RECOMMENDATIONS ON LOJIC GOVERNANCE, FUNDING, AND OPERATIONAL IMPROVEMENTS

Innovative GIS Best Practices Project for the Louisville/Jefferson County Information Consortium (LOJIC)

Prepared under contract with the Louisville and Jefferson County Metropolitan Sewer District

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FINAL

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SECTION 1: INTRODUCTION AND PROJECT BACKGROUND

1.1 PROJECT BACKGROUND

This Innovative GIS Best Practices project is part of a larger Strategy Innovation (SI) initiative launched by LOJIC in March, 2014. This initiative is being led by the LOJIC Manager and includes representatives from all partner organizations. The SI Team has evaluated the status of LOJIC and GIS activities in each organization and will identify best practices for LOJIC. The work of the SI Team in an assessment of status and future needs, surveys of the GIS user community, gathering ideas from industry experts, and other information gathering and evaluation has provided a solid foundation for this best practices project.

A consultant team led by Croswell-Schulte Consultants was hired to carry out this Innovative GIS Best Practices project in coordination with and participation of the LOJIC Strategy Innovation team and management and staff in LOJIC partner organizations. The Croswell-Schulte Team includes personnel from two subcontracted companies: SRISYS, Inc. (West Chester, OH) and GeoMorphics, Inc. (Louisville, KY).

The members of the Strategy Innovation Team (below) also served as the project team overseeing the work of the Croswell-Schulte team:

Curt Bynum LOJIC Manager	Dana Spratt Metro IT Service Level Manager EMA/MetroSafe
James Bates Louisville Water Company Manager of Infrastructure Records	Jay Mickle PVA Mapping/GIS Team Director
Sharon Meador Metro IT Manager	Julie Buckler MSD GIS Services/Records Manager
Debbie Lowery Metro IT Project Manager	Jane Poole LOJIC Customer Support Administrator

The work of the Croswell-Schulte team will support and contribute to the Strategy Innovation effort and culminate in specific recommendations for changes and improvements in LOJIC operations and support to the user community. Croswell-Schulte will address the following main objectives:

1. Assess and summarize best innovative practices in governance, financing, technology, staffing and technical support—from other multi-organizational GIS programs.

2. Identify options and recommendations for innovative sustainable governance and financing--analysis will include an evaluation of various models for user licenses, service level agreements and associated fees.

3. Identify and assess new and innovative opportunities and sources for developing and marketing LOJIC data and services.

4. Identify innovative trends in information technology, data dissemination policies and business practices. Provide recommendations for how LOJIC might best position itself to leverage these trends to the advantage of its partners and the community.

The Croswell-Schulte team is accomplishing these objectives through a work plan described in its proposal (response to MSD RFP 14-0723). Key project activities and deliverables include:

- Review of background information from LOJIC and its partners including reports and data on LOJIC operations, meeting reports, financial information, technical documents, user community surveys carried out by LOJIC, and Self-Assessment reports prepared by LOJIC and each of its partner organizations and further described in this document.
- Interactive Focus Group Sessions with LOJIC Licensee and external user community—public sector, private, and non-profit organizations, that use data, custom products, and on-line services from LOJIC. Notes from these sessions are included in the 1st deliverable, *Status of LOJIC Operations and User Community.*
- National Web-based surveys gathering information about status, structure, technology use, and best practices of existing multi-organizational GIS programs—to provide an expanded knowledge-base on ideas and lessons-learned that may be applicable to LOJIC. Survey results are included in the 2nd project deliverable, *Best Practices Profile Report*.
- Research and literature review (GIS program plans, surveys, comparative research, technology reviews) on GIS and IT governance, management, technical management pertinent to this project. The results of this research are included in the 2nd project deliverable, *Best Practices Profile Report*.
- Remote panel discussion with managers of selected multi-organizational GIS programs in the U.S. (selected organizations responding to the National Survey). (Note: to be conducted in February or March. Results will be reported in a separate document).
- Preparation of the following three main project deliverables with review and comment from project participants:
  - *Status of LOJIC Operations and User Community*
  - *Best Innovative Practices Profile Report*
  - *Recommendations on LOJIC Governance, Funding, and Operational Improvements* (this Deliverable)

1.2 PURPOSE OF THIS DELIVERABLE

This deliverable uses information and analysis conducted by the LOJIC SI Team and Croswell-Schulte work to provide specific recommendations for actions by LOJIC and individual partner organizations. These recommendations target a number of critical areas including:

- Organizational structure and program governance
- Management and communication practices
- Support and service delivery to user community
- Funding sources and strategies
- Technical infrastructure, software, and systems administration

- Enhanced or new applications and services
- Data content, access, and maintenance

All of the recommendations in this report focus on actions that will result in benefits for LOJIC as a whole and for its user community—through positive improvements in efficiency, added functionality, support for and coordination among LOJIC partners and licensees, more active engagement with senior management, stability of funding, and ability to leverage new opportunities.

1.3 BRIEF DESCRIPTION OF LOJIC AND PARTICIPATING ORGANIZATIONS

The Louisville/Jefferson County Information Consortium (LOJIC) is a multi-agency program with a mission to build and maintain a comprehensive Geographic Information System (GIS) to serve all of Louisville Metro Government, Kentucky and provide GIS data and support services to users in Oldham and Bullitt Counties. MSD serves as the LOJIC "project management agency" on behalf of the following four partner organizations which share the cost and effort involved in the full development and successful operation of LOJIC:

- Louisville Metro Government
- Louisville Water Company (LWC)
- Jefferson County Property Valuation Administrator (PVA)
- Louisville and Jefferson County Metropolitan Sewer District (MSD)

In addition to the four main partners, LOJIC serves a larger community of users in Jefferson County. This user community includes licensees (organizations that pay license fees and have access and full use rights for LOJIC data) and "external users". Current Licensees include:

- Buechel Fire Protection District
- Bullitt County
- Center for Neighborhoods
- Courier Journal
- FBI
- Jefferson County Public Schools
- City of Jeffersontown
- Kentuckiana Regional Planning and Development Agency (KIPDA)
- Louisville Metro Housing Authority
- Middletown Fire Protection District
- Louisville Gas and Electric
- Oldham County
- Seven Counties Services
- Transit Authority of River City (TARC)
- University of Louisville
- US Army Corps of Engineers-Louisville District

External users include a wide range of organizations and individuals who access LOJIC online GIS applications, custom map products, and data downloads. External users include engineering and environmental consulting firms, real estate developers, homeowner/neighborhood associations, local governments, non-profit organizations, educational institutions, GIS services companies, and others. Many of these external users regularly access LOJIC services and others do so on a more sporadic basis.

LOJIC's purpose and operational approach is summarized in its Mission, Values, and Vision statements:

Our Mission...

To build, maintain and proactively support a comprehensive Enterprise GIS that promotes information sharing and the effective use of geospatial technology for the benefit of our partners, our customers and our community.

Our Values...

Partnership: We will keep the needs, best interests and success of our partners at the forefront of our actions.

Collaboration: We will seek the cooperation and involvement of our user community toward the most effective applications of geospatial technology.

Stewardship: We will responsibly and securely maintain and promote our community's significant investment in geospatial resources.

Excellence: We will maintain proficiency in technical skills and provide innovative geospatial technology solutions.

Service: We will provide responsive, knowledgeable, effective support to meet our community's needs for geospatial resources.

Professionalism: We will adhere to the highest professional and ethical standards according to the GIS Code of Ethics.

Our Vision...

To be the premier provider of geospatial data and application services throughout the Louisville Metro region in a self-sustained, cost-effective and highly customer-focused manner.

To provide easy and open access to all forms of geospatial information about our community to all who may need it.

The LOJIC Policy Board (previously referred to as the "Policy Committee") is comprised of senior executives from each of the four partner organizations. Original agreements establishing LOJIC describe the role of the Policy Board as follows:

> *"…to provide general oversight of the continued implementation of the LOJIC GIS. They shall meet from time to time to review the policies and practices of the Partnership but no less than quarterly, and that any further policies, procedures, and/or amendments regarding this Agreement shall be jointly acted upon by the LOJIC Partners"*

1.4 SERVICES PROVIDED BY LOJIC

From its inception, LOJIC has embraced a strong customer service focus to provide the main partner organizations and the broader user community in Jefferson County with GIS data, applications, and support. LOJIC continues to provide users with the following key products and services:

- Regular update and access to critical GIS base map data.
- Coordination with partners and other organizations for update and storage of a wide range of other GIS datasets.
- Administration of Esri enterprise software license.
- Access to frequently needed GIS data in a variety of formats.
- Access to a large range of custom map products.
- Licensing of LOJIC data and system access.
- Online, interactive map query and display applications.
- Training services and technical support.
- Special projects and custom development services.
- GIS data support for Oldham County and Bullitt County.

Coordination and access to high-quality GIS data is a core element of LOJIC's mission and a critical service for the LOJIC user community. Working with its partners, LOJIC has developed and oversees standards for GIS data content, structure, presentation, and update policies. Supporting GIS data maintenance and access are well-defined metadata standards and tools developed by LOJIC. LOJIC maintains a Web Site (www.LOJIC.org) which is the main Web portal for obtaining access to information about LOJIC and access to products and services.

SECTION 2: SUMMARY OF PREVIOUS PROJECT WORK AND DELIVERABLES

2.1 STATUS OF LOJIC OPERATIONS AND USER COMMUNITY

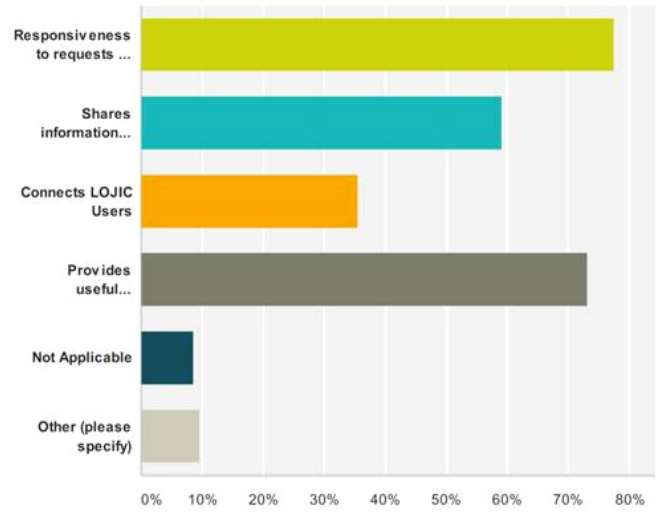
The 1st project deliverable provided by Croswell-Schulte, *Status of LOJIC Operations and User Community*, examined current LOJIC operations and management and current GIS use by LOJIC partners, licensees, and external users. Preparation of this deliverable was based on work carried out by the SI Team and information gathered by the Croswell-Schulte consultants. This deliverable established a baseline for the identification of needs and recommendations for improvements. A summary of that deliverable is included in this subsection.

For over 20 years, LOJIC has provided high-quality and continual services to its users Statistics from calendar year 2013 gives a perspective on the volume and frequency of use:

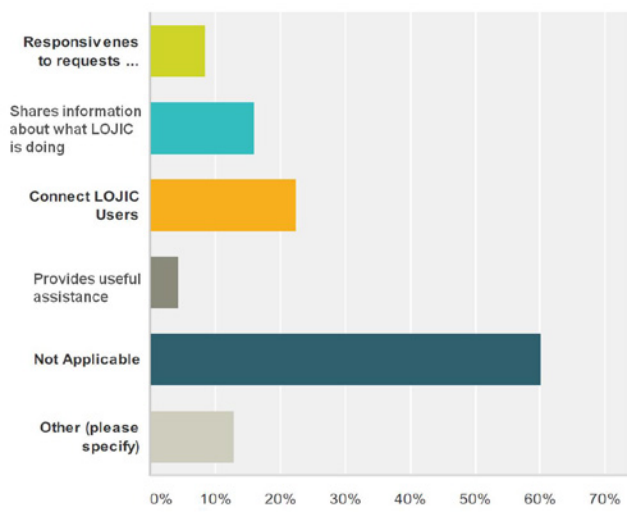
- Among LOJIC's partner organizations, there are about 120 licensed users of ArcGIS in LOJIC, MSD, PVA and Louisville Metro. In addition, LWC has about 25 licensed users of ArcGIS (from LWC servers), over 40 regular users of the LWC Web-based custom GIS application (SPIN), and over 100 field users of MobileSPIN and MapBook mobile applications.
- The four partner organizations are identified as LOJIC "shareholders" with percentage "ownership" as follows: Louisville Metro (40%), LWC (20%), PVA (5%), and MSD (35%). While partner commitments to LOJIC are formally recognized by the LOJIC Policy Board, there are currently no active written agreements that codify the partner relationship with LOJIC.
- LOJIC's Internal (partners and licensees) User Survey shows that over 70% of respondents use LOJIC data or services at least several times per week.
- There are a total of 16 licensees (see Section 1.3) which access data and ArcGIS on LOJIC servers on a regular basis.
- On average per year (in recent years), about 400 requests for data and custom products are handled by LOJIC.
- The LOJIC Web Site and Online Map application receives about 40,000 individual visitations (on average) each month. (Note: LOJIC does not gather statistics on access by individual Web users or frequency of Web applications accessed from the LOJIC Website but this Website "visitation" gives an indication that LOJIC services are being frequently used).

Judging from the results of the recent LOJIC user surveys and information gathered by the Croswell-Schulte Team, LOJIC products are highly valued and users are extremely satisfied with the service and support provided by LOJIC staff. Responses from the Internal Survey (LOJIC Partners and Licensees) reflect this high level of user satisfaction (see Figure 1 below). There were similar results from External User Survey questions.

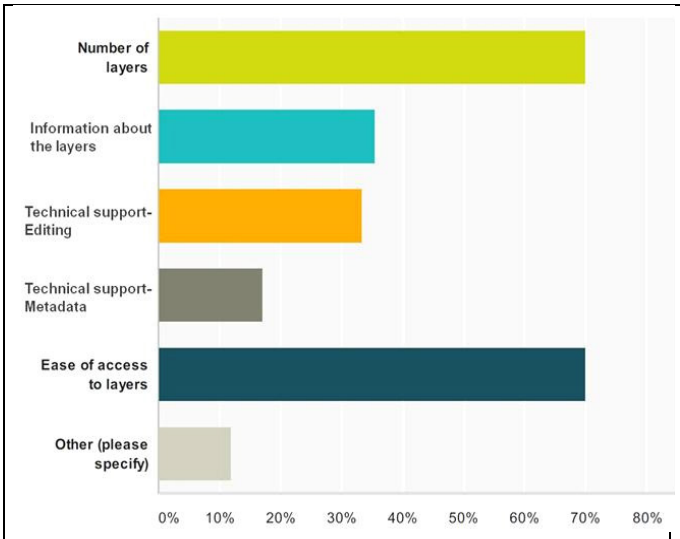
Figure 1: Excepted Results from LOJIC Internal User Survey



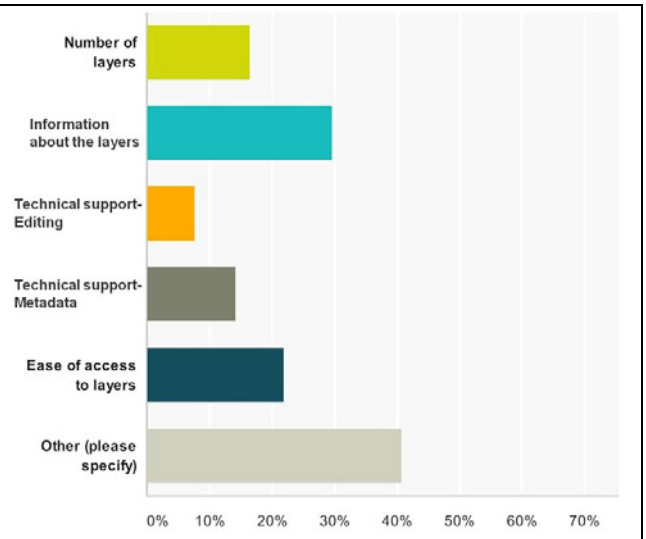
Q5: What does the LOJIC staff do well?



Q6: What does the LOJIC staff need to improve?



Q7: Items about LOJIC data that work well for you



Q8: Items about LOJIC data that need improvement

The high user satisfaction reflected in both the Internal and External User surveys was confirmed through the Croswell-Schulte Focus Group Sessions with LOJIC partner organizations, licensees, and external users (see the deliverable, *Status of LOJIC Operations and User* Community for details of these sessions).

The positive impressions of LOJIC users (partner organizations, licensees, and external users) may be contrasted with the perspectives of LOJIC staff members expressed in LOJIC's self-assessment (Field of Today assessment conducted as part of the SI Initiative) and the Croswell-Schulte Focus Group Session. These sources reflect a staff that is competent, know their jobs, and carry them out with great attentiveness to quality and customer service. There are a number of concerns however that address critical issues that impact future LOJIC operations:

- Staff limitations and time constraints (due in part to existing vacancies) make it difficult for staff to think proactively; test and adopt new methods, procedures; and develop improved

applications and tools to benefit users. Too much time is required to, at a minimum, maintain current operations limiting exploration and tackling of new opportunities that could benefit users.

- There is a lack of access and use of newer GIS technology and tools. There is a general feeling that LOJIC is falling behind in software upgrades and deployment of applications and data services for users (e.g., more effective use of Web services, adoption of applications for mobile platforms, use of new GIS application functionality).
- Decline in interaction and support for LOJIC users (most importantly the large user base in Louisville Metro). Staff limitations and a change in partner funding have reduced the level of direct interaction between users and LOJIC staff. Also, there has been a reduction in the level of direct interaction and communication among the LOJIC user community. The LOJIC User Group and Technical Committee provided a vehicle for communication in the past but these bodies are now inactive.
- Need for additional and more effective professional development and opportunities for advancement. This concern addresses a strong interest to maintain skills with GIS and IT tools (as they advance) as well as opportunities for position promotions and pay increases-with a concern about pay level equity with similar IT positions within MSD.

While LOJIC has operated in a financially sound manner, there are important financial concerns that must be addressed in the near future:

- Revenues from the sale of data and custom products (not including license costs) have declined significantly in recent years—from an average annual total of about $120,000 for the 5 years ending in FY2006 to $45,000 in the last 8 years.
- Annual reimbursements from three LOJIC partners (Louisville Metro, LWC, and PVA), as a percentage of actual LOJIC costs, have decreased substantially—from about 70% in the years prior to FY 2010 to about 30% after this point. MSD has assumed a far greater percentage of LOJIC costs and now covers the cost for all LOJIC staff, most of the IT operations, and maintenance.
- Current LOJIC staff constraints and anticipated future needs (operational improvements, technology modernization, and enhanced support for LOJIC users) point to a need for additional staff and contractor services in the near future.

Based on revenue trends, as well as strong interest in “open data”, we can assume that LOJIC product and service sales will remain at the current low level or decrease further. Budget projections for FY2016 and beyond are adequate to maintain current staff levels and operational responsibilities, but lack significant capacity increases to take on major special projects (e.g., custom application development) or expanded user support. There is a proposal before the LOJIC Policy Board for a substantial increase (3-year ramp-up) in LOJIC Partner contributions from Louisville Metro, PVA, and LWC (restoring the pre-FY2010 levels).

The 2007 *LOJIC Strategic Plan*, approved by the Policy Board, recognized that in spite of a substantial use of GIS technology, there are major opportunities for expanded use and benefits from GIS and LOJIC services. LOJIC staff, in coordination with its four partner organizations, have carried out the core services identified in the 2007 Plan:

1. Become a trusted center of knowledge and expertise about the technology and its uses across the larger Louisville Metro region.
2. Provide access to a repository of the highest quality regional geospatial data.
3. Use sound business development practices as the core in expanding the consortium and user base.
4. Provide high quality customer service in meeting the needs of end users.
5. Ensure that people know and understand how to use the technology to further their business processes.

Significant opportunities exist for LOJIC to better serve its existing user community, to expand that user community, and realize an increasing array of benefits from the use of GIS technology and geographic data.

2.2 NATIONAL SURVEY ON MULTI-ORGANIZATIONAL GIS PROGRAMS

2.2.1 Overview of National Survey

As part of this project, the Croswell-Schulte Team conducted two Web-based surveys to gather information about the status, characteristics, and best practices of existing multi-organizational GIS programs. These two surveys included similar questions but targeted two different GIS program types: a) Local and regional (multi-County) GIS programs and b) Statewide GIS programs. The purpose of these surveys was to gather information about other multi-organizational GIS programs to examine trends, best practices, and strategies that might guide improvements for LOJIC. The detailed results of these surveys are included in the 2nd Croswell-Schulte deliverable, *Best Innovative Practices Profile Report*. A brief summary is provided here. For the purpose of this study, the term *multi-organizational GIS program* is used in a broad sense. The term encompasses formal GIS consortia in which multiple organizations collaborate (through formal written agreements) on a range of GIS development and operational activities and have well-defined leadership and staff to support users in the organizations. But the term also applies to less formal GIS programs in which multiple organizations have agreed to share data, participate in joint funding on GIS projects, or work out common standards that facilitate regional coordination.

There were 38 responses to the Local/Regional GIS Program survey and 5 responses for the Statewide Survey. Responding organizations are identified in Table 1.

Table 1: Multi-Organizational GIS Survey Respondents

Respondent Organization	GIS Program Name (if applicable)	City/State Location
Local/Regional GIS Program Survey Respondents:		
Milwaukee County (WI)	Milwaukee County Automated Mapping and Land Information System (MCAMLIS)	Milwaukee, WI
Pulaski Area (AR) GIS (PAgis)	Pulaski Area Geographic Information System (PAgis)	Little Rock, AR
City of Oshkosh (WI)	not applicable	Oshkosh, WI
Muscatine (IA) Area Geographic Information Consortium (MAGIC)	Muscatine (IA) Area Geographic Information Consortium (MAGIC)	Muscatine, IA
Atlantic County (NJ) Office of GIS	Atlantic County Office of GIS	Northfield, NJ
Clark County (KY) Consortium for GIS	Clark County Consortium of Geographic Information Systems	Winchester, KY

Respondent Organization	GIS Program Name (if applicable)	City/State Location
Southwestern Pennsylvania Commission	not applicable	Pittsburgh, PA
Washington County (MD)	not applicable	Hagerstown, MD
San Diego County (CA)	San Diego Geographic Information Source (SanGIS)	San Diego, CA
City of Hayden, ID	Kootenai County GIS, North Idaho Regional Resource Center, Idaho Geospatial Council	Hayden, ID
Oregon Metro	Regional Land Information System (RLIS)	Portland, OR
City of Phoenix, AZ	not applicable	Phoenix, AZ
County of Allegheny (PA)	not applicable	Pittsburgh, PA
Lane Council of Governments (LCOG)	Regional Land Information Database (RLID)	Eugene, OR
Johnson County (KS)	AIMS (Automated Information Mapping System)	Olathe, KS
Nashville Davidson County (TN)	Metro GIS	Nashville, TN
Metro GIS (Twin Cities, MN)	Metro GIS	St Paul, MN
Arrowhead Regional Development Commission (MN)	North Shore GIS Consortium	Duluth, MN
Knoxville Knox County KUB GIS (KGIS)	Knoxville Knox County Knoxville Utilities Board (KUB) GIS (KGIS)	Knoxville TN
Allen County (IN)	iMap Consortium	Fort Wayne, IN
Palm Beach County (FL)	Countywide GIS (CWGIS)	West Palm Beach, FL
Planning and Development Services of Kenton County (KY)	Land Information of Northern Kentucky GIS or LinkGIS	Fort Mitchell, KY
Sacramento Area Council of Governments (CA)	Sacramento County GIS Cooperative, Yolo County GIS Cooperative	Sacramento, CA
Gwinnett County (GA)	Gwinnett GIS Community Partnership (informal name)	Lawrenceville, GA
Berkeley County (SC)	Berkeley County GIS Consortium	Moncks Corner, SC
Butte County Association of Governments (CA)	Butte County Association of Governments Regional GIS	Chico, CA
City of Mississauga (ON)	not applicable	Mississauga, ON
Contra Costa County (CA)	Bay Area Regional GIS Council (BAR-GC)	Martinez, CA
GIS Consortium (IL)	GIS Consortium	Des Plaines, IL
McLean County Regional Planning Commission (IL)	McGIS	Bloomington, IL
King County (WA)	King County GIS	Seattle, WA
Chester County (PA)	Chester County GIS Consortium	West Chester, PA
Idaho State University	East Idaho Regional Resource Center (EIRRC)	Pocatello, ID
Merced County (CA) Association of Governments	not applicable	Merced, CA
DeKalb County (IN)	City/County GIS CoCiGIS	Auburn, IN
IUPUI / IMAGIS Indianapolis Mapping & Geographic Infrastructure System	Indianapolis/Marion County Geographic Infrastructure System (IMAGIS)	Indianapolis, IN
City of Cincinnati /Hamilton County (OH)	Cincinnati Area Geographic Information System (CAGIS)	Cincinnati, OH
Statewide GIS Program Survey Respondents:		
Oregon Department of Administrative Services-Geospatial Enterprise Office	navigatOR	Salem, OR
New Jersey Office of Information Technology-Office of GIS	not applicable	Trenton, NJ
South Carolina Geographic Information Council	South Carolina Geographic Information Council (SCGIC)	Columbia, SC
State of Florida-Division of Emergency Management	not applicable	Tallahassee, FL
State of Tennessee Department of Finance and Administration-Office of Information Resources	Tennessee Base Mapping Program	Nashville, TN

2.2.2 Summary of Survey Results

Survey responses provided a good picture of the status of multi-organizational GIS programs and approaches and practices used by these programs to address many of the same challenges facing LOJIC. Key observations from these surveys that help guide recommendations in this deliverable are summarized as follows:

- A significant number of formal multi-organizational programs have been operating successfully for 20 years or more.
- Most of the local/regional multi-organizational GIS programs focused on county areas and included multiple organizations (e.g., County government agencies, municipalities, utility organizations) in that County. However, there are a significant number that cover multi-County areas.
- The majority of the GIS programs have formal mission or vision statements and use these as a foundation to direct their operations and services to users.
- All Respondents indicated the existence of some type of formal body supporting multi-organizational collaboration and coordination bodies (e.g., governing board, advisory body, steering or technical committee, task force) with members from participating organizations. With 63% indicating the existence of a "Policy/Governing Body", there is evidence for substantial interest and use of a high level body with authority and oversight on program operations and direction.
- Among those multi-organizational GIS programs most similar to LOJIC (in terms of size, services, participating organizations, and organizational structure), annual budgets range from about $300,000 to $10 million. Staff sizes range from 2 to 27.
- Formal written agreements to define terms for multi-organizational collaboration and the sharing of data and services are used by over 2/3 of the respondents. For the programs considered to be most like LOJIC, all but 2 had formal written agreements.
- There is a broad range of funding sources and approaches used by multi-organizational GIS programs. About 95% of the Respondents indicated that funding is allocated in one or more of three ways: a) GIS line item in the lead organizations' General Fund, b) part of individual departmental budgets, or c) established contributions (according to an agreed formula) for main participant organizations. A substantial number (30% of Respondents) also use allocations for Capital or Special Fund Budgets.
- There is a large range of services provided by multi-organizational GIS programs identified as being important by Respondents. Services that scored highest relate to GIS database development, maintenance, and quality control and that a fundamental role of multi-organizational GIS programs is database management and providing efficient access to the data by user. Multi-organizational GIS program offices have primary responsibility for maintaining base map data layers while it is a common practice for participating organizations to have responsibility for updating thematic data layers that relate to their organization mission and business (e.g., parcels, utilities, public safety, etc.).
- All Respondents are experiencing a range of benefits from multi-organizational coordination and collaboration. The most frequently cited benefits are: a) reduction in redundancies in database development and maintenance, b) leveraging staff time and expertise in joint project

collaboration, c) improved GIS data sharing and access through effective standards and procedures, and d) provides structure to support expansion of the GIS user community.

- Respondents provided information about obstacles and limitations faced by multi-organizational GIS programs with greatest importance cited for: a) Legal, Policy, or Political Obstacles, b) Getting Start-up and Ongoing Funding will be difficult, c) Loss of control or effective management of GIS programs in participating organizations, and d) Differences in database architecture. Respondents indicated that these limitations and obstacles are not factors that prevent the formation or operation of the programs, just issues that need to be addressed through effective management and technical practices.
- Organizational and Management Best Practices considered to be of greatest importance and impact by multi-organizational GIS programs most similar to LOJIC are: a) Maintaining competent technical staff and staff skill, b) Active engagement of and support from senior management, c) Developing and following a strategic plan, d) Sustained funding through contributions by main participant organization, e) Exploring opportunities for expanding user community and GIS applications, f) Effective project planning and management practices, g) Program branding and active promotional activities, h) Supporting an active user group, and i) Active involvement of steering committee or coordination bodies.
- Technical/Technology Best Practices considered to be of greatest importance and impact by multi-organizational GIS programs most similar to LOJIC are: a) Improved approaches for development or acquisition of updated core GIS data, b) Organized process and tools for database update and maintenance, c) Web-based GIS applications , d) Open access to GIS data and services through public clearinghouse or Web portal, and e) Documented procedures and workflows for technical and operational activities.
- Response rates for the following of Technical/Technology Best Practices were lower than expected: a) Use of Open Source Software, b) Use/Integration of Commercial Web-based GIS Services, c) Use of Cloud services and infrastructure but there were a significant number of comments by Respondents indicating interest in these areas.

2.3 LITERATURE RESEARCH

The 2nd Croswell-Schulte deliverable, *Best Practices Profile Report,* gives the results of research and review of literature—plans, surveys, program reviews, policy documents, and academic research on practical technical, management, and organizational topics impacting multi-organizational GIS program operations. The following documents were reviewed:

1. *Industry Trends and Observations on Regional GIS* (2012). Project Report by Applied Geographics for the Cape Cod Commission
2. *Lane County* [Oregon] *Regional GIS Strategic Plan* (2014). Plan defining goals and actions for future operations and services for this long-standing multi-organizational GIS program
3. *Lane County Regional GIS-FY 2015 Workplan* (2014). Description of services and coordination structure and practices and tasks for the RLID and Cooperative Agreements (CPA)
4.*MetroGIS Open Data Resolution* (2013)
5. MetroGIS Draft 2015 Work Plan. Proposed Work Plan under review for approval by the MetroGIS Coordinating Committee
6. *Conceptual Business Model for Regional Multi-Participant Local Government GIS* (2011). Master's Thesis by David Dubaukas Department of Geographical Sciences, University of Huddersfield.

7. *Dynamics of Opening Government Data* (2012). White Paper by the Center for Technology in Government (University at Albany NY)
8. "Business Line Approach to Enterprise GIS Finance" (2003). Paper in URISA Annual Conference Proceedings, 2003.
9. *GIS Technology Trends, Status, and Best Practices In Water And Wastewater Utility Organizations* (2014). Special URISA publication with results of research and US-Canadian Survey (author-Peter Croswell)
10. IMAGIS Participation Allocation (2014).
11. MetroGIS: Free and Open Access to Data—Research and Reference Documents
12. Rules of Procedures for the Governance Board of the Muscatine Area Geographic Information Consortium (2003).
13. Budget for LINK-GIS FY2013.
14 and 15. LINK-GIS project documents
16. *Geospatial Data Sharing—Guidelines for Best Practices,* NSGIC (2011). Publication from the National States Geographic Information Council (NSGIC)
17a and 17b. PlanGraphics reports from KGIS project on GIS data needs assessment (2013).
18 and 19. Articles from *Public CIO* (2014): "Making the Case for IT Investment" (2014 Issue 3) and "The Rising Importance of 'Where' in Government (2014-Issue 2)
20. *A Guide for Data Collaboration* (2010). Special publication of the York Region, Ontario Canada
21a and 21b *Lessons from Practice—A Guidebook for Organizing and Sustaining Geodata Collaboratives* (2001). Special publication of the GeoData Alliance (with FGDC support) and "Data Sharing Lessons" *URISA Annual Conference Proceedings* (2002)
22. *Report and Recommendations of the URISA National Geographic Information Cooperation, Coordination, Collaboration Task Force (3CTF)* (2004)
23. *2012 Employee Job Satisfaction and Engagement*. Research Survey and Report from the Society for Human Resource Management (SHRM).
24. 2015 Salary Guide for Technology Professionals Results from survey and research on salary trends and projections from Robert Half Technology
25. Top 10 Strategic Technology Trends for 2015 Web-delivered summary of IT trends by Gartner www.gartner.com/newsroom/id/2867917)
26. GIS Trends in Surveying (2014). Special study and report from Point of Beginning magazine, BNP Media
27. *Technology Vision 2014-Every Business in a Digital Business* (2014) Special report by Accenture
28. *Tech Trends 2015* (2014). Special report by NextGov (www.nextgov.com/tech-trends-2015)
29. *Technology Trends in Local Government 2015* (2014) Special report by Governing.com www.governing.com/columns/tech-talk/gov-technology-trends-local-government.html
30. *Emerging Technology Adoption in Local Government* (2014) Special report by Government Technology and DigitalCommunities.com. www.digitalcommunities.com/library/Emerging-Technology-Adoption-in-Local-Government.html
31. ArcGIS-What's New in ArcGIS 3.0 (2015)
32. *GIS Management Handbook* (2009). Kessey-Dewitt Publications (distributed by URISA)
33. NSDI Building Blocks: Regional GIS in the United States (2009). *URISA Journal*, Volume 21, No. 2.
34. An Analysis of Benefits From the Use of GIS by King County Washington (2012). Comprehensive cost-benefit study commission by King County and carried out by Richard Zebra and Associates
35. GeoSpatial World, January 2015, issue on technology trends: Insight 2015 http://geospatialworld.net/uploads/magazine/January-2015-Geospatial-World-Magazine
36. URISA 2014 GIS Salary Survey and Review

The review of these sources provides additional evidence and insights on GIS program governance, management practices, staffing, technology use, and operational practices. The information in these sources, summarized in project deliverable #3, *Best Practices Profile Report*, supports recommendations in this deliverable.

2.4 GIS CAPABILITY MATURITY MODEL (GIS-CMM) SCORING

The 1st project deliverable, *Status of LOJIC Operations and User Community*, includes results of the Croswell-Schulte assessment using the GIS Capability Maturity Model (GISCMM). The GISCMM is a tool developed by the URISA GIS Management Institute (GMI) provides a model of a capable and mature enterprise GIS operation and a format for evaluation of maturity. See http://www.urisa.org/clientuploads/directory/GMI/ for more details. This assessment of LOJIC and its coordination with partner organizations includes scores and comments for individual GISCMM components for the two main sections: a) **Enabling Components** (EC) which are the aspects of a GIS that are purchased, developed, acquired, or otherwise form the assets of the GIS and b) **Execution Ability** (EA) which are aspects of a GIS that relate to the process maturity of the management and staff responsible for operating a GIS.

The details of the GISCMM assessment are provided in the 1st deliverable, *Status of LOJIC Operations and User Community*. This assessment helps to identify current strengths and areas which may need improvement. The GISCMM assessment is one source for recommendations in this deliverable. The explanation for the scoring for the EC and EA components is shown below and a summary of scoring is presented in Table 2. This scoring applies to LOJIC as a whole—its organizational structure, LOJIC staff and operations, and the status of GIS operations in individual partner organizations as this impacts LOJIC.

Table 2: Summary of GIS Capability Maturity Model Assessment of LOJIC

ENABLING CAPABILITY (EC) COMPONENTS	
EC Components	**Score**
EC1.a Framework GIS Data[1] - Geodetic Control	1.00
EC1.b Framework GIS Data[1] - Cadastral	1.00
EC1.c Framework GIS Data[1] - Orthoimagery	1.00
EC1.d Framework GIS Data[1] - Elevation	1.00
EC1.e Framework GIS Data[1] - Hydrography	1.00
EC1.f Framework GIS Data[1] - Administrative Units	1.00
EC1.g Framework GIS Data[1] - Transportation	1.00
EC1.h Framework GIS Data[1] - Planimetric	1.00
EC1.i Framework GIS Data[1] - Site Address	1.00
EC2.a Framework GIS Data[1] Maintenance - Geodetic Control	1.00
EC2.b Framework GIS Data[1] Maintenance - Cadastral	1.00
EC2.c Framework GIS Data[1] Maintenance - Orthoimagery	1.00
EC2.d Framework GIS Data[1] Maintenance - Elevation	1.00
EC2.e Framework GIS Data[1] Maintenance - Hydrography	1.00
EC2.f Framework GIS Data[1] Maintenance - Administrative Units	1.00
EC2.g Framework GIS Data[1] Maintenance - Transportation	1.00
EC2.h Framework GIS Data[1] Maintenance - Planimetric	1.00
EC2.i Framework GIS Data[1] Maintenance - Site Address	1.00
EC3. Business GIS Data[2]	.80
EC4 Business GIS Data[2] Maintenance	1.00
EC5. GIS Data Coordination	1.00
EC6. Metadata	.60
EC7. Spatial Data Warehouse	.80
EC8. Architectural Design	.60
EC9. Technical Infrastructure	.60
EC10. Replacement Plan	.80
EC11. GIS Software Maintenance	1.00
EC12. Data back-up and security	1.00
EC13. GIS Application Portfolio	.60
EC14. GIS Application Portfolio Management	.60
EC15. GIS Application Portfolio O&M	.60
EC16. Professional GIS Management	.80
EC17. Professional GIS Operations Staff	.80
EC18. GIS Staff Training, User Support, and Professional Development	.60
EC19. GIS Governance Structure	.60
EC20. GIS is Linked to Agency Strategic Goals	.60
EC21. GIS Budget	.60
EC22. GIS Funding	.60
EC23. GIS Financial Plan	.60

EXECUTION ABILITY (EA) COMPONENTS	
EA Components	**Score**
EA1. New Client Services Evaluation and Development	Level 3
EA2. User Support, Help Desk, and End-User Training	Level 3
EA3. Service Delivery Tracking and Oversight	Level 3
EA4. Service Quality Assurance	Level 3
EA5. Application Development or Procurement Methodology	Level 2
EA6. Project Management Methodology	Level 3
EA7. Quality Assurance and Quality Control	Level 3
EA8. GIS Technical Management	Level 2
EA9. Process Event Management	Level 2
EA10. Contract and Supplier Management	Level 3
EA11. Regional Collaboration	Level 4
EA12. Staff Hiring and Development	Level 3
EA13. Operation Performance Management	Level 2
EA14. Individual GIS Staff Performance Management	Level 4
EA15. Client Satisfaction Monitoring and Assurance	Level 3
EA16.– Resource Allocation Management	Level 3
EA17. GIS data sharing	Level 4
EA18. GIS Software License Sharing	Level 3
EA19. GIS data inter-operability	Level 4
EA20. Legal and policy affairs management	Level 2
EA21. Balancing minimal privacy with maximum data usage	Level 4
EA22. Service to community and profession	Level 3

Footnotes:

[1]For use in the LOJIC assessment, the GISCMM uses the term "Framework Data" to refer to base map layers and other map layers of major importance to all or most LOJIC partners. Framework data is used as a spatial reference for other GIS data layers and to support mission critical needs of users.

[2]Business data (sometimes referred to as "Thematic" data) encompasses all non-Framework data that is associated with specific applications, business areas, and/or groups of users.

SECTION 3: RECOMMENDATIONS FOR ACTION

3.1 INTRODUCTION

This Section presents recommendations for action by LOJIC—LOJIC management and staff and partner organizations. These recommendations are based on work by the SI Team and by Croswell-Schulte, as documented in previous deliverables. Recommendations are organized into the following categories:

- Governance, Management Practices, and Service Delivery (GM): Covers organizational structure, relationships among LOJIC partners and organizational entities, management policies and practices, user support services, staffing, and improved coordination with the broad user community.
- Technical Infrastructure, Software, and Systems Administration (TE): Encompasses all elements of the information technology infrastructure—servers, software, networks and systems administration supporting LOJIC and its GIS users.
- Enhanced or New Applications and Services (AP): GIS and related applications built on GIS software and data and delivering specific products and results to users. This includes custom map products, online applications, and desktop GIS applications provided by LOJIC or developed and deployed by its partners and user community.
- GIS Data Content, Maintenance and Access (DA): Includes all GIS and related database content, administration, development, update operations, metadata maintenance and systems and procedures in place for database quality control, administration, user access, and distribution to users.
- Funding Sources and Financial Management (FI): Addresses all areas of funding and financial management for LOJIC, budgeting, partner contributions, management of fees and revenue, and financial tracking and reporting.
- Other (OT): Recommended actions that do not clearly fall into the other categories above or which cross over multiple categories.

This Section presents information on recommended actions as a series that include a description, priority, business benefits and impact, organizational responsibilities, and resource requirements.

3.2 DESCRIPTION AND PRIORITY OF RECOMMENDED ACTIONS

Each of the recommendations described in this section will, if implemented effectively, have a positive impact on LOJIC as a whole, one or more of the partner organizations, and the general user community. Recommended actions under each of the categories above are assigned one of 4 priority levels explained below and which reflect several factors: a) urgency for addressing operational problems, technology infrastructure, and service delivery, b) expected benefits for and impact on current and future users, c) greater organizational and financial health and sustainability, and d) potential for improvement in user community coordination and collaboration.

Table 3 identifies and describes these recommended actions. Each action is assigned a name and ID, with a description and other context information important for review and consensus:

- Priority with assigned categories: Very High (VH), High (H), Moderate (M), and Low (L). This is a subjective categorization reflecting level of importance and the proposed timing for moving ahead with the recommended action. These priority categories reflect: a) urgency for addressing operational problems, technology infrastructure, and service delivery, b) expected level of benefits for current and future users, c) improved organizational and financial health, stability, and sustainability, d) potential for improvement in user community coordination and collaboration, e) Support for non-GIS initiatives (OneWater, eGov and Open Data Program, capital infrastructure improvement programs, etc.). Those actions assigned a Very High priority should be initiated soon (if not already in progress) with planned completion within the next year or sooner if possible. Those recommended actions assigned a High priority should be initiated before the end of the current calendar year and completed by the end of 2016 or sooner. There is more flexibility in the timing of recommended actions with a Moderate or Low priority but these should be formally adopted and scheduled as soon as budget and resources allow—ideally with completion by the end of calendar year 2017.
- A Status Code gives information about current circumstances including: a) No plans or action initiated (NP), b) Under active consideration (AC), c) Decision made and plans in place (DP), and d) Action underway or already completed (UC).
- The References column identifies sources that give evidence supporting or justifying the recommendation. Sources include: a) Work and documentation of the SI Team and LOJIC staff (including interviews, self-assessments, user surveys), b) Information in Croswell-Schulte assessment of LOJIC operations and user community (including documentation review, Focus Group sessions, other information gathering and assessment), c) Croswell-Schulte scoring using the URISA GIS Capability Maturity Model (GISCMM), d) National Surveys on multi-organizational GIS programs conducted by Croswell-Schulte, and e) External sources including documentation on industry trends, standards, and IT/GIS research.

Table 3: Description and Priority of Recommended Actions

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
Governance, Management Practices, and Service Delivery (GM)				
GM1: Re-state Policy Board mission, membership, and role	VH	AC	The Policy Board is the body with an oversight and governing role for LOJIC and includes senior executives from each of the four partner organizations. Evolution of LOJIC and organizational and leadership changes in partner organizations have impacted activities and engagement of the Board. In addition, the level and approach for engagement of Board needs improvement. This recommendation calls for a "reestablishment" of the Policy Board with a restatement revision of the Board's mission and role, its operating procedures, and its communication with the with the LOJIC Manager and key people in partner organizations to convey business needs for LOJIC services and necessary information to inform decisions made by the Board.	• Croswell-Schulte assessment based on review of documents and meetings with LOJIC and partner organization managers • Scoring for GISCMM items: EC19, EC20, EA20 • National Survey indicating critical requirement for active and engaged governing boards • Research supporting the role of governing board for public sector programs
GM2: Create LOJIC Steering Committee	VH	NP	In the past, the LOJIC Technical Committee enabled communication and coordination among partner organizations but this body is now inactive. This recommendation calls for the reactivation of this Committee but renaming it the "LOJIC Steering Committee" and clarifying its role which will include: a) communication of needs and suggestions regarding LOJIC services and staff support, b) member liaison with their Policy Board members to provide input and recommendations on Board deliberations and decisions, c) ongoing assessment of user needs and concerns as a basis for recommendations, d) communication among LOJIC and partner organizations about GIS applications, database issues, and other activities of mutual interest, e) vehicle for input and the formation of multi-organizational teams supporting projects of interest to the LOJIC user community. The LOJIC Manager will be the administrative lead for this Committee and each partner organization will appoint one or more GIS/IT management positions. Standing meetings should be held on a quarterly basis and called meetings may be arranged as needed. Other communications among members may occur through email or conference calls. The Steering Committee may create standing subcommittees on topics of ongoing interest (e.g., Education/Training) project teams and task forces to carry out work on specific projects and initiatives. Subcommittees and Project Teams may include any management, user, or technical staff from LOJIC, partner organizations, and licensee organizations.	• Input from Croswell-Schulte Focus Group meetings and individual meetings with partner organizations. • National Survey results showing common use of this type of body. • Scoring for GISCMM items EC16, EC19, EA8. • Literature review confirms that active steering committees and advisory bodies are a common practice.

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM3: Prepare and ratify written agreements with LOJIC partners	VH	AC	For several years, LOJIC has been operating without formal agreements among the four major partner organizations. Written agreements had been ratified in the past but none are currently active. LOJIC has operated through informal endorsement of the Policy Board members and management personnel in the partner organizations. MSD has assumed a large portion of the costs and material support for LOJIC operations. Formal, ratified agreements are needed to define the nature of partner participation and commitment and the services to be provided as part of this formal participation. This is a basic organizational best practice for clarifying roles, resource contributions, and access to LOJIC products and services— to support each partner's use of GIS for its business needs.	• Partner self-assessment comments about organizational relationship with LOJIC • Ideas expressed in Focus Group sessions and partner meetings • Scoring for GISCMM items: EC16, EC19, EA20 • National Survey indicating importance of formal agreements
GM4: Prepare Revised Strategic Plan	VH	NP	The most recent *LOJIC Strategic Plan* was prepared in 2007. Many of the goals and actions identified in that plan have been accomplished and in other cases, circumstances have prevented significant progress. The 2007 Strategic Plan is out of date and does not reflect current conditions, opportunities, and needs for the LOJIC user community. This recommendation is for the preparation of a revised strategic plan to guide operations and new initiatives of LOJIC and its partners. This plan should be concise and should include a statement of the current situation and needs, several high-level goals, key activities against these goals, overall timing, and the roles/responsibilities. A revised strategic plan is an outgrowth of the work of the SI Team and Croswell-Schulte work and deliverables. See 3.5.1 for ideas on the formal at content and format of strategic plans.	• 2007 Strategic Plan is out-of-date and not useful for directing LOJIC operations and initiatives • Croswell-Schulte meetings with LOJIC and partner management • Importance of Strategic Plans as indicated in National Survey and literature research • Scoring for GISCMM items: EC16, EC20, EA13
GM5: Fill vacant positions within LOJIC and orient new staff members	VH	UC	Recently existing vacant positions of the LOJIC staff have contributed to a work backlog and overload of existing staff members. These include the following two vacancies out of the total staff complement of 8 positions (in addition to the LOJIC Manager): • Database Analyst (1) (*recently filled*) • Customer Support Specialist (1) (*currently vacant)* This recommendation simply calls for moving ahead with recruitment and employee orientation work currently underway.	• Croswell Schulte Focus Group Session with LOJIC staff and discussions with LOJIC Manager • Work backlog and projected staffing needs for special project work and improved user support • URISA Model GIS Positions and Salary Survey publication • Scoring for GISCMM items EC17EA12, EA14
GM6: Increase level of direct support by LOJIC staff for Metro users	H	AC	Among all of the four LOJIC partner organizations, Louisville Metro has the largest current and potential GIS user community. The current constraints on LOJIC staff time, and the current situation in which MSD has assumed the majority of costs for LOJIC staff, limits the time available for user support--routine technical support as well as work on exploring new applications or special projects. The ideal environment is one that allows LOJIC staff to provide additional support to Metro (at no additional cost beyond standard reimbursement level) with the objective of expanding GIS use and benefits in Metro. Expanded and improved support for Metro would be enabled by a more effective working relationship among LOJIC staff and management personnel and GIS staff in Metro.	• SI Team self-assessments (Metro and LOJIC staff) • Input from Croswell-Schulte Focus Group meetings • Importance of Strategic Plans as indicated in National Survey and literature research • Scoring for GISCMM items: EC18, EA2, EA3, EA1, EA4

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM7: Support initiatives in Metro for improved organizational structure for GIS coordination	H	AC	Use of GIS in Metro has yielded positive results and tangible benefits in not just the technical application of geospatial work, but also in building and strengthening relationships between agencies, promoting the benefits of geospatial technology to non-practitioners, and linking technical practice to policy decisions and fiscal investments. An internal study conducted by Metro Technology Services in 2014 (see "GIS Executive Summary" report) identifies significant use of GIS technology and substantial opportunities for additional applications by multiple departments. This report also cites current limitations of GIS coordination among Metro departments and calls for improved governance, creation of a Metro Enterprise GIS Steering Committee, and preparation of a GIS Strategic Plan. This is a matter of importance for Metro which the LOJIC management and staff, as well as other partner organizations, should support.	• SI Team self-assessments (Metro and LOJIC staff). Identified projects and opportunities which will require additional support • Input from Croswell-Schulte Focus Group meetings • Scoring for GISCMM items EC16, EC19 • Results of National Survey and literature review documenting importance of enterprise GIS coordination and governance
GM8: Create and fill new LOJIC positions	H	NP	The proposed LOJIC budget for FY2016 includes funding for all current LOJIC positions but no additional staff. Croswell-Schulte believes that there is justification for adding positions to the LOJIC staff to support upcoming projects, provide improved user support and services, and for IT infrastructure and system administration. The recommendation is to add 2 positions for FY 2017: a) One (1) additional Applications Analyst specializing in evaluation, design, and development support for enhanced or new applications and to participate in special projects. b) One (1) additional Customer Support Specialist with strong technical and communications skills. This position would augment existing LOJIC staff in a technical support, special project work, and training role but also work with other LOJIC and partner technical staff to support evaluation and design of new applications. In addition, we believe that there should be one additional FTE funded by LOJIC to support IT infrastructure management. This additional funding would augment staff capabilities of the MSD IT Department in its accepted role of system, network, and database administration. The idea is to ensure sufficient expertise with ArcGIS software and ArcSDE database configuration to support existing MSD IT capabilities. LOJIC and some partner organizations have made effective use of student interns in the past. This should become a routine practice—working with educational institutions in Kentucky and the tri-state area to identify and recruit students who have particular skills that will support LOJIC operations and special projects.	• Input from Croswell-Schulte Focus Group meetings • Croswell-Schulte review of current staffing and roles • National Survey results on staffing levels from other GIS consortia • Scoring for GISCMM items EC17, EC21, EA12, EA16 • Resource needs for upcoming projects (ArcGIS SW upgrade, Info/Hansen upgrade) and need for enhanced user support.

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM9: Establish formal project planning and management practices	H	NP	This recommendation addresses current and future needs of LOJIC as a project-centric organization—to build on and improve existing practices and procedures in place for planning and executing projects. Best project management practices should be based on "knowledge areas" described in the Project Management Body of Knowledge (PMBOK) of the Project Management Institute (PMI). This involves the creation of formal policies and template materials to guide key project management activities (e.g., planning, budgeting, assembling teams, delegating work, tracking progress, reporting on results). This includes preparation of an efficient and consistent format and process for the proposing and evaluating the priority of new projects to support decisions on resourcing and initiating new projects. The objective is to carry out projects efficiently and to deliver results that yield expected benefits. A side benefit is the creation of lessons-learned to apply best practices for future projects. See 3.5.2 and 3.5.3 for more elaboration.	• Major upcoming projects (e.g., ArcGIS SW upgrade) will benefit from sound, well-documented PM practices • National Survey responses and sample template PM tools show value of formal PM practices • Scoring for GISCMM items EC14, EC15, EC16, EA4, EA6, EA8, EA12, EA13, EC16, EA1, EA8 • Literature review and research confirms benefits of formal PM practices
GM10: Provide enhanced training offerings and opportunities	H	AC	LOJIC has a solid record of providing training to users and technical people—through its own course offerings and materials and through vendor-provided training. LOJIC staff, partner organizations, and the broader LOJIC user community have benefitted. All LOJIC user organizations deal with the challenge of allocating time and resources for training activities. Effective training is vital—to position organizations to make the most out of GIS technology and data—particularly with planned upgrades to software and new applications for users. This recommendation calls for examining existing training programs and needs, prepare a plan for revised and enhanced training offerings, and putting in place a revised training programs that address the needs of users and technical staff using all viable forms and venues: a) training programs offered by LOJIC staff or by LOJIC partners, b) courses from educational institutions, c) workshops and seminars offered by professional associations, d) on-line seminars and training courses (e.g., Esri virtual campus courses). LOJIC staff and partner organizations will then actively communicate and promote these training opportunities for the entire (internal and external) user community.	• LOJIC internal and external surveys • Results from Croswell-Schulte Focus Group sessions • Scoring for GISCMM items EC18, EA2, EA14 • MSD Staff Development Plan (prepared in collaboration with Esri) • National Survey results on organizational best practices

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM11: Identify certification programs and support staff to earn professional certifications	H	NP	This recommendation is associated with Recommendation GM11 with a focus on certification programs—mainly for technical staff, managers, Users who employ GIS on a routine basis. Professional certifications have several benefits: a) enhance job skills and a professional approach to conducting work, b) preparation for certification testing augments skills and job knowledge, c) provides an important element for an employee's professional development. Also, an active certification program contributes to employee morale. There are many IT and GIS related certification programs but several important ones are: • GIS Professional (GISP) from the GIS Certification Institute (www.gisci.org) • Certified Mapping Scientist (CMS) from the America Society of Photogrammetry and Remote Sensing (http://www.asprs.org/Certification-Program.html • Project Management Professional (PMP) from the Project Management Institute (www.pmi.org) • Esri technical development and management certifications (www.esri.com/training/main/certification). With leadership from the LOJIC Manager and management personnel from partner organizations (Steering Committee members), managers should actively encourage the pursuit of professional certifications by qualified and motivated employees and provide support (time and certification prep materials) for these individuals. Existing managers and staff who already have certifications can act as mentors to employees pursuing certification.	SAME AS ABOVE
GM12: Reactivate LOJIC User Group	VH	AC	This recommendation calls for reactivating the currently inactive LOJIC User Group as a means to encourage and facilitate communication among LOJIC staff, the 4 partner organizations, licensees, and the broader LOJIC user community. Specific objectives of the User Group will be to: a) share ideas, applications, methods among users, b) help new users come up to speed and understand GIS resources and applications available from LOJIC and from partner organizations, c) encourage a community spirit and identify, d) communicate with LOJIC staff about GIS needs, ideas for new applications or services, technical problems, etc., e) provide updates and news from LOJIC (new services, projects), f) provide a basis to form work teams for new application or database initiatives, g) stimulate expansion of the user community, and h) learn about new GIS and IT industry trends and products. LOJIC staff will provide administrative support but the leader (or Chair) of this group should be a manager or user from one of the 4 partner organizations and this lead role should rotate on an agreed schedule (annually recommended). A Web Page for this group should be set-up (link from LOJIC Web Site) and use of social media should be explored and used if determined to be useful. Regular meetings should be held on a quarterly basis and special meetings may be organized at any time. Meetings should be well planned with specific content of value to the user community (industry news, product demonstration, guest speaker, brainstorming on one or more specific topics identified before the meeting, recruitment/formation of project teams).	• SI team assessments pointing to decrease in user community collaboration • Croswell-Schulte Focus Group sessions indicating user group interest • Scoring for GISCMM items: EC16, EC19, EA2, EA4, EA15 • National Survey indicating importance of user groups

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM13: Plan and conduct regular brainstorm sessions focusing on solutions	H	NP	Hold brainstorm sessions, with specific topics identified, to get input and ideas for improvements and solutions using GIS technology. This exercise would occur as part of the recommended Steering Committee and/or User Group activities (see Recommendations #GM8 and #GM12).	• Results from Croswell-Schulte Focus Group sessions—expressing need for improved collaboration and communication • Scoring for GISCMM items EC15, EA1
GM14: Create improved process and practice for documenting and communicating accomplishments	M	UC	Recognition for staff accomplishments is one way to show employees that their hard work is valued and appreciated—thereby enhancing morale and productivity. Formal identification and recognition of accomplishments also serve as "performance indicators" for LOJIC, partner organizations, and licensee organizations. Recognition may include a) annual/monthly awards that may be achieved through demonstrating outstanding performance, b) earning training/conference hours, c) recognition at meetings or events of the User Group (see Recommendation #GM12), d) public recognition (Web site, social media, newsletters, and e) informal recognition by a program or project manager for employees or team members. Recognition must be clearly defined such that all staff are offered an equal opportunity to earn recognition through performance and/or accomplishments. Such recognition should apply to the entire internal and external user community. Employee recognition programs already in place in partner organizations may be better leveraged for GIS users and technical staff. There are sources to consult for ideas on employee recognition methods that work. One such source is the book, *1501 Ways to Reward Employees* (Bob Nelson, ISBN: 978-0-7611-6878-2).	• Results from Croswell-Schulte Focus Group sessions • Scoring for GISCMM items EC16, EC19, EA14, EA15 • General best practices documented in personnel management/HR literature including employee satisfaction surveys
GM15: Explore and pursue opportunities for expanded user community in Jefferson County	VH, H	AC	LOJIC, with its partner organizations, should actively explore expansion in the user community in Jefferson County. Expansion should have two focal points: a) additional expansion of use among partner organizations and b) expansion of users in non-partner organizations including current licensees making use of LOJIC data and services. While such expansion may have a revenue increase component, the primary objective for this recommendation is to maximize use and benefits from the ongoing investment in LOJIC data and services. Possible new user organizations (for LOJIC on-line services or new licensees), include additional municipalities in Jefferson County, special service districts, private companies, additional non-profit organizations, educational institutions, as well as expanded use by the County Clerk and Sheriff's Office.	• General interest in expanding the LOJIC GIS user community (by LOJIC partners and Policy Board) • SI Team assessments indicating opportunities for new applications and users • Croswell-Schulte Focus Group sessions and program evaluation pointing to new opportunities

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM16: Preserve institutional knowledge by documenting GIS business processes	H	AC	This recommendation involves continued work for LOJIC staff and partner organizations to prepare written documentation for GIS related business processes. Such documentation is prepared to ensure consistency, repeatability, and efficiency for existing staff and for future staff not initially familiar with the work. Business process documentation should follow a standard format that typically includes the following elements: a) Business process name and ID #, b) trigger or event that initiates the business process, c) workflow description (steps in process and optionally, a workflow diagram), d) main responsibility and other parties involved, e) data sources/databases used, and f) automated tools or applications used. GIS-related business processes encompass GIS database maintenance activities, handling user/technical support requests, training activities, needs assessment/design for new applications, access/use of existing applications, etc. The need for business process documentation increases with upcoming software version migration, other major technology application development projects, and staff changes.	• Results from Croswell-Schulte Focus Group sessions • Scoring for GISCMM EC18, EA7, EA9 • Standard best practice for IT operations
GM17: Develop and execute branding and promotional strategy	M	AC	The brainstorming process should begin within the partner organizations and LOJIC staff. Support from public relations experts (internal resources in partner organizations) may be required to formalize and develop an effective strategy that may include modifying the name, logo, mission, and vision to align with current innovative GIS technology. Active promotion involves projecting the LOJIC brand to increasing awareness and interest in LOJIC—to stimulate expanded uses. See 3.5.4 for more ideas about GIS program branding and promotion.	• Croswell-Schulte Focus Group Sessions and meetings with LOJIC and partner management • National Survey showing value of promotional programs • Scoring for GISCMM EA1, EA22
GM18: Explore and pursue expanded service area and database	VH, H	AC	This recommendation follows actions already taken by LOJIC to support development and access to GIS data and services outside of Jefferson County. Currently LOJIC has agreements with Oldham County and Bullitt County for GIS database support and software In addition to continuing this support for Oldham and Bullitt, there is an opportunity to provide support and services to other counties in the region. The recommendation is to contact surrounding counties to assess level of interest and then prepare initial plans, cost projections, and formal proposals to pursue with interested counties. Initial LOJIC services should mirror those in place for Oldham and Bullitt Counties (base map layer acquisition, access to specific software and services). As identified in the 2007 *LOJIC Strategic Plan*, this expansion in "service area could potentially extend to 13 counties in Kentucky and Indiana. It would offer an economy of scale in base map acquisition and compilation (orthoimagery, LiDAR, planimetric mapping) and could include other GIS datasets (e.g., governmental jurisdiction/administrative boundaries, street centerline, addresses). Such expansion would also support current programs of LOJIC partners and the other counties that can make use of GIS data and services beyond Jefferson County (TARC services, multi-jurisdiction public safety and emergency management, stormwater and flood control management, solid waste management, and others).	• LOJIC internal and external surveys • Policy Board interest in geographic expansion and positioning LOJIC as a "regional hub" • Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • Scoring for GISCMM EC1, EC2, EC5, EA1, EA11, EA17

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
GM19: Revise GIS position descriptions and pay grade	H	AC	Concerns exist about GIS technical positions (responsibilities, pay scale) in LOJIC and partner organizations relative to IT positions with similar skills and experience requirements. MSD is carrying out a review of staff positions and salary levels. This and other sources (e.g., URISA 2014 *GIS Salary Survey*) should provide information that could support revision to GIS position descriptions and improved pay grad equity. It will have an impact on the LOJIC budget. See 3.5.5 for more information.	• Literature review—IT and GIS compensation surveys providing benchmarks for comparison
Technical Infrastructure, Software, and Systems Administration (TE)				
TE1a: Improve MSD IT server, network, and system administration	VH	UC	LOJIC partner organizations that rely on direct connection to LOJIC servers for access to data and software (MSD, Metro, PVA) have been experiencing frequent connection problems, access interruptions, and other problems likely associated with network services, server configuration, and related IT infrastructure and system/database administration. All LOJIC users benefit from MSD Information Technology Department IT infrastructure and system support for GIS data and applications. MSD will continue to play this role and is in the process of designing for and carrying out a major overhaul of its IT infrastructure that includes server upgrade and consolidation, network upgrades, more efficient provisioning of virtual server resources, re-allocation of user and computer accounts, improved system administration, and more robust system administration, back-up, and disaster recovery environment—serving LOJIC users as well as all MSD IT needs. In addition, the MSD IT Department will be conducting an IT strategic planning effort to examine and identify long-term needs and initiatives. This recommendation calls for LOJIC and partner organization IT personnel to provide support to the MSD IT Department that might be needed for this major enhancement effort. The second, and very critical part, is to provide appropriate resources (internal staff or contracted services) to ensure that GIS components of this IT infrastructure enhancement are optimized. This encompasses such areas of ArcGIS for Server configuration (taking into account recommended version upgrade), ArcSDE configuration with proper connections with Oracle databases, Web Server configuration supporting GIS applications, possible future use of ArcGIS Online, growth in field/mobile GIS applications, and GIS integration with external software and databases.	• LOJIC internal user survey • SI team assessments and Croswell-Schulte Focus Group Sessions indicating to network connection problems and system response problems • Croswell-Schulte meetings with LOJIC manager and MSD IT Department • Croswell-Schulte Focus Group sessions indicating user group interest • Scoring for GISCMM items: EC7, EC8, EC11, EC12, EA8, EA9, EA10, • National Survey indicating importance of user groups
TE1b: Configure GIS software and database for optimal performance	VH	AC	The major IT infrastructure and system administration improvements described in Recommendation #TE1a will provide a much more efficient IT environment with enhanced performance, security, and technical support for GIS users (as well as other MSD systems and applications). In order to optimize performance, there will be GIS-specific activities to ensure best configuration of the GIS database, software, Web services, and custom applications. This GIS-specific configuration work should occur in coordination with the TE1a IT improvement work. LOJIC should make available technical resources (LOJIC staff or contracted support) to ensure effective GIS configuration.	SAME AS TE1a

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
TE2: ArcGIS software upgrade	VH	UC	ArcGIS software from Esri supports the majority of GIS database management and applications for LOJIC users. The current version of ArcGIS server and desktop software is v10.0 which was released by Esri in 2010 and has been in place in LOJIC since 2011. A new version of ArcGIS (v10.2) was released by Esri in 2013 and v10.3 was released in December of 2014. The immediate action is to complete the upgrade to ArcGIS 10.2 which is already in progress. This will provide added functionality and ease of use and allow LOJIC to take advantage of improved GIS integration with external software. In the longer term, an upgrade to ArcGIS 10.3 should be planned and executed (estimated timing would be early 2017). ArcGIS 10.3 has substantial technical improvements and functionality enhancements that can support new applications and also make routine software/database administration tasks easier. See 3.5.6 for additional information about v10.3 features and upgrade and the migration approach.	• SI Team self assessments • Ideas from Croswell-Schulte Focus Group Sessions and meetings with partner organizations • Research on software version offerings and status from Esri • Scoring for GISCMM items: EC11, EA18, EA19 • National Survey indicating importance of user groups
TE3: Optimize mix of desktop GIS versus web users	H, M	NP	As part of the MSD IT infrastructure improvements and ArcGIS software migration, LOJIC and its partners should examine the current mix of ArcGIS server vs. ArcGIS desktop (accessed locally or on server via Citrix) use and, over time, make a move toward greater reliance on Web-based applications through ArcGIS for Server, or potentially some use ArcGIS Online (AGOL). Since such a move will require some re-design and development of existing desktop applications, this will be a gradual process, which, in the long-term will simplify software management, improve performance, and open up a range of new Web-deployed services.	• Research on software version offerings and status from Esri • Scoring for GISCMM items:EC8, EC9, EA8, EA18 • National Survey with strong indication of reliance on and move to Web-based applications
TE4: Define future role of ArcGIS Online	M	NP	The ArcGIS Online (AGOL) service from Esri has become popular in the last 2 or 3 years—at least for a segment of organizations' users accessing GIS via the Web. While Esri has been adding functionality to AGOL, it currently is not a general platform supporting the majority enterprise GIS needs of large organizations. The growth in popularity and functionality of AGOL (and cloud services in general) make it important to consider possible use of AGOL in the future—taking into account the nature and needs of the user community, appropriate Web-based applications, and costs for AGOL credits. Project and strategic planning exercise undertaken by LOJIC and its partner organizations should include consideration of future AGOL use. See 3.5.7 for more information about AGOL.	• Research on AGOL services and status from Esri • General review of the national trends in use of Cloud services and AGOL

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
TE5: Integrate LOJIC Online Map with PVA Web GIS Service	L	AC	Licensees and external users—those organizations with missions dependent on parcel and real-property information have strongly voiced a need for a technical integration of functionality and data offered through the current Web services: LOJIC Online Map and the PVA subscription services. Currently carrying out routine map query and display activities and more detailed real property research requires users to access the two services separately. This recommendation is for the PVA and LOJIC manager and staff to examine and determine the most effective approach for integration, and move ahead with carrying this out—timed appropriately with the move to ArcGIS v10.3 and the PVA's CAMA system upgrade. It should be noted that users who expressed this concern and a need for this integration did not have complaints about costs for PVA subscription services. This is a matter of technical efficiency and manual time required now to research, access, and map needed parcel data.	• LOJIC External User Survey • Information Croswell-Schulte Focus Group Sessions with Licensees and External Users • Meetings with PVA • Scoring for GISCMM items: EA18, EA19
TE6: Upgrade to Infor/Hansen 8.3-with improved GIS integration	H	AC	Infor/Hansen 8.3 includes an enhanced user interface, updated menu layout for easier navigation and much improved ArcGIS integration. The upgrade also applies superior spatial capabilities to interpret and visualize data for day-to-day tasks such as creating service requests; reviewing work orders and managing building permit applications. There are long-term advantages to making the software migration but it is a major undertaking—particularly for MSD for which there has been significant customization with the current Infor/Hansen v8.2. This is major project and requires a clear plan, a project team with representatives from MSD and Metro, and customization as part of a migration from HARP.	• SI Team self assessments (MSD and Metro) • Information from meetings with MSD, Metro, and LOJIC Manager • Current version of Infor/Hansen with ArcView-based HARP integration is legacy software • Scoring for GISCMM items EC18 and EA19
TE7: Define standards for Field-based/Mobile GIS applications	H, M	NP	LOJIC currently has no defined standards supporting field-based GIS applications for tablet computers and smart phones (software platform, design guidelines, device OS and type). With the exception of LWC, there is relatively little use of field/mobile GIS applications but considerable opportunities for future applications exist. LOJIC partners, with support of IT personnel (and leveraging work already done in LWC), should prepare a basic set of standards that guide design and deployment of field/mobile GIS applications. Creating such standards would provide for a more unified development of field-based applications. Such a standard would address the following factors: a) mobile device types, features and operating system (for tablet computers and smart phones), b) wireless communication services, c) GPS-GNSS location specifications and capabilities, and d) server-based or mobile device software.	• Level of interest in field-mobile applications expressed in SI Team self assessments and Croswell-Schulte Focus Group sessions • Many opportunities for new applications and benefits given relatively current low-level of use • Research on offerings from hardware and software vendors provide many cost effective options for development • Scoring for GISCMM items EC8, EC9, EA8, EA13

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
TE8: Explore options and develop strategy for use of open source software	M	NP	Over the past 10 years, open source GIS software (software not subject to vendor-based proprietary licenses) have moved from a limited set of products with small user communities to a mainstream software option for consideration. The open source GIS software community has benefitted from robust data and software architecture standards development by such groups as the Open GIS Consortium (OGC). There are open source GIS software products (server-based, desk-top, and mobile device platforms) that are available now. Some of these products have substantial user communities, support environments, and in-depth functionality. This recommendation calls for the LOJIC staff and user community to keep abreast of open source GIS software trends and products and consider adopting them in certain cases where they may augment and/or provide advantages relative to core proprietary software. See 3.5.8 for more information about open source software opportunities.	• Research on the state and trends of the Open GIS software industry • Scoring for GISCMM items EA10, EA19, EA21
TE9: Support PVA migration to new CAMA software with improved GIS integration	VH	UC	The PVA has selected a new CAMA software package (E-Ring) and has recently begun work for implementation with plans to complete the migration in 2015. This migration will provide robust GIS integration. LOJIC staff should be ready to support development of GIS integration features in cooperation with the PVA and software vendor.	• Meetings with PVA and LOJIC Manager • Plans for ArcGIS version upgrade will introduce technical issues and new features for integration
Enhanced or New Applications and Services (AP)				
AP1: Proactive examination and work on selected high-profile custom applications	H	AC	The LOJIC Manager and staff, in coordination with LOJIC partners, should select one or two “special projects” each year—doable projects that deliver clear benefits for LOJIC partners and which have some high-profile visibility in partner organizations and the community as a whole. This is a vehicle for focusing resources on meaningful projects, contributing to employee morale, helping to promote and expand use and awareness of LOJIC data and services. See 3.5.9 for additional ideas on new applications.	• Scoring for GISCMM items EA1, EA5
AP2: Redesign and deploy enhanced LOJIC Web Site	H	AC	The LOJIC Web Site serves as the main portal for access to information about LOJIC and a range of applications and services. User comments and the Croswell-Schulte review identify areas for substantial improvements that will deliver benefits to users and be a basis for expanding the LOJIC user community. Almost every organization with a Web presence has been through at least one major redesign in their lifetime. Whether it's for corporate rebranding, launching new products, going mobile, or just to increase the site's effectiveness, a redesign is a great way to recharge and breathe new life into your online presence. This work could be done by LOJIC staff or available IT personnel from partner organizations but it is recommended that a large portion of it be a contracted service from a qualified firm—working with a project team from LOJIC (that includes licensees and external users) to provide input on design and prototypes for a new Web Site. See 3.5.10 for more ideas about the LOJIC Website redesign.	• Input from Croswell-Schulte Focus Group Session input from LOJIC staff and partner organizations • Croswell-Schulte review of Web Site • Scoring for GISCM items EA1, EA14, EC15, EC15, EA1, EA15, EA17

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
AP3: Improve functionality of the LOJIC Online Map	H	AC	The LOJIC Online Map is a frequently used application providing access to data and basic GIS query and display functionality—particularly by the licensees and external users. Input received in this project has identified potential improvements in features and functionality. It is recommended that LOJIC examine, design, and implement new features for online map query and display. This should be done in coordination with the planned ArcGIS version upgrade and new Web-based features and development tools provided by Esri. The most frequently identified areas for functionality improvements include: a) re-design of scale thresholds for feature display, b) type in scale for zoom, better printing capability, c) one-click to show adjacent property owners for selected parcel, d) show more utility data, e) reduce size or pop-up windows, f) full integration of GoogleMaps and Google StreetView, g) query to identify specific sewer treatment plant that serves a specific property or location, h) map area selection/zoom tool (draw boundary of rectangle for zoom extent, i) easy tool to select area and extract that content for pasting into document, email message, etc., j) ensure that the Online Map works with all Browsers, k) tool to interactive draw and area and have the application provide count of features inside the area (e.g., number of parcels), l) allow for searches by "development name" entry, and m) add compass rose to see map display orientation.	• LOJIC Internal and External User Surveys • Input from Croswell-Schulte Focus Group Sessions • Scoring for GISCM items EA4, EC13, EC14, EC15, EA5
AP4: Explore connection with commercial, external Web mapping services.	M	NP	There is a growing number and increased sophistication of publicly accessible Web mapping and location-based services from such companies and organizations as Google (GoogleMaps, Google Earth), Microsoft (BingMaps), and smaller start-up companies providing online GIS services. In addition to adding functionality, some of these companies are creating and maintaining rich geographic data sets for online access. Esri, and other commercial GIS software vendors, are in a position of adding some functionality to integrate access to these services (following OGC Web Map Services standards) while avoiding direct competition. LOJIC and its users should better define assets and applications that these sites provide while being clear about their limitations in data content and currency and functionality. Providing greater integration of these services with LOJIC Online tools as well as possible collaboration with these companies should be explored. Google has announced the discontinuation of Google Earth and the software deprecation of the GoogleMaps engine (supporting custom application development on this platform). This will influence future strategies for use of commercial Web mapping services.	• National Survey and review of industry trends • Scoring for GISCM items EC14, EA5, EA19

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
AP5: Design, develop, and deploy new GIS applications for LOJIC participants	H, M	AC	Based on SI Team work and the work of the Croswell-Schulte Team, this recommendation calls for the identification of new GIS applications that have a clear business benefit and impact in support of agency programs. This project has identified some possibilities to pursue (see 3.5.9). In each case, the approach is for participant GIS staff (with LOJIC staff support) to prepare functional and technical specifications for the application and secure funding and/or internal resource commitments. A project team should be assembled and as necessary contractor support retained. Application development should follow a logical methodology (traditional structured approach or Agile methods) which include development of prototypes and iterative review by the project team—leading to acceptance and full deployment. To the greatest extent possible, custom applications should use off-the-shelf functions in ArcGIS with configuration tools for interface, map display, and workflow steps (avoiding detailed software coding). As necessary, additional programming should use accepted application development tools including HTML5, .Net, Python scripts.	• SI Team self assessments and Croswell-Schulte examination of user community and opportunities for new applications and services • LOJIC Internal and External User Surveys • Input from Croswell-Schulte Focus Group Sessions • Scoring for GISCM items EC13, EC14, EA1, EA5
GIS Data Content, Maintenance and Access (DA)				
DA1: Prepare high-Level GIS data catalog and revise LOJIC metadata standards and policies	H	NP	The LOJIC GIS database is extensive—currently including over 800 layers (Geodatabase feature classes and datasets). Many of these are frequently accessed by multiple users and others are special-purpose datasets not in regular use or subject to frequent update. LOJIC has strictly defined standards and a well-organized process for capturing and maintaining geospatial metadata—with the understanding that sound metadata policies support effective discovery, use, and maintenance of the GIS database. With the high volume of data—new GIS datasets being created by users on a regular basis (new data for special projects or general use), it is difficult to follow and "enforce" adherence to metadata standards in all cases. Even with ArcCatalog tools for metadata organization and query, the size of the LOJIC database makes it difficult to find data that might be useful for a project or application. This recommendation has several related parts: a) Examine the entire database and devise a high-level classification that organizes data layers by content (e.g., imagery, planimetric, governmental boundary, utility, etc.) and by use (e.g., enterprise data needed by all users, critical organization-specific data, special-purpose datasets). b) Re-examine metadata policies as it applies to all GIS data and consider easing requirements for metadata capture and maintenance for certain datasets (e.g., special purpose datasets that have limited usage). Adopt new ArcGIS tools or custom tools developed by other users to provide more efficient approaches for metadata capture and maintenance. c) Build a high-level metadata query tool that gives users a better method for data discovery and access—supporting queries on commonly needed data content metadata fields with a graphic view (thumbnail) of the data and information how to access and any restrictions on access.	• Information from Croswell-Schulte Focus Group Sessions with LOJIC staff • Croswell-Schulte review of the LOJIC database and general research on GIS data management practices • Scoring for GISCMM items EC5, EC6, EC7, EA17

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
DA2: Increase frequency of parcel data transfer from PVA	H	DP	Plans have been made to move from a weekly upload of parcel data (reflecting property transfers and new parcels) to the LOJIC database to a daily process which will resolve most of the current problems experience by users (not having up-to-date access on parcel attribute data). This change in upload frequency should be implemented as soon as feasible.	• SI Team self assessments • Croswell-Schulte Focus Group Sessions and meetings with LOJIC Manager and PVA • Scoring for GISCMM items EC4, EC5, EC7
DA3: Establish/enable broader access to Pictometry data for all LOJIC users	H	AC	The PVA has maintained a license for Pictometry data and services—supporting real-property appraisal work. There is currently limited access to this valuable resource by LOJIC users—primarily due to licensing restrictions and related financial issues. The Pictometry data and applications have value to a range of business needs including public safety and support for a variety of field analysis and inspection activities (augmenting and reducing field-time requirements in some cases). The recommendation is for the LOJIC Manager and PVA to reach consensus on an acceptable licensing strategy with Pictometry and implement the necessary technical steps to provide access by all LOJIC partner organizations. In addition to enabling broader access to Pictometry imagery and services, it should be noted that the PVA's agreement with Pictometry will include likely re-flight and acquisition of vertical ortho and oblique imagery in 2016. This acquisition should be coordinated with LOJIC's plans for new orthoimagery with project collaboration and cost-sharing.	• SI Team self assessments • Croswell-Schulte Focus Group Sessions and meetings with LOJIC Manager and PVA • Scoring for GISCMM items EC5, EA17, EA21
DA4: Explore and pursue increased GIS data coverage outside of Jefferson County	VH, H	AC	This recommendation is associated with Recommendation #DA4. With the exception of the PVA, all LOJIC partners have an interest in land outside of Jefferson County—MSD and LWC services areas and a need for regional data for land use planning and emergency management support. LOJIC licensees TARC, KIPDA, and the Kentucky Transportation Cabinet have multi-County areas of responsibility. In addition to Jefferson County data, LOJIC maintains base map data for Bullitt and Oldham Counties. In the 2007 LOJIC Strategic Plan, the Policy Board accepted a goal for LOJIC to become a regional GIS data hub—potentially over a 9 to13-county area (Jefferson, Oldham, Bullitt, Hardin, Trimble, Spencer, Shelby, and Henry Counties in Kentucky and Harrison, Floyd, and Clark Counties in Indiana). With additional input from partners, LOJIC should explore approaches and the operational and financial implications of an expansion in coverage and base decisions to pursue expansion on this review. Any expansion that does occur should be done in a way that does not negatively impact current product and service quality. In preparation for new imagery and LiDAR data acquisition in 2016, multi-County coverage should be considered. Croswell-Schulte gathered information on potential "economy of scale" cost savings for multi-county vs. Jefferson County only coverage (high-resolution orthoimagery and LiDAR). This information shows that on a square mile basis, significant savings would be delivered for multi-county coverage (about $1100/square mile for just Jefferson County vs. about $300/square mile for multi-county coverage).	• LOJIC internal and external surveys • Policy Board interest in geographic expansion and positioning LOJIC as a "regional hub" • Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • Scoring for GISCMM EC1, EC2, EC5, EA1, EA11, EA17 • Croswell-Schulte research on imagery and LiDAR acquisition costs

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
DA5: GIS Support for MetroSafe dispatch and move to Next Gen 911	H, M	AC	MetroSafe and other public safety organizations in Jefferson County depend on accurate street centerline and address data to support emergency dispatch. MetroSafe uses an Intergraph Public Safety Dispatch system with GeoMedia GIS capabilities for dispatch operations. ArcGIS data is regularly exported, translated, and imported to GeoMedia for dispatch use. This is a multiple day operation with considerable manual intervention. There is a need to explore possible direct use of ArcGIS data (by the Intergraph CAD software) and more efficient and more highly automated GIS data export and import. MetroSafe will be adopting Next Gen 911 tools and infrastructure to support more robust emergency dispatch. Next Gen 911 encompasses a digital transmission protocol and more robust capabilities for locating voice emergency calls (from land lines and cell phones) as well as other communication environments (text messaging, social media). Next Gen 911 is heavily dependent on GIS data—accurate boundary data, site addresses and sub-addresses, and other site location data. This may require some modification of the structure of current GIS-based street centerline and address data and workflow changes for loading data to the MetroSafe computer-aided dispatch system. This may drive GIS database changes to fully support services of emergency dispatch software. This recommendation calls for review an examination of data needs to support Next Gen 911 and to create a more efficient tools and process for export of ArcGIS street and addresses data (and other critical layers) to GeoMedia. Since there are many public safety organizations in the U.S. and Canada that are using ArcGIS and the Intergraph Public Safety Dispatch software, there may be custom solutions to this problem.	• Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • Communications with Metro personnel and LOJIC Manager on Next Gen 911 plans • Research on Next Gen 911 data requirements
DA6: Create enhanced place name database	M	AC	It would be valuable to develop and deploy a point location GIS data layer with commonly needed landmarks and place names (e.g. government and commercial buildings, schools, health facilities, parks, major commercial buildings, other landmarks, etc.). This would support a range of enhanced applications addressing needs of LOJIC partners (public safety, field inspections) and Web-based navigation, routing, and location-based services for external users and the public. This recommendation is for creation of a geodatabase point feature class with important attribute information. Following a database design, this feature class would be developed initially from initial data sources (e.g., MetroSafe, important facilities from MSD and LWC, major commercial properties from PVA parcel data). There should be an application allowing new points to be added over time. This data would be managed to allow general access by all users.	• Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • General research on location-based services • Scoring for GISCMM items EC3, EC4,

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
DA7: Explore and implement new applications for increased access to and use of DEM data	M	NP	LOJIC acquires new LiDAR data on a regular basis (coordinated with orthoimagery data acquisition) and uses this elevation data for the generation of topographic contour maps. Digital elevation models are created from processed LiDAR data for use in topographic contour generation. However, there is limited use of the DEM data for topographic analysis and 3D visualization—an application area that has tremendous value for a wide range of uses such as: a) 3D visualization for review of land development plans and project proposals, b) stormwater runoff and flood analysis, c) component for water and sewer hydraulic modeling, and d) support for engineering and architectural planning and design. Most of the tools available for DEM analysis and visualization are already part of ArcGIS or extension software that is available for LOJIC users. This recommendation calls for a LOJIC team to be assembled to explore new uses of DEM data, carry out pilot projects, and identify applications for DEM data that have benefits for users. Then, over time, implement these applications in operational settings.	• Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • General research on DEM processing and applications • Scoring for GISCMM items EC3, EC13, EC15, EA1
DA8: Examine restrictions on access and distribution of water utility data	M	NP	Policies are in place providing limited access to water distribution infrastructure data. These policies balance needs for use of this data with access concerns related to the critical infrastructure nature of water distribution data. Interest was expressed by external users for access to some water distribution facility data. To respond to this concern, it is recommended that the LWC, with LOJIC partners, review current policies for data access—relative to expressed interest in broader access. Then, if access policy changes are considered to be appropriate.	• Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • General research on DEM processing and applications • Scoring for GISCMM items: EA17, EA21
DA9: Examine and put in place protocol for use of UAV acquired data	L	NP	Aerial imagery and data acquisition from unmanned aerial vehicles (UAV) has moved over the last few years from a niche industry to a more mainstream approach—particularly for special projects in which high-resolution data is needed quickly for specific project areas. There are a range of UAV types, sensor devices (ortho and hyperspectral imagery, thermal imagery, georeferenced video data, LiDAR), tools for incorporating the data into GIS, and companies which provide services. Technical advances in UAV devices and sensors and FAA flight regulation changes will provide more flexibility for UAV missions. The recommendation is for LOJIC to keep abreast of the trends and products in this area and, consider using UAV services for projects where it can deliver benefits.	• Research on technology trends and UAV applications
DA10: Develop 3-D urbanscape models	L	NP	Urban-based 3D GIS databases and applications are becoming popular urbanscape visualization and applications that support urban planning, economic development projects, and other business areas. These databases are sophisticated models of urban infrastructure—often using detailed terrestrial LiDAR scanning and imagery that can apply realistic building façade and rendering of grounds and structures. CAD and GIS software tools have become available to sophisticated viewing, fly-throughs, and analysis of these models. Consideration should be given to creation of 3D models for all or parts of the Louisville downtown area and use of these models for real applications.	• Research in GIS technology trends and products

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
DA11: Integrate LOJIC Online map with KIPDA traffic volume stats	L	NP	The Kentuckiana Regional Planning and Development Agency (KIPDA) gathers and provides access to traffic count information (with map interface) on their Website. Since some users have expressed an interest for integrated access, through the LOJIC Online map, to this traffic count data, this should be considered for a possible future development project. With online applications configured as Web Map services, the technical tools are available for such integration.	• Results from Croswell-Schulte Focus Group Sessions • Internal and External user survey • Scoring for GISCMM items EC3, EC4
DA12: Enhance GIS-based tree inventory database	M	AC	Metro Parks has been maintaining a 24,000 point tree inventory database using TreeKeeper software (supporting work order management for tree maintenance) Urban trees are an extremely valuable resource—providing environmental benefit, adding to the esthetic quality of urbanscapes, and raising property values. Many municipalities maintain detailed GIS-based inventory of trees in the public right-of-way, parks, and other public spaces.	• Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • Research on municipal GIS data • Scoring for GISCMM items EC3, EC4
DA13: Examine possible role for high-resolution satellite imagery	M	NP	LOJIC should explore possible use of high-resolution satellite data to augment or instead of high-resolution imagery captured from aircraft scanners. The 2014 launch and commissioning the Digital Globe WorldView 3 satellite--with 30cm resolution panchromatic data and enhanced multi-spectral data capture illustrates a trend that over the next few years will make available commercial imagery from a number of companies. There are currently dozens of commercial and government sources for high resolution imagery and many more missions planned for the next two years. This recommendation is for LOJIC users and technical personnel to keep abreast of satellite imagery trends and to consider use of this imagery when user and project needs offer advantages. See 3.5.11 for more information on high-resolution satellite imagery.	• Croswell-Schulte research on the status of satellite imagery programs and products • Great interest in high-resolution imagery by LOJIC users

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
DA14: Initiate and lead effort for statewide parcel data layer	L	NP	GIS-based parcel and real property data is vital for the majority of LOJIC users. Some LOJIC users require parcel data outside of Jefferson County but there is currently no unified system that would allow these "cross-border" parcel data search and mapping applications. Some states, recognizing the value of a digital statewide parcel database (e.g., states of Wisconsin, Tennessee, Oregon, Minnesota, North Carolina, and others) have developed or are developing statewide GIS parcel databases. In Kentucky, constitutionally-established PVA offices are responsible for parcel mapping for their respective counties and may, like the Jefferson County PVA, have established a subscription program and fee schedule for data access. While the current approach to parcel mapping in Kentucky inhibits cross-county operations, the fact that PVA offices, are state government entities (Kentucky Revenue Cabinet) provides a possible basis for statewide coordination. This recommendation suggests that LOJIC take leadership to explore and generate interest in a statewide, unified, parcel mapping program and GIS database environment that would support query and access to parcel boundaries and real-property data. This would begin with discussions with regional PVAs, the state Revenue Cabinet, and Kentucky Office of GIS, followed by a statewide survey of interest in such a program. If there was sufficient interest, a plan would be prepared defining an approach for statewide parcel database development—one that addresses topics of mapping and data standards, technical issues, financial concerns, impacts on PVA Office responsibilities and administration, and other concerns. A prototype could be designed and developed which could include Jefferson County and several neighboring counties.	• Ideas expressed in Croswell-Schulte Focus Group Sessions • National Survey responses • Review of parcel mapping programs in other states • Scoring for GISCMM items EC1b, EC7, EA17, EA21
DA15: Enhanced access to building permit data	L	NP	This recommendation responds to concerns expressed by LOJIC users. This reflects the fact that there is a wealth of information in building permit and inspection databases that is extremely valuable for many uses beyond meeting code requirements for building construction and maintenance (e.g., housing stock analysis, property appraisal, land use planning, redevelopment projects, etc.). This recommendation involves conducting a more detailed needs evaluation followed by technical specifications and development.	• Ideas expressed in Croswell-Schulte Focus Group Sessions
Funding Sources and Financial Management (FI)				
FI1: Restructure monetary contribution levels from LOJIC partners	VH	AC	Contributions from LOJIC partners (PVA, Metro, and LWC) dropped significantly starting in FY2010. MSD has assumed a much higher percentage of costs--about 75% compared to the original MSD share of 35%. A proposal before the Policy Board calls for a gradual increase in reimbursements by Metro, LWC, and PVA to restore percentage contribution levels in place prior to 2010. These increases would occur over a three-year period starting in FY 2016. This funding allocation comes within an understanding that LOJIC delivers value—in terms of system infrastructure, software, data, and GIS support services. This restructuring should come with a clear definition of LOJIC services and support that will be provided to the partners.	• Review of LOJIC financing history and proposal for restoring previous allocation • National Survey responses supporting partner contributions as primary funding source for multi-organizational GIS programs • Scoring for GISCMM EC21, EC22, EC23, EA16

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
FI2: Examine and put in place new sources for sustained funding.	H	AC	LOJIC should consider pursuing other funding sources and approaches. Some possible new funding opportunities which have worked well for other GIS programs are listed below. Each of these funding approaches is based on their connection with GIS products and services provided by LOJIC : a) Allocation of a portion (standard percentage) of budgeted costs for capital infrastructure projects (MSD and Metro) going to a special fund to support LOJIC and GIS services for partners. b) Allocation from other capital projects (non infrastructure) going to a special LOJIC/GIS fund. c) Portion of a fee for land-related document recordation (County Clerk) to a fund supporting LOJIC and GIS operations and special projects. This would apply to recordation of plats, deeds, surveys, and property transfer documents. May require legislation. d) Portion of a fee for specific permits (e.g., building permits) allocated to a special fund for GIS. e) Greater use of grants from government or non-profit organizations to support special GIS projects. There are few grants available specifically for GIS but there are program-specific grant programs (e.g., public safety, public health, social services) that may have a GIS component. These would require time for grant research and grant application preparation. f) Take on more special project work for which there would be an independent revenue stream—for use of LOJIC staff, software, and data.	• Review of LOJIC of current and historical budget and revenue • National Survey responses providing information on revenue sources • Scoring for GISCMM EC22, EC23, EA16
FI3: Examine and consider restructuring of licensees and data/product fees in light of open data initiative	H	NP	In response to the Partner's concern about meeting the growing projected operational costs of LOJIC, several alternatives to achieve long-term sustainability were considered. License fees for LOJIC data and system access in comparison to fees in other multi-organizational GIS consortiaare quite low. LOJIC license fees have traditionally been set to encourage external organizations to adopt GIS technology to support their missions.	• Review of LOJIC of current and historical budget and revenue • National Survey responses providing information on revenue sources • Scoring for GISCMM items EC22, EC23
FI4: Prepare high-level business case for GIS and LOJIC services	H	NP	LOJIC has operated successfully for many years contributing to adoption of GIS as a core technology supporting needs of partner organizations. The GIS data, products, and services provided by LOJIC has become ingrained in routine business that the benefits it delivers are not always readily apparent to management personnel and staff not directly using GIS. LOJIC management and staff as well as GIS management and users in partner organizations have directed their efforts to developing tools and delivering quality products and services to users—not promoting benefits and positive impacts. This recommendation calls for preparation of a high-level business case document and executive briefing materials—drawing on information on system use and services maintained by the LOJIC staff and information gathered by the SI Team (self assessments, user surveys). This is a high-level document that succinctly conveys level of use, business impact and benefits, and opportunities.	• SI Team self assessments • Croswell-Schulte Focus Group Sessions and meeting with LOJIC and partner management • Need for improved awareness and engagement of executive leadership • National Survey underscoring the importance of senior management engagement

Recommendation ID and Name	Priority[1]	Status[2]	Description	References[3]
FI5: Evaluate and make decision on changes to current LOJIC fee schedule	H	AC	From the time when LOJIC was originally established, a planned revenue source was from the sales of GIS data and map products—with a basic principle that fees should be reasonable and that they should support LOJIC users. While product and service sales continue, volume of sales and revenue have decreased significantly in the last 5**** years—perhaps because there are more, sometimes public, sources of data and on-line mapping services (e.g., GoogleMaps). The decrease in sales volume and revenue is accompanied by a national trend toward lowering or eliminating fees for product/service sales—reflected locally by Metro's Open Data initiative. The recommendation is to gradually reduce and then eliminate fees for GIS data and standard product requests over a 2 or 3-year period. This should be accompanied by enhanced, on-line tools to automate requests and filling those requests. This recommendation for eliminating fees for data and products sales does not apply to license fees for which LOJIC should consider modest increases—along with enhanced services for licensee organizations. Also, this fee elimination does not apply to special project work involving LOJIC staff time and resources for special analysis, applications, and custom products. Current fees associated with special/custom project work should be reviewed as well and perhaps increased to fully reflect burdened personnel and administrative overhead costs.	• Observed trends showing decrease in revenue from LOJIC product/service sales • Open Data initiative led by Metro with interest by other LOJIC partners • National Survey showing trends toward Open Data and reducing or eliminating fees for product/service sales • Interest and ideas expressed in Croswell-Schulte Focus Group Sessions • Scoring for GISCMM EA17, EA21

[1]Priority categories are: Very High (**VH)**, High (**H**), Moderate (**M**), Low (**L**). This is a subjective categorization reflecting level of importance and the proposed timing for moving ahead with the recommended action.

[2]Status includes: No plans or action initiated (**NP**), Under active consideration (**AC**), Decision made and plan in place (**DP**), Action underway or already completed (**UC**).

[3]References: Reference sources giving evidence that support or justify the recommendation. Sources include: a) Work and documentation of the SI Team and LOJIC staff (including interviews, self-assessments, user surveys), b) Information in Croswell-Schulte assessment of LOJIC operations and user community (including documentation review, Focus Group sessions, other information gathering and assessment), c) Croswell-Schulte scoring using the URISA GIS Capability Maturity Model (GISCMM), d) National Surveys on multi-organizational GIS programs conducted by Croswell-Schulte, and e) External sources including documentation on industry trends, standards, and IT/GIS research.

3.3 POTENTIAL IMPACT AND BENEFIT FROM RECOMMENDED ACTIONS

Table 4 provides information on organizations that are impacted by the recommended actions described in Section 3.2 and expected benefits from these actions. Organization Impact uses the following codes:

- P=Primary (those organizations that are mainly affected by the action and which would see the most important results and benefits).
- S=Secondary (those organizations which would be affected by the action but for which there would be a smaller impact on operations or benefits).

Table 4: Potential Impact and Benefits for Recommended Actions

	Organizations Impacted[1]							
Recommendation Name	LOJIC Mgmnt and Staff	Metro	MSD	LWC	PVA	Licensees	External Users	**Expected Benefits**
Governance, Management Practices, and Service Delivery (GM)								
GM1: Re-state Policy Board mission, membership, and role	P	S	S	S	S			• More informed and engaged Policy Board with LOJIC better enabled to connect services with business needs of partner organizations • Improved efficiency in routine operations carried out by LOJIC staff
GM2: Create LOJIC Steering Committee	P	S	S	S	S			• Improved collaboration among partner organizations and communication with LOJIC management and staff • Ability to inform and support decision making of Policy Board • Organizational environment allow creation of work groups and task forces for special initiatives and projects (with participation of by any partner organization, licensee, or external user organization)
GM3: Prepare and ratify written agreements with LOJIC partners	P	S	S	S	S			• Increased organizational stability of LOJIC with focus in long-term viability • More clearly defined commitment level from partner organizations and service requirements from LOJIC staff • Improved services to LOJIC partners
GM4: Prepare Revised Strategic Plan	P	P	P	P	P	S	S	• Improved direction guiding short-term and long-term LOJIC operations and improvements • Provides efficient context for project prioritization, planning, and execution
GM5: Fill vacant positions within LOJIC and orient new staff members	P	S	S	S	S	S	S	• Increased capacity to undertake technology improvements (e.g., ArcGIS upgrade, IT infrastructure upgrades) • Improved support for users
GM6: Increase level of direct support by LOJIC staff for Metro users	P	P	S	S	S	S	S	• Expanded and more effective use of GIS in Metro departments addressing multiple business needs • New or enhanced applications in Metro also support business needs of other partners and licensees

Recommendation Name	Organizations Impacted[1]							Expected Benefits
	LOJIC Mgmnt and Staff	Metro	MSD	LWC	PVA	Licensees	External Users	
GM7: Support initiatives in Metro for improved organizational structure for GIS coordination	S	P						• More efficient GIS operations in Metro • Provides organizational environment for expansion/enhancement GIS applications and user community in Metro
GM8: Create and fill new LOJIC positions	P	S	S	S	S	S	S	• Improved ability for LOJIC to support ongoing operations • Increased capacity to increase level of user support and to handle special GIS projects
GM9: Establish formal project planning and management practices	P	P	P	P	P	S	S	• Consistent method to examine priority and resource requirements for decisions on new proposed projects • More effective, expedient process to initiate and resource new projects and initiatives
GM10: Provide enhanced training offerings and opportunities	P	P	P	P	P	S	S	• Improved skills of technical staff in LOJIC and partner organizations resulting in improved quality and service • More informed user base supporting effective and expended use of GIS
GM11: Identify certification programs and support staff to earn professional certifications	P	P	P	P	P			• Improved skills and capabilities of technical and management • Important element of overall professional development • Positive impact on morale
GM12: Reactivate LOJIC User Group	P	P	P	P	P	S	S	• Environment for sharing ideas and use of GIS and data supports collaboration • Improved opportunity for joint use of applications or data (avoid re-inventing the wheel) • Helps maintain LOJIC's identity and viability • Better informed uses through communication of news and keeping users aware of LOJIC development and industry trends
GM13: Plan and conduct regular brainstorm sessions focusing on solutions	P	P	P	P	P	S	S	• More focused way to identify key issues and opportunities as a basis for action
GM14: Create improved process and practice for documenting and communicating accomplishments	P	P	P	P	P	S	S	• Consistent method for documenting work to support future resource allocation planning and decisions • Basis for reporting on and promoting work of LOJIC staff and partner organizations to inform and engage management • Staff morale benefits
GM15: Explore and pursue opportunities for expanded user community in Jefferson County	P	P	P	P	P	P	P	• Improved ability to meet business needs of GIS users • More effective leveraging of GIS investments for real benefits for users
GM16: Preserve institutional knowledge by documenting GIS business processes	P	P	P	P	P			• Documentation ensures consistency and greater efficiency in GIS processes • Basis for efficient training and orientation of new employees • Provides basis for most effective business process revision or improvements

Recommendation Name	Organizations Impacted[1]							Expected Benefits
	LOJIC Mgmnt and Staff	Metro	MSD	LWC	PVA	Licensees	External Users	
GM17: Develop and execute branding and promotional strategy	P	S	S	S	S	P	P	• Improved communication of LOJIC services and resources increases opportunities for expanded user community • Increased awareness and support from senior management
GM18: Explore and pursue expanded service area and database	P	P	P	P		P	P	• Expanded database supports partner organizations' cross-county business needs (public safety, economic development, utility infrastructure and service planning and operations, drainage and flood control, etc.) • Economy of scale with cost reductions for aerial imagery/data acquisition and base mapping • Support for external users who have need for multi-county data and applications.
GM19: Revise GIS position descriptions and pay grade	P	S	S	S	S			• Better parity of compensation level among GIS and IT technical positions • Improved clarity of job requirements and duties • Improvements in recruitment of GIS technical staff with required skills
Technical Infrastructure, Software, and Systems Administration (TE)								
TE1a: Improve MSD IT server, network, and system administration	P	S	P	S	S			• Enhanced system and network performance (response time, crashes) • Environment for improved system, network, and database administration • Improved opportunities for Web-based applications and services and integration of GIS with external systems • Greater security
TE1b: Configure GIS software and database for optimal performance	P	P	P	P	P	S	S	• Makes most effective use of improved MSD IT infrastructure
TE2: ArcGIS software upgrade	P	P	P	P	P	P	S	• Adds functionality to support new and enhanced applications • Improved environment for integration of GIS with external systems and applications
TE3: Optimize mix of desktop GIS versus web users	P	P	P	P	P	P	S	• More efficient software license management • Web environment gives much better technical environment to expand user community
TE4: Define future role of ArcGIS Online	P	S	S	S	S	P	P	• Basis for planning and design of new applications • For some users, will provide better environment for application access
TE5: Integrate LOJIC Online Map with PVA Web GIS Service	P	S	S	S	P	P	P	• More efficient environment for Web-based users (those users making frequent use of LOJIC Online Map and PVA subscription services)
TE6: Upgrade to Infor/Hansen 8.3-with improved GIS integration	P	P	P					• Allows use of new functionality included in Hansen v 8.3 • Easier to maintain integration with GIS (with new GIS integration tools in Hansen v8.3)
TE7: Define standards for Field-based/Mobile GIS applications	P	P	P	P	P	P	P	• Supports most consistent and efficient basis for designing and implementing field/mobile applications • Helps open up opportunities for expanded field/mobile applications and user community

Recommendation Name	Organizations Impacted[1]							Expected Benefits
	LOJIC Mgmnt and Staff	Metro	MSD	LWC	PVA	Licensees	External Users	
TE8: Explore options and develop strategy for use of open source software	P	S	S	S	S	S	P	• Clarifies possible role of open source software for future applications and users • Potential software cost savings for specific applications in which open source software provides required functionality
TE9: Support PVA migration to new CAMA software with improved GIS integration	S				P	P	P	• Efficient, expedient deployment of new CAMA system with GIS integration for PVA users • Enhanced, up-to-date data for licensees and external users needed real property information
Enhanced or New Applications and Services (AP)								
AP1: Proactive examination and work on selected high-profile custom applications	P	P	P	P	P	S	S	• Delivers useful tools and information supporting important community programs and events • Increases awareness of LOJIC value by external users and senior management in partner organizations
AP2: Redesign and deploy enhanced LOJIC Web Site	P	P	P	S	S	P	P	• Enhanced ability for users to find LOJIC information and services. • Improved environment for deploying new applications and services (including mobile apps) • Basis for considerable expansion in user community • Supports efforts for enhanced branding and promotion of LOJIC
AP3: Improve functionality of the LOJIC Online Map	P	P	P	S	S	P	P	• Greater functionality and support for business needs of for frequent users—including high volume use by licensees and external users. • Basis for considerable expansion of Web-based user community
AP4: Explore connection with commercial, external Web mapping services.	P	P	P	P	P	P	P	• Expanded access to LOJIC services by frequent users of commercial applications (GoogleMaps) • Enhancement of LOJIC applications and services with connection to external Web services
AP5: Design, develop, and deploy new GIS applications for LOJIC participants	P	P	S	S	P			• Opportunity for greatly increased user community who need a simple, intuitive interface for routing GIS query and display—mainly for Metro users.
GIS Data Content, Maintenance and Access (DA)								
DA1: Prepare high-Level GIS data catalog and revise LOJIC metadata standards and policies	P	P	P	P	P	P	P	• Greatly improved and more efficient environment for managing data and metadata maintenance • Ease of use—more effective, quicker approach for users to find and access needed data
DA2: Increase frequency of parcel data transfer from PVA	P	P	S	S	P	P	P	• Improved service delivery to users requiring up-to-date real property data
DA3: Establish/enable broader access to Pictometry data for all LOJIC users	P	P	P	P	P	S		• Greatly expanded use by LOJIC partners for business needs making use of oblique imagery (e.g., public safety, inspection activities, urban planning) • Delivers full benefit from this ongoing investment

Recommendation Name	Organizations Impacted[1]: LOJIC Mgmnt and Staff	Metro	MSD	LWC	PVA	Licensees	External Users	Expected Benefits
DA4: Explore and pursue increased GIS data coverage outside of Jefferson County	P	P	P			P	P	• Expanded database supports partner organizations' cross-county business needs (public safety, economic development, utility infrastructure and service planning and operations, drainage and flood control, etc.) • Economy of scale with cost reductions for aerial imagery/data acquisition and base mapping • Support for external users who have need for multi-county data and applications.
DA5: GIS Support for MetroSafe dispatch and move to Next Gen 911	P	S				S	S	• Direct support for more effective, enhanced public safety response • More efficient (less labor intensive) approach for routine import of GIS data to CAD system
DA6: Create enhanced place name database	P	P	P	P	P	P	P	• Enhanced support for emergency dispatch personnel • Enhanced support for wide range of location-based services query and mapping
DA7: Explore and implement new applications for increased access to and use of DEM data	P	P	P	S	S	S	S	• Better leveraging of existing data and software tools for terrain visualization and analysis—including high-value applications for urban development and drainage analysis.
DA8: Examine restrictions on access and distribution of water utility data	P			P		P	P	• More flexible access to water utility data and use in additional applications
DA9: Examine and put in place protocol for use of UAV acquired data	P	P	P	P	P			• Readiness to make use of UAV-collected data for special projects
DA10: Develop 3-D urbanscape models	P	P	P	S	S	S	S	• Provides data for future high-value urban planning and construction projects requiring 3D data and supporting BIM practices
DA11: Integrate LOJIC Online map with KIPDA traffic volume stats	P	P					P	• Ease of access to data through LOJIC Online Map
DA12: Enhance GIS-based tree inventory database	P	P	S	S	S	S	S	• Provides database and tools for more effective management of a very valuable public resource
DA13: Examine possible role for high-resolution satellite imagery	P	P	P	P	P	P	P	• Possible cost savings and/or more frequent orthoimage data—may provide source as needed for up-to-date data acquired in-between scheduled aircraft acquisition • Provides data for specific hyperspectral and non-visible (infrared) wavelength bands to support special applications
DA14: Initiate and lead effort for statewide parcel data layer	S	S			P	S	P	• Provides consistent basis and saves time for cross-county parcel mapping and data access for local and statewide users
DA15: Enhanced access to building permit data	P	P				P		• Lower cost and time for getting access to and providing map-based query and display by a large number of users and applications requiring building-related data (economic development, Housing Authority, public health).
Funding Sources and Financial Management (FI)								

Recommendation Name	Organizations Impacted[1]: LOJIC Mgmnt and Staff	Metro	MSD	LWC	PVA	Licensees	External Users	Expected Benefits
FI1: Restructure monetary contribution levels from LOJIC partners	P	P	P	P	P			• Basis for long-term sustained financial health of LOJIC • Establishes more equitable formula for LOJIC support thereby creating basis for partner commitment and collaboration • Basis for improved support to partner organizations by LOJIC staff
FI2: Examine and put in place new sources for sustained funding.	P	P	P	P	P	P	P	• Improves financial stability and ability to address decreases revenue from product/service sales • Increased revenue to support new projects and expanded user community
FI3: Examine and consider restructuring of licensees and data/product fees in light of open data initiative	P	P				P	P	• Supports Open Data initiative through use of GIS tools to support access and delivery of data • Cuts down on staff time for responding to requests
FI4: Prepare high-level business case for GIS and LOJIC services	P	P	P	P	P			• Helps focus LOJIC management and partner organizations on high value services and projects • Gives Policy Board and senior management a concise picture of the business value and benefits of LOJIC
FI5: Evaluate and make decision on changes to current LOJIC fee schedule	P	S	S	S	S	P	P	• Supports Open Data initiative • Simplifies current management of responding to product requests and processing payment

[1]Codes for level of impact are: P=Primary (those organizations that are mainly affected by the action and which would see the most important results and benefits) and S=Secondary (those organizations which would be affected by the action but for which there would be a smaller impact on operations or benefits).

3.4 RESPONSIBILITY AND RESOURCE REQUIREMENTS

Table 5 is a resource matrix that shows the roles and responsibilities for key organizations and groups with involvement in work on recommended actions. The following role/responsibility codes are used in this table:

- L = Lead responsibility. In charge of planning, project tracking, delegation of work, coordination of participants, and completion of work.
- O = Oversight or Approval. Includes formal responsibility for approving plans, policies, budgets, and deliverables.
- R = Review and Comment. Participation through a review of deliverables or specifications and submittal of comments, recommendations, or suggested changes to deliverables.
- P = Participation/Support. General involvement or support, or other assistance in project tasks that may or may not include formal review and comment as in "R" above.

The last column of Table 5 also provides general estimates on staff time commitment and monetary costs with the following categories:

- Staff Time categories are: Low (0 to 50 hours), Moderate (50 to 400 hours), High (400 to 1000 hours), Very High (more than 1000 hours).
- Direct Cost includes expenditures for vendors, contractors, and other monetary costs with categories: Low (0 to $20,000), Moderate ($20,000 to $50,000), High ($50,000 to $200,000), Very High (more than $200,000).

Table 5: Responsibility and Resource Requirements for Recommendations Actions

Recommendation Name	Responsibilities[1]										Resource Requirements and Organization[2]
	LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	
Governance, Management Practices, and Service Delivery (GM)											
GM1: Re-state Policy Board mission, membership, and role	L	O,R				P	P	P	P		LOJIC Manager with current SI Team support and approval. Staff Time: Low Direct Cost: None
GM2: Create LOJIC Steering Committee	L	R				P	P	P	P		LOJIC Manager and current SI Team define structure, membership, and operating rules. Review and approval by Policy Board. Staff Time: Low Direct Cost: None
GM3: Prepare and ratify written agreements with LOJIC partners	L	O	P			P	P	P	P		LOJIC manager prepares draft for Steering Committee (or SI Team) review. Work with Policy Board for adoption. Staff Time: Low Direct Cost: None
GM4: Prepare Revised Strategic Plan	L	O,R	L			P	P	P	P		Form project team led by LOJIC Manager. Review, revision, and adoption by Policy Board. Staff Time: Moderate Direct Cost: Low
GM5: Fill vacant positions within LOJIC and orient new staff members	L	O									LOJIC Manager with staff support and approval by Policy Board. LOJIC staff time required for orientation. Staff Time: Low Direct Cost: None
GM6: Increase level of direct support by LOJIC staff for Metro users	L	R				L					Review needs in detail relative to LOJIC staff ability and Metro reimbursement level and formally allocate LOJIC staff time. Staff Time: High or Very High Direct Cost: Low or Moderate
GM7: Support initiatives in Metro for improved organizational structure for GIS coordination	P	O				L					Metro has lead role with support from LOJIC Manager and Steering Committee. Possible consultant support. Staff Time: Moderate Direct Cost: Low
GM8: Create and fill new LOJIC positions	L	O	P								LOJIC Manager with support from Steering Committee prepare proposal for Policy Board review and approval. Staff Time: Low Direct Cost: None
GM9: Establish formal project planning and management practices	P		R	L							LOJIC Manager with support and approval of Steering Committee prepare PM practices, templates, etc. Staff Time: Moderate Direct Cost: Low

Recommendation Name	Responsibilities[1]: LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	Resource Requirements and Organization[2]
GM10: Provide enhanced training offerings and opportunities	L		P		P	P	P	P	P	P	LOJIC staff, with Steering Committee and partner support, prepare training plan with new training options/offerings. Staff Time: High Direct Cost: Moderate
GM11: Identify certification programs and support staff to earn professional certifications	P	R	L		P	P	P	P	P		Steering Committee identify programs and procedures with input from partner organizations and review by Policy Board. Staff Time: Moderate (training plan). Need ongoing allocation of time for trainers and trainees. Direct Cost: Moderate (annual costs for vendor training programs)
GM12: Reactivate LOJIC User Group	P	R	L		P	P	P	P	P		New Steering Committee defines structure, membership, operating rules, and forms group. Staff Time: Moderate (formation of User Group). Ongoing allocation of time for organization of and participation in User Group activities Direct Cost: None
GM13: Plan and conduct regular brainstorm sessions focusing on solutions	L		L		P						Led by LOJIC Manager or Steering Committee Chair with participation of staff and users. Staff Time: Moderate Direct Cost: None
GM14: Create improved process and practice for documenting and communicating accomplishments	P		L		P	P	P	P	P		New Steering Committee prepare guidelines and practices (reflecting staff recognition programs currently in place in partner organizations). Managers in LOJIC and partner organizations put in place. Staff Time: Moderate Direct Cost: None
GM15: Explore and pursue opportunities for expanded user community in Jefferson County	L	R	P	P							LOJIC Manager has lead with support from Steering Committee and possibly a Project Team. Review/by Policy Board. Staff Time: Moderate Direct Cost: None
GM16: Preserve institutional knowledge by documenting GIS business processes	P,R		P	L	P	P	P	P	P		New Steering Committee prepare basic format and identify processes for documentation. LOJIC and partner staff prepare documentation. Staff Time: High Direct Cost: Low
GM17: Develop and execute branding and promotional strategy	P	O	P	L							Form Project Team to examine and prepare specific branding/marketing plan. Policy Board approves. LOJIC staff and partner organizations apply strategy. Staff Time: Moderate Direct Cost: Low

Recommendation Name	Responsibilities[1]: LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	Resource Requirements and Organization[2]
GM18: Explore and pursue expanded service area and database	L	R,O	L			P	P	P	P		LOJIC Manager leads with input from new Steering Committee. LOJIC Manager opens dialogue with other counties and works toward agreements. Policy Board reviews and approves. Staff Time: Moderate to High Direct Cost: None
GM19: Revise GIS position descriptions and pay grade	P	O	P				L				MSD has lead (part of ongoing position and compensation review). SI Team or new Steering Committee provides input. Staff Time: Moderate Direct Cost: Moderate (existing MSD consulting services)
Technical Infrastructure, Software, and Systems Administration (TE)											
TE1a: Improve MSD IT server, network, and system administration	P	R				P	L	P	P	P	MSD IT Department responsibility with contractor services. Staff Time: Very High Direct Cost: Very High
TE1b: Configure GIS software and database for optimal performance	L			P			L			P	LOJIC staff and possible GIS vendor/contractor support working with MSD IT Department. Staff Time: Moderate Direct Cost: Low
TE2: ArcGIS software upgrade	L		P	L			P				LOJIC staff with GIS vendor support. Staff Time: Moderate to High Direct Cost: Low
TE3: Optimize mix of desktop GIS versus web users	L		P				P				LOJIC staff work with MSD IT Department. Coordinated with TE1b. Staff Time: Low Direct Cost: Low
TE4: Define future role of ArcGIS Online	L		P		P						LOJIC staff lead with Steering Committee and User Group input. Staff Time: Moderate Direct Cost: Low
TE5: Integrate LOJIC Online Map with PVA Web GIS service	L		P						L		LOJIC and PVA staff define technical approach and carry out development and testing with possible contractor support. Staff Time: Moderate to High Direct Cost: Low to Moderate
TE6: Upgrade to Infor/Hansen 8.3-with improved GIS integration	L			P		P	L			P	Technical evaluation and design led by LOJIC Manager with project team—including main participation by MSD and Metro. Vendor and contractor role in implementation and deployment. Staff Time: Moderate Direct Cost: High
TE7: Define standards for Field-based/Mobile GIS applications	P		R,O	L	P					P	Assign project team to evaluate options and provide recommendations. Participation by LOJIC staff and User Group. Steering Committee reviews and adopts. Staff Time: Moderate Direct Cost: None

Recommendation Name	Responsibilities[1]: LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	Resource Requirements and Organization[2]
TE8: Explore options and develop strategy for use of open source software	P		R,O	L	P						Assign project team to evaluate options and provide recommendations. Participation by LOJIC staff and User Group. Steering Committee reviews and adopts Staff Time: Moderate Direct Cost: None
TE9: Support PVA migration to new CAMA software with improved GIS integration	P								L	P	PVA has lead with participation of LOJIC staff and support from GIS and CAMA vendors (Esri, E-Ring). Staff Time: High Direct Cost: High
Enhanced or New Applications and Services (AP)											
AP1: Proactive examination and work on selected high-profile custom applications	L		P	P	R	P	P	P	P		LOJIC Manager and staff have lead with input from Steering Committee and LOJIC partners. May also involve external support (e.g., community groups or businesses). Staff Time: High to Very High Direct Cost: Low to Moderate
AP2: Redesign and deploy enhanced LOJIC Web Site	L		R	P						P	Led by LOJIC Manager but work by a Project Team to review and recommend specifications for re-design. Majority of work carried out by Contractor. Staff Time: Moderate Direct Cost: Moderate
AP3: Improve functionality of the LOJIC Online Map	L		R	P						P	Led by LOJIC Manager but work by a Project Team to review and recommend specifications for functionality enhancements. Majority of work carried out by Contractor. Staff Time: Moderate Direct Cost: Moderate
AP4: Explore connection with commercial, external Web mapping services.	L		R	P						P	Led by LOJIC Manager but work by a Project Team to review and recommend actions. Staff Time: Moderate Direct Cost: Low
AP5: Design, develop, and deploy new GIS applications for LOJIC participants	P			P	P	L	L	L	L	P	Partner organizations take lead to prepare specifications for applications impacting them. Project Teams assembled when necessary. LOJIC staff participates in design and development with likely use of contracted services for development (depends on specific application). Staff Time: Moderate to Very High Direct Cost: Moderate to Very High
GIS Data Content, Maintenance and Access (DA)											

Recommendation Name	Responsibilities[1]: LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	Resource Requirements and Organization[2]
DA1: Prepare high-Level GIS data catalog and revise LOJIC metadata standards and policies	L		O	P	P						LOJIC Manager and staff have lead working with an assembled Project Team and Steering Committee. Possible support from Esri. Staff Time: High Direct Cost: Low
DA2: Increase frequency of parcel data transfer from PVA	L								L		LOJIC and PVA staff conclude work now underway and deploy improved data transfer process. Staff Time: Moderate Direct Cost: Low
DA3: Establish/enable broader access to Pictometry data for all LOJIC users	L	R,O	P						L		LOJIC Manager and PVA work out terms for access with Policy Board review and adoption. Work with Pictometry to put in place access. Staff Time: Moderate Direct Cost: Low
DA4: Explore and pursue increased GIS data coverage outside of Jefferson County	L	R,O	L			P	P	P	P		LOJIC Manager leads with input from new Steering Committee. LOJIC Manager opens dialogue with other counties and works toward agreements. Policy Board reviews and approves. Staff Time: Moderate to High Direct Cost: None
DA5: GIS Support for MetroSafe dispatch and move to Next Gen 911	P			P		L				P	Metro has lead with technical support from LOJIC staff and software vendors Staff Time: High Direct Cost: High
DA6: Create enhanced place name database	P		O	L		P					Project Team formed with Steering Committee oversight and involvement of key staff from Metro. LOJIC staff support in design and development. Staff Time: High Direct Cost: Low
DA7: Explore and implement new applications for increased access to and use of DEM data	P		O	L	P	P	P	P	P	P	Project Team formed to examine needs and opportunities and prepare recommendations. LOJIC participates in technical development with likely contractor support. Staff Time: High Direct Cost: Moderate
DA8: Examine restrictions on access and distribution of water utility data	P	O	P					L			LWC works with Steering Committee to evaluate issues and recommend possible policy changes. Policy Board adopts. LOJIC staff put in place recommended access changes. Staff Time: Moderate Direct Cost: None
DA9: Examine and put in place protocol for use of UAV acquired data	P		R,P	L						P	Project Team formed to evaluate status of technology and services and prepare protocol. Input from industry sources. Staff Time: Moderate Direct Cost: None

Recommendation Name	Responsibilities[1]: LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	Resource Requirements and Organization[2]
DA10: Develop 3-D urbanscape models	P			L		P	P			P	Project Team formed to evaluate status of technology and services and prepare protocol. Likely work with private firms (e.g., architects, land developers) to implement. Staff Time: High to Very High Direct Cost: Moderate to Very High
DA11: Integrate LOJIC Online map with KIPDA traffic volume stats	L		O	P							LOJIC staff take lead working with Project Team to evaluate requirements and prepare specifications. LOJIC works with KIPDA to integrate Web Services connections. Possible contracted services. Staff Time: Moderate. Direct Cost: Low to Moderate
DA12: Enhance GIS-based tree inventory database	P					L				P	Metro has lead (GIS staff and Metro Parks) to evaluate and prepare specifications. Mix of in-house and contracted staff for development. Possible use of community groups for data compilation. Staff Time: Moderate to High Direct Cost: Moderate
DA13: Examine possible role for high-resolution satellite imagery	P			L		P	P	P	P	P	Project teamed formed with participation by LOJIC staff and all partners to examine status and prepare recommendations. Input from product/service vendors. Staff Time: Low Direct Cost: Low
DA14: Initiate and lead effort for statewide parcel data layer	P		L	P					P		Steering Committee take lead and form Project Team with PVA participation. Prepare initial ideas and engage State GIS Office (COT) and Revenue Cabinet. LOJIC staff and PVAs in surrounding counties participate in prototype. Contracted services for prototype development Staff Time: High Direct Cost: High
DA15: Enhanced access to building permit data	P		O	L			L				New Steering Committee form Project Team (with Metro leadership) and oversee development of specifications and development. Contract services may be required for development work. Staff Time: High Direct Cost: Moderate to High
Funding Sources and Financial Management (FI)											
FI1: Restructure monetary contribution levels from LOJIC partners	L	O				P	P	P	P		LOJIC Manager has lead and Policy Board reviews and approves (with input by partner organizations). Staff Time: Low Direct Cost: None

	Responsibilities[1]										
Recommendation Name	LOJIC Mgmnt and Staff	Policy Board	New Steering Committee	Project Teams	New User Group	Metro Mgmnt and Staff	MSD Mgmnt and Staff	LWC Mgmnt and Staff	PVA Mgmnt and Staff	Vendors/ Contractors	**Resource Requirements and Organization[2]**
FI2: Examine and put in place new sources for sustained funding	L	R,O	P			P	P	P	P		LOJIC Manager takes lead and works with Steering Committee and partner organizations to explore options and make recommendations with review and adoption by Policy Board. Staff Time: Moderate to High Direct Cost: None
FI3: Examine and consider restructuring of licensees and data/product fees in light of open data initiative	L	O	P								LOJIC Manager takes lead and works with Steering Committee to make recommendations with review and adoption by Policy Board. Staff Time: Low to Moderate Direct Cost: None
FI4: Prepare high-level business case for GIS and LOJIC services	L	R	P			R	R	R	R		LOJIC Manager and staff take lead with input from Steering Committee and review by Policy Board and senior management in partner organizations. Staff Time: Moderate Direct Cost: Low
FI5: Evaluate and make decision on changes to current LOJIC fee schedule	L	O	P								Policy Board make decision based on proposal submitted by LOJIC Manager. Staff Time: Low Direct Cost: None

[1]Responsibility Types: L=Lead Responsibility, O=Oversight or Approval, R=Review and Comment, P=Participation/Support

[2]Staff Time categories are: Low (0 to 50 hours), Moderate (50 to 400 hours), High (400 to 1000 hours), Very High (more than 1000 hours). Direct Cost includes expenditures for vendors, contractors, and other monetary costs with categories: Low (0 to $20,000), Moderate ($20,000 to $50,000), High ($50,000 to $200,000), Very High (more than $200,000).

Many of the recommended actions described in Table 5 have interrelationships with other actions—influencing the timing and approach for implementation. Table 6 summarizes that main relationships and dependencies that must be taken into account.

Table 6: Relationships/Dependencies Among Recommended Actions

Recommendation Name	Relationships/Dependencies
Governance, Management Practices, and Service Delivery (GM)	
GM1: Re-state Policy Board mission, membership, and role	• Should precede GM3
GM2: Create LOJIC Steering Committee	• Coordinate with re-formed Policy Board (GM2) • Steering Committee reactivates User Group (GM12)
GM3: Prepare and ratify written agreements with LOJIC partners	• Dependent on GM2
GM4: Prepare Revised Strategic Plan	• Strategic Plan adopted by re-formed Policy Board (GM2)
GM5: Fill vacant positions within LOJIC and orient new staff members	NONE
GM6: Increase level of direct support by LOJIC staff for Metro users	• Coordinate with GIS organizational changes (GM6) • Supported by increased Metro reimbursement level (FI1)
GM7: Support initiatives in Metro for improved organizational structure for GIS coordination	• Coordinate with GM5

Recommendation Name	Relationships/Dependencies
GM8: Create and fill new LOJIC positions	• Dependent on additional funding and Policy Board approval • Supports MSD work on IT improvements (TE1a, TE1b)
GM9: Establish formal project planning and management practices	NONE
GM10: Provide enhanced training offerings and opportunities	• Coordinate with other professional development actions (GM1, GM7, GM11)
GM11: Identify certification programs and support staff to earn professional certifications	• Coordinate with training activities (GM10)
GM12: Reactivate LOJIC User Group	• Follows establishment of Steering Committee (GM8) • User Group participates and provides input for a number of recommended actions (see Table 5)
GM13: Plan and conduct regular brainstorm sessions focusing on solutions	NONE
GM14: Create improved process and practice for documenting and communicating accomplishments	• Formal activity occurs after formation of Steering Committee (GM8) • Coordinate with marketing and promotional activities (GM17)
GM15: Explore and pursue opportunities for expanded user community in Jefferson County	• May begin at any time but decisions require review by new Steering Committee (GM8) and re-newed Policy Board (GM2)
GM16: Preserve institutional knowledge by documenting GIS business processes	• Follows creation of Steering Committee (GM8)
GM17: Develop and execute branding and promotional strategy	• Follows creation of Steering Committee (GM8) • Coordinate with Web site enhancement work (AP2, AP3) • Coordinate with training programs (GM10) • Coordinate with communication of accomplishments (GM14)
GM18: Explore and pursue expanded service area and database	• Coordinate with DA4
GM19: Revise GIS position descriptions and pay grade	• Coordinate with MSD job classification review
Technical Infrastructure, Software, and Systems Administration (TE)	
TE1a: Improve MSD IT server, network, and system administration	• Coordinate with work under TE1b • Must precede LOJIC Website redesign and development (AP2, AP3) • Must precede major new or enhanced GIS application work (AP1, AP5)
TE1b: Configure GIS software and database for optimal performance	• Coordinate with work under TE1a • Must precede LOJIC Website redesign and development (AP2, AP3) • Must precede major new or enhanced GIS application work (AP1, AP5) • Coordinate with TE3
TE2: ArcGIS software upgrade	• Future upgrades (after ArcGIS 10.2 this year) will occur after IT upgrades and GIS configuration (TE1a, TE1b).
TE3: Optimize mix of desktop GIS versus web users	• Coordinate with TE1b
TE4: Define future role of ArcGIS Online	• Initiated any time after Steering Committee formation (GM8)
TE5: Integrate LOJIC Online Map with PVA Web GIS service	• Dependent on completion of IT infrastructure improvements (TE1a, TE1b)
TE6: Upgrade to Infor/Hansen 8.3-with improved GIS integration	• Dependent on completion of IT infrastructure improvements (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2) • Must acquire and install new Infor/Hansen version

Recommendation Name	Relationships/Dependencies
TE7: Define standards for Field-based/Mobile GIS applications	• Dependent on completion of IT infrastructure improvements (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2) • Coordinate with PVA CAMA system implementation (TE9) • Coordinate with any new field/mobile application development (AP5)
TE8: Explore options and develop strategy for use of open source software	• Dependent on completion of ArcGIS 10.2 upgrade (TE2)
TE9: Support PVA migration to new CAMA software with improved GIS integration	• Coordinate with development field/mobile device standards (TE7)
Enhanced or New Applications and Services (AP)	
AP1: Proactive examination and work on selected high-profile custom applications	• Follows creation of Steering Committee (G8) • Follows IT upgrades and ArcGIS 10.2 migration (TE1a, TE1b, TE2) • Coordinated with LOJIC Website improvements (AP2, AP3)
AP2: Redesign and deploy enhanced LOJIC Web Site	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with LOJIC Online Map improvements (AP3)
AP3: Improve functionality of the LOJIC Online Map	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with LOJIC Website improvements (AP2) and external Website connections (AP4)
AP4: Explore connection with commercial, external Web mapping services.	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with LOJIC Website improvements (AP2) and LOJIC Online Map improvements (AP3)
AP5: Design, develop, and deploy new GIS applications for LOJIC participants	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with LOJIC Website improvements (AP2) and LOJIC Online Map improvements (AP3)
GIS Data Content, Maintenance and Access (DA)	
DA1: Prepare high-Level GIS data catalog and revise LOJIC metadata standards and policies	• Can begin at any time but changes to metadata schema occurs after ArcGIS 10.2 upgrade (TE2)
DA2: Increase frequency of parcel data transfer from PVA	• Occurs after IT infrastructure upgrades (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2)
DA3: Establish/enable broader access to Pictometry data for all LOJIC users	• Can begin at any time but occurs after IT infrastructure upgrades (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2)
DA4: Explore and pursue increased GIS data coverage outside of Jefferson County	• Coordinate with GM18 • Needs to be in place before contracting for 2016 re-flight (ortho, LiDAR) • LOJIC and PVA Pictometry reflight should be coordinated (DA3)
DA5: GIS Support for MetroSafe dispatch and move to Next Gen 911	• Can begin at any time but occurs after IT infrastructure upgrades (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2) • Coordinate with enhanced place name database (DA6)
DA6: Create enhanced place name database	• Can begin at any time but occurs after IT infrastructure upgrades (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2) • Coordinate with Next Gen 911 work (DA5)
DA7: Explore and implement new applications for increased access to and use of DEM data	• Can begin at any time but occurs after IT infrastructure upgrades (TE1a, TE1b) and ArcGIS 10.2 upgrade (TE2) • Coordinate with related application development work (AP5) • Coordinate with possible future work on 3D models (DA10)

Recommendation Name	Relationships/Dependencies
DA8: Examine restrictions on access and distribution of water utility data	• Take into account policies from Metro Open Data initiative • Coordinate with enhancements to LOJIC Online Map (AP3) if LWC approves additional access
DA9: Examine and put in place protocol for use of UAV acquired data	• Follows any time after Steering Committee formation (GM8)
DA10: Develop 3-D urbanscape models	• Follows any time after Steering Committee formation (GM8) • May incorporate data and tools from DA7 • Likely dependent on participation of external partner
DA11: Integrate LOJIC Online map with KIPDA traffic volume stats	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with LOJIC Website improvements (AP2) and external Website connections (AP4)
DA12: Enhance GIS-based tree inventory database	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with related application development (AP5)
DA13: Examine possible role for high-resolution satellite imagery	• Follows IT infrastructure improvements (TE1a, TE1b) • Coordinate with PVA Pictometry data access (DA3) • Coordinate with expanded data coverage outside Jefferson County (DA4)
DA14: Initiate and lead effort for statewide parcel data layer	• Involves coordination with PVAs in multiple counties, State Revenue Cabinet, and State GIS Office (Commonwealth Office of Technology)
DA15: Enhanced access to building permit data	• Follows IT infrastructure improvements (TE1a, TE1b) • Follows ArcGIS 10.2 upgrade (TE2) • Coordinate with related application development (AP5)
Funding Sources and Financial Management (FI)	
FI1: Restructure monetary contribution levels from LOJIC partners	• Requires partner and Policy Board approval
FI2: Examine and put in place new sources for sustained funding.	• Follows creation of Steering Committee (GM8)
FI3: Examine and consider restructuring of licensees and data/product fees in light of open data initiative	• Follows creation of Steering Committee (GM8) • Coordinate with partner contribution restructuring (FI1) • Takes into account status of Metro Open Data Initiative
FI4: Prepare high-level business case for GIS and LOJIC services	NONE
FI5: Evaluate and make decision on changes to current LOJIC fee schedule	• Follows creation of Steering Committee (GM8) • Coordinate with partner contribution restructuring (FI1) and identification of new funding sources (FI2)

3.5 ELABORATION ON KEY RECOMMENDATIONS

3.5.1 Strategic Planning Approach

Strategic planning as applied to GIS programs may be defined as a disciplined effort to set a foundation and long-term direction for GIS program development and operations that address an organization's mission and business needs. Strategic plans (sometimes referred to as "master plans") for GIS programs should do the following:

- Show support for the missions, goals, and business drivers of participating organizations.

- Present comprehensive and long-term targets for GIS implementation and operation—giving an overall direction for all GIS implementation work and ongoing operations.
- Depict the role of the GIS within the entire organization and its information technology architecture.

GIS strategic plans vary in format, length, and content, depending on the needs and practices of specific organizations. The recommendation for LOJIC is to make it brief and concise with references as necessary to external documents (e.g., materials prepared as part of the SI initiative and Croswell-Schulte deliverables). Recommended components are explained below.

1. Current Situation and Organizational Context: A summary of the current business and organizational environment, system resources and standards, and status of GIS activities:

- Organization mission and goals
- Summary of current GIS management, activities, and program status
- Overview of technical resources and staff
- Organizational context, GIS users, and stakeholders

2. Strategic Foundation: Key pieces that provide a basis for action and create a picture of the end result to be achieved through this plan. This major part of the plan includes concise high-level goals and establishes a business justification for accomplishing those goals:

- LOJIC mission statement and missions of partners
- LOJIC governance structure and partner organizations (includes elements based on recommendations in this deliverable)
- Guiding principles and values
- Key business processes impacted by GIS
- High-level goals
- Critical success factors
- Business case justification summary

3. Strategic Initiatives: Elaborates on high-level goals and provides more specific information on particular actions to accomplish the goals. While still high-level, this part of the plan provides sufficient detail to define the nature of the work, the overall timing, and the resources necessary:

- Objectives or initiatives (related to high-level goals)
- General timing
- High-level budget and anticipated funding sources
- Major management and stakeholder roles and responsibility
- Performance measurement and monitoring.

3.5.2 Project Management Best Practices

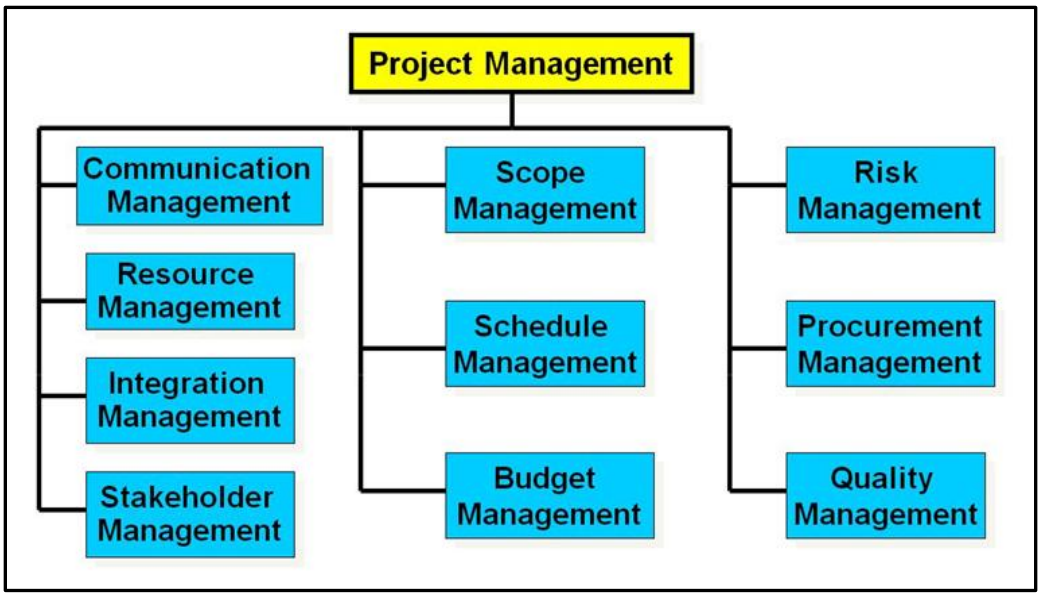
Recommended Action #GM9 calls for the creation of formal policies and template materials to guide key project management activities (e.g., planning, budgeting, assembling teams, delegating work, tracking progress, reporting on results). This includes preparation of an efficient and consistent format and process for the proposing and evaluating the priority of new projects to support decisions on resourcing and initiating new projects (see 3.5.8). The overall objective is to help focus work and resources on high priority activities and to carry out work in an optimized way—the most expedient and resource-effective approach that meets business/user needs. The recommended "LOJIC Project Management Best Practices" documentation takes into account current documented or undocumented practices shown to be effective with an appropriate application of practices and procedures defined in the *Project Management Body of Knowledge* (PMBOK), 5th edition from the Project Management Institute (www.pmi.org/PMBOK-Guide-and-Standards).

The PMI defines a "project" as, "temporary endeavor undertaken to create a unique product or service". This focuses on two key concepts—a project must have a clearly defined deliverable or outcome AND it must have a planned time period and completion point. The PMI defines, "project management" as, "the application of knowledge, skills, tools, and techniques to project activities to meet requirements". Sound, consistent project planning and management simply makes sense because it:

- Helps to put the project manager, team, and the organization in the best position to meet project objectives and deliver real results.
- Provides a structure that makes the best use of people, money, and resources.
- Establishes an effective means to anticipate and deal with changes and problems.
- Saves time, gives focus, and reduces confusion and misdirection that often accompanies poorly coordinated projects.
- Boosts the productivity, creativity, and morale of project team members.
- Helps to keep sustained support from senior management.

The PMI organizes project management practices, methods, and tools into the "knowledge areas" shown in Figure 2. Except for some, very simple, projects which are short and involve limited resources, there should be a consistent, inclusive planning and project execution approach that addresses all of the PMI Knowledge Areas.

Figure 2: Project Management Knowledge Areas (source: Project Management Institute)



Documented LOJIC project management practices, accompanied by sample documents, templates, and tools should be prepared and approved by the Steering Committee. A summary of the topics to be covered the documented project planning and management practices are summarized in Table 7.

Table 7: High-Level Summary of Project Planning and Management Best Practices

Project Management Best Practice	Description
Have consistent process for project scoping, prioritizing, and approval	Use consistent format and approach for initial scoping of proposed new projects that provides a clear picture of project approach, outcomes, resource needs, and priority. This allows an individual or team to present a potential project for review and approval before the expenditure of major funds or staff time. It gives a basis for management approval and resource assignment. See 3.5.3 for suggested format.
Assign project manager, team, and identify stakeholders	Early in the project planning process, assign one project manager—a person with the necessary technical, subject area, and management skills to take the lead on detailed planning and project execution. Assign competent team members (which may include contracted personnel) with specific project roles. Clearly define the wider stakeholder community—organizations and individuals that will: a) contribute to the project, b) may be the end "customers" or users, c) provide management oversight, or d) will have a deliverable review or approval role.
Prepare effective, comprehensive project plan	Prepare a detailed plan that includes tasks (and associated subtasks), task relationships, timing, and task responsibilities (people and/or organizations). For most projects, it is recommended that project management software be used in this planning stage (e.g., Microsoft Project).
Define deliverables	Clearly define the project outcomes and deliverables and associate these with tasks in the project plan. The way in which deliverables are defined will depend on the specific project and types of deliverables (e.g., database product, deployed application, technical document, etc.) but it is important to include information on format, content, functionality, performance, and quality. To the greatest extent possible, identify specific standards and "metrics" that can be used for deliverable review and acceptance (confirming that they meet specifications).
Accurate estimation of cost and resources	Project resources include: a) people's time (project team and other stakeholder time expressed in hours or person-days), b) monetary costs expressed in dollars, and c) specific equipment or tangible products required (e.g., computer hardware or software). Research the project sufficiently to prepare an accurate estimate and include a contingency to address potential risk impacts. Then, put in place an efficient process to monitor resource use (compared with work progress) throughout project execution.

Project Management Best Practice	Description
Establish and maintain senior management understanding and support	Garnering senior management support is essential and begins early in the project scoping and approval. When appropriate, a "project champion" (a senior official with interest, influence, and resource allocation authority) should be engaged. It may be useful to enlist a "project oversight body" for major projects (a committee or board with senior management charged with formal oversight and ensuring the project proceeds properly. Regular briefings and reporting to this person and other senior management should occur throughout the project. The PMI also recommends preparation of a Project Charter (formal document that establishes a commitment of participation and support by key stakeholders). While Charters are not always appropriate, they should be considered for major projects lasting more than months and requiring significant staff time and/or costs.
Monitor and communicate progress	Project monitoring and communication is a necessary aspect of project execution. Monitoring is the main responsibility of the Project Manager to have a continual picture of the status of project work, deliverable preparation, and all project conditions impacting work and productivity. Communication uses multiple channels to convey information about project status and accomplishments to multiple stakeholders (management, team, other stakeholders). As an "overhead activity", project monitoring and communication should use appropriate tools and templates to make it efficient. This means use of project management software, creation of status report templates that can easily by populated with current project information, and use of automated tools for delivery of information (well-organized in-person ad remote meetings, Web-based project portals, Web-based collaboration and meeting tools, tools, social media). Effective communication means focusing the message on the specific audience—adjusting the delivery approach and level of detail for a particular stakeholder group (high-level and low detail status reports for management as opposed to more detailed reports for team members).
Effective team management	Beginning with recruitment of team members with appropriate experience and competencies as well as clear definition of team member roles at the task level (in the project plan), team member management has a number of elements that all contribute to high-productivity, effective stakeholder management, and morale. Effective team management includes: a) effective delegation of work with clear definition of expectations, b) addressing team synergies in a way that promotes teamwork and useful interaction on project work, c) effective oversight and monitoring without "micro-management", d) making sure that team members are provided with the necessary resources, tools, and special training, and e) formal and informal recognition of accomplishments, f) well-organized meetings and brainstorm sessions on project topics.
Effective meeting management	Use of meeting preparation and execution practices that make the best use of time and resources. Meeting preparation should include a documented purpose and agenda distributed to appropriate attendees prior to the meeting along with any other meeting materials and directions to attendees on their preparation. Invite those individuals whose participation is important but avoid invitations to others whose role is not associated with the meeting topic. Use remote meeting tools (conference calls and Web-based meeting tools) when appropriate. Moderate the meeting by engaging participants, listening, capturing key information, and keeping the meeting on topic and within the stated time period. Close the meeting with a summary of results and action items and a thank you too participants. Soon after the meeting close, transmit (email) a meeting summary and identification of actions (with responsible parties and dates noted).
Don't gold-plate and manage project changes	The PMI makes a point about avoiding "gold-plating"—informally adding tasks, deliverable features, or other changes to scope that deviate from the project plan. This is common in many projects but should be avoided because there are always impacts to the project timing, resource requirements, and quality of the outcomes or deliverables. Project conditions and requirements which impact the project may change during the course of execution. If they do, possible changes to the project schedule, team, deliverable specifications, and resource requirements should be assessed and then formally approved (or rejected). If changes are approved, these should be communicated to the project team and all stakeholders. If contracted entities are involved there may be a need for formal contract amendments or change orders.
Identify potential risks and manage risk events	The PMI's definition of "risk management" is, "systematic process of identifying, analyzing, and responding to project risk". "Project risks" are, "potential events or conditions that cannot be fully predicted and which may have an impact on the schedule, cost, quality, or overall scope". For projects involving a significant resources and having a high priority, formal risk assessment and management is a recommended best practice. During project planning, this includes: a) preparation of a "risk identification matrix"—description of potential risks, triggers, potential impacts, and probability and b) risk response strategies (avoidance, mitigation, transference). During the project, status should be monitored so that risk events can be identified early and an appropriate risk response strategy can be employed before significant negative impacts have occurred.
Deliverable quality control and quality assurance checks	With a clear definition of deliverable specifications (e.g., content, format, quality, performance) the project should have effective procedures and tools for quality control (QC) during development and quality assurance (QA) checks as part of final deliverable acceptance. The specific types of QC and QA procedures and tools will depend on the type of deliverables and their specifications but typically will involve manual and automated steps with a clear path to acceptance or rejection of deliverables.

Project Management Best Practice	Description
Celebrate and communicate accomplishments	The project should plan for and ways to celebrate and communicate accomplishments—completion of project milestones and deliverables. Accomplishments are identified in formal status reports but other communication channels can be used—announcements on the organization's Web page, organization newsletters, press releases, and at organization meetings. At key points in the project, and organization manager or project manager may conduct events in which project teams and individual team members are recognized—perhaps with some type of award. Finally, the successful completion of major projects or project milestones may be presented in a paper or presentation at a professional association conference, publication, or Website.

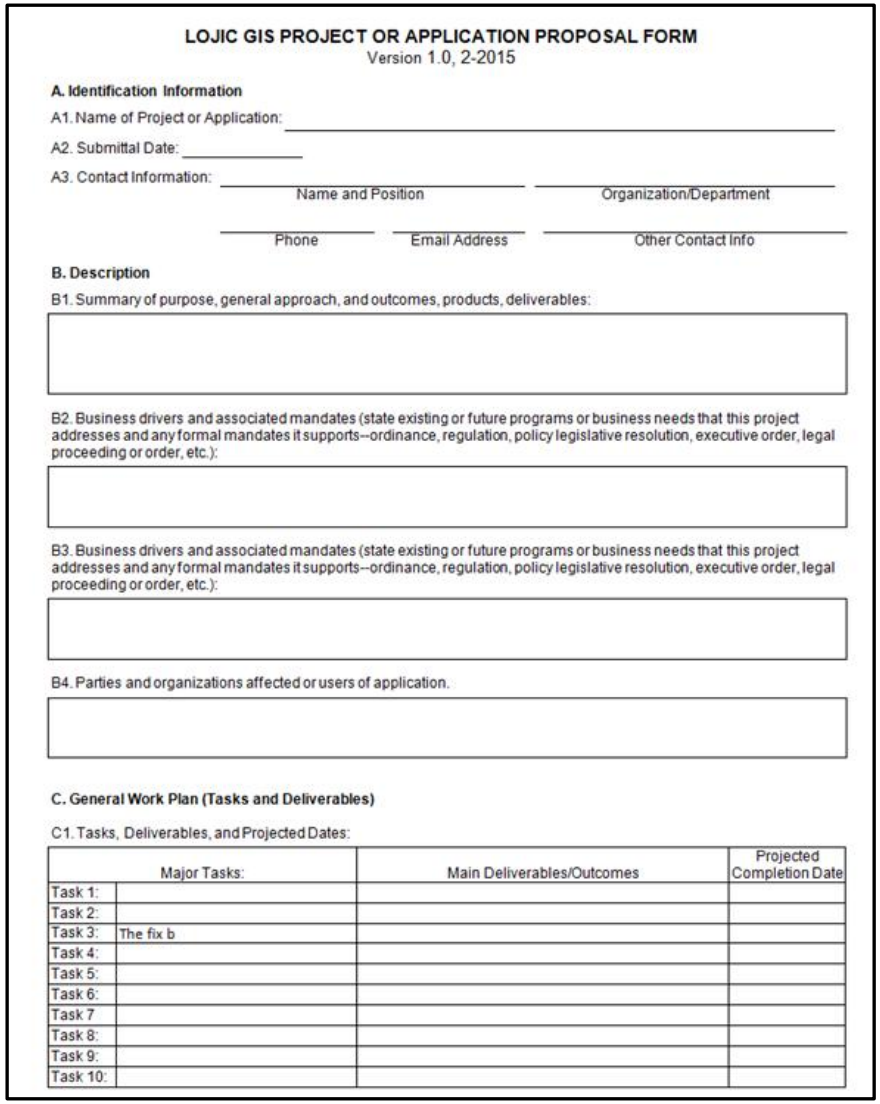
In addition to the PMI's PMBOK, two other sources to consultant include:

- *Information Technology Project Management*, 7th Edition, 2013, ISBN: 978-1285847092.
- *The GIS Management Handbook*, 2009, ISBN: 978-0982409305 (see Chapter 9).

3.5.3 Sample Template for New Application/Project Scoping

Recommended Action #GM9 suggests that LOJIC put in place more systematic project planning and management procedures. Part of this involves a consistent process for proposing new projects (including new or enhanced applications) and making an expedient decision to move ahead with the project, reject it, or indicate another action (e.g., delay decision for specific time period). This is a step in the process of project approval, getting necessary management approval, and allocating necessary staff time or monetary resources. For all significant GIS-related projects, this form would be completed by an individual (assumed to be a management or staff person on the LOJIC staff or in a LOJIC Partner organization). The individual completing this form will have done a preliminary investigation and scoping and a high-level assessment of needs and interest. The completed form will be submitted to the LOJIC Steering Committee followed by a review by Committee members (which includes the LOJIC Manager). This review may trigger review comments and revisions by the submitter. The revised form will be submitted again to the Steering Committee and members will complete the proposal review portion of the form (Part F) and then it will be forwarded to the LOJIC Policy Board and any other management personnel identified for the specific proposal. The results of the review process will dictate the action to be taken—rejection, postponement, proceed with project (or identify funding source). Figure 3 shows this suggested form, a fillable version of which is included in Appendix A.

Figure 3: LOJIC GIS Project/Applications Proposal Form
(see Appendix A for a fillable Word .doc form)



LOJIC GIS PROJECT OR APPLICATION PROPOSAL FORM
Version 1.0, 2-2015

A. Identification Information

A1. Name of Project or Application: _____

A2. Submittal Date: _____

A3. Contact Information: _____ _____
Name and Position Organization/Department

_____ _____ _____
Phone Email Address Other Contact Info

B. Description

B1. Summary of purpose, general approach, and outcomes, products, deliverables:

B2. Business drivers and associated mandates (state existing or future programs or business needs that this project addresses and any formal mandates it supports--ordinance, regulation, policy legislative resolution, executive order, legal proceeding or order, etc.):

B3. Business drivers and associated mandates (state existing or future programs or business needs that this project addresses and any formal mandates it supports--ordinance, regulation, policy legislative resolution, executive order, legal proceeding or order, etc.):

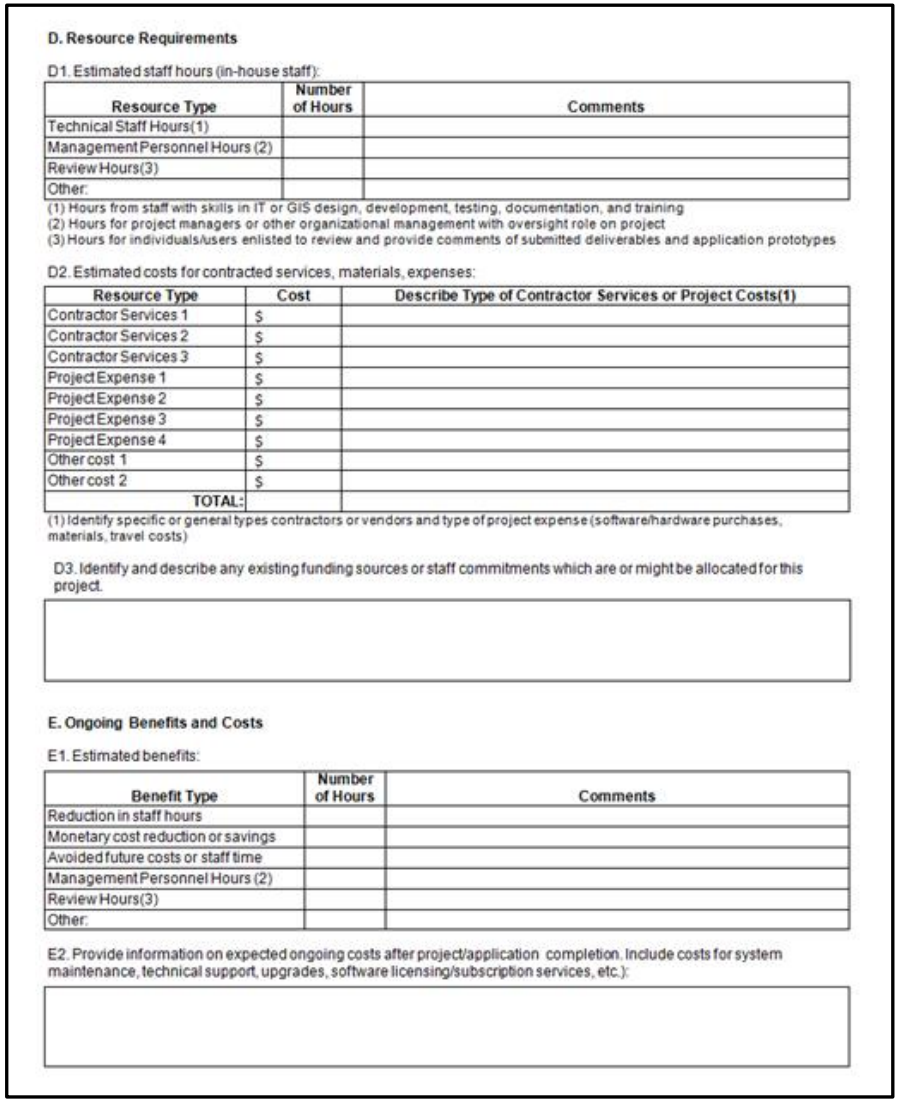
B4. Parties and organizations affected or users of application.

C. General Work Plan (Tasks and Deliverables)

C1. Tasks, Deliverables, and Projected Dates:

Major Tasks:		Main Deliverables/Outcomes	Projected Completion Date
Task 1:			
Task 2:			
Task 3:	The fix b		
Task 4:			
Task 5:			
Task 6:			
Task 7			
Task 8:			
Task 9:			
Task 10:			

Project Proposal Form—Page 1



D. Resource Requirements

D1. Estimated staff hours (in-house staff):

Resource Type	Number of Hours	Comments
Technical Staff Hours(1)		
Management Personnel Hours (2)		
Review Hours(3)		
Other:		

(1) Hours from staff with skills in IT or GIS design, development, testing, documentation, and training
(2) Hours for project managers or other organizational management with oversight role on project
(3) Hours for individuals/users enlisted to review and provide comments of submitted deliverables and application prototypes

D2. Estimated costs for contracted services, materials, expenses:

Resource Type	Cost	Describe Type of Contractor Services or Project Costs(1)
Contractor Services 1	$	
Contractor Services 2	$	
Contractor Services 3	$	
Project Expense 1	$	
Project Expense 2	$	
Project Expense 3	$	
Project Expense 4	$	
Other cost 1	$	
Other cost 2	$	
TOTAL:		

(1) Identify specific or general types contractors or vendors and type of project expense (software/hardware purchases, materials, travel costs)

D3. Identify and describe any existing funding sources or staff commitments which are or might be allocated for this project.

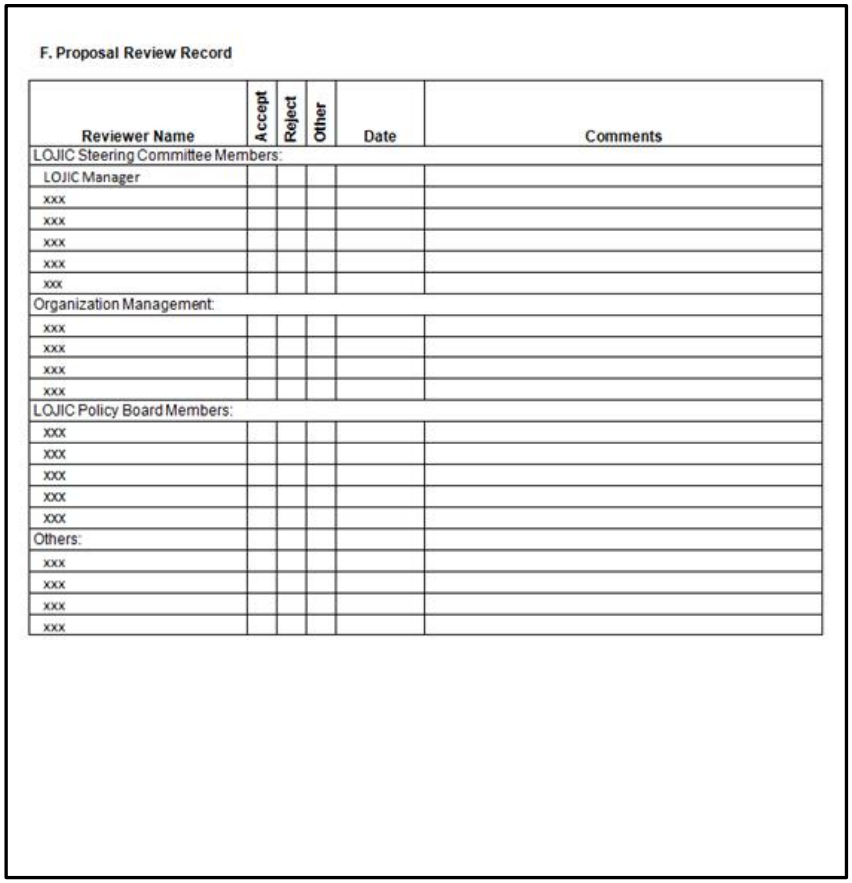
E. Ongoing Benefits and Costs

E1. Estimated benefits:

Benefit Type	Number of Hours	Comments
Reduction in staff hours		
Monetary cost reduction or savings		
Avoided future costs or staff time		
Management Personnel Hours (2)		
Review Hours(3)		
Other:		

E2. Provide information on expected ongoing costs after project/application completion. Include costs for system maintenance, technical support, upgrades, software licensing/subscription services, etc.):

Project Proposal Form—Page 2



F. Proposal Review Record

Reviewer Name	Accept	Reject	Other	Date	Comments
LOJIC Steering Committee Members:					
LOJIC Manager					
xxx					
xxx					
xxx					
xxx					
xxx					
Organization Management:					
xxx					
xxx					
xxx					
xxx					
LOJIC Policy Board Members:					
xxx					
xxx					
xxx					
xxx					
xxx					
Others:					
xxx					
xxx					
xxx					
xxx					

Project Proposal Form—Page 3

3.5.4 LOJIC Branding and Promotion

Recommended Action #GM17 suggests that LOJIC (LOJIC Manager, staff and partner organizations) pursue more active promotion of LOJIC services. This encompasses the concept of "branding", a marketing term that means the creation and communicating of a recognizable name and identity that represents and product or service. LOJIC has already addressed branding in creation of a logo and use of that log on the LOJIC Website and map products. But with the main exception of its training offerings and information delivered on its Website, there has been little active promotion of the LOJIC "brand". It should be emphasized that embarking on a more active marketing and promotional campaign, is not an end in itself or done for reasons of aggrandizement. More active promotion has a very specific objective—to increase the awareness of LOJIC and convey how its products and services can meet the needs of, and deliver benefits to, a broader user community. A LOJIC promotional campaign is the public face of a comprehensive, robust, and high-quality set of products and services.

Possible promotional strategies are:

- Affixing the logo and slogan to all project materials, the Web site, and other channels for delivering information.
- Use multiple local and regional media channels (newsletters and Websites of partner organizations, trade publications, newspapers, etc.) for local and regional publications and news to convey information about LOJIC, LOJIC partner use of GIS technology and LOJIC services, major project accomplishments.
- Produce and stock appealing promotional items with the program logo (e.g., buttons, luggage tags, zipper pulls, compass balls, bookmarks, mouse pads, etc.) for distribution at events where the GIS is featured. Avoid selecting expensive items, and choose those that will be appealing to audiences and used in environments where they would likely receive additional exposure.
- Devise an awards/recognition program, perhaps in association with other GIS organizations or bodies, where individuals or organizations can be formally recognized for accomplishments that contribute to the GIS program and user community. Conduct and promote awards ceremonies in conjunction with special events.
- Preparing a musical introduction or sound cues that could be used in presentations. This would be a short but memorable "sound bite" that, after some use, people would associate with the GIS program.

Recommendation #GM17 calls for additional brainstorming and identification of specific promotional activities, coordinated with other activities including LOJIC Website improvements. The SI Team (or new Steering Committee as called for in Recommended Action #GM8), with support from other resources available to partner organizations (e.g., trainers and public relations personnel), should pursue this as soon as possible.

3.5.5 GIS Position Classifications and Compensation Level

The 2014 *URISA GIS Position and Salary Survey Report* provides recent information on GIS positions and compensation levels based on survey results from 521 respondents representing the following GIS position types:

- GIS Manager, 21% of responses
- GIS Coordinator, 15% of responses
- GIS Specialist, 13% of responses
- GIS Data Analyst, 24% of responses
- GIS Technician, 7% of responses
- GIS Systems Software Analyst/Programmer, 5% of responses
- Director of GIS/Geographic Information Officer (GIO), 5% of responses
- Other, 10%

The majority of the responses were from local and state/provincial government organizations and public utilities. Among respondents in these organization types, the average annual compensation level (for all GIS positions) was about $80,000 which represents an increase of over 20% from the 2010 survey. Annual compensation reported by GIS management positions (GIO, GIS Manager) was about $100,000. Average compensation for GIS Software Analyst/Programmers was about $85,000 and about $75,000 for GIS Specialist and GIS Data Analyst positions. The annual compensation for GIS Technicians was $50,000.

An advanced copy of this URISA publication has been provided to the SI Team. A final version should be released by URISA by the end of March, 2015.

3.5.6 ArcGIS Software Upgrade

Recommended Action #TE2 is for a migration of ArcGIS software to more recent releases. This includes completion of the current migration in progress (from ArcGIS v10.0 to v10.2). Plans should be put in place for a future migration to ArcGIS v10.3. This version has substantial technical improvements and enhancements from the current version being used by LOJIC and its partners. ArcGIS 10.3 includes a variety of useful applications, tools and enhancements from previous versions. Some of the new features include, but are not limited to:

- ArcGIS Pro – a new application that changes the graphical user interface (GUI) making GIS easier to use and learn. Using 64bit architecture, the geoprocessing speed is enhanced compared to ArcMAP. ArcGIS Pro also enables to users to edit and visualize data in 2D and 3D simultaneously and publish to ArcGIS online or Portal.
- Server – ArcGIS for Server is now a complete Web GIS suite of applications hosted by Esri. Organizations can now provide Web GIS within their infrastructure making it possible for users within the organization to leverage GIS.
- Embedding – The ability to allow embedding of maps has been enhanced. Map Options now include various themes, base map selector options, legend panels and navigation controls.

- Portal ArcGIS for Server has a configurable front end that makes it easy to find and use maps, giving it the same Web GIS capabilities as online while being able to connect to various ArcGIS applications such as Explorer, Collector and Operations Dashboard. The portal for ArcGIS Server broadens the ability to use maps and GIS externally and within the organization. Spatial analysis and mapping is enhanced and accessible for both experienced and inexperienced GIS users. Portal can provide a way for users to acquire data via a simple clean web portal (can be used for open data).
- Streaming Data - Streaming feature layers are now supported and stream data in real-time.
- Collector for ArcGIS (Mobile Devices) – Gives the ability to extend ArcGIS into the field, improve accuracy, and update spatial data on the fly. Users have the ability to collect data while connected or offline.
- Web AppBuilder – includes customizable themes, widgets and enhanced tools for creating web based mapping applications useable on desktop and mobile devices. AppBuilder incorporates tools for geoprocessing for advanced spatial analysis capabilities for ArcGIS Server.

To support the migration, a Work Team, led by a LOJIC staff person and including individuals from each of the partner organizations, should be formed. Contracted technical services should be considered to support the migration. The LOJIC Manager will oversee the migration. A plan should be prepared addressing all aspects of the migration (software configuration, modifications of custom applications ArcSDE connections, transition from current version, etc.). This migration should be coordinated with major IT infrastructure and system administration changes in progress in the MSD IT Department with an evaluation of software compatibility with other software packages that must be integrated with GIS. An estimate for the timing of this ArcGIS v10.3 migration would be a start in the first quarter of 2017. This would include any service packs or revisions issued by Esri after the 2014 release.

3.5.7 ArcGIS Online Information

ArcGIS Online (AGOL) is Esri's open cloud platform for GIS organizations to web-enable their maps and related geographic information for sharing with their users. ArcGIS Online includes tools for geospatial content management, simple web mapping, and ultimately a full GIS running in a hosted cloud platform provided by ArcGIS. This technology includes some online content—hosted base maps for web, mobile, desktop, and server deployment. It enables users to upload and share their datasets (shape files, spreadsheets, map packages, web maps), provides a common catalog for LOJIC Web Page referencing online maps and geo services, and has tools for organizing shared content into groups for both secure management and organizational purposes. Other system capabilities include being able to easily create maps from your own non-GIS data. Esri is making continual enhancements to AGOL, a range of applications that work with this service, and Esri is actively promoting AGOL use by organizations and as a platform for public access. The cost for AGOL services, in the form of online credits, is evolving. It is not possible to make any accurate projections on the cost of AGOL for LOJIC and if the current Esri enterprise software license would include needed AGOL credits. This cost is a negotiation item after future decisions are made about the level of AGOL use.

3.5.8 Open GIS Software

Definition—Free and Open Source Software

The term "Open Source" is a general description of a class of software products with a licensing scheme that allows unrestricted use and modification of the software by anyone. In general, software modifications made to an open source software product by a user are also made available and shared. A basic principle of open source software is that it remains vendor neutral. While not all open source software is free of cost, there is typically low or no cost—supporting the basic principles of open use and share-ability. This has given rise to the term "Free and Open Source Software" (FOSS) which is often used to characterize open source software products. Open Source software is contrasted with proprietary software from commercial vendors or other organization involving products that have restrictions on use, modification, and distribution (and often substantial cost).

Terms for use and modification of open source software have been prepared by a number of organizations but the most prominent ones are:

- Open Source Initiative (OSI): The OSI has prepared the "open source definition" (http://opensource.org/definition) which provides basic terms for software use, modification, and access. See www.opensource.org.
- The Open Group (OSF): A vendor consortium (formerly the Open Software Foundation), began in the 1980s as a basis for implementation of UNIX operating systems. It has expanded to encompass a wide range of information technology standards that support the interoperability of software and systems. See http://opengroup.org/.
- Free Software Foundation (FSF): FSF is a not-for-profit organization to promote the development and use of free and open software. This group has prepared a "free software definition" and is a main supporter of the GNU operating system (open and free variant of UNIX) software and tools. See http://www.fsf.org/.
- Open Source Software Institute (OSSI): A not-for-profit organization with a mission to promote the development and implementation of open-source software solutions within U.S. Federal, state and municipal government agencies. OSSI was established in 2000 and has focused on strategic initiatives to promote the adoption of open source within US Department of Defense and Department of Homeland Security. See http://oss-institute.org.

There are dozens of organizations that support and promote open source software licensing terms that reflect the basic principles espoused by the OSI, FSF, and OSSI but which may add or modify terms for specific types of software and user communities.

Status of Open Source Software and Reasons for Use

There has been an open source software movement for more than 30 years and the community of software developers willing to adhere to open source licensing terms has steadily grown. The basic arguments in support of open source software use are:

- Software reliability and quality: The users of open-source are treated like co-developers and so they should have access to the source code of the software. Furthermore users are encouraged to submit additions to the software, code fixes for the software, bug reports,

documentation, etc. Having more co-developers increases the rate at which the software evolves and, theoretically at least, quality and functionality should improve on a rapid cycle, not dependent on a specific software vendor.

- Unrestricted Use: Unlike proprietary software, no restriction on the number of users who can use the software or fields of endeavor in which software can be used.
- Low Cost: Open source software is often free of cost or available at low costs---for software license purchase and ongoing maintenance.
- No Supplier Lock-in: Lack of dependence on a particular supplier due to proprietary restrictions may be reduced by the use of open source software, which can be operated and maintained by multiple vendors.
- Interoperability, Audit ability & Integration: In a general sense, open source software is often better at adhering to open standards than proprietary software—although it should be noted that many vendor proprietary software packages do comply with specifications from multiple standards organizations. But open source licensing terms ensure that software specifically promote vendor neutrality and interoperability with other software and IT systems.

Today, there are a wide range of open source software packages covering many topic areas. There are open source software packages that address operating system and system administration utilities, software development tools, a wide range of special purpose utilities (e.g., file/image viewing, database management (e.g., MySQL, PostgreSQL), and many specific business and application areas including Office software functions (e.g., Open Office), document/content management, financial management, computer-aided design, and many others. A fairly comprehensive directory of open source software can be found at www.opensourcesoftwaredirectory.com.

Open Source GIS Software

There are a significant number of open source GIS software packages currently available. In preparation of this report, no recent survey was found that characterizes size and characteristics of the open source GIS software user community. It is clear however that the number of users and frequency of use of open source GIIS software products is significantly below that of proprietary software products from such vendors as Esri, Intergraph, Autodesk, and others. Types of open source GIS software may be categorized as follows:

- Desktop GIS
- Server/Web-based GIS software
- Web browser plugins and apps for office and field/mobile devices
- Remote sensing and aerial image analysis software
- Other application-specific mapping and geographic analysis software

This report does not include a comprehensive survey of open source GIS software but Table 8 identifies some of the more prominent packages. Most of these software packages are available with no license costs and have well-organized communities of users and developers that maintain the software and provide user support.

Table 8: Identification of Selected Open Source GIS Software

	Open Source GIOS Software Category					
Software Product	Desktop GIS	Server/Web-based	Web Browser Plug-ins/ Mobile Device Apps	Remote Sensing/ Image Analysis	Other Application Specific	**Comments/Web Link**
GeoMobile for ArcGIS			X			http://www.webmapsolutions.com/free-mobile-arcgis-viewer-upgraded
GeoMOOSE			X			www.geomoose.org
GeoServer		X				www.geoserver.org
GeoTools					X	www.geotools.org
GRASS	X	X		X		http://grass.osgeo.org/. Originally developed by the U.S. Army Construction Engineering Research Laboratories (CERL) now supported by a non-profit group that is part of OSGeo.
gvSIG	X		X			http://www.gvsig.com
ImageJ				X		http://rsbweb.nih.gov/ij/)
KOSMO	X					www.opengis.es/
Map Server		X				http://mapserver.org. Developed by the University of Minnesota and now maintained by an independent community of users.
MapBender	X					http://mapbender3.org/
MapBuilder			X			http://communitymapbuilder.osgeo.org/
MapFish			X			http://www.mapfish.org/
MapGuide		X	X			Developed originally by AutoDesk as proprietary product but now adheres to OSGeo license terms
MapWindows	X					http://www.mapwindow.org/
Marble	X		X		X	https://marble.kde.org/
OpenLayers	X		X			http://openlayers.org/
Optiks				X		http://opticks.org
OSSIM				X		(www.ossim.org)
PostGIS	X		X			Spatial extender for the open source PostgreSQL database management software.
Quantumn GIS (QGIS)	X	X				www.qgis.org
SAGA GIS	X				X	http://www.saga-gis.org/
Space-Time Analysis of Regional Systems (STARS)					X	http://regionalanalysislab.org/index.php/Main/STARS
Udig	X					http://udig.refractions.net
Client-Side Plug-ins for Web Browsers from GIS software vendors			X		X	Some GIS software vendors provide free plugins allowing certain GIS query, viewing, and map display functions for Web-browsers for desktop or mobile devices. While not Open Software strictly speaking. They are included here because they are free (for individual use) and generally provide tools for accessing GIS data in multiple formats. (e.g., ArcExplorer).

In addition to the software packages described in the table above, there is another class of open source software that occupies an important niche in Web-based mapping services. These are server-based and client side applications that provide tools for mapping and GIS applications with access to open GIS data sources. Two such products are worthy of note are Mapbox (www.mapbox.com) and CartoDB (www.cartodb.com). These services have been characterized as alternatives to the

Google Maps Engine. There are a significant number of commercial and open source Web services that make use of the tools in Mapbox and CartoDB for mapping applications.

More information about open source GIS software is available from the Open Source Geospatial Foundation (OSGeo) is a not-for-profit organizations formed in 2006 with a mission to support and promote the collaborative development of open source geospatial software, and promote its widespread use. OSGeo also serves as an outreach and advocacy organization for the open source geospatial community, and provides a common forum and shared infrastructure for improving cross-project collaboration. Also, OSGeo is a sponsor of the FOSS4G conferences and events at which information on open source GIS projects and products is discussed (see https://2014.foss4g.org/about).

The growth in types and popularity of open source GIS software raises a question about if and how open source GIS software products should be considered for use along with proprietary software from Esri and other vendors. The answer to this question should be based on questions of functionality, ease-of-use, and cost. Since most LOJIC users (partner organizations and licensees) are included in terms of LOJIC's enterprise license agreement (ELA) with Esri, the need to consider open source software for cost savings purposes is not much of an issue.

At this time, there is not sufficient evidence, from a functionality standpoint, justifying consideration of major use of open source software—even through some of the products shown in Table 8 are very robust and functionally rich. There may be special cases where open source GIS software may be considered particularly:

- Use of open source Web-client Browser plug-ins for accessing and viewing server based GIS data in special cases where proprietary products are not suitable. This may include mobile device client software
- Special purpose software that provides functionality not fully available in ArcGIS desktop or server software or extensions.
- Cases in which a user needs robust desktop GIS software and does not have access to ArcGIS Desktop software.

3.5.9 Ideas for New Application Development

This subsection elaborates on Recommendation #AP6. Table 9 provides additional ideas on possible new applications useful to LOJIC partners and the broader LOJIC user community.

Table 9: Ideas on Possible New GIS Applications

Potential Application	Priority[1]	Description	Primary Users					
			Metro	MSD	PVA	LWC	EX[2]	CM[3]
High-profile application/project of community interest	H	On an annual basis, the LOJIC staff, with partner involvement, should select at least one new application with high-visibility and that has interest and value for the Louisville/Jefferson County community or region. This would use LOJIC GIS data with appropriate Web-based and possibly mobile technology for a wide user community. One possible example is a map-based "Gallopalooza Map Query and Navigation" application—provide an easy way for community organizations and the public to locate and find information about the entries in this 2015 Derby Festival Event. Depending on the type of project, it could use resources and participation from community groups, students, etc.					X	X
New application with street navigation and routing capability	M	The rich and regularly updated LOJIC GIS database and Esri GIS tools provide a basis for special applications to support routing requirements for LOJIC partners (e.g., field appraisers of PVA, MSD and Louisville Metro inspection work, LWC inspections and meter reading). A custom interface would provide users with an ability to identify start point, end point, and intermediate stops and the application would delineate an optimal route in map form and directions.	X	X	X	X	X	X
Custom GIS query and access tools	H	Louisville Metro and PVA have expressed interest in design and development of interactive Web-based tool, with an intuitive interface to perform query, simple analysis, and map display—geared toward user needs in those organizations. This would be deployed in an ArcGIS Server environment.	X		X			
Property owner search	H	A general tool (ideally Web-based) allowing users to enter a location (parcel or address) and search parameters. The application performs a buffer search and retrieves information on property owners within the buffer area—and generation of a list that can be exported.	X	X	X	X	X	X
GIS based-query and mapping to display current and upcoming construction projects	H	Establish database with point features or polygons, updated by users, with information on planned construction projects (capital projects and potentially large private development projects) and prepare custom interface and query tools to support coordination of multiple projects from different organizations (Louisville Metro, MSD, LWC, other utility organizations) and avoid multiple excavations/repaving.	X	X	X	X	X	X
Use GIS to support LouieStat	M	LouieStat (http://louiestat.louisvilleky.gov/) is managed by Louisville Metro's Office of Performance Improvement (OPI) to provide data on department performance (for key programs and services) to support decision making and improvements in performance. The OPI and individual departments could potentially benefit from tools to geographically query and mapping of LouieStat data.	X				X	X
Land development factor query tool	H	Custom interface for LOJIC partners, licensees, external users providing a quick method to identify development factors and restrictions associated with a location or parcel—floodplain, zoning, preservation districts, environmental concerns, utility service availability. Result would be a map display with tabular listing of development restrictions.	X	X			X	
New application: economic development query	H	Tool to perform query to identify economic development—including retail and commercial sites and larger industrial sites (examining size of land tracts, vacant building space, utility service, and zoning) and identification of candidate sites. This would be available as an application for LOJIC partners as well as a public Web-based service.	X	X		X	X	X
Terrain visualization and analysis	M	For use by LOJIC partners can make more effective use of digital elevation data and ArcGIS analysis and visualization tools to generate 3-D views (shaded relief, GIS map layers draped over 3-D view) and terrain analysis—including renderings for land development scenarios, viewshed analysis, and slope analysis.	X	X				
Traffic and security camera monitoring	M	Web-based GIS interface to query and see locations of cameras, video feed in window, and ability to control camera angle. May be applied to traffic cameras or site security cameras.	X					

Potential Application	Priority[1]	Description	Primary Users					
			Metro	MSD	PVA	LWC	EX[2]	CM[3]
External user portal development	M	Develop external user portal for partnering agencies as appropriate to allow users such as developers, realtors, engineers, and the public to access and view the status of applications, permits (building, floodplain, and others), real estate transfers, certification and other common requests. A committee should be developed with one member of each partnering agency to establish content and feasibility of overall development and integration. The portal may be hosted by LOJIC and linked to corresponding departmental websites with Louisville Metro, LWC, MSD, and PVA.	X	X			X	X
Develop prototype BIM application	L	Building information management (BIM) along with "geodesign" is a discipline that has recently evolved to embrace GIS data and technology to support the design and management of buildings, structures, and landscapes for efficiency and sustainability. This discipline uses complex, detailed, 3-dimensional models with specialized GIS and CAD software tools to support design, construction, and ongoing building and infrastructure management. BIM practices are being adopted as a standard for some major construction projects. LOJIC should consider collaboration with one or more real estate, architectural, or construction management firms to use its data as a basis for BIM applications for selected projects.	X	X			X	
Promote the use of Story Maps	M	Story maps have increased in popularity and have become a focus for many GIS organization's and consortiums to "Inform and Inspire" users and visitors. LOJIC and its Partners may incorporate Story Maps to elegantly blend interactive mapping and multimedia to enhance and promote ideas.	X	X	X	X	X	X

[1]Priority categories are: Very High (**VH)**, High (**H**), Moderate (**M**), Low (**L**). This is a subjective categorization reflecting level of importance and the proposed timing for moving ahead with the recommended action.

[2]EX: External users including Licensees and regular users of LOGIC data and Online services

[3]CM: Community organizations and the general public

3.5.10 LOJIC Web Site Improvement Ideas

To provide a starting point for the possible re-design and re-deployment of the LOJIC Website (www.lojic.org), an evaluation on Website content, quality, and performance was conducted by the Croswell-Schulte team. This included a high-level review and testing of the main pages of the Website and a rating of the following factors:

- Overall layout, appearance, ease of navigation
- Content quality, accuracy, currency
- Intuitiveness of navigation
- Use of graphics, multi media
- Overall performance
- Functionality and features (online map)
- Platform Browser Compatibility

Each of the factors listed above is score on a sliding scale in which a "1" means "major problems and significant re-design and development are needed and a "5" means that current design and performance is excellent and no significant changes are needed. Table 10 presents the results of this Website review. This review does not fully take into consideration a number of factors that should be assessed in preparing specifications for re-design and re-development of the Website:

- Changing the overall look-and-feel of the site to stimulate interest and be a part of a LOJIC branding and promotion effort.
- Adding significant functionality and feature changes not currently provided through the Website.

Table 10: High-Level Evaluation of LOJIC Website

LOJIC Web Page and Evaluation Factor	Quality/ Content Rating (1 to 5)[1]	Comments
LOJIC Web Page: Home Page		
Overall layout, appearance, ease of navigation	4	Good concise design. Not too busy or overloaded with content.
Content quality, accuracy, currency	4	Use of the term "participant" (referring to the 4 partner organizations) should perhaps be changed to "main partners"—avoiding an impression that Metro, MSD, LWC, and PVA are the only users of LOJIC—as opposed to using "participant" to include all users (licensees, external users). Think about standards for items under the "Highlights" section—what types of items should be included here—is it the same as News?
Intuitiveness of navigation	4	
Use of graphics, multi media	3	Possible changes would be useful for the ortho/map image banner below the Web address line.
Overall performance	4	
Functionality and features (online map)	NA	
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	2	Overall site is not set up for mobile viewing. Pan and zoom is required more frequently than desired.

LOJIC Web Page and Evaluation Factor	Quality/ Content Rating (1 to 5)[1]	Comments
LOJIC Web Page: About LOJIC		
Overall layout, appearance, ease of navigation	3	Text heavy, lacking graphics, navigation is straightforward, switches from hover menu to linked menu at the top (for consistency and ease keep as hover menu). Add partnering agency's logos to the "What is LOJIC?" section.
Content quality, accuracy, currency	3	Most of the content is dated; presentations last updated in 2008, achievements in 2003, etc.). Content may be accurate, but is not relevant. Text heavy content.
Intuitiveness of navigation	4	Consider moving the mission, values, and vision section after the "What is LOJIC". You may also combine the in depth and strategic plan sections to compress and simplify. (Note: Hover comment above)
Use of graphics, multi media	1	This section can be improved by incorporating photos, graphics, and graphical links to engage users.
Overall performance	4	
Functionality and features (online map)	NA	
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	2	Overall site is not set up for mobile viewing. Pan and zoom is required more frequently than desired.
LOJIC Web Page: Products		
Overall layout, appearance, ease of navigation	3	Text heavy, lacking graphics, navigation is straightforward, switches from hover menu to linked menu at the top (for consistency and ease keep as hover menu). There are many references to "contact Jane Poole" for questions. This should be easily accessible in the contact us section with a form including drop downs and check boxes to further specify the help need. Consider using dropdown menus to compact the content.
Content quality, accuracy, currency	3	Consider including include a "Download" and "Free Download" section. The Title Map Catalog is similar to FEMA's catalog; however many users would be more familiar with the term download. This section should be updated with revised rates, links, options based on this study.
Intuitiveness of navigation	3	This section can be improved by adding a "What are you looking for" drop down with main categories for each subsection to simplify and shorten the page length. The delivery and fee information can be abbreviated by developing an "add to cart/check out" feature that would calculate fees associated with staff, media, system processing, etc. This would be a great place to link up with data the other partnering agencies have produced for public consumption (PVA site).
Use of graphics, multi media	1	Consider including thumbnails of the online products to provide the user with a visual example of each dataset.
Overall performance	4	
Functionality and features (online map)	NA	
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	1	Extremely text heavy for mobile devices. Pan and zoom is required more frequently than desired.
LOJIC Web Page: Interactive Maps		
Overall layout, appearance, ease of navigation	3	For the interactive online maps, have centerlines and borders antialliased to clean up and smooth the view.
Content quality, accuracy, currency	3	Geodetic Control Map has an extensive history. Condense to most current with a link to past and historic control points. In general, text heavy and may not be relevant for most users.
Intuitiveness of navigation	4	
Use of graphics, multi media	2	Minimal use of graphics on the main interactive maps page.
Overall performance	4	

LOJIC Web Page and Evaluation Factor	Quality/ Content Rating (1 to 5)[1]	Comments
Functionality and features (online map)	3	Have a link to PVA property data, key MSD links, and other public information. Consider embedding the LOJIC Online Map and Snow Status Map with the option of going full screen. (Note: Snow Status Map is an opportunity to partner with local weather stations for public outreach, smart phone app development, and marketing. This should be publicized on Louisville Metro's site.) Print feature should include an option to print to PDF, graphic, or to printer (currently generates a separate html page).
Platform Browser Compatibility:		
Firefox	4	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	1	Online maps are difficult to navigate with a mobile device and difficult to interact with the layers/menu).
LOJIC Web Page: Training		
Overall layout, appearance, ease of navigation	4	Condense all training pages into 1-2 total pages.
Content quality, accuracy, currency	4	Include a link to sign up for various training alerts/mail lists and interest check boxes. Highlight or use the word "FREE" instead of "There is not cost for this class."
Intuitiveness of navigation	3	Consider adding an initial page that gives an overview of the trainings (intro to LOJIC, Online Maps, ArcGIS 10.x, etc.) offered.
Use of graphics, multi media	1	Opportunity to embed video webinars (both LOJIC and Esri).
Overall performance	5	
Functionality and features (online map)	N/A	
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	2	Due to minimal content, mobile device viewing is not as strenuous.
LOJIC Web Page: LOJIC Members		
Overall layout, appearance, ease of navigation	4	
Content quality, accuracy, currency	3	Clarify that LOJIC Members are actually LOJIC Partners; consider adjusting title to match Partners. Under each partner and licensee, include a brief description of how they use LOJIC. List core data contributions for partners. On the LOJIC License page, explain what a LOJIC License is, eligibility, and how to get one.
Intuitiveness of navigation	4	
Use of graphics, multi media	3	
Overall performance	4	
Functionality and features (online map)	N/A	Incorporate expandable descriptions under each partner, instead of links to another page. The LOJIC Committees page is bullet heavy; could be condensed with dropdowns.
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	2	Due to minimal content, mobile device viewing is not as strenuous.
LOJIC Web Page: Data Help		
Overall layout, appearance, ease of navigation	3	Submenu titles don't always correlate with content.
Content quality, accuracy, currency	4	Text heavy.
Intuitiveness of navigation	2	"Data Help" should reflect content within. Consider modifying to Metadata, Standards and Accuracy. Metadata search should be the title of the Data Explanations page.
Use of graphics, multi media	3	Minimal graphics are used in this section. Opportunity to include/embed video detailing coordinate systems and projections.
Overall performance (bandwidth)	4	Metadata search had latency issues. This could be due to the database size and request rather than bandwidth.

LOJIC Web Page and Evaluation Factor	Quality/ Content Rating (1 to 5)[1]	Comments
Functionality and features (online map)	N/A	
Platform Browser Compatibility		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	2	Extremely text heavy for mobile devices. Pan and zoom is required more frequently than desired.
LOJIC Web Page: Tech Help		
Overall layout, appearance, ease of navigation	3	Tech Help tab link should be below the Data Help tab. The lines connecting the left menu to the top submenu overlap.
Content quality, accuracy, currency	4	Combine the "General GIS Tips" section with the "Tech Help."
Intuitiveness of navigation	3	Titles of links and headers don't match (Tech Help vs. Tech Tips). Interactive Map Tips should be labeled Interactive Map FAQs and consider moving to the Tech Help page.
Use of graphics, multi media	1	Lacking visual graphics. Text heavy.
Overall performance	5	
Functionality and features (online map)	N/A	
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	2	Extremely text heavy for mobile devices. Pan and zoom is required more frequently than desired.
LOJIC Web Page: Contact Us		
Overall layout, appearance, ease of navigation	4	
Content quality, accuracy, currency	3	Provide mailto: option for the contacts. Include option or page for a contact form, or product inquiry that corresponds to specific website or LOJIC content (drop down or checkboxes).
Intuitiveness of navigation	5	
Use of graphics, multi media	1	Include embedded map of LOJIC's location.
Overall performance	5	
Functionality and features (online map)	N/A	
Platform Browser Compatibility:		
Firefox	5	
Internet Explorer	5	
Chrome	5	
iPhone, Safari	3	Lack of content; did not hinder mobile viewing.

[1]Scores on a sliding scale in which a "1" means "major problems and significant re-design and development are needed and a "5" means that current design and performance is excellent and no significant changes are needed.

3.5.11 Sources of High-Resolution Satellite Imagery

Table 11 provides information on current satellite remote sensing programs. These satellite imaging systems have sensors for optical and near-infrared wavelengths. Not included are radar sensing satellites of which several exist: RadarSat (Canada), TerraSar (Germany), ALOS (Japan). Most of the satellite programs offer imagery for purchase, sometimes through third-party service providers.

Table 11: Currently Available High and Medium Resolution Satellite Imaging Systems
(status as of December, 2014)

Satellite Name	Country/ Source Organization	Launch Year	Status	Resolution (P)[1]	Resolution (M)[2]
Advanced land Observation Satellite (ALOS) aka: Daichi[3]	Japan Aerospace Exploration Agency (JAXA)	2006	Lost power in 2011	2.5	10
ASTER	NASA-USA.	1999	In Operation	NA	15 to 90[4]
Cartosat-1	Indian Space Research Organization (ISRO)	2005	In Operation	2.5	None
Cartosat2	Indian Space Research Organization (ISRO)	2007	In Operation	1	None
DMC3 (constellation of 3 satellites)	DMC International Imaging (UK)	N/A	Planned for 2014	.75	3
IKONOS (formerly Ikonos 2)	DigitalGlobe (formerly GeoEye)	1999	In Operation	1	4
Pleiades 1A, 1B	Astrium-Geo (now Airbus Defence and Space)	2011	In Operation	.7	2
FORMOSAT-2	Taiwan National Space Program Office (NSPO)	2004	In Operation	2	8
SPOT5	Astrium-Geo (now Airbus Defence and Space)	2002	In Operation	2.5	10
SPOT6	Astrium-Geo (now Airbus Defence and Space)	2012	In Operation	1.5	8
SPOT7	Astrium-Geo (now Airbus Defence and Space)	2014	In operation	1.5	8
Quickbird 2	DigitalGlobe (USA)	2001	In Operation	0.6	2.4
WorldView 1	DigitalGlobe (USA)	2007	In Operation	0.5	None
WorldView 2	DigitalGlobe (USA)	2009	In Operation	.46	1.84
WorldView 3[5]	DigitalGlobe (USA)	2014	In Operation	.31	1.24
RapidEye Constellation	RapidEye AG (now Blackbridge) Germany	2008	In Operation		5
GeoEye-1 (formerly OrbView 5)	DigitalGlobe (USA)	2008	In Operation	.41	1.65
Landsat 8	USA (NASA, USGS)	2013	In Operation	15	30
KOMPSAT-2 (Arirang-2)	South Korea--Korean Aerospace Research Institute (KARI)	2006	In Operation	1	4
KOMPSAT-3 (Arirang-3)	South Korea	2012	In Operation	.7	2.8
Sentinel-2A	European Space Agency	2014	In Operation		10 to 60[6]
Sentinel-2B	European Space Agency	N/A	Planned (2016)		10 to 60[b]
Ziyuan 3-01 (ZY3)	China-Ministry of Land and Resources	2012	In Operation	2.1[7]	6.0
Ziyuan 3-02 (ZY3)	China-Ministry of Land and Resources	N/A	Planned (2015)	2.1[7]	6.0
Gaofen-1[8]	China-Chinese Academy of Space Technology (CAST)	2013	In Operation	.8	3.2
Gaofen-2[8]	China-Chinese Academy of Space Technology (CAST)	2014	In Operations	.8	3.2
TianHui (TH-1)	China-Chinese Academy of Space Technology (CAST)	2013	In Operation	5.0	10.0
KazEOSat-1	National Space Agency of Kazakhstan	2014	In Operation	1.0	

Satellite Name	Country/ Source Organization	Launch Year	Status	Resolution (P)[1]	Resolution (M)[2]
KazEOSat-2	National Space Agency of Kazakhstan	N/A	Planned (2014)		6.5
KazSTSAT	National Space Agency of Kazakhstan	N/A	Planned (201?)		22.0
DubaiSat-1	Emirates Institution for Advanced Science and Technology (EIAST)	2009	In Operation	2.5	5.0
DubaiSat-2	Emirates Institution for Advanced Science and Technology (EIAST)	2013	In Operation	1.0	4.0
Kanopus-V1	Russia Ministry of natural Resources	2012	In Operation	2.5	12.0, 25.0
Kanopus-V2	Russia Ministry of natural Resources	N/A	Planned for 2015	?	?
Resurs-P1	Russia	2013	In Operation	0.7	?
Resurs-P2	Russia	2014	In Operation	0.7	?
EROS A	Israel	2000	In Operation	2.1	N/A
EROS B	Israel	2006	In Operation	.7	N/A
SkySat-1	Skybox Imaging[9], USA	2013	In Operation		.8
SkySat-2	Skybox Imaging[9], USA	2014	In Operation		.8
SkySat-3	Skybox Imaging[9], USA	N/A	Planned for 2015		.8

[1, 2]Resoultion (P) is the pixel size (ground distance in meters) for panchromatic imagery and Resolution (M) is the pixel size for multi-spectral imagery. Most of the systems with multi-spectral sensors include bands for the visible light and near infrared wavelengths. In a few cases, thermal infrared is included.

[3]ALOS has, in addition to the 10m resolution multi-spectral sensor and the 2.5m panchromatic sensor, a side-looking radar scanner (10 to 100m resolution).

[4]Aster had a number of different multi-band sensors including a 3-band visual and near-infrared with 15m resolution, a shortwave infrared at 30m resolution and a thermal infrared at 90m resolution.

[5]Worldview 3 includes a number of multi-spectral sensor devices including an 8-band visible/near infrared scanner (1.24 meter resolution), 8-band shortwave infrared scanner (3.7m resolution), and a specialized 12-band hyperspectral scanner (CAVIS) at 30m resolution.

[6]Sentinel-2 will have three multi-spectral sensors: a) 4-band scanner (10m resolution), b) 6-band scanner (20m), c) 3-band scanner (60m resolution).

[7]The Ziyuan-3 has an array of 3 panchromatic sensors—one pointed down at nadir and 2 others pointing forward and after with scene overlap

[8]in addition to its panchromatic and multi-spectral scanners, the satellite carries a SAR radar instrument

[9]TSkyBox Imaging was purchased by Google in 2014. In addition to its multi-spectral scanner, SkySat collects high resolution video.

SECTION 4: SUMMARY AND OVERALL APPROACH FOR TAKING ACTION

This deliverable is the culmination of work by the Croswell-Schulte team which began in October of 2014. It summarizes our evaluation of the current status and needs of LOJIC, its partner organizations, and broader community of users and analysis of best practices for multi-organizational GIS programs nationally. This work complements and augments information gathering and analysis by the Strategic Innovation (SI) Team. The overall purpose is to support consensus and decisions for action, by the SI Team, for the future of LOJIC and GIS use. The recommendations in this document address important topics and concern that will have both a short-term and long-term impact on LOJIC operations and GIS use by LOJIC Partner organizations, licensees, and the broader LOJIC user community.

Information in this deliverable describes the scope, results, expected benefits, and resource requirements for carrying out the recommended actions. The information gathered and analyzed by the SI Team and Croswell-Schulte has provided a comprehensive picture on the current status of LOJIC and the needs of its user community. In addition, detailed information on the status and best practices of multi-organizational GIS programs nationally has been gathered and evaluated. This extensive knowledge base provides strong evidence for moving ahead, expeditiously, with the recommended actions—taking into account the relative priorities noted in this deliverable.

Many of the recommendations involve organizational changes and the commitment of staff and monetary resources. For this reason, it is important that recommendations that result from the work of the Croswell-Schulte team and SI Team be presented to the LOJIC Policy Board and other senior management in the four partner organizations, Metro Government, Louisville Water Company, Metropolitan Sewer District, and the Property Valuation Administrator. Croswell-Schulte will provide any needed support for management briefings that help to explain recommendations and their requirements and impacts.

A central question which impacts all the recommendations is, “What should be the scope and nature of the LOJIC user community?” The LOJIC stated mission and past strategic planning targets a broad user environment that includes the main partner organizations, licensee organizations, and the broader regional community of users that includes businesses, community groups, and the general public. LOJIC operations and the products and services it provides has done a reasonably good job in supporting this broad user community but availability of resources and formal work programs of the LOJIC staff and GIS management and staff in partner organizations have not always addressed that broad community. Early in the project, the Croswell-Schulte team considered formal presentation of an alternative for LOJIC in which its mission would be narrowed—with a focus mainly on GIS data with a reduction on a range of direct and on-line services for users. Serious consideration of this alternative was dismissed early on for the following reasons:

- Historically, LOJIC has successfully provided a range of GIS services to a large community of users which has come to rely on those services (data, applications, on-line services, training and support). Limiting or elimination of services would have a direct and immediate negative impact on users.
- Centralized services provided by LOJIC through a multi-organizational model delivers great benefits and a structure for effective user coordination and collaboration which would be diminished if LOJIC’s mission was substantially reduced

- The best way to maximize benefits from the substantial investment in GIS data, technology tools, and user services is to further expand the user community—including new organizations as well as expanded use in current LOJIC partner organizations and licensees.
- Geographic expansion (of GIS data and services) outside of Jefferson County presents an opportunity for economy of scale costs savings and a range of enhanced benefits for current and new users.

In over 25 years of operation, LOJIC has been extremely successful and has provided a model for other multi-organizational GIS programs in the U.S. The recommendations in this document are the basis for a work plan for long-term enhancements and improves with a focus on the broad user community. As described in detail in Section 3, there are critical themes and issues that will drive needed changes:

1. Reestablish the formal structure and relationships of the four main LOJIC partner organizations by formalizing roles and commitments and putting in place an engaged Policy Board with senior management support. Use this improved organizational and governance structure to focus on user business needs and as a basis for expansion and enhancement of LOJIC services and products.

2. Create a more effective environment for coordination, communication, and collaboration among all users—LOJC partners, licensees, and other user organizations. This includes putting in place an active coordination body and user group as well as expanded and enhanced services and support from the LOJIC staff.

3. Examine and make changes to the current LOJIC financial and funding structure. There are several aspects to this—agreement to restore the prior contribution levels ("shares") which more realistically reflects the user communities in main partner organizations. There are also opportunities for securing new funding sources which can help sustain LOJIC operations in the long-term. Finally, recommendations call for an increase in LOJIC staff as well as expansion of GIS resources in partner organizations—to help support an expanded GIS user community and benefits.

4. Actively explore and expand the LOJIC user community. This expansion is directed at additional users and applications inside existing LOJIC partners and licensees, but it also means bringing in new user organizations—including public sector, non-profit organizations, and the private sector. LOJIC should play a role to support major infrastructure development projects in the public and private sectors.

5. Realize the value of LOJIC as a key tool in support of Open Data initiatives. GIS technology provides excellent tools for data integration as well as user-friendly query, analysis, and visualization to make meaning out of raw data.

6. Actively explore and promote ongoing and expanded GIS data and user coverage outside of Jefferson County—multiple adjacent counties in Kentucky and Indiana. Moves toward an expanded regional GIS supports applications for existing LOJIC users with programs and business needs involving areas outside of Jefferson County. Expanding the area of operation also can deliver economy of scale cost reductions as well as creating opportunities for benefits by public and private sector users outside of Jefferson County

7. Support major information technology infrastructure and system administration improvements in LOJIC partner MSD. Provide necessary resources to use these improvements as a basis for more efficient and secure IT and GIS operations, better performance for GIS users, and more effective environment for GIS integration with non-GIS systems and databases.

8. Keep aware of IT and GIS technology changes and advancements impacting data acquisition and development, software, applications, and GIS technical management practices. Adopt new technology tools and practices in an informed and planned manner always with a focus increased benefits to users, operational efficiencies, and lower costs.

The results of this project have pointed strongly to continuing, enhancing, and expanding LOJIC services to a broad user community. This project presents recommendations that will continue focus on and enhance current LOJIC operations with organizational, management, and technology improvements.

APPENDIX A: LOJIC GIS PROJECT OR APPLICATION PROPOSAL FORM

Version 1.0, 2-2015

A. Identification Information

A1. Name of Project or Application: _____

A2. Submittal Date: _____

A3. Contact Information: _____ (Name and Position) _____ (Organization/Department)

_____ (Phone) _____ (Email Address) _____ (Other Contact Info)

B. Description

B1. Summary of purpose, general approach, and outcomes, products, deliverables:

B2. Business drivers and associated mandates (state existing or future programs or business needs that this project addresses and any formal mandates it supports--ordinance, regulation, policy legislative resolution, executive order, legal proceeding or order, etc.):

B3. Business drivers and associated mandates (state existing or future programs or business needs that this project addresses and any formal mandates it supports--ordinance, regulation, policy legislative resolution, executive order, legal proceeding or order, etc.):

B4. Parties and organizations affected or users of application.

C. General Work Plan (Tasks and Deliverables)

C1. Tasks, Deliverables, and Projected Dates:

Major Tasks:		Main Deliverables/Outcomes	Projected Completion Date
Task 1:			
Task 2:			
Task 3:			
Task 4:			
Task 5:			
Task 6:			
Task 7			
Task 8:			
Task 9:			

Task 10:			

D. Resource Requirements

D1. Estimated staff hours (in-house staff):

Resource Type	Number of Hours	Comments
Technical Staff Hours(1)		
Management Personnel Hours (2)		
Review Hours(3)		
Other:		

(1) Hours from staff with skills in IT or GIS design, development, testing, documentation, and training
(2) Hours for project managers or other organizational management with oversight role on project
(3) Hours for individuals/users enlisted to review and provide comments of submitted deliverables and application prototypes

D2. Estimated costs for contracted services, materials, expenses:

Resource Type	Cost	Describe Type of Contractor Services or Project Costs(1)
Contractor Services 1	$	
Contractor Services 2	$	
Contractor Services 3	$	
Project Expense 1	$	
Project Expense 2	$	
Project Expense 3	$	
Project Expense 4	$	
Other cost 1	$	
Other cost 2	$	
TOTAL:		

(1) Identify specific or general types of contractors or vendors and type of project expense (software/hardware purchases, materials, travel costs)

D3. Identify and describe any existing funding sources or staff commitments which are or might be allocated for this project.

E. Ongoing Benefits and Costs

E1. Estimated benefits:

Benefit Type	Number of Hours	Comments
Reduction in staff hours		
Monetary cost reduction or savings		
Avoided future costs or staff time		
Management Personnel Hours (2)		
Review Hours(3)		
Other:		

E2. Provide information on expected ongoing costs after project/application completion. Include costs for system maintenance, technical support, upgrades, software licensing/subscription services, etc.):

F. Proposal Review Record

Reviewer Name	Accept	Reject	Other	Date	Comments
LOJIC Steering Committee Members:					
LOJIC Manager					
xxx					
xxx					
xxx					
xxx					
xxx					
Organization Management:					
xxx					
xxx					
xxx					
xxx					
LOJIC Policy Board Members:					
xxx					
xxx					
xxx					
xxx					
xxx					
Others:					
xxx					
xxx					
xxx					
xxx					