RFQ No. 014195

GIS Technical Consulting Services

City of Columbus, Ohio, Department of Technology • December 16, 2019

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Cover Letter

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December 14, 2019

Mr. H. Samuel Orth lll, Director & CIO
Department of Technology
City of Columbus, Ohio
The Jerry Hammond Center
1111 East Broad Street, Suite 300
Columbus, Ohio 43205
Submitted Via: **https://columbus.bonfirehub.com/opportunities/21111**

RE: GIS Technical Consulting Services

Dear Mr. Orth,

I am pleased to submit this proposal, on behalf of the Woolpert team, to provide the Department of Technology (DoT) with continued support maintaining and enhancing its GIS. We have been directly supporting the DoT's GIS Division through application development, data acquisition, and business process analysis since the 90s. Most recently, Woolpert provided consulting and application development for the City's 2016 on-call GIS services contract, which supported the Department of Public Utilities (DPU). We are excited to expand on that work to assist the DoT in further advancing Columbus's citywide GIS and its related software capabilities.

Nationally recognized as a premier provider of architectural, engineering and geospatial (AEG) services, Woolpert provides multidisciplinary competencies in several GIS-specific services, such as application development, data conversion, integration, business process analysis, as well as related services such as surveying, data acquisition, asset management, permitting and licensing, urban planning, and water management. With our comprehensive knowledge of the services related to this contract and our successful record of performance, our team proves to be not only uniquely qualified but also an optimal, full-service solution to the DoT.

Legal structure. Established in 1911, Woolpert Inc. is a Corporation incorporated in the state of Ohio and operates throughout the United States. Woolpert's home office is located at 4454 Idea Center Boulevard, Dayton, OH 45430.1500 with a principal place of business located at One Easton Oval, Suite 310, Columbus, OH 43219-6062.

Tax identification. Woolpert's federal tax identification number is 20-1391406.

Contributing authors. Individuals who have contributed to this proposal include:

- Brian Stevens—Program Director
- Frank Orr—Project Manager
- Crystal Childress—Project Coordinator
- Christina Mannix—Proposal Manager
- Lisa Meinhardt—Technical Writer

Summary of Proposed Solution. Our proposed solution is to leverage our past experience with the City of Columbus, which encompasses GIS, data acquisition, surveying and transportation design, to develop focused solutions for the departments the DoT supports—while also assisting the DoT in implementing solutions that will improve the City's GIS capabilities as a whole. Our intimate knowledge of the City's past, present and future goals, paired with our cross-discipline expertise, will allow us to hit the ground running on any project the DoT may assign. From developing applications for the DPU or Public Services to collecting infrastructure data to feed the City's asset management system, and from business process analysis to empowering field staff with user-friendly GIS tools, we offer a one-stop-shop for any and all needs the City may have under this contract.

Woolpert, Inc.
One Easton Oval, Suite 400
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We are capable of providing all of these services in-house, or with the assistance of small, local business partners. Our team is comprised of GIS application developers, database specialists, systems analysts, information management specialists, GIS technicians, surveyors and project management professionals—many of whom have either worked directly on the previous on-call GIS services contract or on other projects for the City.

In addition to this dedicated project team, Woolpert is supported by over 27 GIS Professionals (GISPs), an additional 30 GIS specialists, and over 100 cross-trained staff, including Certified Scrum Masters, Esri Certified ArcGIS Desktop Developers, Certified Asset Management professionals, Licensed Surveyors and Network+ certified IT professionals. In recognition of the DoT's expansion of the potential scope of work under this contract, we have introduced the following additional service offerings in Section One: Firm Introduction under the "other GIS-related tasks" heading:

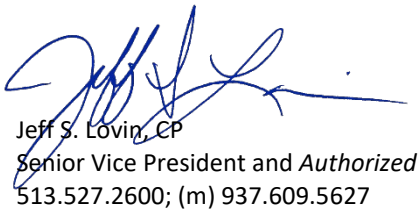
- Topographic Lidar
- Planimetric Data
- Feature extraction
- Land Cover/Land Use Mapping
- 3D Building Models
- Contour Mapping
- Thermal Mapping Services
- CAUV Cropland Delineation
- Utility Inventories
- Unmanned Aircraft System/Vehicle (UAS/V)
- Mobile Mapping

These represent only a portion of Woolpert's services; if any additional capabilities are desired, we are happy to provide more information.

Woolpert is also aware of the City's "Smart Columbus" initiative, which will rely heavily on mapping and GIS technology. We will continue to work in collaboration with the City to develop a "master map" of Columbus to support the Smart Columbus initiative, the Columbus Connected Transportation Network (CCTN) and the City's Autonomous Mobility Initiative. Given our past experience with the City and our multidisciplinary expertise in mapping, GIS development, planning and information management, Woolpert is capable of providing dynamic support during the City's transition to becoming the nation's first "Smart City."

Since our founding in 1911, Woolpert has continuously adapted our services to meet the needs of a changing world. Each decade has contributed to our heightened focus on the markets we serve and the services we perform. Today, our core technologies coincide well with the services you are seeking. With that in mind, thank you in advance for considering Woolpert. We hope that you will give us the opportunity to remain your partner in helping the City stay at the forefront of GIS technology and improve the level of services offered to its citizens.

Sincerely,



Jeff S. Lovin, CP
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Section 1 | Firm Introduction

Our Team

Offeror Information	
Address:	One Easton Oval, Suite 310 Columbus, OH 43219
Telephone:	614.476.6000
CCCN#:	CC001040

Woolpert has a strong history providing services to the City of Columbus and understands the importance of making the necessary investments to revitalize our City's infrastructure. Founded in 1911 in Dayton, Ohio, Woolpert has maintained an office in the City of Columbus for over 30 years. Our four Ohio offices (Columbus, Dayton, Cincinnati and Cleveland) are complemented by 24 other offices located throughout the United States, and they collectively include over 900 employees. Our Columbus office continues to expand, and currently employs 23 professionals locally. This office has been quickly growing, with five hires since June and eight total since January.

While Woolpert has the skills, equipment and capacity to accommodate the Department of Technology's (DoT) needs under this contract, we have long standing relationships with various local small businesses (SB), small disadvantaged businesses (SDB), and minority or woman owned business enterprises (MBE or WBE) and can augment our capacity with their services as needed. For this on-call project, we have added **Dynotec, Inc. (Dynotec)**, a Columbus-based certified DBE company in the state of Ohio. Dynotec will support the Woolpert team by providing computer hardware and software solutions and GIS consulting services. Established in 1990, Dynotec is an approved DBE program participant under the Information Technology Services procurement category and currently holds two contracts with the City of Columbus to provide Dell and Lenovo desktop and laptop hardware.

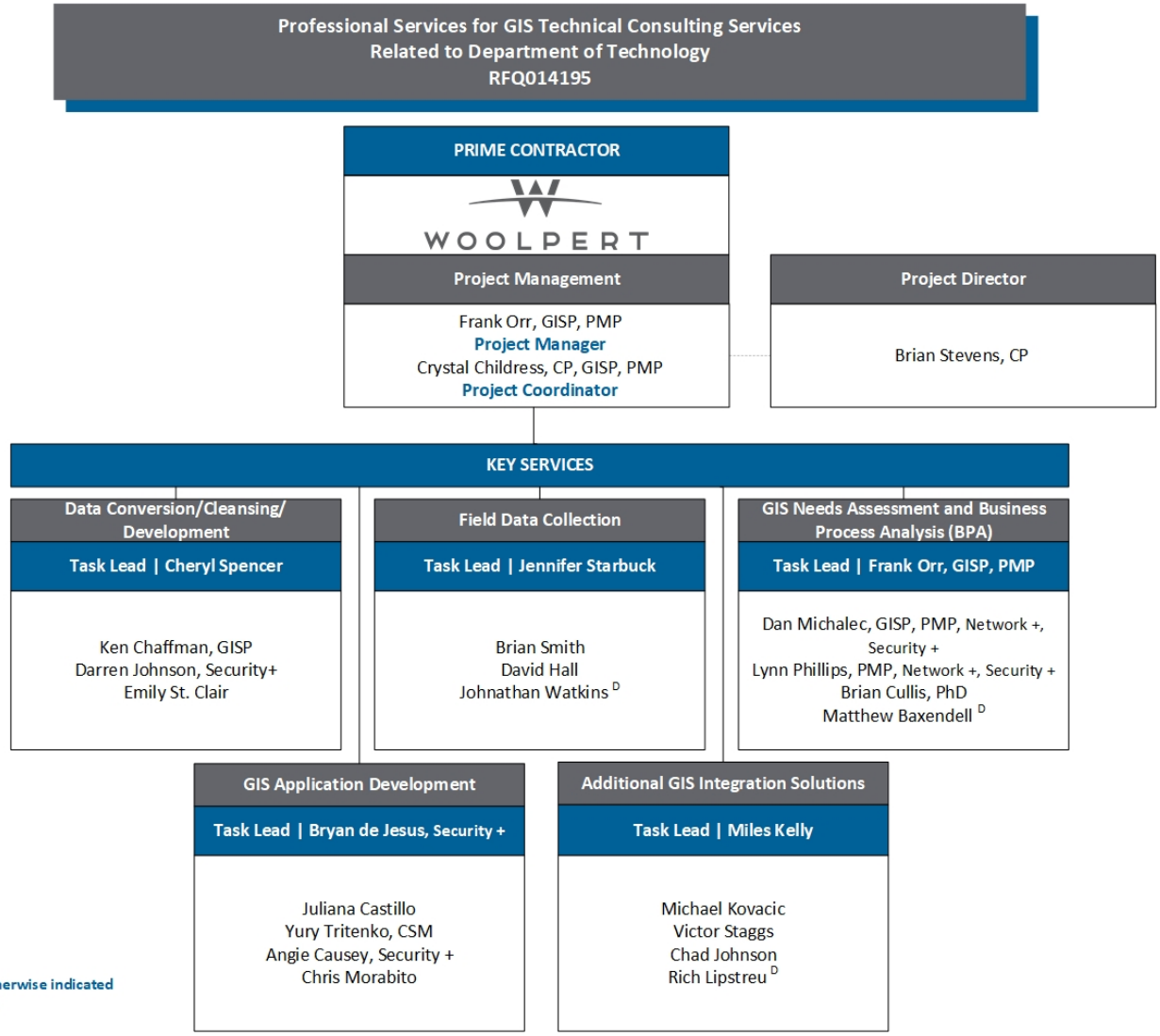
Dynotec has been using Esri ArcGIS products to provide services to clients for the last decade, including Desktop, Pro and the Collector Application. Dynotec has been involved with Blueprint Columbus since the program's inception, providing field data collections services beginning with the ArcPad through the Collector application field. They routinely work with another consultant to make improvements to the custom Collector App template for use by all Blueprint program consultants.

Dynotec provides staff to the City of Columbus to assist in the Enterprise Application Integration and Business Intelligence Systems. These projects require working with City databases including the Work Order Management (WAM), the Columbus Human Resources Information System (CHRIS) and the Columbus Utility Billing System (CUBS). Dynotec is currently working with the City to provide services for the WAM, including creation of Benchmark Work Orders (BMWO) and Preventive Maintenance (PMs) and Preventive Maintenance Optimization (PMO).

We recognize the value of mutually beneficial relationship with small businesses and have demonstrated a commitment to actively seeking these relationships. It is a policy of Woolpert to continue to improve supplier diversity and to make good faith efforts to meet all goals as established in small business subcontracting plans.

While the City has not set forth specific small or disadvantaged business goals for this contract, our team wants to emphasize its support for diversity and the City of Columbus's goals to provide M/W/DBE businesses with maximum practicable opportunity to participate in contracts awarded by the City. Similarly, it is also Woolpert's goal to support the communities in which we work by engaging the services of local subconsultants whenever practical.

The following chart illustrates our team's organization, hierarchy of communication, and distribution of responsibilities. The individuals shown possess the relevant experience, professional registrations, certifications, licensure and accreditations to successfully perform all of the required services and are expected to be the most involved in the GIS Technical Consulting Services contract.



All staff Woolpert unless otherwise indicated

- D = Dynotech, Inc. (MBE)

Firm Overview

Woolpert, Inc.

Woolpert delivers dynamic consulting and design services, worldwide, to clients who require architectural/engineering/geospatial assistance, technology integration, or a combination of both. Our clients range from nationwide military programs to small towns, and from college campuses to private industry. We solve clients' problems through results-focused consulting, creative yet practical design, and the appropriate use of technology.

Our clients benefit from Woolpert's professional expertise over a wide range of services in engineering, design, geospatial and IT management. Specific services that Woolpert provides include: architectural/engineering design, design-build, aviation design, energy solutions, sustainable design, planning, surveying, photogrammetry and mapping, remote sensing, information management, enterprise asset and maintenance management systems, custom application configuration and development, GIS, permitting, watershed management, water/wastewater design and analysis, and regulatory compliance. Our multioffice, multidisciplinary capability distinguishes us from other firms. Woolpert has the relevant experience, expertise, technical support and quality review personnel to complete virtually any assignment in its given timeframe.

Geospatial/IT Services

At Woolpert, we don't wait for new geospatial/IT technology to arrive on the market; we create it. While our geospatial professionals are mapping and surveying tens of thousands of square miles each year for our clients across the country, our research and development group is finding new and better ways to visualize, analyze, deliver, and integrate data. Our clients reap the benefits of Woolpert's visionary approach and state-of-the art services and products.

Woolpert_Labs. Woolpert is one of the only geospatial companies of our size with a dedicated Research & Development group. Coined "Woolpert_labs," this group is made of our own highly skilled technical experts who continuously monitor, test and advocate for emerging technologies in imaging, lidar, GIS, the internet of things (Iot), and web services. A cross-functional group of industry leaders, our team brings together the power of the web, parallel computing, GIS, remote sensing and visualization to create new methods for analyzing and serving geospatial information.

Esri Business Partner. As a Gold Esri business partner, Woolpert provides industry-leading GIS consulting and spatial solutions software development services to help communities improve their workflows for collecting, maintaining and sharing location data. We use many different Esri products for GIS applications and thematic mapping, and to create interactive maps, web solutions and GIS databases. Our staff's proficiency in developing technology infrastructure solutions using Esri's technology as a platform is unparalleled.

Google Platinum Business Partner. Woolpert also has a Premier-level partnership with Google and can advise the City of Columbus on Google-related data products, distributed analytical services, and map-based solution integrations. Woolpert can provide guidance and consulting around the Google Maps Platform, Google Cloud Platform for hosting and cloud infrastructure, and G Suite enterprise applications.

We are leading the geospatial/IT industry by bringing you tomorrow's technology solutions at the same time we're delivering today's state-of-the-art services and products.

Commitment to Sustainable Practices

Woolpert believes that being an environmentally preferable offeror comes from a creative approach to our projects and the way we do business. As a firm, we strive to be responsible corporate citizens, neighbors, and stewards of the environment by leading by example, in alignment with our **corporate environmental principles**. Our sustainability program is employee-driven, with a diverse team of Woolpert professionals engaged in our "green initiative," which is backed at the CFO level.
Our employee green initiative has led to the following actions:

- Purchasing 100% green power since 2011
- Creating waste-reduction through robust recycling programs in each office

LEED certifying five of our offices since 2009

- Pursuing Energy Star in several offices where we occupy all or the majority of the building
- Greening our communities through employee-led, Woolpert-sponsored service projects
    - In Columbus, our office has been an "Adopt a Highway" participant since 2013

- Eliminating our paper-based processes in favor of a web-based ones

As a result of our commitment to promoting a green environment, Woolpert's Columbus office has received **Green Spot Certification**.

Project Approach

Staff and Resources

Woolpert brings a full spectrum of personnel and non-personnel resources—including experienced staff, available facilities and support infrastructure, and complete corporate commitment—to ensure a rapid initiation of any project under this contract.

To manage its projects effectively, Woolpert uses state-of-the-art programs that enable us to monitor, schedule and budget for each project or task order. We also use a resource management application to track the workload of our personnel. Based on workload as a percentage of capacity, the application indicates to managers whether various disciplines in our offices are under goal, on target, or overworked on their projects. This tracking method allows managers to see where problems or opportunities with workload exist and adjust their priorities accordingly.

Woolpert recognizes that a project plan is only as good as the staff and resources fueling it. That's why our project management starts before we even begin the project. When pursuing additional contracts, we evaluate our staff's current workload to verify that we have more than sufficient staff to complete the work in the given time-frame, and compare anticipated equipment needs with existing project timelines to ensure that necessary resources will be available without delay. In preparing this response, our discipline managers evaluated their teams' current workloads and the availability of necessary personnel, equipment and facilities; ***we are confident that we have the resources and capacity to meet or exceed expectations on this contract.***

Contingency Staff

In the event that the DoT requests a task to be completed on an accelerated schedule, our proposed team has reach back support of over 100 cross-trained geospatial staff, as well as more than 50 GIS specialists and developers.

Overall Project Management Methodology

Through Woolpert's extensive experience with as-needed contracts similar to this project, we have developed a series of project management tools and techniques, which will be used throughout our work with the City. The most significant tool that the project management team will use is our cost accounting/management information system: **Deltek**. This system is capable of segregating project-related costs at an aggregate level, which allows charges to be queried by project, task, employee or description of work performed. Deltek allows us to monitor project milestones, identify deviations from budgeted costs and quickly develop corrective actions if needed. As a result of Woolpert's experience with this type of work, our team has a deep understanding of the associated (and expected) costs—and the management best suited for this contract.

Before starting an assignment, the Project Manager will prepare a Project Plan that includes the following components: scope, schedule, budget, roles/responsibilities, communications, quality control, and risk management. The Project Plan will be reviewed and approved by Woolpert's senior leadership. The project management team will identify all of the required resources necessary to complete the project successfully. All stages of the project deliverables will go through the quality control procedures established in the Project Plan before being released to the City for review and use. The project's progress and staffing needs will be reviewed weekly by the project manager. A visual representation of our project plan is as follows:

Additional Project Coordination Tools

In addition to Deltek, Woolpert's project management team utilizes collaborative, web-based communication tools, such as **Microsoft Teams, Smartsheet** and **iMeetCentral**. These applications provide us with a centralized location, accessible by all parties, to develop, document and make changes to the project work plan; track issue logs; manage subconsultants and team resources; review critical path tasks with risk analysis and mitigation; control costs; and report progress. The result is a "project history" that is always accessible to the management team. Woolpert's experience with these tools reduces overall project administration costs and offers significant time savings to our clients.

In addition to his role as Project Manager, Frank Orr's experience also enables him to lead the software development and systems architecture team. This unique leadership/subject-matter-expert dual role will keep Frank continually involved in all project aspects, ensuring a well-planned and well-executed integration of software requirements and functionality with business process improvements, using accurate and authoritative GIS data.

Project Management Team

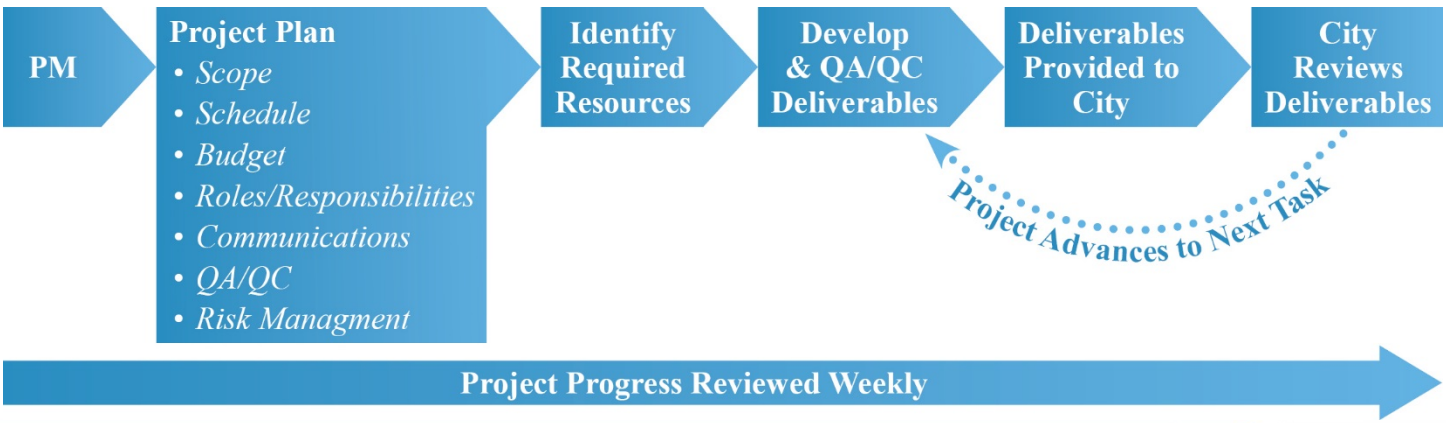
Woolpert intends to use the same proven project methodology that we have successfully employed on the previous City of Columbus GIS technical consulting services contract. Our project methodology is based on our philosophy that a successful project requires a highly-skilled and experienced project management team. A seasoned Project Manager is essential for providing strong leadership and establishing clear lines of communication, authority, roles and responsibilities.

Woolpert's Project Manager ensures that project roles and responsibilities are defined in such a way that clear accountability is known to all project participants. In addition, the Project Manager actively involves key team members of project working groups in the decision-making process, giving the most knowledgeable people the opportunity to provide input. By closely coordinating with these key team members and obtaining their input, the Project Manager builds checks and balances into the decision-making process.

Brian Stevens, CP, will serve as the team's Program Director, bringing years of experience in photogrammetry and GIS to his clients in the state, local and federal markets. He has supported numerous mapping and GIS projects in the state of Ohio, providing expertise in developing and implementing customized asset management solutions and supporting tasks that range from requirements gathering and business process analysis to conceptual designs, data migration, software configuration, implementation, testing and training. Brian will provide general oversight of the project and guidance to the City of Columbus, the DoT and Woolpert's project management staff. He will listen intently to the City's comments and concerns and work diligently to resolve any issues should they arise.

Frank Orr, GISP, PMP, will serve as the Project Manager. With over 20 years managing and delivering GIS projects and programs, he brings a thorough understanding of the DoT's needs and the requirements of the work. Frank's primary responsibilities will be project planning; setting the schedule; determining and acquiring the needed resources; subcontractor management; monitoring budgets and schedules; monitoring tasks to ensure quality control; and establishing project expectations. As Project Manager, he is responsible for the overall success of the project and client satisfaction. Frank will meet with the City and its designated stakeholders to develop a full understanding of the current project goals and expectations.

Crystal Childress, CP, GISP, PMP will be assisting Frank with project management responsibilities**.** With a broad background in photogrammetry and GIS, Crystal serves as the Project Manager for a number of the firm's geospatial projects. She has assisted with operational duties for numerous projects, including the Ohio Statewide Imagery Program (OSIP) since 2016, as well as the current City of Columbus GIS on-call services contract, giving her a solid understanding of the state's photogrammetric/GIS needs and an experience with the DoT's needs and requirements of the work. Crystal will be the secondary contact for the day-to-day operation of



the project, in the event that Frank is not available. Crystal will not only provide Frank assistance during this multi-year project but will play a pivotal role as backup to ensure that quality, deadlines and customer service are achieved.

Proximity and Accessibility

Brian is located in our Columbus, Ohio, office, giving him close proximity to City management. Crystal is located in our Dayton, Ohio, office, which will provide her the opportunity to be directly involved with production tasks on a daily basis and if needed she can also be available onsite in Columbus within an hour. Woolpert's project management team will be fully dedicated for the duration of the program.

Below is the management team's contact information:

Brian Stevens, CP
One Easton Oval, Columbus, Ohio 43219-6062
Phone: 614.827.6155; Mobile: 937.938.0307; brian.stevens@woolpert.com

Crystal Childress, CP, GISP, PMP
4454 Idea Center Boulevard, Dayton, Ohio 45430-1500
Phone: 937.531.1247; Mobile: 407.489.1104; crystal.childress@woolpert.com

Frank Orr, GISP, PMP
116 Inverness Drive East, Suite 107, Englewood, CO 80112
Phone: 720.279.3795; Mobile: 303.885.4781; frank.orr@woolpert.com

Project Management Responsibilities

The key to a successful project delivery methodology is having a skilled project management team with the background to leverage past experiences, intimate project knowledge, the use of technology, and effective communication with the client, subcontractors and internal staff to ensure a successful project.

Our proven project management style includes seven components:

1. Perform project planning
2. Establish project budgets
3. Set the schedule
4. Determine and acquire needed resources
5. Monitor budgets and schedules
6. Monitor tasks to ensure quality control
7. Establish project communications

We have outlined the requirements for all seven steps below to demonstrate the importance we place on project management for this assignment.

Step 1: Perform Project Planning. Frank will begin planning each work assignment after the specifications for that assignment have been agreed upon and finalized in writing. Woolpert team members, with significant input and feedback from City staff, will thoroughly discuss the scope of work to gain a clear understanding of the requirements, goals and objectives for each assignment. Project planning requires that the work be divided into phases and subdivided into work tasks. Most importantly the inclusion and feedback from relevant personnel will be communicated, both internally for the Woolpert team, and externally to appropriate staff.

Step 2: Establish Project Budgets. Frank—with input from Brian and Crystal—will assign a budget of work hours for each phase. These budgets help Woolpert monitor the financial status of each work assignment. The budgeting process has the following components:

- Identify labor categories required for each phase or task
- Estimate the number of hours
- Calculate fees and establish invoicing procedures

Step 3: Set the Schedule. Using this proposed schedule as a starting point, Woolpert and the City will arrive together at an incremental schedule that meets the needs of all parties.

Step 4: Determine and Acquire Needed Resources. Frank—working with our production managers—will evaluate the staff and equipment available for the project, taking the following factors into account:

- Amount of equipment and number of staff available
- Available staff hours and equipment hours
- Hours budgeted for a phase or project
- Time to complete the work
- Existing workload

Step 5: Monitor Budgets and Schedule. Frank's responsibility for project management doesn't end with project planning, budgeting and scheduling. In addition, she will monitor budgets and schedules to identify potential problems so that the project stays on track. We use Microsoft Project to track milestones, timelines and budgets. The project Gantt chart is often included on a project website, as detailed later in this document.

Step 6: Monitor Tasks to Ensure Quality Control. Frank—in concert with Brian and Crystal—will set the standards for quality products and is responsible for ensuring that quality control procedures are carried out continuously.

Step 7: Establish Project Communications. The level of communication and coordination required to successfully execute a project of this scope is extensive. For this reason, Woolpert uses a wide variety of communication techniques, including: telephone, email, FTP site, WebEx, onsite visits, meetings, progress reports, and a project website.

Utilizing all these methods, Frank and Crystal can properly coordinate our team's efforts and give the City timely answers to questions. All these communication devices add up to an environment that allows our clients to stay well informed about the progress of demanding projects.

QA/QC Processes

Woolpert's Quality Management Program (QMP) is based on the International Organization for Standardization model ISO 9001:2008. ISO standards are used to certify the quality systems and processes of an organization. Woolpert has over a decade of experience working with ISO, and a portion of our company is certified.

By modeling our QMP after the requirements of ISO, Woolpert demonstrates consistency of products and services that meets our clients' expectations and applicable governmental statutes and regulations. Additionally, every document submitted to our clients is always first considered a draft. We always account for continuous feedback on our deliverables to ensure they meet expectations. Even before our deliverables are submitted, they go through a formal quality control checklist and grammar review.

Quality Assurance/Quality Control QA/QC). Woolpert believes that quality is measured by our clients and is achieved when a service meets mutually agreed-upon requirements. We are committed to providing quality services and products to our clients. This commitment is more than quality control steps added to a process. It's a philosophy that is practiced by our Project Managers and production personnel. It's an integral part of each phase of a Woolpert-managed project.

Quality Controls. For product delivery, our Quality Assurance Plan (QAP) covers four important areas of quality assurance:

1. Assigning team responsibilities with individual accountability;
2. Formal internal review procedures to ensure compliance with scopes, standards and codes;
3. Internal tracking and weekly coordination to prevent delays and errors; and
4. Periodic overview of products, internal processes, team performance and client feedback to ensure continued optimum performance and client satisfaction.

Woolpert Project Managers develop and maintain project plans, which are key components of Woolpert's quality control plan. Project Managers' most crucial duties are to develop and maintain those plans. Proper planning helps Project Managers to divide their projects into manageable phases and tasks that can be accomplished over short periods of time. Most project plans contain work breakdown structures, fee budgets, schedules and project team organizations. All team members receive copies of the plans and amendments, and review the plans with his or her Project Manager.

Because the plan is essentially a map for the project, Project Managers monitor, evaluate, and amend their plans throughout the project. Monitoring a project's progress against its plan keeps both the project team and the client up-to-date. Frequent and consistent monitoring also reveals scheduling, staffing, and budgeting problems that may arise unexpectedly.

Woolpert believes that our consistent approach and the significant experience of our personnel are substantial reasons for our years of success. QA/QC is a term used to define the efforts put forth to produce quality products. Our reputation is built on the excellence of the work we have done in the past, and we strive each and every day to maintain that reputation. Quality assurance can only be provided with constant quality control throughout the project. As the layers of data are brought into the framework of the project, they are checked for compatibility with all other plan elements and the overall compatibility with your requirements.

Woolpert's QA/QC managers will take the lead in setting the quality standards, and will have the responsibility of ensuring that quality control procedures are continuously carried out. Another key component of quality control is maintaining constant communication with the client. By keeping the client informed of progress and the content of design deliverables, delays and conflicts can be mitigated. With this plan in mind, our QA/QC process always includes meetings (as required), progress updates, risk questionnaires, and a teamwork approach with all involved in the process. Quality control will be exercised throughout the life of the contract. Data will be reviewed and checked for accuracy and compliance with the project scope.

Demonstrated Competency and Capabilities

Woolpert provides GIS services that include enterprise consulting, data creation, and application development—services that range from business process, workflow analyses implementation planning, and application development, to deployment, onsite operation, and maintenance of systems. Woolpert develops and administers geographic information systems that address all levels needed for client operations—from hardware acquisition through security protocols, and data optimization to application configuration and development and end-user training.

The following section demonstrates our capabilities and typical processes for all services outlined in the RFP.

Data Conversion, Cleansing and Development

A premier provider of GIS services in Ohio, Woolpert specializes in GIS consulting for municipal clients and has provided conversion services on over 20 similar contracts over the past five years.

With over 27 Geographic Information Systems Professionals (GISP), an additional 30 GIS specialists, 40 application developers, and over 100 cross-trained geospatial staff, Woolpert has the capability to meet the GIS needs of a diverse client base.

Data Conversion

Our specialization in data conversion means that our staff understands how geographic information systems are designed and built. This allows us to make intelligent decisions when building data conversion processes and workflows that will work seamlessly with geospatial applications and enterprise systems.

Data conversion at Woolpert begins with a review of existing source material. All of our technicians are comfortable reading and interpreting a multitude of source types. Sources include hardcopy and CAD construction drawings, BIM models, property and easement data, address information, base map data such as orthophotography, planimetric and topographic mapping, and existing GIS data. Once the sources have been identified, the material is reviewed and assessed to determine the primary sources and how they will be used during the data conversion efforts.

Woolpert employs several methods for data construction. The two most prevalent methods are heads-up digitizing and dimensional construction.

Digitizing

Digitizing is the quickest method of developing GIS data. Digitizing has three basic steps:

1. **Data Preparation.** Drawings are scanned, and known points are registered on the drawings to corresponding points on the base map in a process known as geo-referencing. This allows the scanned source documents to be used as spatially correct background information during the heads-up digitizing process.
2. **Data Construction.** Woolpert uses a combination of out-of-the-box tools and custom applications to create data. These tools and applications allow for more efficient data conversion while implementing strict quality control standards. During conversion the source document information is captured to create digital layers that represent data on the hardcopy documents.
3. **Attribution Input.** Woolpert has designed and developed tools to automate the manual input of attribute data with maximum accuracy and minimum keystrokes. These tools are designed to follow domains lists, define prerequisites, and allow attributes to be incremented and persisted where necessary. In addition, they ensure attribute correctness and completeness, minimizing the need for extensive backend QA/QC.

Dimensional Construction

This method uses a complete base map and accurate source documentation. The base map should be a rectified or semi-rectified image; this is usually a digital orthophoto.

Data can then be digitally constructed using the orthophoto as a backdrop. Data can be placed in reference to the base mapping using dimensions supplied by the source documentation. For example, a fire hydrant is placed 15 feet from the street centerline.

Dimensional construction applies accuracy to subsurface features based on the accuracy of surface features. In addition to an accurate base map with limited planimetrics, source documentation must be up-to-date, consistent, and geographically and referentially accurate. While full dimensional construction is seldom used for data construction, some use of dimensional techniques are often employed.

Data Cleansing

Woolpert recognizes that an enterprise GIS is only as good as the quality of its data. We understand that individual datasets can present unique challenges for the cleansing of data. At Woolpert, we use a combination of manual, semi-automated and automated methods for data cleansing.

Manual

During manual cleansing, features are visually reviewed to ensure that they are appropriately drawn and located based on specified requirements. Visual inspection allows users the opportunity to review data against the appropriate source documentation. Manual review is typically employed against all data regardless of the method of capture.

In addition to visual review, manual review can be applied to attribution through database queries. These queries allow users to quickly identify errors such as null, incorrect, or incomplete attribute values. Often times, the attribution errors can be globally corrected using this method.

Semi-automated

Semi-automated cleansing takes advantage of built-in tools such as Esri's topology and geometric network generation to identify data anomalies In addition, Esri's Data Reviewer extension can be used to build rules that define the behavior of features in relationship to one another. Once the data errors have been identified, users can use additional out-of-the-box tools and the manual techniques described above to address the errors.

Automated

Automated data cleansing is achieved through the use of custom applications or commercial off-the-shelf (COTS) software such as Safe Software's FME. Custom applications are built specifically to the design of the data and can programmatically report and in some cases fix data issues. COTS software typically uses extract/transfer/load (ETL) techniques to move data from one state to another using workflow models. These models can be designed to apply data transfer rules ensuring the output meets the data requirements. Database design adherence, attribute assignment and validation, and data refinement, are just some of the functionality of the software.

Data Development

Woolpert understands that data development relies on sound database design. Woolpert has developed database design processes that rely heavily on the input of our clients. We accomplish this by conducting a series of database design workshops where client and Woolpert staff come together to build consensus on the design. The end result is a design that accommodates all of the needs and requirements necessary for the building of a quality GIS.

Custom databases can be built from the ground up using Esri's ArcGIS Pro or by using off-the-shelf software such as Microsoft Visio. Databases can also be built using predefined and standardized database models such as Esri's Local Government Information Model (LGIM) and Utility Network Data Model. These models can serve as the foundation of the database and can easily be modified to meet the requirements of the client. Woolpert has worked extensively with all major relational database management platforms including Oracle, SQL Server, PostGIS, MongoDB, and others. We have assisted dozens of clients moving from Oracle to SQL Server as well as upgrading their Oracle and SQL Server versions. Woolpert understands the intricacies of updating database triggers and stored procedures when switching from one RDBMS to another.

Esri Utility Network Migration

Woolpert is currently working with numerous clients that are interested in migrating their utility GIS data to the Esri Utility Network platform and data model. As an Esri Gold Partner, we are working closely with Esri staff to develop ETL tools to take data from current data models into the Utility Network Data Model. That said, we also understand that migrating to the Utility Network is no trivial task. There are many prerequisites for and ramifications of making this transition. Woolpert recommends performing a gap analysis to determine what foundation components are required before an organization can implement the Utility Network. These

include data, processes, software, hardware, staff, and training. Woolpert is currently working with our customers to plan for the migration to the Utility Network in 2020 and beyond.

Field Data Collection

As a multidiscipline firm, surveying and field data collection cross over into nearly every project Woolpert performs. Our proposed team includes local staff that are well-versed in both resource- and survey-grade GPS field data collection for utilities, development and zoning using both traditional and emerging technologies. We have additional surveyors within the state and region available for reach-back support.

From aerial photography to utility designating and locating, Woolpert excels at tailoring solutions to project requirements using the most appropriate technology, equipment and personnel. Depending on the project purpose, timeline and budget, Woolpert deploys one or more of the following collection methods.

GPS/GNSS Field Data Collection Using Trimble Business Center

Woolpert has proven experience in developing and implementing GNSS control networks and procedures in accordance with the Ohio Department of Transportation's Mapping and Survey Specifications. We employ Rapid-Static GPS/GNSS surveying techniques for establishing primary control. For primary control survey missions, field crews utilize Woolpert-owned, Trimble Navigation R8 series and Trimble Navigation R10 series multi-frequency geodetic GPS/GNSS receivers. Our trained professionals process session baselines each day using Trimble Navigation's Trimble Business Center (TBC) version 5.20 baseline processor with the broadcast ephemeris. Daily processing allows for immediate feedback to field crews to discover any weak links in the control network and immediately schedule re-observations of the affected baselines.

Our team also takes full advantage of RTK GPS via Virtual Reference Systems throughout Ohio. These systems allow for the rover operator to connect and receive broadcasted correction information from a network of base stations. Because this procedure does not require a ground base station near the project location, it inherently reduces man power required to complete a project, provides greater productivity, and yields more accurate results.

Processing and Survey Adjustments

Each survey crew will be capable of performing data processing in the field. Crews carry laptop computers with wireless internet access for immediate uploads/downloads of data, email access, and for data processing. Data is/can be uploaded to secure FTP sites and downloaded from the field or office. Field laptop computers are equipped with data processing software such as Leica GeoOffice and/or Topcon Tools, AutoCad, MicroStation, etc. Technicians also have the ability to remote login to office computers to utilize software that is not available on the field laptops.

For GPS surveys, technicians using GPS processing software (Leica GeoOffice or Topcon Tools) export the Static data collected at the GPS base station to a RINEX file and send the file to NGS On-line User Positioning Service (OPUS). The data is automatically processed by OPUS and sent back via e-mail. Usually this process takes about 10 minutes, including downloading the GPS data from the card until the solution is received back from OPUS. The RMS values and ambiguity information of OPUS solution is reviewed and the position is either accepted or rejected based on the project specifications. The static baselines to published or known control near the site are then processed and the horizontal and vertical components of the position from the OPUS solution are compared to the positions derived from known baselines. The GPS base station position is then adjusted and the RTK data is adjusted to the corrected base station position. The data is then exported out of the GPS processing software and ready for input into CAD.

Asset Inventories Using Woolpert's Optech M1 Mobile Mapping System

Today's surveyors have a wide variety of high-tech tools at their disposal; one of these powerful technologies is mobile mapping. This collection method eliminates disruptions to motorists and removes surveyors from harm's way. Woolpert's unique system combines latest-generation lidar sensors, digital cameras, and position and orientation systems to collect fast, accurate and valuable 3D data. Woolpert has collected and processed tens of thousands of miles of mobile mapping data for the transportation, asset management, energy, aviation and disaster response industries.

Woolpert's Optech M1 mobile mapping system (MMS) is a safe, ideal tool for projects that require the capture of a large volume of assets and infrastructure. Our MMS incorporates state-of-the-art lidar sensors (1,000,000 points per second), multiple cameras (360° coverage) and precision positional/navigational equipment. These qualities make mobile mapping ideal for quickly and accurately mapping assets such as signs, traffic signals, power poles, light poles, parking meters, pavement markings, manholes, fire hydrants, curbs and sidewalks.

GPS Data Collection of Various Surface Infrastructure Features

All structure information collected in the infrastructure inventory will be done utilizing an appropriate GPS unit and pentablet computer. A two or three person field crew (depending on need) will navigate the project site utilizing source documents where available, locating desired infrastructure features. Once a feature is found, the crew will make appropriate measurements and attribute the feature accordingly.

During the inventory sweep, features will be classified as RTK GPS, Total Station, Impeded, or Not Found. This classification catalogs the type of inventory that is attained by the survey crews and can assist with locating problematic features for the reporting process. During the field collection, Woolpert will provide and review at project meetings a list of all structures designated as Impeded, or Not Found with City staff.

In the event that the GPS user is unable to position a feature using the GPS technique, the surveyor will 'manually position' the structure by placing or digitizing the structure. This is accomplished by referencing the structure to the planimetric base map that will be loaded onto the data collectors. The accuracy of the locations using this approach would be 5 to 15 feet, dependent upon existing nearby planimetric data.

For customer relations, field personnel will carry a letter from the City that authorizes the work for this project. An official temporary contractor's badge may also be helpful to inform property owners that the surveyors are working for the City. Woolpert will provide samples of these letters that previous clients have written for the City's review.

If access is hampered or made impossible due to high fence lines, trees or brush, right to trespass, paved over, parked cars, etc., Woolpert will address these issues with the City as defined below under the section entitled, Problematic Feature Reports.

Problematic Feature Reports. One attempt during the primary sweep will be made to gain access to the desired feature. If safe access cannot be gained or the feature cannot be found on the first attempt, it will be attributed as such. Problematic issues flagged by the field crews will be reported to the City via a project website and will be discussed in the project meetings. Problematic features will be grouped by delivery areas and posted on the project website after the first sweep is completed. The City will be notified of the posting and given rights to edit the data. Once the project team has determined the appropriate course of action to resolve the issues related to a 'problematic' feature, Woolpert will return to the field for one final visit to complete the inventory and update the resolved problematic feature. If for some reason the structure still cannot be inventoried, the feature will be annotated with the appropriate information and submitted to the City. We anticipate some City assistance throughout the field effort to deal with specific matters. Roles and responsibilities will be defined during the kick-off meeting and refined after the completion of the Pilot Test Area. Woolpert's experience has shown that often times schedules become delayed when dealing with these 'problematic' issues either as a result of a limited amount of resources available to the client or due to a breakdown in communication between project participants. In order to remain on schedule and maintain the flow of data throughout the inventory process, Woolpert suggests that a close review of this process be conducted by Woolpert and the City and that a mutually beneficial process be developed in order to avoid delays.

Accuracies and Tolerances. Woolpert surveyors recognizes the importance of setting data collection expectations. Accuracy is the definition of the "exactness" of the measurements taken. Tolerance is the "acceptable range" (plus and minus) for each piece of attribution. Typical accuracy requires that 90% of the field-checked measurements are correct, within the agreed upon tolerance range. This criterion differs for objective versus subjective attributes. The agreed upon accuracies and tolerances will dictate the field data collection efforts required and the final acceptance criteria for the data.

Data Development QA/QC. Quality control is built into every step of our methodology guaranteeing overall quality for the City of Columbus. Steps are taken to ensure quality control from the beginning of the field inventory, to the network connectivity and to the final delivery of data. As the City is well aware, "quality assurance" is defined as having the appropriate processes and procedures in place to allow for the collection and processing of the needed data. "Quality control" is the continuous checking of the data during the individual steps of the process to ensure the data is of the highest quality. This section identifies some of the many key quality assurance procedures that Woolpert will employ for this project. Quality control for this project is divided into two categories: (1) field quality control, and (2) office quality control. The two phases combined will provide accurate and consistent data for the City. Through a system of procedures, redundancies and verifications we can provide precise and accurate data to populate the database. Field quality control is the starting point for data collection, and every phase of data collection relies on the quality control procedures to ensure its accuracy. From the first attribute collected to the last, consistency is the key. The job of the field crew is to interpret and record data in a way that is duplicable to others. The process and resources used by Woolpert enables a high level of confidence in data capture.

Field Data Collection Using Esri's Collector for ArcGIS

Woolpert has been using Esri's Collector for ArcGIS software on projects since it was first released, and has been working with clients to identify opportunities to leverage the application in their GIS workflows ever since.

Our field staff uses the application on various mobile devices to record infrastructure such as utilities, potholes and signs. Collector taps into devices' location capabilities to collect points, lines, polygons and any other attributes associated with it, and prompts field staff to fill in customized, map-driven forms. As data is recorded, it can be sent directly to ArcGIS Online (AGOL) and immediately shared with office staff for quality control and inclusion into the GIS. With traditional survey techniques, field data often does not reach office staff until the end of the project—meaning that by the time errors are identified, equipment has already been packed up, or worse, remote crews have already left the site. This real-time data stream between field crews and office staff enables teams to catch and correct errors during the collection, which ultimately leads to a quicker project turn-around for clients.

In fact, Woolpert has been so successful at leveraging Collector to make projects more efficient that some of our clients have given us more work than they would have otherwise been able to afford. Collector's versatility, user-friendly interface and real-time data streaming enables us to complete work faster and with less manpower than traditional survey techniques.

Pairing Collector with External Hardware

Collector's accuracy is driven by the device on which it is used. When used with a typical modern mobile device, the application can achieve mapping grade accuracy, or about 10 to 15 feet. This is accuracy level is sufficient for many uses, especially when incorporated as part of an everyday workflow. However, Collector also allows your mobile device to be paired with external GPS hardware to customize and enhance its accuracy level.

For instance, Woolpert uses Trimble R2 antennas with Collector to capture survey-grade data on pipeline mapping projects. We currently rent these antennas from a vendor in the Columbus area, but given the rising demand for deploying Collector, we plan to purchase one or more soon.

Collector Best Practices

While Collector is an affordable solution for large-scale mapping and surveying efforts, it is also ideal for maintaining GIS data on a day-to-day basis. Shortly before Collector came into the market, Woolpert worked with the City of Columbus's Department of Public Utilities (DPU) to analyze existing workflows for communicating GIS data between field and office staff. One of the DPU's key concerns was that the workflow for updating maps was cumbersome and, as a result, frequently neglected.

Collector is a viable solution for resolving this issue, as it gives each and every field staff member the ability to quickly and easily report data discrepancies back to the GIS office staff. Because the application is so user-friendly and the forms are straight-forward, it requires minimal training to teach field staff how to record data. The data can be immediately streamed to the office, eliminating the risk of valuable updates slipping through the cracks. This real-time data sharing between field crews and office staff enables teams to quickly identify and resolve discrepancies between existing GIS data and the reality in the field.

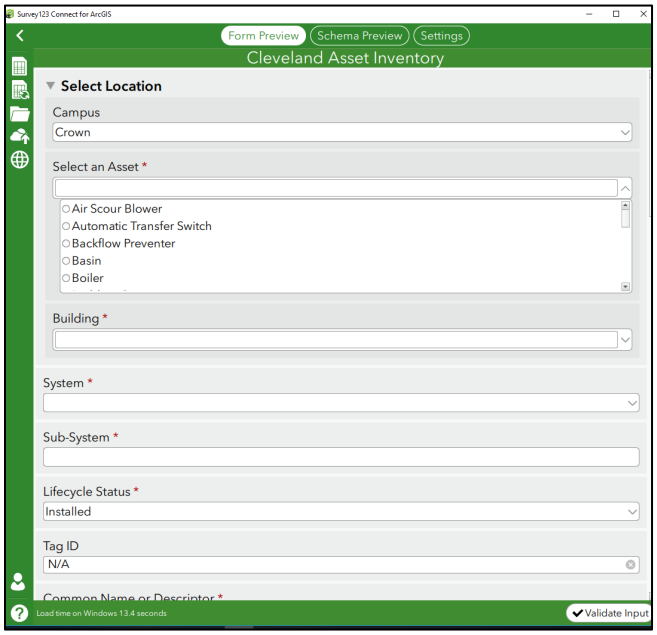
To assist the City in developing best practices for Collector, Woolpert would:

- Perform a needs assessment to identify opportunities for on-going data collection by staff who work in the field. For example, some staff might be able to capture or validate location data while performing work orders. Others might be in a position to report images and locations of damages when they are seen, which can then be attached to a work order for repairs.
- Evaluate existing workflows for field staff informing GIS staff of data discrepancies.
- Evaluate other existing workflows which are dependent on up-to-date GIS data.
- Provide recommendations based on stakeholder input, existing workflows and the City's technology environment.

Woolpert understands that field data collection often occurs in areas without reliable data network coverage. Woolpert has worked with many clients to develop reliable "offline" workflows for data collection in a disconnected environment. Part of this process is developing standard work processes and training field data collection staff how to follow them and work through the process of download, collect, and upload at the end of the day. We have developed easy to follow routines for field staff that include developing mobile map packages (MMPKs) with the required data and local basemap data that can be loaded onto the mobile device and provide a full mapping experience even without a data connection.
Collector is highly-versatile, efficient, affordable and user-friendly—making it an excellent option for the clients who are looking for ways to better manage their in-house GIS data collection and maintenance processes. Woolpert looks forward to assisting the City in leveraging this technology.

Survey123 and QuickCapture

Woolpert has been making use of Survey123 since it arrived on the scene several years ago. Survey123 supports the creation of complex data collection forms that many field data collectors and inspectors require. As an example, Woolpert is supporting a major asset inventory data collection project for the City of Cleveland. We have developed a dynamic Survey123 form that supports collection of asset information for hundreds of different asset classes, each with their own unique set of attributes and rules. Because most of the assets are inside buildings without reliable GPS locations, Woolpert developed the building and asset location data separately and also developed a backend process that links collected asset information with its location within the facility.



Woolpert has also started utilizing QuickCapture for smaller, more proscribed data capture activities. QuickCapture is designed to support simple, targeted data collection workflows, even from a moving vehicle. Woolpert has developed QuickCapture forms for sign inventories, tree inventories, and neighborhood condition assessments.

GIS Staff Augmentation

Few firms have the skills and organizational depth to successfully manage personnel on-site at remote client locations, but at Woolpert it's an everyday part of our business. Along with providing geospatial, engineering and design services, we place qualified, reliable, technical professionals on-site at your location. Unlike a staffing shop, we don't just put people in seats at job sites and leave them to fend for themselves. We provide our on-site professionals with managerial, technical and administrative support through a network of more than 28 offices across the country.

Woolpert's support network for on-site staff includes both your Woolpert Project Manager and Project Coordinator, whose purpose is personnel management. The benefits to you are immediate. While the on-site professionals focus on your technical tasks, our managers handle any other issues that arise. If additional technical expertise is needed, your on-site professionals and the Woolpert Project Manager collaborate to determine who has the capability to provide it. The Project Manager then secures the additional reach-back support. If a personnel issue occurs, the management works with the staff member to resolve it. Experience has taught us that keeping on-site personnel focused on the technical tasks at hand provides you with the results you need when you need them. Your projects run more smoothly, remaining on schedule and within budget.

The Project Manager is also focused on making sure our on-site staff stay technically competent and trained. Each year, Woolpert sends multiple staff members to various trainings and events so we can ensure that our skills stay sharp and we are providing the best up-to-date solutions for our clients.

In Section 3: Relevant Project Experience, many of the projects profiled involved providing on-site staff augmentation. These include the Architect of the Capitol (AOC); the City of Cleveland, OH; the City of Indianapolis/Marion County, IN; and Artex Oil.

Additional examples of projects for which we have deployed on-site staff include:

Air Force Global Strike Command (AFGSC) GeoBase Support Services

Woolpert provided GeoBase program support for the Air Force Global Strike Command (AFGSC). GeoBase services provide enterprise installation and missile field visualization services for the USAF to include collaboration with other DoD organizations. The four GeoBase program components are Strategic (aggregates all geospatial data produced in the Air Force at the HQ level), Garrison (provides the foundation for the strategic GeoBase program with an emphasis on individual Bases and mission sets), GeoReach (the process to enable selection and analysis of Forward Operating Locations (FOL) by serving geospatial libraries of potential forward sites across the Air Force network), and Expeditionary (a forward deployed version of Garrison GeoBase capabilities with outputs tailored to the deployed mission set).

This program provides dynamic software development, program management, and IT services to sustain and enhance GeoBase capabilities in both the expeditionary and garrison geospatial environments. Services support the GeoBase Program in its strategic- and tactical-level objectives—providing commanders and Air Force professionals with a flow of timely geospatial information and providing direct assistance to strategic deterrence and combat support for both nuclear and conventional global strike missions. Our team develops standard and agile core capabilities depicting installations; employs Air Force specific standards to collect, create, and maintain geospatial data sets; implements geospatial enterprise architecture for long-term sustainment and increased cost-efficiency and utility; and develops web-based geospatial tools and applications.

On-Site Staffing

Certain complex projects demand a consultant's presence on a constant basis. For nearly two decades, Woolpert has been placing and managing on-site geospatial experts at locations across the country at over 20 U.S. Air Force bases and various other federal agencies, airports, city governments and county offices.

Our highly trained geospatial professionals augment client project teams with daily, face-to-face expertise. From surveyors and photogrammetrists to GIS analysts and application developers, Woolpert's qualified and reliable geospatial professionals provide the bench strength your project needs—when and where you need it.

- **Experience**. Woolpert's experienced team of managers has been overseeing personnel at remote client locations since 1995. Many of these managers have worked on site at client locations themselves, so they know firsthand the challenges of working and communicating remotely.
- **Communication**. Our on-site professionals always have direct access to their Woolpert project managers. Constant communication facilitates problem resolution and maximizes productivity. Project managers maintain continual awareness of the progress, accomplishments and problems associated with the project, while on-site personnel develop a detailed understanding of project requirements and expectations. This relationship helps prevent any confusion in the interpretation of contract activities.
- **Management**. With effective management, projects run smoothly, remain on schedule and adhere to budgets. As part of the support system available to our on-site staff, our field team leads provide direction, answer questions, locate additional technical expertise, and arrange reporting and administrative support. Additionally, they offer career mentorship and continuing education opportunities to on-site employees.
- **Support**. While Woolpert's on-site professionals serve as an extension of their client's team, they come with the support of Woolpert's full architecture, engineering and geospatial (AEG) staff. Connected to their technical peers and the firm's administrative resources, our on-site personnel have full access to Woolpert's comprehensive suite of technologies, tools and expertise.

GIS Needs Assessment and Business Process Analysis (BPA)

Woolpert staff take pride in providing quality services to its clients. As part of this, we strive to help make our clients' lives easier, not more complicated. In order to do this, we must become familiar with your current process, understand your organization's mission, workflows, limitations, and culture, to provide you with a solution that fits your needs. Taking this custom approach may be more time-consuming than a one-size-fits-all approach, but we have found that it leads to a greater return on investment over the long run.

Needs Assessment

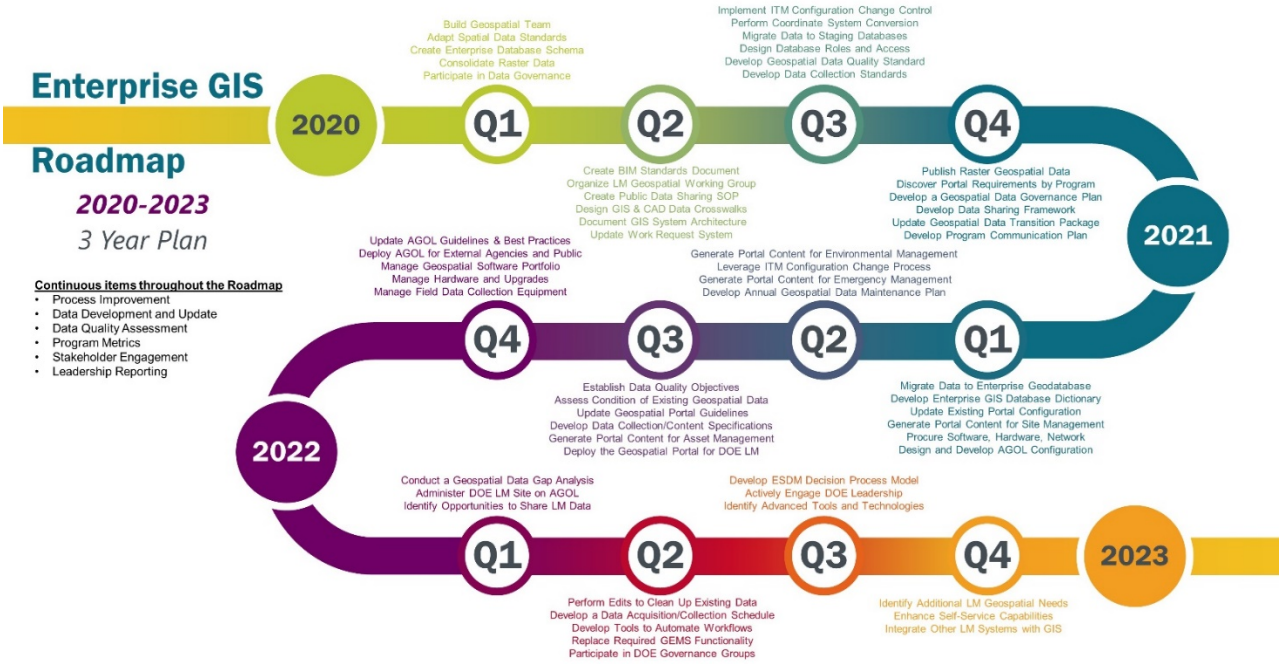
The first step is to discuss the City's needs with the City's Project Manager. We need to understand the overall goals, issues, and pain points and get a sense of the different parties involved. After this first overview, Woolpert staff will meet with the City's staff in one or more workshops to delve into the details of the current situation. By meeting with City staff, listening to what works and does not work, and asking the right questions, we can get a very clear picture of the current environment. At times, we may even want to "look over your shoulder" while you perform a specific task to truly understand all of the steps, and sometimes frustration, involved in getting the work done.

Gap Analysis

After meeting with the project's stakeholders, we will process all of the information we have gathered, summarize it, and propose one or more potential solutions to the identified needs. This may require some prototyping or research to determine what is or is not technically feasible. The goal during this step is to provide the City with realistic options from which to choose. At times, the answer may be very clear, but at others, it may require some back and forth to determine the right approach. The proposed options will be documented in a report, which will be presented to all stakeholders for feedback. Once all feedback has been received, Woolpert staff will review this feedback with the City's Project Manager and incorporate those updates and comments into the final report. This report will include recommendations regarding technology, gap analysis, cost/benefit analysis, and what, if any, business practices need to be modified.

Implementation Roadmap

Woolpert has over 30 years developing and implementing enterprise GIS for our clients. We understand the process of developing and defining the activities required to get from Point A to Point B.



The implementation "roadmap" identifies the detailed steps needed to implement the recommendations and create the organizational or operational changes. This plan will identify the specific tasks and procedures in a logical order, the responsible parties for each task, recommended start/finish dates for each task, and the budget required per task and each year. Based on discussions from the workshops, tasks will be phased to take into consideration internal City goals, budget constraints, and priorities. All recommendations and their associated costs and levels of effort will be input into a Microsoft Project file. Schedules and sequencing can be manipulated to determine the best distribution of both budget and time requirements across a multi-year implementation period.

GIS Application Development

Application Development Approach

Software Requirements Specification

Woolpert recommends that for all application development and/or integration projects, a Software Requirements Specification (SRS) document be developed. This document summarizes the requirements, defines the look, feel and functionality of the application's interface. Whether you are integrating with another system or developing a new GIS application, the development of an SRS greatly reduces the inherent risks associated with writing customized software applications. An SRS is developed to

completely describe the behavior of a system or application to be developed and eliminates risk between software development and systems integration.

Development Approach

Upon completion of the SRS and agreement from all stakeholders, Woolpert will design the application, determining the proposed software's architecture and technology components. This step includes the database design, development languages and coding libraries, and any integration points with other software, as necessary.

Given that modern development platforms, including the Esri JavaScript 4.x platform, provide many tools, functions, and "widgets" out-of-the-box, Woolpert has adopted a "configure first, customize second" approach to application development. Wherever possible, Woolpert will take advantage of existing tools and functionality, and only write custom code to support those specific City requirements that cannot be satisfied otherwise.

Once the application has been designed, development can begin in earnest. The Woolpert development team has adopted the Agile approach. Woolpert's Senior Developer Bryan de Jesus practices the Agile/Scrum methods with training that has allowed him to better lead technical teams and manage development projects. Following the Agile approach improves quality by:

- Encouraging communication among the development team. The development team meets daily in the morning, usually for just a few minutes, to discuss progress from the previous day, tasks to be completed, and any difficulties that have been encountered. These daily standup meetings ensure that developers are talking to each other and everyone is aware of how various tasks are implemented. It encourages dialogue between the developers, ensuring a common approach is followed throughout, thereby leading to a better end product with better structured code. It also ensures that mistakes are caught early, such as misinterpretations of requirements, avoiding potential cost overruns.
- Encouraging communication with City staff. The development lead typically meets with City staff on a weekly or bi-weekly basis to show progress, obtain input and discuss upcoming tasks. Even with the generation of mockups, it is often difficult to truly visualize how a new program will work. We have found that by regularly showing progress and allowing stakeholders to see and play with the software during the development process, new ideas are generated that can significantly improve the quality and usefulness of the end product.

Documentation, Deployment, Training, and Support

Woolpert works with its clients to not only configure and develop applications that meet the needs of the end users, but also to empower its IT and GIS staff to be able to support applications after development. In order to do so, Woolpert will work with the City's IT staff to deploy the application, taking the time to document and explain all of the components that make up the software solution. Woolpert will provide staff with deployment and administration documentation so that the City's IT staff can maintain and support the application without the need to reach out to Woolpert. Woolpert developers also take great care to limit any hard-coding and create clear and well-documented configuration files so that our clients can update any values, such as map service URLs or server names, themselves. Woolpert can provide detailed in-person and remote classroom training to key staff in a "train the trainer" scenario and also provide general user training either in-person or making use of recorded videos.

We understand that taking ownership of a custom application can be difficult. Woolpert always includes support hours after deployment to support IT and GIS staff in case of issues that arise after deployment.

Developing New Applications Using Esri's Best Practices

Each year, Woolpert sends a number of developers to Esri's Developer Summit. Our developers know that our industry is very dynamic and changes quickly. Attending the Developer Summit provides us with an updated view of Esri's software offerings and standards and allows us to better serve our clients by taking into account not only the latest development but a more long-term view of our field. Attendance of this conference has, for example, allowed us to plan well in advance the transition from ArcGIS Server 9 to 10 for the City of Indianapolis. There were some significant changes between the two versions of the software that impacted the City's service oriented architecture, resulting in a conversion of many web services to Server-Object Extensions (SOE).

Woolpert developers have embraced Esri's ArcGIS Online, Portal for ArcGIS, and Web AppBuilder software platforms. We have created a number of custom Web AppBuilder widgets, have stood up ArcGIS Online for numerous clients, and also use ArcGIS Online and ArcGIS Enterprise internally, both for sharing geographic information within our company and for field collecting data using Collector, Survey123, and QuickCapture. Darren Johnson and Jennifer Starbuck are our primary and backup ArcGIS Online and ArcGIS Enterprise administrators and as such are intimately familiar with these platforms.

Our current standard for any type of web development with Esri revolves around HTML 5 and JavaScript. When needed, we may develop web services or server-side code. Our internal standard development language is C#.NET, although we also have experience

developing Node.js or Python services. We have used Esri's ArcGIS for JavaScript (JSAPI) since its inception in 2008. Most of our current development work is focused on 3.x but we have successfully used 4.x for the City of Indianapolis. We traditionally use other JavaScript libraries, such as Angular (1 and 2), Bootstrap, and Material Design. Angular's MVC framework has been very beneficial in providing a more robust infrastructure for our website development but also by making development faster by taking advantage of many of the library's functionality. Bootstrap and Material Design have become our standard responsive design libraries, which we have used with consistent success, especially when developing websites that will run on both mobile devices and desktop computers.

Developing Add-Ins and New Tools for ArcGIS Desktop

As a geospatial company, Woolpert extensively uses Esri software on a daily basis. With over 100 ArcGIS Desktop licenses in daily use, our staff is an expert with the software. At times, we identify areas where the development of custom tools would benefit our internal workflow. Woolpert developers not only support our "external" clients, but also our internal team of GIS analysts. Most of the custom add-ins we have developed for our internal staff revolve around QA/QC. These include:

- A tool that verifies all deliverables against a polygonal grid feature class, ensuring that file names, spatial references, etc. match each grid.
- A tool that splits vector data according to areas of interest so that the work can split into multiple teams and individuals.
- A tool that merges vector data back together (following the work done after the split tool described above).

Some examples of the tools we have developed for our clients include:

- An ArcMap extension that automatically populates attribute data after every edit, storing information such as a custom identifier, username, date, etc.
- A tool that synchronizes data edits between a selected set of feature classes and an Oracle-based master address database.
- A tool that checks text fields in an entire geodatabase for empty strings and converts those to NULL values.
- A tool that automatically populates a configurable set of fields based on a list of values in an Excel spreadsheet.

In addition to add-ins and other Desktop tools, our staff has extensive experience developing Server Object Extensions using ArcObjects.

ArcGIS Mobile Development

While the Collector for ArcGIS application cannot be modified, Woolpert does have extensive experience setting up data, services, and maps for use within Collector. Through our experience utilizing this software both internally and setting it up for our clients, we understand how to set up data and services to ensure the right information is accessible and editable. We work with our clients to determine permissions and offline (disconnected) editing settings.

Additionally, Woolpert has used and customized mobile applications since the ArcPad days. Today, we typically recommend Collector as a first solution, but there are cases where Collector is not suitable. When we encounter those situations, we evaluate the requirements and our client's environment to determine the best solution. It may involve the use of ArcMap on a laptop computer in the field, a custom application developed using one of Esri's Runtime APIs, or even a custom website that can be used for data collection. At times, we have also used third-party applications, such as Fulcrum, when they matched the requirements and proved to be much more cost effective than a custom solution.

Migrate Legacy GIS & Non-GIS Applications

Technology is advancing at an incredible rate and the past 15 years have seen quite the evolution in web-based technologies. In the GIS field alone, looking at Esri software, we have gone from ArcIMS in the early 2000s to the WebADF based on .NET in the mid-2000s, to three web-based APIs (JavaScript, Flex, Silverlight) in the late 2000s and early 2010s, to an almost exclusive focus on HTML/JavaScript today. Woolpert developers have worked with all of those technologies and have performed their fair share of migrations.

For the City of Indianapolis/Marion County, we have upgraded eight web applications in the past year that used outdated technologies such as Flex or JSAPI 1.x libraries to JSAPI 4.x. In addition, we performed 16 web service upgrades, including many from an older version of the .NET Framework to the latest one. For Sandusky County, Ohio, we recently rewrote their Silverlight-based parcel viewer website to HTML5 and JSAPI 3.x. During that conversion, we made some changes to the overall look of the application, modernizing its look and making it responsive so it can be used on phones, tablets, and desktop computers.

Having legacy applications does not always mean upgrading whenever a new technology becomes available, it can also mean maintaining current applications so they are still useful to users. One such example involved Woolpert's support of the City of Columbus' GIS Dashboard. This application is a customized version of Esri's ArcGIS Viewer for Flex. Over the past two years,

Woolpert has developed a number of new widgets as well as enhanced several existing widgets for the City. Woolpert is currently working with the City to develop a project plan to re-develop the City's HydrantWeb application from Flex to JavaScript by the end of 2020.

Additional GIS Integration Solutions

In an enterprise environment, multiple software systems are in use, each with their own purpose. For example, most cities will have an asset management system, a permitting system, an accounting system, etc. While each system does what it is intended to do, they often only work within their own silo. In some cases, in order to share data between systems or streamline workflows, software integrations need to be developed. While some systems may be configured to communicate with others, the need for a custom integration solution frequently arises. GIS can be the perfect hub—the perfect means with which to tie the various systems together.

Woolpert understands this need, and this understanding is a result of our demonstrated experience helping our clients solve their integration challenges. We develop smart solutions that integrate enterprise systems with the GIS, and together with each other, through the GIS.

Integration with GIS

Often a client's GIS lives in a vacuum, where it provides focused functionality through the development of custom applications, websites, and maps. These resources provide specific functionality, analysis capabilities, or show information in a way required by the end-user.

But just as citizens and staff can use GIS tools and data, so can other systems. In fact, these systems can use GIS functionality and information to streamline workflows, provide more accurate and automated analysis, and eliminate duplicate data. Woolpert has leveraged this capability with its clients to build solutions that tie the GIS together with these other systems.

It is estimated that 80% of all data has a meaningful spatial component, that organizations can leverage to make better decisions. Many systems deal with entities that have a physical location. This includes items such as building permits, work orders, service requests as well as physical assets like vehicles and equipment. Woolpert has developed solutions that allow systems to leverage GIS to better define the accuracy of their assets, gather attributes more effectively, reduce process workflows, and share information about their assets with the enterprise.

Spatial Web Services

One of Woolpert's most effective solutions was the creation of spatial web services that systems can consume retrieving data from GIS layers, all based upon a location. Woolpert built a series of web services that extend the capabilities of ArcGIS Enterprise to query features that are within a proximity, or intersect with, or are nearest to a given location, such as an address. Systems can then utilize these services to retrieve information automatically upon creating items like a new work order or service request, perform some sort of spatial analysis behind the scenes such as jurisdiction checking, or return a validated, standardized address string. In these scenarios, these web services use GIS functionality to streamline and limit the need for manual data entry, promote more accurate data, and perform validation processes not available in the native system.

Automated Mapping Workflows

In other cases, clients have wanted to spatially track and analyze information created within enterprise systems. Mostly this is related to entities such as service requests, permits, and work orders – but nonetheless, clients have found it extremely useful to conduct automated mapping of these items within the GIS. For example, Woolpert has developed configurable services that allow for the creation of GIS features with corresponding geometry and attribute information. The result is a set of GIS layers containing service requests, permits, work orders, or even items like crime incidents, that staff can then analyze later or use in other applications to support the decision making process.

Integration through the GIS

Woolpert has also worked with clients to build solutions that take GIS integration to the next level. In these cases, GIS is an integral part of the overall flow of data in and out of the system, almost acting as the hub. Rather than simple queries to retrieve information or send data to the GIS, the workflows rely on the GIS for validation, analysis, and data visualization throughout.

Permitting and Notifications

Woolpert has developed services that perform this type of integration with Accela and its Address/Parcel/Owner (APO) service, configuring it to consume web services that pull this information from both the GIS and an address database. This interface is used throughout the permit creation process and once completed results in a permit mapped in the GIS. Another aspect of this workflow is the submittal of Zoning change permits to a separate notifications system from Accela through the GIS. This allows staff to view on

a map those citizens who may be impacted based upon a spatial selection. Staff can then generate a mailing list to inform citizens of the zoning change.

Salesforce.com Integration

Another key integration solution through GIS that Woolpert has performed is with Salesforce.com and the RequestIndy citizen's portal with the City of Indianapolis. Indianapolis uses the Salesforce.com system for handling requests for service from citizens, and the RequestIndy portal integrates with Salesforce providing citizens the ability to create and submit service requests via the web. Not only is RequestIndy a map-centric application for end users to submit requests, it uses automated workflows to route the service request information to the City's Salesforce.com instance, as well as other subsequent systems down the line, including as a feature in the GIS.

While a user is creating a request, the portal is validating the address and jurisdiction through the GIS to ensure the request is within a maintainable area of the City. The portal also checks the new request against similar requests in the area in order to eliminate duplicate requests.

While RequestIndy is used by citizens, City staff use Salesforce.com to create new requests. Woolpert developed a Salesforce plugin that utilizes the same rules and workflows as RequestIndy, including a map visualization piece. The result is a direct, seamless integration between Salesforce and the GIS that pulls data from GIS layers that is necessary for the creation of a service request. Since the service requests are mapped, further analysis can be performed down the line for making informed decisions in the future.

Woolpert GIS Integration Development Process

Integrations can be complex, but they can also be powerful to the end-user. Woolpert understands the incredible power that enterprise software integrations can provide to our clients, and also understands the range of complexity that can be involved.

While our core approach to integration development is in line with the way we approach other development, integration work can pose some different challenges, and the process therefore benefits from some modifications. Building solutions such as these requires a well-defined process

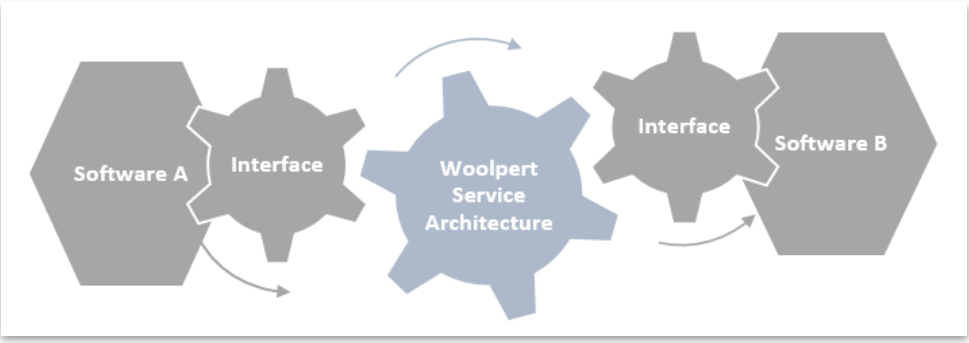
Workflow and Data Requirements

During requirements meetings, we lead stakeholders through discussions to identify what data should be sent back and forth, and what data should not. We determine when the data should be sent (every few minutes? Every night? When a user performs a specific action?), as well as what workflows are involved (public users submit data through a website; internal users create or close work orders; etc.) It is also very important to identify and plan for the inevitable alternate workflows, such as work orders being cancelled or permits being denied, and define how the integration should handle those scenarios.

The resulting Software Requirements Specification (SRS) is generally very similar to one produced for more traditional software development, with the exception that there are usually fewer items that can be considered low priority, or that could be rolled out in a later deployment. The data has to get all the way from system A to system B, not just part way. So although we still employ the Agile methodology, we have to identify priorities according to core units of work.

Software Interfaces

A typical integration consists of software A and software B; an interface for each side, such as APIs, interface tables, flat file import/export, or custom development; and a mechanism that pulls, transforms, and pushes the data from one system to the other. One of our first tasks on an integration project is to identify what interfaces exist for the software involved. We use existing interfaces whenever available, and customize software when necessary. If the client engages another vendor or consultant to customize or configure a particular system, Woolpert will work with the client to identify the documentation and technical specifications they need from that vendor. Communication and clear documentation are critical to make sure that data being sent matches what is expected.



Integration Architecture

With the desired workflows defined and the interfaces identified, we then need to look at the mechanism for sending the data back and forth. For a complex integration, Woolpert typically employs an architecture based on the use of a messaging queue and service bus, which creates an integration that can do the following:

- Reliably send data when and where it is supposed to send it
- Gracefully handle normal networking challenges, such as a database being temporarily unavailable
- Raise active notification of critical errors for those who need to respond
- Log all integration activity

Deployment and Testing

Integration development often involves working against software for which Woolpert does not have a license, such as Oracle WAM. In that case, we can either develop the integration in the client's development environment through VPN access, or in a Woolpert environment. If we build in our environment, we create mock interfaces representing that software according to the technical specifications defining the interface. In that way, we are able to build and execute tests against all workflows, regardless of the software involved. Once that initial testing is complete, the software is ready for full system integration testing in the client environment, and testing is managed according to the standard process.

Documentation

Because software integrations often involve processes that have little or no user interaction, it is critical to provide system administrators with what they need to manage and monitor the services. A typical administrator's guide details the architecture of the system including components installed, database customizations, configuration options, and logging and troubleshooting information.

Other GIS-Related Tasks

The following is a representative listing of additional options deliverables that Woolpert can provide the City and its stakeholders if requested.

Topographic Lidar

Woolpert has delivered hundreds of thousands of square miles of USGS 3DEP QL1 and QL2 lidar for a range of clients, including the U.S. Geological Survey (USGS); Federal Emergency Management Agency (FEMA); National Oceanic and Atmospheric Administration (NOAA); National Park Service (NPS); and multiple state and local government clients.

Woolpert's lidar technologies lead the industry with system and data processing advancements. Our lidar offerings provide a wide range of applications—from impervious surface and flood plain mapping to change detection and 3D infrastructure modeling. In 2018 Woolpert obtained Leica's newest proven lidar technology, the Leica TerrainMapper sensor, along with new TerrainMapper HxMap processing software. With 2 MHz pulse repetition frequency (15 returns) and sensitive collection optics, Leica TerrainMapper increases data collection while providing more efficient flight planning and even point distribution. As part of the Leica RealTerrain solution, TerrainMapper uses Leica HxMap to process raw data. The high-performance HxMAP workflow features the industry's fastest data processing throughout lidar data. The Leica TerrainMapper delivers USGS lidar quality Level 0 data at flying heights up to 2 km higher than ever before, reducing cost and saving time. Delivering 5 cm accuracy at greater flying heights allows high collection efficiencies, even in complex areas of interest (AOI) and changing terrain. Our Terrain Mapper Sensors incorporate the RCD30 digital camera system, which simultaneously captures 4-Band (R,G,B,NIR) digital imagery, providing the opportunity to produce digital orthoimagery of AOIs.

Beside the current linear mode lidar technology, Woolpert pioneered and developed the first high latitude single photon lidar (SPL). SPL is the next generation of lidar technology that provides unprecedented point cloud density and accuracy. In addition, Woolpert offers another new breed of lidar – the Geiger Mode Lidar (GML). Unlike conventional linear mode lidar, which is based on a single pixel receiver, both GML and SPL utilize a focal plane array receiver (multi-pixels) similar to a digital camera to amplify the laser pulse density. Providing both linear mode lidar, GML, and SPL acquisition capabilities help Woolpert provide flexible solutions that are tailored to our clients' needs. Woolpert's unique capability in collecting and processing SPL and GML data has proved to be a great asset to projects that require large area lidar coverage with typical point density of more than 20 points per square meter.

As an Option, Woolpert can provide the state or counties with new lidar data. Lidar has numerous benefits beyond its use as a DEM and/or DTM, especially when combined with orthoimagery, to include but not limited to automated building extraction | Change detection | Impervious surface analysis | Land use/land cover extraction | Forestry analysis | Flood analysis | Watershed delineation.

Feature Extraction

As an industry leader in providing geospatial data, we are committed to the delivery of a high-quality product that supports the multidisciplinary data requirements of our clients. As an example, our **impervious surface** delineation process has been developed to provide a suitable, cost-efficient solution to successfully identify sources of storm water runoff and pollution.

Impervious surface mapping is a necessary component in conducting qualitative and quantitative storm water analysis relating to establishing storm water billing, identifying point and non-point source pollution sources, watershed characterization, hydrologic and hydraulic modeling (H&H) and master planning. In addition to providing impervious surface mapping models, Woolpert performs change detection in conjunction with existing impervious surface data to ensure the impervious surface database is current. By providing the capability to perform up-to-date analysis more cost effectively, our clients are equipped with reliable storm water billing and management systems to address NPDES requirements.

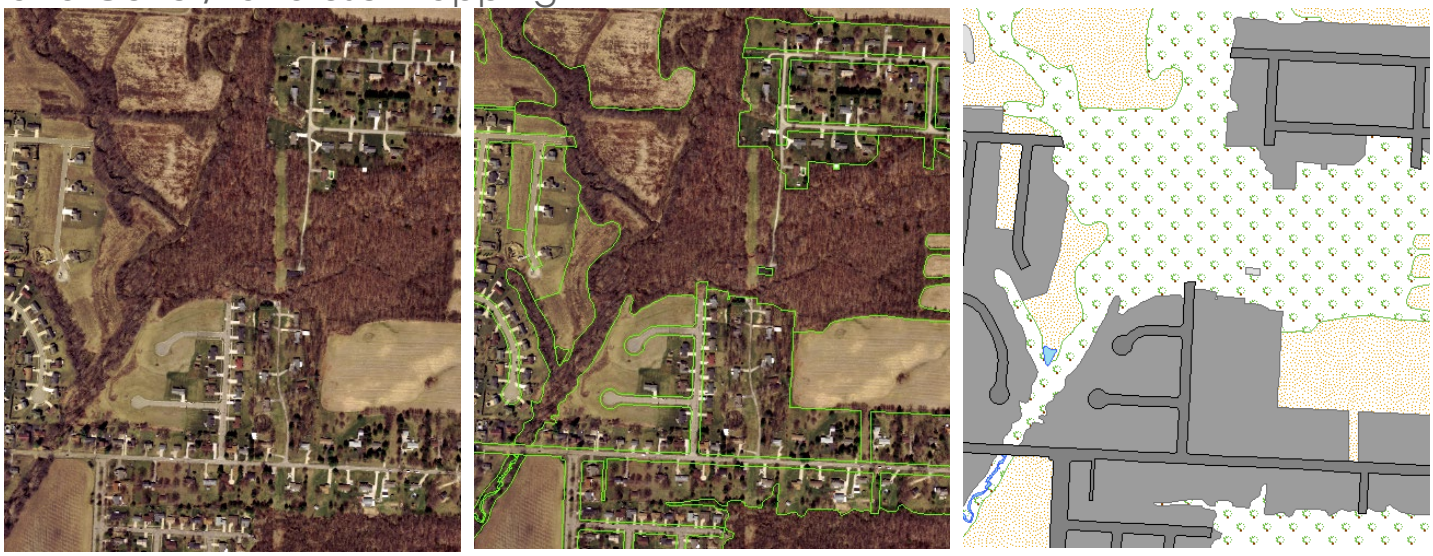
Woolpert has long sought a targeted solution to the problem of lidar exploitation, so we devised and developed a framework, Automated Building Extraction (ABE), that uses open-source data toolkits and libraries to detect

objects in lidar data, extract them and construct realistic surfaces representing solids within the point cloud. The main goal of this approach was to create a framework that extracts accurate polygons for use as a mapping product in GIS from lidar data of varying densities.

Toolkits such as the Point Cloud Library, GDAL, PDAL and libLAS were incorporated in the framework to overcome the challenges of unstructured point clouds and extract planes and edges of physical structures. Open-source tools are highly customizable and enable the detailed investigation of point cloud characteristics and manipulation of modeling parameters for the production of robust solutions.

This framework has been successfully used on multiple projects to extract building polygons and derive information that could be used in other mapping applications.

Land Cover/Land use Mapping



Traditionally the creation of a land cover/land use map was performed using manual interpretation from only aerial photography and manual digitizing polygons of feature classifications. Today, Woolpert's remote sensing specialists have automated the creation of classified polygons by utilizing 4-band digital imagery and lidar.

Central to Woolpert's land cover/ land use mapping approach is the concept of object-based analysis of both imagery and lidar. Woolpert has developed and successfully implemented a mapping approach that incorporates all available sources of data (4-band imagery, airborne, terrestrial and mobile lidar) to produce highly accurate land use and land cover maps. This approach is informed by the understanding that technology is always advancing and we strive to leverage pattern recognition, feature extraction and scene reconstruction techniques in our mapping procedures. Our approach draws on more than 45 years of experience providing mapping services to clients across the country.

Woolpert's solution is based on:

- Intimate knowledge gained from successful completion of land cover and land use mapping projects for local, regional, county and municipal clients.
- Lessons learned from current and past projects with similar specifications.
- Implementation of robust and proven data processing technologies.
- Advancements in production workflow allowing for increased productivity and accuracy while reducing cost and turnaround time.
- A capacity to utilize:
  - ✓ Lidar Classification | elevation, intensity and patterning
  - ✓ RGB/CIR Classification | visual inspection, signature extraction, and color extraction
  - ✓ Historical Data | existing land use, centerlines, and parcels

Advantages:

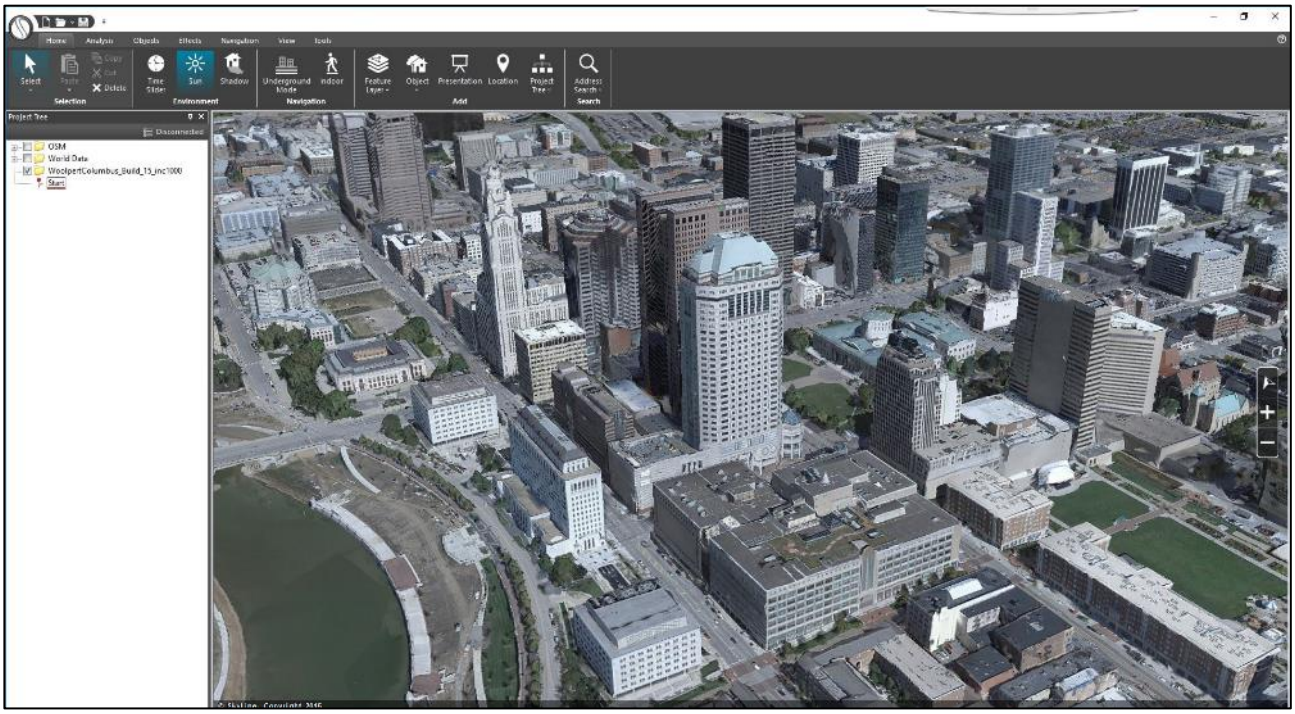
- A robust design that is capable of scaling to serve clients with complex land cover/land use classification schemes
- An opportunity to maintain a more up-to-date and accurate database

- An opportunity to offer a fairer assessment of land cover/land use by removing human subjectivity from the process resulting in a more repeatable and objective analysis
- Reduced time frame of maintaining the land cover/land use database
- Reduced costs associated with maintaining a land cover/land use database
- Reduce human error (using computer software and geo-spatial datasets)
- Track growth through change detection of land cover/land use surfaces (where is population growth occurring?)
- Utilize the existing data and process to extract additional data layers (i.e. land-cover, woodlands, building outlines, etc.).

Assessing land cover map quality is an important concern for land cover mapping projects. It is one of the few ways to establish the accuracy and reliability of the map product. Woolpert considers our approach as an internal validation: validation in the sense that our purpose is to validate the quality of the map and "internal" because we use data collected for and used within the feature extraction process. The internal validation process involves randomly selecting at least 20 percent of the available training site samples and withholding them from the feature extraction process. The intermediate map (generated with 80 percent of the available training site samples) is assessed against the 20 percent withheld samples, producing and error matric and kappa statistics. An error matrix is a square array of numbers laid out in rows and columns that express the number of sample units (pixels, segments and polygons) assigned to a particular category relative to the actual category as verified in the field. The columns normally represent the reference data, while the rows indicate the classification generated from the remotely sensed data.

3D Building Models

The Woolpert team has sensors and software capable of creating of 3D building modeling – the next evolutionary step for GIS.



3D wire mesh

Asset Management

Woolpert's Asset Management Program implementations and consulting services are focused on delivering a comprehensive set of technology tools based upon an asset management best practices methodology. Our asset management best practices methodology first works to understand your organizational asset management policy and defines the planned performance management strategies to achieve your policy. We then design the system implementation and management required to build the system to meet your goals, as well as to support sustained monitoring and continuous improvement activities that are aligned with your long-term Asset Management Program objectives.

In 2014, a multi-year effort through the International Organization for Standardization (ISO) led to the development of three international standards for Asset Management; ISO 55000 (overview), ISO 55001 (management systems), and ISO 55002 (guidelines). These standards, which are referred to collectively as ISO 55000x, are based on the PAS 55 and other international methodologies and have become the best practice industry standards in asset management.

Woolpert has been a leader in using the PAS 55 and now, ISO 55000x methodologies in the practice of asset management for a number of years. Woolpert has 14 staff members currently certified by the Institute of Asset Management (IAM) in Asset Management Practice. This leads to projects which achieve their objectives in accomplishing long term improvements in operations of organizations worldwide. A superb illustration of the Asset Management Journey, as envisioned by IAM (and our certified IAM staff) can be found at: https://www.youtube.com/watch?v=8xM5P4CrUnY.

Oracle WAM Implementation and Integration. Both Woolpert and our subconsultant Dynotec have experience implementing and integrating the Oracle Work and Asset Management (WAM) platform. Woolpert has made use of Oracle WAM application programming interfaces (APIs), designed and developed our own APIs, and created direct database connections to integrate WAM with Esri ArcGIS, Accela, and Cityworks. Woolpert team member Chad Johnson leads our Oracle WAM practice and has over 15 years of Oracle Utilities implementation experience. Chad works closely with our enterprise GIS consultants to devise new and efficient ways to share authoritative data between these two systems of record.

Cityworks Asset Analytics. Woolpert is a Cityworks Strategic Development Partner that integrates the software with other systems and builds custom add-ons to increase productivity. Cityworks has recently acquired the intellectual property rights of Woolpert's Infrastructure Optimization (IO) tool. IO is a GIS-centric planning tool that incorporates asset condition, risk, and levels of service into different infrastructure investment scenarios. IO enables planners, engineers, utility managers and other stakeholders to develop short, medium and long-range rehabilitation and replacement scenarios using methods recommended by the leading international asset management standards (ISO 55000 and PAS-55).

Recognizing the growing adoption of failure modes, levels of service, consequence of failure, probability of failure, and total lifecycle costs in rehabilitation and replacement planning, the IO acquisition helps Cityworks Asset Analytics meet the needs of customers. The expanded framework will enable customers to create budget scenarios and define capital projects using these metrics, regardless of creating them within Cityworks, in the GIS, or consuming them from other third-party modeling systems.

Woolpert's Work with Accela. Woolpert has a proven track record for delivering the Accela Automation solution for more than 50 clients. Accela provides one of the leading civic engagement platforms, powering thousands of services and millions of transactions daily for large and small public agencies worldwide. Accela connects governments to people, and accelerates and streamlines core civic land management, licensing, asset management, and public health and safety processes.

Woolpert has successfully implemented dozens of municipal permitting systems, including some of the largest cities, counties and utilities in the United States. Technology is at the core of Woolpert's service profile. Woolpert is an experienced software system integrator with relevant experience implementing Asset Management, Land Management, Permitting, and Licensing Solutions.

Unmanned Aircraft System/Vehicle (UAS/V)

Woolpert's rich history in photogrammetry and surveying, which spans more than 50 years, forms the foundation for its industry-leading **unmanned aerial system/vehicle (UAS/V)** mapping and surveying services. We have the capability to ensure the entire workflow—from sensor selection, calibration and collection to processing and dissemination—is seamlessly integrated and optimized. We offer high-performance UAS/V technology, but the equipment is only part of the overall solution. We have experience tackling aerial acquisition technology, practical application, and regulatory compliance challenges for successful data collection projects. We maintain direct collaboration with FAA regulatory leaders, ensuring aerial acquisition applications are conducted with the approval of airspace authorities. Woolpert owns and operates multiple UAS/V platforms and payloads in all classifications of airspace, with proven success operating when and where clients require, and have provided UAS consulting for the FAA, DOD, and state and local government, as well as private industry. When used with the proper equipment, safety management protocols, and data processing procedures and software, UAS can be a great option for quickly and safely accessing difficult-to-survey areas.

Woolpert was the first surveying and mapping firm in the country to receive its Section 333 Exemption to commercially fly UAS/V and has been actively utilizing and deploying UAS to collect commercial geospatial data ever since. We now deploy of fleet of over 20 UAS/V platforms and have 25 FAA Part 107 licensed pilots across the country providing rapid and cost-efficient, quality-driven solutions to our clients. Woolpert is constantly researching, developing, and testing the latest UAS technology to expand and enhance its service offerings. They have the capabilities to ensure the entire workflow—from sensor selection, calibration, and collection to processing and dissemination—is seamlessly integrated and optimized. Woolpert offers high-performance UAS technology, but they recognize that the equipment is only part of the overall solution. They also bring the depth of understanding that comes with decades of industry-leading photogrammetry and data production. It is this combination of technology and hands-on know-how that sets them apart from competitors.

Woolpert views UAS as a layer to its sensor platform solutions that leads to final deliverables such as orthomosaics, colorized point clouds, 3D mesh models, digital surface models (DSM), and digital terrain models (DEM). Their focus is identifying the best data collection solution for clients.

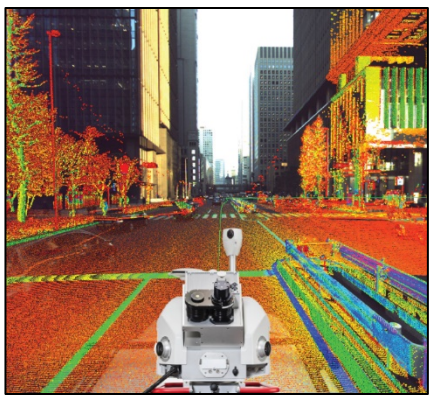
Matching the technical approach to a project's specific requirements is critical to the successful application of UAS/V. To achieve this, Woolpert weighs the objectives of specific tasks with the limitations and advantages of UAS technology to determine whether it is the most advantageous solution. When deploying UAS/V, Woolpert's experts leverage best practices in quality control and risk/safety management, refined throughout extensive and ongoing research and development efforts, to ensure successful project outcomes. Their staff understands, and has experience dealing with, the regulatory requirements associated with completing UAS missions—a unique capability Woolpert brings to its clients that many commercial operators have not yet mastered.

Mobile Mapping System (MMS)

MMS combines state-of-the-art Lidar sensors, high-resolution digital cameras, and a position/orientation system into one mobile platform. Deployed on cargo vans, trucks, all-terrain vehicles, boats, and even rail cars, MMS collects survey-grade, 3D mapping data while on the move—at up to highway speeds. By removing surveyors from project sites, this mobile technology improves safety and eliminates disruptions to the motoring public.

Woolpert recently purchased a Leica Pegasus Two Ultimate, Leica Geosystem's trusted mobile mapping platform, which removes the need for six camera stitching by incorporating two back-to-back cameras creating a 24 MP 360-degree image calibrated to the Lidar profiler, enabling digital reality captures from car, train, or boat. To enable faster processing at the office, a removable solid-state hard drive (SSD) allows users to simply eject the data and walk into the office.

Additionally, Woolpert's Lynx Mobile Mapper M1 by Optech allows for the collection of 1 million points per second while maintaining survey-grade precision. With a 360-degree field of view, it incorporates two lasers, four 5-megapixel cameras that can be mounted in customizable, project specific positions (to enable more accurate and detailed image capture), GPS/GNSS receivers, and a 200Hz Applanix POS LV IMU and DMI to produce survey-grade 3D Lidar data from a mobile platform. With system accuracy better than 0.05' vertical and 0.20' horizontal @ 1σ on paved surfaces, the Lynx offers unprecedented 3D detail and quality. This type of data collection lends itself to surveying large structures such as bridges, locks, dams, and offshore oil platforms, where the data is used to create 3D CAD models for these structures. Position and attitude correction are handled by the Applanix PosLV System. Data is collected with Optech Lynx Survey software and post-processed with Optech DashMap and TerraSolid, TerraScan, and TerraMatch Software.



Modifications and Clarifications

Woolpert has reviewed the terms of the RFP and generally finds the terms to be acceptable although Woolpert would like to have the opportunity to request the following clarifications and modifications if fortunate enough to be awarded the Project. Please note that the City and Woolpert have entered into numerous contracts and Woolpert is confident we will once again be able to agree on mutually acceptable terms.

Section 2 | Qualified Project Staff

Qualified Project Staff

The proposed project team was assembled through careful consideration of the proposed scope of services compared to our team's expertise and experience working with municipal clients on related tasks. For ease of review, we have also included a personnel matrix which encompasses many of the desired competencies and experience identified in the RFP. Detailed information for these staff, including technical competencies and recent experience relative to the proposed scope of services, is also provided in this section.

Proposed Key Staff	Data Conversion/Cleansing/Development							Field Data Collection		GIS Staff Augmentation	GIS Needs Assessment and Business Process Analysis (BPA)				GIS Application Development						Additional GIS Integration Solutions
	Convert construction design plans into the GIS and editing of existing data	Develop new datasets from existing digital and hardcopy information	Develop automated routines to cleanse existing datasets	Conduct quality control of various datasets such as traffic asset features (both spatial and attribute data)	Geodatabase redesign/ standardization - Enterprise System Upgrade task	Migration to Esri's Utility Network environment	Develop and support new databases in SQL Server and Oracle	GPS data collection of various surface infrastructure features	Develop best practices for data collection using various Esri products including: Collector, Survey 1-2-3, Quick Capture, etc.	Provide on-site staff support (duration will vary based on the assigned task)	Evaluate current GIS business practices utilizing industry best practices	Identify opportunities for business process improvement based on knowledge of GIS trends in municipal organizations	Reengineer workflows to facilitate data population and reliable data maintenance	Prepare documentation (SOP's, Training Docs, etc.)	Develop new applications using Esri's best practices leveraging against ArcGIS Online & Web AppBuilder; develop applications using JavaScript 4.X, HTML5, and .NET 4.0 and higher	Develop add-ins and new tools for ArcGIS Desktop	ArcGIS Mobile Development including various Esri products including: Collector, Survey 1-2-3, Quick Capture, etc.	Migrate legacy GIS & non-GIS applications –Enterprise System Upgrade task	Assist in building and enhancing ArcGIS Hub sites	Develop web applications with SQL Server backend database	Support the integration of GIS with other business systems (311, permitting, work order asset mgmt, optimized routing) to ensure compliance with the City's overall IT vision and direction
Frank Orr, GISP, PMP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Crystal Childress, CP, PMP, GISP	■	■	■							■	■	■	■	■							
Ken Chaffman, GISP	■	■	■	■	■		■				■	■	■	■							■
Dan Michalec, GISP, PMP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Lynn Phillips, GISP, PMP				■	■						■	■	■	■							
Brian Cullis, PhD											■	■	■	■							
Darren Johnson, Security +			■					■	■				■		■		■	■			■
Emily St. Clair	■	■			■		■	■		■					■						■
Cheryl Spencer		■	■								■	■		■							
Jennifer Starbuck	■	■	■					■	■				■	■							
David Hall								■	■												
Bryan Smith								■													
Bryan de Jesus	■	■	■							■	■	■	■	■	■	■		■			
Miles Kelly			■													■					■
Julianna Castillo							■							■	■	■	■	■	■	■	■
Angie Causey, Security +							■			■	■			■	■	■		■			■
Yury Tritenko	■	■	■				■			■	■	■	■	■	■	■		■			
Chris Morabito		■	■												■	■	■	■	■	■	
Victor Staggs							■								■	■	■	■	■	■	
Michael Kovacic		■						■							■	■	■	■	■	■	
Chad Johnson		■		■							■	■	■	■							■
Matthew Baxendell - Dynotec											■	■	■	■							
Johnathan Watkins - Dynotec	■	■	■					■	■				■	■							
Rich Lipstreu - Dynotec			■													■					■

Frank Orr, GISP, PMP

Project Manager

Frank Orr is Woolpert's Program Director for GIS Solutions. He serves as principal consultant and subject matter expert on complex, cross-discipline project teams with a focus on enhancing client GIS solutions. Frank brings a vast amount of geospatial expertise to this role and leads the way with a holistic view of networks, systems, and facilities to determine how best to integrate geospatial services using cutting-edge solutions, custom application development, enterprise GIS consulting, and cloud hosting services. Operating from Woolpert's Denver office, Frank is developing strategic GIS programs and implementations for state, local, utility, and commercial sectors.

Prior to joining Woolpert, he held positions with Critigen/CH2M including Senior Solutions Architect, OSIsoft Partner Manager, Senior Program Manager, and GIS Analyst. Frank is a seasoned GIS consultant with impressive business development, program management, project delivery, and client service management experience. He has managed large-scale programs and projects for federal, state, local, and commercial clients including GIS application development, needs assessments, enterprise GIS implementations, and business systems integration.

Frank helps organizations transform the way they do business by helping them invest wisely in enterprise-class IT and GIS solutions. He is a polished public speaker and adjunct professor at the University of Denver and is involved with the local GIS community at the grassroots level.

Project Experience

ArcGIS Upgrade and Redline Application Redesign, Targa Resources—Houston, Texas. Project Director overseeing upgrade from ArcGIS 10.3 to 10.5.1, migration of the existing enterprise geodatabase from Oracle 11g to SQL Server 2016, and creation of a new Redline web mapping application built on the latest Esri web mapping application platform. This will replace the existing application built on the Silverlight platform, which is no longer supported. The project also requires training for Targa staff and documentation, including a high-level disaster recovery plan, a GIS enterprise database administration guide.

Vertical Asset Data Collection System Design, EPCOR Water—Phoenix, Arizona. Project Director overseeing project for GIS data modeling and field data collection process development for EPCOR USA.

Virtual Facility Tour Application, Entergy Corporation—New Orleans, Louisiana. Project Director overseeing project to create a custom website allowing administrators and users to view and manage the data behind a custom street view application of the inside of Entergy's facility.

Panduit Distributor Smart App Development, Panduit—Chicago, Illinois. Project Manager leading project to develop a pilot PowerApps application to be used by distributors to better sell Panduit products in the marketplace. The pilot application steps the user through sample screens to simulate the finished application. The goal of the pilot was to generate discussion, get input, and gather requirements for future implementation.

Professional Data

Years of Experience

21 years

Technical Skills

Education

Master of Science | Geographic Information Science

Bachelor of Science |Mathematics

Professional Registration

PMP, Project Management Institute, 1700939

GISP, GIS Certification Institute, 24000

Professional Membership

GIS Colorado

Presentations and Publications

Keeping it Real: Integrating Real-time Data with Your Water Infrastructure, presented at Esri Water Conference, Nashville, TN, 2019

Where are the Fish? Developing a Tool for Intelligent Fish Habitat Restoration, presented at Esri User Conference, San Diego, CA, 2016

Energy Insite: Visualizing Real-time Energy Data in a Spatial Context, presented at OSISoft Users Conference, San Francisco, CA, 2016

Starting from Scratch: Enterprise GIS from the Ground Up, presented at GIS in the Rockies, Denver, CO, 2015

Modeling Climate Change Vulnerability for Southwestern Forests, presented at GIS in the Rockies, Denver, CO, 2015

Crystal Childress, CP, GISP, PMP

Project Coordinator

A Certified Photogrammetrist and GIS Professional, Crystal Childress provides GIS and mapping services to city and airport clients. She oversees Woolpert's mapping specialists in the field and office on projects ranging from countywide mapping to airport obstruction surveys and drives the completion of projects, ensuring requirements are accurately followed and elements delivered on time. Her expertise is with digital map database construction, quality control, database maintenance, product generation, output processing, and production workflow development.

Crystal uncomplicates metadata compliancy, providing expertise in the creation of FGDC-compliant metadata. She easily navigates the ArcGIS FGDC Metadata Editor to update all metadata components and verify that they conform to the FGDC metadata standard. Using the USGS metadata parser in the Geospatial Metadata Validation Service, she greatly improves the quality of metadata and its production process.

Professional Data

Years of Experience

21 years

Technical Skills

ArcGIS Desktop, SDE, AutoCAD Map 3D and Civil 3D, ArcMap, ArcView, MicroStation, ERDAS Imagine, SAFE FME, TerraModeler, TerraScan, VROne

Education

Associates | General Studies,

Bachelor of Science | Geomatics,

Continuing Education

FAA Level 3 IDLE Certification | 20130315-266

Esri Introduction to GIS I

Esri Introduction to GIS II

Professional Registration

Certified Photogrammetrist | #1529

Certified GIS Professional | #91075

Professional Membership

Member | American Society for Photogrammetry and Remote Sensing

Project Experience

On-Call GIS Consulting Services Contract—Columbus, Ohio. Project Coordinator/Manager for Woolpert's current contract with the City of Columbus to provide as-needed professional services in support of the Department of Technology and various other city departments' GIS applications and projects. To date, six projects have been completed or are currently being completed.

- City of Columbus, OH, 2018 Water GeoSync that involved investigating and detrmining a solution for Water GeoSync errors due to workflow where features are moved from one feature class to another.
- City of Columbus, OH, 2018 County Parcel ETL (2018) that involved creating a process to standardize and combine seven counties worth of GIS parcel data that can be run manually or through a scheduled task. The objectives of this task involved County Coordination, Schema/Script Development, Script Implementation, and Documentation and Training.
- City of Columbus, OH, 2018 Spatial Reference that involved standardizing the spatial references in the City's GIS Enterprise Geodatabase, so that all feature classes used the same spatial reference.
- City of Columbus, OH, 2018 Addressing that involved revising and updating the City's LBRS addressing system.
- City of Columbus, OH, 2019 ArcGIS Editing for an AOI covering the limits of the service area of Columbus, Ohio (± 680.25 square miles).
- Columbus DPU Valve Application that enhancing a Valve Exercise and Pipe Isolation Trace application (Valve Application) by adding a map printing tool.
- 2018 DoT Needs Assessment that involved assessing software systems to support both local municipality and county GIS business objectives.

Indianapolis Traffic Sign Inventory & Pavement Condition Assessment, City of Indianapolis DPW—Indianapolis, Indiana. Geospatial specialist responsible for metadata creation and for processing collected data into a final geodatabase deliverable. Woolpert performed a traffic sign inventory and curb and sidewalk assessment utilizing our Mobile Mapping system for approximately 3,200 miles of roads and streets. Mobile lidar and still-frame digital photographs were used to extract signs, sign information, and their locations per MUTCD specifications. The resulting data was subsequently processed into a geodatabase and delivered to the client.

GIS Implementation Sequence 1 Project, City of Dayton, Ohio—Dayton, Ohio. GIS Specialist responsible for creating a base map deliverable in GeoTIFF format. Tasks included data and feature conversion and the development of attribute features. Woolpert implemented and deployed an enterprise GIS to support the needs of the airport, including increased efficiencies to everyday business practices, support of ongoing and future capital programs through powerful analytical tools, and unified data sharing.

Brian Stevens, CP, GISP
Program Director

A leader in the geospatial industry and Program Manager for county and statewide GIS base mapping (Lidar and orthoimagery) programs, Brian Stevens is a respected Photogrammetrist and GIS Professional. As a technical project manager, his technical expertise and leadership abilities intersect. He builds specialized teams coordinating planning, acquisition, and production of base mapping and GIS data while also leveraging the best GIS capabilities that add the value of closer relationships with clients by meeting their needs, requirements, and challenges. Brian engages with clients, assesses their needs, and delivers responsive and accurate solutions. He bridges the gap between clients and project staff to ensure scopes, schedules, and budgets align with client needs. Mapping out every task and deliverable to get across the finish line, Brian implements stringent QA/QC protocols, performs final QC of deliverables, and works with the team troubleshooting technical challenges and providing training.

To strengthen Woolpert's geospatial outreach, he is active in industry organizations and seeks small business partners with niche services. He excels at securing in-state partners to keep client money in local economies and collaborates with clients and subconsultants to promote awareness of emerging geospatial applications. Brian directed the recent Maine Statewide Imagery Program (SIP) and has been leading the Ohio Statewide Imagery Program (OSIP) since its inception in 2006. Under these contracts, his team produced derivative products that increased states' returns on investment including an interactive solar map and feature extraction derivatives. He manages orthoimagery and lidar projects for state agencies such as Ohio Department of Natural Resources (ODNR) and a nationwide base mapping and utility inventory contract with private clients.

He is currently working with Woolpert's in-house photogrammetrists and researchers to develop new mobile mapping products, applications, and workflows for existing geospatial technology to support critical field activities.

Professional Data

Years of Experience

24 years

Technical Skills

Data fusion, mobile mapping, aerial lidar, and United State Geological Survey's (USGS's) 3Dep Lidar Program

Education

Bachelor of Science, Geography & GIS, The Ohio State University

Professional Registration

Certified Photogrammetrist, National #1293

Certified GIS Professional, National #67817

Professional Membership

American Society for Photogrammetry and Remote Sensing (ASPRS)

Presentations and Publications

"Advances in Impervious Surface Mapping Lead to Fairer Assessments," APWA Reporter, August 2017

"Use of Automated Impervious Area Calculations," presented to Southeastern Stormwater Association (SeSWA)

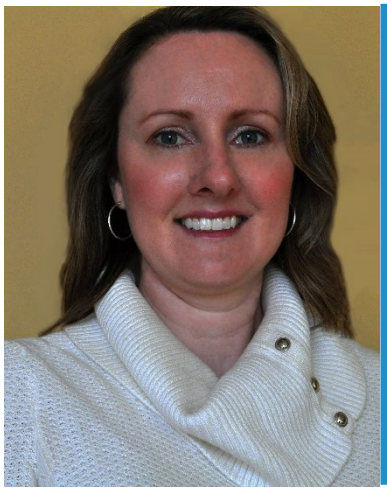
Project Experience

OSIP Project Management, Ohio Office of Information Technology | Statewide Ohio. Project Director who maintains continuous communication with the client and numerous Ohio counties and interested government and non-government organizations; attends numerous conferences and workshops to promote use of spatial data within the state of Ohio; and continues to provide technical guidance, project management, and QA/QC for the Ohio Statewide Imagery Program (OSIP).

2018 Orthoimagery Program | Delaware County, Ohio. Project Director who is leading the Woolpert team in acquiring new aerial lidar covering the entire land area of Delaware County which is 457.4 square miles with a project buffer that extends 100 feet past the county line. This lidar will have an average point density of 0.7-meter and acquired at a flying height capable of producing lidar products meeting the United States Geological Survey 3DEP QL2 standard. Vertical accuracy of the lidar data will be assessed and reported in accordance with ASPRS guidelines. Using this 2018 three-inch aerial imagery and 0.7-meter QL2 lidar, Woolpert will create a countywide hydrographic layer (rivers, lakes, streams, and other bodies of water) that will be digitalized in the direction of flow. The two-foot contours will meet a vertical accuracy of approximately 12 inches. Lidar data will be provided in .LAS 1.4 format and delivered as individual 1,250 by 1,250-foot tiles. The hydro-flattening will be provided in Esri geodatabase format, along with a digital copy of the ground control and QA/QC points as a shapefile, and FGDC-compliant metadata in XML format.

Cheryl Spencer

Task Lead | Data Conversion/Cleansing/ Development



Cheryl Spencer is an accomplished GIS Analyst with Woolpert's Geospatial. An expert on the ArcGIS Suite, she has worked with every version of the software since ArcGIS 9.1. Her in-depth knowledge of ArcGIS includes multi-machine setups and security capabilities, implementing the framework for authentication, authorization, encryption, and auditing. She has a long history of working with city clients providing onsite consulting, handling daily maintenance, stepping in to troubleshoot issues, performing server migration and installation, creating new services, and coordinating with developers.

With her diverse background, Cheryl offers hands-on help as a GIS expert in analysis, consulting, programming, and application development. She understands that quality control is paramount in the data conversion process and is highly skilled in all essential tasks and supporting tools for conversion, cleansing, and development of data. She teams up with other industry leaders and assists project teams using GIS technology to advance collaboration, inspire action, and solve a multitude of business-related challenges.

Professional Data

Years of Experience

18 years

Technical Skills

ArcGIS Server, SDE and Desktop v10.3.1, Windows IIS, Esri's ArcPad, Pictometry, HTML, CSS, ArcXML, Java Script, Dojo, Visual Basic, VB .NET, ASP, and ASP .NET

Education

Bachelor of Science | Earth Space Science

Presentations and Publications

Indy Snowfighter: Using GIS to Monitor Snow Removal and Track Costs, Indiana GIS Conference, Muncie IN, 2011

Transparent Government: Solving Citizen Problems through Efficiency and Accessibility, Indiana GIS Conference, Muncie IN, 2011

Project Experience

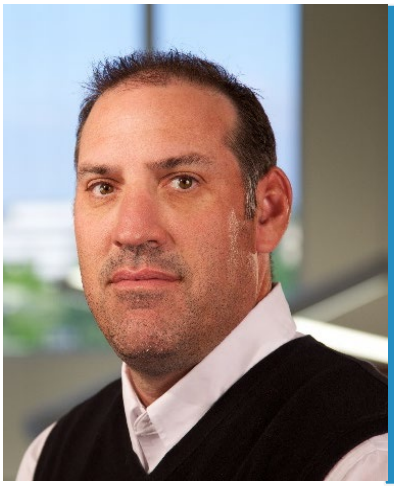
GIS Consulting and Application Development Services, City of Indianapolis | Indianapolis, Indiana. GIS Analyst and Web Developer who has been providing dynamic on-site support to install, administer, maintain and tune the City's ArcIMS and ArcGIS Server infrastructure, including multiple machine deployments. She has updated scripts, data and the GIS description list; developed a variety of new and existing applications; and configured, installed and tested various applications. Cheryl has been involved in dozens of task orders for the City, some of which have included a vacant housing viewer, intranet data viewer, polling place manager, My Neighborhood web portal, property assessment viewer, Rebuild Indy, and a crime view application.

GIS/IT Support Services, City of Hamilton | Hamilton, Ohio. Application Developer who provided subject matter expertise on the City's ArcGIS Server upgrade. Woolpert provided GIS and IT consulting to the City for the following elements of their technical environment: Oracle Database Server, Cityworks Server AMS, Cityworks Desktop, ArcGIS Server, ArcGIS Desktop, ArcGIS extension for infrastructure editing, and various Woolpert-developed tools.

City Water D&M Hydraulics for Cityworks, City of Cleveland | Cleveland, Ohio. GIS Analyst who has provided data prep support to the City of Cleveland's Department of Public Utilities for their AMS software implementation. The services support the Distribution/Maintenance, Hydraulics, Inventory/Warehouse, Plants/Facilities and Water Pollution Control divisions. The team integrated the AMS software application to meet activity requirements; established a stable, high-availability platform for program deployment; conducted discovery to establish project foundations; facilitated asset inventory data collection; and trained the staff on product use.

Ken Chaffman, GISP

Data Conversion/Cleansing/Development



Ken Chaffman manages a team of experts in designing and implementing cutting-edge GIS solutions for local government, oil, gas, and utilities clients. He also serves as a technical resource, responsible for designing, analyzing, and implementing processes, tools, and systems in support of GIS production and quality control efforts. These include developing applications, database structures, user documentation, and conversion and QA/QC processes.

Ken played a critical role in establishing Woolpert's Geospatial Discipline and continues to develop improved processes and technologies to extend its capabilities. A stellar reputation in the GIS industry, he brings to the team high caliber work that encompasses parcel, cadastral, and utility mapping; condition assessments; business process reengineering; and asset and facilities management.

Project Experience

UC West Campus Utility Infrastructure GIS Master Plan Update, University of Cincinnati | Cincinnati, Ohio. System Designer responsible for development of GIS database architecture. Woolpert provided an updated GIS Master Plan and created a GIS data model for the University of Cincinnati. Tasks included holding workshops with stakeholders, performing field surveys, data conversion and consolidation, and implementation planning and documentation.

GIS On-Site Support, Cleveland Department of Public Utilities | Cleveland, Ohio. Geospatial Team Lead who provided subject-matter expertise to the Cleveland Department of Public Utilities for interpreting as-builts, connection logs, village maps, legal descriptions and other documents used to accurately update the GIS with utility location and asset properties and using DPU systems to research and resolve data inconsistencies in the GIS.

Citywide GIS Design and Implementation, City of Cleveland | Cleveland, Ohio. System designer who assisted in designing and implementing an enterprise-wide GIS with a highly integrated suite of applications. This project included creating workflow models, developing database models and application designs, developing GIS standards and manuals, defining maintenance procedures, and providing training. Before citywide implementation, Woolpert conducted pilot projects to test base mapping, applications and data conversion processes.

Artex Data Cleanup, Artex Oil | Marietta, Ohio. Geospatial Team Lead responsible for overseeing the project team in building a structured enterprise data dictionary based on meetings with Artex staff, developing workflows to streamline SSI/GIS data integration, and providing on-site training.

dBASE Migration Assessment Services, Ohio Department of Transportation | Columbus, Ohio. Geospatial Phase Manager who provided GIS consulting services for this project to assess the current condition of, and document upgrade recommendations for, ODOT's roadway inventory and Highway Performance Monitoring System (HPMS) data management and reporting systems. These systems are currently based on a dBASE environment that is no longer sustainable. Woolpert and its subcontractor performed on-site data, script and technical environment reviews and developed a plan to transition from a dBASE environment to MS Access.

Professional Data

Years of Experience

34 years

Technical Skills

ArcGIS Server, ArcGIS Desktop, SDE, ArcObjects, ArcView, ArcInfo; Visual Basic, Oracle, SQL Server, Access, dBase

Continuing Education

Various Esri Training:

ArcObjects with Visual Basic; ArcSDE using ArcInfo and ArcView; Introduction To Microstation; Using ArcInfo NETWORK, TIN, COGO, ArcStorm and ArcScan; Advanced ArcInfo; ArcInfo AML Development; ArcView GIS; Designing Geodatabases Using ArcInfo

Structured query language (SQL), Wright State University

Solaris advanced system administration training, Solaris Training Center

Visual Basic programming levels 1 and 2, Wright State University

Professional Registration

Certified GIS Professional, National, 00058402

Professional Membership

Southwest Ohio GIS Users Group

Darren Johnson, Security+

Data Conversion/Cleansing/Development

As a Database Specialist with Woolpert's Geospatial IT group, Darren Johnson provides support to a variety of federal, aviation and municipal clients. He has extensive experience supporting complex Air Force GeoBase programs, including as a GeoBase Technician, GIS Analyst, and Geospatial Database Specialist. Darren has assisted in multiple airport GIS implementations and has worked with municipal and private sector clients to integrate utility features into existing GIS systems. His experience includes developing geodatabase platforms, coordinating system upgrades, inputting GeoXT and GeoXH survey data into geospatial databases, and developing layered AutoCad maps depicting facilities, parcel boundaries, utilities, topography, and other features. Darren stands at the forefront of using and moving with the fastest GIS technology, Esri software. He has installed and configured the Web Adaptor for ArcGIS Server; HTTPS for ArcGIS Server; and Portal for ArcGIS. He configured reverse proxy servers to allow clients to make edits to enterprise geodatabase behind firewalls, and frequently implements web-based applications to support geospatial analysis, viewing, editing, and routine maintenance for installation data owners.

Professional Data

Years of Experience

19 years

Technical Skills and Proficiencies

ArcGIS Server, SDE, ArcGIS Desktop, Portal for ArcGIS, Collector for ArcGIS and ArcGIS Online, ArcPad, and ArcObjects, Windows IIS, Ventyx Customer Suite v4.1, Oracle RDBMS, 11g, and 12c, C#, VBA, HTML, JavaScript (including Esri JavaScript API), ASP, PLSQL/SQL, XML, .NET, AutoCAD, Microstation, Trimble Geomatics Office, Reference Station, Pathfinder Office, GeoXT, ProXRS, 5700, and 5800, Geodimeter 608s, Auto-Level

Education

Associates | Construction Technology

Professional Registration

Security+ | COMP001020233468

Project Experience

Dayton International Airport GIS Implementation, City of Dayton | Dayton, Ohio. Team Member who is providing dynamic support for this project, including coordinating upgrades, inputting GeoXH data into the geospatial database and training DAY staff in the use of GeoXH and the organization of their data into the new GIS. Woolpert implemented an enterprise GIS to support the needs of the airport. The primary goals of DAY's enterprise GIS are to provide increased efficiencies to everyday business practices, support ongoing and future capital programs through powerful analytical tools, and be able to share a common set of data.

CRAA Wayfinding Signage Program Update, Columbus Regional Airport Authority | Columbus, Ohio. Team Member who configured an ArcGIS Online hosted feature service for field collection and demonstrated the application's capabilities to Woolpert's transportation engineers who are performing the signage inventory. Woolpert is updating the CRAA's existing signage inventory using Esri's Collector and designing signage improvements. What makes this project truly unique is that we are performing survey work—without putting any of our surveyors in the field.

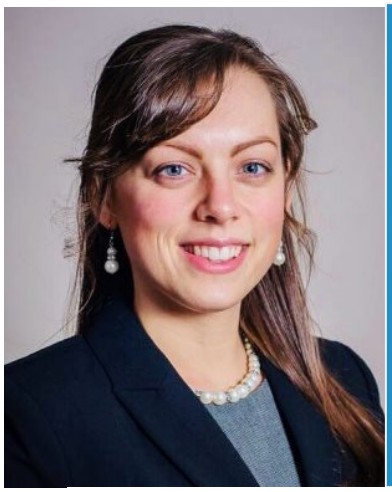
ArcGIS Online Implementation, Artex Oil Company | Marietta, Ohio. Database Specialist who performed workflow scripting, AGOL configuration, hyperlink analysis and training to implement ArcGIS Online for the Artex Oil Company. Woolpert provides ongoing on-site and remote support to Artex Staff on geospatial data management, editing, analysis and map production.

GIS Implementation Study, Tucson Airport Authority | Tucson, Arizona. Database Specialist who performed on-site interviews and data gathering to identify GIS-related needs and develop a GIS implementation strategy and FAA AGIS data maintenance recommendations. As a result of this GIS implementation study, Tucson Airport Authority has received the necessary funding to move forward with implementation.

GIS Consent Decree for CMOM Program, Miami-Dade Water and Sewer Department (WASD) | Miami, Florida. Database Specialist for this task order to populate the WASD sanitary sewer GIS with manhole rime elevations and pipe inverts. Darren assisted in developing a workflow for managing the data edits and tested and implemented the process. Woolpert is assisting Miami-Dade County to comply with a Consent Decree from the USEPA, and Florida Department of Environmental Protection (FDEP).

Emily St. Clair

Data Conversion/Cleansing/Development



As a system analyst, Emily assists clients in analyzing, designing, and implementing information systems to improve functionality, workflow management, and productivity. She specializes in Geographical Information and Asset Management Systems, with groundwork from technical sub-components such as programming, project management, and documentation.

Emily is currently configuring and implementing ArcGIS Indoors for business organizations, assisting business units with their asset management configuration and mobile solutions, and developing standard documentation and operating procedures for internal and external use. She has experience transforming Cityworks from a single-department software to an enterprise solution, developing reports and reporting tools advising management of productivity and cost-efficiency, and moving applications across platforms to provide successful and leading solutions to business units.

At Woolpert, Emily has brought a strong foundational knowledge of technical and creative solutions with her to support her team in delivering quality and valuable answers to clients. She knows how to optimize the Esri technology stack and work with emerging technologies in a collaborative environment to implement innovative technical strategies. Emily navigates Azteca Cityworks Asset Management Software applying GIS to the toughest challenges that clients and cities face. She expertly publishes ready-to-use reports, customized to client specifications.

Professional Data

Years of Experience

3 years

Technical Skills

Microsoft Office Suite, SQL, XML, HTML, Python, Javascript, Azteca Cityworks Asset Management Software

Education

Bachelor of Applied Science, Art History and Anthropology, Northern Michigan University

Associates and Certificate, Geographic Information Science and Cartography, Lansing Community College

Continuing Education

MOOC – Going Places with Spatial Analysis, Esri

Presentations and Publications

Lightning Talk: “Introduction to ArcGIS Indoors”, Cityworks Where Conference, 2019

Project Experience

Cityworks Installation for Bureau of Utilities | Baltimore County, Baltimore. Baltimore County required an Asset Management Program that would support long-term consistent decision making for asset renewal/replacement, capital expenditures, and other financial projections such as required funding and resource staffing to support an acceptable level of service to the citizens within the County. As part of the required system replacements, Woolpert educated various County work groups on the purpose and benefits of an Asset Management Program; assessed their readiness for a new work and asset management software solution; developed a plan for a phased software implementation; and established global processes, record naming conventions, and system configurations across all County work groups so that the implemented solution would share common foundational elements across all divisions.

Asset Management Program Development and Cityworks AMS Implementation, Pinellas County | Pinellas County, Florida. Pinellas County is part of the growing Tampa/St. Petersburg/Clearwater Metropolitan Statistical Area. The county business, under the direction of the Board of County Commissioners (BCC) is responsible for providing different levels of services to citizens across the county, including courts, jails, animal services, economic development, 911, emergency medical system, mosquito control, social services and arterial roads. Pinellas County is looking for a more effective and efficient means of managing assets at an enterprise level. Woolpert is in the process of implementing and integrating Cityworks AMS to meet the County's overall business and asset management requirements as part of their EAM system. Professional services include developing and establishing ISO 55000 framework; training county personnel on EAM/AMS usage; assessing current Organizational Change Management procedures to develop; and post-assessment and improvements as needed for processes and procedures.

Jennifer Starbuck

Task Lead | Field Data Collection

Jennifer Starbuck is a cross-trained Geospatial Specialist with experience in GIS analysis, geodatabase creation and management, data processing, sensor operations, and field surveying. She is an expert and tenacious data collector who captures, processes, and returns accurate field data that integrates seamlessly back at the office, which helps clients streamline and share data. Jennifer began her career with Woolpert tasked with processing and producing GIS data in the office for federal and private clients and statewide imagery programs. When Esri's Collector technology hit the market, Jennifer worked in the field with energy clients helping them leverage the application in their GIS workflows. She uses the application to collect field data, upload it into the ArcGIS Online environment, and provide on-site training and documentation to clients' field staff.

Through Esri technology, Jennifer helps reduce time, cost, and manpower required to complete projects. After seeing client success and how efficient it made Woolpert's own collection processes, Jennifer spearheaded an initiative to use Collector internally. She developed a multi-functional solution that improves workflows and data management. Fieldworkers can capture accurate data, edit it, and return it to the office with reduced user errors and incomplete data submissions. Jennifer works with Woolpert's multiple disciplines to identify opportunities to use Collector in place of traditional survey methods. She also operates and maintains Woolpert's lidar and digital camera systems.

Professional Data

Years of Experience

5 years

Technical Skills

ArcGIS Online, ArcGIS Desktop, Defense Mapping, 3D Analyst, Network Analyst, Spatial Analyst, Data Reviewer, Production Mapping, AutoCAD, geodatabase management and creation, GIS analysis, feature extraction, data conversion, editing, and attribution, MicroStation, and Rinex, to convert, create, and manage GPS dataTraining, Esri Collector

Education

Bachelor of Arts, Geological Science, Wright State University

Master of Science, Geographic Information Technology, Northeastern University

Continuing Education

Certificate, Advanced Technical Intelligence, 2010

SOCET GXT Training

ENVI Training

Project Experience

CRAA Wayfinding Signage Program Update, Columbus Regional Airport Authority | Columbus, Ohio. GIS Analyst who consulted with Woolpert's transportation engineers to develop a plan for using Esri's Collector. For this project, Woolpert is updating the CRAA's existing signage inventory using Esri's Collector application for field collection, designing signage improvements, and will assist the CRAA throughout the bid evaluation and selection process. What makes this project truly unique is that we are performing survey work—without putting any of our surveyors in the field.

Eclipse Water Meetings, Eclipse Resources Holdings | Ohio. GIS Analyst responsible for data collection using Esri's Collector, hosting data to ArcGIS Online, and providing AGOL training and support to the client. Woolpert collected field data and integrated it to the AGOL environment, performed deed research, attended weekly meetings to facilitate land use agreements, and performed water quality testing, flow testing and wetlands delineation.

ArcGIS Online Implementation, Artex Oil Company | Ohio. GIS Analyst who collected field data using Esri's Collector and configured the client's ArcGIS Online platform. Jennifer also developed Collector support documents and provided training to ensure end-users had the tools they needed to continue to leverage Collector and AGOL, independently. Woolpert provides ongoing, on-site and remote support to Artex staff on geospatial data management, editing, analysis and map production.

Gulfport Energy Field Routing and Verification, Gulfport Energy | Ohio. GIS Analyst who performed field route planning to support field data collection using Esri's Collector. Woolpert provided routing, field verification, and ArcGIS Online configuration for this energy client that operates in southeast Ohio.

GIS Database Development - Ohio Gas GIS Database Development and Related Services, Ohio Gas Company | Bryan, Ohio. GIS Analyst who examined and evaluated the use of existing sources for capturing location and attribute data for service-related features such meters and service lines and contributed to a summary of results. Woolpert worked with the Ohio Gas Company (OGC) to convert all legacy geospatial data into a standard format and build an associated GIS to storage, maintain, visualize, and analyze their gas system.

Bryan Smith

Field Data Collection

Bryan Smith is a Geospatial Specialist who provides data solutions in multiple GIS environments for clients and industries. He knows data creation, design, maintenance, and integration from beginning to end—field and survey data collection, building intelligent analysis, and data deliverables to support advanced behavior and visualization. Bryan has worked extensively transitioning data from field into office and the integration of CAD and GIS datasets into client workflows. Equipped with data visualization and spatial analysis skills, he continues to support large federal, Navy, Air Force, Army Corp of Engineers, city, and private industry geospatial programs applying standards, designed data structures, and normalized data. Bryan understands the most important part of GIS is training and documentation and has created numerous technical and end-user manuals.

His deep understanding of GIS and geospatial concepts supports improved field data condition calculations, utility inventories, infrastructure assessments, and unique analyses associated with these large data visualizations. Passionate about using geospatial technology to help solve challenges, Bryan assists in programs to optimize geospatial mapping standards and tool capabilities through an enterprise GIS system. He is actively working with the internal migration of GIS workflows to Esri's newer offerings.

Professional Data

Years of Experience

5 years

Technical Skills

Esri desktop software suite (including ArcPro 2.x, ArcGIS 10.6.x, PLTS, Collector, ModelBuilder, etc.), C++, Python, and Visual Basics for programming, MacroMedia Director MX, ERDAS Imagine, AutoCAD, Microstation, FME, ArcGIS Online,Defense Mapping, 3D Analyst, Network Analyst, Spatial Analyst, Data Reviewer, Production Mapping, AutoCAD, geodatabase management and creation, GIS analysis, feature extraction, data conversion, editing, and attribution, on-site training, and training documentation

Education

Bachelor of Arts, Geological Science, Wright State University

Master of Science, Geographic Information Technology, Northeastern University

Continuing Education

Certificate, Advanced Technical Intelligence, 2010

SOCET GXT Training

ENVI Training

Project Experience

CRAA Wayfinding Signage Program Update, Columbus Regional Airport Authority | Columbus, Ohio. GIS Analyst who consulted with Woolpert's transportation engineers to develop a plan for using Esri's Collector. For this project, Woolpert is updating the CRAA's existing signage inventory using Esri's Collector application for field collection, designing signage improvements, and will assist the CRAA throughout the bid evaluation and selection process. What makes this project truly unique is that we are performing survey work—without putting any of our surveyors in the field.

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ArcGIS Online Implementation, Artex Oil Company | Ohio. GIS Analyst who collected field data using Esri's Collector and configured the client's ArcGIS Online platform. Jennifer also developed Collector support documents and provided training to ensure end-users had the tools they needed to continue to leverage Collector and AGOL, independently. Woolpert provides ongoing, on-site and remote support to Artex staff on geospatial data management, editing, analysis and map production.

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GIS Database Development - Ohio Gas GIS Database Development and Related Services, Ohio Gas Company | Bryan, Ohio. GIS Analyst who examined and evaluated the use of existing sources for capturing location and attribute data for service-related features such meters and service lines and contributed to a summary of results. Woolpert worked with the Ohio Gas Company (OGC) to convert all legacy geospatial data into a standard format and build an associated GIS to storage, maintain, visualize, and analyze their gas system.

David Hall

Field Data Collection

David Hall performs basic field calculations, assists with construction staking, accurately documents crew time for billing, coordinates with survey crew chiefs in adjacent areas for efficient field work operations, records pertinent data into construction drawings and system maps, and prepares reports, maps, and basic spreadsheets as needed. He reviews, analyzes, and summarizes recorded and collected data and coordinates with the field crew to effectively perform data collection tasks. David ensures the capture and return of accurate and complete field data.

He is responsible for data collection utilizing Ground Penetrating Radar, electromagnetic toning equipment, and terrestrial laser scanning platforms. He performs utility designation services and SUE Level B and SUE Level A vacuum excavation services to expose and map underground utility facilities.

Professional Data

Years of Experience

21 years

Technical Skills

AutoCAD, Trimble, Esri, MicroStation, Unmanned Aerial Systems

Continuing Education

American Red Cross First Aid/CPR/AED

Respirator Fit Test, 2007

Project Experience

Citywide Aerial Imagery/Lidar/DTM 1-Foot Contour | Columbus, Ohio. Survey Technician who recorded and quality assured data for ground control and one-foot contours. Woolpert was contracted by the City of Columbus and Franklin County to develop and update their geospatial datasets for use by city agencies and the general public. This project utilized existing 0.25-foot resolution aerial imagery and one-meter maximum density lidar in order to produce a citywide Digital Terrain Model (DTM) capable of generating 1-foot contour layers with a ±9-inch vertical accuracy, delivered in ESRI and AutoCAD formats. Approximately 75 new photo-identifiable GPS points were established and distributed evenly across the project area.

Ambulatory Care Center, Topographic & SUE Surveys | -Columbus, Ohio. Survey Technician who assisted with site data collection and preparation of specifications. Woolpert performed a topographic and SUE survey at the Ambulatory Care Center in Columbus, Ohio. Having previously completed a survey at this project location, Woolpert validated the current topographic survey and performed a SUE survey. A drawing of the project area in AutoCAD was also provided.

Stelzer Road Phase II | Columbus, Ohio. Survey Technician who assisted in review and plan preparation utilizing collected data. Woolpert was selected by MS Consultants to perform a topographic survey including utilities per the City of Columbus survey standards; prepare an existing conditions base map in MicroStation format; prepare the necessary right-of-way plans; design the improvements scoped and prepare construction documents for the improvements north of 17th Avenue to the northerly end on the project limits and design and prepare construction documents for the entire corridor defining the necessary improvements to the signing and striping.

Dayton Wright Brothers Airport, New Entrance | Miamisburg, Ohio. Survey Technician who performed construction staking and utility data collection services. Woolpert was selected by the City of Dayton, Department of Aviation to install a new three-lane entrance for the Wright Brothers Airport. The installation of a new pipe culvert and relocation of any conflicting utilities was also required as part of this effort. Design services included coordination with ODOT in the preparation of standards and specifications, a geotechnical report, traffic analysis, topographic survey, utility coordination, roadway design, site lighting and landscaping/airport signage.

Johnathan Watkins

Field Data Collection

Mr. Watkins leads Dynotec's Field Investigations division and has had an integral role in developing the ESRI Collector for ArcGIS App template, which is used by all consultants for the important Clintonville 3 round of the Blueprint Columbus initiative. Because of his proficiency and quality work, he now oversees Dynotec's AutoDesk and CAD production. His motivation and work efficiency have proven invaluable in the office and out in the field on numerous important municipal projects over the last two years.

Professional Data

Years of Experience

6 years

Technical Skills

AutoCAD and Autodesk programs including Revit, Inventor, and Civil 3D

Education

Associates Degree | Applied Science, Drafting, and Design Technology

Project Experience

Blueprint Columbus–Clintonville 3–Winthrop/Milton–City of Columbus, Department of Public Utilities, Division of Sewerage and Drainage | Columbus, Ohio. *Lead Field Investigator*. Dynotec is prime consultant for the team that includes subconsultants, consultants, and Donahue IDEAS on Clintonville 3–Winthrop/Milton project area, the current round in the Blueprint Columbus initiative, focused on stormwater BMP's, Green Infrastructure, drainage, residential runoff, and water quality. Field investigations include individual houses for development of enhanced stormwater model. Field work was completed using iPads with ArcGIS Collector for direct loading of data into a cloud-based GIS system. Johnathan played a large role in the field topographic survey including field measurement of stormwater inlet dimensions for the enhanced stormwater model. Dynotec has been involved since the inception of Blueprint Columbus and has worked on numerous rounds of the program, routinely providing field investigation and topographical surveying services for other prime consultants to complete the Blueprint projects in compliance with Columbus' Ohio EPA-approved Wet Weather Management Plan.

Blueprint Columbus, Agler and Berrell – City of Columbus, Department of Public Utilities, Division of Sewerage and Drainage | Columbus, Ohio. Lead Field Investigator, AutoDesk and CAD Technician. GIS tablet survey and geo-tagged images of over 500 residences for mapping of building corners, downspouts, sump discharges, and related conditions in Clintonville as part of a survey to improve drainage through green infrastructure.

Dublin Road and Hap Cremean Water Plants Standby Power – City of Columbus, Department of Public Utilities, Division of Water | Columbus, Ohio. Lead Field Investigator, AutoDesk and CAD Technician. Base mapping using field topographic data for design of standby power improvements at City's main water treatment plants including electrical duct bank alignments.

Southerly Wastewater Treatment Plant Improvements, CEPT – City of Columbus, Department of Public Utilities, Division of Sewerage and Drainage | Columbus, Ohio. Lead Field Investigator, AutoDesk and CAD Technician provided base mapping in AutoCAD Civil 3D using field topographic data in support of the Chemically Enhanced Primary Treatment design project. Critical water surface elevations were obtained at the influent flow splitter weirs to verify the plant hydraulic model.

Jackson Pike Wastewater Treatment Plant Fueling Station – City of Columbus, Department of Public Utilities, Division. of Sewerage and Drainage | Columbus, Ohio. Lead Field Investigator, AutoDesk and CAD Technician provided base mapping in AutoCAD Civil 3D using field topographic data in support of the biosolids improvement design, including detailed survey at existing vehicle fueling station for facility improvements.

City of Columbus Sewer Maintenance Operations Center (SMOC) – City of Columbus, Department of Public Utilities, Division of Sewerage and Drainage | Columbus, Ohio. Lead Field Investigator, AutoDesk and CAD Technician provided base mapping in AutoCAD Civil 3D using field topographic data.

Daniel Michalec, GISP, PMP

GIS Needs Assessment and Business Process Analysis (BPA)

Daniel Michalec is a GIS and Project Management Professional and experienced analyst, designer, manager, and teacher. As a Project Manager for Woolpert's Geospatial Discipline, he coordinates and executes GIS projects for energy clients. Understanding how relationships between natural resources and energy are inherently geographic, he integrates new GIS technology to use spatial analysis that help clients improve energy production, transmission, and delivery—components that result in efficiency and huge improvements. He is integral to Woolpert's Energy Market growth and collaborates with interdisciplinary experts to maximize quality and value of client services. Having taught GIS at Columbus State Community College, Daniel helps clients understand how GIS data can benefit their endeavors and how relying on GIS technology can empower decisions that support progress of their organizations.

Having managed aerial lidar, mobile mapping, orthoimagery, thermal, and terrestrial scanning projects, he knows the intricacies of remote sensing equipment and flight planning. He has installed and secured software at numerous Air Force Bases. As a project manager and application specialist for Air Force Material Command's (AFMC) GeoBase Program, Daniel provided application development and support services for all nine AFMC Bases, assisted in project development and research, and acquired, compiled and edited GIS data. He specializes in utilities and land management, acquiring data, and designing enterprise-wide GIS solutions for water, land, and energy clients. He designed a GIS-system for an active drilling oil and gas company to assist in resource management and implemented terrestrial data acquisitions to assist private clients in project planning. His diverse project experience makes Daniel an agile navigator of industry technologies.

Professional Data

Years of Experience

21 years

Technical Skills

Python, MicroStation, Esri, JavaScript, HTML, AutoCAD, Google Maps

Education

Master of Arts, Geography (GIS and Urban Planning), Ohio University, Athens

Bachelor of Science, Cartography, Ohio University, Athens

Professional Certification

Certified GIS Professional, National, #00049521

Project Management Professional, #1572300

Professional Membership

Comp TIA Network+® Certification, #229670216

Comp TIA Security+® Certification, #230863377

Continuing Education

Presentations and Publications

Unmanned Aerial Systems: Current State of the Technology and Relevance to Rural Electric Utilities

Project Experience

AFMC IGI&S (GeoBase) Program Data, Option Year 2, Air Force Materiel Command | Multiple Air Force Bases. Project Manager In support of the AFMC's GeoBase program, Woolpert acquired digital aerial imagery of nine bases and extracted the planimetric features from the imagery. Woolpert also performed field surveys to collect attribute data for various features and enable vector rendering of features. The feature data was delivered as a geodatabase file with FGDC-compliant metadata, in accordance with GeoBase specifications. Woolpert also delivered 3D terrain models for anti-terrorist/force protection (AT/FP), base planning and civil engineering operations. Woolpert personnel assisted with loading, manipulating, maintaining and disseminating geospatial data in the GeoBase system.

GIS Database Development and Related Services, Ohio Gas Company | Bryan, Ohio. Project Manager Ohio Gas Company (OGC) is a privately-owned utility company that provides natural gas service to a multi-county region of Northwest Ohio. Their operations date back to 1914 and as such, their legacy geospatial data is extremely varied in accuracy, completeness, and format. OGC realized their need for accurate and dependable geospatial data and partnered with Woolpert to convert all legacy geospatial data into a standard format and build an associated GIS to storage, maintain, visualize, and analyze their gas system.

Esri Modeling Services, Florida Gas Transmission | Orlando, Florida. Florida Gas Transmission selected Woolpert to develop a Portal application for the client, Eureka Midstream (EHP). The objective is to download and configure Web Application Builder (Developer Edition on the EHP servers. Woolpert was able to create a widget in the framework of Developer Edition, which is a valuable skill for constantly evolving Esri technology. After the implementation of the table-editing widget, the team provided training to the client's staff.

Lynn Phillips, MSTS, PMP

GIS Needs Assessment and Business Process Analysis (BPA)

Lynn Phillips is a seasoned Geographic Information Systems (GIS) and Information Technology (IT) industry leader with significant experience in Federal and Civil Service with the Department of Defense. She is passionate about program management oversight, applying critical thinking and strategic planning to achieve mission success. Lynn's proficiencies lie in her ability to develop plans and initiate programs, processes, or systems with a 'big picture' approach, enabling best practices to ensure quality deliverables. As a natural communicator and mentor, she leads by example with integrity and accountability.

Lynn is responsible for program and project management, business process analysis, engineering and integration, technical oversight, performance standards monitoring, enterprise architecture, budget forecasting and execution, strategic planning and analysis, and requirements analysis. She authored five-year strategic plans for regional IT and GIS programs, applying team approach, critical and analytical thinking, and focusing on ensuring quality deliverables. She holds the Esri Special Achievement in GIS (SAG) Award for her efforts in consolidating GIS systems at military installations into an enterprise GIS she architected to reduce overall program cost and support requirements.

Ms. Phillips has extensive experience designing, implementing, and integrating the Esri ArcGIS platform and aligning IT service management processes with business needs.

Professional Data

Years of Experience

34 years

Technical Skills

ESRI ArcGIS platform, ArcGIS 10.5, Portal for ArcGIS.

Education

Master of Science, Technology Systems, East Carolina University

Bachelor of Business Administration, Campbell University

Professional Certification

Chief Information Officer (CIO)

Project Management Professional (PMP), #20699570

Business Process Reengineering (BPR)

Professional Membership

Comp TIA Network+® Certification, #PR6SG5XJG3Q4KP90

Comp TIA Security+® Certification, #XD5SHKHJMK14C1SG

Membership

Urban and Regional Information Systems Association, URISA

Project Experience

Geospatial Efficiencies & Geo-Integration Office (GIO) Support, Headquarters Air Mobility Command (HQ AMC)—O'Fallon, Illinois. Woolpert has been contracted by SI Systems Technologies, LLC (SIST) to provide strategic consulting support to the HQ AMC/A4 GIO to specifically organize and mobilize appropriate U.S. Air Force elements in support of a new Logistics Geospatial Information & Services (LGI&S) capability.

Geospatial Mapping Standards GeoBase Optimization Phase III, Air Force Special Operations Command—Langley AFB, Virginia. Woolpert has been contracted by the Air Force Special Operations Command (AFSOC) to sustain, modernize and standardize GeoBase tools and capabilities across six major Air Force commands. Woolpert is creating and implementing an enterprise-wide GeoBase system that can be used across the Air Force, with all geospatial capabilities driven from one location and one platform housed at ACC.

GS-14 Supervisory IT Specialist/Director, Strategic Plans for the Assistant Chief of Staff, G-6, Marine Corps Installations East (MCIEAST) - Camp Lejeune, North Carolina. Provided strategic planning, enterprise architecture, and geospatial information systems (GIS) management for the Assistant Chief of Staff (GS-15), G-6, MCIEAST in support of global IT services and national GIS services. Ms. Phillips led strategic planning, IT Data Center architecture and consolidation, IT/GIS Application Portfolio Management, and GIS Solutions management activities. She developed and maintained a 5-year Regional IT Strategic Plan, Implementation Strategy, IT Roadmap, IT Services Catalog, technical capabilities and system architecture views, mission-structure reviews, and business requirements analysis/modeling for continuous process improvement. She planned, directed, and coordinated cross-functional teams and enterprise architecture activities to implement high visibility, interrelated IT and GIS solutions from initiation to final operational stage while maintaining awareness of emerging technologies, higher headquarters' policies, and program/ project management techniques.

Brian Cullis, PhD

GIS Needs Assessment and Business Process Analysis (BPA)

Dr. Brian Cullis (Colonel, USAF, retired) works in a spatial information resource leadership position and has advocated for enterprise-wide geospatial information programs for the military. He assists active duty and private sector organizations in building effective strategies to mobilize and deliver enduring spatial IT capabilities, starting with the U.S. Air Force (USAF) GeoBase program in 2001. As Woolpert's Installations and Logistics Geospatial Information and Services (I&L GI&S) Practice Lead, Dr. Cullis provides strategic consulting to DoD clients to assist them in enhancing GI&S capabilities. He is involved in full life-cycle of projects, from engaging with stakeholders to perform requirements elicitation and documentation, to leading Woolpert's team of system architects, database administrators, developers, and GIS analysts in implementing new capabilities.

Recognized as a leading expert in the field of organizational GIS technology adoption, Dr. Cullis has assisted countless organizations in capturing measurable Return on Location (RoL) from their GI&S investments by focusing on organizational issues that prevent IT solutions from performing optimally. After establishing the USAF GeoBase program for the Air Force, he led a team that mobilized GI&S capabilities across the Services and delivered the DoD's Installation Visualization Tool (IVT), which was the first use of GI&S to visualize more than 300 defense sites for Base Realignment and Closure (BRAC) 2005 deliberations. Dr. Cullis closed his active duty career by chartering the Defense Installation Spatial Data Infrastructure (DISDI) program in the Office of the Secretary of Defense which continues today to provide policy and resource advocacy for GI&S programs worldwide for U.S. Army, Navy, Marine Corps, Air Force, and National Guard installations. Dr. Cullis is an outspoken advocate for the value of lending balanced attention to technical and non-technical issues (i.e., DOTMLPF-P) associated with enterprise geospatial IT innovations to enhance securing desired mission outcomes. His drive for continual improvement has been integral to the development, sustainment, and enhancement of GI&S capabilities in DoD beyond the battlespace. Dr. Cullis recognizes the need for consistency and compliance with standards, but also promotes new paradigms to achieve new outcomes for long-standing problems.

Professional Data

Years of Experience

32 years

Education

Doctor of Philosophy (Organizational GIS Adoption), University of South Carolina

Master of Arts, Geography (Remote Sensing), University of California-Santa Barbara

Bachelor of Science, Geography, United States Air Force Academy

Presentations and Publications

"Applying Geospatial Information and Services Capabilities Beyond the Battlespace"

Project Experience

Mobility Command (HQ AMC)—O'Fallon, Illinois. Woolpert has been contracted by SI Systems Technologies, LLC (SIST) to provide strategic consulting support to the HQ AMC/A4 GIO to specifically organize and mobilize appropriate U.S. Air Force elements in support of a new Logistics Geospatial Information & Services (LGI&S) capability.

Geospatial Mapping Standards GeoBase Optimization Phase III, Air Force Special Operations Command (AFSOC)—Langley AFB, Virginia. Project Director responsible for chartering a new governance process for the Air Force Civil Engineer Center (AFCEC) GIO, which is led by the USAF GeoBase Program Manager. This governance process will necessarily incorporate multiple cross- functional Air Force enterprise interests, and initial governance models he produced were well received by the AFCEC Director. At the request of the USAF GeoBase Program Manager, Dr. Cullis has presented a keynote address to the first two GeoBase Compass Workshops hosted by the AFCEC GIO for the USAF GeoBase community. Woolpert has been contracted by AFSOC to sustain, modernize and standardize GeoBase tools and capabilities across six major Air Force commands. Woolpert is creating and implementing an enterprise-wide GeoBase system that can be used across the Air Force, with all geospatial capabilities driven from one location and one platform housed at ACC.

GeoBase Modernization Tasks, AFSOC and AFMC—Hurlburt Field, Florida. Project Director responsible for providing strategic consulting and guidance, including leadership, organizational and meeting support. Dr. Cullis has facilitated face-to-face meetings and multiple teleconferences with and between AMC, AFCEC, DISDI, and AFSOC to develop strategies for aligning GeoBase tasks and architecture. Dr. Cullis is also leading efforts on behalf of Woolpert to ensure a tight coupling between the IGI&S capability led by the AFCEC GIO and the LGI&S capability led by the AMC GIO, which reports to the HQ AMC Director of Logistics.

Matthew Baxendell, PE

GIS Needs Assessment and Business Process Analysis (BPA)

Mr. Baxendell has a diverse background in transportation and civil design. His experience in design and project management includes numerous projects using Whole Building Design Guide (WBDG), ODOT, and City of Columbus standards. This experience includes project management, civil, utilities, and roadway design. Mr. Baxendell's design experience includes urban street and rural road design. He has prepared all aspects of roadway plans, including drainage design, intersection geometrics and grading, parking, waterline, storm and sanitary, ADA curb ramp design, maintenance of traffic (MOT), and traffic control plans. He provides close coordination of the design with utility companies and reviewing agencies, prepares cost estimates, and assists with public involvement. He has prepared specification for DOD projects using SpecsIntact. His project history includes roadway widening and realignment and bridge replacement. He has prepared construction documents using AutoCAD Civil 3D, Microstation and Geopak.

Professional Data

Years of Experience

13 years

Technical Skills

AutoCAD Civil 3D, Microstation, Geopak, Esri Collector

Education

Bachelor of Science, Civil Engineering (focus on Structures)

Project Experience

Columbus DPU/Franklin County Water & Sewer Assessment – City of Columbus, Department of Public Utilities | Columbus, Ohio. Mr. Baxendell led the field crew and coordinated the effort for this data collection and assessment project that encompassed facilities for both the City of Columbus Department of Public Utilities and the Franklin County Sanitary Engineer's Office. He oversaw the field staff in the use of Esri's Collector app and the processing of data, using the latest GIS application. In charge of presenting the data, findings, and recommendations to the prime firm (Brown and Caldwell) and clients. **Note:** It was Matt's recommendation to use the ArcGIS application for the field work. For Matt's exemplary work, leadership, and recommendations, he received a Letter of Endorsement from Brown and Caldwell.

Blueprint Columbus 2016 – Clintonville 3 (Dorris-Weber, City of Columbus, Department of Public Utilities | Columbus, Ohio. *Lead Engineer* overseeing team responsible for the collection of all field data, including downspout locations, curb cuts, yard drains and significant drainage features affecting Right of Way for 700 parcels. Mr. Baxendell was part of the team that coordinated with City of Columbus to create a standard Collector template for all future Blueprint projects based on his experience and design. He was involved in recommendation for green infrastructure locations throughout the project and providing needed data for modeling phase of the project such as roof drainage areas associated with each feature.

Blueprint Columbus 2014 Hilltop (Palmetto/Westgate)–City of Columbus, Department of Public Utilities | Columbus, Ohio. *Lead engineer* overseeing team responsible for collection of all field data including downspout locations, curb cuts, yard drains, and significant drainage features affecting Right of Way for 2,000 parcels, including location of roof drainage areas tied to each feature and managing a large team for timely completion of work on one of the largest Blueprint projects yet created.

Parsons Avenue Roadway Improvements–City of Columbus, Department of Public Service | Columbus, Ohio. Responsible for plan development of full detail design of curb ramps per City of Columbus standards for 40 intersections, as well as the improvements in roadway and sidewalk pavement associated with this project. Overseeing the design team, Mr. Baxendell ensured quality control and hands-on design for a successful project delivery on schedule while working in coordination with two other consulting firms.

Bryan de Jesus, PSM, CFedS

Task Lead | GIS Application Development

Bryan de Jesus is an experienced GIS Developer with a strong background in geospatial domains. His Esri software development experience includes building mapping services with ArcGIS Server; web mapping applications using ArcGIS JavaScript API, Dojo, jQuery and Bootstrap; native apps using ArcGIS iOS API; and desktop applications and add-ins using ArcObjects for .NET. He has created web services using WCF and WebAPI, worked extensively with ArcGIS geodatabases and SDE, and is familiar with SQL Server, PostgreSQL, MySQL, and Oracle spatial data.

Bryan has managed survey projects throughout the state of Florida since 2002. His experience includes large-scale topographic and basemapping, utility location and layout, and operation and direction of conventional and global positioning system (GPS) surveys.

Project Experience

GeoBase Modernization Tasks, AFSOC/AFMC/Fairchild Air Force Base | Hurlburt Field, Florida. Woolpert performed GeoBase modernization tasks in Florida, Ohio and Washington in support of Air Force Special Operations Command (AFSOC), Air Force Materiel Command (AFMC) and Fairchild AFB. Tasks involved designing, configuring and implementing updated GeoBase systems.

Geospatial Mapping Standards GeoBase Optimization Phase III, Air Force Special Operations Command | Langley AFB, Virginia. Woolpert has been contracted by the Air Force Special Operations Command (AFSOC) to sustain, modernize and standardize GeoBase tools and capabilities across six major Air Force commands. Woolpert is creating and implementing an enterprise-wide GeoBase system that can be used across the Air Force, with all geospatial capabilities driven from one location and one platform housed at ACC.

AOC Enterprise GIS Part 2, TMA Systems, LLC | Washington, D.C. For the Architect of the Capitol (AOC), Woolpert developed a custom web-based GIS application. The application is the foundation for other AOC GIS applications and integrations that will follow. The web-based GIS application will be used exclusively by internal AOC staff and approved contractors. Its intent is to become a critically important tool that pulls together a geographic view of data from multiple sources into a simple but powerful mapping tool that serves the needs of many users.

Accela Tidemark Upgrade, Accela, Inc. | Mesa, Arizona. For the City of Mesa, Arizona, Accela, Inc. and Woolpert implemented the cloud-based solution, Accela Automation. As a part of this effort, Woolpert replaced the Tidemark system, implemented Accela Automation and converted historical data, migrated the City's existing permitting/case data into Accela Automation, utilized Accela Best Practice Templates, Increased access to pertinent information, provided citizens with enhanced online services, provided wireless access to users, improved business processes and customer service, and trained City staff on the use of Accela Automation.

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Professional Data

Years of Experience

15 years

Technical Skills

ArcGIS JavaScript API, Dojo, jQuery and Bootstrap; native apps using ArcGIS iOS API; ArcObjects for .NET, WCF and WebAPI, ArcGIS geodatabases, SDE, SQL Server, PostgreSQL, MySQL, Oracle spatial data, C#, JavaScript, Java, Python, HTML, XML, and JSON

Education

Bachelor of Science, Geomatics, University of Florida

Bachelor of Science, Computer Science, University of Maryland, University College

Continuing Education

Google Maps API Developer training course, Google Partner University

Professional Registration

Certified Federal Surveyor, 1210

Security+

Professional Surveyor and Mapper, Florida, 6668

Professional Membership

Florida Surveying and Mapping Society (FSMS)

Presentations

A One-Stop-Shop Solution: Best Practices for Integrating State and City Permits, presenter, 2019 Cityworks Conference, Salt Lake City, Utah

Juliana Castillo

GIS Application Development

Juliana Castillo is an Application Developer with Woolpert's IT group. Her focus is web development. She works with municipal and federal clients to gather requirements, identify and resolve issues and develop and edit applications. Her extensive background in web development grants her a deep knowledge of a wide range of technologies, particularly HTML and JavaScript.

Julianna is adept at digging deep to find out what a client truly needs, finding and solving any existing issues, and developing tools that address them. She serves as a point of contact for clients, keeping them updated throughout the project and ensuring their questions and concerns are being addressed.

Professional Data

Years of Experience

16 years

Technical Skills

ArcGIS Server, SDE and Desktop, Esri's ArcObjects, and ArcInfo, HTML, ActiveX Connector, Visual Basic, Python, JavaScript, JavaScript API, Angular, Bootstrap, SQL Server Databases, ASP, JavaScript, Coldfusion, Access, Oracle 11.2 and RDBMS

Education

Master of Science | Geographic Information Sciences

Bachelor of Science | Systems Engineering

Awards

Apex Award of Excellence—2006

Award of Publication Excellence - Most improved web and intranet sites for Aerodrome - McGhee Tyson Airport Intranet Site

Project Experience

Architect of the Capitol House Moves Application, TMA Systems | Washington, Washington, DC. Lead Application Developer providing software production, training, workflow, and documentation necessary for the House Superintendent's Office and the Information Technology Division to independently manage and utilize a new web-based HTML and JavaScript interface which has interactive views of available office suites and enhanced suite selection capabilities. The application uses the Esri JavaScript library as well as Dojo and jQuery.

GIS Application Development and On Call Services, Metropolitan Sewer District (MSD) | Cincinnati, Ohio. Application Developer and Phase Manager who provided GIS consulting and application development services. Juliana led the development of modifications to the Dispatch Decision Support Tool and Cincinnati MSD currently utilizes an asset management system. She also assessed the functionality of existing and potential server-side and client-side remote access applications. Woolpert has been providing professional services including technical evaluation, workshop facilitation, training, gap analysis, and system configuration and guidance with MSD's Cityworks system.

GIS Property Viewer Application Upgrade, Sandusky County | Fremont, Ohio. Lead Application Developer who co-created an updated application that provides citizens with quick and easy access to property information, maps, building sketches, and other relevant information. The existing application was ArcGIS Server web-based; Dominik and Julianna Castillo used Silverlight technology and the Esri Silverlight API to recreate and upgrade the application. Woolpert later converted the application to JavaScript, the result of which can be found at www.sanduskycountygis.org.

GIS Development Support, ATOS IT Solutions | Ft. Wayne, Indiana. Application Developer who assisted in converting the existing searchable election map viewer from Silverlight to Esri-API JavaScript HTML for mapping visualization and dojo for front-end framework. This project required the integration of new GIS data, and included the addition of two custom Esri widgets: a polygon selection tool and a search on load tool.

GIS Consulting and Application Development Services, City of Indianapolis | Indianapolis, Indiana. Application Developer who provided dynamic application development services across multiple projects for the City. Juliana upgraded the existing public-facing Registered Organizations website from ArcIMS to an ArcGIS server 10.1. She also upgraded several spatial web serves to Services-Oriented Enterprise (SOE) to accommodate a change in the City's method of connecting to ArcGIS Server. Additionally, Juliana installed and configured a Citizen's Dashboard JavaScript template application from Esri.

Yury Tritenko

GIS Application Development

Yury Tritenko is a Web Developer with Woolpert's IT (Information Technology) group. With significant experience in software development, Yury is an expert at developing new applications. He primarily works on-site with GIS projects for the City of Indianapolis, where he develops and designs new applications, tests and delivers software enhancements, performs software maintenance tasks within existing software applications and modules, and contributes to the production of functional and technical specifications.

Yury's specialty is problem solving issues during the development life cycle. Clients appreciate his open communication and skill at identifying problems and finding solutions. A few of his numerous accomplishments include work on the Indy Snow Fighter application, the Impervious Area application, and Indy Small Claims Court Finder application. Yury is also fluent in English and Russian.

Project Experience

Application Services - Year 4, Daniels Associates Inc.—Indianapolis, Indiana. This project is a continuation of the work we have been doing for the City of Indianapolis Information Services Agency since 2003. Our services remain the same (GIS Application Development). We have three goals for this project: perform application development planning, coding, testing, and rollout of new applications as directed by ISA; support existing applications through enhancements and software upgrades; and support the GIS infrastructure (ARCSDE, geodatabase design, layer development, and testing applications involving GIS integration.

DAI Application Services Year 2, Daniels Associates, Inc. (DAI) | Indianapolis, Indiana. This project is a continuation of the work we have been doing for the City of Indianapolis Information Services Agency since 2003. Our services remain the same (GIS Application Development). Our goals are to perform application development planning, coding, testing, and rollout of new applications as directed by ISA; to support existing applications through enhancements and software upgrades; and to support the GIS infrastructure (ARCSDE, geodatabase design, layer development, and testing applications involving GIS integration.

Application Services - Year 3, Daniels Associates Inc. | Indianapolis, Indiana. This project is a continuation of the work we have been doing for the City of Indianapolis Information Services Agency since 2003. Our services remain the same (GIS Application Development). We have three goals for this project: perform application development planning, coding, testing, and rollout of new applications as directed by ISA; support existing applications through enhancements and software upgrades; and support the GIS infrastructure (ARCSDE, geodatabase design, layer development, and testing applications involving GIS integration.

DAI - Application Services Year 1, Daniels Associates Inc. | Indianapolis, Indiana. This project is a continuation of the work we have been doing for the City of Indianapolis Information Services Agency since 2003. Our services remain the same (GIS Application Development). We have three goals for this project: perform application development planning, coding, testing, and rollout of new applications as directed by ISA; support existing applications through enhancements and software upgrades; and support the GIS infrastructure (ARCSDE, geodatabase design, layer development, and testing applications involving GIS integration.

SnowFighter Rewrite, City of Indianapolis, IN | Indianapolis, Indiana. Application Developer Lead developer for project The SnowFighter application required a complete update. Woolpert provided recommendations and cost estimates to create a new SnowFighter web portal and developed the new portal for IndyGIS.

Professional Data

Years of Experience

11 years

Technical Skills

HTML, JavaScript, Dojo JS Framework, Angular, TypeScript, Flex, ActionScript, C#, MS Sql Server, Oracle, ArcObjects, WCF, PHP, ASP.Net, VB.Net, ArcGIS Desktop, ArcGIS Server, iOS development, Objective C, Swift, Subversion, Git, Python, VBA, Windows, IIS, Apache HTTP Server, Matlab, Java, MS Office

Education

Master of Science, Computer Engineering, University of Memphis

Bachelor of Science, Electrical Engineering, North-Caucasus State Technical University

Professional Registration

Certified ScrumMaster, National, 000498779

AWS Certified Cloud Practitioner

Presentations and Publications

Managing Sensor Deployments with Geographic Information Systems, *IEEE Sensors Application Symposium,* New Orleans, LA, To Appear

A Web Service Interface for an Unattended Ground Sparse Sensor Detector Proceedings of the International Conference on Semantic Web and Web Services, *CSREA Press,* Las Vegas, Nevada

Indiana Geographic Information Council (IGIC), 2016; IGIC, 2017; IGIC, 2018; IGIC, 2019

Angie Causey, Security+

GIS Application Development

As a GIS Application Developer within Woolpert's Geospatial IT group, Angie Causey specializes in designing web-based geospatial and mapping applications. She leverages substantial experience in graphic design to craft highly effective and user-friendly interfaces that allow clients to fully realize the capabilities of their applications. Clients appreciate her attention to detail and commitment to developing integrative solutions that meet their needs, while also complementing their existing business environments.

Angie's project experience encompasses a diverse range of applications for municipal, utility, and federal clients. She has extensive experience designing web applications for the Air Force integrating software within servers that have stringent security policies. She developed a GPS-based tablet application for an energy company, for which she also developed a custom tool to accurately communicate GPS data with the hardware of the client's existing tablets—a task no off-the-shelf software was able to accomplish.

Professional Data

Years of Experience

23 years

Technical Skills

ArcGIS Server, SDE and Desktop v10.3.1, Oracle 11.2, Windows IIS, HTML, HTML5, CSS, JavaScript, Action Script, ASP .NET, C#, VB, WebAPI, Python, HTML/HTML5, XML, CSS, Visual Basic, PHP, SQL Server, MySQL and PostgreSQL, WebAPI, OData, Flex API's Angular, Node JS, JQuery, Leaflet and Google API, and Adobe Photoshop, Illustrator and Flash

Education

Bachelor of Arts | Communication Arts/Advertising

Associates | Computer Science

Professional Registration

Security+ | COMP001020437101

Project Experience

GIS Dashboard, City of Columbus | Columbus, Ohio. GIS Application Developer who provided upgrades to the City's internal GIS Dashboard. All functionality targeted ArcGIS 10.0 and the Flex Viewer 3.3. Angie assisted in the development and implementation of a universal Google-type search box, theme selection widget, get coordinates widget, 'where am I widget', water valve isolation widget, sewer and storm upstream and downstream search widget, and an imagery slide base widget. She also made various other improvements and resolved bugs within the existing application.

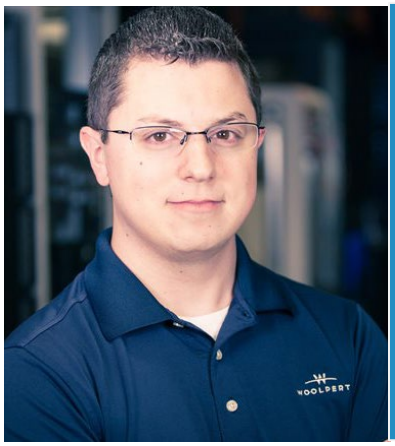
Wright-Patterson GIS Application Development Services, General Services Administration | WPAFB, Ohio. GIS Developer who deployed and supported multiple Flex-based mapping tools, widgets and applications for the Air Force Special Operations Command (AFSOC) and the Air Force Military Command (AFMC). She assisted in the development of an ICEE framework, an operational environment that provides enterprise-wide asset awareness and management, controls and commands disparate sensors and systems, provides cyber security measures and allows device configuration on a secure network. For the ICEE framework, Angie created, integrated and tested a customized dashboard, assured secure operation on WPAFB CE VLAN and presented a path forward for GeoBase Interoperability. She also developed an Energy Audit Visualization tool for the AFMC, which included viewer products as well as customized energy and asset visualization tools and emergency response tools.

EMA Application Development, Fairfield County, Ohio EMA | Lancaster, Ohio. Lead Application Developer for a Flex website based on Esri's ArcGIS Viewer for Flex version 3.4 in conjunction with ArcGIS Server 10.2. The County's GIS data is stored in SDE with SQL Server as the backend database.

Indianapolis Traffic Sign Inventory & Pavement Condition Assessment, City of Indianapolis DPW | Indianapolis, Indiana. GIS Application Developer responsible for developing software to automatically extract signs, sign features and sign locations. Woolpert performed a traffic sign inventory and curb and sidewalk assessment utilizing our Mobile Mapping system and in-house feature extraction software for approximately 3,200 miles of roads and streets.

Chris Morabito

GIS Application Development



Chris Morabito is an Application and Software Developer within Woolpert's Geospatial IT group. Chris is credited as the lead developer and system administrator of SmartView Connect (SVC), Woolpert's in-house webhosting platform. His conceptual and technical design and oversight pertaining to the development of SVC has played a critical role in the successful completion and outstanding QA/QC measures of many large scale aerial mapping projects. Its usability and simplicity allow for continual review, updates, and feedback—limiting the amount of re-work necessary and saving clients' time and money. With extensive project experience at Woolpert and working at the Wright Brothers Institute Tec^Edge Innovation and Collaboration Center, Chris is equipped with a comprehensive knowledge of cutting-edge technology and applications.

Professional Data

Years of Experience

14 years

Technical Skills

ArcGIS Server, SDE and Desktop, Esri ArcPad, ArcCatalog, ArcMap, ArcView and ArcInfo, C# and the .NET framework, C++, Java, Python, Apache Flex, Ruby, Oracle 11g SQL database and PostgreSQL, ASP.Net, Microsoft Visual Studio, GDAL, OpenLayers, Google Maps API, NASA World Wind, GeoServer, Google Earth Enterprise, and Open Consortium (OGC)

Education

Bachelor of Science, Computer Science, Wright State University

Project Experience

GIS Dashboard, City of Columbus | Columbus, Ohio. GIS Application Developer who provided support in upgrading the City's internal GIS dashboard. All functionality targeted ArcGIS 10.0 and the Flex Viewer 3.3. Woolpert developed and implemented a several widgets and resolved bugs.

Footprint Software Implementation, University of Dayton Research Institute (UDRI) | Dayton, Ohio. Application Developer responsible for co-developing this integrated 2D and 3D web-based visualization technology that ingests sensor data and display is for the user. The software, Footprint, is a geospatial video and data visualization platform for crime analytics that will be available to law enforcement agencies across the nation. Footprint interfaces with a department's existing video management software to georegister video feeds onto a map AND perform automated real-time and forensic analysis on each feed.

Northwest Ohio Solar Resource Map Ohio Solar Potential Map, Ohio Department of Development | Columbus, Ohio. Lead Application Developer for this interactive solar map website that allows users to view the solar potential of over 250,000 structures across a 1,000-square-mile area. He designed the website based on Woolpert's online imagery viewer and redlining tool, SmartView Connect, which Christopher also created. The website enables users to search for properties, see available rooftop areas and calculate structures' annual solar potential output. He worked closely with the client and Daniel to establish requirements; designed and developed the websites functionality and user-interface; deployed and tested the website at Woolpert; deployed and tested the website on OIT servers; and incorporated additional feedback into the design before final deployment. This project team consisted of two primary staff: Christopher for the web development and Daniel for the data development.

SmartView Connect, Internal (Woolpert) Technology Development | Dayton, Ohio. Lead Application Developer and System Administrator of SmartView Connect, Woolpert's in-house webhosting platform. His conceptual and technical design and oversight pertaining to the development of SmartView Connect has played a critical role in the successful completion and outstanding QA/QC measures of many large scale aerial mapping projects—including the Ohio Statewide Imagery Program (OSIP). Its usability and simplicity allows for continual review, updates and feedback—limiting the amount of rework necessary and saving clients' time and money. Chris provides ongoing support and training to help Woolpert and its clients leverage this valuable webhosting and QA/QC tool.

Miles Kelly

Task Lead | Additional GIS Integration

As a GIS Application Developer and Technical Architect within Woolpert's Geospatial IT group, Miles Kelly is responsible for building integrations between GIS-centric Asset Management Solutions (AMS) and other systems to help clients fully leverage the power of their software investments in a distributed enterprise system. After graduating with a degree in urban planning, Miles began her career at Woolpert as a GIS Analyst, processing field data for stormwater clients. Her keen attention to detail, knack for automating processes, and continued interest in city planning led her to her current position where she works directly with municipal clients to determine their needs, develop GIS-centric software solutions to meet them, and create automated processes for integrating data. Miles has led the programming and integration of numerous AMS implementations for city and county clients across the U.S. She is known for her strong organizational and communication skills and commitment to leaving clients with the knowledge and tools they need to manage their system independently.

Professional Data

Years of Experience

21 years

Technical Skills

ArcGIS Server, SQL Server, Oracle, Access, T-SQL, HTML, data integration, data migration, message-queuing, service-oriented-architecture, technical documentation, and on-site training

Education

Bachelor of Science, Urban & Regional Studies, Cornell University

Certificate, Graduate Certificate in GIS and Spatial Analysis, State University of New York at Albany

Project Experience

Cityworks Service Request Configuration and Citizen Portal Deployment, City of Dublin | Dublin, Ohio. GIS Application Developer who performed on-site requirements gathering, facilitated discovery workshops with City staff, and developed configuration documentation to ensure Woolpert delivered a tailored and effective solution. Woolpert re-configured and expanded the functionality of the City's Cityworks MMS Service Requests and customized and deployed a Citizen Request Portal Application. Prior to deploying the configured systems to the City's production environment, Woolpert's GIS analysts and developers performed user acceptance testing and provided on-site training to city staff.

City Water D&M Hydraulics for Cityworks, City of Cleveland | Cleveland, Ohio. Senior Developer and Technical Lead for data integration. Miles has been assisting in data prep and Cityworks implementation for the City of Cleveland's Department of Public Utilities. The services support the Distribution/Maintenance, Hydraulics, Inventory/Warehouse, Plants/Facilities and Water Pollution Control divisions. The team integrated the AMS software application to meet activity requirements; established a stable, high-availability platform for program deployment; conducted discovery to establish project foundations; facilitated asset inventory data collection; and trained the staff on product use.

Maintenance Management System Implementation and Customer Information System Integration, Henrico County | Henrico, Virginia. GIS Application Developer who provided configuration, integration, testing and training support for the implementation of a computerized maintenance management system that tracks maintenance activities for their water, sewer, solid waste, meter service, and customer service divisions. For the customer information system, Miles developed and documented testing and acceptance plans—to include an overall plan for migrating data in manageable chunks, as well as detailed test scripts for confirming system functionality. She also ensured the successful migration of large volumes of data into a live system; performed coding, deployment, and testing; and managed software modifications and data cleanup.

Michael Kovacic

Additional GIS Integration Solutions

Michael Kovacic is an application developer supporting Woolpert through the creation of dynamic applications that improve a client's user experience. His expertise includes testing, application software development, and Esri framework and widget development.

While most developers have a background in STEM disciplines, Michael comes to Woolpert with a unique perspective, having served a year and a half in Paraguay as a Peace Corps Community Health Facilitator. Since his return, he has worked to expand his knowledge and experience to keep pace with a continuously growing industry. Michael credits his adventurousness as a developer and his innovative ability to learning and using a new language, Spanish, through immersion. He understands the amount of effort and perseverance it takes to succeed in something challenging and enjoys the opportunity to face a new problem such as troubleshooting bugs in software, persevering until he finds the solution. On a recent project, he modified software without any documentation or guidance available and determined through testing where to implement the code. Michael offers clients technical know-how, creative thinking, a passion for discovery and learning, and an excitement for the possibilities the industry has to offer.

Professional Data

Years of Experience

1 year

Technical Skills

HTML, CSS, JavaScript, jQuery, Node.js, Express, and MySQL, MongoDB.

Education

Bachelor of Arts, Global Studies, Spring Arbor University

Certificate, Full Stack Web Development, Computer Software Engineering, University of Denver

Project Experience

2018 County Parcel Extract-Transform-Load (ETL) Scripts, City of Columbus | Columbus, Ohio. Junior Developer creating Python scripts to support the project. The City of Columbus required a process to standardize and combine GIS parcel data for seven counties that could be run manually or through a scheduled task. Woolpert met with each of the seven counties to record information and develop a master parcel file schema, based on the Esri Local Government Information Model (LGIM) with additional fields. Woolpert is creating a series of Extract-Transform-Load (ETL) scripts, including checks for incoming data source structure changes, as well as the ability to send email notifications in the cases of unexpected input or errors.

ArcGIS and Redline Upgrade and Enterprise Planning, Targa Resources | Houston, Texas. Junior Developer supporting project through Esri framework and widget development. Woolpert was approached by Targa Resources to perform an upgrade from ArcGIS 10.3 to 10.5.1, migrate the existing enterprise geodatabase from Oracle 11g to SQL Server 2016, and create a new Redline web mapping application built on the latest Esri web mapping application platform. This will replace the existing application built on the Silverlight platform, which is no longer supported. The project also includes documentation, including a high-level disaster recovery plan and a GIS enterprise database administration guide, and training for Targa staff.

GraniteNet Software Add-ons, Woolpert Research and Development | Dayton, Ohio. Junior Developer supporting research and development project by writing conditional statements for form validation within the GraniteNet application software. Project improved software efficiencies, add-ons, report templates, and data validation tools for GraniteNet to drastically reduce the time and effort to create final data reports and deliverables while increasing efficiencies and data quality in the field. Scope included creating/customizing databases, building validations for office and field, streamlining final inspection reports, and implementing GraniteNet for all tasks (dye flooding, acoustics, smoke testing, etc.).

Victor Staggs

Additional GIS Integration Solutions

Victor Staggs is an experienced Application Developer who expertly designs data management systems. His goals are to maximize efficiency, improve resource allocation, and increase tracking and reporting capabilities. Victor works with public and private sectors to design systems that are customized to their needs, yet friendly to everyday users. Victor proactively implements Cityworks components that integrate separate information tracking and processing systems into one cohesive and effective program. He performs Discovery for data migration, configures software requirements, and prepares for future integrations in a constantly evolving enterprise. Victor is well-versed in Accela custom interfaces that improve client permitting practices, enhance data sharing, and offer easy access to centralized geographic information. He is excellent at replacing outdated systems and ensuring historic legacy data is accounted for and fully migrated.

Victor has used different ECM (Enterprise Content Management) systems in developing code so clients can have a content management system and integrate with it. With more data than ever to collect, track, and analyze, his list of technical skills is impressive.

Professional Data

Years of Experience

22 years

Technical Skills

Microsoft .NET/C# (in Microsoft Visual Studio), Microsoft T-SQL (in Microsoft SQL Server Management Studio), Oracle PL/SQL (In Oracle SQL Developer), Javascript (mostly browser-based for web development, but also Rhino-based for integrations), Python. Developer libraries: .NET (C#), which involves MVC, WebApi, Entity Framework, Linq, etc.; Javascript, incorporating jQuery, Dojo, ESRI; Silverlight (XAML), ArcGIS Server, ArcCatalog and ArcMap; on spatial databases--ESRI ArcSDE on both Oracle and SQL servers, Microsoft BizTalk, NServiceBus, MS SharePoint, LaserFiche Server, EMC ApplicationXtender.

Education

Certificate, Information Systems, Virginia Commonwealth University

Bachelor of Arts, English Literature, University of California, Santa Cruz

Project Experience

Enterprise Asset Management, Collier County | Collier County, Florida. Lead Developer responsible for tasks essential to development of the database-driven web application and meeting the project schedule objectives. Woolpert is providing development services and assistance for Ad-hoc support, which includes GIS Database Support, Materials Management/Inventory Optimization (Storeroom), Enterprise Content Management System Integration Evaluation, and Custom Development of Cityworks AMS Functionality.

Accella Resource Augmentation, City of Denver | Denver, Colorado. Woolpert was contracted to be an information technology consultant for the City of Denver to perform Accela support services. This included augmenting reporting resources on a time and material basis.

Dublin | Dublin, Ohio. Woolpert assisted the City of Dublin with their Cityworks Service Request Configuration and Citizen Portal deployment efforts. Tasks included replacing the City's prior web request solution with an automated site that integrates with the Cityworks Request System utilizing the Cityworks Request API, expanded the City's use of the system so all service requests are entered into the system, and enabling City employees to enter requests into the system.

Accela Tidemark Upgrade, Accela, Inc. | Mesa, Arizona. For the City of Mesa, Arizona, Accela, Inc. and Woolpert implemented the cloud-based solution, Accela Automation. As a part of this effort, Woolpert replaced the Tidemark system, implemented Accela Automation and converted historical data, migrated the City's existing permitting/case data into Accela Automation, utilized Accela Best Practice Templates, Increased access to pertinent information, provided citizens with enhanced online services, provided wireless access to users, improved business processes and customer service, and trained City staff on the use of Accela Automation.

Enterprise Cityworks Implementation, City of Raleigh | Raleigh, North Carolina. The City of Raleigh currently uses Cityworks Anywhere within the Parks and Recreation Department and the Sign Shop. The City contracted with Woolpert to implement the software across the City organization. The critical components of this effort include analysis and design of enterprise configuration, installation and implementation of Cityworks AMS, upgrade of existing users, configuration and localization of the software, migration of reference data and specified asset data into the new software, required process reengineering, integration with required external systems, test plan development and acceptance testing, and project management of these responsibilities and activities.

Chad Johnson

Additional GIS Integration Solutions

Chad Johnson is a Program Director providing Oracle Utilities implementation leadership and expertise to Woolpert's IT Management Consulting group. Chad has technical leadership experience overseeing complex utilities IT development and implementation projects from the analysis phase to the delivery phase while balancing financial, team, and client needs.

As a promoted speaker at Oracle and utility industry conferences, Chad is recognized as an industry leader among product owners, utility partners, and fellow industry leaders. Chad has a deep understanding of implementations for the entire array of the Oracle Utilities application suite, including Work and Asset Management, Meter2Cash, Smart Grid delivery, and Settlement and Quotations.

Chad's skills and experience include project leadership, Work and Asset Management, complete Meter2Cash solutions, ERP solutioning and integration, conversion and migration, strategic planning, middleware and infrastructure, business development, environment management, full software development life cycle (SDLC), agile and waterfall methodology, service-oriented architecture, vendor and partner management, complex billing, budget planning and cost control, and delivery timelines.

Professional Data

Years of Experience

16 years

Continuing Education

Software Engineering Courses, Auburn University

Oracle Utilities Smart Grid Gateway 2 for Advanced Metering Infrastructure Certified Implementation Specialist

Oracle Utilities Meter Data Management 2 Certified Implementation Specialist

Professional Membership

Institute of Electrical and Electronics Engineers (IEEE)

Project Experience

Oracle Utilities Work and Asset Management Modules Integration and Implementation, Icon Water | Canberra, Australia. Functional Architect supporting integration and implementation project for Icon Water, a water and wastewater public utility operating and maintaining 48 service reservoirs, 25 pump stations, and over 3,300 km of water pipelines in the Australian Capital Territory. Provided Oracle Utilities Work and Asset Management (WAM) v2 Finance and Inventory modules, as well as the integration of an asset and works management implementation comprising of Oracle Utilities WAM, Oracle Utilities Mobile Workforce Management (MWM), and Oracle Utilities Analytics, integrating with Oracle E-Business Suite (EBS), Esri GIS, supervisory control and data acquisition (SCADA), and internal condition monitoring systems (CMS). Designed integration supporting Oracle EBS, Oracle Utilities WAM and MWM, CallTaker, SCADA and Esri GIS using Oracle Service-Oriented Architecture (SOA) Suite. Agile team leader, defining schedule, driving team collaboration and development, and resolving road blocks to achieve Icon Water requirements and project success. Provides technical direction within team for Oracle Utilities Application Framework (OUAF) and SOA architecture and design of the complete WAM/MWM solution.

WorkAssetMigration, Red Clay | Atlanta, Georgia. Product Owner managing WorkAssetMigration, an Oracle Utilities WAM platform-to-platform upgrade designed to facilitate and expedite upgrades of WAM v1 to WAM v2. The WorkAssetMigration framework provides mechanisms for data migration, exception handling, legacy data clean-up, and data reconciliation.

SmartGridMigration, Red Clay | Atlanta, Georgia. Product Owner successfully managing the SmartGridMigration product, an Oracle Utilities Meter Data Management (MDM) platform-to-platform upgrade designed to facilitate, expedite, and reduce risk for a smooth transition from the LODESTAR (1.6) platform to OUAF (2.x). Developed and prioritized the product backlog to anticipate future partner needs and new markets, and maintained and groomed the product development roadmap, goals, and vision based on the needs of the marketplace, competition, and future trends of the industry.

SmartGridONE (SG1), Red Clay—Atlanta, Georgia. Product Owner of SmartGridONE, a proven MDM solution built upon OUAF for all sizes of utilities, providing a low-risk and affordable upgrade into the Smart Grid space. The solution is a robust, pre-configured, and pre-tuned accelerator that is wholly based on the best practices derived from successful and referenceable solutions.

Oracle Utilities MDM Upgrade, American Electric Power (AEP) | Columbus, Ohio. Technical Architect for AEP, a major investor-owned electric utility in the U.S., drove the delivery of the upgrade design for the Oracle Utilities MDM 1.6 solution to 2.1 platform. Coordinates communication with Oracle Product to facilitate AEP's roadmap planning, design decisions and execution of enterprise infrastructure strategy.

Rich Lipstreu

Additional GIS Integration Solutions

Rich Lipstreu is a Senior Engineering Technician with extensive experience in utility system data collection and analysis, condition assessment, and development of standard operating procedures for O&M management. He has been involved with the City of Columbus' asset management project since its inception, providing data collection protocols supporting the Work and Asset Management (WAM) software database under the Enterprise Application Integration and Business Intelligence Systems project. He assisted city staff in developing procedures related to O&M ready practices. His expertise has earned him universal praise and key roles on large-scale projects for national consulting firms.

Professional Data

Years of Experience

21 years

Technical Skills

Oracle WAM, AutoCAD, Confined Space Entry Certified

Education

A.A.P., Civil Engineering Technology

B.A., Political Science (Environmental Policies and Issues)

Areas of Expertise

Utility Systems, Asset Management, Business Case Evaluations, Sewer Condition Assessment, Sewer Collection Maintenance and Operations Management

Project Experience

Professional Construction Management (PCM) Service–City of Columbus, Department of Public Utilities | Columbus, Ohio. (Southerly Wastewater Treatment Plant – Chemically Enhanced Primary Treatment (CEPT) and Biosolids Land Application Facility (BLAF); Dublin Road Water Treatment Plant (Contracts 1-5); Upground Reservoir; Parsons Water Treatment Plant; Hap Cremean Water Treatment Plant; Alum Creek Pump Station.) He is currently performing and has performed O&M Ready Commissioning Services for projects listed under City of Columbus' PCM Service contract. His tasks include Work Order and Asset Management (WAM), coordinating data collections, meeting with plant staff to review new and existing assets, Preventative Maintenance items (PMs), and Benchmark Work Orders (BMWOs). He has also worked with plant staff and the City's WAM DBA to finalize asset lists and build PM and BMWO tasks into WAM.

Asset Management Program Development Project–Phases 1 & City of Columbus, Department of Public Utilities | Columbus, Ohio. Involved since program inception, Mr. Lipstreu has led or helped develop program initiatives, specifically working with DPU divisions to create forms for data collection for the WAM software database. Mr. Lipstreu was on the team that performed the O&M Ready Pilot project for the City of Columbus. He was involved in data collection; creation of assets, BMWO's, and PM's in WAM; and creation of O&M Ready requirements for implementation by the city. He worked on Preventive Maintenance Optimization (PMO) for Southerly Wastewater Treatment Plant, Jackson Pike WWTP, Hap Cremean WTP, and Hoover Dam. He has prepared methodology and procedures for generating Business Case Evaluations (BCE's) for each capital investment and maintenance initiative undertaken by the department.

Enterprise Application Integration/Business Intelligence Systems–City of Columbus, Department of Public Utilities | Columbus, Ohio. Mr. Lipstreu has been involved in this project since its inception and continues to refine key performance indicators to align with other technology department systems (CHRIS, GIS, CUBS). He participates in discussions to prioritize business processes and define performance metrics with WAM portfolio experts. Tasks include WAM dashboard performance and acceptance testing, development of data dictionary, and providing GIS and performance system support.

OSIS Augmentation and Relief Sewer (OARS)–Phase 1 & 2 City of Columbus, Department of Public Utilities | Columbus, Ohio. Mr. Lipstreu performed O&M Ready Commissioning Services for the OARS project. He coordinated data collection with CMT consultants and met with plant staff to review new assets, PM's, and BMWO's. He reviewed existing assets, PM's, and BMWO's in WAM and worked with plant staff and the City's WAM DBA to finalize asset lists and build PM and BMWO tasks into WAM.

Section 3 | Relevant Project Experience

Relevant Project Experience

Provided in this section are descriptions of current and past (<5 years) projects describing many of the services--and specifications—highlighted in the RFP. As an experienced consultant, our goal is to take a complex initiative and make it uncomplicated and straightforward. Because we have evolved with you over the past 20+ years, we understand the City's mission of supporting your stakeholders, and have tailored our approach based on intimate knowledge gained from the successful completion of projects involving application development, municipal utility mapping and GPS collection, data conversion and development, and staff augmentation under our current On-Call GIS Services program with the City of Columbus. We hope that in your review of these projects, you find that they substantiate our qualifications and experience in implementing GIS solutions within a municipal entity.

The following matrix identifies those key competencies and experiences showcased in the project profiles that follow.

Relevant Project Experience	Data Conversion/Cleansing/Development							Field Data Collection		GIS Staff Augmentation	GIS Needs Assessment and Business Process Analysis (BPA)				GIS Application Development						Additional GIS Integration Solutions
	Convert construction design plans into the GIS and editing of existing data	Develop new datasets from existing digital and hardcopy information	Develop automated routines to cleanse existing datasets	Conduct quality control of various datasets such as traffic asset features (both spatial and attribute data)	Geodatabase redesign/ standardization - Enterprise System Upgrade task	Migration to Esri's Utility Network environment	Develop and support new databases in SQL Server and Oracle	GPS data collection of various surface infrastructure features	Develop best practices for data collection using various Esri products including: Collector, Survey 1-2-3, Quick Capture, etc.	Provide on-site staff support (duration will vary based on the assigned task)	Evaluate current GIS business practices utilizing industry best practices	Identify opportunities for business process improvement based on knowledge of GIS trends in municipal organizations	Reengineer workflows to facilitate data population and reliable data maintenance	Prepare documentation (SOP's, Training Docs, etc.)	Develop new applications using Esri's best practices leveraging against ArcGIS Online & Web AppBuilder; develop applications using JavaScript 4.X, HTML5, and .NET 4.0 and higher	Develop add-ins and new tools for ArcGIS Desktop	ArcGIS Mobile Development including various Esri products including: Collector, Survey 1-2-3, Quick Capture, etc.	Migrate legacy GIS & non-GIS applications –Enterprise System Upgrade task	Assist in building and enhancing ArcGIS Hub sites	Develop web applications with SQL Server backend database	Support the integration of GIS with other business systems (311, permitting, work order asset mgmt, optimized routing) to ensure compliance with the City's overall IT vision and direction
On-Call GIS Consulting Services Contract | City of Columbus, Ohio	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■		■	■
Valves Exercising and Water Main Isolation Tools | City of Columbus, Ohio											■	■	■	■	■					■	
Columbus Watershed Management Application | **Requirements Gathering** - City of Columbus, Ohio											■	■	■	■							■
Columbus GIS Dashboard Web Application Upgrade and Support | City of Columbus, Ohio											■	■	■	■							■
Targa Resources Redline Application Re-Development | Houston, Texas				■	■		■				■		■	■	■	■	■	■		■	■
GIS Development, Implementation and Integration Services | City of Indianapolis/Marion County, Indiana		■	■							■	■	■	■	■	■	■	■	■			■
GIS and Mapping Services | Ottawa County, Ohio		■	■		■		■	■	■		■	■	■	■			■	■		■	■
Cleveland Water Cityworks Data Preparation and Implementation | City of Cleveland, Ohio	■	■		■	■		■	■	■	■							■				■
Ohio State University (OSU) GIS Support Services | The Ohio State University (OSU)		■												■	■	■		■			■
Architect of the Capitol Enterprise GIS Development | Washngton, DC		■		■	■		■			■			■	■	■	■					■
Artex Oil Onsite and Remote GIS Support Services | Marietta, Ohio	■	■	■		■			■	■	■	■		■	■	■		■	■			■
Ohio Gas Company GIS Services | Bryan, Ohio	■	■	■	■	■		■		■		■		■	■							
SD4 Water Services Asset Location | City of Columbus, Ohio								■	■								■			■	
Blueprint Columbus Initiative |City of Columbus, Ohio								■	■		■	■	■	■			■			■	

On-Call GIS Consulting Services Contract

Columbus, Ohio

In 2017, the Deparment of Technology (DoT) entered into a contract with Woolpert, Inc. to provide professional services in support of the Department of Technology and various other city departments' GIS applications and projects. The single point coordination and management of these cotracts by DoT increases efficiencies and provides flexibility as it allows for the utilization of resoruces. Woolpert had this contract for three years – the initial one-year term of this contract and two additional one-year renewal terms.

The successful performance of task orders performed by Woolpert under this on-call consulting servcies contract as showcased below.

Project Data

Client

City of Columbus, Department of Technology

Contact

Shoreh Elhami

1111 East Broad Street

Columbus, OH 43205

614.645.2109

SHElhami@columbus.gov

Date

2016 – 2019

Fee

$62,887 | $15.004 | $23,530 | $32,498 | $44,130 | $67,227

City of Columbus, OH, 2018 Water GeoSync. This task involved investigating and detrmining a solution for Water GeoSync errors due to workflow where features are moved from one feature class to another. Specifics included:

- Solution for Water GeoSync errors. The City was experiencing errors during the synchronization process between the Oracle WAM database and the Esri enterprise geodatabase in the case of certain workflows where assets are edited and moved from one feature class to another. Woolpert researched the issue to determine if changes to either the GIS editing process or the GeoSync configuration (or both) could be made to resolve the synchronization issue. Once the investigation was complete, Woolpert provided the investigational findings to Columbus DPU.
- Troubleshoot Timeout Issues with GeoSync. Woolpert investigated whether some or all GeoSync processes should be moved to server with more resources or if there are configuration changes, database tuning opportunities, or other recommendations or best practices from the GeoSync vendor that can solve this issue without the need to move the processes.
- Hide Geodatabase System Views in Responder Schema.Woolpert investigated whether hiding views is achievable, research potential negative impacts of hiding views, and if views can be hidden, provide a documented plan for how to complete the process.
- Update CUBS to Responder Customer Loading Script. Woolpert revewed the current script and process and will create a new script that can be used to replace the existing one, with the inclusion on a comprehensive duplicate check.

City of Columbus, OH, 2018 County Parcel ETL (2018). The City of Columbus had a need to create a process to standardize and combine seven counties worth of GIS parcel data that can be run manually or through a scheduled task. The objectives of this task involved County Coordination, Schema/Script Development, Script Implementation, and Documentation and Training.

Woolpert met with each of the seven counties Franklin, Delaware, Licking, Fairfield, Pickaway, Madison, and Union, where parcel information was to be collected and recorded information per project requirements. Woolpert started by developing a master parcel file schema, based on the Esri Local Government Information Model (LGIM) with additional fields. This file structure served as the template for all seven county's data to be manipulated into. Woolpert then created a series of Extract-Transform-Load (ETL) scripts that can be run independently of one another or together, by manual means or through a scheduled task. The scripts are configurable for City staff to configure locations of source data, temporary data, and final data as well as email addresses for error message notifications. Woolpert ensured the scripts included checks for incoming data source structure changes as well as the ability to send email notifications in the cases of unexpected input or errors. Scripts were tested in a development and test environment and, upon approval of the City, Woolpert moved the scripts into a production environment. Throughout the duration of phases 2 & 3, Woolpert documented the process created with inline script comments where appropriate. Additionally, document deliverables such as technical requirements, source code, and instruction manuals were delivered at the end of this task. Woolpert will provided up to two hours of training for administrators on how to use the system.

City of Columbus, OH , 2018 Spatial Reference. The City of Columbus had a need to standardize the spatial references in the City's GIS Enterprise Geodatabase, so that all feature classes used the same spatial reference. Woolpert included the steps for investigating potential impacts and devising a strategy for implementing a standardized spatial reference. Investigation and implementation considered and accounted for all applications and users that were are currently using GIS enterprise geodatabase.

Woolpert created a catalog all layers and projections used by each feature class in the enterprise geodatabase. Those using a spatial reference other than the preferred standard were identified and reported. Woolpert documented all feature classes in the enterprise geodatabase and identify spatial reference to each layer; identified feature classes using a non-standard spatial reference; researched and documented where layers are used. (e.g., existing map documents, existing map services, existing geodatabase replicas and/or existing third-party client integrations), and documented the potential impact(s) of changing the spatial reference for any feature classes identified as using a non-standard spatial reference. This report documented the impact on existing services, applications, and integrations.

Based on the findings, Woolpert devised a recommended course of action for standardizing the spatial reference in the City enterprise geodatabase. This plan identfied areas of low and elevated risk and included instructions on how to implement standardized spatial references, with graphics where applicable. This document included a plan to resolve identified impacts. Woolpert provided 12 hours of remote assistance, as requested, to help solve issues that arise as part of the testing and implementation of standardizing the spatial reference in the enterprise geodatabase.

City of Columbus, OH, 2018 Addressing. The City of Columbus had a need for revisions/updates to their LBRS addressing system. The proposed solution precisely followed the technical requirements detailed in the Centerline Editing Procedures document. Existing information was modified and, where necessary, new data and attribution was created that adhered to LBRS specifications within the City's enterprise GIS data layer.

Corrections were made to the address range attribution in the City's enterprise GIS data layer. The City provided a spreadsheet (Address Range Overlaps.xlsx) identifying 5,632 even address corrections and 5,235 odd address corrections. Procedures outlined in the Address Range Correction Procedure section of the Centerline Editing Procedures document provided by the City were strictly adhered to throughout the project. Woolpert technicians completed work on-site at the City and will be performed in an enterprise, versioned geodatabase using ArcGIS Desktop version 10.3.1.

City of Columbus, OH, 2019 ArcGIS Editing. The AOI for this task covered the limits of the service area of Columbus, Ohio (± 680.25 square miles). This task involved georectifying Historic Ohio Bell Plat Maps and Creating Index Map Layer (converting 256 pdf files to tiff format, using client-provided data, georeference all tiff files, creating index map (256 polygons) showing extent of each tiff file).

Columbus DPU Valve Application. The City of Columbus Department of Public Utilities (DPU) currently had a Valve Exercise and Pipe Isolation Trace application (Valve Application) that they wanted enhanced by adding a map printing tool. The print tool conformed to the existing Valve Exercise and Pipe Isolation Trace application architecture. Additionally, the out-of-the-box ArcGIS Server Map Export services were used for printing functionality. A Columbus ArcGIS map service was set up in Woolpert's development environment to mirror target environment, and located original source code, validating that it built and ran. Woolpert's GIS Specialist performed coding and provided updated files to Columbus with instructions for deployment.

2018 DoT Needs Assessment. The City of Columbus, OH, was interested in a needs assessment of their software systems to support both local municipality and county GIS business objectives. This task involved conducting on-site interviews with DODS staff and document requirements for the new application that will potentially replace PAWS, ADA Database, ArcGIS Collector, and resurfacing Design Tracker. This task also proposed preliminary design for the new application and created a written scope document for the web application that the City can subsequently use to issue another Request for Quotation.

Valves Exercising and Water Main Isolation Tools

Columbus, Ohio

Woolpert created a web application for use by Department of Utilities staff to electronically log all valve exercises while in the field. Prior to the development of this application, staff logged this information on paper, making it difficult to track which valves had been exercised or easily query and visualize the historic records. The web application provides an easy way for staff to log exercises, provide details about each exercise, as well as perform simple queries. In addition to the valve exercise functionality, the application allows users to determine which valves must be shut off in case of issues and identify which critical facilities would be affected.

Project Data

Client

City of Columbus, Department of Public Utilities

Contact

Mike Edwards, GIS Manager
910 Dublin Road
Columbus, OH 43215
614.645.8276
MGEdwards@columbus.gov

Date

2015 – 2017

Fee

$62,789

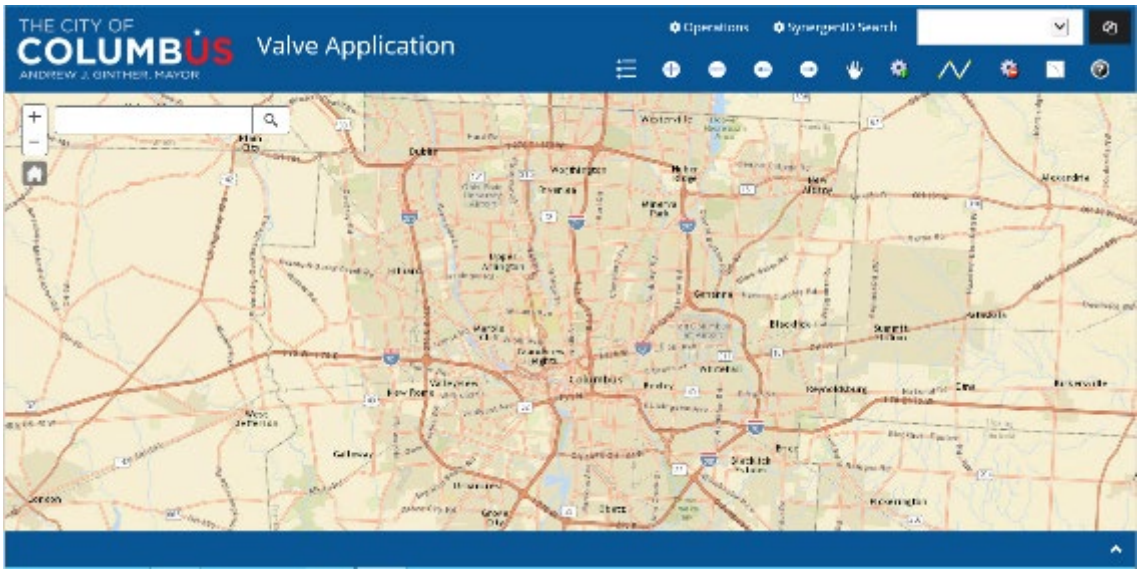
Nature of Work

Water valves are a very important element of a water system as they help start, stop, and regulate the flow of water. As part of their maintenance, water valves should be "exercised" on a regular basis. Exercising a valve involves opening and closing the valve to ensure that it does not rust shut and can be opened or closed in the case of an emergency.

The City of Columbus, Ohio, has historically tracked which valves have been exercised using paper records. Not keeping track of this electronically makes it very difficult to visualize where and when valves have been exercised. In order to improve the querying and visualization of this information to help ensure that all valves are getting exercised within a reasonable timeframe, the City wished to track the process electronically. To this end, Woolpert worked closely with the City to design the layout, functionality, and workflow of the web application. It was crucial that this new process not become an additional burden for field personnel. After multiple rounds of discussions and mockups, all parties were comfortable with how the new system would look and work.

As with all of its projects, Woolpert took an Agile approach to the development of this application, providing several opportunities to the City to view and try out the application as it was being developed. In addition to the valve exercise tracking functionality, the web application also offers users the ability to perform a main isolation trace. This task allows users to determine which valves must be closed to isolate a specific water main. All of the valves, water mains, service lines, curb stops, and meters connected to this section of the network are highlighted on the map display along with a list of critical customers that would be affected.

To develop this modern website, Woolpert used a combination of Esri's ArcGIS API for JavaScript and the Angular JavaScript framework. Woolpert also developed a detailed user guide to ensure users understand how to use the functionality of the site, which includes querying valves, seeing which valves have recently been exercised, viewing a valve's history and, of course, adding new valve exercise operations.



Columbus Watershed Management Application – Requirements Gathering

Columbus, Ohio

The City of Columbus currently uses an Access-based application to keep track of information related to the City's watershed management program. This application has two main functions: (1) to keep track of information about properties that border the three reservoirs the City manages (Griggs, O'Shaughnessy, and Hoover) and (2) to keep track of dock and stake permits at those three reservoirs. This application was developed many years ago with the data initially stored in Access and later converted to a SQL Server database.

The application has become troublesome to maintain and does not provide all of the functionality that the Watershed Management and Recreation and Parks departments require.

Project Data

Client

City of Columbus

Contact

Shoreh Elhami, GISP, MCRP
Citywide GIS Manager
109 N. Front Street
Columbus, OH 43215
614.645.2109
SHElhami@columbus.gov

Date

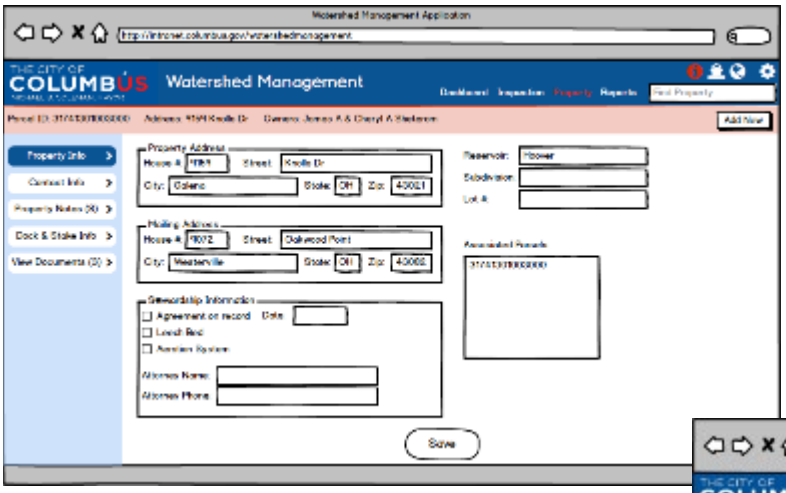
2016

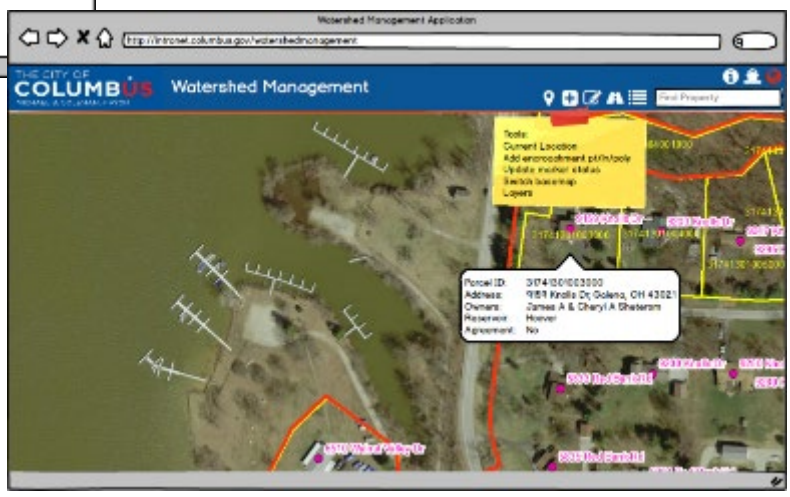
Fee

$13,684

Nature of Work

Over the course of multiple workshops, Woolpert met with GIS, Watershed Management, and Recreation and Parks departments to better understand the current application's functionality and determine the needs of the new application. After this round of workshops, Woolpert provided and presented to the City a detailed report listing all requirements, the proposed new database (going from 65 to 15 tables) as well as a vast number of mockups showing the proposed look and workflow. Woolpert incorporated the stakeholders' comments into a final version of the Software Design Specifications document.





Columbus GIS Dashboard Web Application Upgrade and Support

Columbus, Ohio

Woolpert provided assistance in upgrading and supporting the city of Columbus' Dashboard web application. City staff originally developed the GIS Dashboard using Esri's Flex Viewer.

Project Data

Client
City of Columbus, Ohio
Contact
Mike Edwards, GIS Manager
910 Dublin Road
Columbus, OH 43215
614.645.8276
MGEdwards@columbus.gov
Date
2014 – 2016
Fee
$84,358

Nature of Work

Woolpert performed a number of tasks for the City, including:

- Developing a **universal Google-type search box** that allows users to select a category (address, parcel, etc.), entering search criteria, and zooming to that location.
- Developing a **theme selection widget** that allows users to select one of multiple themes (water, sewer, electric) to automatically turn on or off a predetermined set of layers.
- Developing a **save map settings widget** that allows user to save which layers are turned on/off as well as the map's extent.
- Developing a **coordinates widget** that allows user to select a point feature and save its coordinates to the clipboard as X,Y coordinates.
- Developing a Where Am I widget that provides functionality similar to Dubscovery's "What's Here" widget (http://maps.dublin.oh.us/dubscovery/).
- Developing a **water valve isolation widget** that allows users to determine which valves should be shut off to isolate a specific pipe.
- Developing a **sewer and storm upstream/downstream search widget**, which allows users to perform upstream and downstream traces in sewer and storm geometric networks.
- Developing a **slider bar widget** that allows users to switch between aerial photography from various years using a slider bar.
- Making modifications to a number of existing widgets, tweaking their functionality as desired by City staff, such as the Identify, Drawing, Print and Attribute Table widgets.
- Performing a number of fixes to existing widgets and dashboard functionality.
- Working with GIS staff during deployment, ensuring all configuration files are set up correctly.

Targa Resources Redline Application Re-Development

Houston, Texas

Targa Resources (targaresources.com) is a Fortune 500 oil and gas midstream company based in Houston, TX, and is one of the largest providers of oil and natural gas liquids in the United States. Targa has operations across 13 states and uses Esri ArcGIS extensively across their enterprise.

Project Data

Client
Targa Resources

Contact
Trish Avery
811 Louisiana St
Houston, TX 77002
tavery@targaresources.com
713.584.1426

Date
2018 - 2019

Fee
$394,000

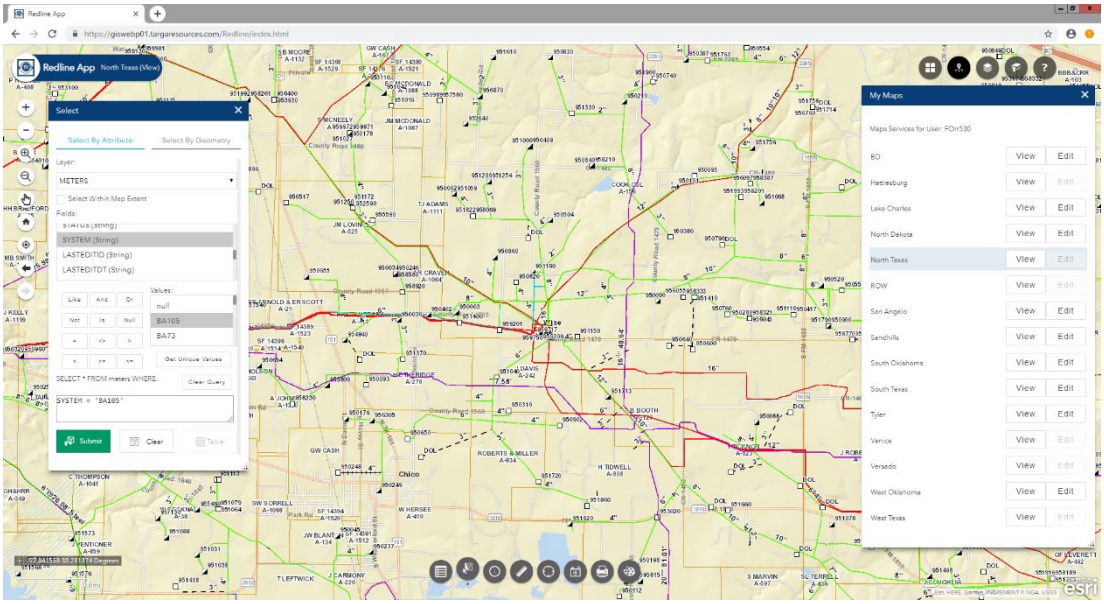
Nature of Work

Targa contracted with Woolpert to perform three primary tasks:

- Migrate their enterprise geodatabase from Oracle 11g to SQL Server 2017
- Upgrade their enterprise GIS platform from ArcGIS Version 10.3.1 to Version 10.6.1
- Re-develop their enterprise web mapping and data editing application from Silverlight to the latest Esri JavaScript HTML 5 platform

Woolpert first met with the core Targa technical team to understand the existing and required database schema and configuration and establish the server and network requirements for the new Enterprise GIS environment. Woolpert consulted on industry best data schema practices and provided suggestions for data model improvement. We created an updated geodatabase design based on the recommended improvements and migrated existing data to support application development.

We met with key operators and stakeholders to understand the data and functional requirements of the existing "Redline" enterprise web mapping application. Woolpert created scripts to automate the transfer of data and re-creation of database triggers and stored procedures from Oracle to SQL Server. We installed and configured all the required software in the new server environment and created new development, test, and production databases.



Woolpert conducted a requirements-gathering workshop to understand the existing Redline application and determine what changes needed to be included in the new business requirements. Once the requirements were agreed-upon, prioritized, and documented, Woolpert employed an agile development methodology over nine two-week sprints to develop the new application. Woolpert worked with Targa to cut over from the existing database to the new database with zero downtime for Targa users.

The new application supports complex editing and linear referencing workflows and integrates with SharePoint, Maximo, and several custom information management tools supporting Targa business operations.

GIS Development, Implementation and Integration Services

City of Indianapolis/Marion County

The City of Indianapolis/Marion County GIS division (IndyGIS) is a mature geospatial services group and software system that has been in existence since 1986. Over the course of time, the geographic information system (GIS) evolved from a decentralized team of individuals in separate departments to a centralized division called IndyGIS. As the division grew, more and more layers of information were included in the GIS. As a result, more staff in various City departments including public works, planning, and parks began using the system. No longer an on-demand map shop, IndyGIS evolved into an enterprise-wide system, providing over 150 data layers to more than 500 GIS users throughout the City.

As the GIS grew, the City embraced the understanding and the need for GIS data and functionality throughout the City enterprise. Through the production of static maps and use of interactive mapping applications, City departments began to understand how GIS could be used behind the scenes to query and analyze data as well as provide a common, intuitive hub with which to integrate multiple systems. IndyGIS realized that the real power of GIS was the ability to leverage existing GIS information and functionality across multiple disciplines and departments, serving to support their needs and integrate GIS into their operations and with other departments. The result was a sophisticated and integrated enterprise GIS that continues to expand and evolve.

Project Data

Client

City of Indianapolis/Marion County

Contact

Geneva Roembke, Application Services Manager, Information Services Agency

200 E. Washington Street, Ste. 322

Indianapolis, IN 46204

317.327.2772;
geneva.roembke@indy.gov

Date

2003 – 2019

Fee

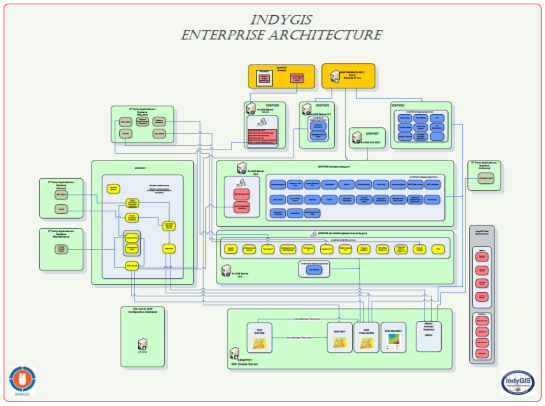
$715,260/year

Awards

Citizen-Engaged Community 2011-2013 Award from the Public Technology Institute to the City of Indianapolis, Indiana, for RequestIndy citizen access portal, created by Woolpert

Nature of Work

In 2002, IndyGIS selected Woolpert as a GIS consulting and application development firm to provide consulting services for its existing GIS environment including architecting a system to bring GIS to the public. Project leads from both IndyGIS and Woolpert worked together to create a standardized process for needs assessment, requirements gathering, planning, and implementation of projects that could be used for initiatives of any scale. In addition, Woolpert worked with IndyGIS staff to collectively define a vision for the GIS program including various needs and desires for the future evolution of the program. This spawned numerous initiatives from application development and system design to data development within the IndyGIS division that would define the foundation of the GIS program and its ability to grow in the years to come.



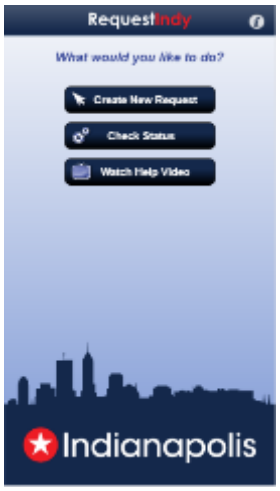
As a result, from January 2003 to the present, Woolpert has provided programming, system integration/architecture, data development and project management services for more than 150 separate project work orders.

Today, the City's enterprise-wide GIS solution continues to prosper and evolve. IndyGIS has become an embedded element across numerous City departments, such as the Mayor's Action Center, the Department of Public Works, Public Safety, County Assessors, and Voting/Elections just to name a few. IndyGIS has become about allowing staff and citizens the ability to navigate Indianapolis information through intuitive geospatial maps, apps and data.

Process

IndyGIS had the vision to bring GIS to the masses - to the citizens and staff of Indianapolis/Marion County. The goal was to make GIS a part of the process and use GIS functionality to provide a more efficient means of data visualization, retrieval, and analysis. To do this, IndyGIS chose to deploy a server-based GIS using ArcGIS Server, developing a "modular" Service-Oriented Architecture (SOA) where common GIS operations for data query and analysis were exposed as web services. Each web service developed could be used by multiple applications and systems for a similar purpose. The goal of this approach is to improve service delivery to internal GIS customers and be more responsive to the public (more accurate information delivered quickly) while better using GIS resources and

minimizing redundant code. Woolpert worked with the City to identify some key areas of functionality that were used commonly among GIS applications as well as those which may benefit non-GIS systems and users across the City. Woolpert then developed a series of web services to perform these key functions, from geocoding and address validation to printing, to spatial analysis/selection web services such as point in polygon analysis and buffer analysis. These web services together form a central, reusable, and maintainable architecture that can easily evolve with the technology, and provide the means for GIS to simply become a part of City operations.



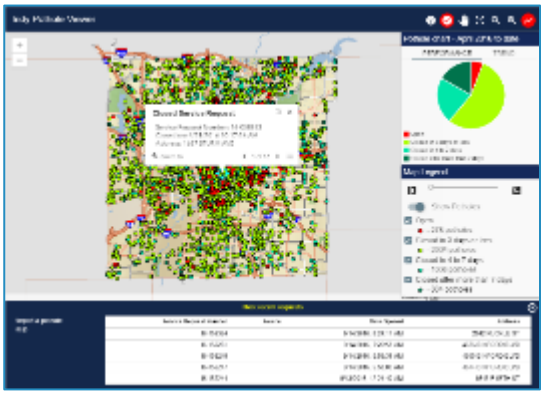
Today, these services not only continue to be an important piece of the IndyGIS environment, but various non-GIS agencies and departments within the City use these services to integrate GIS functionality with systems such as Hansen, Accela, and Salesforce.com.

In addition, GIS has provided the means to streamline processes through integrated workflows such as the City's citizen access portal, RequestIndy, which enables residents to submit service requests for issues they encounter—from potholes and high weeds to abandoned vehicles and more through an intuitive, map-centric interface.

Behind the scenes, workflows validate the jurisdiction and location, check for duplicates, and then route the requested information to the responsible back-end system for further processing, automatically. Citizens can then return to the site to check the status of their request. You can explore RequestIndy at: http://maps.indy.gov/RequestIndy .

Data

To have an effective data flow and visualization process, you need to have good data. IndyGIS spent years building their GIS layers and a Master Address Database (MAD), but they needed a way to maintain it and keep it up-to-date effectively and efficiently. Most applications within the City/County operate based upon address locations, often user-defined addresses. Web services were developed to validate these user-defined addresses against the GIS and the MAD, therefore the data needs to be accurate. Woolpert worked with IndyGIS to create an ArcMap extension containing a suite of tools for maintaining the various addressing GIS layers in conjunction with the Master Address Database keeping the data clean and in sync.



As GIS integration with the various systems increased, IndyGIS and City staff saw value in mapping items such as service requests, work orders and permits. However, hundreds of these items are created within their respective systems each week. Manually mapping these items real-time was simply not feasible, and any mapping that did occur happened in batches at irregular intervals resulting in data that was not up-to-date or incomplete. Woolpert worked with City staff to define automated workflows for these types of items using Esri's server-based technology that would automatically map service requests, work orders, and permits as they are created within their respective systems. All of this resulted in a more up-to-date, accurate, and almost self-maintaining set of GIS layers that could be used and analyzed by City staff.

Because of these automated mapping workflows and portals such as RequestIndy, spinoff applications have been developed allowing citizens to view status, track and analyze data resulting from citizen input, such as potholes.

Systems

With the process and the data tier in place resulting in solid integration of the GIS with other systems, it was time to take the GIS to the next level, expanding the system by developing map-centric applications for internal and public consumption that not only use GIS visually on the front-end for an intuitive user experience, but that also use the suite of geospatial web services and automated workflows on the backend resulting in a truly seamless and integrated environment. Using ArcGIS Server technology and the various web frameworks such as JavaScript, Flex, iOS and Android, Woolpert worked with IndyGIS to start creating a series of interactive applications and components to tie it all together.

Applications have been developed for numerous City/County agencies providing services ranging from citizen access and engagement, voting information, zoning notifications, to pothole maintenance and even snow

removal tracking. The Voter Information Portal allows citizens to not only see information about their polling place, but also verify their registration, view elected officials, candidates as well as sample ballots for their precinct. An interactive map is available tying all of this together. The Department of Metropolitan Development's Notifications application provides an effective means for staff to notify citizens of upcoming zoning changes.

The Department of Public Works (DPW) worked with IndyGIS and Woolpert to develop the Snowfighter application, which provides a map-centric interface for DPW staff to dispatch crews and monitor snow plowing efforts for City streets during a snow event. Streets are color-coded in the map based upon whether a crew is actively plowing, how long it has been since they were plowed, and tracks the personal and equipment resources used over the course of the event. All of this information is tracked and integrated directly into Hansen as work orders at the completion of each shift, allowing management not only the ability to more efficiently monitor operations during the snow event, but also provide the ability to better analyze the time/effort being spent and the associated cost during a snow event.

The Indy Snow Force Viewer (http://maps.indy.gov/IndySnowForceViewer) is a public facing application for Citizens to view the current progress of streets being plowed. These are just a few examples of how GIS has become integrated and part of the overall workflow with the enterprise-wide systems at the City of Indianapolis/Marion County.

Performance

Because of the RequestIndy citizen access portal, the City of Indianapolis received a Citizen-Engaged Community 2011-2013 Award from the Public Technology Institute. The City was honored for its use of citizen participation processes, integrated communication channels, integrated technology, and performance reporting.

Talented staff is a critical aspect of performance in an organization as complex as IndyGIS, and the performance demands on the GIS department's staff fluctuate. The need for experts in specific areas of application development, systems, and data changes with new projects and initiatives. Woolpert has provided onsite resources on an as-needed basis since 2003. These subject matter experts have assisted the City with tasks such as:

- Collection, field verification, and input of over 100,000 addresses
- Reconciliation of the GIS with the City's Hansen CMMS through Hansen's GeoAdministrator tool
- Input of backlogged infrastructure as-built information
- System design
- Application development

Through a partnering approach, Woolpert has become an extension of IndyGIS and an integral part of the Information Services Agency (ISA), allowing the organization to be more responsive and nimble when providing timely service to citizens and internal users while providing GIS application and system development direction and expertise. Additionally, the solutions we've developed with IndyGIS help City staff be more productive and allow the citizens to have a better user experience as well.

Snowfighter provides a solution where crews can be monitored more effectively, both in terms of location and time/cost. DPW staff can run reports at any time during the snow event and see how much time has been spent and how much salt has been used up to that point for that event. This is all possible through direct integration between the GIS and Hansen system.

The RequestIndy portal saves dispatchers and crews time by ensuring duplicate service requests are not submitted to a department's database. In the past, requests were transferred by email or paper, and each department had to re-enter the information in its respective system. Now, the portal sends the service request to a suite of integration services that pushes the information directly to the correct maintenance management, permitting, or animal control system. Once this information arrives, dispatchers are automatically notified to send crews to investigate and fix the problem. And, by enabling citizens to check the status of their service requests, and providing various means to use the application (website, iOS, and Android), it also helps the City reassure its citizens that their requests and involvement are important and their issues are being dealt with in a timely manner.

Woolpert is constantly working with the City to identify areas of improvement, whether it is through new applications, or increased efficiency and performance in current applications. Sometimes this involves leveraging new technologies, accommodating new platforms, and not being afraid to evolve and grow to support the ever increasing demands in the world today.

Woolpert and the City of Indianapolis have long embraced technology and using the right technology for the job, and in today's ever changing technical landscape, this trait is more important than ever. As a result, the City's enterprise GIS application suite continues to evolve. New technologies, frameworks, and techniques are constantly being adopted in order to best serve the citizens and staff of Indianapolis/Marion County.

Ottawa County GIS and Mapping Services

Woolpert has been providing mapping and GIS services to Ottawa County since 1989. In addition to designing the County's network to support a GIS, we have provided the following services:

- **GIS Infrastructure Assessment and Design Report** the current conditions of the GIS Server in was produced to assess detail, documented the existing structure, and provided recommendations to support expansion.
- **Aerial Enlargements** have been produced over the course of many years as a foundation to support the County's parcel mapping program.
- **Base Mapping** has been produced both countywide color and black-and-white orthoimagery and a countywide digital elevation model (DEM).
- **Lidar** has been acquired Lidar on a consistent basis for the County that is used to support the ortho base mapping and to perform the extraction of building outlines and for change detection. In 2016, the County contracted for the USGS 3DEP QL2 Lidar Standard.
- **Feature extraction** of planimetric features, including building outlines and hydrology for use in countywide change detection.
- **Process development** for migrating CAD data used to update the County's parcel mapping into a truly enterprise-level GIS environment. Services included GIS consulting, data translation and conversion, public access viewer upgrades, and Esri licensing assistance.
- **Application development** designed for the public to access (view and print) property information. The property information were calculations based on spatial data collected, extracted, and integrated by Woolpert.

Project Data

Client

Ottawa County, Ohio

Contact

Michael J. Wittman, P.S.
GIS/Technical Coordinator
315 Madison Street, Room 105
Port Clinton, Ohio 43452
419.734.6777.
OttawaCoEng@co.ottawa.oh.us

Date

1989 - 2018

Fee

$1,700,000

- **Oblique aerial imagery**, including flights performed by Woolpert and Pictometry were produced and used by the Auditor's Office to perform and validate properties during re-appraisals.
- **GIS assessment of existing conditions and needs** was performed including discovery of needs, desire, and vision for future GIS use (including for additional County departments, local jurisdictions, and open/public internet access); data inventory, standards, and quality control procedures; resources for staffing, training, and technical support; networking, hardware, and software; security concerns; database design and system integration workflows; and creation of a County GIS Committee.
- **GIS expansion feasibility study** to gather details on the existing conditions of the GIS infrastructure, including setup, health, and network of local GIS Server, replication process for Bruce Harris & Associates Server, and Ottawa County ArcGIS account.
- **GIS support,** including the configuration of ArcGIS Server and Portal for ArcGIS, installation of Esri's Web Adaptor, recreation of the Bruce Harris & Associates imagery services, and remapping of existing map services.

Cleveland Water Cityworks Data Preparation and Implementation

Woolpert was contracted to implement Cityworks hydraulics data preparation for the City of Cleveland. The project will include services provided for the Distribution and Maintenance plus Hydraulics unit. The system will support a multitude of service request, work order and inspection workflows. Workflows will be configured to support the range of maintenance activities including preventative maintenance, scheduled corrective maintenance and un-planned maintenance. This implementation will service approximately 310 people in the Distribution and Maintenance, 14 people in the warehouses, and 22 people in the Hydraulics Unit. This implementation is limited to the water distribution assets owned and maintained by the Division of Water, which are generally described as water mains, valves, hydrants and other appurtenances.

Project Data

Client

City of Cleveland, Department of Public Utilities

Contact

Xander Mavrides, PhD, GISP
GIS/Cityworks Services Manager
1201 Lakeside Avenue E
Cleveland, Ohio 44113
216.664.2444 ext. 74788
xander_mavrides@ClevelandWater.com

Date

2016 – 2019 current/ongoing

Fee

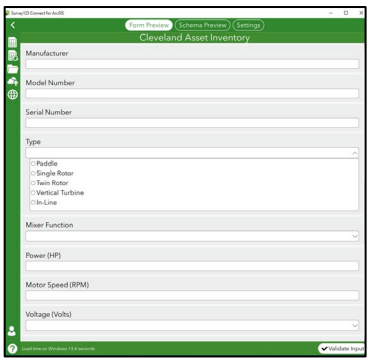
$2,200,000

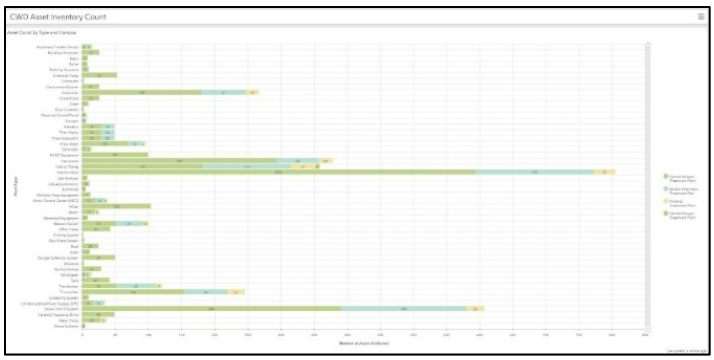
Nature of Work

Data Preparation

Woolpert performed data preparation for use in implementation planning and system design. After thoroughly reviewing information provided by the Cleveland Department of Public Utilities (DPU), Woolpert's specialists:

- Held data review workshops with key staff involved in Distribution and Maintenance (DM), Hydraulics, and Inventory and Warehouse business processes to determine the extent of data required to support the desired Cityworks functionality
- Developed database schemas for both activity-based data and asset-based data and subsequent plans to populate them
- Presented the database schemas and analysis of the condition and completeness of existing data
- Worked with the Cleveland DPU to establish plans for populating the database schemas
- Performed on-site data collection to gather existing data and identify data gaps
- Developed complex data collection forms in Survey123 and developed data collection methodology, schedule, and back-end data conflation processes





Implementation

Woolpert is currently in the implementation phase of this project, which is scheduled to be complete in October 2020. As a part of this three-year program, we are providing the following services:

- Implementing the Cityworks asset management system (AMS) software to meet the Cleveland DPU's business requirements
- Conducting workshops to train Cleveland DPU project team members on the features and functions of Cityworks
- Facilitating a series of implementation and configuration training courses to introduce Cityworks AMS software in greater detail to Cleveland DPU team members
- Configuring the Cityworks AMS software based on results from the workshops and training courses
- Providing legacy data conversion and creating custom reports and dashboards
- Working with the Cleveland DPU to deploy advanced mobile Cityworks AMS capabilities

Ohio State University (OSU) GIS Support Services

Columbus, Ohio

For the past three, years, Woolpert has provided a variety of GIS-related services to the Ohio State University (OSU).

OSU had previously developed individual stand-alone BIM models of each of the buildings on their Columbus campus. While those models were immensely valuable in visualization and planning for building renovations or improvements, as individual BIM files they did not provide all the functionality desired by the University.

Woolpert provided services to OSU to develop a GIS website for the public, staff, as well as faculty to view information about the campus. In addition to the public website, advanced GIS functionality has been provided to select groups of internal staff. Such functionality includes visualizing and obtaining reports about campus facilities and their condition, viewing and locating utilities, and viewing the campus in a 3D environment.

The following outlines some of the projects performed for OSU that are relevant to the type of work being requested under this city of Columbus GIS on-call services contract.

Project Data

Client
The Ohio State University (OSU)

Contact
Larisa Kruger
2003 Millikin Road, Suite 225
Columbus, OH 43210
614.292.9521
kruger.57@osu.edu

Date
2014 – 2018

Fee
$912,000

Nature of Work

AutoCAD Transition to Esri

The Ohio State University contracted with Woolpert for services to support the transition of their Utilities GIS data management from AutoCAD/Oracle Spatial to the Esri platform. Services provided meet OSU's business objectives with goals that included:

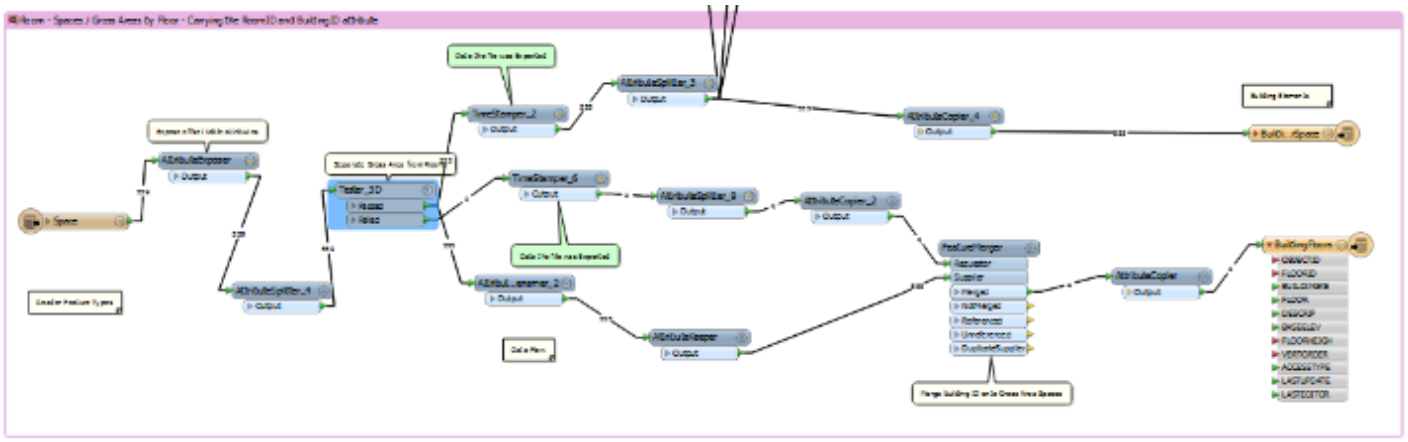
- Developing the key components necessary to facilitate the transition from the current AutoCAD/Oracle Spatial environment to the Esri environment for utilities.
- Developing improvements to current data maintenance procedures with the use of new software/technology (Esri).
- Development of a strategy to resolve the existing backlog of utilities updates.
- Documenting reasonable expectations for data management staff.

In support of these goals, Woolpert performed the following tasks:

- Developed a set of Esri data models to contain new utility data.
- Migrated the utility data from the current CAD/Oracle environment to an ArcSDE geodatabase.
- Conducted Esri data management training to supplement formal Esri training.
- Documented backlog resolution strategies and project associated efforts.
- Defined, documented, and trained on new survey processes for the Esri platform.
- Developed staff expectations report that defined what can reasonably be expected from the current staffing levels.

Enterprise GIS

Data Migration Workflow. To reduce the redundancy of maintaining a Revit BIM, CAD and GIS environment for each of the campus buildings, Woolpert used Safe Software's Feature Manipulation Engine (FME) to create a workflow that uses the Revit BIM files as the sole source to generate spatially accurate 2D and 3D GIS building data. Workflows were set up to update the enterprise geospatial database (building floor footprint and rooms, including custom attributes) every time a change occurs in the BIM. The enterprise geospatial database is the source for the 2D and 3D applications.

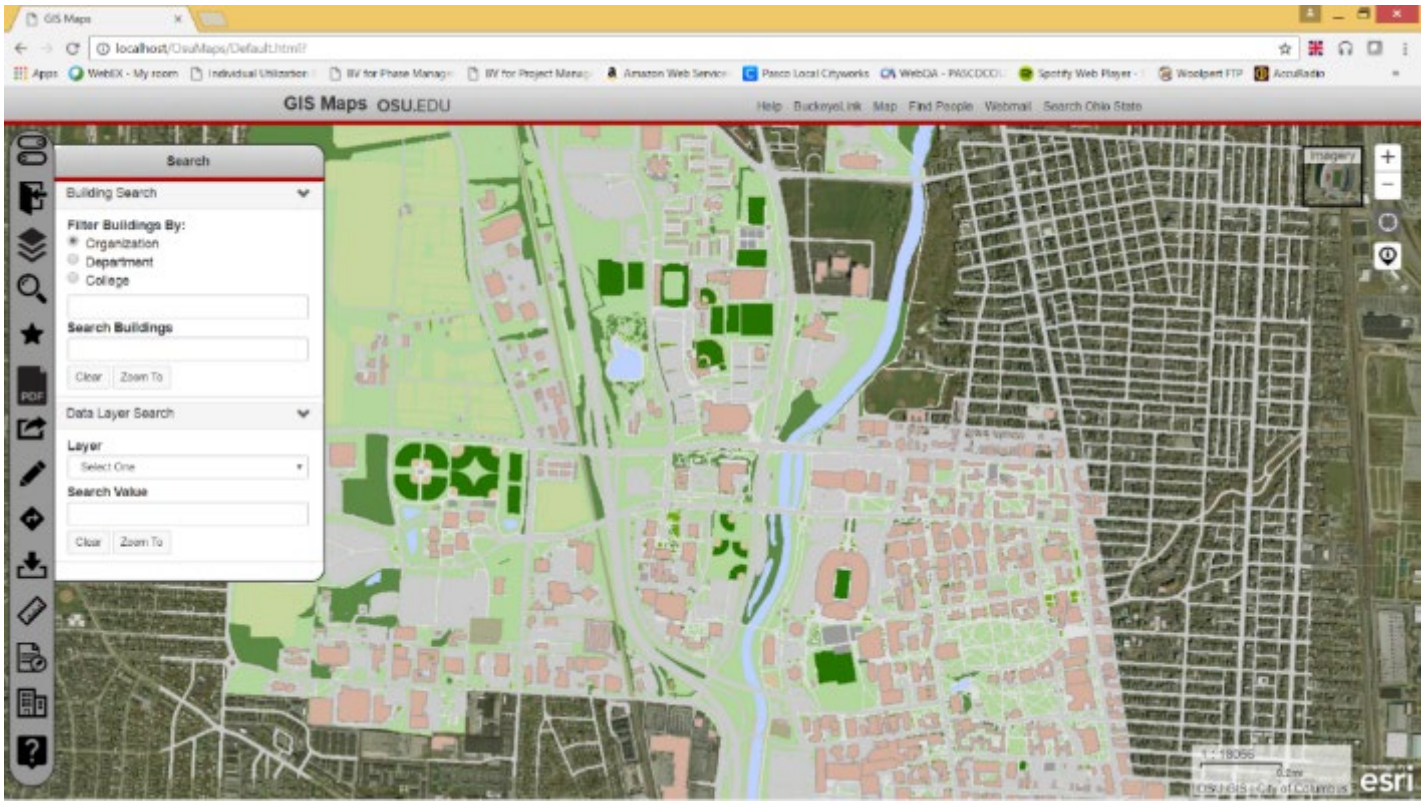


OSU Maps Application

Woolpert developed OSU Maps, an enterprise GIS web application developed to provide students, staff, and faculty the view into useful information about the campus as a whole. The application provides basic information such as GIS data, building information, parking locations, and public transportation routes. In addition, OSU Maps displays energy usage, information about interior space data, building assessment data and provides editing capability for utilities data. The application was developed using a modern responsive design approach that makes it accessible on desktops, tablets, and smartphones.

OSU Maps is built using:

- Esri JavaScript API for ArcGIS Server
- JavaScript / HTML 5
- ASP.NET
- WCF REST enabled data services

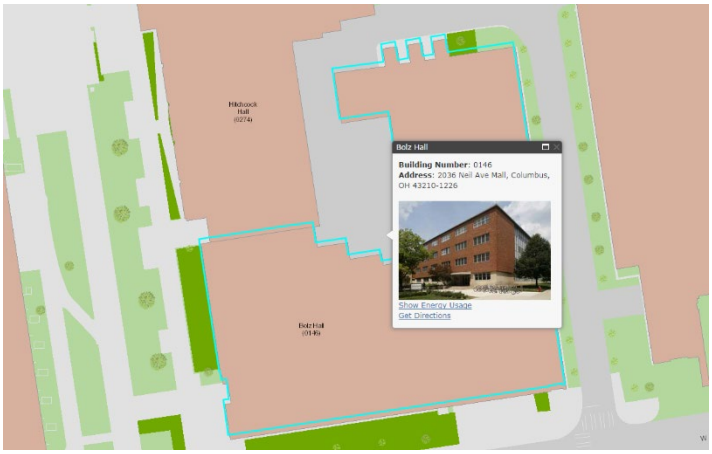


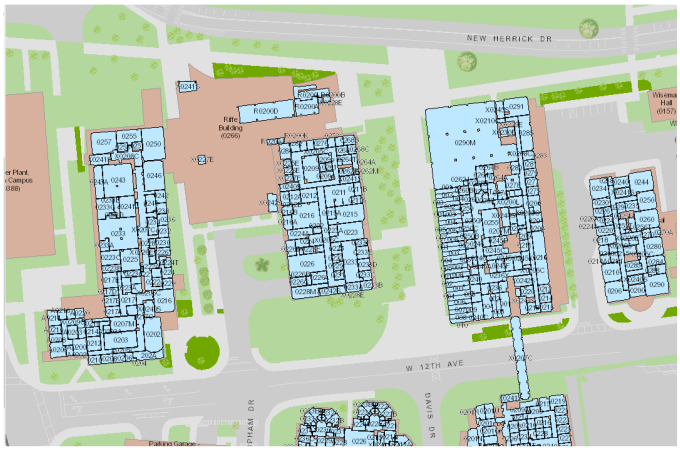
The OSU Maps application includes the following capabilities:

- Basic 2D mapping capabilities of both exteriors and interiors of buildings using Esri's Local Government Information Model

(LGIM) with modifications to incorporate additional feature classes.

- Visualization of and information about various bus lines (including real-time location), parking garages (including real-time space availability), student services points of interest and amenities.
- Building search functionality.
- Printable PDF map.
- Construction information.
- Integration of real-time building-level energy consumption data.
- Integration of building, floor, and room level Facility Condition Index (FCI) data, including advanced query and reporting functionality. (limited to staff)
- Advanced Utility query, visualization, and tracing (limited to staff)





3D GIS Viewing. Woolpert also deployed a 3D web-based model of the Columbus campus using the CityEngine web viewer for internal staff with the following functionality:

- Turn layers on/off
- Walls on/off comparison
- Setting sunlight based on time of day and year
- Setting feature shadows
- Generic out-of-the-box GIS search

Architect of the Capitol Enterprise GIS Development

Washington, DC

Since 1793, the Architect of the Capitol (AOC) has managed the facilities comprising the nation's Capital complex, responsible for maintaining nearly 17 million square feet of building space and grounds across 450 acres of land. Facilities under its authority include: U.S. Capitol Building, Library of Congress, U.S. Supreme Court, and the House and Senate Office Buildings.

Like many institutions made up of multiple structures and jurisdictions covering a significant geographic footprint, the AOC has its share of facilities management challenges. Facilities data exists in separate jurisdictions, and sometimes there are multiple databases in each one. In many cases, databases often support individuals (through adapted processes, tools and software) to perform specific job functions. As a result, data often exists in silos that cannot be easily acquired when needed by other facilities managers throughout the agency.

In both day-to-day operations and maintenance activities and longer term construction and preservation work, there is a pressing need for accurate, reliable information in order to support decision making and organizational performance metrics. Historically, this information has been very atomized across the Agency – held in a variety of databases, spreadsheets, hard copy documents and enterprise data systems and with individuals as corporate knowledge gleaned from years of experience.

Project Data

Client

Architect of the Capitol (through TMA Systems, LLC)

Contact

Ross Powell

5100 E. Skelly Drive

Tulsa, OK 74135

503.944.7404

ross.powell@tmasystems.com

Date

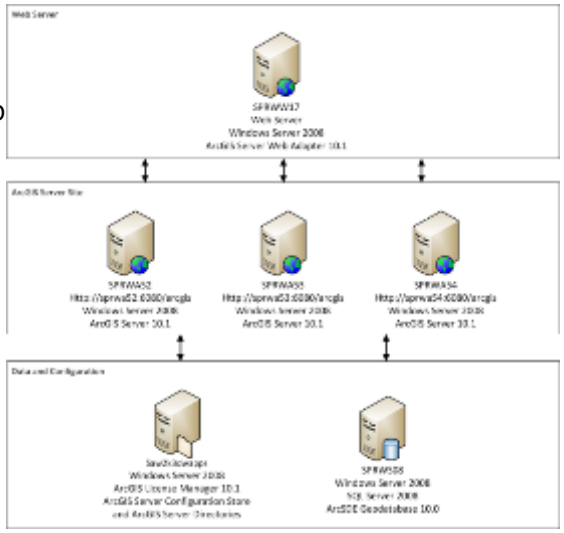
2012– 11/2019 current/ongoing

Fee

$2,850,000

Nature of Work

As a subcontractor to TMA Systems, Woolpert has developed an Enterprise GIS for the Architect of the Capitol in Washington, DC. The work includes the design and development of a comprehensive geodatabase, migration of existing 2-D CAD data into a 3-D Esri GIS Geodatabase, development and deployment of an Enterprise GIS Server architecture, development of custom GIS applications, and onsite GIS support.



Data

For the AOC, an initial goal of the Enterprise GIS was to assign a location to features (e.g., rooms, floor plans, statuary, trees, etc.), providing the "where" component to what previously had only been a "what." The AOC realized the potential to expose existing data for the creation of specific functionality that meets its internal customers' needs. And, in doing so, the Enterprise GIS would allow the AOC to achieve its larger goal of true data transparency throughout the agency.

Woolpert has developed an Enterprise GIS to provide access to AOC's facility data in ways that has the end-user, and their information needs, in mind. This approach is focused on leveraging existing sources of basic facility data (CAD drawings, BIMs, and CMMS) to form a GIS foundation to overlay other business line data (grounds, historic preservation, utilities, equipment, emergency management, etc.). The GIS includes data from underground features (utilities, tunnels, parking garages, etc.), above ground features (paved surfaces, street furniture, security assets, buildings, trees, etc.), and 3-D interiors of all of the buildings on Capitol Hill, including the Capitol, House and Senate office buildings, Supreme Court, and Library of Congress. Interior features include all walls, doors, windows, and spaces, along with emergency equipment and selected mechanical/electrical equipment items. All spaces are attributed with a unique ID which provides the linkage to other information systems.

The resulting geodatabase incorporated a number of existing Esri geodatabase templates and extended the templates to support needs that were specific to AOC. Data was then migrated from over 1000 source documents using Safe Software's Feature Manipulation Engine (FME) and an elaborate set of scripts to automate the processing wherever possible. The result is a comprehensive spatial database of all of the features underground, on the surface, and inside the building across the entire agency complex. All of the spatial query, geo-processing, and analytical powers that are inherent in GIS can now be used to develop solutions to meet the specific needs of users across the organization.

Enterprise GIS Pilot Application—Congressional Office Moves Viewer (2012)

Launched in 2012, the Congressional Moves Office Viewer is the first example of how the AOC created specific GIS-based data to assist House members (and their staff) with the office selection process. As a supplement to the AOC's existing Congressional Lottery Moves process application, the new office viewer enabled the House to exploit spatial data about the office suites and reveal 3-D views of available suites.

Every two years when there's an election for the House, the newly elected House members have a four-week window where they can choose new office suites, based on seniority and other variables. For years, members have used an existing "moves" application to manage this process.

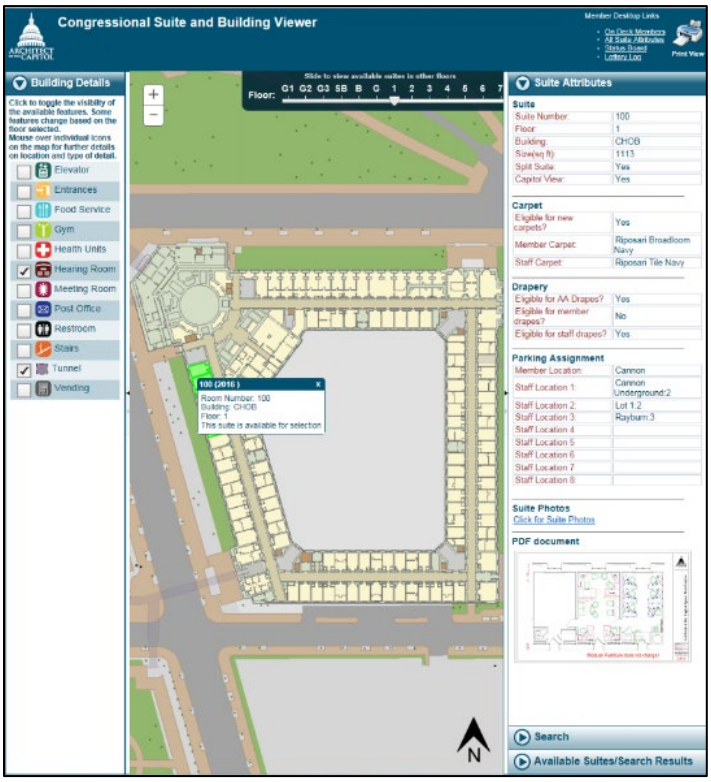
The GIS-enabled office viewer allowed authorized users to display a two-dimensional, standard map view of suites and their orientations within the building (floor number, location on the floor). End users could also toggle on additional amenities and view them on a map, providing visibility to restrooms, elevators, hearing and committee rooms, tunnels between buildings, parking, and more.

GIS data was converted into a 3-D model and used to generate static near-3-D images of each suite, allowing members to examine suites in various views, including: building, floor, and at least two different angles of each suite. Members could examine specific attributes about the suites (carpet, drapes, square footage, and scenic view of the Capitol) along with the spatial views of the suites themselves.

The office viewer preserved data in the original "moves" application by linking back to its existing videos and other still photos. To make the application functional on tablets or in standard browsers, it makes use of responsive design principles available in HTML5.

Congressional Office Moves Viewer (Phase 2 - 2014)

As part of the 2014 Congressional Office Moves Viewer, the existing application was updated to provide additional functionality to the House Moves GIS Viewer. The interface was now integrated with the existing AOC hosted Lottery Moves application in such a way that only available suites would be display as part of the interface. The Lottery Moves continued to be the primary interface although the GIS Viewer now allowed the users search and filtering of available suites.



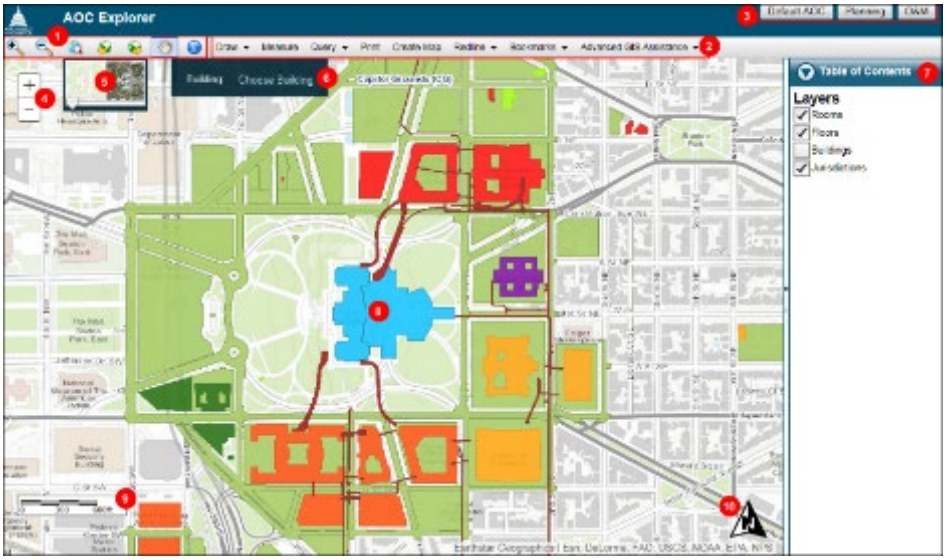
The House Moves GIS Viewer is updated every 15 seconds with live data from the AOC Lottery Moves application. All available suites were displayed with a green highlight. Any taken suites would be highlighted in red on the map and removed from the interface after a few seconds (Set to 6, but configurable).

2016 House Moves Transition

Looking forward to the House Moves Transition in 2016 the GIS House Moves website may take a more active role in the selection process of the member suites. Once that happens, a failover and replication environment must be in place to provide high availability to the users.

AOC Explorer

In June 2015, the AOC Explorer web application was deployed. The purpose of this project is to provide new and comprehensive GIS functionality to all AOC employees. Available AOC GIS data was provided in three map themes to address the different levels of functionality required for general users, operations and maintenance (O&M), and planning staff. As additional GIS data becomes available, the themes will be updated.



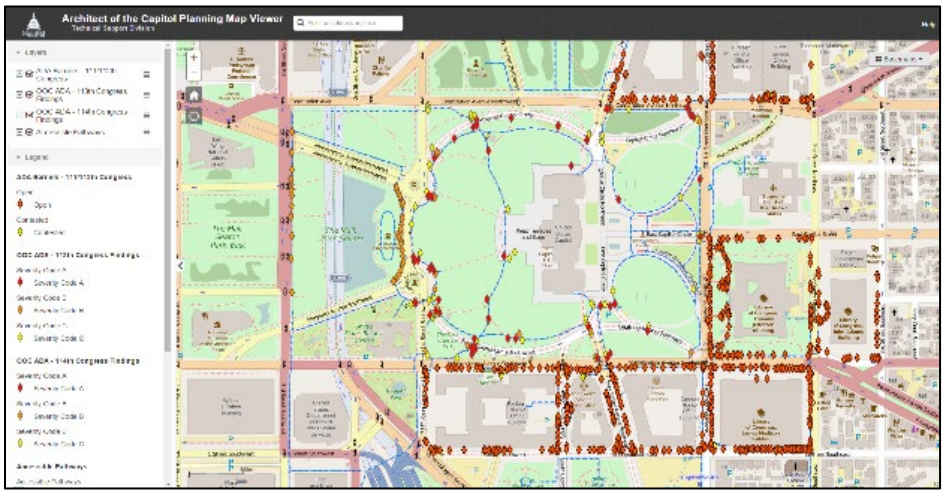
Users are able to navigate the map through standard panning and the ability to zoom to campus, building, floor, and suite level allowing the user to see information in relation to other buildings, rooms and amenities within the capitol complex. Users are able to navigate from building to building and transition from floor to floor displaying information on each floor of the building, which will be displayed as additional layers that the user can toggle on/off. This information is published live from the AOC GIS via Esri's ArcGIS Server software. This application provides a core set of GIS tools for navigating the map, drawing/measuring tools, printing as well as searching and query tools.

Pilot Project: Project and Planning Management Map Viewer

Beginning in late 2014, a series of map viewers were created for the AOC's Planning and Project Management (PPM) division, used by master planners, for such use-cases such as determining whether barriers and accessible pathways comply with the American Disability Act (ADA) findings from the United States Congress Office of Compliance and symbolized based on open-closed or severity status.

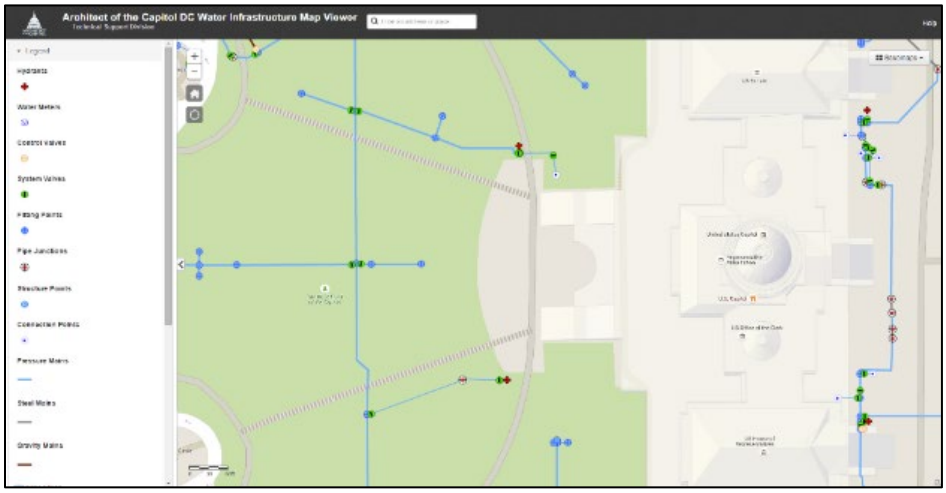
Using live data from the AOC GIS and using Esri's Javascript map viewer templates, the Planning map viewer provides an easy to use application for planners, who do not have prior GIS experience, to visualize ADA findings from source documents and spreadsheets, and visualize each finding on a map. Additionally, authorized users are able to directly add and update for each ADA finding in real-time.

PPM is interested in pulling CAD drawings of the entire campus to accurately depict pedestrian ramps, curb ramps, sidewalks, and accessible walkways into a custom basemap.



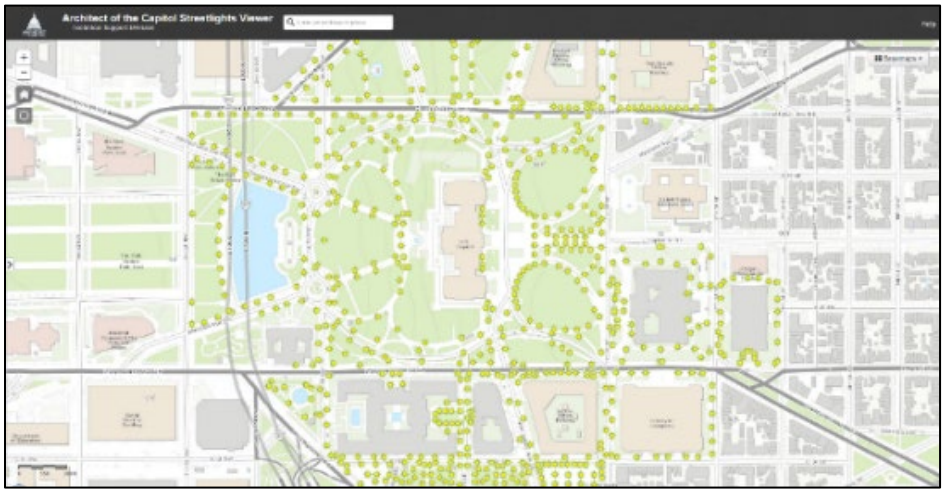
Pilot Project: DC Water and Sewer Authority (WASA) Map Viewers

In early 2015, stakeholders in the AOC's Energy, Sustainability, and Water Conservation Division (ESWC) were interested in visualizing the District of Columbia's Water and Sewer Authority's water, sewage, and catch basin locations in two map viewers, to separate water and sewage data. GIS Data was provided by DC's Office of the Chief Technology Officer. The ESWC Division plans to use these map viewers, with cooperation from WASA, to identify catch basins manholes that require cleaning and maintenance.



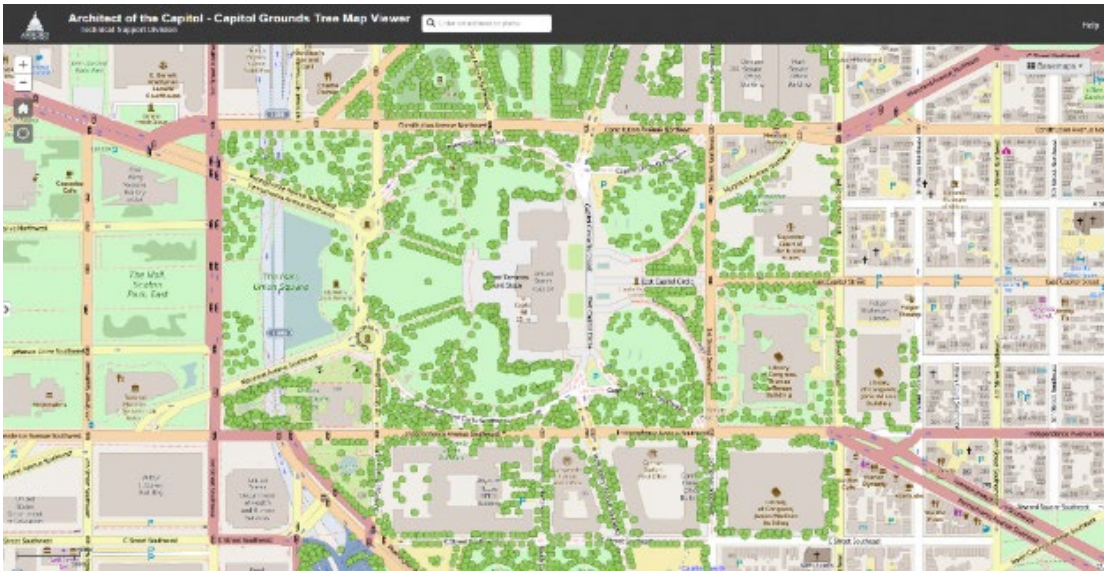
Pilot Project: Capitol Grounds Streetlights Map Viewer

AOC's Energy, Sustainability, and Water Conservation Division (ESWC) is interested in utilizing GIS to maintain and visualize the over 1,000 street lights under the AOCs jurisdiction. Discussion is currently underway to lockdown and finalize the data schema, including plans to barcode each streetlight for unique identification to tie into WebTMA and GIS.



Pilot Project: Capitol Grounds Trees Map Viewer

The Office of the Superintendent for Capitol Grounds is interested in migrating from their current desktop-only Davey Asset Management system to an enterprise system, such as the AOC's GIS enterprise system to maintain the over 4,000 trees under the AOC's jurisdiction. Several AOC Capitol Grounds employees met with the District of Colombia's Department of Transportation (DDOT) Urban Forestry Administration (UFA) arborist detailing a success story utilizing Collector for ArcGIS, ArcGIS Online/Portal for ArcGIS, and CityWorks to manage tree work requests and keeping tree information up-to-date directly in the field. A pilot map viewer was created as an introduction to show the capabilities of a GIS. Discussion is still on-going with interested stakeholders to utilize the GIS.



Artex Oil Onsite and Remote GIS Support Services

Marietta, Ohio

Woolpert was contracted to provide as-needed professional services that include but are not limited to: Geographic Information Systems (GIS), surveying, engineering, landman, aerial mapping and remote sensing, and architecture.

Project Data

Client
Artex Oil Company
Contact
Chad Spence
2337 State Route 821
Marietta, OH 45750
740.373.3313
cspence@artexoil.com
Date
06/2014 – 07/2017
Fee
$70,000

Nature of Work

The following highlights the specifics of the work being performed under this contract.

Ongoing GIS Support

Woolpert provides ongoing onsite and remote support to Artex staff on geospatial data management, editing, analysis, and map production. Typical tasks include spatial and attribute data editing, map production, data conversion and geoprocessing tasks.

Streamlined SSI / GIS Data Integration

SSI is an enterprise database used to store all lease hold information for Artex. Since SSI does not have a geospatial component, Artex followed a manual process to visualize lease data geographically. This workflow was time consuming, error-prone, and created lag in data currency. Woolpert worked to analyze the data and technical capabilities and limitations of the SSI software to determine a more efficient and timely method for integrating lease hold data into the GIS. Woolpert then suggested a new workflow to streamline SSI/GIS integration, created scripts and batch files to support the integration process and conducted onsite training.

Artex Data Dictionary Creation

During recent staff support visits, it become apparent that existing datasets contained little to no underlying data structure. This lack of structure applied to all levels of the geospatial data. Woolpert worked with Artex staff in documenting all desired data elements, and then built a logical/structured enterprise data dictionary for staff use. This data dictionary further refined the underlying data by limiting data input to known coded values and ranges. With the data dictionary complete, Woolpert staff created an Esri file geodatabase with all appropriate data elements, and loaded existing Artex geospatial datasets into the structured geodatabase.

Artex Legacy Lease/Parcel Data Adjustment

Artex staff had concerns regarding the underlying spatial and temporal accuracy of their legacy lease and parcel data. Woolpert reviewed the existing parcels datasets and determined their currency and accuracy. Woolpert then detailed various options for providing accurate parcel data for Artex's GIS. Options presented included: compiling existing publicly available parcel datasets, third party data providers, or digitization of legacy datasets. Once a valid parcel dataset was identified, Woolpert spatially adjusted existing lease polygons to properly align with underlying parcel datasets.

Artex Legacy Geospatial Data Cleanup and Adjustment

Beyond lease and parcel data, Artex has other legacy geospatial datasets. These datasets are comprised of various non-standard naming conventions, mismatched attribute fields and values, and are of an unknown source and currency. Woolpert investigated available datasets, and worked with Artex staff to identify all usable map data. Once the datasets were identified, Woolpert loaded all relevant datasets into the defined database schema and made spatial adjustments as appropriate. An outline provided by Artex served as a starting point for the analysis with some of the major datasets including pipelines, well locations, pad locations, drilling locations, fairways, plays, and other geological features. Woolpert provided Artex with a file geodatabase containing all of the relevant feature classes.

Ohio Gas Company GIS Services

Bryan, Ohio

Ohio Gas Company (OGC) is a privately owned utility company that provides natural gas service to a multi-county region of Northwest Ohio. Their operations date back to 1914 and as such, their legacy geospatial data is extremely varied in accuracy, completeness, and format. OGC realized their need for accurate and dependable geospatial data, and partnered with Woolpert to convert all legacy geospatial data into a standard format and build an associated GIS to storage, maintain, visualize, and analyze their gas system.

Project Data

Client

Ohio Gas Company

Contact

Adam Pietrzyk, PE

715 E. Wilson St

Bryan, Ohio 43506

419.636.1117

Adam.pietrzyk@ohiogas.com

Date

2015 – 2018

Fee

$570,000

Nature of Work

This process started with database design and source document review to completely understand OGC's legacy data and ultimate end goal. The review incorporated a wide range of datasets, from CAD files and GPS data, to paper maps and ancillary scanned documents. These varied legacy datasets were used in the compilation of both spatial and attribute data for OGC. Woolpert also worked with OGC to define logical pilot projects for the overall effort to ensure project success.

For this conversion project, Woolpert utilized all available base map data – both internal and external to OGC. Because of the abundance and complexity of the source materials available for this project, Woolpert used a hierarchical approach to capture and process system data. The data conversion began with the most detailed and spatially accurate data available and worked through to secondary sources.

Based on past experience, Woolpert utilized a complete "compilation" or re–digitization of data rather than adjustment of existing data. This method reduced additional complexities and errors that can ultimately increase time and costs associated with the conversion process. In OGC's case, compiling data from the source documents was the most economical approach to provide accurate GIS data. During digitization, data creation rules and quality control measures will be in place to ensure that the most complete and accurate data is created.

SD4 Water Services Asset Location

Columbus, Ohio

The City of Columbus and Franklin County desired to fill data gaps in several water service areas by locating water meters currently situated in the County which could be accepted by the City, potentially reducing responsibilities to the County and increasing revenue to the City. Dynotec collected data on curb stops, water meters and water wells, including geolocations, photographs tied to the location and other data using the ESRI Collector App on tablets and posting the data to an ArcGIS online map for tracking and review by the clients. Using the Collector App and ArcGIS online provided simple sharing to multiple users with a visual representation of the completed work. Nearly 1500 homes, several apartment complexes and commercial developments were investigated including placement of pre-visit door hangers and knocking on doors to alert owners and obtain permission for entry for meters located in houses.

Project Data

Client

City of Columbus Department of Public Utilities

Contact

Bruce Bassett, PE

Project Manager, Brown and Caldwell (Prime Consultant)

(D) 614.923.0866 direct; (C) 614. 849.2272

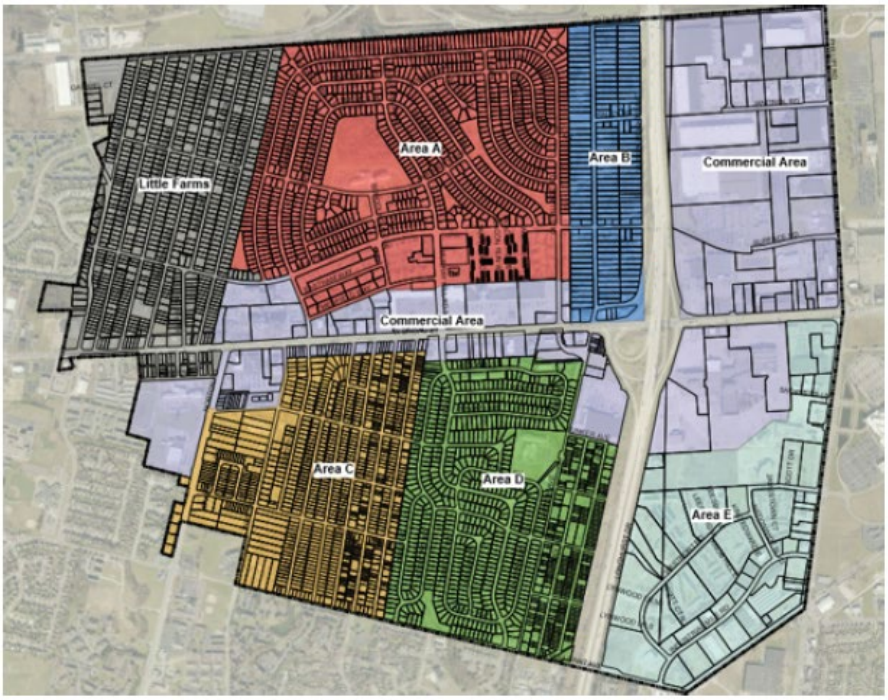
bbassett@brwncald.com

Date

2017 - 2019

Fee

$65,000



Blueprint Columbus Initiative

Columbus, Ohio

Blueprint Columbus is an innovative approach to eliminating sanitary sewer overflows while also investing in Columbus's neighborhoods and economy. Implementation of green infrastructure will strive to meet multiple goals including compliance with the 2015 Wet Weather Management Plan through reduced infiltration and inflow, improved water quality with total suspended solids reduction, and increased long-term sustainability and affordability through more natural, integrated solutions.

Project Data

Client
City of Columbus Department of Public Utilities

Contact
Mark Timbrook, PE
PM, City of Columbus-DOSD
614.645.0298
MDTimbrook@columbus.gov

Date
2011 – 2019 ongoing

Fee
$1,070,000

Nature of Work

Dynotec has been involved with the Blueprint Columbus program since the early days with the Third Avenue CSO Increased Capture & Green Infrastructure project in 2011 and the first round of Blueprint Clintonville in 2012. Our involvement continued most recently with "Blueprint Columbus 2016 – Clintonville 3." Prior to this project, Dynotec was the prime consultant for "3rd Avenue CSO Increased Capture & Green Infrastructure," which included the full design documents as well as permeable pavers and rain gardens with storage. For Clintonville 2012, Linden 2013 and Miller-Kelton/Hilltop 2014, Dynotec provided both private property field investigation services and topographic surveying. Dynotec has utilized the latest tools for private property data-gathering beginning with Arc Pad using the Juno handheld in 2012. Teamed with ms consultants for Miller-Kelton, Dynotec assisted in the development of the Collector for ArcGIS application menus for use with tablets for the private property data-gathering, including training the field crews. As the prime consultant for Blueprint 2016 Clintonville 3, Dynotec teamed with ms consultants and Donahue IDEAS. As part of our prime role for the Winthrop/Milton project area – and leveraging the lessons learned during our involvement in the previous rounds of Blueprint – Dynotec developed the Esri Collector for ArcGIS App template with our partner, ms consultants. This data-gathering template is being used by all Clintonville 3 consultants, furthering the DOSD's goal to standardize the process. The Collector for ArcGIS application can be used in other aspects of the Blueprint program including capturing data during construction, rainfall events, and logging operation and maintenance data. Dynotec will take the lead on preparing the Preliminary Design Memorandum and developing the 30% plans.

Section 4 | Proposed Rates

Proposed Rates

Per the requirements of the RFP, labor classifications and associated descriptions that include minimum education and/or certifications, average years of experience and typical responsibilities for each personnel category have been provided. Woolpert has performed an assessment using named resources from our current proposal and other staff with similar experience based on current staff mix across the company to re-baseline our rates for the City of Columbus. The result is that some personnel categories will see a decrease from 2019 rates.

Personnel Category | Description of Service	2020	2021	2022
Project Director | BA/BS with 12 years' experience, MA/MS with 10 years' experience, or 16 years' experience. Project responsibilities include maintaining client relationships and ensuring services are performed in a manner compatible with being an industry leader.	$220.00	$225.50	$231.14
Project Manager | BA/BS with 8 years' experience, MA/MS with 4 years' experience or 12 years' experience. Project responsibilities include serving as primary point of contact with client, and managing project team, scope, schedule, and budget.	$215.00	$220.38	$225.88
Project Coordinator | BA/BS and 6 years' related experience, MA/MS and 4 years' years related experience, or 8 years' related experience. Possesses a certification in data creation and data dissemination with strong organizational skills and a keen sense of detail, accuracy and follow-through. This position is primarily responsible for defining, enhancing and guiding technical advancement at the geospatial department level with responsibilities that include helping to define optimal workflow processes, assisting in identifying technology needs, assisting in the development and implementation of geospatial QA/QC standards providing technical expertise and leadership in the project definition and planning phases.	$120.00	$123.00	$126.08
Senior Developer | BA/BS with 12 years' experience, MA/MS with 10 years' experience, or 16 years' experience. Project responsibilities include application development; providing technical expertise and leadership in project definition and planning phases; coordinating the technical execution of complex, diversified projects; communicating developments and practices through appropriate firm channels; developing and documenting standard practices; coaching and mentoring other team members in skill development areas; and performing project QA/QC.	$180.00	$184.50	$189.11
Mid-Level Developer | BA/BS with 6 years' experience, MA/MS with 4 years' experience, or 10 years' experience. Project responsibilities include application development, providing technical expertise in project definition and planning phases, coaching and mentoring other team members in skill development areas; and performing project QA/QC.	$155.00	$158.88	$162.85
Junior Developer | Associates degree or 2 years' experience. Project responsibilities include application development.	$135.00	$138.38	$141.83
Senior GIS Analyst |BA/BS with 6 years' experience, MA/MS with 4 years' experience, or 8 years' experience. Project responsibilities include providing technical expertise and leadership for data conversion, cleansing, and development projects; geodatabase design; preparation of complex data transformation models; ArcSDE administration; preparation and monitoring of budgets and schedules; develop end-user documentation; conduct client training, and performing project QA/QC.	$130.00	$133.25	$136.58
Mid-Level GIS Analyst | BA/BS with 3 years' experience, MA/MS with 1 years' experience, or 5 years' experience. Project responsibilities include providing technical expertise for data conversion, cleansing, and development projects; geodatabase design support; preparation of transformation models; and perform project QA/QC	$95.00	$97.38	$99.81
Junior GIS Analyst | Associates degree or 2 years' experience. Project responsibilities include data conversion, cleansing, and development.	$65.00	$66.63	$68.29
Database Administrator | BA/BS with 4 years' experience, MA/MS with 2 years' experience, or 8 years' experience. Project responsibilities include database	$160.00	$164.00	$168.10

Personnel Category | Description of Service	2020	2021	2022
administration, geodatabase design, ArcGIS Server administration, Portal for ArcGIS and ArcGIS Online administration.			
Remote Sensing Specialist | BA/BS with 5 years' experience or MA/MS with 3 years' experience. Project responsibilities include image processing, image interpretation, feature extraction, data development, spatial analysis and problem solving. Additional skills in project management, research and development are also required.	$175.00	$179.38	$183.86
Professional Surveyor | BA/BS and 4 years' related experience, MA/MS and 2 years' related experience or 8 years' related experience and possess a Professional Survey License and applicable OSHA certifications. Responsible for performing advanced surveying work on a variety of office and field projects.	$137.00	$140.43	$143.94
Field Survey Technician | Associates degree or 2 years' experience and applicable OSHA certifications. Project responsibilities include data collection using electronic total stations, Global Positioning System receivers, digital levels, and ground-based laser scanners in the field.	$66.00	$67.65	$69.34
Geospatial Technician | BA/BS and 4 years' related experience, MA/MS and 2 years' related experience or 6 years' related experience. Responsibilities include performing geospatial mapping tasks (ie: orthophotography, lidar edits, compilation, cartography, etc.) on projects to include the management of computer data in multiple operating system environments.	$100.00	$102.50	$105.06
Senior Administrative Staff | BA/BS with 4 years' experience, MA/S with 2 years' experience or 8 years' experience. Depending upon the specific project role, responsibilities may include accounting and business administration.	$123.00	$126.08	$129.23
Mid-Level Administrative Staff | BA/BS or 4 years' experience. Depending upon the specific project role, responsibilities may include accounting, billing, business administration, human resources, purchasing, record keeping, and IT support.	$86.00	$88.15	$90.35
Junior Administrative Staff | Associates degree or 2 years' experience. Depending upon the specific project role, responsibilities may include accounting, billing, business administration, human resources, purchasing, record keeping, and IT support.	$67.00	$68.68	$70.39

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