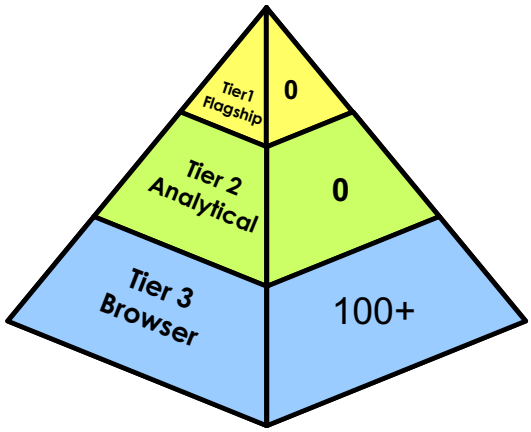
Additional Information
The grant program is limited to one grant per eligible organization. Preferential consideration for grant awards will be given to organizations not currently using ESRI software. Maintenance for ESRI software becomes the responsibility of the grantee after the first year.

Recommended Departmental GIS Users

The Public Library will be a Tier 3 GIS user. All library staff with access to a computer will be able to use the Internet solution. Library patrons will have access to this geospatial Web portal via designated computers in the new library.

Champaign Public Library





Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ **GIS Administration** ☑ **Data maintenance** ☑ **Data conversion, creation** ☑ **Spatial Data Management** ☑ **Technical support** ☑ **Coordination**
Tier 2 Analytical	☑ **Data Maintenance** ☑ **Analytical functions/Geoprocessing** ☑ **Complex queries** ☑ **Modeling** ☑ **Use of desktop extensions** ☑ **High quality map production**
Tier 3 Browser	☑ **Browsing/Look-up** ☑ **Standard reports** ☑ **Simple query** ☑ **Map production**

Existing Personnel and Duties

The Public Works Department employs approximately 104 full-time staff members. The mission of the Public Works Department is; "to develop and maintain the City's infrastructure and buildings, grounds, and vehicular equipment; and provide specialized community services, such as tree care, recycling service, and parking management. Public Works operates in partnership with the community to develop and maintain its publicly owned physical assets."

The Public Works Department is responsible for the operation, maintenance, and management of the City's infrastructure. The Department is comprised of a Director and three divisions as follows:

- **Engineering Division**
  Services include working with developers and contractors to insure well-planned and well-constructed subdivisions. The division designs and inspects infrastructure maintenance projects and manages other non-building Capital Improvement Plan (CIP) projects. Engineering also maintains traffic signals, traffic signs, and streetlights.

- **Operations Division**
  Responsible for maintaining all City facilities, overseeing all solid waste activities, the Encephalitis Control program, trees on City rights-of-way, asphalt pavements, alleys, and sanitary storm sewers within the City. This Division also provides concrete repairs on City streets and sidewalks, snow and ice control, and weed control.

- **Administrative Services Division**
  Responsible for centralized administrative functions of the Department; management of the City's parking system including enforcement, collection, and meter maintenance; and fleet management vehicle purchasing and maintenance.

The complexity and cost of managing the vast amounts of infrastructure, which the City of Champaign Public Works Department manages, has greatly increased the demand for geographic information systems and global positioning system technology. The Public Works Director and key personnel understand that it is becoming essential to have an up-to-date and accurate digital representation of infrastructure within the City. The City is experiencing a steady population growth and with it increased pressure for the efficient and effective management of its infrastructure. The Public Works Department provides the physical infrastructure essential to social and economic development, which is indispensable to community, commerce and industry.

The Public Works Department will be by far the biggest user of GIS within the City of Champaign. A vast of amount of GIS data will need to be created and maintained by the Department. A GIS based work order system is essential for Public Works. It is

recommended that the Public Works Department create a GIS Technician position for maintaining GIS data for the department. More information on GIS staffing can be found in Chapter IV– Governance Model.

Existing Hardware and Software

The Public Works Department currently has personal computers for all office staff. All Public Works Department PCs have the Windows XP or Windows 2000 operating system (citywide standard). The department has a large E-sized plotter for printing maps. The department has two Trimble GEO XH mapping grade GPS units and one survey grade GPS unit.

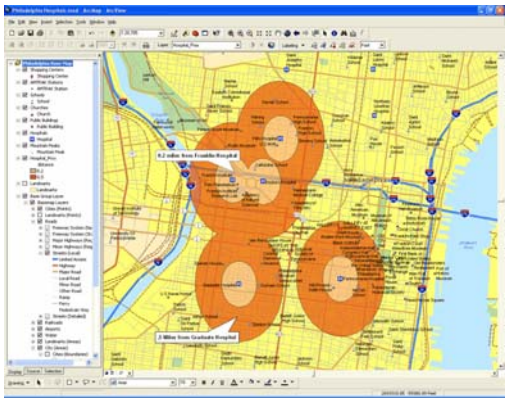
The Public Works Department uses the following software applications:

1. MS Office – for office productivity
2. ArcGIS – ArcEditor two licenses and three licenses of ArcView
3. AutoCAD and AutoCAD Map – computer aided drafting and design
4. TRAKiT – new development permits, erosion control, driveways, etc.
5. DataCap – sanitary and storm video monitoring
6. AutoTURN – for traffic modeling
7. Haestad Methods Suite – for infrastructure modeling
8. T-2 systems – parking
9. GroupWise- email, calendaring, and scheduling

The Department utilizes the aforementioned software in varying capacities. ArcView and ArcEditor are used for mapping and spatial analysis. However, seven staff need access to the software and they are often locked out due to the limited number of licenses now available. Also, the network speed between Public Works and City Hall is slow and makes software utilization very difficult. There are plans underway to upgrade the speed between the two facilities. Fiber connectivity and associated data speed is essential. Otherwise, data and software duplication on two servers will be required. Due to the volume of data housed by Public Works a second SDE based GIS server may be required. Additionally, the Department maintains a vast array of large data files. A data server containing these video and image files should be dedicated to Public Works.

ArcView and ArcEditor

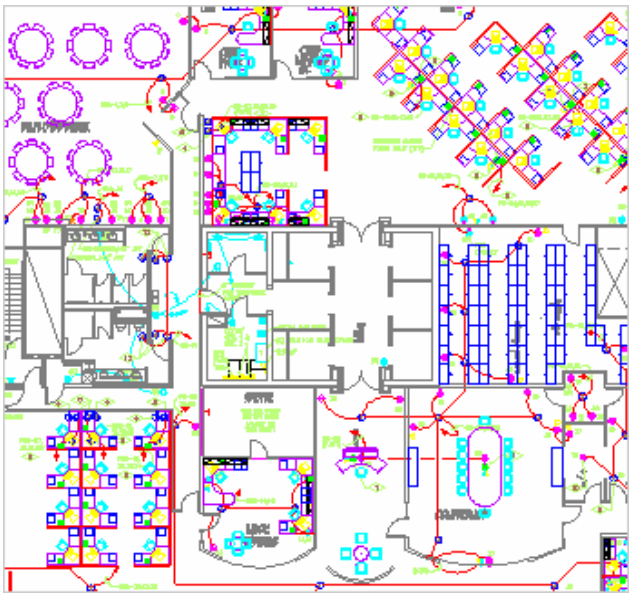
ArcEditor is utilized to edit GIS data layers. ArcView is used to view and query data. The Department also uses ArcView to generate other cartographic products for use by administrative and field staff. The current number of licenses is insufficient to meet the needs of Public Works.



ESRI's ArcGIS

AutoCAD and AutoCAD Map

AutoCAD is used extensively to view, markup, and modify computer aided design (CAD) files of the facility/infrastructure data maintained by the Department. AutoCAD is limited in its use as a GIS application due to the format of CAD data files. Public Works will continue to utilize AutoCAD for design functions but should conduct all of their GIS functions with ESRI based software. Over 100 ESRI based GIS layers will be available throughout the City and ESRI software is being recommended as the enterprise GIS software suite.



AutoDesk AutoCAD

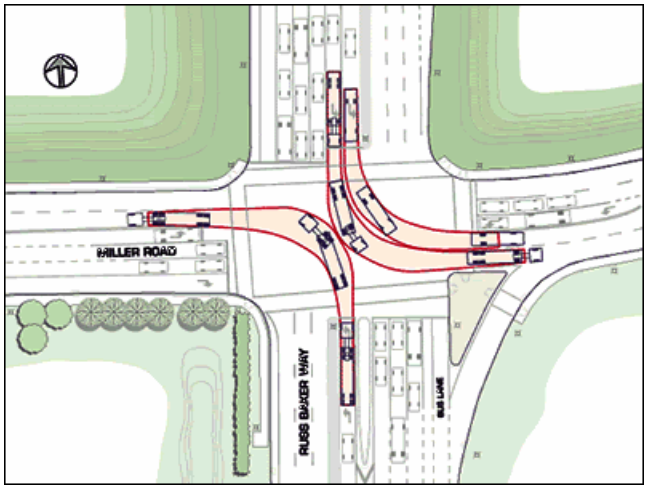
TRAKiT - TRAKiT is available from CRW. The TRAKiT system is comprised of a series of interrelated modules that are linked with a GIS-centered database to provide a system for creating, issuing, and tracking any type of Planning activity. TRAKiT is utilized to track various information for Public Works including; new development permits, erosion control, driveways, grading and drainage, sewer connects, and right-of-way occupancy. Data from TRAKiT will need to be GIS enabled.

TRAKiT

DataCap – DataCap by Cues is utilized for tracking video taken of the interior of sanitary and storm water features. Champaign creates 80GB of video files annually on pipe inspections. These files should be logically stored and given an attribute that links them back to the GIS feature that is associated with the video. These videos could then be made available by selecting the feature on the GIS and launching the DataCap video.

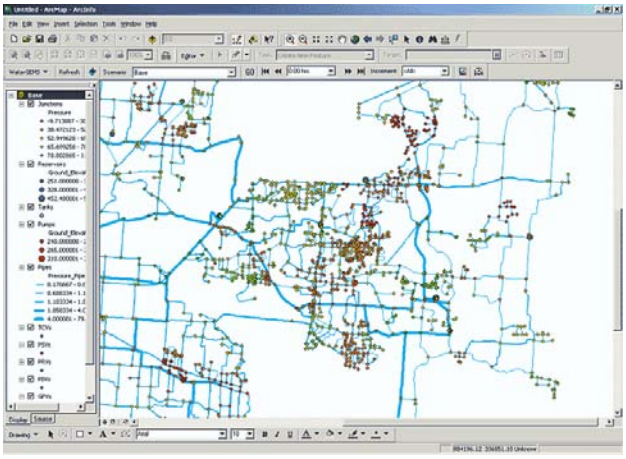
DataCap

AutoTURN - AutoTURN is a CAD-based software tool specifically created for the transportation design professional. This program is utilized for analyzing and evaluating vehicle maneuvers for projects such as intersections, roundabouts, bus terminals, loading bays or any on or off-street projects that may involve access, clearance, and maneuverability checks. This software utilizes CAD files. Champaign may need to export ESRI GIS files to a CAD format in combination with project based CAD files for various studies.



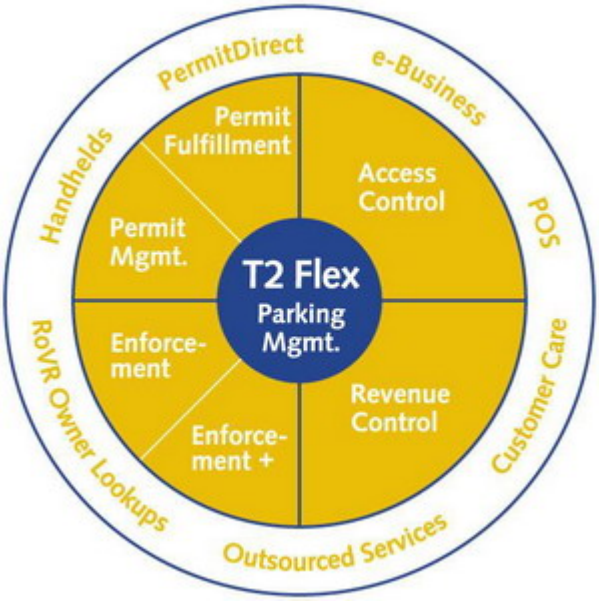
AutoTURN

Haestad Methods – Champaign utilizes various Haested products for infrastructure modeling. Public Works currently has PondPack, FlowMaster, Culvert Master, and StormCAD modules. These applications work seamlessly with ESRI based software. Bentley Systems has recently acquired Haestad and will continue to improve and support the product suite.



Example of Haestad Method's StormCAD

T-2 Systems - T2 Flex™ manages multiple parking tasks including: accounts receivable, residential and other permits, access cards, transient parking, citations, towing, monthly contract parking, and much more. Data from T2 will need to be integrated to GIS. The 2,100 metered and 1,800 permit spaces will need to be mapped and tied to their T2 records.



T2 Systems

Recommended GIS Needs and Duties

It should be noted that the Public Works Department is a major data generator. Establishing a process of automated data capture and the effective use of GIS will be critical to the success of an enterprise-wide implementation of GIS.

Based on this needs assessment, the Public Works Department has several GIS needs, including:

- Mapping and spatial analysis of facilities and infrastructure data

- Field access to geospatial data
- GIS-based work order management
- Wastewater and storm water modeling and monitoring
- Public access to geospatial public works data
- GIS-based public notification for emergencies and maintenance
- CAD Standards for Plan Submissions
- Automated Vehicle Location (AVL)
- Access to spatially enabled as-builts and CAD drawings - links to document management system via GIS
- Pavement Management
- Parking Management via GIS

Collaboration with several departments/divisions will be instrumental in establishing GIS as a complementary technology used to meet Public Works objectives. Initial efforts should be aimed at increasing GIS awareness within the Department, allowing staff from all divisions to become familiar with the efficiencies that can be gained through the use of GIS for mapping, analyzing, and tracking information.

Mapping and Spatial Analysis of Facilities and Infrastructure Data

Mapping and spatial analysis are key tasks that will enable the Department to improve management, operations, administration, and maintenance of the City's infrastructure. Public Works departments throughout the country have realized significant gains in both time and efficiency by using GIS.

The most expensive yet important aspect of the Public Works GIS initiative is the creation of complete and accurate data sets. The following table was provided by Champaign Public Works staff with additional comments and layers added. The table details the needed data layers for Public Works, their status, and issues for completion.

Parking – A majority of this information has been created. Additionally, a project should be undertaken to relate the data residing on the T2 parking system to the GIS. Users should be able to look up parking features and view the T2 data associated with that feature. More information on uses on GIS for parking is discussed later in this chapter.
Handicap Parking – 99% complete
Loading Zones – 99% Complete
Metered Parking – 99% Complete
Parking Lot Boundaries – 100% Complete
Parking Lots – 100% Complete
Parking Lot Pavement Markings – 90% Complete
Permit Parking – 99% Complete
Towing Zones – 100% Complete

Streetlights – A Trimble GPS unit was utilized to capture streetlight information. A GIS based database design was created to house this data. Every two months the condition of these lights is inspected. This information should be combined with the GIS layer and then managed and tracked via GIS. Photographs of each streetlight should be linked to their

corresponding GIS feature. A full GPS inventory of traffic signals should be conducted and managed within GIS. A GPS based signal pre-emption system is being implemented.

- Controller – 100% Complete
- Electrical – 100% Complete
- Handholes – 100% Complete
- Power Disconnect – 100% Complete
- Streetlights – 100% Complete
- Traffic Signals – 0% Complete

Sidewalks – The sidewalk inventory was recently completed and needs to be input into a database. Once completed, information about repairs, replacements, and reported injuries due to tripping should be maintained on the GIS.

- Sidewalks – 30% of Data Entry is Complete (Linking of data to the database)

Signs – Currently none of these have been collected. The current intent is to GPS the location of each of these as they are being replaced. The City is on a 15 year replacement cycle.

Private Infrastructure – Public Works maintains the urban forest within the City right-of-way. A database of trees is being maintained. A seven year pruning cycle is conducted by the City. A tree GIS layer should be created and all of the information in the existing database should be maintained in GIS.

- Mowing – 30% Complete
- Tree Inventory – 0% Complete – Within the City right-of-way.

Transportation – A street centerline layer exists for the City of Champaign. It is currently maintained by the GIS Consortium. It has been recommended that the City begin to maintain this data layer internally. ERI conducts pavement management surveys. This information should be tied to the GIS and a GIS based pavement management system should be utilized. More information on a GIS based pavement management system is discussed later in this chapter. Pavement markings can be captured via heads-up digitizing from the aerial photography.

- Alleys – 50& Complete
- Pavement Management (ERI) – Unknown% Complete
- Bridge – 0% Complete
- Pavement Markings – 0% Complete
- Traffic Counts – Champaign has some traffic counts. Other traffic counts can be obtained from the MPO and the State. These should be housed as a point based GIS layer.

Miscellaneous Layers

- Northwest Interceptor Fees – 80% Complete
- Newly Developed Areas – 0% - special fees can be charged for these areas.

Therefore, as GIS layer should be created of these areas.

- Mosquito Breeding Areas – 0% GIS Consortium has some of this data

Storm Water – (5 to 10% Complete) – The City currently has approximately 15,000 storm water structures. This will grow to the 20,000 range in the near future. An ESRI based geodatabase model has been created to house this data. This data was in AutoCAD but was incomplete and positionally inaccurate. Operational staff are using GPS to correct features. At the current rate it will take 10-15 years to complete the collection of the storm water data. It is recommended that the collection of these features is outsourced and then maintenance is done by the City. Various data tables exist and should be tied to their associated features as they are captured.

- Storm Lines
- Manholes
- Repair Inventory
- Storm Sewer Inspection (Table)
- Storm Sewer General Information (Table)
- Repairs (Table)
- Condition Rating (Table)
- Detention Basins (Table)

Sanitary Sewer – The City has approximately 5,000 manholes and 1,000,000 feet of pipe. An ESRI based geodatabase model has been created to house this data. AutoCAD drawings were converted to an ESRI GIS format. The City is working with the GIS Consortium to populate the attributes on this layer.

- Manholes and linear features – 0% GPS verified – original CAD drawings converted to GIS exists for the City.
- Septic Tanks – Exists as a table now. Table data needs to be mapped as a point layer and then managed via GIS.
- Sewer Overflows – Tracked on a paper map now. Needs to be moved to GIS.
- Flooding problem areas – Tracked on a paper map now. Needs to be moved to GIS.
- Sinkholes – need to be tracked.

Public Works Routes

- Snow and Ice Removal Routes – 0% Complete
- Sweeping Routes – 0% Complete

City Owned Property – The City maintains a database of City owned property with data about each property. A GIS layers should be created to house and track this information. As-Builts of each of these buildings should be scanned and linked to the GIS.

- Champaign Owned Facilities – 0% Complete

Each of the above layers needs to be completed and then maintained by Public Works. A GIS based work order management system must be implemented to maintain and analyze all of this data. Current efforts are underway to do much of this data collection in-house but this

will take many years to complete. It is highly recommended that the creation of these data layers is outsourced.

These layers represent a significant investment for the City, and the Public Works Department has identified the need to acquire this data and ensure that these layers are comprehensive and up-to-date. A general recommendation is made for the completion of this geo-spatial data creation within the first three years of implementation. Before any data conversion or collection begins, agreed-upon utility data models (as discussed later in this needs assessment) must be created.

The success of the Public Works data creation is the ability to maintain the data once created. The recommended GIS Technician for Public Works is critical. This person will be instrumental in maintaining current data. It is advised that the recommended GIS Technician maintain the City's infrastructure map data, working in close cooperation with the recommended GIS Coordinator to address any data design or data acquisition issues. Other existing staff will need to be trained to assist in data maintenance.

Additionally, it is recommended that the infrastructure data that is generated reside in the recommended City-wide Enterprise GIS database offering. This platform will allow for a rich environment for the editing and viewing of Geo-spatial data and flexibility for versioning and concurrent multi-user access.

The next step is to perform a data audit to determine which features are missing and in what locations. There are three primary methods for collecting or creating geo-spatial public works data:

1) GPS
2) Heads-up digitizing from paper as-builts
3) Digitizing from aerial photography

Of the three methods, digitizing is the least preferred, as no means of assigning attribute information is possible. GPS is the most efficient method for collecting new data and will allow the Department to quickly realize a return on investment.

GPS Receivers and Data Collection

As the Department moves forward with its GIS implementation, GPS data collection should be conducted for all surface point features for road and facility features. GPS data collection of all features should be spread out over the next three years.

The complete collection and conversion of road and facility data typically requires a large investment in time and money. However, that investment will quickly lose its value if newly created datasets are not maintained. All new features that are installed or constructed, as well as changes to existing infrastructure, must be reflected in the digital database; spatial and attribute information must be captured immediately.

It is recommended that the Department understand the advantages of internal vs. outsourcing GPS data collection. The primary advantage of internal data collection is the cost savings

gained by not paying an outside contractor. Disadvantages include the cost of purchasing and maintaining GPS receivers and the extended period of time involved to complete a full collection. Outside GPS data collection contractors can conduct a City-wide data collection project in a much shorter amount of time. The proper use of GPS equipment can be complex in nature. Therefore, care should be taken before tasking untrained internal personnel with GPS data collection. It is recommended that Champaign outsource the initial data collection and then maintain the data in-house.

An important consideration when collecting infrastructure GIS data layers is determining the accuracy level at which to collect data. The collection and maintenance of high accuracy data can be a complex and costly endeavor. It is recommended that the department work with the recommended GIS Coordinator to determine if survey-grade accuracy is required for the department's geo-spatial data.

If it is determined that high-accuracy data are required, the department will need to allocate the appropriate staff and financial resources for the collection and maintenance of this data. In addition, the Department will need to develop precise and detailed data standards should survey-grade accuracy be deemed necessary.

It should be noted that lesser accuracy levels may be adequate for the department's GIS needs, depending on the type of mapping and analysis that will be performed by department staff.

Below are some considerations that should be noted when determining the need for survey-grade geo-spatial data:

- Consumer GPS units cost $200-300 per unit, whereas survey grade GPS units cost as much as $15,000 - $20,000 per unit
- It is important to determine real-time corrections versus office post-processing options; it is optimal to have both real-time differential corrections and office processing for raw satellite data
- Costs incurred beyond the initial purchase should be considered as well. Equipment costs may be much less than the actual cost of data collection
- Training and data processing time can be extensive for survey-grade data collection
- Landscape conditions may affect data collection; it may not be possible to collect GPS data in some locations
- GPS data collection budgets should reflect how frequently new data sets will be collected

According to price and functionality offered, features can be located within 5 meters ($200-300 GPS receiver), within 1 meter ($6,500+ combined GPS receiver, mobile computer, and mapping software, such as the Trimble GeoXH), to within less than 10 centimeters ($15,000+ survey-grade GPS receiver).

< 5 meters

< 1 meter

< 10 cm

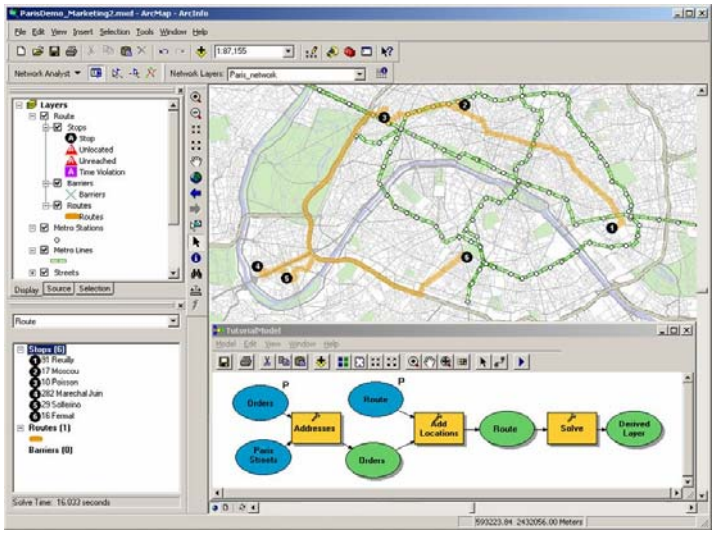
The Public Works Department will need to work closely with the recommended GIS Coordinator to implement the short and long-term GIS goals and objectives outlined in this document. The Department will need access to additional data layers, such as zoning districts, subdivisions, and parcels, to leverage the true potential of the City's GIS. Personnel expressed a need for the creation of additional GIS data layers for use in mapping and spatial analysis in support of departmental objectives.

Department personnel also expressed the need to have access to all other data produced by other departments. The City-wide initiative to migrate to a centralized database for all GIS data will allow this. Additional layers may be required as the Department increases its GIS utilization and incorporates additional data.

The Department also indicated interest in routing analyses (routing of vehicles; such as snow plows) and functions available via GIS. Routing analyses can be performed using ESRI's Network Analyst in conjunction with ArcGIS.

With ArcGIS Network Analyst the Public Works Department can conduct:

- Drive-Time Analysis
- Point-to-Point Routing
- Route Directions
- Service Area Definition
- Shortest Path
- Optimum Route
- Closest Facility
- Origin Destination Matrix



ArcGIS Network Analyst

An additional geospatial data issue that needs to be addressed is the consolidation and synchronization of databases. Public Works Department staff identified the need to ensure that geospatial data layers are consistent with city databases. Database normalization is needed to consolidate disparate, inconsistent data sources. It is expected that these issues will be eliminated by the consolidation, integration and centralization of data into a geodatabase.

The Public Works Department can utilize GIS to assist in several tasks, including:

- Transportation infrastructure mapping and analysis
- Sidewalk mapping
- Wastewater and storm water system mapping and analysis
- Water system mapping and analysis
- Water quality data mapping and analysis
- Inventory mapping and analysis
- Project activity mapping
- Cost-Benefit analyses
- Work order tracking, mapping, and analysis
- Mobile infrastructure tracking, mapping, and analysis
- Routing, scheduling, and districting
- Production of public meeting and exhibition maps
- Statistical analysis for budgetary preparations
- GIS management of the addressing process

It is recommended that Public Works personnel utilize an Intranet GIS data browser to conduct basic spatial analysis and produce maps. This Intranet browser will be based on the enterprise-wide Intranet GIS data browser procured by the City. More information on the Intranet GIS data browser is provided in the Enterprise-Wide Applications section of this chapter.

☑ Field Access to Geospatial Data

Public Works personnel will benefit from field access to maps and GIS data. At present, field personnel in each division rely on hard copy maps provided on an ad-hoc basis by office staff. There are two methods for Public Works personnel to access spatial information in the field:

I. Map Books
II. Mobile Computers

Map books are recommended as a basic means of providing field personnel with access to updated and accurate maps. Once designed and developed, these map books can provide both short and long-term access for a variety of staff (including part-time workers). Mobile computers, specifically hand-held computers, are recommended as more sophisticated means of providing field personnel with access to dynamic mapping and basic spatial analysis capabilities. Mobile computers are recommended for use in the long term, as field personnel become more familiar with GIS and the need for field-based GIS becomes more prevalent within the Department.

I. Map Books

The most cost effective solution for access to spatial information in the field is via map books. Map books can be generated for all Public Works staff. Each page can display a different section of the City or region. The location of pertinent features, such as signs, sanitary sewer, and storm water infrastructure, can be displayed on top of base map information, such as labeled streets, tax parcels, and aerial photography. Map books represent an effective means of referencing the location of all pertinent features. As features are changed or added, new map books can be generated to reflect these changes.

II). Mobile Computers

A more advanced method for accessing spatial data in the field is through the use of mobile computers, including notebook computers, tablet PCs and hand-held computers. A GIS data browser, such as ESRI's ArcPad, can be loaded on hand-held computers, allowing the same capabilities offered by map books, but also the ability to query attributes, such as streets, infrastructure, and facilities; link to GPS receivers, and more. These mobile computers, configured with ArcPad, can also be used by staff to update information while working in the field (see EVMWD Case Study below). A GIS data browser can be loaded on notebook computers, allowing the same capabilities offered by map books, but also the ability to query attributes, such as streets, infrastructure, and facilities; link to GPS receivers, and more. These mobile computers, configured with a field editing tool application, can also be used by staff to update information while working in the field.

At present, the Department does not use mobile computers with mapping software. The benefits of mobile computers are numerous; however acquisition of this type of hardware can quickly become cost-prohibitive. There are two viable options for acquisition of mobile computers by the Department.

1. Basic: Compact Hand-Held
2. Intermediate: Small Laptop with $100 GPS Receiver

Basic: Compact Hand-Held

Compact hand-held computers can be purchased and distributed at a relatively small cost. The typical hand held computer may be purchased as low as $300 dollars. Software packages such as ESRI's ArcPad can be installed and used as a primary mapping application on these devices. Although this is may be the lowest cost solution there are some common limitations such as screen size that can be encountered with hand-held computers.

Intermediate: Small Laptop with 100$ GPS Receiver

Recent advancements in GPS technology have produced relatively low cost location solutions that can plug-and-play with a standard laptop. City GIS data layers can be stored on a laptop computer and used in conjunction with an off-the-self GPS receiver to show a location.

GPS receivers similar to the one in the adjacent graphic are available at relatively low cost. These types of receivers can be used in conjunction with a variety of laptop or hand-held computers.

It is recommended that hand-held computers be purchased for field staff use. A GIS data browser, such as ArcPad, should be loaded onto each hand-held computer.

Public Works currently has map books of the sanitary and storm sewers. As data is collected and updated these books should be updated. A free map book extension is available from ESRI to assist with map book creation if needed. Preliminary GIS access via mobile (hand-held) computers is recommended for year four. Comprehensive GIS access (all users) via mobile (hand-held) computers is recommended for year five.

<u>Case Study: Elsinore Valley Municipal Water District Uses ArcPad to Update Data</u>

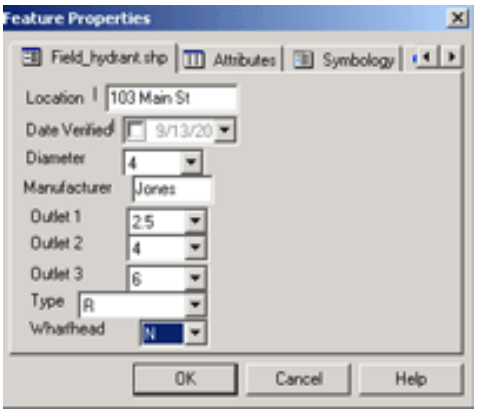
The Elsinore Valley Municipal Water District (EVMWD) in Southern California will update data on approximately 4,000 fire hydrants using ArcPad, a handheld computer, and a GPS unit. By using custom forms created for ArcPad, data collectors will not only verify the

location of the district's hydrants but will also gather information on the make, condition, and capacity of each hydrant.

EVMWD has provided water service for the past 48 years. Located in the southwestern portion of Riverside County, the district covers a 96-square-mile area from the Temescal Valley to Murrieta and serves the cities of Lake Elsinore, Canyon Lake, and Murrieta and the unincorporated communities of Wildomar, The Farm, Cleveland Ridge, and Lakeland Village. EVMWD has approximately 28,000 water, wastewater, and agricultural services.

EVMWD is updating data on approximately 4,000 fire hydrants using ArcPad.

EVMWD's 125 employees maintain a water distribution system that consists of 420 miles of transmission and distribution pipelines. This system includes roughly 4,000 fire hydrants. EVMWD uses an ArcInfo-based enterprise GIS to manage this system. In 1999, the district's GIS staff began inputting fire hydrant flow tests into the GIS database and linking the results to features. During this process, staff discovered that many hydrants were not in the GIS database. These hydrants exist in an older part of the distribution system that has poorly kept records.



A custom form was created for collecting hydrant data

In addition to the need to simply locate all the hydrants to link the test results, the local fire authorities wanted detailed information about fire hydrants such as the type of hydrant, number of outlets, size of each outlet, and other information. Requests for hydrant information originating from two sources-within EVMWD and from local fire agencies-made the GIS staff decide that it was time for a fire hydrant inventory.

The solution proposed by the staff used a Sokkia GIR 1000 GPS unit, a Compaq IPAQ PocketPC, and ArcPad from ESRI. The existing fire hydrant database, street rights-of-way, street centerlines, and miscellaneous layers are be loaded on the IPAQ and set up in ArcPad.

A custom form was created for the hydrants for data collection and update. For each hydrant, the data collector refers to the hydrant database, verifies the hydrant in the field, and inputs data into the form. A hydrant that does not show up in the database is located using GPS. At the end of the day, data is downloaded from the IPAQ and the GPS receiver. Points taken with the GPS are loaded in the ArcInfo database, and attribute information is loaded into a Microsoft SQL Server database.

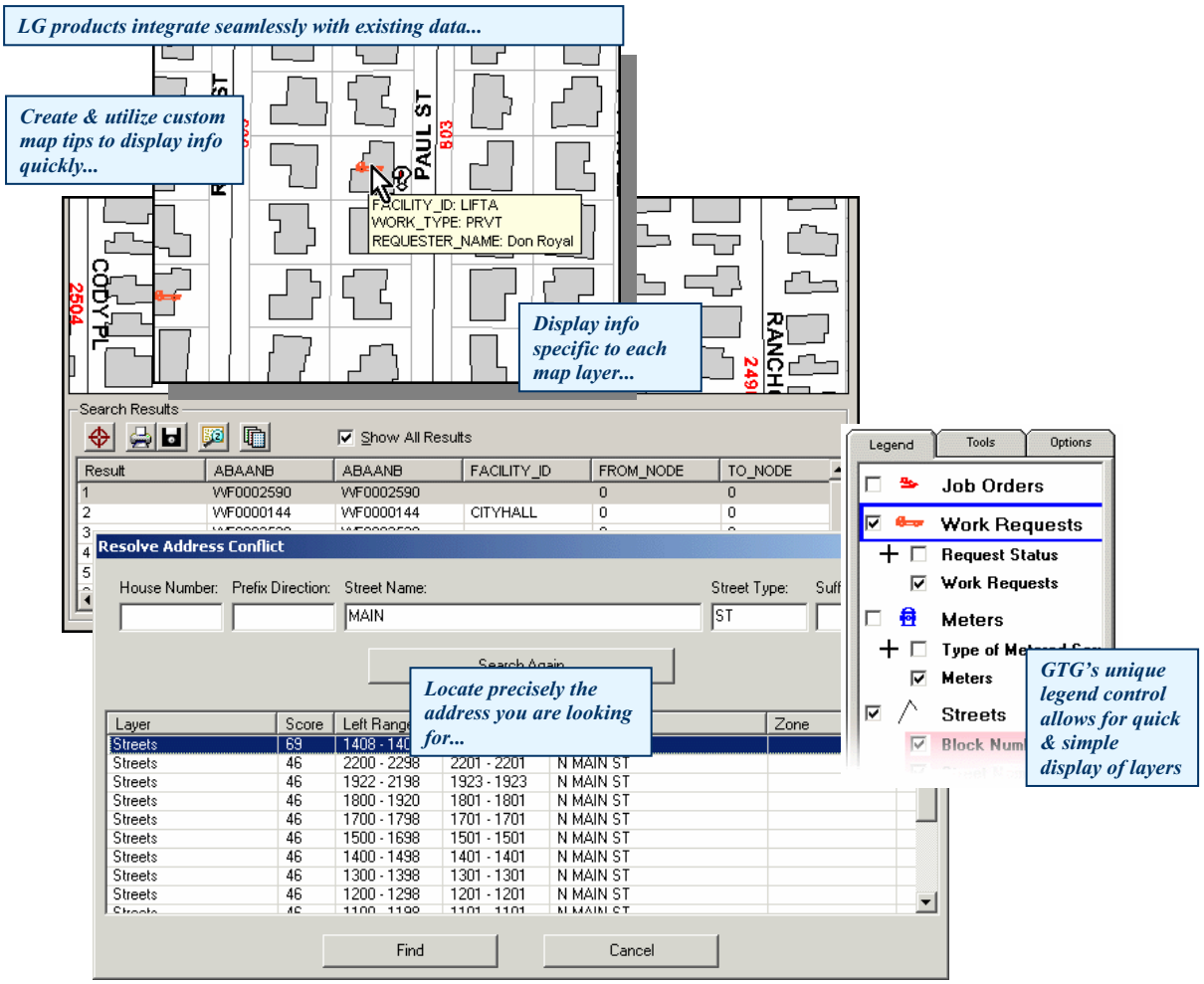
A pilot area study is being used to refine this method. Based on the pilot area, EVMWD will calculate the time needed to complete the fire hydrant inventory for the entire district. Staff time will be allocated, and the data collection effort will go into full swing. The data that is collected will be linked to fire flow test data and will be accessible from the various GIS interfaces within the district. Having this information readily available will save the district time and money and ultimately benefit the ratepayers.

☑ GIS-Based Work Order Management

A critical component of successful Public Works GIS implementations is accurate and complete data. Maintenance crews and other field personnel will go out into the field and make changes or additions to the infrastructure and not report these changes back to GIS staff. Very quickly GIS layers are missing pertinent data or contain erroneous data. Users will not know what data is accurate and what is not. Therefore, data sets can become suspect and staff may begin to doubt its usefulness and reliability.

The solution to this problem is a GIS-based work order management system. A properly implemented work order management system would allow staff to quickly input specific information about a task and then print out a paper work order with an accompanying map. This map would show the infrastructure for the area of concern. Field crews would then mark any changes or additions to the system on the work order. Once the job was complete field crew would turn return the work order with changes back to support staff for input into the work order management system and for update of appropriate data layers. An added benefit of such a system is continual fine-tuning and improvement of mapped (GIS) data. If any errors exist on the GIS maps, then field crew will mark and correct the error. In turn, this information will be corrected in the GIS. Therefore, instead of GIS data degrading because of information not flowing back from the field, GIS data will continually improve because of corrections made in the field. Subsequently, GIS data will reflect a very accurate depiction of what is in the field. In addition, there are residual benefits of such a system. Implementing a work order system will insure that this data is accurate and will facilitate rapid determination of assets in the field.

There are several applications available to meet this need (see GIS Applications below). It is recommended that the Public Works Department implement an application that will easily integrate with existing information technology, including the City's various enterprise databases.

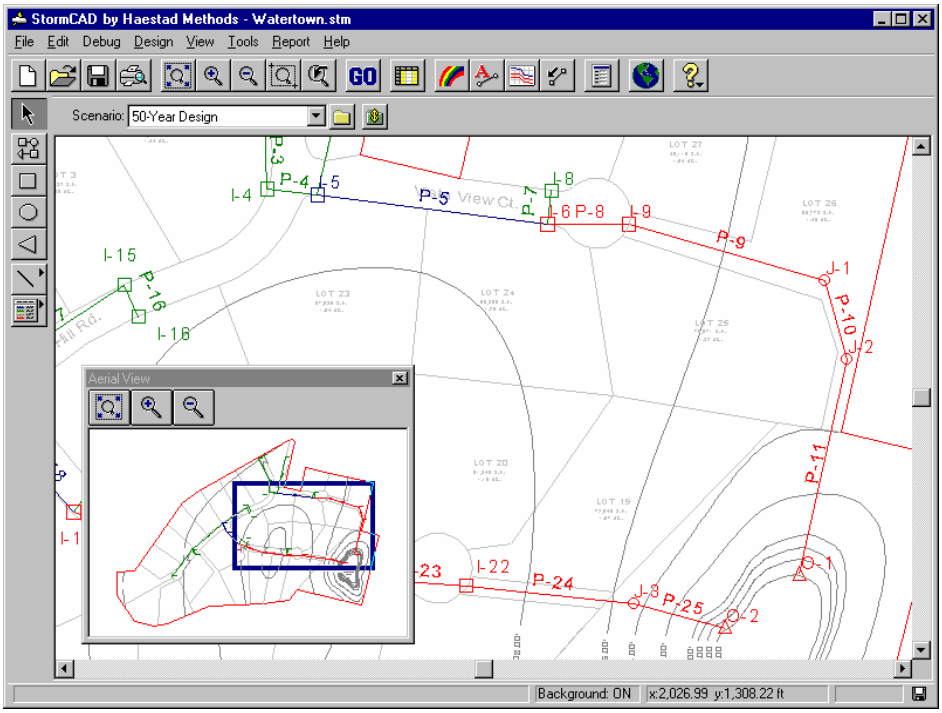


Work Orders and GIS Integration

Wastewater and Storm Water Modeling and Monitoring

The Public Works Department can also use GIS to conduct wastewater and storm water modeling. Accurate modeling requires accurate utility data. ArcGIS will let Public Works staff perform basic modeling tasks. For example, assuming the sanitary sewer network was setup correctly, users could select a lift station, choose to perform a "trace upstream" task, and all structures that flow to that specific lift station would be selected.

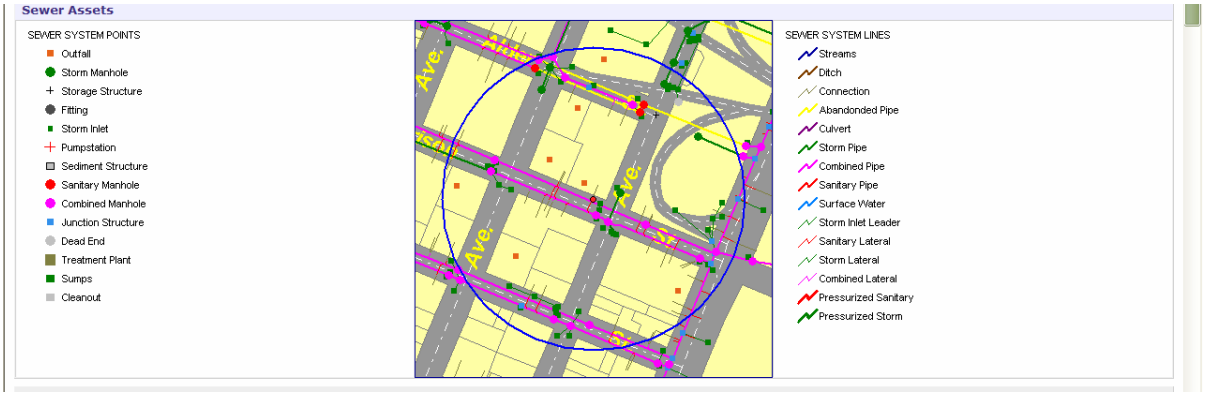
The Public Works Department has acquired Haestad Method's FlowMaster application for wastewater modeling and Haested Method's StormCAD, FlowMaster, CulvertMaster, and PondPack for storm Water modeling—these applications offer modeling that provides full, completely seamless integration with ArcGIS applications. As the data layers are finalized, the investment in these various modeling packages will be realized.



Example of Haested Method's StormCAD

Public Access to Geospatial Public Works Data

The Public Works Department expressed the need to disseminate spatial information to the public by providing a mapping application that will enable citizens to view infrastructure and utility information. The mapping application should incorporate the ability for the public to view ongoing maintenance and construction projects and associated areas, as well as storm water and sewer system features.



Example of sewer system features available via an online GIS application

As part of the City's objective to provide an Internet GIS data browser, the Department should coordinate with the GIS Coordinator to integrate departmental GIS data into the Internet-based application. In addition the Department should identify additional functionality that may be required in addition to the City's base enterprise offering.

☑ GIS-Based Public Notification for Emergencies and Maintenance

Public Works staff identified the need for a GIS-based public notification solution. It is recommended that the Department leverage the notification system that the City is considering implementing as a tool for notifying the public about maintenance, outages, and emergencies. See the GIS Applications section below for more information on notification applications.

☑ CAD Standards for Plan Submissions

Based on the Public Work's utilization of outside consultants for construction and rehabilitation projects, as well as the Department's receipt and review of construction plans from private parties, such as developers, it is recommended that the Department gradually establish a set of standards for all CAD data submitted to the Department (and the City).

An initial recommendation is for the Department to require that all construction plans be provided in digital format as CAD drawings. In doing so, the Department will be able to establish a consistent means for review. In addition, the Department will be able to archive this digital data and link it to specific points for visualization in GIS applications.

In the short term, it is recommended that the Engineering Division establish a preliminary set of CAD standards to which all submitted CAD drawings must conform. It is recommended that in the long term the Department work to implement the Federal Geo-Spatial Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering, Construction, and Facilities Management (FGDC-STD-007.4-2002); this standard is generally known as Part 4 of the FGDC's Geospatial Positioning Accuracy Standards .

Part 4 provides accuracy standards for engineering drawings, maps, and surveys used to support planning, design, construction, operation, maintenance, and management of facilities, installations, structures, transportation systems, and related projects. It is intended to support geospatial mapping data used in various engineering documents, such as architectural, engineering, and construction (A/E/C) drawings, site plans, regional master planning maps, and related GIS), Computer-Aided Drafting and Design (CADD), and Automated Mapping/Facility Management (AM/FM) products. These products are typically created from terrestrial, satellite, acoustic, or aerial mapping techniques that output planimetric, topographic, hydrographic, or feature attribute data.

The Part 4 standard defines accuracy criteria, accuracy testing methodology, and accuracy reporting criteria for object features depicted on A/E/C spatial data products and related control surveys. It references established voluntary standards that may be used for some smaller-scale A/E/C mapping applications. In addition, the standard contains general guidance for specifying accuracy criteria for selected types of A/E/C features or control surveys. Using the standards and guidance contained in this section, end users of A/E/C products (e.g., Utilities Services Department) can specify surveying and mapping accuracy requirements needed for their projects or specific CADD/GIS layers, levels, or entities. From these specifications, data producers (e.g., surveyors, engineering firms, consultants) can

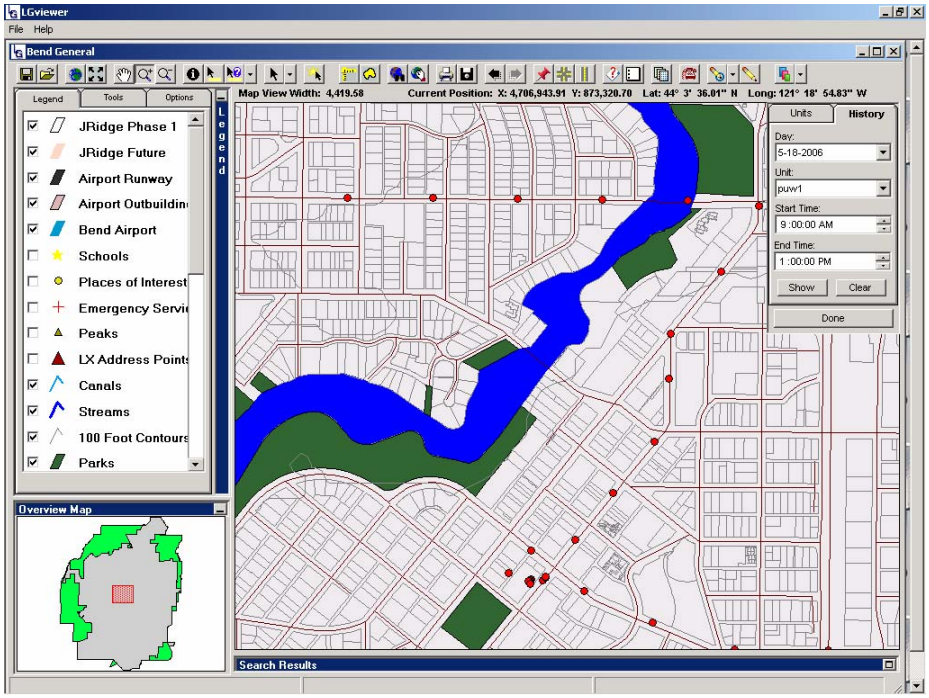
determine the instrumentation, procedures, and quality control processes required to obtain and verify the defined accuracies.

By implementing this common standard, the Department will be able to maintain consistent documentation of construction designs/plans provided by external entities. This will facilitate the review and assessment process, and ensure that staff can interpret data consistently.

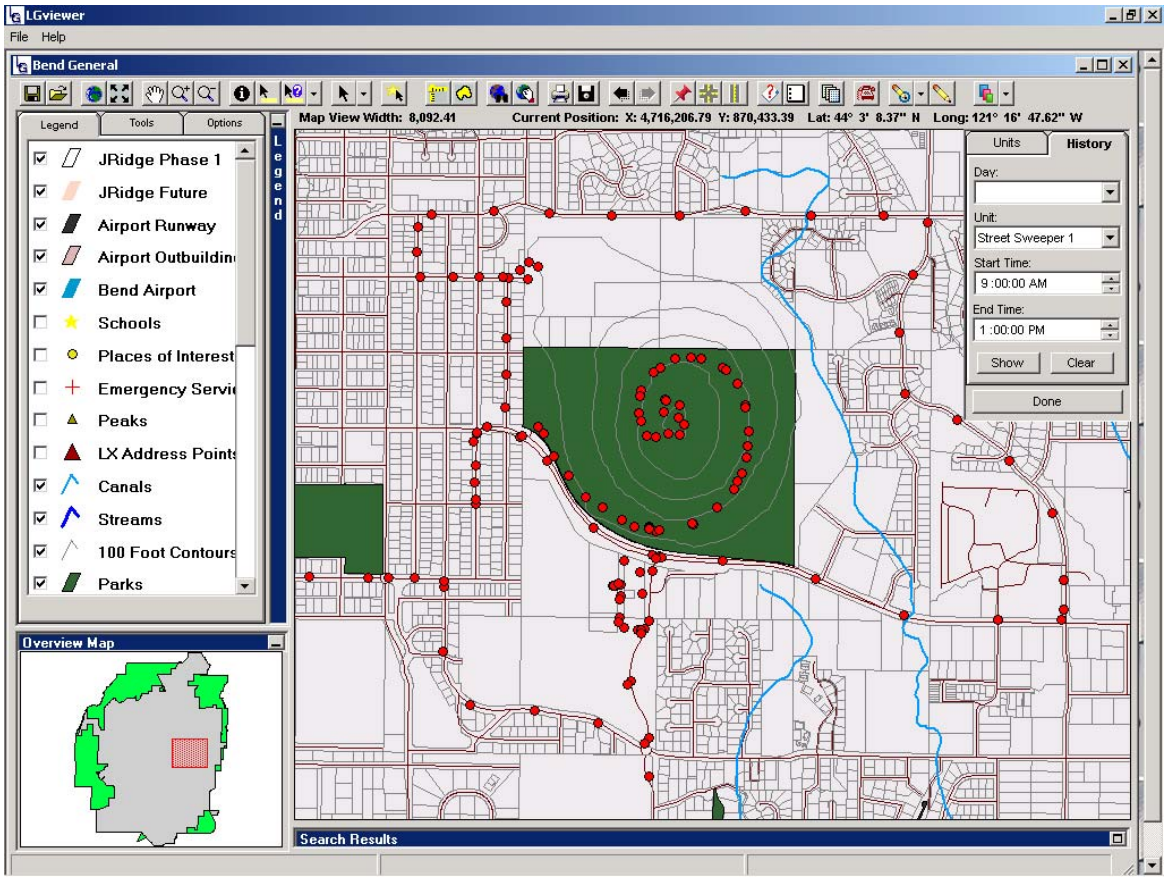
By implementing a common standard, the Department will be able to maintain consistent documentation of construction designs/plans provided by external entities. This will facilitate the review and assessment process, and ensure that staff can interpret data consistently. Most developers are already utilizing CAD technology and will be able to adhere to a well written policy with little extra burden and cost.

Automatic Vehicle Location (AVL)

Currently, Public Works maintains vehicles that are used for various purposes. Staff members have expressed an interest in implementing AVL technology for its vehicles. This will allow for tracking the location of all the vehicles of the fleet in order to improve response time and monitor the location of vehicles in case of an emergency. Additionally, this would provide information on route/task accomplishment which would allow staff to respond to queries about service provided in specific locations. AVL would helped identifying underserved locations (for street sweeping, snow removal, etc.).



Using GIS to Track Utility Vehicles

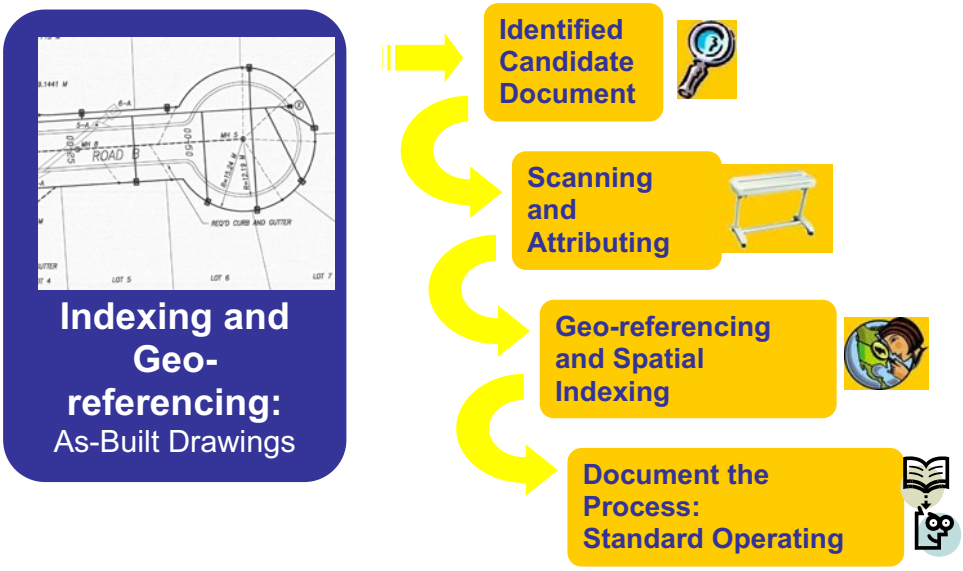


View Historic AVL Information for Any Vehicle

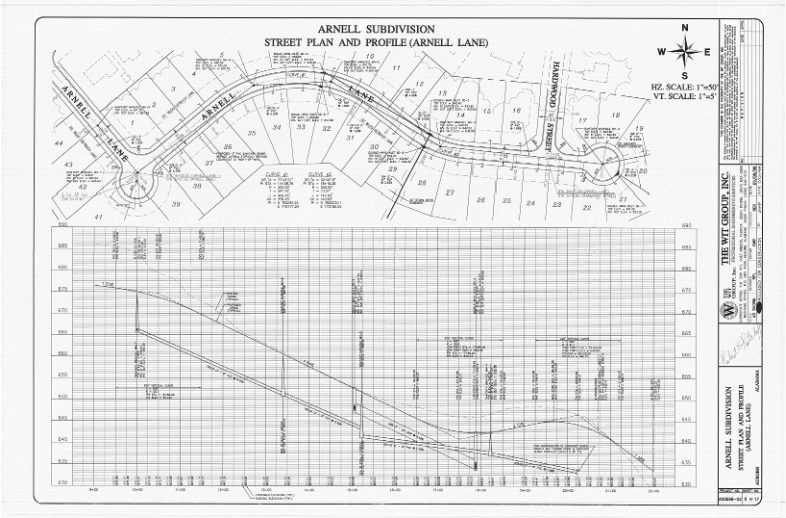
<u>Access to spatially enabled as-builts and CAD drawings - links to document management system via GIS</u>

Public Works, Planning, Neighborhood Services and the City as a whole handles volumes of paper and digital data that is important for daily decision making. This data can be found in filing cabinets, digitally on computer, or as submitted plans. Using GIS as a portal for all of this information would be a huge advantage for Public Works staff. The city does not have an imaging system. Champaign should consider acquiring an imaging system to house documents that are currently stored as paper and other digital documents such as photos and scans. Recently, the Town of Blacksburg, Virginia needed the same kind of central storage and conducted a detailed study on how to optimally implement their imaging system and how to interface the data with the GIS. The city will need to take similar steps to implement a solution effectively.

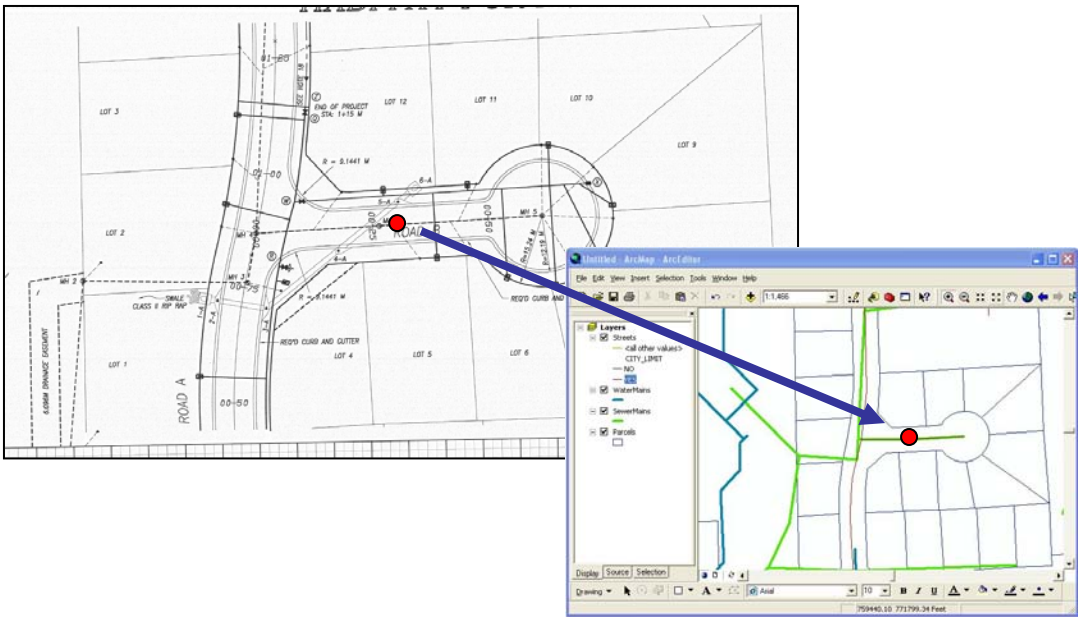
Public Works would benefit by having access to digital copies of as-builts. Scanning documents and maintaining them in a document management system is the first step. However, each of these documents will need to be spatially referenced for access via the GIS. The following steps need to take place when tying images to the GIS.



Linking Documents to a GIS



Documents will be scanned and geo-referenced



Each document will have a geographic link

The following example details how Richardson, TX integrated imaging and GIS.

Integrated GIS/Document Management System - City of Richardson, TX

Implementation Services Based on ESRI Technology

Redlands, California--The city of Richardson, Texas, is deploying an integrated ArcGIS/document management system as its enterprise geographic information system (GIS) environment, automating and streamlining how it manages, disseminates, and uses information. GIS Technology, Inc. (GTI) is providing software and implementation services based on ESRI technology. GTI was initially contracted to install a FileNET-based integrated document management system and link it to the city's GIS in September of 2001. The city has now entered the implementation phase of the system.

"The city has recognized the advantages of integrating GIS with document management," says Jeff Hecht, chief executive officer, GTI. "It will be able to spatially enable documents that, up until now, have resided in a manual storage system with limited access and consuming valuable floor space. The city is going to have a unique capability here that few cities can match."

"Our city hall is limited in space, and we were faced with the prospect of losing even more space to document storage," says Sylvia Kendra, GIS project manager, city of Richardson. "We needed to solve the space problem, but more importantly we wanted to change the way we do business. The ArcGIS/integrated document management (IDM) integration enabled us to accomplish both goals."

"The city of Richardson showed tremendous leadership and vision in outlining the solution it wanted," says Amy Thorson, corporate alliance representative, ESRI. "GTI is a leader in providing integrated ESRI and FileNET solutions. ESRI's relationships with best-of-breed

solution providers like GTI help us focus on providing the best technology possible while leveraging the industry expertise of other organizations."

GTI supplied the city with FileNET's Panagon software solution as the preferred document management system as well as provided IDM for ArcGIS and IDM for ArcIMS middleware solutions. IDM for ArcGIS includes powerful tools for creating and manipulating connections between the two information sources. IDM for ArcIMS extends integrated access to GIS and document information to remote locations via the Web. In addition, the city of Richardson has retained GTI to design the document repository, recommend adjustments to the existing GIS database, train staff, and design and implement the integration of the GIS/document management system.

The integrated ArcGIS-FileNET solution will replace paper and manual document management and indexing methods including hanging file folders and microfiche machines. Faster, more efficient data management will significantly reduce the number of hours spent retrieving information, whether for planning and zoning, economic development, property assessment, or a myriad of other government application areas. The new solution also provides remote data access, meaning users from various offices can digitally retrieve information rather than having to physically visit one site for submitting information requests.

The city of Richardson has completed the pilot stage of the project and is currently loading documents. Planning documents, as-built drawings, plats, building inspection records, and ordinances are being incorporated into the document repository and linked to the city's existing GIS. With completion of the database design, the city of Richardson will be undertaking a pilot test of the system that will involve three of the city's departments. Use of the integrated GIS/document management system will then be extended throughout the city. The city will be integrating both thick and thin clients in this Internet-enabled solution. A large number of users will access the system via the Internet and a thin client, while a smaller number of users will be utilizing thick clients on a limited number of desktops.

Case Study Provided By: ESRI
Press Information: Jesse Theodore, ESRI
Tel.: 909-793-2853, extension 1-1419
E-mail (press only): press@esri.com
General Information: info@esri.com

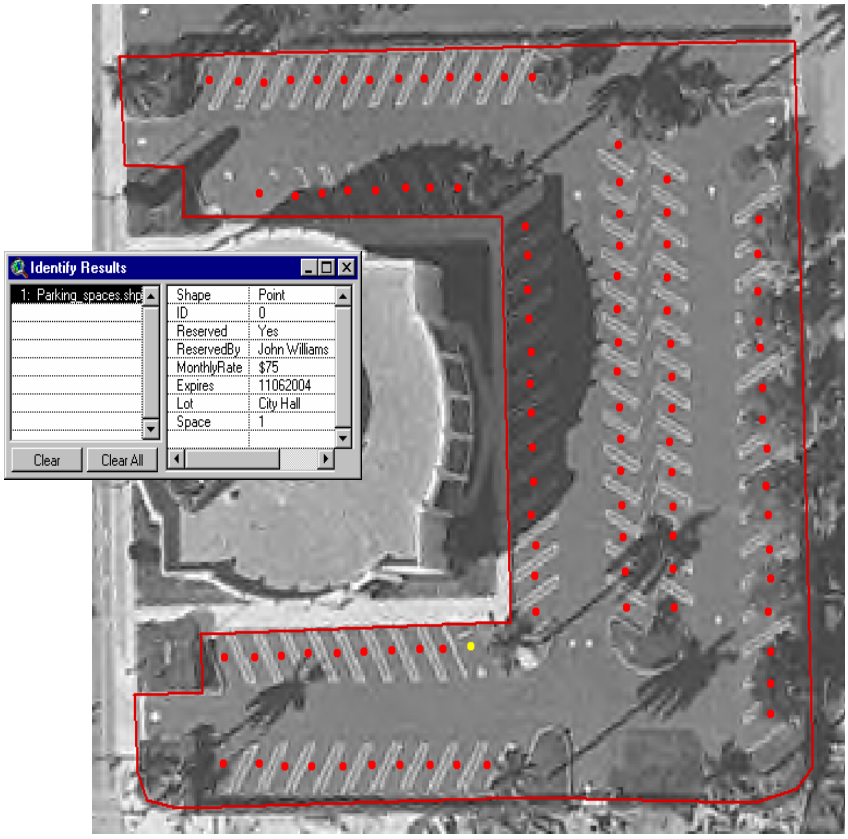
☑ Pavement Management

Currently one-third of the City of Champaign's roads are given a condition rating annually. A block-by-block analysis is completed and a rating is given to each segment. This pavement condition rating should be tied to the GIS and a pavement management application should be implemented to ascertain paving priorities, track paving history, and calculate the cost of repaving by segment. Various off-the-shelf applications exist for pavement management. These are discussed below in the work-order/Public Works software section.

Parking Management via GIS

Administrative Services is responsible for parking enforcement functions. Staff have indicated they would like to map each City-owned parking lot, parking spaces (including turnover, occupancy, who is leasing each space, and when that lease expires), and parking meters. Much of this mapping has already been completed. Data about rental, fines, etc. is housed in the T2 Systems software. Data from T2 will need to be linked to the GIS layer by a unique identification number.

One of the primary recommendations for GIS implementation in the City of Champaign is the deployment of a City-wide Intranet GIS Data Browser (please refer to the Enterprise-Wide Applications section of this Needs Assessment for a complete description). An Intranet GIS Data Browser is an easy-to-use web-based GIS application available only to City of Champaign government employees. It can be configured to include selected City spatial data layers to allow employees to display, query, and analyze information about the City. Once each parking lot, parking space, and parking meter spatial data layer is created and fully attributed, they can be loaded into the Intranet GIS Data Browser for use by Administrative Services personnel. A nightly download of data from T2 will be automated and linked to the GIS parking data.



Example of displayed parking lots and parking spaces in a GIS application

GIS Management of the Addressing Process

It is being recommended that an address point layer be created for Champaign. This layer in conjunction with an accurate street centerline layer is critical for GIS success at the City. It is understood that the Consortium currently maintains a street centerline layer and intends on maintaining an address point layer in the near future. However, due to the critical nature of these layers it would be prudent for the City to maintain these layers on their own.

It is recommended that the GIS Coordinator will need to work with the Public Works Department to implement appropriate processes and procedures that will ensure that addresses are added and/or updated in a consistent, standardized manner. Such efforts typically require several iterations of design and implementation in order to develop adequate processes and procedures. Validation rules and routines can greatly improve address entry into systems, by preventing users from entering incomplete or invalid addresses.

An address point layer will need to be created and then be utilized as the primary source of address data for the city. The applications section further in this section will detail the use of GIS based addressing application to maintain an address point layer and street centerline layer.

Existing GIS Data Layer Inventory and Future Recommendations

The Public Works Department is the largest GIS data generator at the City. The GIS Technician in conjunction with other Public Works staff will maintain the vast storehouse of digital data. Use of an Intranet GIS application, as well as mobile computers, will provide Public Works personnel with dynamic mapping and analysis capabilities—it is expected that this will prove to be mutually beneficial, as it will allow the Public Works Department to produce many of its own maps.

In addition, to department-specific layers, the Public Works Department will benefit from access to several other departmental GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other City departments.

Department personnel expressed that access to the following GIS data layers would be beneficial:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Address Points	Extract, cleanse, geocode, and map from TRAKit and other sources; georeference based on aerial photography and GPS field work	Public Works and GIS Coordinator	Recommended
Aerial Photography	GIS Consortium	GIS Consortium	Existing
Building Permits	Automated extraction from TRAKiT	Automated	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
City Limits	Official City Limit Map	Planning	Existing
City Owned Property	Digitize on screen	Public Works	Recommended
Comprehensive Plan, Land Development Code, Development Agreements	Scan into database and link to parcel information	Planning	Recommended
Council Districts	Create in an initial data conversion	GIS Coordinator	Recommended
Easements	Digitize from base map data	Public Works / GIS Coordinator	Some exist from the County
Flood Zones	Acquire from FEMA	GIS Consortium	Recommended
Hazardous Materials	From Fire Department Files	Fire Department	Recommended
Historical Properties	Field collection and documentation	Planning	Recommended
Hydrology	USGS	GIS Consortium	Existing
Impervious Surfaces	Digitize polygons from aerial photographs; derive polygons by raster analysis of remotely-sensed data	Public Works; GIS Coordinator	Recommended
Land Use	Digitize polygons from aerial photographs and existing maps; existing CAD data	Planning	Recommended
Mosquito Breeding Areas	Digitized heads-up on screen	Consortium and Public Works	Recommended
Mowing Zones	Digitized heads-up on screen	Public Works	Partial
Municipal Boundaries	GIS Consortium	GIS Consortium	Existing
Neighborhoods and Subdivisions	Needs to be created from paper maps and local knowledge	Neighborhood Services	Recommended
Newly Developed Areas	Digitized heads-up on screen	Public Works	Recommended
Northwest Interceptor Fee Boundary	Digitized heads-up on screen	Public Works	Completed
Parcels	GIS Consortium	GIS Consortium	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Parking Features **Handicap** **Loading Zones** **Metered** **Lots** **Space markings** **Permit parking** **Towing zones**	GPS and heads-up digitizing	Public Works	Existing
Public Works Routes (Snow Removal and Sweeping)	Digitized heads-up on screen and optimized using GIS software	Public Works	Recommended
Rights-of-way	Site plans and other documents	Public Works	Partial Existing
Schools	Digitize from base map data	GIS Coordinator	Recommended
Sewer Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Sidewalks	GPS and head-up digitizing on screen	Public Works	Partial
Signs	GPS field work	Public Works	Recommended
Speed Zones	GPS field work; derive from aerial photography	Public Works	Recommended
Storm Water Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Streetlights	GPS data capture	Public Works	Existing
Streets	GIS Consortium	Public Works	Recommended
Striping & Pavement Markings	GPS field work; derive from aerial photography	Public Works	Recommended
Topography	Derived from LIDAR	GIS Consortium	Existing
Traffic Accidents	Extract, cleanse, geocode, and map from police database	GIS Coordinator; Crime Analyst	Recommended
Traffic Counts	Extract, cleanse, geocode and map from Access database	GIS Coordinator	Recommended
Traffic Service Requests	Scan into database and link	Public Works	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Traffic Signals	GPS field work	Public Works	Recommended
Transportation **Alleys** **Pavement Management** **Bridges** **Markings** **Streets**	GPS and heads-up digitizing	Public Works	Partial
Tree Inventory	GPS	Public Works	Recommended
Underground Storage Tanks	GPS and heads-up digitizing	Public Works	Existing
Vacant Properties	Query from parcel layer; other sources as needed	GIS Coordinator (eventually automated)	Recommended
Water Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Recommended
Water Sampling Station Data	GPS and field collection	Public Works	Existing
Waterways	USGS	GIS Consortium	Existing
Zoning	Digitized on screen	Planning	Recommended

Additional layers will be required as the Department increases its GIS utilization and incorporates additional field data.

Recommended GIS Applications

Intranet GIS Data Browser

An Intranet GIS data browser has been recommended for use by Public Works Department personnel. A full description of recommended GIS data browser solutions is provided in the Enterprise-wide Applications section at the end of this chapter.

Internet GIS Data Browser

An ArcGIS Server-based Internet GIS data browser has been recommended to provide citizen's with access to the City's geospatial data. A description of recommended GIS data browser solutions is provided in Enterprise-wide Applications at the end of this chapter.

ArcPad 6.0

ArcPad software is an easy-to-use, lightweight, low-cost solution for mobile mapping and geographic information systems. ArcPad enhances portable touch screen computers with intuitive mapping, GIS, and GPS functionality. ArcPad makes field data collection fast and easy, improves data accuracy, and provides immediate data availability and validation. It is recommended that ArcPad technology be utilized in the Public Works Department. ArcPad will enhance and streamline infrastructure maintenance and repair as well as field surveys.

With ArcPad, Public Works personnel can:

- Use existing data - ArcPad supports industry-standard vector and raster image display.
- Add data from the Internet - Data can be provided from the Internet via wireless technology.
- Move around the map - ArcPad includes a number of map navigation tools including zoom and pan, spatial bookmarks, and center on the current GPS position.
- Query data - Identify features, display hyperlinks, and locate features.
- Measure distance, area, and bearings on the map.
- Navigate with GPS - Connect a GPS and with ArcPad.
- Edit data - Create and edit spatial data using input from the mouse pointer, pen, or GPS.
- Extract, convert, and project existing data using ArcGIS Desktop

GIS Based Notification

GIS has proven to be a valuable technology for community alerting and public outreach, via a GIS based notification tool. Champaign is analyzing the implementation of tools for notification. Notification is inherently a GIS application as spatial selection and analysis are fundamental for effective utilization. It is recommended that the Public Works Department leverage the GIS-based notification solution that the City decides to implement.

The uses of GIS-based notification applications include:

- Emergency Evacuations
- Water Boils
- Utility Outages
- Public Service Announcements
- Maintenance Notification & Alerts
- Utilities Service Alerts
- Water Contamination Alerts

Several effective GIS-based notification applications are currently available on the market. It is recommended that the City procure and implement a solution that integrates GIS technology with the telecommunications capability of the Internet. Listed below are several notification applications that include mapping and spatial analysis functionality.

CodeRED™ Emergency Telephone Calling System

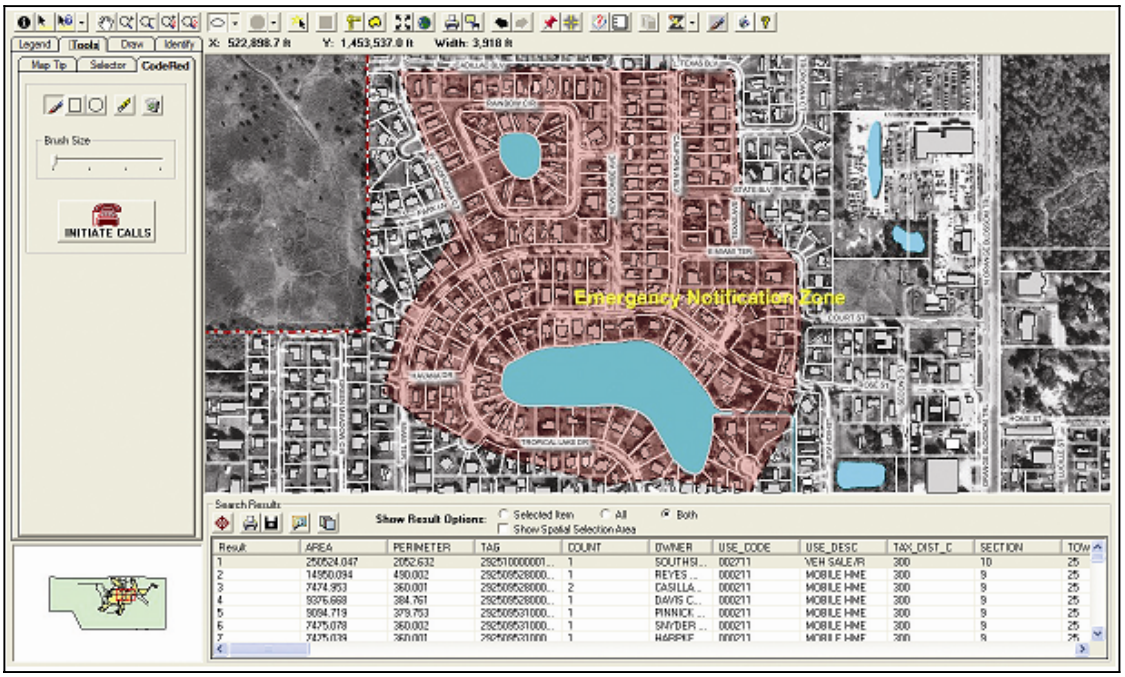
The CodeRED™ Emergency Telephone Calling System is a high-speed telephone communication service available for emergency notifications. CodeRED™ utilizes Internet mapping capability for geographic targeting of calls, coupled with a high speed telephone calling system capable of delivering customized, pre-recorded emergency messages at the rate of up to 60,000 calls per hour. CodeRED™ subscribers control their emergency broadcasts from anywhere in the world via a secure Internet Portal.

More information can be found at http://www.coderedweb.com

TeleWorks - FirstResponder

FirstResponder is a communication tool capable of sending coordinated audio and visual information to telephones, cellular phones, email, email pagers, TDD/TTY, fax machines, web sites and personal digital assistants (PDA). FirstResponder allows for accurate data tracking through their SelectAlert tools.

SelectAlert is a personal alert and subscription manager for an agency and citizens. Subscribers decide what they want, when they want it and how they want it delivered. SelectAlert organizes these preferences automatically so all you administrate is content releases.



Using GIS for Citizen Notification

Work Order – Public Works Enterprise Software

A critical component for the success of any Public Works GIS implementation is accurate and complete data. Maintenance crews and other field personnel routinely make changes or additions to infrastructure. When these changes are completed it is critical that they are tracked and that all effected layers are updated in the GIS. Very quickly GIS layers can contain missing pertinent data or contain erroneous data. Users will not know what data is accurate and what is not. Therefore, data sets can become suspect and staff may begin to doubt its usefulness and reliability.

As the public works systems are migrated to a GIS managed system a GIS-based work order management system should be implemented. A properly implemented work order management system would allow staff to quickly input specific information about a task and then print out a paper work order with an accompanying map. This map would show the infrastructure for the area of concern. Field crews would then mark any changes or additions to the system on the work order. Once the job was complete field crew would return the work order with changes back to support staff for input into the work order management system and for update of appropriate data layers. An added benefit of such a system is continual fine-tuning and an improvement of mapped (GIS) data. If any errors exist on the GIS maps, then field crew will mark and correct the error. In turn, this information will be corrected in the GIS. Therefore, instead of GIS data degrading because of information not flowing back from the field, GIS data will continually improve because of corrections made in the field. Subsequently, GIS data will reflect a very accurate depiction of what is in the field. In addition, there are residual benefits of such a system. Implementing a work order system will insure that this data is accurate and will facilitate rapid determination of assets in

the field. Integrating a GIS-based work order management system will increase efficiency and provide a mechanism to move the data from the office to the field and vice-versa.

It is imperative that the personnel in charge of updating the GIS be advised of all infrastructure changes and additions through access to the work order system. There are several solution providers that support applications that meet this need. Each solution has various degrees of interaction between work orders, assets and GIS systems. It is important to note that most effective GIS centric work order software is one that stores data in an open database (ODBC compliant). This will allow use of various Tier 3 GIS applications that can access data directly from the work order system. The solution should allow users to quickly print out a map and a work order form for field crews to take into the field. It is critical that this application have the ability to track open work orders. Work orders that are not returned from the field will cause degradation in the GIS data. This must be avoided.

Champaign Public Works should choose from one of the following software packages to meet the enterprise needs of the department.

The following four solutions are specifically tailored to support a GIS-centric work order and asset management system:

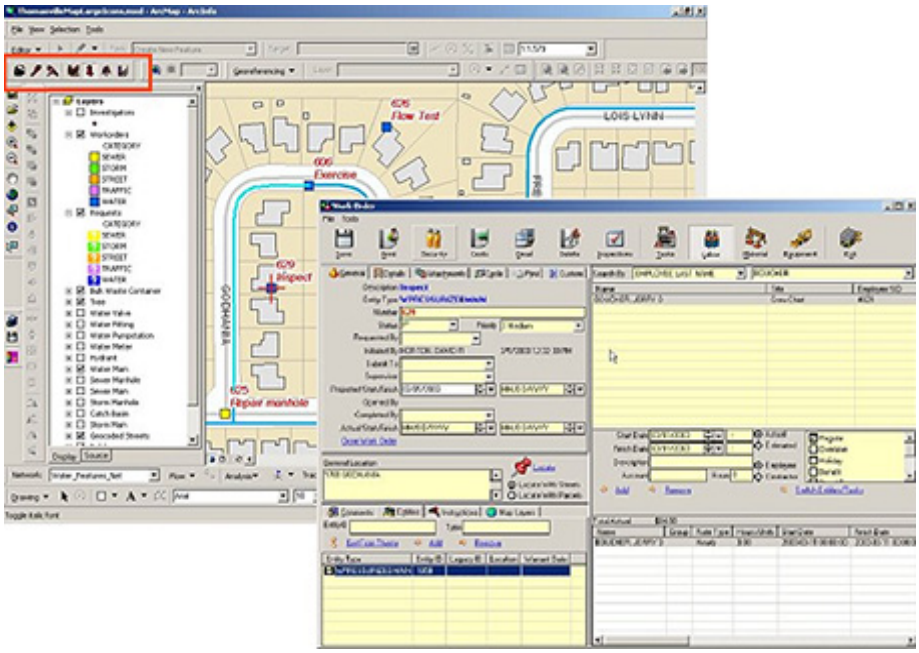
1. Azteca Systems Inc.
2. GBA Master Series
3. Hansen
4. CartêGraph

Azteca Systems Inc. City-works

Cityworks® is a GIS-centric Asset and Computerized Maintenance Management System (or CMMS) created specifically for Public Works and Utilities. Utilizing the data contained in the GeoDatabase, Cityworks works to manage the dispersed infrastructure with tools for creating and tracking maintenance activities associated to assets and/or addresses. These include handling requests for service, conflict resolution, work orders, tests and inspections, ad-hoc search and reporting and much more.

With integration of ESRI's technology, Cityworks is compatible with ArcGIS®. CityworksFM, whose underlying infrastructure data models are based on industry standards. Off-the-shelf GeoDatabase models are available for Water, Wastewater, Storm water, Streets, Traffic, Signs, Trees, Parks and Recreation facilities and many others.

Cityworks is built on open standards and with industry standard technology allowing for access to data in an open architecture that is easy to integrate with your existing business systems. With support for industry leading relational databases like Microsoft SQL Server and Oracle, Cityworks is fully compatible with Microsoft Office.



Cityworks allows for workorder module access within the GIS environment and as a standalone application.

Cityworks can be deployed as a desktop or browser application solution. Cityworks Desktop can be configured in standalone mode, address-based mode or full asset-based mode and may be deployed using the Cityworks ArcGIS interface. Cityworks browser add-ons are designed for field operations and include Cityworks Wireless® and Cityworks Inbox.

GBA Master Series

The GBA Master Series Infrastructure and Asset Management Software is based on integration of the following three solutions; maintenance management, asset management and GIS integration. Similar to other GIS centric asset management solutions the GIS interface is a critical component for the dissemination of data from the various systems.

GIS is an integrated piece of the GBA Master Series software. The GIS platform allows for the dissemination of various components of each system.

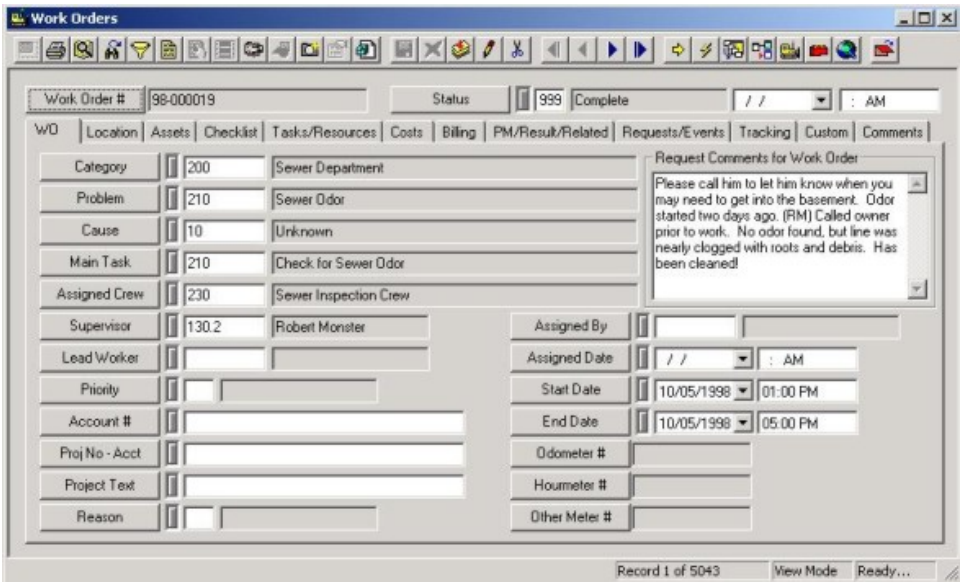
GBA Master Series software combines maintenance management, asset inventory and inspection, and GIS compatibility to provide the user a comprehensive infrastructure management program. GBA Master Series software can easily integrate with ArcGIS. By combining Department asset data with the intuitive nature of a GIS map, employees can quickly locate assets, accurately analyze information and ultimately make better decisions.

GBA Master Series offers the following functionality:

- Work Orders
- Customer Service Requests
- Preventive Maintenance
- Task Planning and Budget Tracking
- Parts Warehousing and Inventory Management
- Mobile/field applications
- Communications
- Traffic Accident Management
- Traffic Volume Management

GBA Work Orders

GBA Work Master offers three versions of work orders: Standard, Lite, and Daily Work. All three are integrated with the same data set, the Work Order Standard is the most comprehensive of the three. It contains additional functions such as cost, billing, tracking, associated preventative maintenance, resulting tasks, and related work orders. Work Order Lite contains only the basic functions of Work Order Standard which allows for easier, faster data entry. The smallest of the three work order modules, Daily Work was designed for easy, fast entry.



Similar to all systems the GBA Master Series work order interface can be viewed through the GIS or as a standalone system.

Hansen

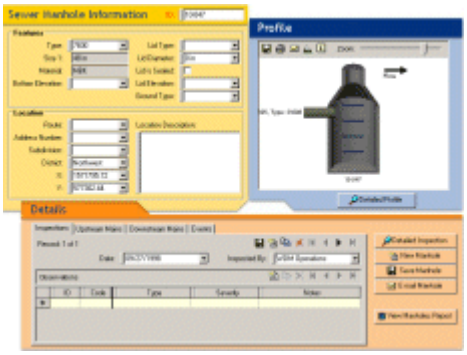
Hansen Information Technologies is a supplier of application software that helps manage the operations of government organizations. Hansen's products aggregate citizen and business requests for services and business transactions, across the enterprise, offering multiple channels (i.e. web portal, kiosk, front counter, telephone, and email) of secured access to back-office functions. Hansen offers several enterprise product suites including; Citizen Relationship Management, Financial Accounting, Revenue Management, Operations Management, Business Intelligence.

Hansen has several options for adding spatial decision support tools to a GIS solution, from integrated mapping within Hansen's 7 Series solutions to interfaces that create, link and synchronize your Hansen data with leading GIS applications. The Hansen solution is best when paired with other Hansen systems within the organization. This should be considered when evaluating the usefulness of Hansen as a utilities management solution. Hansen is an ESRI business partner and has several interfaces available for integrating GIS.

CartêGraph
CartêGraph is an ESRI business partner that specializes in offering several solutions to help manage the ongoing activities of local government organizations. The CartêGraph offerings can be categorized into three solutions suites;

1. Management Suite
2. GIS Suite
3. Developer Suite

Management Suite
The management suite includes several specific applications to manage different assets within the organization. The following outlines the key features in of each solution within the CartêGraph management suite.



SEWERview
SEWERview is designed to manage both storm sewer and sanitary sewer assets. SEWERview is a management tool to inventory, inspect, test, manage and map all information related to sewer networks. Tabs on the side of the SEWERview screen allow easily access detailed information about the main components in your sewer network:

- pipes
- junctions (manholes)
- intakes
- channels
- pump stations

Each of these components may record a wide range of identification, feature, location, inspection and history information. SEWERview also allows users to associate photos, documents, plans and other pertinent information to sewer network components.

SEWERview has the flexibility to record as much or as little detail as desired.

Functionality:

- identify network connectivity
- keep on-line inspection records
- record miscellaneous tests
- associate video distress logs
- queries and reports
- user-defined data entry fields
- user-defined Overall Condition Index
- interface with standard hydraulic modeling programs

BRIDGEview

BRIDGEview is a tool designed specifically for bridge and culvert management. Bridge and culvert information can be recorded, queried, displayed and reported. BRIDGEview is designed to optimize inspection processes, improve record accuracy, streamline SI&A reporting and decrease maintenance costs. BRIDGEview facilitates inventory, inspection, appraisal, maintenance and state-specific Structure Inventory and Appraisal (SI&A) information for all structures. BRIDGEview is designed utilizing FHWA guidelines and National Bridge Inventory Standards, BRIDGEview and can be used for both the field and office

Functionality:

- complete bridge inventory
- inspection records by category and element level
- structure history and database rollback
- queries and reports
- on-line SI&A forms
- complete support for FHWA, NBI and PONTIS data
- check in/check out
- full English and metric support
- SQL server and Microsoft Access support

MARKINGview

MARKINGview is a tool for developing and maintaining a database of intersections, streets and highway pavement markings. View important details including the cost of materials for reapplication, amount of paint needed for reapplication and predicted condition of the marking at any time. In-depth records that include location, features and maintenance history are available with a click of a button and can be used for reporting, budgeting, improving safety and more.

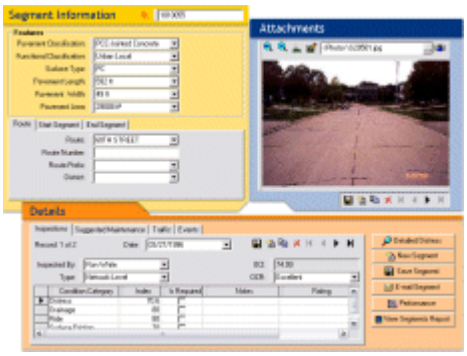
Functionality:

- identify location by vicinity, coordinate, network or intersection
- calculate estimated costs of marking applications automatically
- record data describing how the material was applied
- run queries and reports
- access on-line libraries

PAVEMENTview

PAVEMENTview allows users to maintain accurate and up-to-the-minute pavement inventory, inspection and maintenance information for high-volume paved roads to low-volume unpaved roads. PAVEMENTview is based on concepts introduced by the Federal

Highway Administration and the U.S. Army Corps of Engineers and is suited for both field and office use. PAVEMENTview facilitates optimized data collection, improved records accuracy, departmental efficiency, simplified analysis and decision making, streamlined work plan development, and decreased maintenance costs.

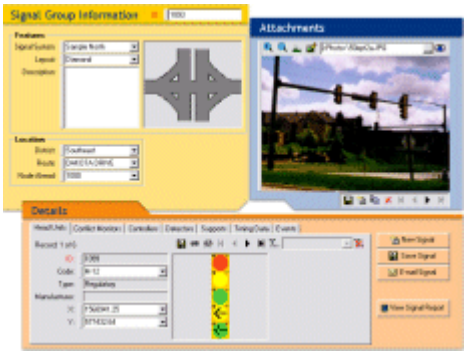


Functionality:

- detailed inventory of paved and unpaved road segments
- inspection records
- location identification
- identify road segment classifications
- queries and reports
- on-line SI&A forms
- reference FHWA (SHRP) and USACE distress libraries and deduct curves
- record ADT history
- establish user-defined Overall Condition Index

SIGNALview

SIGNALview provides traffic engineers and technicians with a tool for the collection, inventory, maintenance and management of all components in a signal system. Its interface includes tabs on the side of the screen allows users to quickly switch between the five main areas of the program:



- supports
- faces
- detectors
- controllers
- auxiliary equipment

On-line reference libraries facilitate the recording and classification of every component and intersection in your system. SIGNALview is designed for use in the field or in the office.

Functionality:

- inventory faces, supports, detectors, controllers and auxiliary equipment
- location identification
- attach digital images and videos
- queries and reports
- on-line signal libraries
- user-defined data entry fields
- maintenance/scheduled activities log
- historical rollback of timing sheets and database fields

SIGNview

SIGNview® delivers a practical and efficient approach available for the collection, inventory, maintenance and management of all sign assets. In the field and in the office, SIGNview reduces the effort required to create and maintain an accurate, up-to-date sign management database.

SIGNview includes an on-line Federal MUTCD library, containing predefined data for all standard signs to help reduce the tedious task of data entry. Select a sign from the library and SIGNview automatically records the attribute information. All SIGNview libraries can be completely customized to reflect any unique signs organization may have.

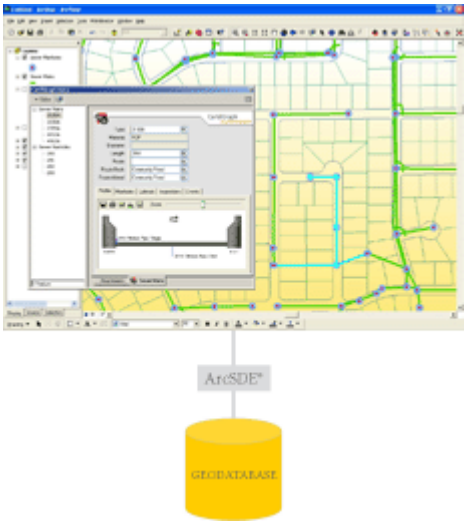
Functionality

- detailed inventory of signs and supports
- on-line MUTCD sign library
- location identification
- complete history log
- queries and reports
- attach images and videos
- user-defined data entry fields
- data synchronization with multiple field commands

All of CartêGraph's software operates independently or in conjunction with ESRI's GIS software. Tabular data stored in CartêGraph's software can be dynamically linked to ArcGIS if spatial information is available for each asset that is being tracked.

GIS Suite

CartêGraph offers several specific GIS solutions that can interact with existing ArcGIS investments. The following outlines the specifics of each offering within the GIS suite.



GEODATAconnect

The GEODATAconnect allows you to specify which fields are viewable and editable inside CartêGraph. It reads all the attribute data for the selected feature class and provides tools to specify which CartêGraph field corresponds to the appropriate attribute. If the field does not exist you can automatically create it in CartêGraph with the same geodatabase field name.

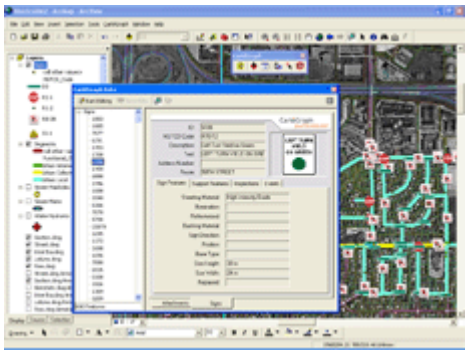
Functionality

- Live geodatabase connectivity
- ArcGIS - embedded interface

- No redundant data entry
- Map attributes to fields
- Create new fields in CartêGraph to match attributes in the geodatabase
- Read and write to the geodatabase right from your CartêGraph flexFORM

GISdirector

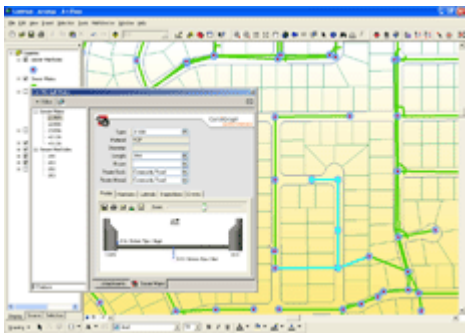
The GISdirector™ is flexTECHNOLOGY inside of ArcGIS. The GISdirector allows users to view and edit CartêGraph data within ArcGIS. Create customized interfaces—CartêGraph flexFORMS—for integrated Public Works Management in ArcGIS.



- Integrated Public Works management in ArcGIS
- Fully customizable flexFORMS in ArcMap
- Edit CartêGraph data from ArcMap

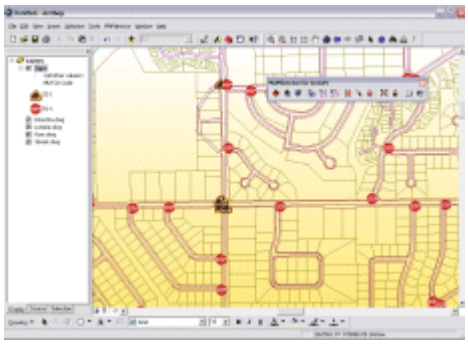
MAPdirector

CartêGraph's MAPdirector for ArcGIS exposes the tools a users needs to view and manipulate detailed asset information from a CartêGraph database in the ESRI® ArcGIS environment.



MAPdirector for ArcGIS provides the tools to simplify the process of selecting and displaying the information to view on a map, including asset condition, groups of assets, and scheduled versus completed maintenance activities.

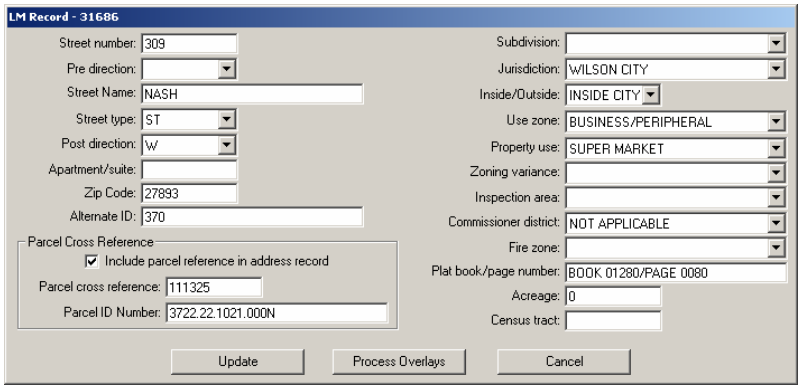
- Add Asset Layer Wizard displays assets from a CartêGraph database in an ArcMap Layer
- Customizable symbology for asset graphics
- Pan and zoom
- Placement/editing tools
- Display CartêGraph asset data in tables for data query operations
- Display CartêGraph data records by selecting an asset or group of assets in ArcMap
- As a record is viewed in a CartêGraph application, the corresponding asset is highlighted in ArcMap



GIS Addressing Application

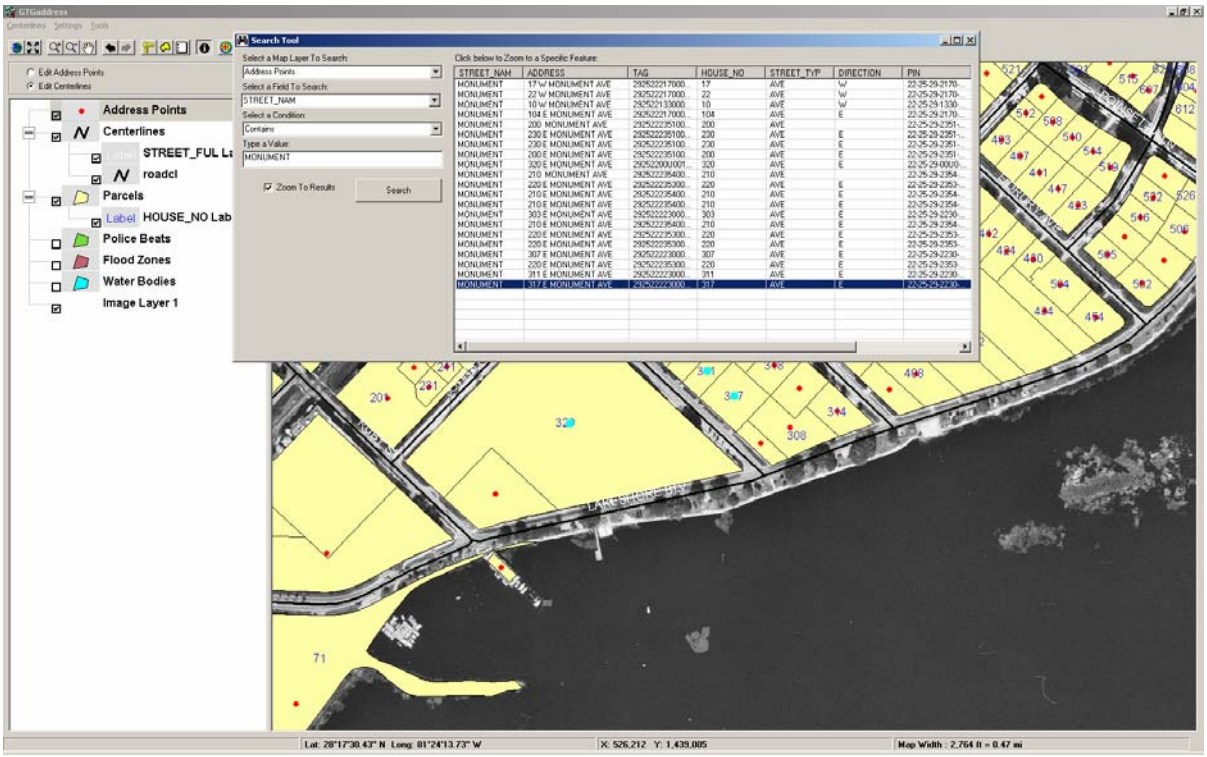
Various solutions for maintaining accurate centerlines and address points are commercially available. These applications have specialized toolsets for optimal maintenance and creation of these critical base layers. It is recommended that Public Works, in conjunction with the

GIS Coordinator, utilize an addressing tool to manage and maintain address information. One license is recommended for Public Works and one for the GIS Coordinator.



Administrative Setup for Addressing Tool

Using Addressing Tool to Edit Address Data

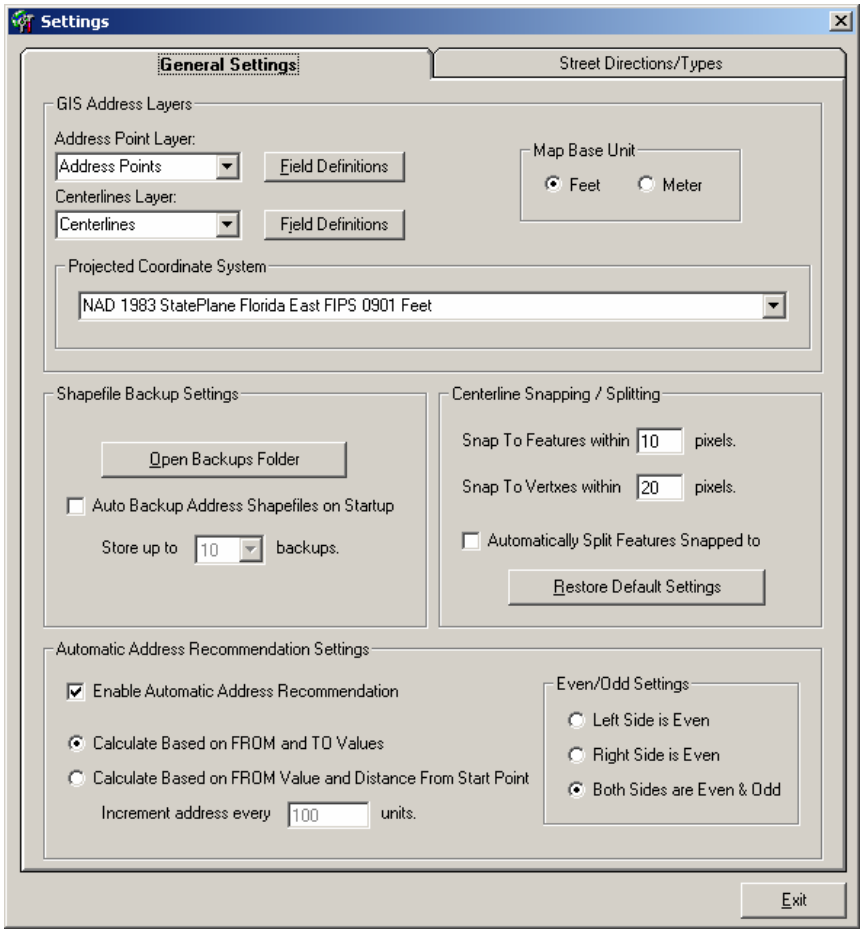


Example of Addressing Application's GIS Search Tool

The application should also allow users to carry out custom queries to search for specific information stored in various GIS layers such as streets and parcels. Users will be able to search for specific street names or addresses within the address point layer or street centerline layer. Also, users can find specific locations on the map by entering a latitude and longitude.

This application will also allow users to customize settings such as the following:

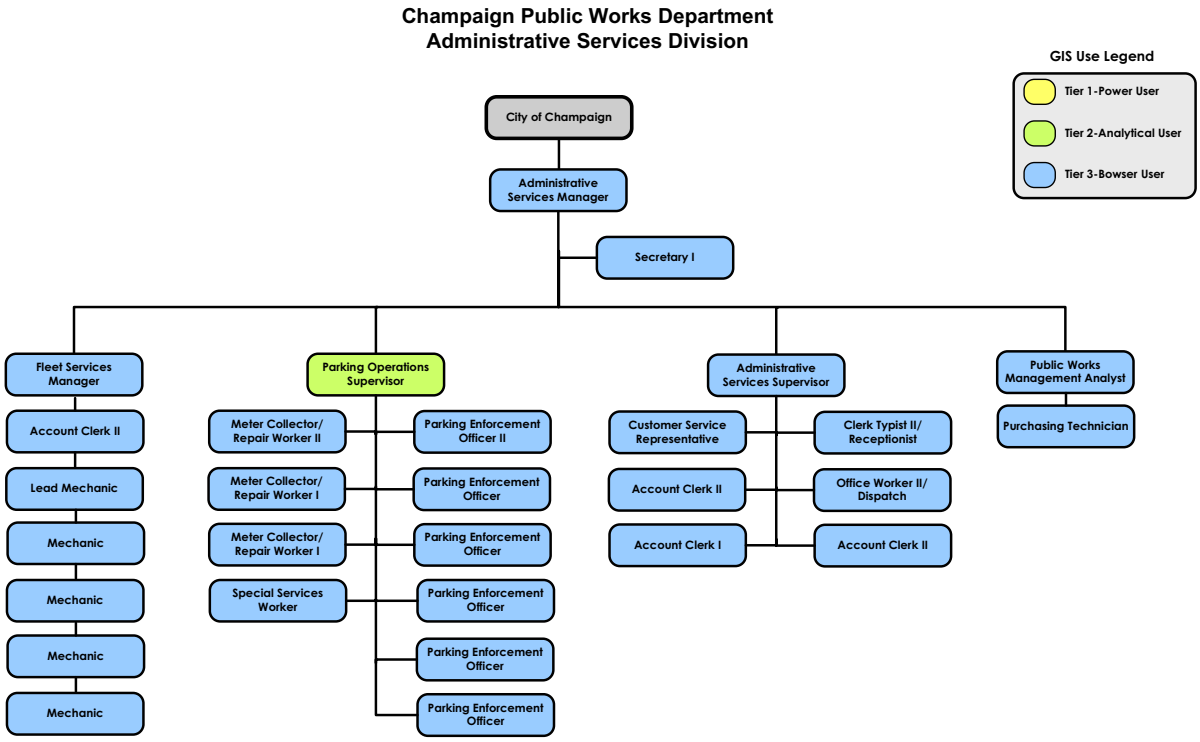
- Change the Projected Coordinate System
- Set Custom Snapping Tolerance (for use when moving address points)
- Enable Automatic Address Recommendation
- Calculate Based on From and To Values



Screen Shot of General Settings Tab in the Addressing Application

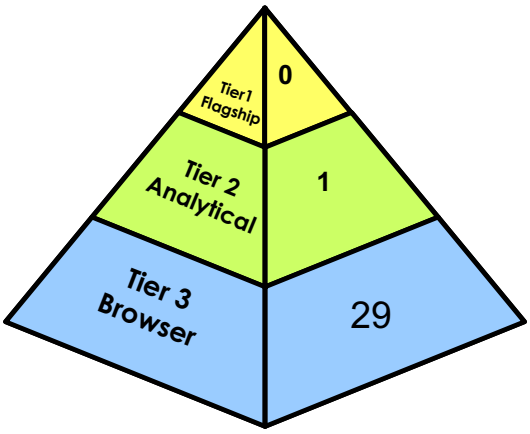
Multi-Tier GIS Application Use within the Public Works Department

The following chart describes the recommended GIS application use by the Public Works Department. A Tier 1 user is a power GIS user who should have access to a fully functioning GIS toolset. A Tier 2 users focus is data analysis in addition to general browsing capabilities. A Tier 3 user requires only general browsing GIS data functions.

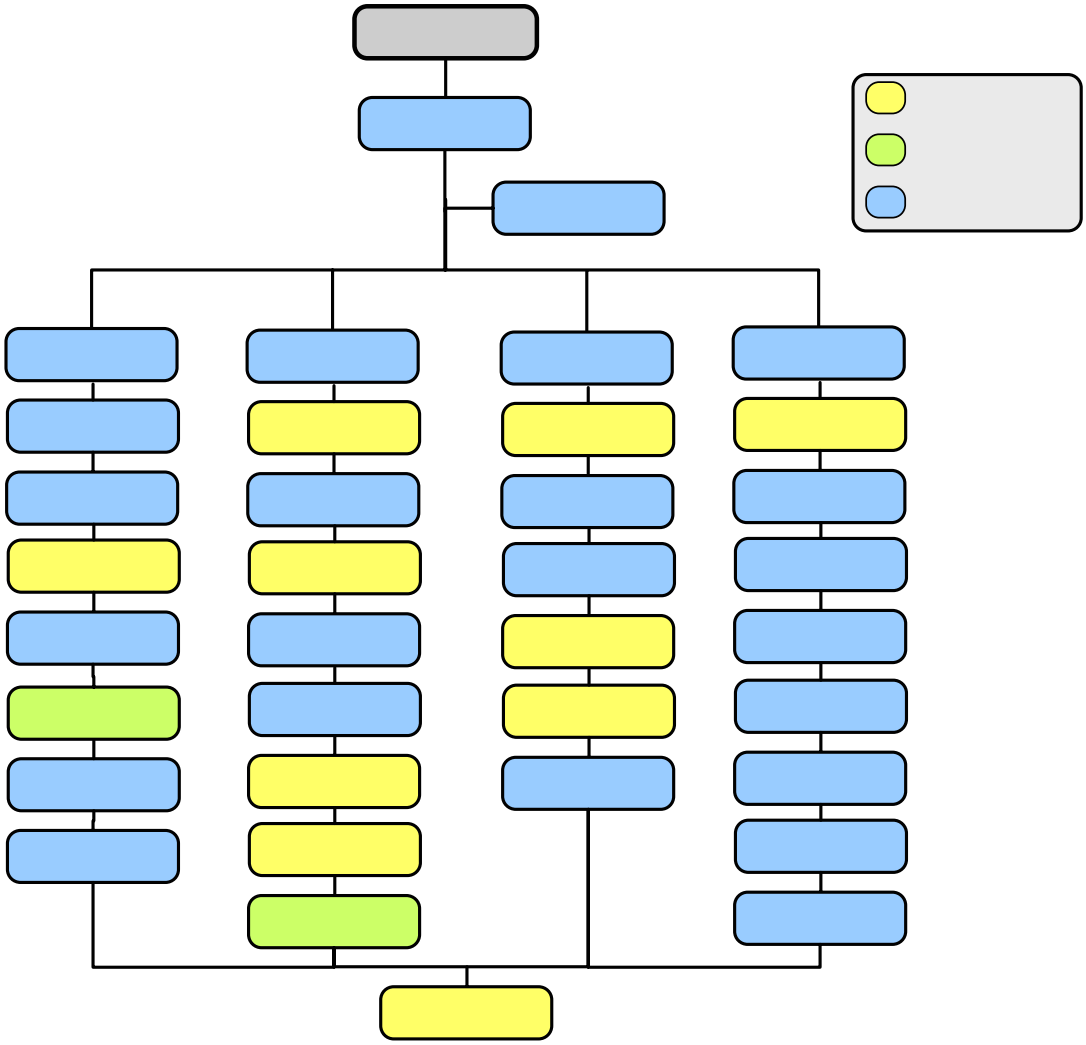


Public Works Department Administrative Services Multi-Tier GIS Application Use

There are only Tier 3 users within the Public Works Administrative Department.

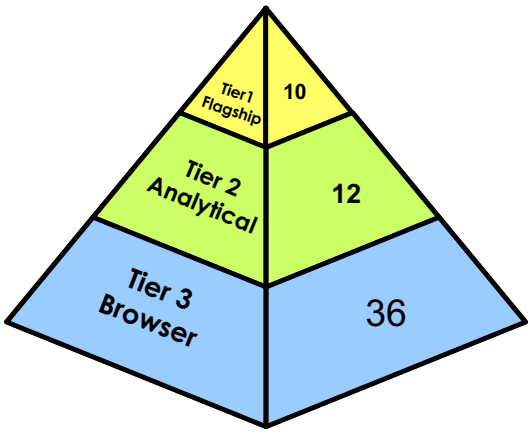


Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ **GIS Administration** ☑ **Data maintenance** ☑ **Data conversion, creation** ☑ **Spatial Data Management** ☑ **Technical support** ☑ **Coordination**
Tier 2 Analytical	☑ **Data Maintenance** ☑ **Analytical functions/Geoprocessing** ☑ **Complex queries** ☑ **Modeling** ☑ **Use of desktop extensions** ☑ **High quality map production**
Tier 3 Browser	☑ **Browsing/Look-up** ☑ **Standard reports** ☑ **Simple query** ☑ **Map production**



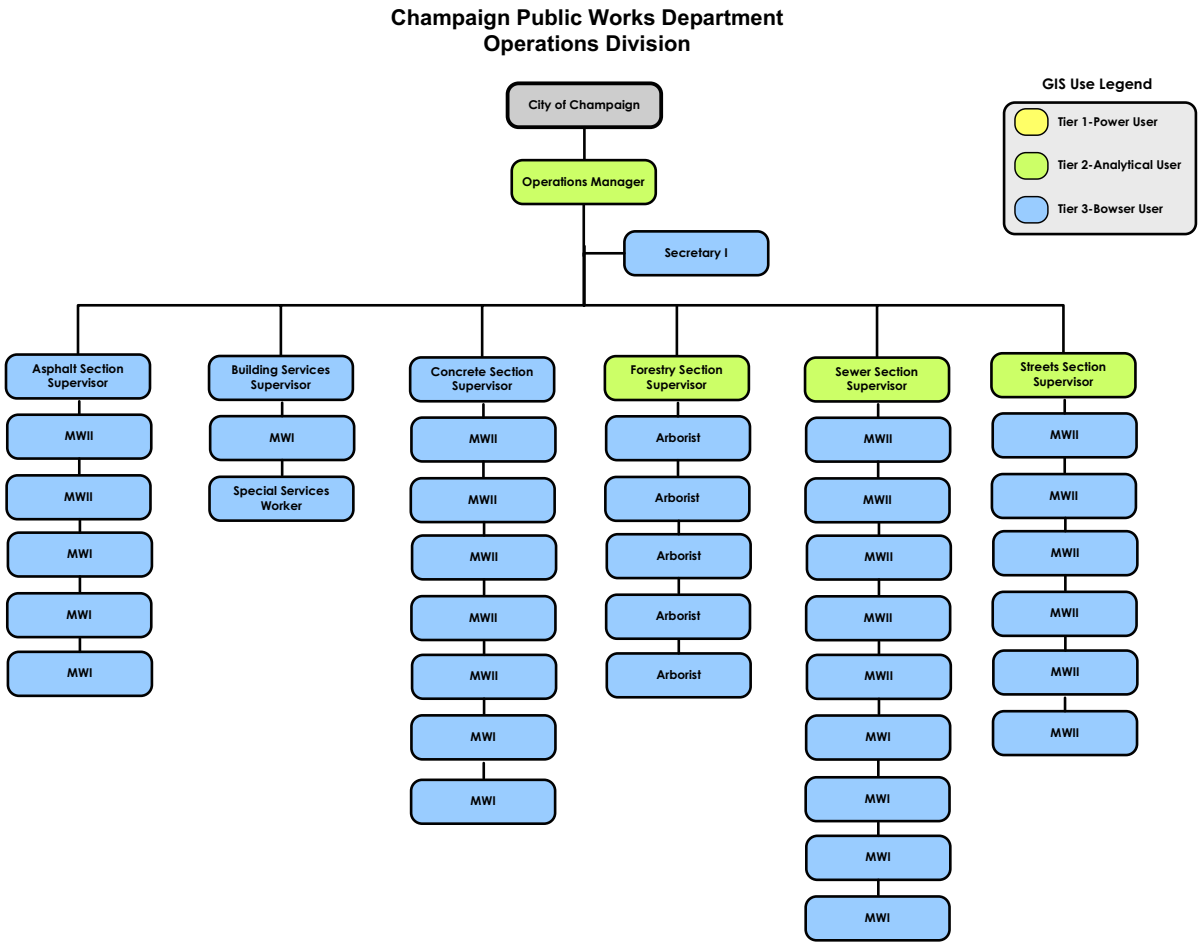
Public Works Department Engineering Division Multi-Tier GIS Application Use

There are eight users within the Public Works Engineering Department that is considered a Tier 1 user; all other staff members are Tier 3 users.



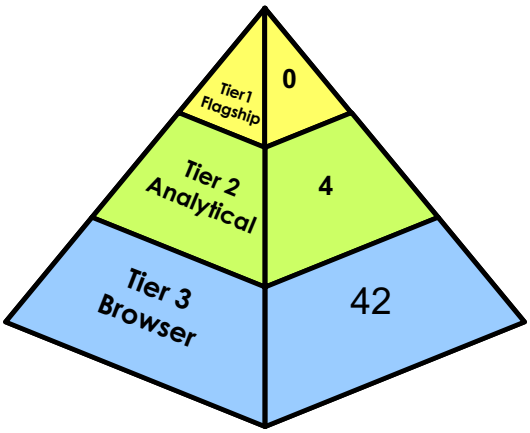
Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Assistant City Engineer



Public Works Department Operations Division Multi-Tier GIS Application Use

There are only Tier 3 users within the Public Works Operations Department.



Tiers of GIS Users	
Group	**Activity**
Tier 1 Flagship	☑ **GIS Administration** ☑ **Data maintenance** ☑ **Data conversion, creation** ☑ **Spatial Data Management** ☑ **Technical support** ☑ **Coordination**
Tier 2 Analytical	☑ **Data Maintenance** ☑ **Analytical functions/Geoprocessing** ☑ **Complex queries** ☑ **Modeling** ☑ **Use of desktop extensions** ☑ **High quality map production**
Tier 3 Browser	☑ **Browsing/Look-up** ☑ **Standard reports** ☑ **Simple query** ☑ **Map production**

City of Champaign – Vision, Goals, and Objectives

The City of Champaign understands that GIS technology has become a critical component of good government. City Departments recognize that the use of GIS technology can often mean improving efficiency, and increasing productivity. Implementing GIS technology, if done haphazardly, results in limited effectiveness and limited utility. City staff realized that systematic planning on how best to implement the technology is a must. One key component of planning for GIS is to understand and establish a vision, goals and objectives at the city-wide level and at the departmental level.

City-Wide Goals

A city-wide vision statement was created based on interviews with staff throughout the city and city leaders. Based on this feedback the proposed GIS vision statement of the City is to:

> ***Geographic Information Systems will provide for reliable and consistent data, and the tools and applications to interpret and analyze it, essential to improving baseline customer and operational services while adding new services related to meeting Council's goals and the City's overall vision.***

To accomplish this vision city-wide goals and objectives have been created as follows and in a separate table (Table#3.1) following.

Goal #1 – Build and Maintain Reliable GIS Data – focus on building and maintaining accurate, consistent, and reliable geographic data.

Objectives to Accomplish Goal #1:

- Establish a centrally managed geographic database
- Ensure proper staffing levels, led by a GIS Coordinator and GIS Technicians in Public Works, to maintain the geographic database
- Establish and implement a system design for enterprise GIS architecture
- Establish standards and procedures for the development and maintenance of geospatial data
- Establish standardized methods and procedures for application deployment

Goal #2 - Make GIS Data Accessible - make data accessibility simple and easy for City departments and citizens

Objectives to Accomplish Goal #2:

- Establish effective organization-wide access to geospatial data
- Ensure network connectivity and system architecture can handle all departmental needs
- Guide the implementation of web based applications (Intranet and Internet) that facilitate access by Champaign citizens and departments
- Use GIS as a tool to provide timely and accurate data to City Council

Goal #3 - Integrate GIS Functionality with Existing Systems – ensure that existing IT investments are leveraged and that the technology is integrated with existing City business processes and systems

Objectives to Accomplish Goal #3:

- Ensure that GIS software tools integrate with and leverage data within existing systems
- Integrate GIS as fully as possible with:
  - GEMS
  - TRAKiT
  - Firehouse
  - OneRoof
  - Police Records Management
  - Other Existing Systems

Goal #4 - Train, Educate and Inform City Staff – continue to improve the GIS knowledge base within City departments

Objectives to Accomplish Goal #4:

- Implement a total governance model for sharing ideas, discussions, and information about GIS and related topics
- Provide GIS training and educational opportunities to all city staff to empower them to fully utilize GIS knowledge
- Establish a GIS user group network within the organization to help facilitate growth

Goal #5 - Implement an Optimum GIS Governance Model – a clear and understandable strategy for the management and effective utilization of GIS

Objectives to Accomplish Goal #5:

- Establish a governance structure for review and coordination of all GIS initiatives
- Hire a GIS Coordinator and other needed staff to oversee and maintain the GIS initiative
- Develop an on-going GIS program to ensure efficient use of enterprise GIS resources
- Utilize intergovernmental agreements and data sharing agreement to benefit the city

Goal #6 - Build and Maintain Enterprise IT Infrastructure – Implement infrastructure for an enterprise GIS initiative that will sustain growth and change

Objectives to Accomplish Goal #6:

- Implement networking infrastructure that creates an efficient technological environment for the GIS initiative
- Conduct performance and IT capacity planning for optimum use of GIS
- Ensure that each department has the adequate resources to do their GIS tasks without any technological impediments

Table #3.1: Overall Vision for the City

City of Champaign's Enterprise Geographic Information System (GIS) – Vision, Goals

Citywide and Enterprise Vision Geographic Information Systems will provide for reliable and consistent data, and the tools and applications to interpret and ana baseline customer and operational services while adding new services related to meeting Council's goals and the Cit				
Citywide Goals				
Goal #1 **Build and Maintain Reliable GIS Data** Focus on building and maintaining accurate, consistent, and reliable geographic data.	**Goal #2** **Make GIS Data Accessible** Make data accessibility simple and easy for City departments and citizens	**Goal #3** **Integrate GIS Functionality with Existing Systems** Insure that existing IT investments are leveraged and that the technology is integrated and interoperable with existing City business processes and systems	**Goal #4** **Train, Educate and Inform City Staff** Continue to improve the GIS knowledge base within City departments	**Goal #5** **Implement an Optim GIS Governance Mo** A clear and understandable strate for the management a effective utilization GIS
Citywide Objectives				
Objective: Establish a **centrally managed geographic database** Objective: Insure **proper staffing levels**, led by a GIS Coordinator and GIS Technicians in Public Works, to maintain the geographic database Objective: Establish and implement a **system design** for enterprise GIS architecture Objective: Establish **standards and procedures** for the development and maintenance of data Objective: Establish **standardized methods** and procedures for application deployment	Objective: Establish effective **organization-wide access** to geospatial data Objective: Insure **network connectivity and system architecture** can handle all departmental needs Objective: Guide the **implementation of web based applications** (Intranet and Internet) that facilitate access by Champaign citizens and departments Objective: **Use GIS as a tool to provide timely and accurate data to City Council**	Objective: Ensure that **GIS software tools** integrate with and leverage data within existing systems Objective: **Integrate GIS as fully as possible** with: • GEMS • TRAKiT • Firehouse • OneRoof • Police Records Management • Other Existing Systems	Objective: **Implement a total governance model** for sharing ideas, discussions, and information about GIS and related topics Objective: Provide GIS **training and educational opportunities** to all city staff to empower them to fully utilize GIS knowledge Objective: Establish a **GIS user group network** within the organization to help facilitate growth	Objective: Establish a **governance structure fo review and coordinatio all GIS initiatives** Objective: Hire a GIS Coordinator and other needed staff to oversee a **maintain the GIS initia** Objective: Develop an **o going GIS program** to ensure efficient use of enterprise GIS resources Objective: **Utilize intergovernmental agreements and data sharing agreement to benefit the city**

Departmental Goals

The previous section described the overall goals for the City in regards to GIS implementation. However, taken by themselves they are not specific enough to ensure that the needs of the individual departments are fully met. The next several pages review the goals and objectives identified by Champaign staff during on-site interviews and subsequent feedback on the needs assessment (Chapter 2). These goals will be utilized to prioritize projects through the five year implementation of GIS at the City. Therefore, it is imperative that staff review, understand, and agree with the goals for their department and the priority of these goals.

Each goal has been given a priority based on departmental feedback. The priority ranking is threefold: high, medium, and low. A high priority is one that is critical for the department to function effectively and efficiently. A medium priority is important but one in which an immediate adverse effect on the department is not occurring due to its absence. A low priority is one that will make a department more efficient and effective but is not as critical to the department and can wait for implementation later in the project.

Additionally, each goal has been given a level of effort to accomplish the task. The level of effort ranking is threefold: high, medium, and low. A high level of effort indicates that the project requires a large non-existing data component, requires the alteration of multiple existing City workflows, and/or is technologically difficult to implement. A medium level of effort indicates that the project has a moderate non-existing data component, requires the alteration of some City workflows, and/or has a few technological hurdles. A low level of effort indicates that the project can be put into place without significant data constraints, without significantly altering City workflows, and has few technological hurdles.

The departmental goals and objectives also review data layers that will need to be maintained/created by each department. These are given a ranking in regards to criticality for the department or organization. A ranking of high means that the data layer is critical to the success of the Champaign GIS effort. Medium means the data layer is important but its initial absence will not impede the overall success of the initiative. Low means the data layer needs to be created but can wait until later in the five year GIS implementation cycle.

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Neighborhood Services

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Utilize GIS to automate the "Neighborhood Wellness Action Plan" analysis	High	High
2. Use hand-held devices for access to GIS data in the field	Low	Low
3. Use GIS software to support Community Investment programs and project including: a. Environmental Assessments b. Demographic Analysis c. Land Use Analysis d. Code Enforcement	High	Medium
4. Use GIS analysis and mapping capabilities for grant applications	Medium	Low
5. Three staff members in Neighborhood Services receive Certified GIS Training on Tier 2 applications	High	Low
6. Integrate GIS with the TRAKiT database	High	Low
7. Use GIS to conduct Mapping and Spatial Analysis tasks to include: a. Proposed development location analysis b. Neighborhood wellness and infill analysis c. Land use and land development mapping and analysis d. Census/Demographic analysis e. Creation of mailing labels based on geography f. Project activity mapping g. Production of public meeting and exhibition maps h. Access to nuisance abatement issues i. Access to land use information j. Access to information on properties – owner occupied, rental, homeowner, liens, affordable housing, etc. k. Use GIS to create mailing labels	High	Medium
8. Integrate GIS with OneRoof database	High	Low
9. Use GIS at Public Forums for On-the-fly mapping and analysis	Medium	Low
10. Provide Public Access to Neighborhood Services Data	Medium	Low

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Neighborhoods	High	Partial
	Nuisance Abatement Records	Medium	Recommended
	Planning Areas	High	Recommended

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Fire Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Utilize GIS to view, and analyze patterns and locations of all fire incidents (Firehouse)	High	Low
2. Use GIS to map inspections, building permits, and Certificate of Occupancy (COO)	High	Low
3. Integrate GIS with the TRAKiT database	High	Medium
4. Create digital files of all building pre-plans and geo-reference using GIS software	High	Medium
5. Use Internet GIS to improve Public access to building safety and inspection data* (TRAKiT)	High	Low
6. Use mobile devices for access to GIS data in the field	High	Medium
7. Use GIS for Emergency Operations and Disaster Response a. Recommended Field Applications • Currently utilizing Remote Access	High	Medium
8. Use GIS for emergency notification	High	Medium
9. Three Fire Department staff will receive Certified GIS Training on Tier 2 applications	High	Low
*Public Access Issues (Council Approval)		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Evacuation Routes	Medium	Recommended
	Fire Response Times	High	Recommended
	Fire Response Zones	High	Existing
	Hazardous Materials	High	In Progress
	Knox Box Locations	Medium	Existing
	Building Pre-plans	High	Recommended
	Tornado Siren Locations	Low	Recommended

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Finance Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Use GIS to support regular daily tasks be accessing and analyzing financial information, billing, business licenses and permits, and general CIP budget information by integrating, accessing, and viewing the data stored in the following software solutions: a. GEMS b. TRAKiT c. Questica	High	Low
2. Use the city-wide Intranet GIS software solution to access all digital city-wide data layers.	Medium	Low
3. Use GIS to generate maps for the following: a. Fee Recovery b. Capital Improvement Plan (CIP) Maps	Medium	Medium
4. Replace the Public Works spreadsheet documents with in-house GIS software for all GASB34 reporting	Medium	High
5. For the purposes of analysis, use GIS to access digital files including legal documents and other data, NSD Nuisance Abatement, planning documents and other data, and County property assessment tax rates	High	High
6. Use GIS for financial analysis and planning, including: a. Evaluating average and median property values, including trends b. Map and evaluate various tax revenues in a defined area, including trends c. Map and analyze building permit activity d. Predictive modeling for property values and future tax revenues	Medium	High
7. Certified GIS training for two staff members on Tier 2 software tools	High	Low

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	NO DATA LAYERS		

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Human Resources Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Use the Intranet GIS browser to access all pertinent data layers within the City, including access to data within GEMS.	Low	Medium
2. Develop enterprise GIS staffing job descriptions, including: a. GIS Coordinator b. GIS Technician	High	Low
3. GIS Training for six staff members on Tier 3	Medium	Low

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	NO DATA LAYERS		

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Legal Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Establish City-wide GIS data sharing, cost recovery, or revenue generation policies*	Medium	Medium
2. Develop disclaimer notifications on all digital GIS data, and all hardcopy maps*	High	Low
3. Utilize the GIS Intranet to access all City-wide data	High	Low
4. GIS Training for nine staff members on Tier 3	Medium	Low
5. Use GIS for various tasks including: a. Access to on-going property issues and legal collection activities b. Integration of legal department datasets c. Disposition of legal cases as they relate to properties and/or projects		
*Public Access Issues and Data Disclaimer Issues (Council Approval)		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	NO DATA LAYERS		

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Mayor, Council, and City Manager's Office

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Use GIS technology to give Council Members access to spatial data from an Internet Solution. This would allow Council members to: a. View the potential impact of Annexation, Re-zoning, other properties b. Show residences within Council districts	Medium	Low
2. Make GIS tools available during Council meetings. This would all on-the-fly analysis including: a. e.g. Cell tower ordinance distance requirements and location of dog grooming facilities	Medium	Low
3. Use GIS to allow City Council and City Manager's Office access to data layers.	Medium	Medium
4. Use GIS for forecast/ predictive modeling such as infill analysis, population trends, and neighborhood wellness.	Medium	High
5. Use GIS to improve economic development efforts	High	High
6. Work with departments and EMT to determine the best solution for providing GIS data access and associated costs.	Medium	Low
7. Address the Return on Investment- Quantify how GIS can improve services to customers and internal	High	Low
8. Use GIS tools analyzing and managing development, annexation requests, incentives, liquor licenses, fines, fees, CRO, and a variety of other tasks.		
9. GIS training for City Manager's staff members on appropriate GIS tools.	High	Low

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Liquor License Locations	Medium	Recommended

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Planning Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Use GIS for mapping and spatial analysis of predominantly: a. Land use b. Zoning c. Environmental data d. Neighborhood Wellness e. Infill Analysis f. Capital Improvement Projects (CIP)	High	Medium
2. Utilize GIS software to automate all neighborhood and vicinity mapping tasks, including: a. Producing tabular reports b. Providing automated form letters c. Produce hard-copy and digital maps	Medium	Medium
3. Use GIS with new Planning Support Systems	Medium	Medium
4. Use GIS to improve public access to planning data through the use of touch screen Kiosks and the Internet*	High	Medium
5. Eight staff of Planning Department staff receive certified GIS training on Tier 1 and 2 applications	High	Low
6. Integrate GIS with existing databases such as TRAKiT and Questica	High	Low
7. Use GIS to integrate and utilize image data including: a. Variances b. Development plans-hardcopy c. Zoning regulations d. Sign and billboard photos	High	High
*Public Access Issues (Council Approval)		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	City Limits	High	Existing
	Comprehensive Plan, Land Development Code, Development Agreements	High	Recommended
	Enterprise Zones	Medium	Recommended
	Tax Incentive Zones	Medium	Recommended
	Special Services Area	Medium	Recommended
	Historic Properties	Medium	Existing
	Land Use (Existing & Future)	High	Recommended
	Liquor License Locations	Medium	Recommended
	Lot Survey	Medium	Recommended
	Signs (Private)	Medium	Recommended

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Variances	Medium	Recommended
	Well Head Protection Zones	Medium	Recommended
	Zoning	High	Complete

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Public Library

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Facilitate the use of a GIS Internet browser* within the new Library	High	Low
2. Utilize the enterprise-wide GIS Intranet browser for access to local City data and information	Low	Low
3. GIS training for 100+ staff members on Tier 3	Low	Low
*Public Access Issues (Council Approval)		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	NO DATA LAYERS		

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Public Works Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Continue to improve the utilization of GIS software for mapping and spatial analysis of facilities and infrastructure data	High	High
2. Use hand-held devices (or GIS hard-copy map books) for access to GIS data in the field	High	High
3. Integrate GIS with a Work Order Management solution	High	High
4. Create Public access through a GIS Internet Portal*	Medium	Low
5. Use GIS for public notification	Medium	Medium
6. Develop CAD standards for plan submissions and GIS integration	High	Medium
7. Use GIS to support Automated Vehicle Location (AVL)	High	High
8. Complete, or build reliable, consistent, and repeatable digital data layers of all City infrastructure (see custodianship)	High	High
9. Link as-built and CAD drawings to the GIS base layers	High	High
10. Use GIS networks and data to manage all City infrastructure systems	High	High
11. Certified GIS Training for: • One staff member on Tier 2 within Administrative Services • Twelve staff members on Tier 1 & 2 within Engineering • Four staff members on Tier 2 within Operations Division	High	High
12. Use GIS for Management for Citywide Addressing	High	Low
*Public Access Issues (Council Approval)		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low ,Medium, High*	*Status*
	Address Points	High	Recommended
	City Owned Property	High	Recommended
	Easements	High	Partial Existing
	Impervious Surfaces	Medium	Recommended
	Mosquito Breeding Areas	Low	Recommended
	Mowing Zones	Medium	Partial
	Newly Developed Areas	Medium	Recommended
	Northwest Interceptor Fee Boundary	Medium	Partial
	Parking Features: Handicap, Loading Zones, Metered, Lots, Space Markings, Permit Parking, Towing Zones	High	Existing
	Public Works Routes (Snow Removal and Sweeping)	High	Recommended

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low ,Medium, High*	*Status*
	Right-of-Way	High	Partial Existing
	Sewer Base Map	High	Recommended
	Sidewalks	High	Partial Existing
	Signs	High	Recommended
	Speed Zones	Medium	Recommended
	Storm Base Map	High	Recommended
	Streetlights	High	Existing
	Striping & Pavement Markings	High	Recommended
	Traffic Service Requests	Medium	Recommended
	Traffic Signals	High	Recommended
	Transportation: Alleys, Pavement, Management, Bridges, Streets, Traffic Counts	High	Partial
	Tree Inventory	Medium	Recommended
	Water Sampling Station Data	High	Existing

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

Police Department

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Use GIS to perform many ad-hoc and daily activities including but not limited to the following: a. Map patterns of crime b. Analyze criminal activity, reportable incidents, and traffic accidents c. Weekly PIN mapping d. Mapping crime for roll call e. Regional crime analysis	High	Medium
2. Use mobile computers for access to GIS data in the field (45 mobile units)	High	Medium
3. Integrate an off-the-shelf crime analysis application with the AS/400 in-house Records Management System (RMS)	High	High
4. Use GIS for emergency notification for the following: d. Emergency Evacuations e. Missing Person Alerts f. HAZMAT Emergencies g. Public Service Announcements (PSA's)	High	Medium
5. Use Internet GIS to allow public access to Police data*	Medium	Low
6. Create and maintain a digital representation of critical police data layers (see data custodian)	High	Low
7. Two Police Officers will receive formal certified GIS Training on Tier 2 applications	High	Low
* Public Access Issues (Council Approval)		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	ATM, Banks, Branches	Medium	Recommended
	Beats and Response Zones	High	Recommended
	Drug Free Zones Around Schools	Medium	Recommended
	Hot Spots	High	Recommended
	Neighborhood Watch Groups	Medium	Recommended
	Parolees	Medium	Recommended
	Persons On Probation	Medium	Recommended
	School Crisis Plans	Medium	Recommended
	Sex Offenders	High	Recommended
	Underground Parking	Medium	Recommended

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

IT/ GIS Coordinator

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Facilitate the Coordination and Management of the City's enterprise-wide GIS initiative	High	High
2. Coordinate all GIS support activities including: g. Software i. User Support ii. Troubleshooting h. Hardware i. Network Administration j. Governance i. Coordination with External Entities (Consortium) k. Training and Education	High	High
3. Two IT Staff will receive Certified GIS training on all tiers of GIS	High	Low
4. Understand and Educate the organization on the utility of GIS for all departments	Medium	Low
5. Establish metadata standards and data policies	Medium	Medium

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

JOINT CUSTODIAN

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Address Points	High	Recommended

JOINT CUSTODIAN

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Beats and Response Zones	High	Recommended
	Council Districts	Medium	Recommended
	Critical Facilities	Medium	Recommended
	Easements	Medium	Partial Existing
	Fire Response Zones	High	Existing
	Impervious Surfaces	Low	Recommended
	Pre Plan Data (Buildings)	High	Recommended
	Schools	Low	Recommended
	Traffic Counts	Low	Recommended
	Vacant Properties (eventually automated)	Medium	Recommended
	Variances	Medium	Recommended

Automated Process Guided By GIS Coordinator

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Building Permits, Certificates of Occupancy	High	Recommended
	Commercial Addresses	Low	Recommended

Automated Process Guided By GIS Coordinator

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Crime Data	High	Recommended
	Delinquent Tax Properties	Low	Recommended
	Fire Incidents	High	Recommended
	Fire Inspections	Medium	Recommended
	Fire Investigations	Medium	Recommended
	Sign Violations	Medium	Recommended
	Traffic Accidents	Medium	Recommended
	Zoning Violations	Medium	Recommended

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

METCAD

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Continue to independently use GIS technology with little support from the City of Champaign	High	Low
2. Work with the City EMT and the GIS Coordinator on strategic initiatives, including software licenses and grant applications	Low	Low
3. Maintain and update a digital representation of the City's street centerline layers*	High	Medium
4. Use digital address points for emergency dispatch	Medium	Low
5. Integrate GIS with the Tiburon CAD/Ti I. View calls for service	High	Low
6. Certified GIS Training for one staff member on Tier 2 (Already trained)	High	Low
*Acceptable duplication/redundancy		

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Special Needs Residents	Medium	Recommended

CITY OF CHAMPAIGN:
DEPARTMENTAL GOALS AND OBJECTIVES, AND DATA CUSTODIANSHIP

GIS Consortium

GOALS AND OBJECTIVES:	*Priority Low, Medium, High*	*Level of Effort*
1. Adhere to the GIS Consortium mission statement that offers the City of Champaign regional data and support.	High	Medium

Legend	Description
	Point GIS Data Layer
	Line GIS Data Layer
	Polygon GIS Data Layer
	Raster GIS Data Layer

DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Aerial Photography	High	Existing
	Census Data	High	Existing
	Environmentally Sensitive Areas	High	Recommended
	Flood Zones	High	Existing
	Hydrology	High	Existing
	Mosquito Breeding Areas	Medium	Recommended

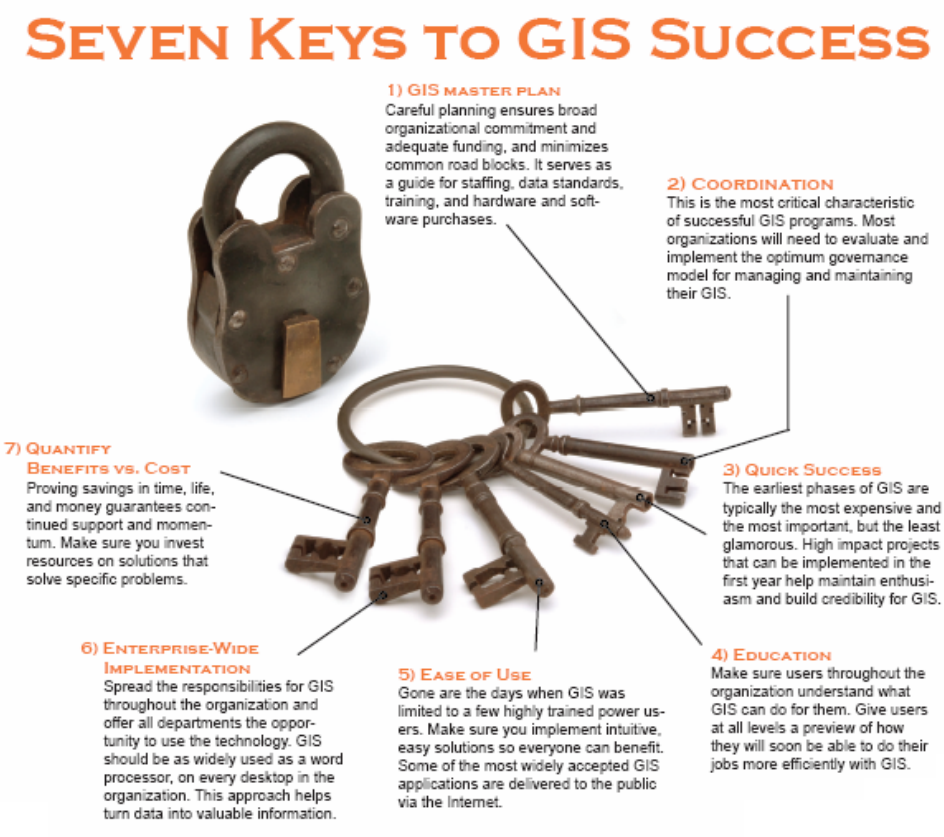
DATA CUSTODIAN:

Type	*Data Layer*	*Priority Low, Medium, High*	*Status*
	Municipal Boundaries	Medium	Existing
	Parcels	High	Existing
	Streets (maintained in PW)	Medium	Existing
	Topography	High	Existing
	Waterways	High	Recommended
	Wetlands	Medium	Recommended

Seven Keys to a Successful GIS

A detailed analysis of the most successful municipal GIS implementations in the country has shown that seven common ingredients exist for all of these successes. The following graphic (Figure 3.1) depicts the seven key ingredients for a successful GIS implementation.

Figure 3.1 - Seven Keys that Guarantee the Success of Your GIS



The elements above can be defined as the Seven Keys to GIS Success at the City of Champaign. The absence of one or more of these keys will greatly reduce the effectiveness of an enterprise-wide GIS. The following are the seven keys as they apply to Champaign.

Key #1 – Have a GIS Master Plan

There is no documented successful enterprise-wide municipal GIS that has not developed a GIS Master Plan (Needs Assessment/Implementation Plan). This is a critical first step that must be undertaken. This document is the GIS Master Plan. The document should be relied upon to guide the day-to-day activities of Champaign in regards to the GIS implementation. This document should be updated annually to reflect changes in technology and priorities.

Key #2 – Have an Effective Coordination Strategy

Chapter four of this document details the staffing needs of the City in regards to GIS. First and foremost is the need to hire a GIS Coordinator. An organization must have a go-to person that guides the implementation of the technology. Additionally, staff in heavy GIS data custodian departments, like Public Works, will need staff to maintain the vast storehouse of information under their auspices.

Key #3 – Have Quick Successes

Many GIS implementations have not been successful because early successes were not identified and realized. It is critical that early successes be accomplished in Champaign. This will serve to illustrate to the organization, elected officials, and the public that the technology is worthwhile and realizing a return-on-investment. A needs assessment was conducted for each department and priority projects were identified. Some of these projects can be done in the first year and should be seen as early successes. Some of these projects are as follows:

- Create a comprehensive address point layer that will allow the data within existing IT investments to be utilized in a geographic context
- Begin to use TRAKiT data via an Intranet GIS data browser
- Begin to use OneRoof data via an Intranet GIS data browser
- Begin using GIS for public access to geospatial Neighborhood Services projects
- GIS enable all Firehouse data
- Begin using GIS tools for City Council decision making
- Begin creating and demonstrating the use of GIS for the vast amount of Public Works data
- Utilize GIS for smart growth and economic development
- GIS enable police data and allow officers to do their own digital crime mapping

Key #4 – Have an Effective Education Strategy

The City of Champaign needs to understand the power and utility of GIS. This is not a one time process. Formal training needs have been identified. However, software training is only one component of the education process. Other key items include:

- A quarterly EMT meeting
- A monthly users group meeting
- An internal GIS newsletter
- Dissemination of pertinent GIS articles for each department
- City-wide seminars detailing GIS progress and successes

Key #5 – Implement Easy-to-Use Tools

This needs assessment has identified many areas in which GIS tools can assist in conducting the work of the City. These tools must be easy-to-use. The appropriate tool-set will need to be provided to the appropriate staff. Other organizations have failed because they have given tools that were too complex to staff and those staff were unable to realize any utility from these tools. Some Champaign staff will need to have more robust tools such as ArcView that require a higher level of expertise. However, even these staff will need access to the easy-to-use integrated tools identified in this plan.

Key #6 – Ensure Enterprise-wide Implementation

A failing of some organizations is that they have not provided tools that allow the masses to realize the benefit from the investment in the data and technology. This plan has identified the need for a city-wide Intranet browser for internal use and focused Internet applications for public consumption. These tools will prevent the pitfall of a few chosen staff having access to all the data yet the organization failing because the data is not available to those who need it on a daily basis.

Key #7 – Quantify the Benefits vs. Costs

Quantifying the benefits of GIS is an on-going task. The GIS Coordinator should keep a running list of ways the technology has saved the City of Champaign time, lives, and money. Examples abound of how other cities have used the technology to realize a significant return on investment. Some obvious ways that Champaign will realize a return-on-investment are as follows:

- Disparate data will be available via a common portal allowing City staff to save time that is currently being utilized gathering data from various sources. This will save hundreds if not thousands of staff hours a year.
- City staff will have data via this common portal that will allow them to make more informed decisions. For instance, currently the Neighborhood Wellness initiative requires that data be gathered from almost every department in the City. This is a laborious process that is culminated in a document that is by default dated. With GIS this same data will be available at all times and instantaneously as it is gathered. This will allow for much better decision making and much better public service.
- Potential saving of lives will be realized as Police and Fire GIS enable their existing reporting data. Police officers will be able to quickly visualize patterns of crime and be able to deploy resources more efficiently and effectively. Fire and Police officials will be able to access fire pre-plans and hazardous materials information that will assist in optimizing life saving operations. Reverse dialing capabilities will be implemented that will allow emergency personnel to notify targeted areas in the case of an emergency, missing person, or an abduction.
- Public Works will have access to information about the infrastructure they maintain. This will allow them to do modeling and allocate resources more effectively thus saving staff time and tax dollars.
- Potential costs savings for citizens exists by utilizing GIS to maintain the city's fire insurance rating of two and reducing the FEMA national flood insurance premium. Both of these result in reduced insurance premiums for the citizen's of Champaign.

Many more examples of how the technology can be utilized to save time, lives, and money will become apparent as the technology is implemented. These should be tracked and quantified by the GIS Coordinator. Figures 3.2 and 3.3 on the following pages identify areas in which a return-on-investment can be realized.

Figure #3.2: Return on Investment (ROI)

Figure #3.3: Departmental Benefits

City of Champaign
The Benefits of GIS

● = low

Return on Investment (ROI) Opportunities	City Departments									
	IT Department	Neighborhood Services	Fire Department	METCAD	Finance Department	Human Resources Department	Legal Department	City Manager's Office	Planning Department	Library
Save Money	•	•	●	•	•	•			•	
Save Time	•	●	●	●	•	•	●	•	●	
Increase Productivity	•	●	•	•	•	•			●	
Improve Efficiency	•	●	•	•	•	•	•	•	●	
Improve Data Accuracy	●	●	•	•		•		•	●	
Make Better Quality, and More Effective Decisions	●	●	•	•	•	•		•	●	
Save Lives	•	•	●	●		•			•	
Automate Workflow Processing	●	•	•	•		•		•	•	
Improve Information Processing	●	•	•	•		•		•	•	
Comply with State and Federal Mandates	•	•	•	•		•			•	
Protect your Community	•	•	●	●		•			•	
Improve Communication, Coordination and Collaboration	•	•	•	●	•	•	•	●	•	
Provide Data to Regulators, Developers, and Other Interested Parties	•	●	•	•					●	
Respond More Quickly to Citizen Requests	•	●	●	●	●			●	●	●
Improve Citizen Access to Government	●	●	•	•				●	●	●
Effective Management of Assets and Resources	•	•	•	•					•	

A Management Strategy for the City of Champaign

Essential to the success of the City of Champaign's enterprise GIS effort will be how GIS fits best within the organization. There are two primary organizational structures used to implement enterprise GIS within organizations throughout the United States.

The first type of structure is centralized. A centralized organizational structure maintains a central department 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 employs 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.

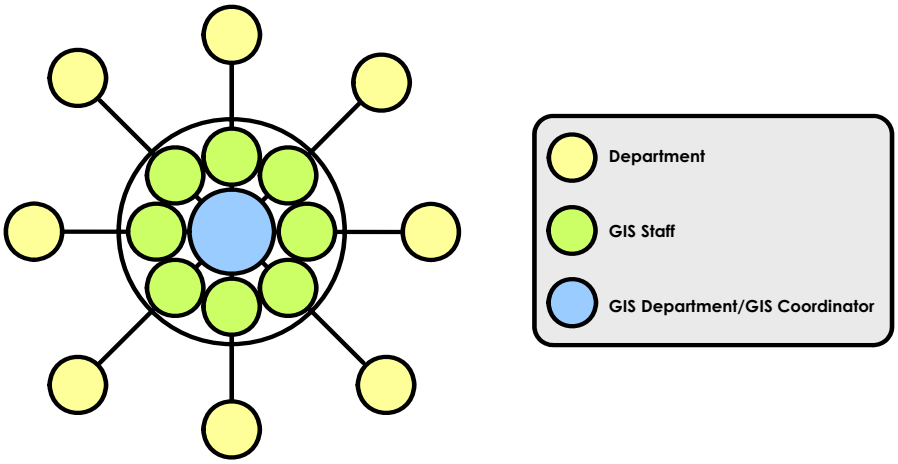


Figure 4.1: Centralized GIS Organizational Structure

The second type of structure is decentralized. A decentralized organizational structure divides GIS responsibilities throughout various departments. Decentralized organizational structures may still have a GIS Division, operating independently or under the jurisdiction of another department. This approach divides system and data maintenance between the GIS Division 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 Division 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.

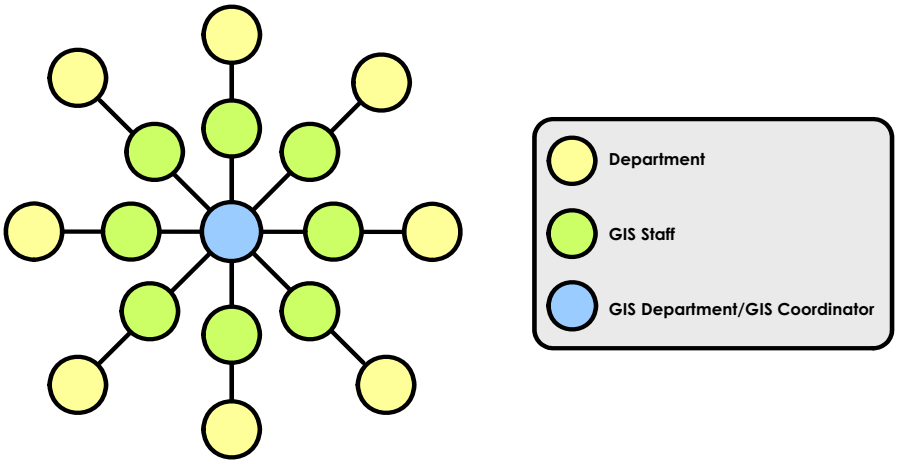


Figure 4. 2: Decentralized GIS Organizational Structure

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.

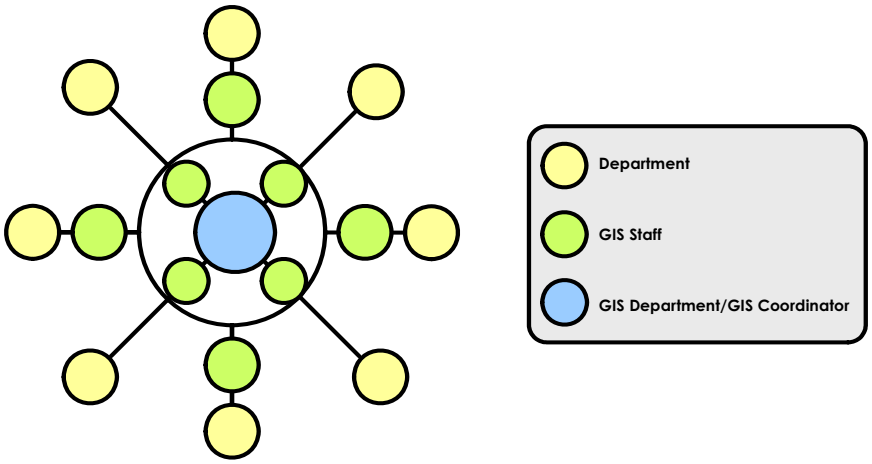


Figure 4.3: Hybrid GIS Organizational Structure

Table 4.1 on the next page summarizes the different type of GIS organizational structures.

Table 4.1 - 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.

Table 4.2 below summarizes the findings of twelve case studies (see Appendix 1 at the end of this plan). The table illustrates that the preferred model for the management and governance of GIS is the "hybrid" model.

Table 4.2 Governance Case Studies

Organization	Key GIS Department	Governance Model
Athens-Clarke County, GA	Planning Department	Hybrid
City of Tampa, FL	IT Department	Hybrid
City of Charleston, SC	IT Department/Public Works Department/Utilties Department	Decentralized
City of Norfolk, VA	Public Works/Planning Department	Hybrid
City of Columbia, SC	IT Department	Hybrid
City of Baltimore, MD	IT Department	Hybrid
City of Charlotte/Mecklenburg County, NC	IT Department	Decentralized
City of Wilmington, NC	IT Department	Hybrid
City of Raleigh, NC	IT Department	Hybrid
City of Chesapeake, VA	IT Department	Hybrid
City of Hampton, VA	Enginneering Department/Public Works Department	Hybrid
City of Roanoke, VA	IT Department	Hybrid
City of Orlando, FL	IT Department	Hybrid
City of Annapolis, MD	IT Department	Hybrid

Additionally, this table indicates that the Information Technology (IT) Department is the predominant choice for overseeing an enterprise-wide GIS initiative. There are exceptions to this pattern that indicate some organizations rely heavily on the Public Works Department or the Planning Department to spearhead their GIS initiative. However, GIS is becoming more technologically complex and thus IT centric.

City of Champaign GIS Proposed Organizational Structure

The following City of Champaign departments will utilize GIS in various capacities and should have representation on the proposed EMT (discussed later in this chapter):

- City Manager's Office
- Public Library
- Finance Department
- Fire Department
- GIS Consortium
- Human Resources Department
- IT Department
- Legal Department
- METCAD
- Neighborhood Services
- Police Department
- Public Works Department
- Planning Department

The utilization of GIS in these departments will vary from consistent daily use to more sporadic use (weekly or monthly). In addition, the 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 heaviest GIS use, as identified in this document, will be in the Public Works Department, Planning Department, and with the GIS Coordinator. However, all City departments will have access to GIS applications and data. Table 4.3 below illustrates the City of Champaign's current utilization of GIS. It illustrates the current utilization of GIS by some departments, and the overall lack of current utilization by other departments.

The City of Champaign User Profiles						
Neighborhood Services	0	**1**	2	3	4	5
Fire Department	0	**1**	2	3	4	5
METCAD	0	**1**	2	3	4	5
Finance Department	0	**1**	2	3	4	5
Human Resources	**0**	1	2	3	4	5
Legal Department	**0**	1	2	3	4	5
City Manager's Office	**0**	1	2	3	4	5
Planning	0	1	2	**3**	4	5
Library	**0**	1	2	3	4	5
Public Works Department	0	1	2	3	**4**	5
Police Department	0	1	**2**	3	4	5
GIS Consortium	0	1	2	3	4	**5**
IT Department	0	1	2	**3**	4	5

0 **No GIS Use**

5 **High Level of GIS Use**

Table 4.3: Existing User Profiles

The basic context for GIS use within the City, as a whole, has incorporated mapping and limited spatial analysis. Each department has identified the need for a holistic coordination effort aimed at managing an integrated enterprise 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 the City of Champaign currently has a decentralized GIS organizational structure. This decentralized structure is based on staff members in multiple departments serving as the lead GIS contacts for the organization. GIS functions have yet to be distributed within each department.

This organizational structure is adequate to meet a limited set of GIS needs; however, this structure will benefit from the addition of a strategic resource: a GIS Coordinator, GIS Analyst, and a GIS intern. A GIS Coordinator can identify, pursue, and foster strategic

objectives that will allow the City of Champaign to meet its short-term and long-term GIS goals and objectives. The Executive Management Team (EMT) will work with the GIS Coordinator to strategically implement the enterprise GIS. The GIS Coordinator will work with the EMT to provide leadership and management in support of the City's long term GIS vision. The GIS Coordinator will initially support the basic implementation of the enterprise GIS in accordance with the City's GIS Strategic Implementation Plan; focusing on data development/conversion efforts, application connectivity, and centralized data management. As the basic system infrastructure is established the GIS Coordinator will assist and guide departments/Line of Business with their day-to-day, tactical GIS tasks. The GIS coordinator will also be the primary liaison with the Consortium and METCAD.

GIS Organizational Structure Recommendations

The City of Champaign should implement a hybrid organizational structure for its GIS effort. Initially it is recommended that the City hire a GIS Coordinator to help support initiatives identified in this plan from the beginning of the implementation cycle. Interviews with the members of the City departments served to identify a consensus for the need to create a GIS Coordinator position. Ultimately the GIS Coordinator position could operate in one of the following capacities:

1. Option 1 - In the Information Technology (IT) Department, as a manager reporting directly to the IT Director, and the EMT. In this scenario it is recommended that the GIS Coordinator report findings and key issues to the City Manager at least in report form.
2. Option 2 – In the City Manager's Office, as a manager reporting directly to the City Manager, and the EMT. In this scenario it is recommended that the GIS Coordinator work closely with IT in regards to all aspects of the GIS implementation.
3. Option 3 – In a heavy GIS using department such as Public Works or Planning. In this scenario the Coordinator will need to keep City Management apprised of GIS progress and work closely with IT to insure seamless integration.

Based on Table 4.4 and experience, placing the GIS Coordinator in a GIS using department has more negatives than positives and therefore should be eliminated as an option. Having the GIS Coordinator reside in IT and the CMO is balanced with regards to the pros and cons. Both scenarios should work for the City of Champaign. However, based on industry trends the GIS Coordinator is found to reside most often within IT. This is especially true now due to the ever increasing complexity of the backend tools that have been incorporated into the latest GIS technology. The remainder of this document is going to presuppose that the GIS Coordinator is going to reside in the IT Department. However, if the City decides that the GIS Coordinator should reside within the City Manager's Office the following information will still apply.

Table 4.4 Pros and Cons of GIS Coordinator Departmental Placement

Variables	IT	CMO	Other
Must be Allowed to be Autonomous - Serve all Departments Equally	👍	👍	👎
Needs Unfettered Access to Other Technical Staff	👍	👎	👎
Needs Quick Access to Decision Makers	👎	👍	👎
Needs to Spend More Time with Heavy Using Departments	👍 👎	👍 👎	👍
Needs Equal Access to Key Personnel in GIS Using Departments	👍	👍	👎
Must have Ability to Make Strategic Decisions for City-wide Issues	👍	👍	👎

IT = Information Technologies Department
CMO = City Manager's Office
Other = Other Departments such as Public Works or Planning

☑ GIS Coordinator Position in IT Department

The GIS Coordinator within IT would report directly to the IT Director. IT provides planning, direction, coordination and oversight of citywide operations; as a focal point for the City's departments and strategic and tactical technology operations, the Department has visibility and exposure to the majority of existing and potential GIS users. In addition, the Department has frequent access and interaction with other regional organizations that utilize GIS and provide the City with GIS data, such as the Consortium, utilities companies, State, and Federal agencies.

Inclusion of a GIS Coordinator in this Department would provide a comprehensive foundation for coordination of efforts across departments as well as with other local organizations. In such a structure, the GIS Coordinator would work in a more independent capacity, with direction from and supervision by the IT Director and EMT, to efficiently and comprehensively expand GIS use across the enterprise.

Key advantages of the GIS Coordinator position in the IT Department include:

- Coordination of GIS efforts with citywide goals and objectives
- Full integration with IT Services staff
- Administrative hierarchy is maintained by the IT Director
- Visibility into general support issues that may be complementary to GIS
- Close cooperation with all departments and external entities
- Independent prioritization of GIS projects and tasks (City Manager and EMT will have direct contact for prioritizing projects)
- Facilitated and timely transition of knowledge and protocols to other staff that will use GIS

Key disadvantages of the GIS Coordinator position in the IT Department are:

- GIS Coordinator may be too focused on tactical objectives and consequently may not have adequate time/resources to address strategic objectives.
- GIS Coordinator may lack sufficient access to political clout necessary for enterprise GIS implementation (requires more management involvement on EMT).

GIS Coordinator Responsibilities

Data content and metadata standards should be created and enforced by the GIS Coordinator. A central data repository (centralized GIS server or servers) should be created for all GIS data. This is especially effective with ESRI's ArcGIS software, which is designed to operate from centralized GIS servers, utilizing the geodatabase model.

The GIS Coordinator, in conjunction with other personnel that will serve as "GIS liaisons" from several departments, will be responsible for managing and coordinating data creation and maintenance of department-specific data layers, as well as establishing data integrity checks for critical enterprise layers.

Based on the resources available to the City, it is recommended that the GIS Coordinator serve as a project manager for data development efforts. In addition, the GIS Coordinator will need to provide data editing support for some departments. Additionally, the GIS Coordinator will facilitate the exchange of data with external entities that participate in mutually beneficial data sharing.

The GIS Coordinator will serve as the lead resource for identifying, evaluating, and procuring GIS applications for department-specific functions, as well as the City in general. It is recommended that the GIS Coordinator work in conjunction with the IT Director and IT support staff with regard to application support and large-scale installations. The GIS Coordinator should ensure that application maintenance agreements be maintained between the City and the application provider. Public Works will play a vital role in data collection and data management.

GIS-participating departments should have visibility, access, and significant input to the GIS Coordinator's application evaluation, as well as some authority to recommend new GIS applications for their own use. The GIS Coordinator will review all requests for compatibility and applicability with IT personnel.

The GIS Coordinator should implement three levels of departmental support, depending upon the current level of GIS use and internal capabilities per department (these levels of support correlate to tiers of GIS utilization (GIS user tiers).

The GIS Coordinator should provide these levels of support:

- **Level 1** — GIS Coordinator provides minimal support for department GIS activities, system and application support. The GIS Coordinator is used primarily for strategic and procedural support. At present, the Public Works Departments and to a slightly lesser degree the Planning Department are the only Level 1 departments.

- **Level 2** — GIS Coordinator provides partial support for department GIS activities. A Level 2 department will do some data maintenance, but the GIS Coordinator will provide advanced support; the GIS Coordinator will also be responsible for advanced spatial analysis, geodatabase development (where/when applicable), and application development (e.g. IMS integration, GIS browser configuration, mobile application development). By the end of the first year of implementation, the Neighborhood Services Department, Fire Department, Finance Department, and Police Department will receive Level 2 support.

- **Level 3** — GIS Coordinator provides all support for department GIS activities. The GIS Coordinator is responsible for data maintenance, complex data analysis, and high-end cartographic products. The Human Resources Department, Legal Department, City Manager's Office, and the Library are the City departments that will receive Level 3 support from the GIS Coordinator.

Each department should strive to achieve Level 2 or higher support status as GIS develops and is incorporated into its respective business processes. The first few years of implementation will be focused on enterprise initiatives that support the dissemination of GIS technology to the department level.

The GIS Coordinator should facilitate training and technical support for all enterprise GIS applications. All GIS software training should be coordinated through the GIS Coordinator to ensure maximum efficiency and effectiveness at a minimum cost. In some instances the GIS Coordinator should organize and lead classes (e.g. new browser configurations or features). Additionally, the GIS Coordinator should document application configurations specific to personnel needs (e.g. modifications to out-of-box functions) so that self guided training and reference materials exist for all GIS supported workflows.

Not every department at the City of Champaign 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 Coordinator will assist these departments with their GIS needs. However, as usage of GIS grows, the GIS Coordinator must encourage and facilitate the acquisition of appropriate training to handle data maintenance responsibilities for these departments.

To reiterate, how GIS fits within the organization is essential to the success of this enterprise effort. The City of Champaign should implement and utilize a hybrid organizational structure. Having a GIS Coordinator is an important factor with regard to GIS success. The GIS Coordinator should be utilized to direct the overall GIS efforts of

the organization. The GIS Coordinator will provide technical expertise, training, and direction for all City of Champaign's staff. Working in tandem with the IT Department, the GIS Coordinator can provide sound and sophisticated technical GIS services for the City of Champaign. However, each department should eventually develop its own expertise and begin to utilize GIS in its daily routine as the City's GIS implementation progresses.

GIS Enterprise Staffing

Staffing issues will be critical to the success of the City of Champaign's enterprise GIS effort. Unfortunately, staffing can also be a complex and frustrating issue. Budgetary and political realities within local governments place constraints on what can be accomplished. Ideal staffing structures are sometimes difficult to attain. Nonetheless, there are fundamental steps that the City of Champaign can take to ensure a proper staffing foundation, which can be improved upon as time and necessity dictate.

The size of a local government organization plays a significant role in staffing issues. The needs of a large city are different from those of a small town. Enterprise staffing can be categorized into functional areas.

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 multiple functional areas, as will be the case for the City of Champaign. Individual job descriptions are provided later in this document. The City of Champaign already has its own job classification structure in place, so careful consideration will be needed when assigning employees of particular functional area to the proper job classification. The following describe the GIS functional areas of expertise:

GIS Coordination

It is vital to the success of the City's GIS effort to have a GIS Coordinator. The GIS Coordinator is responsible for all resource and project coordination pertaining to GIS initiatives, as well as the effective day-to-day operation of the enterprise GIS. This includes hardware and software issues, database design and maintenance, technical support, and management of the GIS. A GIS Coordinator must have the technical savvy to use diverse GIS software and coordinate the development and deployment of enterprise GIS components in an organized and efficient manner, and the people skills to coordinate, sell, champion, teach, and referee the implementation of GIS.

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 that maximizes system availability for all GIS end-users is the responsibility of IT and GIS staff. System Support within the City of Champaign will be provided primarily by the GIS Coordinator who will ensure proper system knowledge transfer and training recommendations for existing IT personnel.

GIS Application Development (Especially Web Based Applications)
Many larger organizations have their own GIS application development staff. Software development environments such as ESRI's ArcObjects allow for custom application development to suit individual department and enterprise needs. Flagship and desktop GIS packages such as ESRI's ArcGIS allow customization of design and functionality. Primarily developed with ESRI's ArcServer, these GIS-based web applications require staff for its creation and maintenance.

It is recommended that the GIS Coordinator determine if any application development efforts can be implemented in-house. Given the application development resources available to the City, it is expected that many application development initiatives will be outsourced on a project basis to qualified application development consultants/vendors. Equally important, the GIS Coordinator should ensure that out-of-the-box functionality or off-the-shelf applications will not meet the needs of user groups prior to making the decision to outsource development.

GIS Database Support
Most GIS solutions are designed to operate from commercial relational database management systems (RDBMS), such as Oracle or MS SQL Server. 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 are responsible for implementing and maintaining the effective operation of the central GIS repository.

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 the City of Champaign. However, the City's existing IT staff in conjunction with the GIS Coordinator and outside consultants (as-needed) should establish a logical and physical model for a centralized geodatabase repository. Access to the repository should be based on network permissions and can be coordinated with the IT Department. One of the existing Network Engineers will need to have training on database setup and support. This has been discussed in the IT needs assessment.

User Support (GIS Analyst and GIS Technician, and GIS Specialist)
This is a very broad category, and encompasses both GIS-core staff and GIS-departmental staff, depending on organizational structure. Generally, GIS Analysts, Technicians, and Specialists fall under the User Support category. This staff provides enterprise GIS activity support as well as support to departments beyond what existing staff requires. This is important as an analysis is performed of the three options for the first year's data creation activities. 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 Coordinator provide User Support for those departments that he/she deems appropriate. As GIS usage grows throughout the City, the City may wish to hire additional GIS resources, such as GIS Analyst or Technician, or continue to utilize external consultants on a contractual basis to meet future GIS user support demand. The GIS Coordinator should have the system knowledge to tactically implement the user requests, and/or streamline and configure GIS workflows to meet the analytical needs of GIS users.

It is recommended that the GIS Coordinator serve to collect, produce, and maintain primary GIS datasets, such as the City's base map layers. The GIS Coordinator will be responsible for ensuring the appropriate migration of data.

It is recommended that additional data collection, production, and maintenance for new GIS datasets be coordinated by the GIS Coordinator; however, in the long term, as personnel are trained and gain the relevant knowledge for data collection/production, some departments may engage in collection, production, and/or maintenance of datasets specific to their own needs (with guidelines from the EMT and GIS Coordinator).

An additional source of data collection and production could be provided by a formal internship program, interns could be provided locally by the University. Intern qualifications will have to be carefully screened to fulfill this role and ensure data accuracy and reliability. In some instances an external resource should be retained to collect and develop field data.

GIS Technician/s will need to be hired to maintain the large data sets for Public Works.

Hiring vs. Retraining

A fundamental question encountered by organizations during implementation of an enterprise 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. Some cities, typically larger cities, will require GIS staff in several functional areas (outlined in the previous section).

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.

Staffing issues in GIS-participating departments are more complex when compared to core GIS staff. A primary reason for implementing an enterprise GIS is to facilitate and improve existing business processes and provide a common platform for data access and use. 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 ArcView, ArcEditor or ArcInfo, 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. However, 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 or as discussed previously the City may choose to hire an external consultant on a contractual basis to full specific requirements.

☑ Salary Structures

Equitable and consistent salaries for GIS staff and professional staff with GIS skills are important for the success of the City of Champaign's GIS endeavor. Enterprise 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 the City of Champaign is willing to provide. Salaries primarily depend on two factors: market conditions and skill sets. Although every organization is unique, the City of Champaign must ensure that salaries for GIS personnel are in line with other organizations of equal size and structure.

Different functional areas require positions with varying skill sets. The GIS Coordinator is the most important position to the success of the City of Champaign's GIS effort. It is also the only recommended position dedicated to GIS that the City should acquire immediately. A GIS Coordinator 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.

The City's GIS Coordinator will have operational responsibilities for system support, application development, and database support functions. However, existing personnel will assume tactical responsibility of the aforementioned positions. The GIS Coordinator

should provide guidance for GIS training required by existing IT Services personnel with advanced technical capabilities. These positions require knowledge of hardware specifications, networks, programming, and database administration that currently exist within the City IT Department. User support will also be provided by the GIS Coordinator in conjunction with current IT personnel with GIS skills and training.

A full-time GIS Coordinator typically has bachelor's degree in Geography at a minimum, and often they have a graduate degree. In many cases, GIS is not their only skill set – they learned it in addition to another field of study. Salaries for GIS Coordinator's will typically range from $66,700 to $93,800 depending on the market place, cost of living, and experience.

Staffing Analysis

An in-depth look has been undertaken to ascertain the additional level of effort required of each department within the City of Champaign. The initial reaction of many staff when implementing a new technology is that it will add significantly to their workload. In some cases this is true. However, in many cases GIS will yield a net reduction in effort required of existing staff. The following is a detailed look at the impact that each GIS need will have on the specific departments. A net time burden or time savings is quantified for each GIS task identified for each department. These quantifications are based on the experience of similar GIS implementations throughout the country. Three different scenarios were analyzed for Public Works due to the volume of needs and data that they will need to maintain. Options for Public Works range from outsourcing all data collection to doing all data collection in-house.

This analysis presupposes that funding will be available for the initial data creation of layers for various departments (other than Public Works, which is being addressed separately). However, an alternative to outsourcing the creation would be hiring a GIS Technician under the GIS Coordinator. This Technician would assist in the creation and maintenance of various data layers and would assist on project work as needed.

The following tables illustrate the approximate level of effort (measured in hours per week) for specific departmental GIS tasks or activity.

Legend for Staffing Analysis

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Neighborhood Services Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Mapping and Spatial Analysis of Neighborhood Wellness, Community Development and Other Key Data – Including automatic dialing and mailings • Staff currently conducting these tasks using various methods – similar tasks are taking at least twice as much time	5 hours per week
Public forum neighborhood and vicinity mapping • Staff currently conducting these tasks using various methods – similar tasks are taking at least twice as much time. New data layers will add value to this and save additional time.	3 hours per week
Creation of a GIS enabled Neighborhood Wellness Action Plan • This is a change of way data is managed and handled. Data for the neighborhood wellness plan is currently being managed in various ways. This task automates some of this.	2 hours per week
Mapping and Spatial Analysis for Support of Community Investment Programs and Projects • Staff currently conducting these tasks using various methods – similar tasks are taking at least twice as much time	5 hours per week
Cartographic Products for Grant Proposals • Staff currently conducting these tasks using various methods – similar tasks are taking at least twice as much time. New data layers will add value to this and save additional time.	1 hour per week
Public Access to Geospatial Neighborhood Services data • Staff will save time since the public will be able to answer question via the Internet and Public Access Kiosks	5 hours per week
Formal GIS training for Neighborhood Services staff • Training on Various Tools	Annual average of four staff hours per week
Neighborhood wellness plan managed as an ESRI data model • Automation of data for wellness plan – change business flow	Net Break Even Weekly
Interfacing TRAKiT and OneRoof data with GIS • Automated	Net Break Even Weekly
Field access to GIS data • Quick Access to data that would have to have been gathered in the office	5 hours per week

Neighborhood Services Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Maintenance of Neighborhood Services Data Layers and New Data Needed for GIS	10 hours per week
Net Time Savings or Burden	11 hours per week

Overall Time Burden or Savings – Staff will see net savings of 11 hours per week.
Staff Recommendations – No new staff are required for the Neighborhood Services Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Fire Department	
Identified GIS Task	**Time Savings Realized**
Spatial analysis of fire incidents • Data will be automatically mapped from FireHouse. Any analysis done now has to be performed by hand.	2 hours per week
Spatial analysis of inspections, building permits, and certificates of occupancy for Building Safety • Similar to the fire incidents. These GIS layers will be automatically created from existing data sets. Having all of this data in one portal will save staff a few hours per week.	2 hours per week
GIS for ISO rating • This task is done every few years. Various mapping components are required. This will be easier with the availability of more GIS data.	Break Even
Field access to geospatial data (MDCs currently in-house) • New capability • Ability to view data in the field to quickly access key data • Staff will now be able to obtain data that would have required an office visit.	1 hours per week
Emergency Operations disaster response and recovery • Automation of some current tasks and implementation of new data sets	Break Even
Enterprise access to digital pre-plans and hazardous material data • Accessibility of current data in-house and in the field. • These files are already being collected and stored in existing systems. GIS will allow for easy access and viewing by location.	Break Even
Mass Notification • New capability • Not doable now • New time burden is negligible	Impossible without GIS
Public access to building safety and inspections data • Via Internet • Files automatically generated	Break Even
Net Time Savings or Burden	5 hours per week

Overall Time Burden or Savings – Staff will see a negligible amount of time burden and will be able to perform more and new tasks in an expedient manner.
Staff Recommendations – No new staff are required for the Fire Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Finance Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Use GIS to map financial information, billing, business licenses and permits, and general CIP budget information by integrating, accessing, and viewing the data stored in the following software solutions; GEMS, TRAKiT, Questica	Automated Process – Break Even
Use the city-wide Intranet GIS software solution to access all digital city-wide data layers.	Break Even
Use GIS to generate maps for the following: • Fee Recovery • Capital Improvement Plan (CIP) Maps – generated by Planning and Public Works.	1 hours per week (Presumed to be a new operation)
Replace the Public Works spreadsheet documents with in-house GIS software for all GASB34 reporting	(Finance will work closely with Public Works Activity – Joint Activity)
Use GIS to access digital files including legal documents, NSD Nuisance Abatement, planning documents, and County property assessment tax rates	4 hours savings per week
Use GIS for financial analysis and planning, including: a. Evaluating average and median property values, including trends b. Map and evaluate various tax revenues in a defined area, including trends c. Map and analyze building permit activity d. Predictive modeling for property values and future tax revenues	3 hours of savings per week (Automated process replaces existing manual process)
Certified GIS training for two staff members on Tier 2	120 hours (3 staff 5 days of GIS Training)
Net Time Burden Added or Savings Realized	Potential savings of 8 hours per week

Overall Time Burden or Savings – All of the time savings or burdens are an educated guess and indicate a general understanding of the impact. An initial 120 hours of one-time training, 6 hours of additional new GIS related work, and a potential savings of 1 hour per week (re-occurring)
Staff Recommendations – No new staff are required for the Finance Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Human Resources Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Use the Intranet GIS browser to access all pertinent data layers within the City, including access to data within GEMS.	3 – 6 hour per week savings– (previously accomplished using manual techniques)
Develop enterprise GIS staffing job descriptions, including: • GIS Coordinator • GIS Technician	5 hours (one-time occurrence)
GIS Training for six staff members on Tier 3	6 hours (one-time occurrence)
Net Time Burden or Savings	Slight initial burden – 11 hour one time commitment and 6 hours of time savings

Overall Time Burden or Savings – No Significant Burden on the Human Resources Department – Slight burden of 5 hours (one-time)
Staff Recommendations – No new staff are required for the Human Resources Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Legal Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Establish City-wide GIS data sharing, cost recovery, or revenue generation policies	10 -20 hours (Council Approved) one-time occurrence
Develop disclaimer notifications on all digital GIS data, and all hardcopy maps	5 hours (one-time occurrence)
Utilize the GIS Intranet to access all City-wide data	3-6 hours per week time savings
GIS Training for nine staff members on Tier 3	18 hours (one-time occurrence)
Net Time Savings or Burden	Slight initial burden – 43 hour one time commitment and 3-6 hours ad-hoc optional GIS daily use that will save time

Overall Time Burden or Savings – No Significant Burden on the Legal Department – 44 hours of initial work and 3-6 hours optional use that will save time
Staff Recommendations – No new staff are required for the Legal Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

City Manager's Office	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Use GIS technology to give Council Members access to spatial data from an Internet Solution. This would allow Council members to: • View the potential impact of Annexation, Re-zoning, other properties • Show residences within Council districts	General Saving (automating a manual process)
Make GIS tools available during Council meetings. This would all on-the-fly analysis including: • e.g. Cell tower ordinance distance requirements and location of dog grooming facilities	General Saving (automating a manual process)
Use GIS to allow City Council and City Manager's Office to track and map historic zoning records, and other key issues including: • Zoning Variances • Business Licenses	2-3 hours saving time a week
Use GIS for forecast/ predictive modeling of population • trends	General Saving (automating a manual process)
Use GIS to assist in Council Redistricting	General Saving (automating a manual process)
Use GIS to potentially improve economic development	General Saving (automating a manual process)
Determine the best solution for providing GIS data to: • Outside interests? Cost recovery or revenue generation?	Council to Approve Task
Address the Return on Investment- Quantify how GIS can improve services to customers and internal	1 hour a week
GIS training for City Manager's staff members on Tier 3	24 hours (12 staff 1 time occurrence)
Net Time Savings or Burden	Significant Time Savings

Overall Time Burden or Savings – No Significant Burden on the City Manager's Office. New technology offers improvement to the business process.
Staff Recommendations – No new staff are required for the City Manager's Office.

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Planning Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Mapping and spatial analysis of land use, zoning, environmental and other key data • Staff currently conducting these tasks using various methods – similar tasks are taking at least twice as much time	10 hours per week
Automated neighborhood and vicinity mapping • Staff currently conducting these tasks using various methods – similar tasks are taking at least twice as much time. New data layers will add value to this and save additional time.	3 hours per week
Planning support systems • Some analysis is not possible now without these tools. Other analysis can be accomplished but requires gathering from disparate sources.	5 hours per week
Public access to geospatial planning data • Staff will save time since the public will be able to answer question via the Internet and Public Access Kiosks	5 hours per week
Formal GIS training for Planning staff • Training on Various Tools	Annual average of four total staff hours per week
Integration and utilization of imaging data in conjunction with GIS • Addition of scanning and archiving data	8 hours per week
Neighborhood wellness plan managed as an ESRI data model • Automation of data for wellness plan – change business flow	Net Break Even Weekly
Interfacing TRAKiT data with GIS • Automated	Net Break Even
Maintenance of Planning Data Layers and New Data Needed for GIS	8 hours per week
Net Time Savings or Burden	3 hours per week

Overall Time Burden or Savings – Staff will see net savings of 3 hours per week.
Staff Recommendations – No new staff are required for the Planning Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Public Library	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Facilitate the use of a GIS Internet browser within the new Library	Break Even
Utilize the enterprise-wide GIS Intranet browser for access to local City data and information	Break Even
GIS training for 100+ staff members on Tier 3	12 hours of training (6 staff – train the trainer) 1 time occurrence
Net Time Savings or Burden	Slight Training Burden

Overall Time Burden or Savings – No Significant Burden on the Public Library – 12 hours of training, 1 time occurrence
Staff Recommendations – No new staff are required for the Public Library

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Public Works Department	
Identified GIS Task	**Time Savings Realized**
Mapping and spatial analysis of facilities and infrastructure data • Much of this analysis is not being done now • If being done it is being done by gathering data from disparate sources	10 hours per week
Field access to geospatial data • Can only be done with hardcopy maps now • Availability of highly accurate data in the field will save time in regards to finding features and not having to gather information back in the office.	10 hours per week
GIS-based work order management • Will require moving from a paper based work order system to a digital system • Time savings in current efficiencies in the field	Break Even
Wastewater and storm water modeling and monitoring • Much of this analysis is not being done now • New data will allow decision makers to make much more informed decisions	Break Even
Public access to geospatial public works data • Automated	Break Even
GIS-based public notification for emergencies and maintenance • New service – not being done now • Negligible staff burden	Break Even
CAD Standards for Plan Submissions • One time standardization – no ongoing time burden • GIS Coordinator will be heavily involved	Negligible
Automated Vehicle Location (AVL) • Potential of time savings by tracking efficiencies and optimizing services	5 hours per week
Access to spatially enabled as-builts and CAD drawings – links to document management system via GIS • Addition of scanning and archiving data	8 hours per week
Pavement Management • Data being gathered in the field and reviewed manually. Will result in optimization of costs but not significant time savings	Break Even
Parking Management via GIS • New data creation time balanced with time savings once implemented.	2 hours per week

Public Works Department	
Identified GIS Task	**Time Savings Realized**
Creation and maintenance of utility data sets • Scenario 1 – outsource initial data collection. New position plus moving co-op position to a full time GIS Technician position. These staff will be charged with maintaining data sets. • Scenario 2 – utilize a combination of outside data collection experts and in-house staff. ½ of data collection outsourced. Will require 3 new technicians and moving co-op position to a full time GIS Technician. Three to five year data collection time horizon. Once initial data collection has been completed over a three year period. 80 staff hours would be needed to maintain the data. • Scenario 3 – conduct all data collection and maintenance in house. Will require 6 new technicians and moving co-op position to a full time GIS Technician. Three to five year data collection time horizon. 80 staff hours would be needed to maintain the data.	80 hours per week 160 hours per week. 280 hours per week.
Net Time Savings or Burden **Scenario 1** **Scenario 2** **Scenario 3**	63 hours per week 143 hours per week 263 hours per week

Overall Time Burden or Savings – Three scenarios were presented for data collection yielding an overall a time burden ranging from 63 hours to 263 hours.

Staff Recommendations – Hiring a GIS Technician is recommended in the second year of implementation and others should be hired as needed (determined by GIS Coordinator and Public Works Director).

Scenario 1 – outsource initial data collection – Requires hiring of one new GIS Technician and moving the co-op position to a full-time GIS Technician position.

Scenario 2 – outsource ½ of the initial data collection. Requires the hiring of three new GIS Technicians and moving the co-op position to a full-time GIS Technician position. Once the data collection is complete the need for retaining two of these technicians will not be required.

Scenarios 3 – conduct all of the initial data collection in-house. Requires the hiring of six new GIS Technicians and moving the co-op position to a full-time GIS Technician position. Once the data collection is complete the need for retaining five of these technicians will not be required.

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Police Department	
Identified GIS Task	**Time Savings Realized by Police Staff**
Mapping and spatial analysis of criminal activity, incidents, and accidents • A few minutes per map per officer • Gathering information by hand or utilizing existing mapping staff - many needs currently impossible to attain now.	A few hours per task
Field access to geo-spatial data • New capability • Ability to view data in the field to quickly access key data	A few hours per task
Mass Notification System • New capability • Not doable now	Impossible without GIS
Public Access to Geo-Spatial Police Data • Via Internet • Files automatically generated	A few hours per week
Formal GIS training for Police staff • Training on Intranet tool	2 hours per staff person annually
Net Time Savings or Burden	Negligible Time Burden

Overall Time Burden or Savings – Staff will see a negligible amount of time burden and will be able to perform more and new tasks in an expedient manner.
Staff Recommendations – No new staff are required for the Police Department

Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

Information Technologies Department	
Identified GIS Task	**Net Time Burden Added or Savings Realized**
Coordinate all GIS Activities • GIS Coordinator	40 hours per week
Provide database support – network engineer	2 hours per week
Provide GIS support for various departments above what the GIS Coordinator will be able to manage. This should not occur until year three.	40 hours per week
Net Time Savings or Burden **Years 1 and 2** **Year 3 and beyond**	42 hours per week 82 hours per week

Overall Time Burden or Savings – An additional time burden of 42 hours per week will be realized in years one and two, which will increase to 82 hours per week in year three.
Staff Recommendations – A GIS Coordinator will need to be hired in the first year of this project. The need for the addition of a GIS Analyst will occur in Year 3.

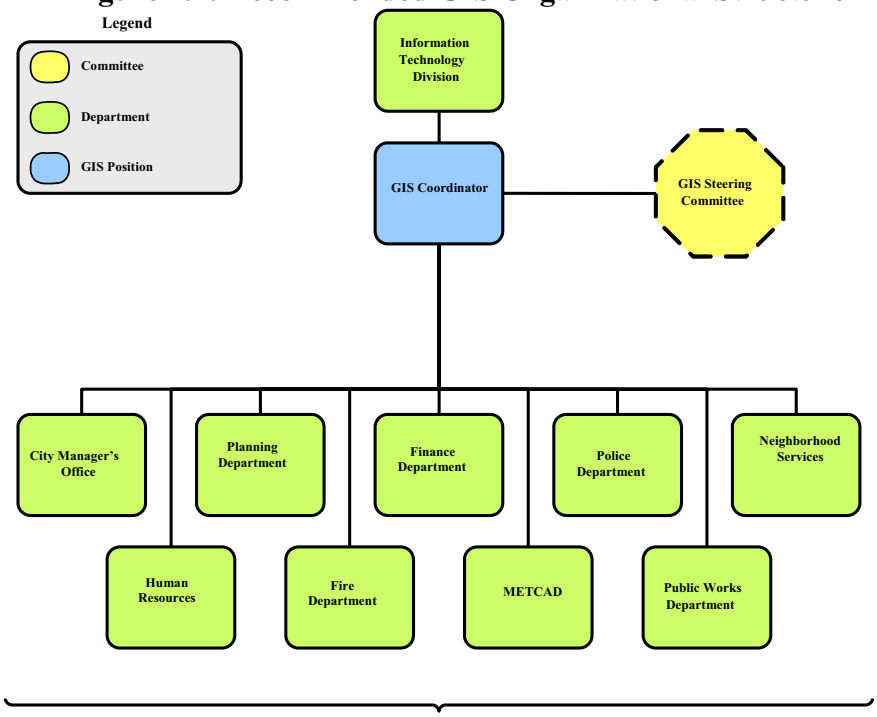
Blue: Time Saving
Red: Additional Time
Orange: Break even or New Function Impossible without GIS

GIS Staffing Recommendations

A new position of GIS Coordinator; in the IT Department, reporting directly to the IT Director, and the EMT is being recommended for the first year of this project.

The GIS Coordinator is an IT (or enterprise position) and should be funded as such. Each contributing department will be responsible for ensuring that their respective personnel work in conjunction with the GIS Coordinator to meet GIS goals and objectives as well as to follow GIS-related regulations and procedures.

Figure 4.4: Recommended GIS Organizational Structure



Additionally, a GIS Specialist is being recommended to work under the GIS Coordinator in year three of the project. Utilization of interns is recommended throughout the life of this project. Public Works will need from 2-7 new GIS Technicians based on outsourcing decisions.

Model GIS Job Descriptions

GIS Coordinator (Assistant IT Director for GIS - City of Champaign)

Nature of Position: This position requires a broad range of management, business, and technical skills to guide the successful implementation of an enterprise GIS within the City of Champaign. The GIS Coordinator has overall responsibility for ensuring that key GIS work elements – hardware, software, networks, databases, and staff resources – are managed, maintained, and enhanced to meet agreed-upon city requirements.

Oversee all enterprise GIS operations including database management and administration, data structure and metadata development, system administration, GIS software selection, implementation and user support, GIS project management, budgeting, marketing, and training. The GIS Coordinator should be expected to spend 40% of their available time focused on tactical and operational implementation of GIS components for Citywide and department initiatives (e.g. analysis, mapping, application configuration and deployment, geodatabase development). 60% of their available time should be spent on strategic and program management ensuring the enterprise GIS goals and implementation schedule is maintained (e.g. project management, guiding internal resources, managing external consultants).

Education: Bachelor's Degree required in Geography, Computer Science, Earth Science, Engineering, Planning, or related discipline and minimum 3 years experience in GIS project management for local governments and 2 years experience GIS development and maintenance, or an equivalent combination of education and experience. Master's Degree in Geography preferred.

Skills: Experience with government GIS applications, especially in business areas such as planning, public utilities, transportation, police, fire, EMS, and city base map creation and maintenance. Experience developing schedules and managing complex information technology projects. Familiarity with business process analysis as it relates to GIS. Active participation in professional GIS, mapping, and/or surveying organizations and activities. Excellent verbal, written, and interpersonal communication skills. Ability to communicate technical information in a non-technical manner. Ability to lead and motivate work teams.

Computer Skills: Experience with ESRI's ArcGIS suite of products in a Windows environment and Autodesk AutoCAD applications and architecture. Experience in database administration, relational database design, development, and implementation. Working knowledge of ArcSDE, ArcServer, and ArcGIS modeling and analysis is required.

Nature of Contact with Other People: The GIS Coordinator will act as the geographic information expert for the City. The GIS Coordinator provides oral and written progress reports and updates to superiors and oversight committees. The position requires an extensive amount of communication at all levels of the City government and external organizations.

Salary: $66,700 - $93,800, commensurate with experience.

GIS Specialist
Nature of Position: GIS application support and project oversight, spatial data layer creation and conversion, geodatabase management and administration, data analysis, map production, GPS data collection, user support, and specific GIS project management.

Education: Bachelors Degree in Geography, GIS, Computer Science, Earth Sciences, or related discipline.

Skills: This position is highly technical in nature and requires a candidate with existing GIS and GPS knowledge and skills in order to perform tasks efficiently; software design and development skills are required as well. Familiarity with geodatabase design, implementation, maintenance, and management. Familiarity with geographic projections and cartographic principles, as demonstrated through coursework or work experience. Working knowledge of how to edit GIS data, including geodatabases, shapefiles, and CAD files, and knowledge of how to perform logical queries of the database. Proficiency with spreadsheets and tabular data desirable. Understanding of GIS in City governments is highly desirable.

Computer Skills: Proficiency with ESRI software, particularly ArcGIS, is essential. Additional skills include object-oriented GIS application development, ArcIMS customization, and database programming, as well as GIS data conversion and GPS data collection skills. Detailed understanding of enterprise-wide GIS applications and environments is desirable.

Relevant Experience: Two years of experience with GIS and GPS concepts; two years of experience with GIS application development, specifically with ESRI software. One year of experience with enterprise geodatabases, preferably with ArcSDE and SQL Server.

Personnel Supervised: None

Salary: $45K - $65K

GIS Technician (Co-op Engineering Technician for GIS)
Nature of Position: GPS data collection, spatial data layer creation and conversion data analysis, map production, and specific GIS project management.

Education: Bachelors or Associates Degree in Geography, GIS, Engineering, Earth Sciences, or related discipline.

Skills: This position is highly technical in nature and requires a candidate with existing GIS and GPS knowledge and skills in order to perform tasks efficiently. Familiarity with geographic projections and cartographic principles, as demonstrated through coursework or work experience.

Working knowledge of how to edit geodatabases, coverage's, and shapefiles, and how to perform logical queries of the database. Proficiency with spreadsheets and tabular data desirable. Understanding of utility and transportation infrastructure highly desirable.

Computer Skills: Proficiency with ESRI software, particularly ArcGIS, is essential, as well as GIS data conversion and GPS data collection skills.

Relevant Experience: One year of experience with GIS and GPS concepts and applications. (Coursework and special projects which emphasize GIS and GPS may be counted towards this experience requirement).

Personnel Supervised: None

Salary: $25,100K - $33,700K

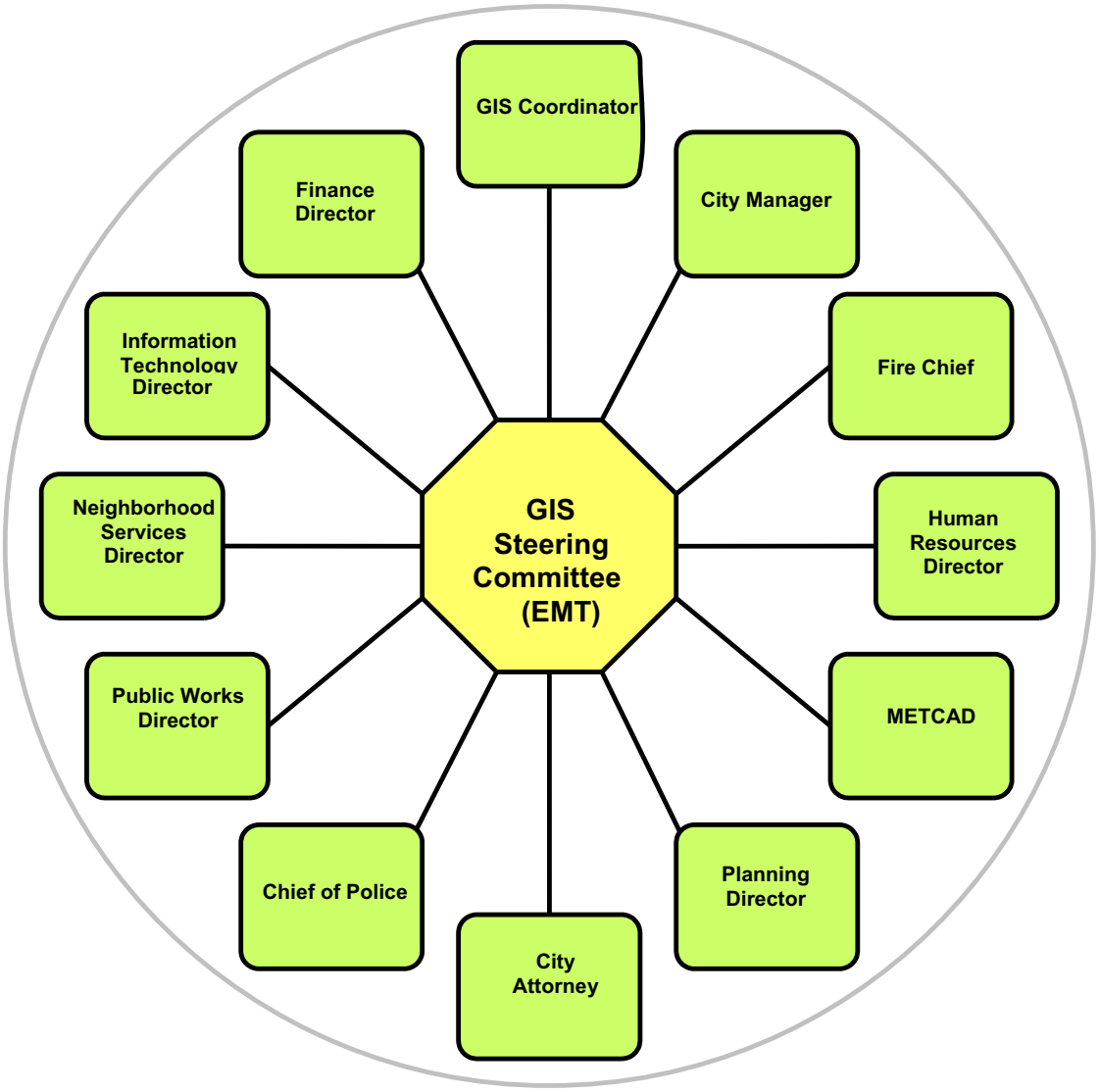
GIS Technician II – As GIS matures at the City, a GIS Technician II position can be introduced that will require a Bachelor's degree and a higher level of experience.

GIS Steering Committee (EMT) and Users Group

The City of Champaign should ensure that its EMT includes upper management staff from each major department. This committee ensures that GIS is implemented effectively throughout the organization and ensures enterprise goals and objectives are being met. The committee should develop a charter and mission/vision statement that will help guide the strategic oversight of the citywide GIS.

The EMT provides critical, high-level commitment to investment in GIS. The committee participants will be indispensable during budgeting, and each serves as a champion for GIS within his or her own department. Committee members see the benefits of GIS, subsequently lobbying for greater utilization of the technology.

Figure 4.5: Recommended GIS Steering Committee Representation (Executive Management Team)



City of Champaign GIS User Group

The City of Champaign needs to create an active GIS Users Group. However, the GIS Users Group should include GIS-utilizing staff regardless of the GIS platform from all departments with identified GIS needs as well as GIS technical staff from local and regional organizations, including the Consortium. The GIS Coordinator 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, as well as identify issues to be addressed by the EMT. 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.

Appendix I: Governance Case Studies

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Athens-Clarke County, GA	Mary Martin GIS Administrator 706-613-3515	Enterprise-wide-GIS under the planning department. Data housed on GIS server. Successful implementation of enterprise-wide GIS. Review and financial backing by commissioners and mayor were important parts of the City's success	Public Works Bob Faucett Land Developer Coordinator 706-613-3440	PW uses the aerial photography for storm water issues, and centerline mapping. All data creation, editing and maintenance is done by PW dept. Policy and Technical committees helped the departments work together.	Yes. Committee consists of mayor and commissioners. Served primarily as a review board and approved funding. Matrix model.
			Kyle Hendrix Assistant Fire Chief 706-613-3360	The Fire Department uses fire hydrant locations, water mains and 3 mile response files. There is live data available on the Chief's computer and static data available at the various stations. One person within the fire department oversees the GIS and coordinates with other departments	
Tampa, FL	David Frame Senior Programmer/Analyst 813-274-8401	The city is in the planning stages of enterprise-wide GIS. It will be located under the strategic planning and IT department.	Public Works Dallas Pryor Civil Drafting Supervisor 813-274-8580	GIS implementation is in the early stages. Currently they are using GIS for road mapping, and event mapping (evacuation routing etc.) Too early to comment on success but people are realizing the value of GIS	Yes. Committee was formed to assess department needs. No authoritative power, simply assessing needs. Beginning to define a Matrix model.
			Planning Dept. Allen Baker Research Analyst 813-274-8487	Planning Department currently uses GIS for demographic mapping, neighborhood mapping.	

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Charleston, SC	Tracy McKee GIS Director 843-724-3769	The city has enterprise-wide GIS located in the planning and neighborhoods department. A Unified database warehouse is used. GIS implementation has been very successful.	Planning Department Phillip Overcash, Planner 843-724-3787	Data is created and Maintained for the planning department. Zoning, Mapping and addressing are primary tasks. Implementation has been slow but successful.	No steering committee or review board. No clearly recognizable model. Most likely a Distributed -Matrix model.
Norfolk, VA	Charlie Kennedy GIS Tech 757-664-6743	GIS is implemented in the IT, public works and utilities departments. Success has been fair but could have been improved with more Unified oversight.			No steering committee or review board. Distributed model.
Columbia, SC	Phillip Clouss GIS Applications Tech 803-545-3338	City is in the process of implementing enterprise-wide GIS. There is a Unified data warehouse. Implementation has been very successful.	Kim Fowler 803-545-3780 Senior Administrator for Public Works	PW Dept uses to route sanitation routes, street sweepers. Editing can be done by PW on certain layers. Overall very happy with how GIS is working.	No steering committee or review board. Implementing a Matrix model.
			Skip Hudson Planning 803-545-3222	Planning Dept. database maintains real property ownership, Annexation and historic preservation. GIS is successful with the staff using however financial backing from elected official would be outstanding.	
Baltimore, MD	Miranda Brunett GIS Analyst 410-396-4106	GIS is used throughout this city and located in the IT department. Processes have been very successful.			No steering committee or review board. No clearly recognizable model. Most likely a Matrix.

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Charlotte, NC /Mecklenburg County	Andy Goretti GIS Division Manager 704-336-4918	GIS has been implemented in the city and county. GIS falls under the IT department. The County has a Central data warehouse; the city does not. The city has had some issues in its success.			Steering committee was formed for the city's implementation for policy and procedures only. County had none. No authoritative power was provided for the committee. Clearly a complex Matrix model with distributed components.
Wilmington, NC	Jim Sahlie GIS Coordinator 910-341-5826	GIS is used throughout most city departments. GIS is located in IT department. There is a central data warehouse. Implementation has been very successful.			Yes; ad hoc committee was formed for oversight more than guidance and funding approval. Matrix model.
Raleigh, NC	JJ Walters GIS Tech 919-516-2526	The city has an enterprise-wide GIS under the IT department. There are multiple sites for data. Success has been moderate.			No steering committee or review board. No official model adopted; informal modal typically distributed.
Chesapeake, VA	Paul Paris GIS Administrator 757-382-6391	The city has an enterprise-wide GIS located in the IT department using a Unified data warehouse. Very successful.	Bob Wethering Public Works 757-382-6101	Public Works uses GIS for creation of Maps, sanitation routing. The data warehoused by the IT department but PW is responsible for creating and maintaining their data. Not the best system but they have learned to work around it.	No steering committee or review board No official model adopted; data structure suggest Matrix
Hampton, VA	Jonah Adkins GIS Specialist 757-727-6881	Implemented throughout the city, GIS is located in the engineering and public works departments. Data centrally warehoused. Very successful.	Allen Lambert Public Works 757-727-6372	Public Works department creates edits and maintains their Departmental specific data.	No steering committee or review board. No official model adopted; data structure and location suggests distributed-Matrix model.
Roanoke, VA	Tracy Leet GIS Coordinator 540-853-2144	Steering committee had a minimal effect on success.			Steering committee Matrix model.

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Orlando, FL	Mark Hooker GIS Manager 407-246-3060	Located in IT department, GIS is integrated throughout the city. GIS has been used for 15 years but is still not where it should be. Has been successful for the most part.	Allen Owler, Director Public Works 407-246-3623	PW uses electronic mapping for utilities political boundaries and zoning. Data is centrally warehoused, and maintained by IT group. Some editing is allowed outside of IT.	IT Dept steering committee. Maturity of the system and integrated use suggest the evolution of a Matrix model.
Annapolis, MD	Paul Thorn IT Manager 410-295-7806	In the early stages of implementing GIS in the IT department; GIS does have a Unified data warehouse.			Yes. Steering committee has been formed to guide general policy and procedures. No other authority has been given. Migrating to a well-defined Matrix model

Chapter 5 - Recommended GIS Initiatives and Five Year Strategic Plan

The following sections recap and further define some of the key components that are integral to the successful five-year implementation of GIS at the City of Champaign.

System Governance

As discussed in detail in Chapter 4, proper governance of the implementation of the enterprise GIS will improve organizational effectiveness and efficiency, as well as generate a return on investment (ROI). GIS Implementation is largely a social and political process which has to be nurtured, cajoled, imposed, and controlled? A Rational Management Strategy with supporting technical competence (a corporate approach) rather than purely technology driven is the basis for a successful governance model. GIS tools should not be simply expected to succeed because of their inherent potential but rather a consequence of the strategies implemented by managers.

The need for a few new GIS positions has been identified. Additionally, existing staff will need to receive the training to become GIS users. Most departments will be able to utilize existing staff to meet their needs. However, IT and Public Works will need staff to support the enterprise effort. The following table summarizes the staff needs identified in Chapter 4:

Table 5-1: Recommended GIS Staff

Staff Position	Department	Notes
GIS Coordinator	Information Technologies	This position should be acquired in year one of the project. Will serve as GIS liaison for all departments.
2 GIS Technicians (Scenario 1)	Public Works	Scenario one assumes outsourcing of a majority of GIS data collection. Two technicians would then be tasked with maintaining the data. A GIS Technician has been recommended for year two and others will be hired as needed.
4 GIS Technicians (Scenario 2)	Public Works	This scenario assumes that some of the data collection will be outsourced. Four technician positions will be created. Once the data collection project is over, two of these positions will not be needed.
7 GIS Technicians (Scenario 3)	Public Works	This scenario assumes that none of the data collection will be outsourced. Seven technician positions will be created. Once the data collection project is over, five of these positions will not be needed.
GIS Analyst	Information Technologies	This position is recommended for the third year of this project. As GIS usage grows at the City, there will be a much larger need for expanded support and technical assistance requiring additional staff.

This chapter will detail the costs and timelines associated with GIS implementation. Staffing costs will be handled separately and will not be addressed in the cost section later in this chapter.

Software

The City of Champaign currently maintains the following software that can be used as part of the City's GIS:

Table 5-2: Existing GIS Software

Software	Version	Number of Licenses	Department(s)
ArcInfo Floating	9.2	3	Public Works and Planning
ArcView Floating	9.2	2	Public Works, Planning, and Fire
ArcSDE	9.2	1	Enterprise
ArcIMS	9.2	1	Enterprise
ArcView Single Use	9.2	3	Police
ArcPress	9.2	1	Enterprise
Grid Extension	9.2	1	Enterprise
Plotting Extension	9.2	1	Enterprise
TIN Extension	9.2	1	Enterprise
ArcServer Standard Enterprise (Two Sockets – Replaces ArcSDE and ArcIMS)	9.2	1	Enterprise

ArcServer is the latest version of ESRI's enterprise software and replaces the older technology. Therefore, ArcSDE and ArcIMS will no longer need to be maintained as ArcServer encompasses the functionality of these products. It is recommended that a standard be established for the maintenance and management of software licenses; this standard will ensure that all GIS users have the same version of a specific type of software. All licenses should be under one account number and maintained by IT and the GIS Coordinator.

The following table identifies GIS software recommended for the City of Champaign by department (based on license requirements):

Table 5-3: Recommended GIS Software by Department

Department/Division	Software	Recommended Number of Licenses or Users
All Departments	Intranet GIS Data Viewer	Site License – Different Views for Each Department

Department/Division	Software	Recommended Number of Licenses or Users
All Departments	ArcServer	Site License
All Departments	Emergency Notification	Site License
Public	Internet GIS Data Viewer	Site License – Multiple Public Applications
All Departments	GeoManager - For automating download of data from existing IT investments (TRAKiT, OneRoof, etc.)	1License
Neighborhood Services	Public Access Kiosk	1 License (Atrium City Hall)
Neighborhood Services	Mobile GIS Data Browser	2 Licenses
Neighborhood Services	Automated Neighborhood Wellness Plan Application	Site License – Custom Application
Neighborhood Services	ArcView	3 Users
Fire	Mobile Application and Disaster Management	Implementing Remote Access Now
Fire	ArcView	3 Users
Finance	ArcView	2 Users
City Manager's Office	ArcView	1 User
Planning	Planning Support System	1 License
Planning	Public Access Kiosk	1 License
Planning	ArcView	8 Users
Planning	ArcEditor	1 User
Public Works	ArcPad	10 Licenses
Public Works	Mobile Data Browser	10 Licenses
Public Works	AVL	50 Licenses
Public Works	Work Order Management/Field Editing	15 Licenses
Public Works	Addressing Application	1 User

Department/Division	Software	Recommended Number of Licenses or Users
Public Works	ArcView	17 Users
Public Works	ArcEditor	10 Users
Police	CrimeView	1 License
Police	ArcView	1 License
Police	Mobile Data Browser	45 Licenses
Information Technologies	ArcInfo	1 User
Information Technologies	Addressing Application	1 User

Table 5-4: Summary of Recommended Enterprise GIS Software

Software	Number of Licenses	Department(s)
ArcInfo Floating	3	Shared by Public Works, IT, and Planning
ArcView Floating	34 Users; 10 Floating Licenses (2 Exist Now)	Shared by all Tier 2 Departments
ArcSDE	1	Information Technologies (managed)
ArcIMS	1	Information Technologies (managed)
ArcServer	1	Information Technologies (managed)
ArcEditor	11	Planning (1); Public Works (10)
ESRI Extensions	1	Information Technologies (managed)
GeoManager	1	Information Technologies (managed)
ArcPad (Field Data Collection)	7	Public Works
Address Management	2	Public Works, IT
CrimeView	1	Police
AVL	50	Public Works
Work Order Management	15	Public Works
Mobile Data Browser	57	Neighborhood Services (2); Public Works (10); Police (45)
Planning Support System	1	Planning
Automate Neighborhood Wellness Plan	Site License	All Departments

Software	Number of Licenses	Department(s)
Intranet GIS Data Browser	Site License	All Departments
Internet Data Viewer	Site License	Public
Emergency Notification System	Site License	All
Touch Screen Kiosk	2	City Hall (Public) and Planning

Software Options

A variety of GIS software solutions exist for local government. The following table gives final recommendations on each one of the recommended solutions:

Table 5-5: Enterprise GIS Software Recommendations

Software Solution	Notes
ESRI Suite: ArcInfo, ArcView, ArcEditor, ArcServer, Various Extensions	ESRI has become the standard in the GIS industry. Other enterprise applications do exist such as MapInfo and Intergraph. However, software from ESRI has a vast majority of the market share, especially for local government. Therefore, it is the recommended solution for Champaign. Additionally, the GIS Consortium has identified this as the recommended county-wide standard.
GeoManager	This is a behind the scene data mining product, that extracts data from existing IT databases (TRAKiT, OneRoof, etc.) for data layer creation.
ArcPad (Field Data Collection)	This application will be utilized for field collection and field updates. This is an ESRI application. Other solutions exist such as those from Trimble. However, ArcPad offers Champaign the most flexibility and integration.
Address Management	This application will allow users to update street centerlines and address points. Solutions should be ArcEngine/ArcServer based. Solutions exist from Spatial Systems Associates, GTG, and others.
CrimeView	This is a solution from the Omega Group. It allows for sophisticated crime analysis. Other solutions exist but CrimeView is the most stable and is the industry leader.
AVL	Many vendors offer varying levels of AVL software solutions. The key is that the product allows users to receive data via a TCP/IP transport. Inexpensive GPS devices and services from the local cellular companies can be utilized. It is highly recommended that the AVL solution works with the ArcServer Intranet solution.
Work Order Management	Various solutions were discussed in Chapter Two (Azteca, GBAMS, Hansen). The Azteca solution is being recommended as it most closely fits the needs identified in this plan.
Mobile Data Browser	This application should offer remote syncing capabilities. It should be an ArcEngine based application that can run disconnected from the network.
Planning Support System	Chapter two identifies three possible solutions. It is recommended that Planning staff participate in demonstrations of each of these products to determine the best solution for their needs.
Automate Neighborhood Wellness Plan	This will be a custom application. The application should leverage the ArcServer implementation and should have live maps within the digital on-line document.

Software Solution	Notes
Intranet GIS Data Browser	This application must be ArcServer based and should allow for multiple departmental views of the data. Many companies are just releasing their ArcServer versions of their local government browser solution. Solutions exist from TDC (Freeance), GTG (Geoblade), and other vendors. The GIS Coordinator should review the various solutions and pick the one that best meets the City's needs.
Internet Data Viewer	This application must be ArcServer based and should allow for multiple public views of the data. Many companies are just releasing their ArcServer versions of their local government browser solution. Solutions exist from many vendors. The GIS Coordinator should review the various solutions and pick the one that best meets the City's needs.
Emergency Notification System	This application is bigger than just GIS. It is a corporate IT application that can include IVR or can just be utilized for notification. It is recommended that IT staff determine the full need of this application. Telworks offers a full IVR solution with notification functions. CodeRed offers a solution that is focused solely on notification. Other solutions exist. The IT Department with other City leaders will need to decide the best solution for the City. However, any solution should have a strong GIS component.
Touch Screen Kiosk	This application will have a touch screen interface and will allow the public and staff to have quick and easy access to the corporate GIS database. The application should integrate with the City's ESRI ArcServer environment.

Hardware

Desktop Computers

Like many organizations, the City of Champaign is continually upgrading personal computers. New software solutions often require new computer hardware. Individual departments are budgeting replacements for their older PCs. Therefore, recommendations are given in this report that specify minimum and desired configuration of personal computers to run GIS applications. The City of Champaign needs to refer to these specifications to see if it will need to upgrade PCs to run specific GIS applications. Specifications will be looked at in two tiers.

- **Level One**: PCs to run robust GIS software such as ArcGIS (ArcInfo, ArcEditor or ArcView)
- **Level Two**: PCs to run ArcServer client applications, such as the Intranet Data Browser

There is a difference between a typical personal computer and a GIS workstation. A typical personal computer for word processing is not likely appropriately configured for GIS use. A GIS workstation demands, at a minimum, a high-end processor, large amounts of memory (RAM), and large disk space.

In the short-term, it is important that all City of Champaign personnel that will utilize Level One computers are capable of effectively supporting recommended GIS applications. In the long-term, as more City of Champaign personnel begin to use Level 1 and Level 2 GIS

applications, they should have access to computers that can effectively support these applications.

Level 1 PC to Run ArcInfo, ArcEditor and ArcView

Minimum Configuration

Approximate cost = $1,500 each

- Windows XP Professional Edition
- 1.2 GHz Pentium PC or Greater
- 1 GB of RAM or Greater
- 17" or Greater High Resolution Monitor
- 30 Gigabyte hard drive or greater
- 10/100 MBPS Ethernet Card
- 32 MB Video RAM or greater

Recommended Configuration

Approximate cost = $2,250 each

- Windows XP Professional Edition
- 2.8 GHz Pentium Processor or Greater
- 2 GB of RAM or Greater
- 19" or Greater High Resolution Monitor
- 80 Gigabyte Hard Drive or Greater
- 100 MBPS Ethernet Card
- 64 MB Video RAM or Greater

Level 2 PC to Run ArcServer-based End User Applications

Minimum Configuration

Approximate cost = $800 each

- Windows XP
- 512MB of Ram or Greater
- 17" Monitor
- 1.2 GHz Processor or Greater
- 100 MB of Unused Disk Space or Greater
- 10/100 MBPS Ethernet Card
- 16 MB Video Ram or Greater

Recommended Configuration

Approximate cost = $1,500

- Windows XP
- 1GB of Ram or Greater
- 19" Monitor or Greater
- 2.0 GHz Processor or Greater
- 100 MB of Unused Disk Space or Greater
- 100 MBPS Ethernet Card
- 32 MB Video RAM or Greater

Table 5-6: Summary of GIS PC Specifications

Level	OS	RAM	Monitor	Processor	Disk Space	Video RAM
❶	XP Pro	1 GB	>17"	>1.2 GHz	>30 GB	>32 MB
	XP Pro	2 GB	>19"	>2.8 GHz	>80 GB	>64 MB
❷	XP	512 MB	>17"	>1.2 MHz	>100 MB	>16 MB
	XP	1 GB	>19"	>2.0 GHz	>100 MB	>32 MB

Legend

Minimum

Recommended

Notebook Computers

The recommended solution for field access to spatial data for the Neighborhood Services, Public Works, Fire and Police departments is the use of notebook computers. Notebook computers have much more memory capacity and processing speed than hand-held computers, and also have much larger screens.

Ruggedized notebook computers are recommended for field personnel for access to GIS data in the field. Mounts for notebook computers should be installed in any vehicle that will contain a notebook computer. Mounting computers in vehicles makes them much easier to access and reduces wear on the machine. The mount should not be permanent, however, as notebook computers will need to be taken out of the field periodically to update data. Ruggedized notebook computers are more expensive than regular notebook computers, but the cost of ruggedized notebook computers is offset by their longevity.

Figure 5.1: Panasonic Toughbook outfitted with wireless capabilities

The following is the recommended configuration for notebook computers:

Notebook Computer – Approximate Cost = $3,500

- Ruggedized
- Weigh Less than 5 Pounds
- 1.6 GHz Processor or Greater
- 12 Inch or Greater Anti-glare Display
- CD-ROM Drive
- 1 GB RAM or Greater
- 80 GB Hard Drive Space or Greater
- 10/100 MBPS Ethernet Card and Wireless Network Adapter

Table 5-7: Notebook Computer Recommendations

Department/Division	Number of Units
Neighborhood Services	1
Fire	Already Acquired
Police Department	Already Acquired
Public Works	10
Total:	**11**

Servers

The City of Champaign will need to consider server configuration to host the City's GIS data and server-based desktop GIS applications. This server will store and distribute spatial data to all GIS applications. The City currently has two dedicated GIS Servers. One of which is classified as the ArcSDE server, and the other as the ArcIMS server. It is of utmost criticality that these servers are robust enough to run ArcServer based applications. A vital importance in this discussion is the new ESRI pricing models for ArcServer. As part of paid maintenance, Champaign received ArcServer Standard Edition. The Standard Edition allows for the use of two sockets to run ArcServer. At the Standard level each additional socket requires an additional $10,000 payment to ESRI. At the ArcServer Enterprise level the cost rises to $20,000. Therefore, hardware configurations become very important. GTG has run four scenarios that embrace one or both of the existing servers as follows:

Scenario 1: Utilization of both existing servers – no new servers (One container machine and one database server)

This scenario utilizes both existing servers. One server, the current ArcIMS server, will serve as the container machine and use both sockets. The other server, the current SDE sever, will be the database server. The database server socket usage does not affect ESRI pricing levels. As the graphic below illustrates, the server reaches a 97% capacity with twenty concurrent users. The scenario uses an average of 6 page loads a minute for each user, resulting in 120 page loads a minute overall. Additionally, 7.2 MBPS will be utilized on the network. Based on these statistics, this scenario is not recommended. The City should have many more users than 20 utilizing the system. This configuration will result in slow access, which will alienate users. Table 5.8 on the next page illustrates the performance based on this scenario. The following are definitions of terms found in the hardware specifications on the next pages:

SOC – Server Object Container - This is the primary interactive component for the ArcGIS Server application server. The SOC is the component of ArcGIS Server that handles the direct interaction with the GIS data.

SOM – Server Object Manager - This component manages requests from users by assigning the requests to an available SOC process or by spawning a new SOC process if needed.

Web ADF – Web Application Development Framework. This component provides the web services that are used to access ArcGIS Server functionality from web pages, custom application, and ArcGIS desktop products.

Cores – Cores refer to the number of embedded processors contained internally on a single CPU. Essentially, a dual core processor is a single processor that internally contains two of the previous generation of processors working in tandem.

Socket – This is a term that is generally referring to a single physical processor regardless of the number of cores present within that processor. This is further complicated when considering the licensing for ArcGIS Server. ESRI allows for up to two cores per socket and if two cores on a single processor is exceeded, licensing cost increases beyond one socket. So, for example, a single quad core processor would actually count as two sockets for ESRI ArcGIS Server pricing.

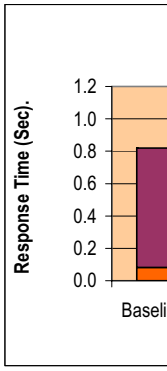
Web Application Server – A server used to host the Web ADF and SOM components of ArcGIS Server when the installation has been scaled beyond a single server.

Container Machines – When ArcGIS Server is installed in a multi server configuration, this machine is dedicated entirely to the SOC component. When installed in a single server environment, this machine contains the Web ADF, SOM, and SOC components.

Database Server – This server is used to host SQL Server and the underlying databases of the SDE Geodatabases. Under our recommendation of using Direct Connect from all client applications and from ArcGIS Server map services, there should be no ESRI software loaded on this server. If the ArcSDE component of ArcGIS Server is placed on this server to host traditional ArcSDE service connections from clients, all processors on this server will need to be licensed under ArcGIS Server socket licensing.

Types of Workflows	Data Source	Requirements Analysis – User Requirements: Users	Peak Workflow DPM/Client	Peak Workflow DPM	Network Mbps	0.0 Actual Mbps	Map Image
						100.000	
P_ArcGIS AI Desktop	SDE DC/DBMS		10				1.000 MB
2_ArcGIS Desktop WTS/Citrix	SDE DC/DBMS		10				1.000 MB
3_AGS9.2 Map Server	SDE DC/DBMS	20	6	120	2.000	7,200	0.100 MB
4_IMS ArcMap Service	SDE DC/DBMS		6				0.100 MB
5_IMS Image Server	SDE DC/DBMS		6				0.100 MB
6_AGS9.1 Map Server	SDE DC/DBMS		6				0.100 MB
1_Batch Map Production Process	SDE DC/DBMS		143				0.100 MB
2_Batch Reconcile and Post Process	SDE DC/DBMS		11				0.100 MB
Total Workload		20		120	2.000		

Web Application Server		Platform	4 GB RAM / Node		SRint2000	
		Arc06 2 core (2 socket) Baseline			44.0	
		Cores = 2	Sockets = 2	1	22.0/Core	
		Service Times Seconds	Capacity Display/Min	Multiple Platforms Nodes	Capacity	Fix Nodes
				1		1
Web Performance = 1.06 sec		1.07 sec	Sockets = 4			Minimal
Container Machines		Platform	4 GB RAM / Node		SRint2000	ADF+SOC
ADF+SOC	0.818	Intel Xeon 2 core (2 socket) 3200 MHz			37.1	SOC
Average User ..... 6 DPM		Cores = 2	Sockets = 2	1	18.6/Core	62
Total Required ..... 120 DPM		Service Times Seconds	Capacity Display/Min	Multiple Platforms Nodes	Capacity	Fix Nodes
CPU Utilization ..... 97% CPU						
Peak Users 20.6	20.6 / Node	0.970	124	1	124	1
			7,422 TPH		7,422 TPH	
Database Server		Platform	4 GB RAM / Node		SRint2000	
	0.082	Intel Xeon 1 core (1 socket) 3200 MHz			19.7	
Average User ..... 6 DPM		Cores = 1	Sockets = 1	1	19.7/Core	655
Total Required ..... 120 DPM		Service Times Seconds	Capacity Display/Min	Multiple Platforms Nodes	Capacity	Fix Nodes
CPU Utilization ..... 18% CPU						
Peak Users 109.2	109.2 / Node	0.092	655	1	655	1



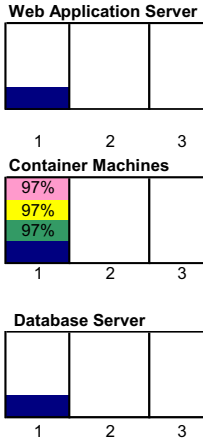


Table 5.8: Utilization of both existing servers – no new servers (One container machine and one database se

Scenario 2: Utilization of both existing servers, no new servers, move SQL to another existing server (one web application server, one container machine, and one database server)

This scenario utilizes both existing servers. Like scenario 1, one server, the current ArcIMS server, will serve as the container machine and use both sockets. The other server, the current SDE server, will become the web application server. Another existing server would then be needed as the database server. The database server socket usage does not affect ESRI pricing levels. However, utilizing the SDE server now as the web application server requires the purchase of an additional socket from ESRI at $10,000. As Table 5.9 on the next page illustrates, the container server reaches a 102% capacity with thirty concurrent users. The scenario uses an average of 6 page loads a minute for each user, resulting in 180 page loads a minute overall. Additionally, 10.8 MBPS will be utilized on the network. Based on these statistics, this scenario is not recommended. The City should have many more users than 30 utilizing the system. This configuration will result in slow access, which will alienate users. Table 5.9 on the next page illustrates the performance based on this scenario.

Scenario 3: Utilization of one existing servers and acquisition of one new server (two socket configuration) – Year One Recommendation

This scenario the existing SDE server and recommends the acquisition of one new server. One server, the current SDE server, will be the database server. The database server socket usage does not affect ESRI pricing levels. Additionally, a new server is acquired to serve as the container machine. This server will utilize two sockets but has more robust specifications than the additional existing server, thus allowing much greater speed and capacity. This configuration does not require the purchase of an additional socket from ESRI. As the graphic in two pages illustrates, the server reaches a 100% capacity with sixty-seven concurrent users. The scenario uses an average of 6 page loads a minute for each user, resulting in 402 page loads a minute overall. Additionally, 24.12 MBPS will be utilized on the network. Based on these statistics, this scenario is recommended for year one of this project. This configuration will result in sufficient access and speed for the initial year of this project. Table 5.10 illustrates the performance based on this scenario.

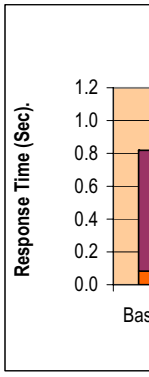
Scenario 4: Utilization of one existing server – acquisition of two new servers (three socket configuration) – Year Two Recommendation

This scenario utilizes one existing server and the acquisition of two new servers. One server, the current SDE server, will be the database server. The database server socket usage does not affect ESRI pricing levels. Additionally, a new server is acquired to serve as the container machine. This server will utilize two sockets but has more robust specifications than the other existing server currently in use, thus allowing much greater speed and capacity. Also, a second new server is acquired to serve as the Web Application Server which will expand capacity further than as in Scenario 3. This configuration does require the purchase of an additional socket from ESRI at the price of $10,000. As the graphic three pages down illustrates, the configuration reaches capacity with one-hundred concurrent users. The scenario uses an average of 6 page loads a minute for each user, resulting in 600 page loads a minute overall. Additionally, 36 MBPS will be utilized on the network. Based on these statistics, this scenario is recommended for year two of this project. The new acquisitions for year two are a new server and another ArcServer socket. This configuration

will result in sufficient access and speed as GIS usage becomes enterprise-wide and reaches the public via the Internet. Table 5.11 illustrates the performance based on this scenario.

Types of Workflows	Data Source	Requirements Analysis – User Requirements: Users	Peak Workflow DPM/Client	Peak Workflow DPM	Network Mbps	0.0 Actual Mbps	Map Image
						100.000	
P_ArcGIS AI Desktop	SDE DC/DBMS		10				1.000 MB
2_ArcGIS Desktop WTS/Citrix	SDE DC/DBMS		10				1.000 MB
3_AGS9.2 Map Server	SDE DC/DBMS	30	6	180	3.000	10,800	0.100 MB
4_IMS ArcMap Service	SDE DC/DBMS		6				0.100 MB
5_IMS Image Server	SDE DC/DBMS		6				0.100 MB
6_AGS9.1 Map Server	SDE DC/DBMS		6				0.100 MB
1_Batch Map Production Process	SDE DC/DBMS		143				0.100 MB
2_Batch Reconcile and Post Process	SDE DC/DBMS		11				0.100 MB
Total Workload		30		180	3.000		

Web Application Server		**Platform**	**2 GB RAM / Node**		**SRint2000**	**13,158**
ADF	0.245	**Intel Xeon 1 core (1 socket) 3200 MHz**			**19.7**	
Average User ..... 6 DPM		**Cores = 1**	**Sockets = 1**	1	**19.7/Core**	219
Total Required ..... 180 DPM		**Service Times**	**Capacity**	**Multiple Platforms**		**Fix**
CPU Utilization ..... 82% CPU		**Seconds**	**Display/Min**	**Nodes**	**Capacity**	**Nodes**
Peak Users 36.5		0.274	219	1	219	1
Web Performance = 1.04 sec		**1.05 sec**	**Sockets = 3**			**Minimal**
Container Machines		**Platform**	**4 GB RAM / Node**		**SRint2000**	ADF+SOC
SOC	0.573	**Intel Xeon 2 core (2 socket) 3200 MHz**			**37.1**	SOC
Average User ..... 6 DPM		**Cores = 2**	**Sockets = 2**	1	**18.6/Core**	88
Total Required ..... 180 DPM		**Service Times**	**Capacity**	**Multiple Platforms**		**Fix**
CPU Utilization ..... 102% CPU		**Seconds**	**Display/Min**	**Nodes**	**Capacity**	**Nodes**
Peak Users 29.4	29.4 / Node	0.680	177	1	177	1
			10,595 TPH		10,595 TPH	
Database Server		**Platform**	**4 GB RAM / Node**		**SRint2000**	
	0.082	**Intel Xeon 1 core (1 socket) 3200 MHz**			**19.7**	
Average User ..... 6 DPM		**Cores = 1**	**Sockets = 1**	1	**19.7/Core**	655
Total Required ..... 180 DPM		**Service Times**	**Capacity**	**Multiple Platforms**		**Fix**
CPU Utilization ..... 27% CPU		**Seconds**	**Display/Min**	**Nodes**	**Capacity**	**Nodes**
Peak Users 109.2	109.2 / Node	0.092	655	1	655	1



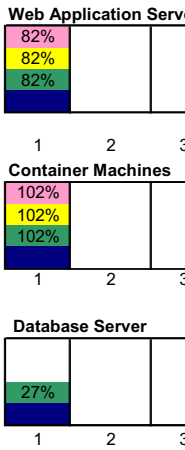
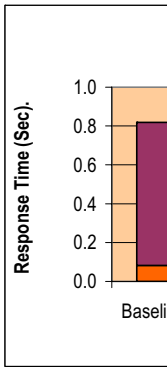


Table 5.9: Utilization of both existing servers, no new servers, move SQL to another existing server (one web application server, one container machine, and one database server)

Types of Workflows	Data Source	Requirements Analysis – User Requirements: Users	Peak Workflow DPM/Client	Peak Workflow DPM	Network Mbps	0.1 Actual Mbps	Map Image
						100.000	
P_ArcGIS AI Desktop	SDE DC/DBMS		10				1.000 MB
2_ArcGIS Desktop WTS/Citrix	SDE DC/DBMS		10				1.000 MB
3_AGS9.2 Map Server	SDE DC/DBMS	67	6	402	6.700	24,120	0.100 MB
4_IMS ArcMap Service	SDE DC/DBMS		6				0.100 MB
5_IMS Image Server	SDE DC/DBMS		6				0.100 MB
6_AGS9.1 Map Server	SDE DC/DBMS		6				0.100 MB
1_Batch Map Production Process	SDE DC/DBMS		143				0.100 MB
2_Batch Reconcile and Post Process	SDE DC/DBMS		11				0.100 MB
Total Workload		67		402	6.700		

Web Application Server		Platform	4 GB RAM / Node		SRint2000	
		Intel Xeon 2 core (1 socket) 3000(4) MHz			60.0	
		Cores = 2	Sockets = 1	2	30.0/Core	
		Service Times Seconds	Capacity Display/Min	Multiple Platforms Nodes	Capacity	Fix Nodes
				1		1
Web Performance = 0.69 sec		**0.70 sec**	**Sockets = 3**			**Minimal**
Container Machines		Platform	4 GB RAM / Node		SRint2000	ADF+SOC
ADF+SOC	0.818	Intel Xeon 4 core (2 socket) 3000(4) MHz			120.0	SOC
Average User ..... 6 DPM		Cores = 4	Sockets = 2	2	30.0/Core	100
Total Required ..... 402 DPM		Service Times Seconds	Capacity Display/Min	Multiple Platforms Nodes	Capacity	Fix Nodes
CPU Utilization ..... 100% CPU						
Peak Users 66.7	66.7 / Node	0.600	400	1	400	1
			24,005 TPH		24,005 TPH	
Database Server		Platform	4 GB RAM / Node		SRint2000	
	0.082	Intel Xeon 1 core (1 socket) 3200 MHz			19.7	
Average User ..... 6 DPM		Cores = 1	Sockets = 1	1	19.7/Core	655
Total Required ..... 402 DPM		Service Times Seconds	Capacity Display/Min	Multiple Platforms Nodes	Capacity	Fix Nodes
CPU Utilization ..... 61% CPU						
Peak Users 109.2	109.2 / Node	0.092	655	1	655	1



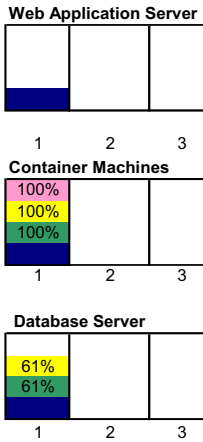
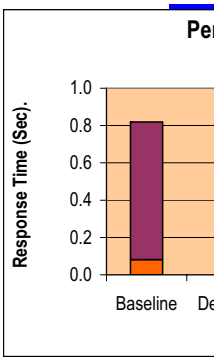


Table 5.10: Scenario 3: Utilization of one existing servers and acquisition of one new server (two socket configuration) – Year One Recommendation

Types of Workflows	Data Source	Requirements Analysis – User Requirements: Users	Peak Workflow DPM/Client	DPM	Network Mbps	0.1 Actual Mbps	Map Image
						100.000	
P_ArcGIS AI Desktop	SDE DC/DBMS		10				1.000 MB
2_ArcGIS Desktop WTS/Citrix	SDE DC/DBMS		10				1.000 MB
3_AGS9.2 Map Server	SDE DC/DBMS	100	6	600	10.000	36,000	0.100 MB
4_IMS ArcMap Service	SDE DC/DBMS		6				0.100 MB
5_IMS Image Server	SDE DC/DBMS		6				0.100 MB
6_AGS9.1 Map Server	SDE DC/DBMS		6				0.100 MB
1_Batch Map Production Process	SDE DC/DBMS		143				0.100 MB
2_Batch Reconcile and Post Process	SDE DC/DBMS		11				0.100 MB
Total Workload		100		600	10.000		

Web Application Server		**Platform**	**4 GB RAM / Node**		**SRint2000**	**40,074**
ADF	0.245	**Intel Xeon 2 core (1 socket) 3000(4) MHz**			**60.0**	
Average User ..... 6 DPM		**Cores = 2**	**Sockets = 1**	2	**30.0/Core**	334
Total Required ..... 600 DPM		**Service Times**	**Capacity**	**Multiple Platforms**		**Fix**
CPU Utilization ..... 90% CPU		**Seconds**	**Display/Min**	**Nodes**	**Capacity**	**Nodes**
Peak Users 111.3		0.180	668	1	668	1
Web Performance = 0.69 sec		**0.70 sec**	**Sockets = 3**			**Minimal**
Container Machines		**Platform**	**4 GB RAM / Node**		**SRint2000**	ADF+SOC
SOC	0.573	**Intel Xeon 4 core (2 socket) 3000(4) MHz**			**120.0**	SOC
Average User ..... 6 DPM		**Cores = 4**	**Sockets = 2**	2	**30.0/Core**	143
Total Required ..... 600 DPM		**Service Times**	**Capacity**	**Multiple Platforms**		**Fix**
CPU Utilization ..... 105% CPU		**Seconds**	**Display/Min**	**Nodes**	**Capacity**	**Nodes**
Peak Users 95.2	95.2 / Node	0.420	571	1	571	1
			34,269 TPH		34,269 TPH	
Database Server		**Platform**	**4 GB RAM / Node**		**SRint2000**	
	0.082	**Intel Xeon 1 core (1 socket) 3200 MHz**			**19.7**	
Average User ..... 6 DPM		**Cores = 1**	**Sockets = 1**	1	**19.7/Core**	655
Total Required ..... 600 DPM		**Service Times**	**Capacity**	**Multiple Platforms**		**Fix**
CPU Utilization ..... 92% CPU		**Seconds**	**Display/Min**	**Nodes**	**Capacity**	**Nodes**
Peak Users 109.2	109.2 / Node	0.092	655	1	655	1



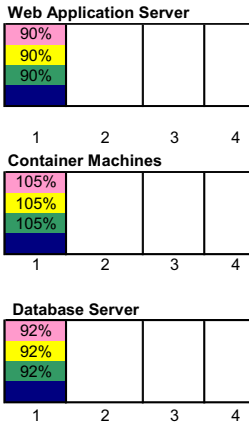


Table 5.11: Scenario 4: Utilization of one existing server – acquisition of two new servers (three socket configuration) – Year Two Recommendation

Data Capture Devices

GPS Receivers

Three mapping-grade GPS receivers (One tripod and two handhelds) currently exists at the City. Additional receivers will be needed depending on which of the staffing scenarios (See Chapter Four – Governance Model) is selected. The GPS receivers will be used to accurately identify the location of City facilities and infrastructure for data layer development and attribution. It is recommended that the City acquire the Trimble GeoXH as its mapping grade GPS receiver. The Trimble is ideal for use by utility companies and local government organizations managing assets or mapping critical infrastructure that requires spatial accuracy and data capture. Some recommended key features of the Trimble GeoXH and accessories include:

Trimble GeoXH - *Approximate Cost = $4,295*

- H-Star technology (enables sub-foot accuracy)
- Microsoft Windows Mobile
- 512 MB memory with removable SD memory
- Bluetooth and wireless LAN connectivity
- TrimPix technology for wireless camera

Zepher Antenna- *Approximate Cost = $2,195*

- Dual frequency antenna for 8 inch accuracy with the GeoXH handheld or GPS Pathfinder ProXH reciever
- Advanced design with sophisticated multipath mitigation and low elevation tracking
- Integrated screw thread allows for easy mounting onto a range pole or backpack

Size:	6.35 in diameter x 2.3 in high (16.1 cm x 5.8 cm)
Weight:	1 lb (0.45 kg)
Operating temperature:	–40 ºF to +158 ºF (–40 ºC to +70 ºC)
Storage temperature:	–58 ºF to +176 ºF (–50 ºC to +80 ºC)
Humidity:	100% humidity proof, fully sealed
Power consumption:	0.6 Watts
Gain:	50 dBm
Noise:	1.5dB max
Frequency:	1575.42 ± 10 MHz
Connector:	TNC
Mounting:	5/8-11 Thread
Cable:	1.5 m TNC to SMB antenna cable

Rover extension Pole for Zepher Antenna- ***Approximate Cost = $250***

Mounting Bracket for GeoXH- ***Approximate Cost = $135***

ArcPad 7 – Approximate Cost as part of Package $95
Enables

- GPS data collection
- GIS data collection
- Integrate external hardware
- ArcPAD tools for ArcGIS desktop
- Symbology and Style Sheets
- Language Support
- Customization

GPS Analyst – Approximate Cost $1995

- View, edit, and analyze GPS data in ArcGIS
- Improve productivity by eliminating extra file conversions and processing outside the GIS
- Differentially correct for improved GPS position accuracy including Trimble H-Star processing for subfoot accuracy
- Check data out to shapefiles for update in the field with ArcPad and the GPScorrect extension, then check new and updated features and GPS positions back into the geodatabase
- Import features and GPS positions from Trimble SSF files, including data collected with Trimble TerraSync software
- Validate GPS positions to ensure features meet your accuracy requirements
- Store detailed quality information for GPS data in the geodatabase
- Use ArcGIS in the field to collect features and GPS data directly to the geodatabase
- Use ESRI ArcObjects to customize workflows or data processing to suit your requirements
- License Manager allows easy management of multiple licenses, including the choice of single-use or floating licenses.

Output Devices

Printers

It is important that the City's GIS users have the means to print maps and documentation generated from these applications. Every GIS user should have access to a high-resolution color printer, to print 8"x11" or 8"x14" maps. In the short-term, each GIS user should have access to at least one networked color printer, even if it is not in their immediate work space. As output demand increases, additional color printers should be purchased for appropriate departments and users.

Plotters

It is important that Tier 1 users (ArcInfo, ArcEditor and ArcView) have access to wide-format plotters. Many maps must be output onto large sheets to be properly visualized. The following are recommend specifications for wide format plotters:

HP Plotter

Plotters – Approximate Cost = $9,000

- 36" or Greater Paper Sheet Size
- 64 MB of Built-in RAM
- 7.5 GB Hard-drive
- 1200 dpi Addressable Resolution
- Adobe PostScript 3 Capability

The City currently maintains three plotters, located in the Public Works, Planning, and Police Departments. One additional plotter is recommended as a shared resource for GIS utilization in various City departments. This plotter should be housed in IT and maintained by the GIS Coordinator. It is recommended for acquisition in year two of this project. As the City expands and departmental needs for wide-format printing increase, additional plotters may be needed.

Networks

The City of Champaign must maintain and manage optimal networking of computers. A major challenge for many enterprise-wide GIS efforts is inadequate network speed (capacity). GIS data are usually quite large, and often such large data sets can slow a network considerably, thereby rendering GIS applications non-functional.

The City's network has been progressively upgraded over the last few years. Network speed is currently sufficient with the exception of the connection to Public Works. However, a fiber connection is anticipated to be implemented this fall. This upgrade is well timed, given that the City's network will need to accommodate increased bandwidth requirements for the use of desktop GIS data viewers, network-based data exchange and access, and telecommunications-dependent GIS technologies such as AVL. If this fiber link does not occur, then hardware and software will need to be duplicated at the Public Works main office.

GIS Services

The City of Champaign will require external support to enable the successful implementation of the City's GIS. Expert support will ensure that the City will realize the maximum return on investment during the implementation and deployment process. Additionally, expertise of external support will enable the gradual transfer of missing knowledge to City personnel. This will ensure that staff have the knowledge for continued utilization of the GIS as a critical decision support system.

The possible tasks and deliverables provided by third-party spatial service providers follow. Some of these tasks can be performed by the GIS Coordinator depending on their skill set and time constraints.

- Setup of Intranet and Internet ArcServer Portals
- Optimal Setup of ArcServer
- Data and Database Development (Creation of all required layers)
- Public Works Data Collection (Multiple scenarios outlined in chapter three)
- Setup of Extraction Routines and Clean Up of Existing IT Databases (TRAKiT, OneRoof, etc.)
- Creation of Neighborhood Wellness Automated Plan
- Creation of Neighborhood Wellness Data Model
- Development of Specialized Economic Development Web Site
- Imaging Integration
- Other Technical Support Issues

Training

Personnel at the City of Champaign will require training for the ArcGIS suite of products. This training will lay the foundation for knowledge transfer and understanding of the technical GIS platform that will be deployed at the City.

Introduction to ArcGIS I - (two days)

Overview

This two-day course introduces participants to ArcGIS and provides the foundation for becoming a successful ArcView, ArcEditor, or ArcInfo user. Participants learn how to use ArcMap, ArcCatalog, and ArcToolbox and explore how these applications work together to provide a complete GIS software solution. The course covers fundamental GIS concepts as well as how to create, edit, and work with georeferenced spatial data. Participants learn how to manipulate tabular data, query a GIS database, and present data clearly and efficiently using maps and charts.

Audience

This course is for those who are new to ArcGIS or to geographic information systems in general.

Goals

- Display feature and tabular data
- Work with georeferenced spatial data
- Query features using logical expressions
- Find features using spatial relationships
- Edit spatial and attribute data
- Associate tables with joins and relates
- Produce maps, reports, and graphs

Topics covered

- ArcGIS overview: Capabilities and applications; Interacting with the interface; Basic display
- Spatial data concepts: Representing spatial data and descriptive information
- ArcGIS data model: Geodatabases; Shapefiles; Coverages; Feature types; Attributes
- GIS software: Components; Functions; Applications
- Spatial coordinate systems and map projections: Georeferencing data; What map projections are; How ArcMap works with map projections
- Querying data: Selecting and identifying features; Creating reports and graphs
- Map displays: Creating; Symbolizing; Scaling; Adding map elements

Prerequisites and recommendations

Participants should know how to use windowing software. This course provides the fundamental ArcGIS knowledge and experience needed to enroll in *Introduction to ArcGIS II (for ArcView 9, ArcEditor 9, and ArcInfo 9)* as well as several other ESRI courses. Many of the topics covered in this course are similar to those in *Migrating from ArcView 3.x to ArcView 9*. Participants who complete this course should not enroll in *Migrating from ArcView 3.x to ArcView 9*. Participants who have worked with prior versions of ArcView and want to learn about ArcView 9 applications should take *Migrating from ArcView 3.x to ArcView 9*.

Introduction to ArcGIS II – for ArcView 9, ArcEditor 9, and ArcInfo 9 (three days)

Overview

This three-day course follows *Introduction to ArcGIS I (for ArcView 9, ArcEditor 9, and ArcInfo 9)* and continues to present important concepts and functionality for successfully working with ArcGIS. With further exploration of ArcMap, ArcCatalog, and ArcToolbox, participants focus on spatial analysis, automation of spatial and attribute data, editing, and advanced options for cartographic display and reports. Hands-on exercises teach ArcGIS procedures in the context of solving real-world problems. Examples and exercises use data from a variety of application areas. A portion of the class is reserved for carrying out an analysis project and applying many of the new skills and techniques learned in this course. Participants conduct queries, perform spatial analysis, and present their results in a hard-copy map and report.

Audience

This course is designed for those with fundamental knowledge of ArcGIS and geographic information systems in general.

Goals

- Perform spatial analysis
- Manage geographic data
- Perform geocoding
- Automate data through heads-up digitizing
- Convert data from other formats
- Edit spatial and attribute data

- Create and use metadata
- Produce high-quality maps and reports

Topics covered

- Spatial analysis and data management: Buffers; Spatial overlays; Extracting features for analysis; Analytical methods and tools
- Geocoding and display of locations from tabular data: Address geocoding; Display of points from x,y coordinates
- Editing: Tools for creating and editing spatial data; Editing attribute data; Spatial adjustment
- Data automation: Data sources; Digitizing; Data conversion
- Project management: Database organization; File and directory naming conventions; Creating and using metadata
- Cartography: Advanced symbology and labeling

Prerequisites and recommendations

This course is for those who have completed *Introduction to ArcGIS I (for ArcView 9, ArcEditor 9, and ArcInfo 9)* or *Migrating from ArcView 3.x to ArcView 9* (instructor-led or Web-based course). If one of the prerequisite courses is not completed, a participant should have comparable experience with ArcGIS before taking this course. The course also provides participants with the fundamental ArcGIS knowledge and experience needed to enroll in *Building Geodatabases I (for ArcEditor 9 and ArcInfo 9)*.

The following two tables identify the full training needs of the City.

Table 5.12 - GIS Applications Training Matrix

Class	Site	Trainer	Days	Year of Training	Participants	Cost
Introduction to ArcGIS I	On	ESRI Authorized Trainer	2	1,2,3,4,5	Various	$5,000
Introduction to ArcGIS II	On	ESRI Authorized Trainer	3	1,2	GIS Coordinator, Tier one GIS Users	$7,500
Building Geodatabases I	Off	ESRI	3	1	GIS Coordinator (if needed)	$1,350
Building Geodatabases II	Off	ESRI	2	1	GIS Coordinator (if needed)	$900
Introduction to ArcGIS Server	Off	ESRI	2	1,2	GIS Coordinator and Network Engineer (if needed)	$900
ArcGIS Server Enterprise and Tuning for SQL Server	Off	ESRI	2	2	GIS Coordinator (if needed) and Network Engineer, Information Technologies	$900
Tier 3 Applications	On	Internal	1	1,2,3,4,5	Various	N/A

Table 5.13 - Recommended Number of Personnel (by Department) for ArcGIS I, ArcGIS II, and Browser Training

Department/Division	ArcGIS I	ArcGIS II	Intranet Data Browser
IT Department	2	2	10
Neighborhood Services	3	0	16
Fire Department	3	0	109
Finance Department	3	0	15
Human Resources	0	0	6
METCAD	0	0	As needed
City Manager's Office	1	0	12
Planning Department	8	1	10
Public Library	0	0	10
Public Works Department	17	10	43
Police Department	2	0	100+
Legal Department	0	0	9
Total	**39**	**13**	**300+**

Implementation Plan Matrix Key

The matrices below provide a list and prioritization of the implementation items and tasks during the first five-years of the enterprise GIS project. The following is a key to the prioritization, item type, and item process. The item type is a categorization of the implementation item as it relates to the system infrastructure, architecture, and user training. The item process is a categorization of the implementation item as it relates to the phase of work of the implementation lifecycle.

Implementation Item Type:		Implementation Item Process:	
Application/Software		Design/Plan	
Network/Communications		Procurement/Provision	
Hardware/Equipment		Development/Test	
Database/Data		Integration	
Training/Information		Deployment/Rollout	

Recommendations for Year-One

Data and Database Development Phase

Year-One will consist of data development and acquisition; software provisioning, and integration; initial geodatabase design and development; and training. The year-one implementation tasks lay the foundation for the enterprise GIS. It is important to note that these recommendations are predicated on a GIS Coordinator being hired during the first year of this project.

Year-One implementation items are as follows:

Item Description	Item Type	Item Process
EMT (initial meeting, prioritization, oversight)	Training	Design
Establish GIS Users Group Meetings	Training	Design
Address Point Data Development Project	Database	Design
Building Geodatabases I	Training	Provision
Building Geodatabases II	Training	Provision
Intranet Data Browser Training	Training	Provision
Geodatabase Logical Design	Database	Design
Geodatabase Physical Design (Tables to Topology)	Database	Development
Geodatabase data loading (test environment)	Database	Development

Item Description	Item Type	Item Process
Geodatabase Configuration, Accessibility, Connectivity Testing	Hardware	Integration
Introduction to ArcGIS I	Training	Provision
Introduction to ArcGIS II	Training	Provision
Hire GIS Coordinator	Personnel	Provision
Hire GIS Intern	Personnel	Provision
Begin Public Works Data Collection Effort	Database	Development
Begin Creation of GIS Data Layers Based on Priorities Identified in Chapter 3	Database	Development
Acquire and Implement GeoManager Software	Application	Provision
Acquire ArcServer Intranet Application	Application	Provision
Enable Neighborhood Services, Fire Department, City Manager's Office, Planning Department, Police Department with Intranet Application	Application	Deployment
Enable Data Mining from TRAKiT, ONERoof, FireHouse, Tiburon and Police RMS Applications	Database	Deployment
Establish CAD Standards	Training	Design

Item Description	Item Type	Item Process
ArcServer Installation	Application	Deployment
Acquire and Install Addressing Application	Application	Deployment
Complete Implementation of Group I Remote Access Solution for Fire Department	Application	Deployment
Acquire GPS Hardware with ArcPAD Software for Public Works	Hardware	Deployment
Upgrade Network for Public Works	Training	Deployment
Acquire GIS Server	Hardware	Deployment
Install New Server	Hardware	Deployment
Acquire Five New Floating ArcView License and Convert the Two Police Department fixed Licenses to Floating Licenses (One in Swat Van not Converted)	Application	Provision
Acquire Three Copies of ArcEditor	Application	Provision
Training on Intranet Application for Neighborhood Services, Fire Department, City Manager's Office, Planning Department and Police Department	Training	Provision
Annual Update of Implementation Plan	Training	Design

Estimated Cost Schedule for Year One

Initial Enterprise-Wide Deployment, Data Creation, Software Implementation, and Initial Database Development

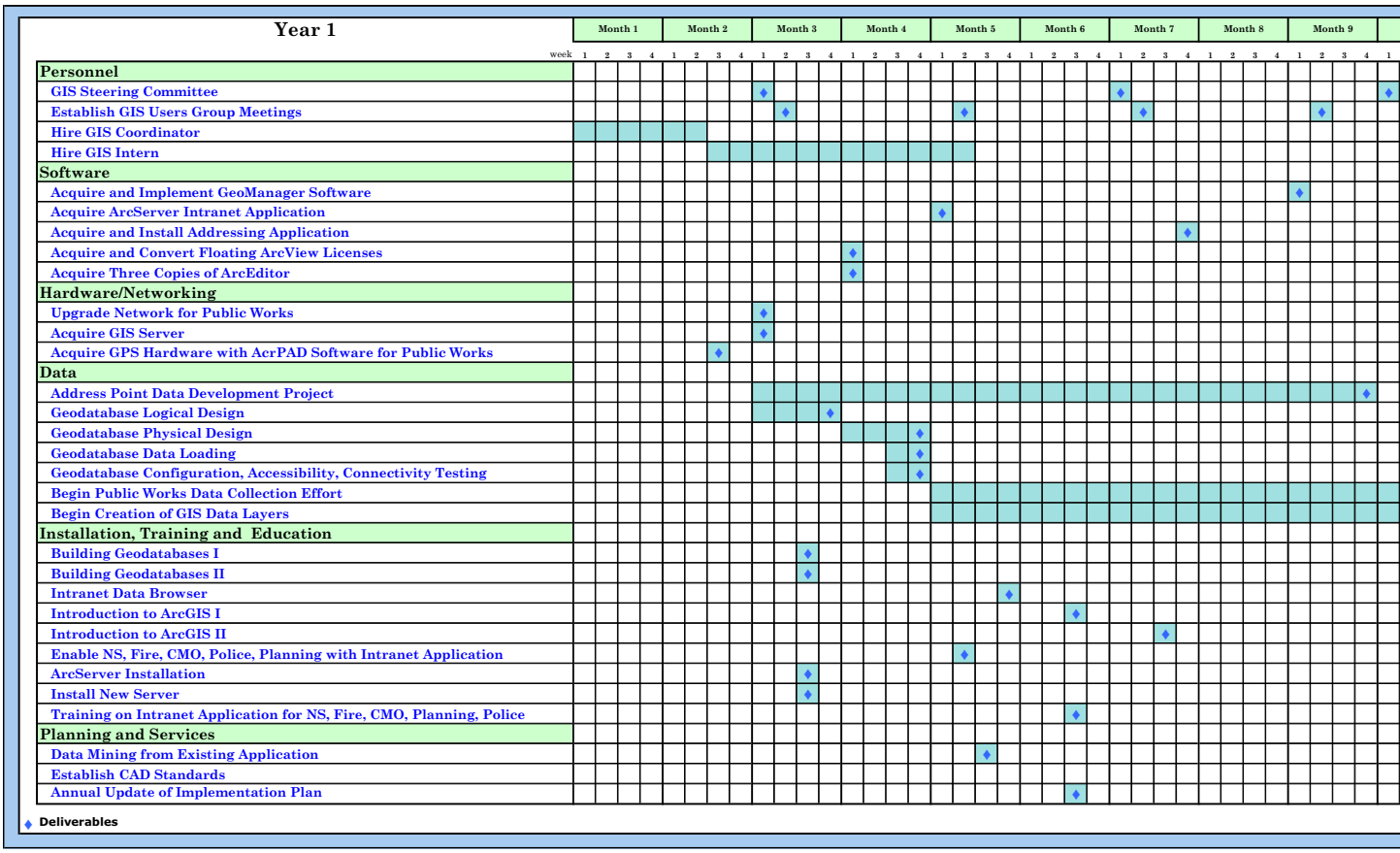
Year One will consist of data creation, software provision and training, and initial database development. Based on the identified enterprise money available, the Public Works initiative will be handled separately each year. Personnel costs are not listed in these tables. Staffing details are discussed in Chapter Four and will be budgeted separately.

Year one costs are as follows:

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Personnel				
Hire GIS Coordinator	Handled Separately	Information Technologies	Job Search	Enterprise Asset
Hire GIS Intern	Handled Separately	Information Technologies	Job Search	Enterprise Asset
Establish GIS Steering Committee	NA	All	GIS Coordinator	Quarterly Meetings Initially – Eventually As Needed
Establish GIS Users Group	NA	All	GIS Coordinator	Every other Month
Software				
Geomanager Software	$6,500	Information Technologies	GIS Software Vendor	Pricing includes setup and training
Intranet Browser Application	$25,000	Enterprise	GIS Software Vendor	ArcServer Application that will allow for departmental portals
Addressing Application	$6,500	IT and Public Works	GIS Software Vendor	Price includes setup and training
Five ArcView Concurrent Licenses at $3,500 apiece	$17,500	To Be Shared by Enterprise	ESRI	Users will need to be implemented on a priority basis
Upgrade two Police Licenses to Concurrent Licenses at $2,000 apiece	$4,000	To Be Shared by Enterprise	ESRI	Users will need to be implemented on a priority basis
Three ArcEditor at $6,300 apiece	$18,900	Shared by ArcEditor Using Departments	ESRI	Users will need to be implemented on a priority basis
Maintenance on Existing Software	Handled Separately	IT	ESRI	This document assumes that existing software is being maintained and budgeted at this time. Full documentation on maintenance begins in Year Two of this plan.
Software Subtotal:	**$78,400**			
Hardware and Networking				
Enterprise GIS Server	$6,900	Information Technologies	Preferred Vendor	Server as discussed in hardware section earlier in this Chapter
Upgrade Network for Public Works	Budgeted Elsewhere	Information Technologies and Public Works	IT	Fiber
Hardware Subtotal:	**$6,900**			

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Data				
Begin Creation of GIS Data Layers Based on Priorities Identified in Chapter Three	$42,200	All	GIS Consultant and In-house	All data layers will be systematically created based on priorities
Address Point Development Project	$35,000	All and then maintained by Public Works and IT	GIS Consultant	• Address Point development (field collection/geocoding) • Will require field work
Logical Database Design	$0	Various	In-house	Done by GIS Coordinator
Physical Database Design	$0	Various	In-house	Done by GIS Coordinator
Data Subtotal:	**$77,200**			
Installation, Training and Education				
Introduction to ArcGIS I – Two classes	$10,000	Selected Departmental Users	ESRI or ESRI Authorized Trainer	On-site
Introduction to ArcGIS II	$7,500	Initial ArcEditor Users	ESRI or ESRI Authorized Trainer	On-site
Building Geodatabases 1	$1,350	GIS Coordinator	ESRI or ESRI Authorized Trainer	Travel related expenses not included
Building Geodatabases II	$900	GIS Coordinator	ESRI or ESRI Authorized Trainer	Travel related expenses not included
Intranet Data Browser Training	$2,500	Enterprise-wide	Software Vendor	Administration Class and End-User Class Additional classes should be conducted by the GIS Coordinator throughout the year
Training and Education Subtotal:	**$22,500**			
Planning and Services				
Data mining setup and services for TRAKiT, OneRoof, Firehouse, Tiburon, and Police RMS Applications	$5,000	IT Department	GIS Consultant	Assistance in data mining and setup for various applications
Intranet Departmental Setup	$5,000	Enterprise-Wide	Various	Funds should be utilized for additional help on setting up portals for each department.
Establish CAD Standards	0	IT Department	GIS Coordinator	Done In-house
Installation of ArcServer Software	0	IT Department	GIS Coordinator	Done In-house
Annual Update of Implementation Plan	$5,000	GIS Coordination Committee	GIS Planning Consultant	Reflect progress and changes in technology
Planning Subtotal:	**$15,000**			
Year 1 TOTAL:	**$200,000**			

City of Champaign
Schedule



Recommendations for Year-Two

Enterprise Integration

Year Two will continue the expansion of GIS applications and access to geodatabases. The GIS will expand across the enterprise during the second year of implementation. The Intranet will provide accessibility to all levels of users as desktop GIS browsers are deployed to all departments.

Year-Two implementation items are as follows:

Item Description	Item Type	Item Process
Introduction to ArcGIS I	Training	Provision
Introduction to ArcGIS II	Training	Provision
Maintenance on ESRI Products	Application	Purchase
Implement Emergency Notification Solution	Application	Purchase
Hire GIS Technician in Public Works	Personnel	Provision
Continue Public Works Data Collection Effort	Database	Deployment
Enable Data Mining from T-2 Systems, GEMS, Questica and any other existing datasets	Database	Deployment
Enable Finance, Human Resources and Legal with Intranet Application	Application	Deployment
Acquire ArcServer Internet Application	Application	Provision

Item Description	Item Type	Item Process
Create Internet Public Access Portals for Neighborhood Services and Planning Department	Application	Deployment
Create Neighborhood Wellness Data Model	Database	Design
Acquire Work Order Management/ Pavement Management/Field Editing Application	Application	Provision
Create Dynamic Neighborhood Wellness Plan	Application	Design
Intranet Data Browser Training	Training	Provision
Internet Data Browser Training	Training	Provision
Acquire Plotter for IT Department	Hardware	Provision
Acquire GIS Server	Hardware	Provision
Install GIS Server	Hardware	Deployment
Acquire Five Floating ArcView Licenses	Application	Provision
Acquire Two Floating ArcEditor Licenses	Application	Provision
Acquire Additional ArcServer Socket	Application	Provision

Item Description	Item Type	Item Process
ArcGIS Server Enterprise and Tuning for SQL Server	Training	Provision
Annual Update of Implementation Plan	Training	Design
Training and Conferences for GIS Coordinator	Training	Provision

Estimated Cost Schedule for Year Two
Enterprise Integration Phase

Year Two will continue the expansion of GIS applications and the implementation of an enterprise geodatabase and access to all departments. Based on the identified enterprise money available, the Public Works initiative will be handled separately each year. Personnel costs are not listed in these tables. Staffing details are discussed in Chapter Four and will be budgeted separately. Additionally, it is recommended that the City invest in an application for Notification. There are many options for this technology that extend beyond GIS. Various software applications have been discussed in Chapter Two of the this document. Costs for these solutions are not included in following tables because they are enterprise IT initiatives with a GIS component. As such, they should be budgeted and acquired as a separate project.

Year Two costs are as follows:

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Personnel				
EMT	NA	All	GIS Coordinator	Quarterly Meetings Initially – Eventually As Needed
Hire GIS Technician	NA	Public Works	Public Works	One Technician initially
GIS Users Group Meeting	NA	All	GIS Coordinator	Every other Month
Software				
ESRI Software Maintenance ArcServer Standard ArcInfo Floating x 3 Arcview Floating x 10 ArcView Extensions ArcEditor x 3	$30,680	Enterprise	ESRI	Based on 20% of purchase fee. Official price will need to come from ESRI.
3rd Party Application Maintenance Intranet Addressing Application Geomanager	$7,600	Enterprise	GIS Software Vendor	Based on 20% of purchase price.
Implement Emergency Notification System	Separate IT Initiative	Enterprise-wide	Selected Vendor	Not GIS Specific
ArcServer Internet Application	$15,000	To Be Shared by Enterprise	GIS Software Vendor	Initial Deployment for Neighborhood Services and Planning
Digital Wellness Plan Application	$35,000	To Be Shared by Enterprise	GIS Software Vendor	Deployed via the Intranet
Five ArcView Concurrent Licenses at $3,500 apiece	$17,500	To Be Shared by Enterprise	ESRI	Users will need to be implemented on a priority basis
Two ArcEditor at $6,300 apiece	$12,600	Shared by ArcEditor Using Departments	ESRI	Users will need to be implemented on a priority basis
Additional AcServer Socket	$10,000	IT	ESRI	For expanded server
Work Order System	Handled Separately	Public Works	Selected Vendor	Acquire via RFP
Software Subtotal:	**$128,380**			
Hardware/Networking				
2nd Enterprise GIS Server	$4,500	Information Technologies	Preferred Vendor	Server as discussed in hardware section earlier in this Chapter

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Plotter	$9,000	Information Technologies	IT	HP
Hardware Subtotal:	**$13,500**			
Data				
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter Three	$50,000	All	GIS Consultant and In-house	All data layers will be systematically created based on priorities
Data Subtotal:	**$50,000**			
Installation, Training and Education				
Introduction to ArcGIS I – Two classes	$10,000	Selected Departmental Users	ESRI or ESRI Authorized Trainer	On-site
Introduction to ArcGIS II	$7,500	Second Phase of ArcEditor Users	ESRI or ESRI Authorized Trainer	On-site
Intranet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Internet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
ArcGIS Server Enterpirse and Tuning for SQL Server	$900	GIS Coordinator	ESRI	Does not include travel and per-diem
Additional Training and Conferences	$5,000	GIS Coordinator	Various	
Training and Education Subtotal:	**$23,400**			
Planning and Services				
Data mining setup and services for T-2 Systems, GEMS, Questica, and other Applications	In-house	Enterprise	GIS Coordinator	Similar to Year One efforts
Intranet Departmental Setup (Finance, Human Resources, and Legal)	In-house	Enterprise	GIS Coordinator	Similar to Year One efforts
Internet Portal Setup	In-house	Neighborhood Services and Planning	GIS Coordinator	Utilize Internet ArcServer Application
Create Neighborhood Wellness Data Model	$12,500	Enterprise-wide	GIS Coordinator and Selected GIS Vendor	Model setup and on-site specifications meetings
Annual Update of Implementation Plan	$5,000	GIS Coordination Committee	GIS Planning Consultant	Reflect progress and changes in technology
Planning Subtotal:	**$17,500**			
Year 2 TOTAL:	**$232,780**			

City of Champaign
Schedule

Year 2	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9				
week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
Personnel																																					
GIS Steering Committee									♦																♦												♦
Hire GIS Technicians (Public Works)																																					
Establish GIS Users Group Meetings										♦								♦								♦								♦			
Software																																					
Maintenance on ESRI and Third Party Products	♦																																				
Implement Emergency Norification Solution																					♦																
Acquire ArcServer Internet Application													♦																								
Acquire Work Order/Pavement Management, Fied Editing Applcation	♦																																				
Create Dynamic Neighborhood Wellness Plan																			♦																		
Acquire Floating ArcView License	♦																																				
Acquire Floating ArcEditor Licenses	♦																																				
Acquire Additional ArcServer Socket	♦																																				
Work Order System	♦																																				
Hardware/Networking																																					
Acquire Plotter for IT Department	♦																																				
Acquire GIS Server	♦																																				
Data																																					
Continue Public Works Data Collection Effort																																					
Installation, Training and Education																																					
Enable Finance, Human Resrouces, Legal with Intranet Application									♦																												
Install GIS Server			♦																																		
Introduction to ArcGIS I																										♦											
Introduction to ArcGIS II																															♦						
Intranet Data Browser Training (as-needed)																																					
Internet Data Browser Training (as-needed)																																					
ArcGIS Server Enterprise and Tuning for SQL Server									♦																												
Training and Conferences for GIS Coordinator/GIS Anaylst (as-needed)																																					
Planning and Services																																					
Data Mining from Existing Application							♦																														
Create Internet Public Access Portals for Neighborhood Services, Planning																	♦																				
Create Neighborhood Wellness Data Model													♦																								
Training and Conferences for GIS Coordinator/GIS Analyst (as-needed)																																					
Annual Update of Implementation Plan																							♦														

♦ **Deliverables**

Recommendations for Year-Three

Mobile Deployment and Public Access

The third year of the project will revolve around data sharing and expansion of the advanced GIS services. Year Three will continue the expansion of GIS applications and access to geodatabases both internally and externally. Additionally, mobile access to GIS will be established.

In addition to the intranet, Internet users (e.g. Citizens) will have access to more accurate and timely data. An Internet GIS website will be developed so that Citizens can take advantage of the City's investment in GIS. At this point in the project, departments should be utilizing the GIS for analysis. It should become another resource that employees rely on, much like a word processor or spreadsheet program.

This phase focuses on the implementation of advanced applications that facilitate data acquisition, sharing, and updating between the City and external entities. By the completion of this implementation phase the enterprise GIS should be considered a comprehensive source for spatial data and information for the City of Champaign.

Additionally, it is recommended that the City invest in an imaging application. There are many options for this technology that extend beyond GIS. Costs for these solutions are not included in following tables because they are enterprise IT initiatives with a GIS component. As such, they should be budgeted and acquired as a separate project.

Year-Three implementation items are as follows:

Item Description	Item Type	Item Process
Maintenance on ESRI Products	Application	Provision
Continue Public Works Data Collection Effort	Database	Deployment
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter 3	Database	Deployment
Hire GIS Analyst in IT Department Hire GIS Technician in Public Works (If Needed)	Personnel	Provision
Implement GIS Enabled Imaging Systems	Application	Provision

Item Description	Item Type	Item Process
Create Internet Public Access Portals for Public Safety and Library	Application	Deployment
Acquire and Implement CrimeView Software for Police Department	Application	Provision
Implement TouchScreen Application in Atrium and Planning Department	Application	Provision
Implement AVL for Public Works	Application	Provision
Implement Mobile Data Browser Solution for Public Works, Police Department and Neighborhood Services	Application	Provision
Acquire Five Floating ArcView Licenses	Application	Provision
Intranet Data Browser Training	Training	Provision
Internet Data Browser Training	Training	Provision
Training and Conferences for GIS Coordinator	Training	Provision

Estimated Cost Schedule for Year Three

Mobile Deployment and Public Access

The third year of the project will revolve around continued sharing data throughout the organization and maintenance of existing investment. External Organizations and citizen will gain access to the City's GIS via the Internet and public kiosk at specific City offices.

At this point in the project, departments should be utilizing the GIS for data collection, analysis, and decision support. It should have become another resource that employees rely on, much like a word processor or spreadsheet program.

Year Three costs are as follows:

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Personnel				
Hire GIS Analyst	Handled Separately	Information Technologies	Job Search	Enterprise Asset
Hire GIS Technician	If Needed	Public Works	Job Search	If Needed
EMT	NA	All	GIS Coordinator	Quarterly Meetings Initially – Eventually As Needed
GIS Users Group Meeting	NA	All	GIS Coordinator	Every other Month
Software				
ESRI Software Maintenance ArcServer Standard ArcInfo Floating x 3 Arcview Floating x 15 ArcView Extensions ArcEditor x 5	$38,700	Enterprise	ESRI	Based on 20% of purchase fee. Official price will need to come from ESRI.
3rd Party Application Maintenance	$17,600	Enterprise	GIS Software Vendor	Based on 20% of purchase price.
Implement GIS Enabled Imaging System	Separate IT Initiative	Enterprise-wide	Selected Vendor	Not GIS Specific
Crime View	$25,000	Police	Omega Group	Includes Setup and Training
Touch Screen Kiosk Software x 2	$8,500	Atrium and Planning	GIS Software Vendor	Hardware listed seperately
AVL Software	$20,000	Public Works	Preferred Software Vendor	Server application only. Will allow for viewing AVL units via Intranet application
Mobile data browsers	$25,000	Police, Public Works, and Neighborhood Services	Preferred Software Vendor	Will reside on existing laptops
Five ArcView Concurrent Licenses at $3,500 apiece	$17,500	To Be Shared by Enterprise	ESRI	Users will need to be implemented on a priority basis
Software Subtotal:	**$152,300**			
Hardware/Networking				
Touch Screen Hardware x 2	$7,000	Atrium and Planning	Preferred Hardware Vendor	All in one units
Hardware Subtotal:	**$7,000**			

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Data				
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter Three	$50,000	All	GIS Consultant and In-house	All data layers will be systematically created based on priorities
Data Subtotal:	**$50,000**			
Installation, Training and Education				
Introduction to ArcGIS I – One class	$5,000	Selected Departmental Users	ESRI or ESRI Authorized Trainer	On-site
Intranet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Internet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Additional Training and Conferences	$5,000	GIS Coordinator	Various	
Training and Education Subtotal:	**$10,000**			
Planning and Services				
Internet Portal Setup	In-house	Public Safety, Public Works, and Library (setuponly)	GIS Coordinator	New portals for Public Safety and Public Works. Insure public access computers at library have links set up
Planning Subtotal:	**$0**			
Year 3 TOTAL:	**$219,300**			

City of Champaign

Schedule

Year 3	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9			
week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Personnel																																				
GIS Steering Committee									♦																♦											
Establish GIS Users Group Meetings										♦								♦								♦								♦		
Hire GIS Analyst in IT Department																																				
Hire GIS Coordinator (if needed)																																				
Software																																				
Maintenance on ESRI and Third Party Products	♦																																			
Implement GIS Enabled Imaging Systems																					♦															
Acquire and Implement CrimeView Software for Police									♦																											
Implement TouchScreen Application in Atrium and Planning													♦																							
Implement AVL for Public Works																					♦															
Implement Mobile Data Browser Solution for Public Works, Police, Neighborhood Services																	♦																			
Acquire Floating ArcView Licenses	♦																																			
Data																																				
Continue Public Works Data Collection Effort																																				
Continue Creation of GIS Data Layers																																				
Installation, Training and Education																																				
Intranet Data Browser Training (as-needed)																																				
Internet Data Browser Training (as-needed)																																				
Training and Conferences for GIS Coordinator/GIS Analyst (as-needed)																																				
Planning and Services																																				
Create Internet Public Access Portals for Public Safety and Library													♦																							
Training and Conferences for GIS Coordinator/GIS Analyst (as-needed)																																				

♦ Deliverables

Recommendations for Year-Four Maintenance Phase

The fourth year of the project will revolve around maintenance of existing systems and some additional data development.

Year-Four implementation items are as follows:

Item Description	Item Type	Item Process
Maintenance on ESRI Products	Application	Provision
Introduction to ArcGIS I	Training	Provision
Continue Public Works Data Collection Effort	Database	Deployment
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter 3	Database	Deployment
Intranet Data Browser Training	Training	Provision
Internet Data Browser Training	Training	Provision
Implement Planning Support System	Application	Provision
Implement Economic Development Website	Application	Provision
Training and Conferences for GIS Coordinator and GIS Analyst	Training	Provision

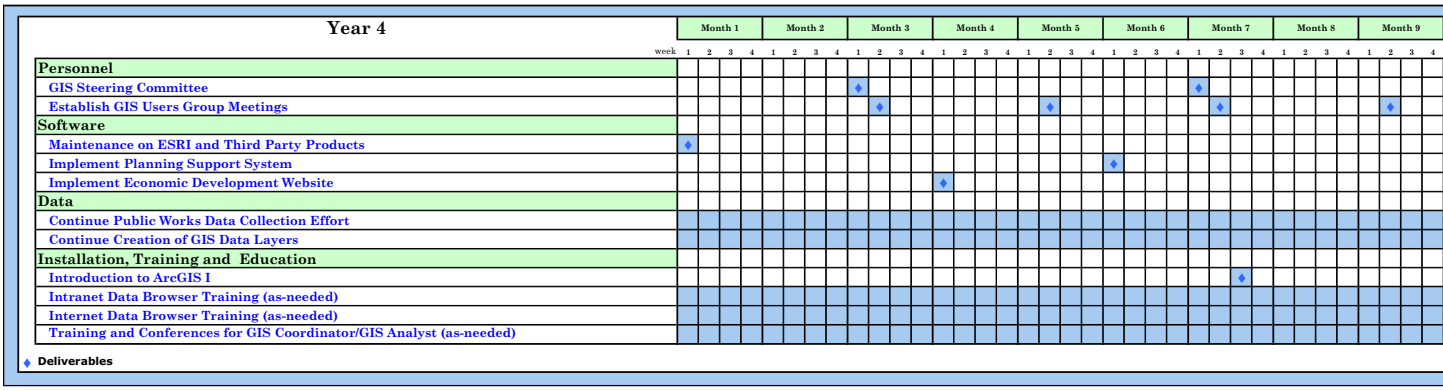
Estimated Cost Schedule for Year Four
Maintenance Phase

At this point in the project, departments should be utilizing the GIS for data collection, analysis, and decision support. It should have become another resource that employees rely on, much like a word processor or spreadsheet program.

Year Four costs are as follows:

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Personnel				
EMT	NA	All	GIS Coordinator	Quarterly Meetings Initially – Eventually As Needed
GIS Users Group Meeting	NA	All	GIS Coordinator	Every other Month
Software				
ESRI Software Maintenance ArcServer Standard ArcInfo Floating x 3 Arcview Floating x 20 ArcView Extensions ArcEditor x 5	$42,200	Enterprise	ESRI	Based on 20% of purchase fee. Official price will need to come from ESRI.
3rd Party Application Maintenance	$33,300	Enterprise	GIS Software Vendor	Based on 20% of purchase price.
Planning Support System	$15,000	Planning	Preferred Software Vendor	Three options discussed in Chapter Two
Economic Development Web Portal	$25,000	CMO	Preferred Software Vendor	Cannot be done until year four because data from the first three years is needed to populate the portal
Software Subtotal:	**$115,500**			
Data				
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter Three	$20,000	All	GIS Consultant and In-house	All data layers will be systematically created based on priorities
Data Subtotal:	**$20,000**			
Installation, Training and Education				
Introduction to ArcGIS I – One class	$5,000	Selected Departmental Users	ESRI or ESRI Authorized Trainer	On-site
Intranet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Internet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Additional Training and Conferences	$5,000	GIS Coordinator	Various	
Training and Education Subtotal:	**$10,000**			
Planning and Services				
Internet Portal Setup	In-house	Public Safety, Public Works, and Library (setuponly)	GIS Coordinator	New portals for Public Safety and Public Works. Insure public access computers at library have links set up
Year 4 TOTAL:	**$145,500**			

City of Champaign
Schedule



Recommendations for Year-Five Maintenance Phase

The fifth year of the project will revolve around maintenance of existing systems and some additional data development.

Year-Five implementation items are as follows:

Item Description	Item Type	Item Process
Maintenance on ESRI Products	Application	Provision
Introduction to ArcGIS I	Training	Provision
Continue Public Works Data Collection Effort	Database	Deployment
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter 3	Database	Deployment
Intranet Data Browser Training	Training	Provision
Internet Data Browser Training	Training	Provision
Training and Conferences for GIS Coordinator and GIS Analyst	Training	Provision

Estimated Cost Schedule for Year Five

Maintenance Phase

At this point in the project, departments should be utilizing the GIS for data collection, analysis, and decision support. It should have become another resource that employees rely on, much like a word processor or spreadsheet program.

Year Five costs are as follows:

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Personnel				
EMT	NA	All	GIS Coordinator	Quarterly Meetings Initially – Eventually As Needed
GIS Users Group Meeting	NA	All	GIS Coordinator	Every other Month
Software				
ESRI Software Maintenance ArcServer Standard ArcInfo Floating x 3 Arcview Floating x 20 ArcView Extensions ArcEditor x 5	$42,200	Enterprise	ESRI	Based on 20% of purchase fee. Official price will need to come from ESRI.
3rd Party Applications Maintenance	$41,300	Enterprise	GIS Software Vendor	Based on 20% of purchase price.
Software Subtotal:	**$83,500**			
Data				
Continue Creation of GIS Data Layers Based on Priorities Identified in Chapter Three	$20,000	All	GIS Consultant and In-house	All data layers will be systematically created based on priorities
Data Subtotal:	**$20,000**			
Installation, Training and Education				
Introduction to ArcGIS I – One class	$5,000	Selected Departmental Users	ESRI or ESRI Authorized Trainer	On-site
Intranet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Internet Data Browser Training	0	Enterprise	GIS Coordinator	Throughout the Year
Additional Training and Conferences	$5,000	GIS Coordinator	Various	
Training and Education Subtotal:	**$10,000**			
Year 5 TOTAL:	**$113,500**			

City of Champaign

Schedule

Year 5	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9			
week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Personnel																																				
GIS Steering Committee									♦																♦											
Establish GIS Users Group Meetings										♦								♦								♦								♦		
Software																																				
Maintenance on ESRI and Third Party Products	♦																																			
Data																																				
Continue Public Works Data Collection Effort																																				
Continue Creation of GIS Data Layers																																				
Installation, Training and Education																																				
Introduction to ArcGIS I																											♦									
Intranet Data Browser Training (as-needed)																																				
Internet Data Browser Training (as-needed)																																				
Training and Conferences for GIS Coordinator/GIS Analyst (as-needed)																																				

♦ **Deliverables**

Estimated Cost Schedule for Public Works Initiative

The Public Works data creation initiative will either be done in-house, outsourced, or through a combination of both. Multiple staffing alternatives were analyzed in Chapter Four. These ranged from total outsourcing to all in-house work. It is imperative that the Public Works initiative move forward. Money will need to be allocated based on which staffing alternative is selected. None of the below costs are reflected in the enterprise funds discussed in the five-year enterprise plan.

Public Works should seek a way to fund the data collection initiative. Enterprise funds and/or a Capital Improvements Project (CIP) are funding alternatives. It is recommended that the collection of a system/data layer not occur over multiple years. Based on lessons learned by other cities, data collection projects that are handled by in-house staff over a long period of time lose momentum and fail before completion. The optimal solution is for internal staff to collect data sets that are manageable given limited time and resources (signs, parking, etc.) Data layers that should be captured by in-house staff are ones that can be completed in a reasonable time period (less than a year). Other major data sets, such as storm water, should be outsourced to an Engineering firm that can complete the project within a year. Of critical importance, is the implementation of a work order management system that will allow the City to track and update system changes as they occur in the field.

Costs are as follows:

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Personnel				
Hire GIS Technicians	Handled Separately	Public Works	Job Search	Anywhere from two to seven Technicians – reference Chapter Four
Software/Hardware				
GPS Hardware and Software	$8,600 per unit	Public Works	Trimble Reseller	Number of units depends on whether data collection will be outsourced or done in house. If in house each Technician will need a unit.
Work Order Management/Pavement Management, and Field Editing Application	$175,000	Public Works	Selected Vendor	Various Vendors Discussed in Chapter Two – Recommended Vendor Azteca
AVL	Prices vary depending on carrier	Public Works	Selected Vendor	Hardware per vehicle around $200 per vehicle and then a monthly fee with local service provider. Server side software included within enterprise funds in Year three

Item Description	Current Cost	Department of Deployment	Accomplished By	Notes
Data				
Creation of data sets identified in Chapter Two	$750,000 - $1,500,000	Public Works	Outsourced or in-house	If outsourced data collection would cost an estimated $750,000 - $1,500,000 depending on detail and level of accuracy. Alternative is to supplement that with in-house efforts.

Appendix

Appendix I: Existing Software Applications

Appendix II: Business Processes Involving GIS

Appendix I - Existing Software Applications

Citywide Approved Hardware, Software, and Communications Standards

APPLICATIONS

Word Processing	Word XP (2002) Acrobat Reader
Spreadsheet	Excel XP (2002)
Databases (PC-Based)	Oracle (Windows) SQL Server (CFD) Access XP (2002) PC-Based
Presentation Software	PowerPoint XP (2002)
Publishing	MS Publisher 2003
Project Management	MS Project 2003
Query and Report Writers	Access XP (2002) GEMS/Harris Software Query Language SkyView (GEMS/Harris Access-based Report Writer) **Microsoft SQL Application Server**
Antivirus	Command Antivirus
PDA	GroupWise PDA Connect
Office Productivity Email Scheduling Calendars Tasks Assignments Notes	GroupWise
Geographic Information Systems (GIS)	ESRI Software
CAD	AutoCAD
Financial Management Budgetary Preparation General Ledger Accounts Payable Accounts Receivable Purchasing and Bid Management Cash Receipts Fixed Assets	GEMS/Harris
Payroll	GEMS/Harris
Human Resources Benefits Management Employee Information Applicant Tracking	GEMS/Harris

Nuisance Abatement (Code Enforcement)	TrakIt (CRW)
Permits and Inspections (1998) including Short term or Special Permits Fire Inspections Housing (Code Enforcement)	 TrakIt (CRW) Firehouse (existing) TrakIt (CRW)
Parcel Information Parcel/Permit	 TrakIt
Document Imaging and Mapping Record Storage & Management Text Search Engine Word Scan Plus (OCR) Computer Output to Laser Disc (COLD)	 DocuShare SmartSend
PC-Based Operating Systems	Microsoft Windows 2000 Pro/ Windows XP Professional
CIP (Capital Improvements Program)	Questica
PC-Based Connectivity Software	**Novell ZEN Client (TCP/IP within Network)** **Client Access 400 (to access METCAD's and the County's AS/400)** TCP/IP (for network, UNIX applications, and Internet Access)
Internet	Cisco PIX w/Websense Novell's GroupWise Internet Agent (Internet interface to GroupWise Accounts) Internet Explorer Municipal Code Corporation's Folio SW (City Code on the Internet)
Screen Savers	MS Windows 2000/XP Professional Supplied Only

HARDWARE

Printers (Network)	HP Laser Printers (BW & Color) Dell Laser/Color Laser HP Plotters
Scanners	HP Scanners
Network Server Standards	Novell Enterprise Operating System MS Windows 2000 Server/2003 Server **Zenworks for Servers** **Zenworks for Desktops v7.0** Veritas Backup Exec (backup software) v9.2 Powerchute software for Uninterruptable Power Supplies Ethernet 10/100/1000 (for the physical communication protocol in the network)
Networking Equipment	***Cisco Routers and Switches*** Category 6 cabling with RJ45 Connectors Certified 10Mbit, 100Mbit, and 1Gbit capacity Certified at 100 Mbit or 1 Gbit capacity ADTRAN TSU LT T1 Modems
UNIX Systems	AIX (IBM) UNIX Operating System (METCAD)
Unisys Systems/Windows	GEMS/Harris Browser Gemstone LINC (Unisys product for 4GL over UNIX-based applications)

Appendix II - Business Processes Involving GIS

City of CHAMPAIGN

Business Processes that will involve GIS	City Departments												
	IT Department	Neighborhood Services	Fire Department	METCAD	Finance Department	Human Resources Department	Legal Department	City Manager's Office	Planning Department	Library	Public Works	Police Department	GIS Consortium
Development Requests		☑	☑						☑		☑		
Building Permits and Licenses		☑	☑		☑				☑		☑		
Zoning									☑				
Land Use Studies		☑	☑						☑				
Environmental Assessment		☑							☑		☑		
Information Processing	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Civil Design (CAD)											☑		
Street Maintenance and ROW Mowing											☑		
Sidewalk Maintenance											☑		
Curbs Maintenance											☑		
Parking Management											☑		
Waste Water Utility Management											☑		
Stomwater Utility Management											☑		
Solid Waste Management (Outsource)											☑		
Garbage Pick-up (Outsource)											☑		
Yard Waste (Outsource)											☑		
Recycling (Outsource)											☑		
Building Maintenance											☑		
Landscaping and Grounds Maintenance											☑		
Police Patrol												☑	
Community Policing												☑	
Citizen Interaction/Involvement		☑	☑	☑				☑	☑	☑	☑	☑	
Crime Investigation												☑	
Crime Records Management												☑	
Traffic Accident Analysis			☑								☑	☑	
Public Safety			☑	☑								☑	
Fire Rescue			☑	☑									
Hazard Mitigation/Response/Recovery		☑	☑	☑								☑	
Fire Prevention			☑	☑					☑				
Fire Supervision			☑										
Fire Services Planning			☑										
Demographic/Household Analysis		☑						☑	☑				
Economic Development		☑						☑					
Business Licensing (Billing)					☑								
Utility Billing and Collection			☑		☑						☑		
Address Systems Management	☑			☑					☑		☑		☑
Street Centerline Management	☑			☑					☑		☑		☑
Address Points Management	☑								☑		☑		☑