# Baltimore County GIS Strategic Business Plan

## Volume 2

## Enterprise Report

| | |
|---|---|
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# 1 GIS Strategic Business Plan Methodology

## 1.1 Study Overview

Baltimore County's Office of Information Technology, in conjunction with the Office of Budget and Finance, contracted with Dewberry to conduct a countywide GIS Strategic Business Plan that analyzes the utilization of GIS technology in Baltimore County. This study was conducted by analyzing the current annual costs and benefits of GIS technology utilization in Baltimore County and did not investigate historical costs or benefits. The study was conducted during a nine (9) month timeframe, from September 2006 through May 2007.

The purpose of this study is to:

- Provide a definition of existing layers, identifying the key users(s) and their use(s);
- Identify current benefits, including costs avoidance, revenue, and productivity gains;
- Identify current costs, including software, hardware, support and maintenance; and
- Deliver a Strategic Business Plan, complete with a set of short- and mid-term recommendations of the key areas for Baltimore County to focus on as they move forward with this program.

The Baltimore County project team executing the GIS Strategic Business Plan includes an extended team of staff from the Office of Information Technology and the Office of Budget & Finance, along with representatives from all the participating agencies in Baltimore County.

## 1.2 Study Participants

The GIS Strategic Business Plan study was scoped to include an analytical assessment of the Baltimore County agencies shown in Table 1. The agencies participating in the study were divided into four groups, named "Clusters," as an efficient approach to manage the workload and schedule associated with gathering the information and developing and reviewing the reports.

| Baltimore County Agencies – Study Participants | Cluster Group |
|---|---|
| Department of Environmental Protection and Resource Management (DEPRM) | 1 |
| Department of Permits and Development Management (PDM) | 1 |
| Department of Public Works (DPW) | 1 |
| Department of Economic Development (DED) | 2 |
| Department of Recreation and Parks (DRP) | 2 |
| Office of Community Conservation (OCC) | 2 |
| Office of Planning (OP) | 2 |
| 911 Center | 2 |
| Fire Department | 3 |
| Health Department | 3 |
| Police Department | 3 |
| Auditor's Office | 4 |

| Baltimore County Agencies – Study Participants | Cluster Group |
|---|---|
| Board of Appeals | 4 |
| Board of Elections | 4 |
| Department of Aging | 4 |
| Department of Corrections | 4 |
| Department of Social Services (DSS) | 4 |
| Executive Office | 4 |
| Human Resources | 4 |
| Liquor Board | 4 |
| Local Management Board (LMB) | 4 |
| Office of Budget & Finance (OBF) | 4 |
| Office of Information Technology (OIT) | 4 |
| Office of Law | 4 |
| Office of the People's Counsel | 4 |
| Sheriff's Office | 4 |
| State's Attorney Office | 4 |
| Workforce Development | 4 |
| **The following groups did not participate in the study, as defined by the scope:** | |
| County Council | N/A |
| Community Colleges of Baltimore County | N/A |
| Cooperative Extension Service | N/A |
| Board of Education | N/A |
| Libraries | N/A |

**Table 1 – Baltimore County Agency – Study Participants**

The Dewberry project team consisted of the following individuals:

- Jeffrey R. Poplin, Senior Project Manager and Senior Business Analyst
- Phil Thiel, Principal-In-Charge, Business Process Advisor
- Sue Hoegberg, Senior Business Analyst
- Shane Engel, Business Analyst
- Rob Hayward, GIS Analyst
- Emily Walker, GIS Analyst

## 1.3 Study Process

This study was conducted following the process described below and included development of the reports and other documents described below.

### 1.3.1 Kick-Off Meeting

In preparation for this study, Baltimore County and Dewberry held a series of Kickoff Meetings at Baltimore County's offices. The following meetings were held to prepare the study participants and to review the scope of the GIS Strategic Business Plan project:

**Internal Cluster Kickoff Meetings**
The Baltimore County project team conducted a series of four kickoff meetings, essentially holding one meeting for each of the clusters of agencies. The attendees included representatives from each participating agency along with several key stakeholders from the Office of Budget & Finance and the Office of Information Technology. The purpose of the meeting was to introduce the GIS Strategic Business Plan initiative and project to all participating agencies, and to review the scope and expectations with each participant. All Internal Cluster Kickoff Meetings were held in October 2006.

**Tactical Kickoff Meeting**
The Tactical Kickoff Meeting was held on October 10, 2006, and was led by the Dewberry project team. This kickoff meeting provided all attendees with an overview of the GIS Strategic Business Plan, including the methodologies and tools to be used, expectations and requirements, project boundaries of the study, and the cost/ benefit methodology for each of the activities. This meeting also served as a forum to address specific aspects of this project needing resolution, such as the required level of detail for discussing activities and costs, how shared costs should be handled, how to quantify intangibles, and how to quantify benefits. Additionally, details of the interview questionnaires and scheduling details were discussed in this meeting.

**Tactical Kickoff Meeting Attendees:**
Rich Sterba, Budget Analyst, OBF
Tom Harner, Budget Analyst, OBF
Angela Artis, Budget Analyst, OBF
Messina Porter, Budget Analyst, OBF
Keith Dorsey, Deputy Director, OBF
Doug Adams, Systems Analyst, OIT
Jeff Tirschman, Project Manager, OIT
Kim Wilson, Project Management Assistant, OIT
Jeff Poplin, Project Manager, Senior Business Analyst - Dewberry
Shane Engel, Business Analyst - Dewberry

**Stakeholders Expectations Meeting**
The Stakeholders Expectations Meeting was held on October 11, 2006, and was led by the Dewberry project team. The purpose of the meeting was to identify and review the expectations of key management stakeholders, in order to ensure the entire team was in agreement about the GIS Strategic Business Plan purpose and intent.

**Stakeholders Expectations Meeting Attendees:**
Rob Stradling, Director, OIT
Lynne White, Executive Business Analyst, OIT
Donna Morrison, Executive Office

Keith Dorsey, Deputy Director, OBF
Rich Sterba, Budget Analyst, OBF
Doug Adams, Systems Analyst, OIT
Jeff Tirschman, Project Manager, OIT
Kimberly Wilson, Project Management Assistant, OIT
Jeff Poplin, Project Manager, Senior Business Analyst - Dewberry
Shane Engel, Business Analyst - Dewberry
Phil Thiel, Principal in Charge, Business Process Advisor - Dewberry

### 1.3.2 On-Line Short-Form Questionnaire

A "short-form" questionnaire was developed as a web-based survey. A total of 309 individuals completed the short-form on-line survey. See Appendix N for a complete list of the short-form questions. The questions included in the short-form survey were designed to solicit basic information about the respondent's involvement with GIS in his or her daily activities and ideas for how GIS could be better utilized within the agency and/or the County as a whole. Based on their responses, representatives from each agency were selected as candidates for the longer, in-person interviews. The short-form responses from personnel in each agency are included at the end of each of the Agency Reports.

| Baltimore County Agencies | Number of Short Form Responses |
|---|---|
| Department of Environmental Protection and Resource Management (DEPRM) | 58 |
| Department of Permits and Development Management (PDM) | 19 |
| Department of Public Works (DPW) | 71 |
| Department of Economic Development (DED) | 10 |
| Department of Recreation and Parks (DRP) | 9 |
| Office of Community Conservation (OCC) | 2 |
| Office of Planning (OP) | 25 |
| 911 Center | 9 |
| Fire Department | 10 |
| Health Department | 13 |
| Police Department | 12 |
| Auditor's Office | 2 |
| Board of Appeals | 1 |
| Board of Elections | 2 |
| Department of Aging | 9 |
| Department of Corrections | 4 |
| Department of Social Services (DSS) | 3 |
| Executive Office | 13 |
| Human Resources | 5 |
| Liquor Board | 3 |
| Local Management Board (LMB) | 5 |

| Baltimore County Agencies | Number of Short Form Responses |
|---|---|
| Office of Budget & Finance (OBF) | 3 |
| Office of Information Technology (OIT) | 10 |
| Office of Law | 1 |
| Office of the People's Counsel | 1 |
| Sheriff's Office | 4 |
| State's Attorney Office | 2 |
| Workforce Development | 3 |
| **Total:** | **309** |

**Table 2 – Short Form Respondents by Agency**

### 1.3.3 Long-Form Questionnaire

A long-from questionnaire was developed for use during the interview process. The long-form questions were designed to gather information about the agency, programs, and activities. See Appendix O for a complete list of the long-form questions.

The agency-level questions were designed to be directed towards the agency or department director and included questions about high-level items such as the agency's role, its customers, its overall use of GIS technology, its personnel and the GIS training programs available to them, and how the agency interacts with other County agencies.

The program-level questions were designed to be directed to program directors within the agencies and included questions about the program's external funding sources, regulatory mandates, political and social benefits, products and services, customers, GIS data layers used, and GIS applications used.

The activity questions were designed to be directed to GIS specialists responsible for the individual activities within the agencies and to solicit detailed information about the activities. The questions included items such as a description of the activity, how long it takes, how it is done using GIS, how it was or would have been done before GIS, what GIS data are used to perform the activity, what GIS applications are used to perform the activity, and recommendations for ways GIS could improve performance of the activity in the future.

### 1.3.4 County Program and Activity Lists

The County developed and provided a detailed listing of programs and activities, including a description of the program or activity, and what agency is responsible for the program or activity. This listing was used extensively during the interviews to make sure that a full understanding of all relevant programs and activities was achieved and that all were fully discussed at the level required to complete the draft agency reports. This preliminary list of programs and activities that was used as a baseline during the interview and investigation process was only available for the following agencies:

| Agencies Providing a Preliminary Program and Activity List |
|---|
| 911 Center |
| Department of Environmental Protection and Resource Management (DEPRM) |
| Department of Permits and Development Management (PDM) |
| Department of Public Works (DPW) |
| Department of Economic Development (DED) |
| Department of Recreation and Parks (DRP) |
| Fire Department |
| Office of Community Conservation (OCC) |
| Office of Information Technology (OIT) |
| Office of Planning (OP) |
| Police Department |

**Table 3 – Agencies Providing a Preliminary Program and Activity List**

See Appendix Q for a listing of Baltimore County Programs and Activities covered in this report. The updated and final listing of Baltimore County Programs and Activities were documented in the Agency chapters of the GIS Strategic Business Plan report.

### 1.3.5 Agency Interviews and Workshops

Interviews were conducted over the period of October 30, 2006, to February 22, 2007. A total of 223 staff members were interviewed for this study. The following personnel were interviewed:

| Interviewees | Agency |
|---|---|
| Lee Ann Shope | 911 |
| Marie Whisonant | 911 |
| Patrick Fangmeyer | 911 |
| Ray Windisch | 911 |
| David Reter | Aging |
| Judy Cook | Aging |
| Mike Lehmuth | Aging |
| Norma Nash | Aging |
| Patti Madigan | Aging |
| Elizabeth Irwin | Auditor's Office |
| Michele Ganjon | Auditor's Office |
| Kathleen Bianco | Board of Appeals |
| Bob Franke | Budget & Finance |
| Ed Blades | Budget & Finance |
| George Klunk | Budget & Finance |
| Keith Dorsey | Budget & Finance |
| Randy Menztel | Corrections |
| Sharon Tyler | Corrections |
| Chris McCollum | DED |

| Interviewees | Agency |
|---|---|
| Helga Weschke | DED |
| Kathleen A. Lewis | DED |
| Richard Cobert | DED |
| Sharon Klots | DED |
| Candace Croswell | DEPRM |
| Daniel D. Artley | DEPRM |
| David Carroll | DEPRM |
| David Lykens | DEPRM |
| Dennis Genito | DEPRM |
| Donald Outen | DEPRM |
| Dorsey Burger | DEPRM |
| Eldon Gemmill | DEPRM |
| Emeka Obilor | DEPRM |
| Eugene G. Siewierski | DEPRM |
| Jerry Siewierski | DEPRM |
| Joan Klair | DEPRM |
| John G. Russo | DEPRM |
| Keith Kelly | DEPRM |
| Kevin Brittingham | DEPRM |
| Kevin Koepenick | DEPRM |
| Kevin Sharbonda | DEPRM |
| Kevin Quelet | DEPRM |
| Megan Brosh | DEPRM |
| Michael Doyle | DEPRM |
| Michael Moorefield | DEPRM |
| Michael S. Kulis | DEPRM |
| Nancy Pentz | DEPRM |
| Patricia H. Cornman | DEPRM |
| Patricia M. Farr | DEPRM |
| Paul Dennis | DEPRM |
| Regina Esslinger | DEPRM |
| Robert Hirsch | DEPRM |
| Robert Schleigh | DEPRM |
| Scott Porter | DEPRM |
| Stephen Adamski | DEPRM |
| Steve Bevard | DEPRM |
| Steve Stewart | DEPRM |
| Thomas Panzarella | DEPRM |
| Wade Shelton | DEPRM |
| Wallace S Lippincott, Jr. | DEPRM |
| William Clarke | DEPRM |
| Yuly Lipsits | DEPRM |
| Yvonne Deloatch | DEPRM |

| Interviewees | Agency |
|---|---|
| Abed Bssisso | DPW |
| Ann Briggeman | DPW |
| Bonny Jasinski | DPW |
| Carl Broyles | DPW |
| Carolyn Bellusci | DPW |
| Dale Volz | DPW |
| Daniel J. Hardisky | DPW |
| David A. Bayer | DPW |
| David Diaz | DPW |
| David Freeman | DPW |
| David L. Thomas | DPW |
| Deb Delahanty | DPW |
| Donald G. Wuest | DPW |
| Donna Selander | DPW |
| Doug Gabbert | DPW |
| Edward Tress | DPW |
| Glen A. Keller | DPW |
| Gloria Simpson | DPW |
| Hal Southern | DPW |
| James Gullivan | DPW |
| James W. Arford | DPW |
| Jim Ford | DPW |
| Joann Pearson | DPW |
| John Ruke | DPW |
| John Vlach | DPW |
| Lisa Eicholtz | DPW |
| Mark Benner | DPW |
| Mark Gonce | DPW |
| Mark Tabisz | DPW |
| Maurice White | DPW |
| Michael Harner | DPW |
| Michael Lorenzo | DPW |
| Patrick C. Semone | DPW |
| Patrick Simon | DPW |
| Paul Bollard | DPW |
| Radu L. Zamfirache | DPW |
| Robert C. Berner | DPW |
| Robert M. Lidard | DPW |
| Robin B. Hurley | DPW |
| Ronald E. Houck | DPW |
| Scott Miller | DPW |
| Sharon Dziwulski | DPW |
| Sheldon Epstein | DPW |

| Interviewees | Agency |
|---|---|
| Stacey Tamalavicz | DPW |
| Steven Makowski | DPW |
| Steven Walsh | DPW |
| Suzanne E. Hale | DPW |
| Terry Curtis | DPW |
| Thomas C. Smith | DPW |
| Thomas Stehr | DPW |
| W  William Korpman | DPW |
| W. Keith Link | DPW |
| Wayne Shorb | DPW |
| William D. Fox | DPW |
| Patrick McDougall | DRP |
| Jean Tansey | DRP |
| Michael Grossman | DRP |
| Tim Winters | DRP |
| Pat McGregor | DRP |
| John Markley | DRP |
| Bud Chrismer | DRP |
| Craig Patterson | Elections |
| Bryan Dunn | Executive Office |
| Cathy Bevins | Executive Office |
| George Dulina, Jr. | Fire |
| Gregory Harrer | Fire |
| Irene Debye | Fire |
| James Korn | Fire |
| James Webster | Fire |
| Mark Demski | Fire |
| Mark F. Hubbard | Fire |
| Richard Petry | Fire |
| Rick Deflavis | Fire |
| Vernon Adamson | Fire |
| William Martz | Fire |
| Dave Taylor | Health |
| Latonya Adams-Smith | Health |
| Lois Fegan | Health |
| Olorunwa Asiru | Health |
| Shawn Kelly | Health |
| Jo Anne Krach | Human Resources |
| Mark Ewing | Human Resources |
| Amy Grossi | Law |
| Chaunte Thomas | Liquor Board |
| Don Schlimm | Local Management Board |
| Mary Pace | Local Management Board |

| Interviewees | Agency |
|---|---|
| Roe Davis | Local Management Board |
| Joseph A. 'Jay' Doyle IV | OCC |
| Katy Kendrick | OCC |
| Liz Glenn | OCC |
| Doug Adams | OIT |
| Greg Vukov | OIT |
| Jonathan Curtis | OIT |
| Richard A. Bohn | OIT |
| Rob Livermore | OIT |
| Scott Messier | OIT |
| Steve Foley | OIT |
| Steve Rollins | OIT |
| Tunde Oyinloye | OIT |
| Caren Beth Hoffberger | OP |
| Diana Itter | OP |
| Donnell Zeigler | OP |
| Jean White | OP |
| Jeff Mayhew | OP |
| Jennifer Meacham | OP |
| Karin E. Brown | OP |
| Kathy Schlabach | OP |
| Kevin Gambrill | OP |
| Kristopher Weaver | OP |
| Kui Zhao | OP |
| Lynn Lanham | OP |
| Ngone Seye | OP |
| Teri Rising | OP |
| Vicki Nevy | OP |
| Don Rascoe | PDM |
| Carl Richards | PDM |
| Colleen Kelly | PDM |
| Darryl Putty | PDM |
| Dennis Kennedy | PDM |
| Dennis Maloney | PDM |
| Don Gabriel | PDM |
| Eric Rockel | PDM |
| Geoff Rice | PDM |
| James Thompson | PDM |
| Janice Kemp | PDM |
| Jeff McCullough | PDM |
| Jeff Perlow | PDM |
| Joe Chmura | PDM |
| John Altmeyer | PDM |

| Interviewees | Agency |
|---|---|
| Karen Koluch | PDM |
| Karen Lewis | PDM |
| Doug Swam | PDM |
| Kristen Weis | PDM |
| Linda Blackmon | PDM |
| Linda Taylor | PDM |
| Phil Martin | PDM |
| Steve Houk | PDM |
| Tim Kotroco | PDM |
| Tony Buckleman | PDM |
| Vishnu Desai | PDM |
| Walt Smith | PDM |
| Rebecca Meile | People's Counsel |
| Phil Canter | Police |
| Carl Koprowicz | Police |
| Chad Cameron | Police |
| Gennet Medhin | Police |
| Mark Demski | Police |
| Samuel Helms | Police |
| Terry Tanguiig | Police |
| Wenjuan Lu | Police |
| Tricia Amburgey | Police |
| Kimberly Lankford | Police |
| Mike Leedy | Police |
| Nina Skinner | Police |
| Capt. Darrin Granger | Sheriff |
| Colonel Robert Haukdale | Sheriff |
| Brendon Bengermino | State's Attorney |
| Elisa Poole | State's Attorney |
| Lois Kramer | Social Services |
| Mike Demidencko | Social Services |
| Nick D'Alessandro | Social Services |
| Betty Racicot | Workforce Development |
| David Berney | Workforce Development |

**Table 4 – Study Interviewees**

### 1.3.6 Conducting Interviews

In-depth interviews were conducted with key technical users and management personnel from each agency, as well as budget analysts from each agency. The interviews were conducted in a sit-down, face-to-face style interview format, and the interview questions were drawn from the detailed, "long-form" questionnaire. Most interviews were conducted on-site at each agency. All interviews were voice-recorded for archival purposes, except for those where the participants did not agree

to the disclaimer that asked for permission to audio record the session. These recordings will be provided to the County as a deliverable upon completion of the project. Interview attendees included the designated agency staff, the agency's budget analyst, at least one staff member of OIT, and two Dewberry staff members (except for some of the smaller Cluster 4 agencies, where only one Dewberry staff member participated).

### 1.3.7 Interview Metrics and Gap Analysis

After each agency's interviews were concluded, a spreadsheet containing all of the agency's programs and activities was filled out with the information gathered during the interviews. This listing of Agency Metrics later became the Program and Activity sections of the Agency Reports. As necessary, Programs or Activities were expanded or consolidated based on the interview information. For each Program, information was entered about its external funding sources, regulatory mandates, political and social benefits, products and services, customers, GIS data layers used, and GIS applications used.

For each Activity, the following information was gathered to calculate and quantify a benefit metric for the use of the GIS technology:

| Benefit Metric Data | Description |
|---|---|
| Process with GIS | Description of the process to complete the activity with GIS |
| Process without GIS | Description of the process to complete the activity without GIS |
| Staff Hours without GIS | How long it takes without GIS |
| Staff Hours with GIS | How long it takes to complete the activity with GIS |
| Difference | Calculated difference between hours to perform the task with / without GIS |
| Annual Iterations | How frequently it is performed, annualized to one year |
| Annual Time Savings Benefit | Difference multiplied by average rate ($33.95) |
| Other Benefits | Other benefits besides time savings were documented and quantified |
| Recommendations and Areas of Improvement | Documented any recommendations that were provided for ways GIS could improve performance of the activity in the future |

**Table 5 – Activity-Based Benefit Metric Information**

If any gaps in information were noted, a series of questions was developed and sent to the County for follow-up with the interviewed agency. The agency could then respond and clarify or complete the required information needed to develop the draft agency report.

### 1.3.8 Draft Agency Reports

Cluster 1 acted as the "pilot" for the business plan. The findings and documentation created for Cluster 1 were accepted and approved, and served to steer the work for the remaining Clusters. The results of the interviews for each agency were synthesized on a rolling basis immediately following the completion of a round of interviews. The raw data were logged in the agency metrics spreadsheets described above. The

Program and Activity tables included in each agency's report were derived from these spreadsheets.

Each Agency Report includes the following information:

1 **Agency** – This section provides an overview of the agency, including its structure and functions; describes information the agency makes available to the public; describes in detail any binding legal agreements the agency must comply with in order to maintain funding or to avoid penalties (e.g., the Consent Decree); and lists all of the agency staff members who participated in this study.

2 **Cost/Benefit Information** – This section summarizes the agency's annual GIS costs and benefits including its annual GIS costs for training, hardware and software, administrative/supply items, personnel, and the agency's share of the annual enterprise costs. This section also summarizes the benefits realized by the agency through the use of GIS in terms of hours saved through use of GIS.

3 **GIS Utilization and Recommendations** – This section provides a brief analysis of GIS use within the agency, summarizing the in-house GIS training received by agency personnel, the primary enterprise GIS data layers used by the agency, the GIS applications used by the agency, the GIS data layers the agency is responsible for maintaining, and how GIS is used to support each the business processes of each agency program. This section also provides an assessment of the agency's GIS needs in terms of applications, data layers, and additional training that would benefit the agency; best practices that have been implemented by other agencies or counties with similar business processes; and ways the agency could benefit from increased communication. Finally, this section provides recommendations that can be implemented in the short- and mid-term to enhance the agency's GIS use and further take advantage of the enterprise system provided by the County.

4 **Programs and Activities** – This section describes in detail each Program and Activity associated with the agency. Programs are usually composed of one or many activities. A few agencies (e.g., OIT and some of the miscellaneous Cluster 4 agencies) did not have any programs or activities associated with them.

Each Program description includes:

- Program funding and mandates;
- Social or political benefits;
- Customer identification; and
- GIS Data and applications being used.

Each Activity description includes:

- Identifying the process with and without GIS;
- Estimating the staff hours to complete the activity with and without GIS;
- Identifying how often the activity is performed annually;
- Identifying any other benefits; and
- Any recommendation for additional GIS implementation, where appropriate.

5 **Short Form On-Line Questionnaires** – This section includes the responses to the short-form questionnaire by all agency respondents.

### 1.3.9 County Review

After each Agency Report was delivered to the County for a detailed review and comment cycle, the County project team completed a review of the documentation and provided feedback for consideration into the final Agency Report document. Agency stakeholders, Budget Analysts, and OIT interview participants reviewed each report and provided feedback to the OIT project manager for consolidation and delivery to Dewberry.

### 1.3.10 Agency Stakeholder Consensus Building Workshops

An Agency Stakeholder Consensus Building workshop was conducted for each agency in Clusters One 1, Two 2, and Three 3 to present a summary of the report's content and findings, and allow for the agency to provide additional feedback on areas of particular interest or concern. This feedback was taken into consideration in the development of the final Agency Reports.

### 1.3.11 Final Agency Reports

After each Agency Report was reviewed and commented on by the County project team, revisions were made to the documents and final Agency Reports were delivered to the County. Upon receipt of a final Agency Report, the project manager distributed the document to all agency stakeholders, budget stakeholders, and the project board. At this time, the agency stakeholders and budget stakeholders reviewed the final document and submitted a formal Acceptance statement verifying the accuracy and integrity of the information documented in the Agency Report.

### 1.3.12 Industry Research

As part of the overall GIS Strategic Business Plan study, Dewberry conducted Industry Research consisting of questionnaires and interviews with other Counties of similar size and composition. Industry research was conducted with the following counties: Mecklenburg County, NC, and King County, WA. A detailed questionnaire was developed for use in conducting the telephone interviews with representatives from each of these entities. These telephone interviews were not exhaustive, but were focused on areas that were identified as "in need of improvement" by Baltimore County. Where appropriate, the input from these external agencies was incorporated as recommendations and used to confirm "best practices." The information gleaned from the Industry Research is contained in Section 4 of this document. See Appendix P for the Industry Research Questionnaires.

### 1.3.13 Draft Final Report

The Draft GIS Strategic Business Plan Final Report consists of three volumes, organized as follows:

**Volume One** consists of a comprehensive high-level summary of the findings, including cost and benefits summaries, and presents the key Strategic

Recommendations. It includes the following sections: Executive Summary; Introduction; GIS Utilization Summary; Cost/Benefit Summary; and GIS Recommendations including recommendations for Organization, Data, Infrastructure, Business Processes, Applications, and Technology.

**Volume Two** outlines the study methodology, the County's enterprise architecture, an assessment of the County's public access programs, a summary of the industry research conducted with several other similarly sized counties, and an assessment of the overall GIS utilization within the County:

1. **Methodology** – This section provides an overview of the study, lists the study participants, describes the study process, and provides details of the cost/benefit methodology.
2. **Enterprise Architecture and Costs** – This section describes the County's enterprise GIS architecture; summarizes the costs of operating and maintaining the GIS architecture; provides a detailed description of the enterprise architecture system and the costs associated with it; and summarizes the other enterprise costs such as personnel, training, and administrative and capital expenses, and describes the method for proportionally distributing these costs to the various County agencies for the purposes of this study.
3. **Assessment of Public Access Programs** – This section describes the County's public access programs and provides an assessment and recommendations for the static maps that are provided on the web, the County's MyNeighborhood interactive mapping website, other interactive web-based mapping sites provided by the County, and the County's GIS data request program whereby requesters can purchase GIS data.
4. **Industry Research and Comparison of Online Mapping Applications** – This section compares King County, WA, Mecklenburg County, NC, and Baltimore County, MD, in terms of their GIS organization structure and GIS utilization; enterprise databases (geodatabase technology) and database development; public access and external partnerships; GIS software and applications; online mapping data availability; online mapping functionality; and the prominence of GIS on each County's website.
5. **Application, Data, and Overall GIS Utilization** – This section provides an analysis of Baltimore County's GIS data utilization, application utilization, GIS utilization by agency, GIS training, GIS personnel, and business processes. It provides some recommendations for improvements and opportunities that would have the most benefits for the County.

**Volume Three** consists of the individual Agency Reports and other details of the study contained in 24 Appendices as follows:

A. Department of Environmental Protection and Resource Management (DEPRM)
B. Department of Permits and Development Management (PDM)
C. Department of Public Works (DPW)
D. Department of Economic Development (DED)

E. Department of Recreation and Parks (DRP)
F. Office of Community Conservation (OCC)
G. Office of Planning (OP)
H. 911 Center
I. Fire Department
J. Health Department
K. Police Department
L. Miscellaneous Cluster 4 Agencies
M. Office of Information Technology (OIT)
N. Short-Form Questionnaire
O. Long-Form Questionnaire
P. Industry Research Questionnaires
Q. Baltimore County GIS Programs and Activities
R. Palm Beach County GIS Best Management Practices Comparable County GIS Program Summaries
S. King County, WA, Organizational Chart
T. Baltimore County GIS Data Inventory
U. Data Usage Analysis - combined all agencies
V. Application Usage - combined all agencies
W. Agency GIS Points of Contact
X. Organization Charts

### 1.3.14 Stakeholder Workshop and Final Presentation

A Final Stakeholder Workshop will be held once the Draft Final Report has been circulated. It is anticipated that the primary stakeholder in this meeting will be Baltimore County OIT, along with representatives from the Budget Office. During the workshop, the major findings of the report will be presented and comments and input will be solicited from the stakeholder group. Consensus will be built on any areas of concern, and any resulting revisions will be incorporated into the final document as appropriate. The GIS Strategic Business Plan report will be prepared once the stakeholder workshop is completed. The finalized report will then be delivered to the County.

The Final Presentation of the GIS Strategic Business Plan will be conducted for the senior Baltimore County managers and stakeholders. This will be a summary of the major findings, cost benefit analysis, and the strategic recommendations for the future of GIS at Baltimore County. This is intended to be a final, formal presentation of the results of the GIS Strategic Business Plan.

## 1.4 Cost/Benefit Methodology Details

The following should be noted about the methodology used to conduct this study and to calculate the costs and benefits presented in this report:

1. For each Agency Report, a percentage of the overall enterprise GIS operating and capital costs were allocated to balance the cost/benefit assessment at the agency level. The agency percentage of the total enterprise GIS costs was determined based on the number of GIS database users identified by counting the number of ArcSDE accounts for each agency in October 2006. For agencies with no GIS users in ArcSDE, 0.5 of a user, or

0.23% of the total users, has been given as a factor to associate some of the costs with every agency. This number does not take into account the number of users that may be using GIS services provided by County web mapping services. This number also assumes that all users are active. This number does not account for differences in use by each person, so there could be great differences in the actual percentage of GIS use and associated cost. Annual enterprise costs have been proportionately distributed to these agencies based on the percentage factor.

2. The costs for an agency did not include one-time costs associated with creating or maintaining datasets/ applications.
3. The study did not capture any historical costs or benefits, but rather analyzed the current GIS usage, costs, and benefits for Baltimore County.
4. The costs for the agency did not include in-house training. Agency costs typically included personnel, training, hardware, software (agency-specific), and supplies. The agency costs were compiled and provided by the agency stakeholders and responsible budget analysts.
5. All benefits were based on an average employee rate calculated and provided to the project team by the Deputy Director of the Office of Budget and Finance. The average hourly rate with fringe benefits used in the GIS Strategic Business Plan study to calculate all benefits was $33.95. This rate was derived by averaging the salary of the general classifications of staff typically performing tasks and business activities that would benefit from GIS technology. This approach was necessary to ensure consistency of the calculated benefit information. This average rate accounts for situations where the individuals performing activities with GIS could differ substantially by agency and job classification (e.g., DPW engineers versus PDM data entry personnel).
6. The costs for the agency did not include consultant fees for developing applications/data.
7. A day was calculated as seven hours.
8. The numbers provided and used to determine benefits were not always confirmed against the business process used to realize that benefit. So, if someone said that it took 4 hours to make a map, or that time was reduced by 30%, that figure was assumed to be true. Where possible, estimates were standardized for consistency across an agency (i.e., site visit durations and manual map creation effort estimates). Agency staff and Budget Analysts worked together to ensure professional integrity of the estimated benefit information being reported in documents.
9. In general, benefits were determined only from interviews with personnel who were using GIS or mapping information. Some benefits could have been overlooked because of this.
10. The following benefits were captured, where appropriate, for the purposes of documenting the value of GIS technology:
    - **Time Savings** – A comparison of the number of hours it takes to complete a task with GIS versus the number of hours to complete the same task without GIS. In some cases, industry standards were applied for situations where the individuals were unable to identify a process to complete the business activity without GIS.

- **Cost Avoidance** – A documentation of costs avoided by utilizing GIS technology. This type of benefit was not factored into the Cost/Benefit Assessment, since it was not a direct, calculated time-savings benefit realized by the County.
- **Other Benefits** – Any additional benefit identified that is not calculated as a time savings.

11. The enterprise costs were documented using actual payroll figures and a 31.45% fringe factor, provided by the Deputy Director of the Office of Budget and Finance. The personnel allocated as a direct cost to the project were identified as those individuals in the County that perform database maintenance, application support, or any other direct service that is necessary for the GIS enterprise to be maintained and available for all users. Therefore, a fraction of the time by these individuals performing these tasks was allocated as a direct cost to the GIS enterprise. The final GIS enterprise operating and capital cost figures were validated and approved by the OIT Budget Analyst, Rich Sterba.
12. The enterprise costs do not calculate time spent using GIS in the agencies, as this represents the benefits of providing the technology. The users performing business activities would perform those tasks manually, if GIS technology was not available; therefore, this is not a direct cost of GIS.
13. All recommendations presented in the GIS Strategic Business Plan documentation are organized and classified as either Short-Term recommendations, indicating a one- to three-year horizon for implementing the recommendation, or as a Mid-Term recommendation, indicating a four- to five-year horizon for implementing the recommendation.
14. All recommendations in the Agency Reports for DEPRM, DPW, PDM and OP have a preliminary business case identifying the costs and benefits of the recommendation. For the costs, the typical approach was to calculate the development costs in year one, followed by two years of maintenance costs. The benefits were calculated with no benefits in year one, during development, while benefits in year two and three were calculated. In most cases, due to the limited scope of the project, the preliminary business case assessment provided benefits only for the agency originating the recommendation. However, where there were perceived opportunities for benefits in other agencies, the documentation indicates this possibility. The County should complete a full business case prior to approving the project for development.

# 2 Enterprise Architecture and Costs

## 2.1 Enterprise Architecture

### 2.1.1 Overview

The Office of Information Technology Department supports countywide GIS databases and web mapping applications with an enterprise system that is composed of various hardware, software, and network configurations. This system hosts most of the data provided to the enterprise and all of the community mapping services, and is critical to the services that are provided to the public and County agencies. The architecture of this system is discussed in this section, including the hardware and network design, as well as the software and spatial database specifications.

In addition, the annual operating and capital costs for supporting the enterprise GIS have been outlined within this document. The annual operating costs identified and documented for the GIS enterprise include hardware, software, OIT enterprise GIS personnel, OIT support personnel, and training and supply costs. The annual capital costs identified and documented for the GIS enterprise include scheduled database maintenance expenditures for the Orthophotography, LiDAR, and Contours databases, along with Planimetric database updates. Please note that the costs in this section have also been distributed to each agency using GIS within the County, based on the number of GIS users, and have been captured in the individual agency chapters.

## 2.2 Enterprise Cost Summary

The annual operating and capital costs for the enterprise GIS system have been documented and detailed in this chapter, in conjunction with the technical specifications of the enterprise GIS architecture. The general summary of the annual cost information is provided in the tables below, for reference. The detailed documentation associated with the operating and capital costs are provided in the remainder of this chapter.

| **Annual Enterprise GIS Operating Costs** | |
|---|---|
| **Category** | **Annual Cost** |
| Hardware | $86,936 |
| Software | $94,294 |
| Administrative OIT Personnel | $351,096 |
| Database Maintenance OIT Personnel | $216,901 |
| OIT Support Personnel | $60,426 |
| Training | $46,211 |
| Administrative Supplies | $3,853 |
| | |
| **Total Annual Enterprise GIS Operating Cost:** | **$859,717** |

**Table 6 – Annual Enterprise GIS Operating Costs**

| **Annual Enterprise GIS Capital Costs** | |
|---|---|
| **Category** | **Annual Cost** |
| Orthophotography Database | $125,000 |
| Planimetric Database (Buildings, Roads, Hydrology) | $117,000 |
| Topographic (Contours / LiDAR) | $30,000 |
| | |
| **Total Annual Enterprise GIS Capital Cost:** | **$272,000** |

**Table 7 – Annual Enterprise GIS Capital Costs**

| **Total Annual Enterprise GIS Costs** | |
|---|---|
| **Category** | **Annual Cost** |
| Annual Enterprise GIS Operating Cost: | $859,717 |
| Annual Enterprise GIS Capital Cost | $272,000 |
| | |
| **Total Annual Enterprise GIS Cost:** | **$1,131,717** |

**Table 8 – Total Annual Enterprise GIS Costs**

## 2.3 Enterprise System Specifications

### 2.3.1 System Overview

The enterprise system consists of a collection servers, workstations, network relations, databases, and software applications. The architecture of this system is given in the diagram below:

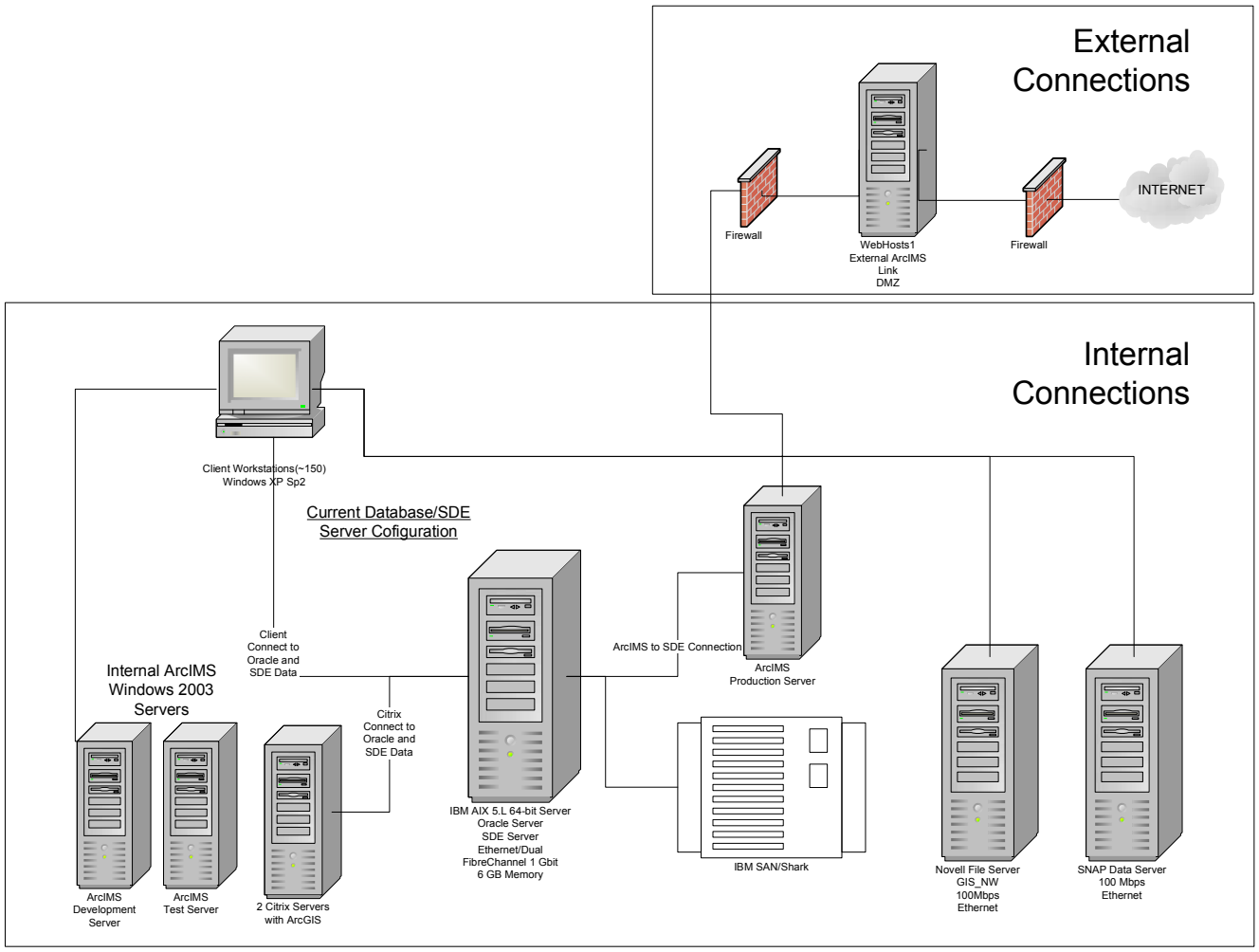


**Figure 1 – Enterprise Architecture Diagram**

Eight servers are connected through a wide area network (WAN) within the enterprise system. Three servers are dedicated to providing ArcIMS web mapping applications to the public. One of the ArcIMS servers is behind the firewall for development and testing purposes, and is accessible to internal client workstations but inaccessible to the public. The external ArcIMS server exists inside the DMZ (the area that allows public access to certain data or services, but protects other data) and is available to the public via the internet, while the ArcIMS production server is connected and located behind the firewall. There are also three servers devoted to data storage and provisioning. One data server, cl1_ora3, hosts the Oracle database and ArcSDE

applications, with data being stored on a storage area network (SAN). Another server, the SNAP server, hosts data files and imagery. The third data server, GISNW, is used for file storage (including departmental data, development data, application and project documentation, user workspaces, shared data, application executables and dll's, image data, public access data, PDF map products, and geodatabase extracts as backups). Two servers are used to manage Citrix connections to County machines. The Citrix servers publish the ArcGIS software to remote County work sites.

Client workstations are connected to the internet and are able to access the servers through the County WAN. These workstations are equipped with ArcGIS 9.0 for data viewing and editing. These workstations also have internet browsers needed to access ArcIMS websites hosted by County servers.

### 2.3.2 Server Specifications

The specifications for the eight servers dedicated to the enterprise GIS system are outlined below:

| Name | Server | Processor | Memory | Disk Space | Connection | Operating System |
|---|---|---|---|---|---|---|
| Novell File Server | HP ProLiant DL380 G4 | Intel Xeon 3.2 GHz /1MB | 2 GB | 500 GB RAID 5 | 100 Mbs Ethernet | Novell |
| Oracle 9.2 server | IBM AIX 5.1L | 2 IBM RISC Processors, 650 mhz | 6 GB | ~400GB SAN Disk Space | 100 Mbps Ethernet and Fiber Channel [Ora3] | UNIX 64-bit |
| Image / Data Server | SNAP NAS | Unknown | N/A | 400 GB | 100 mbs Ethernet | SNAP NAS |
| Citrix Server | HP BL20p Blade | Dual 3.4 GHZ Intel | 4 GB | N/A | NFUSE XML/NFUSE HTML ICA Connection | Windows 2000 SP4 Citrix Metaframe XP |
| Citrix Server | HP BL20P Blade | Dual 3.4 GHZ Intel | 4 GB | (2) 36GB drives | 1 GB to cre 613 switch | Windows 2000 SP4 Citrix Metaframe XP |
| ArcIMS Development/Test | HP 380 G3 | Dual 3.06 GHZ | 4 GB | (3) 72 GB drives, RAID 5 | Ethernet | Windows 2000 Server |
| ArcIMS Production | HP BL20P Blade Server | Dual 3.8 GHZ 2mb cache CPU | 4 GB | Dual 36 GB 15k RPM Disks (mirrored) | 4 GB Ethernet Ports - 2 connected | Windows 2003 Server |
| External ArcIMS | HP BL20P Blade Server | Dual 3.4 GHZ | 4GB | N/A | 100mb Ethernet | Windows 2003 Server |

**Table 9 – Server Specifications**

The specifications for each of the servers in this table are quite different and correlate with the main functional role that each of the machines serve. Machines that are available to the public and that handle data editing through Citrix connections have more memory and processing capability than the other servers. Servers that store and serve data have significantly more disk space, which is necessary for storing large spatial databases. All GIS enterprise servers have a five-year replacement lifecycle.

In addition, client workstations are also provided to GIS users. These machines hold enough processing speed to handle the load necessary from GIS applications. These workstations are included as clients in the enterprise GIS. The replacement cost factor for these workstations was limited to only the difference between the GIS class workstation (with the higher-end processing functionality) as compared to the Standard class workstation, since the workstation being replaced will be reused and reallocated to another user outside of the GIS enterprise. This price difference was documented as $444.80 per workstation. All GIS client workstations have a three-year replacement lifecycle and the County replaces approximately 70 workstations per year.

### 2.3.3 Annual Hardware Costs

The costs of supporting each of the hardware products within OIT are given in the table below:

| Hardware | Replacement Cost | Replacement Lifecycle | Annual Cost (Based on lifecycle) |
|---|---|---|---|
| Annual Cost of GIS PC Replacement | $444.80 | Replaces 70 per year | $31,136 |
| **Enterprise Disk Space** | | | |
| AIX (SAN / SHARK) | $5,500 | Annual Disk Increase | $5,500 |
| Novell | N/A | Included in Novell | |
| **Enterprise Servers** | | | |
| AIX | $100,000 | 5 years | $20,000 |
| Novell | $12,000 | 5 years | $2,400 |
| BCG_ARCIMS1 | $6,500 | 5 years | $1,300 |
| BCGARC1 | $6,500 | 5 years | $1,300 |
| ARCIMS_DEV | $6,500 | 5 years | $1,300 |
| **Peripherals** | | | |
| Plotters | $12,000 | 2 Plotters annually | $24,000 |
| | | | |
| | | **Total Annual Hardware Cost:** | **$86,936** |

**Table 10 – Annual Hardware Costs**

The majority of the costs for hardware are related to the costs of replacing GIS PCs and the AIX server. The remainder of costs is for smaller servers and enterprise disk space.

### 2.3.4 Spatial Databases and Replication

Baltimore County's OIT/GIS Services Unit maintains six Oracle instances and six ArcSDE instances for GIS data in the production environment. Each Oracle instance is associated with one ArcSDE instance. Every ArcSDE instance has a protected default version, SDE.Default, which is the master version. Under the SDE.Default version, a business version of the data is created for all subsequent versions. From that version, all editing versions are generated and the SDE administrator reconciles edits from the business version to the SDE.Default. Baltimore County also has Oracle instances and ArcSDE instances for development, which are used as development and testing environments for ArcIMS and associated GIS applications.

### 2.3.5 Database/ArcSDE Layout

Each of the six enterprise spatial databases store, manage, and serve various spatial datasets including orthophotography, cadastral data, planimetric data, infrastructure data, and public safety data. These database instances are listed by ArcSDE and Oracle instance name in the table below, along with the purpose of each database.

| Oracle Instance | ArcSDE Instance | Purpose |
|---|---|---|
| bcgis | bcgis_sde | These two instances contain the countywide production GIS data, which includes planimetric, topographic, zoning, facilities, utilities, cadastral, administrative, and countywide small-scale or derivative datasets. This is a production location with static data for GIS community users. Data is periodically refreshed based on maintenance to the data layers in the supporting editing instances of Oracle and ArcSDE. |
| bcdpw | bcdpw_sde | These two instances are editing instances containing the Bureau of Public Works sewer and stormwater geodatabases, traffic claming, and traffic signal geodatabases. The instances also hold the sewer service area and sewer subsheds feature classes. |
| bccad | cad_sde | These two instances are editing instances containing the cadastral (parcel data), zoning, and land use geodatabases. The instances also hold easement data (agricultural preservation) as maintained by DEPRM. |
| ortho | ortho_sde | These two instances contain the production imagery datasets (orthophotography, satellite imagery, and DTM data). |
| pubsafe | pubsafe | These two instances are the editing instances for public safety related data. Data includes, fire boundaries, fire boxes, police precincts, police reporting areas, police and fire stations, facilities, and centerlines. |
| nsudb | sdensu | These two instances are a smaller replica of the bcgis and bcgis_sde instances. The purpose of these instances is to provide a mirrored development environment and staging area for new data. Application developers and GIS personnel can safely test code and applications in this environment, along with staging data to be migrated into production. |

**Table 11 – Spatial Databases**

As shown in the table, these databases have been organized according to their main functional purpose. One database holds most of the enterprise vector data and another one is dedicated to serving enterprise raster orthophotography. The remaining databases are primarily dedicated to serving the needs of one agency, including public safety, the Department of Public Works, and DEPRM, all large GIS users.

### 2.3.6 Versioning Workflow

Each of the databases hosted by the enterprise is under a version structure, in order to allow for editing to be performed by multiple users and not impacting the parent database without proper quality control. The versioning structure for each of the databases hosted by OIT is depicted in the figure below:

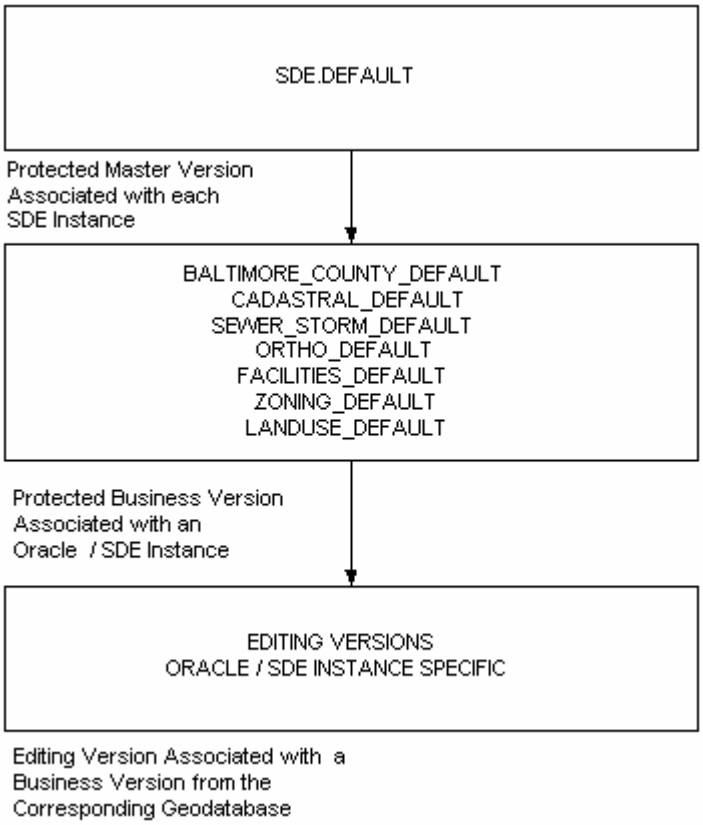


**Figure 1 – Database Versioning Structure**

Each database instance has a default version that acts as the parent or master copy of the database. This is centrally stored and accessible only by database administrators. This database is versioned to a business version, which is distributed to users for viewing purposes only. An editing version is made available for any edits that need to be performed to the databases and is accessible only by registered editors. Databases are reconciled as edits are made and reviewed in the editing version. Revisions are posted to the business version of the database, which are then posted to the default version.

### 2.3.7 Software

Baltimore County OIT uses ESRI's ArcGIS software for maintaining databases. A comprehensive list of software used by the County is as follows:

- ArcSDE 9.0 Service Pack 3 [Ora3]
- ArcGIS 9.0 Service Pack 3—ArcMap, ArcToolbox, ArcCatalog
- ArcIMS 9.0
- Oracle 9.2.0.4 [Ora3]

Each of the databases is stored in an Oracle database. Spatial datasets are managed by ArcSDE 9.0 with service pack 3. ArcIMS is used for viewing and editing databases over the internet. ArcGIS 9.0 with Service Pack 3 is used to view and edit the databases from client workstations.

ArcGIS products are purchased using two licensing types: single use and concurrent use. Single use products are installed on laptops or PCs in instances where a user needs dedicated access to an ArcGIS license. Examples of this are the duty machines in planning, DEPRM, DPW, and also in the Public Safety Van. A license manager on the GIS server, cl1_ora3, manages concurrent use licenses. Licenses are checked out for a user only when the application, ArcGIS, is activated on a PC. Concurrent licenses allow the County to provide Desktop GIS functionality to users on an as-needed basis.

ArcSDE and ArcIMS are licensed per server and per processor on a server. This allows unlimited ArcSDE and ArcIMS services on each licensed server. ESRI allows ArcIMS software to be installed on a development and test server for each ArcIMS license maintained. Oracle is licensed based on the number of processors on a server. Currently, GIS is licensed for a 2 CPU Oracle seat. This allows unlimited database instances on that server, as long as the memory and CPU structures are in place to support the database requirements.

### 2.3.8 Annual Software Costs

The costs for supporting each of these applications are given in the table below:

| Software Support | Annual Cost |
|---|---|
| ESRI | $82,994 |
| GeoExpress (MrSID) | $999 |
| TiffQC | $999 |
| QTModeler | $600 |
| AIX | $2,602 |
| Oracle | $4,000 |
| IMS Server's Operating Systems Support | $2,100 |
| Novell Software Support | $0 |
| Microsoft Desktop Support Costs (clients) | $0 |
| **Total Annual Software Cost:** | **$94,294** |

**Table 12 – Annual Software Costs**

The IMS Server's Operating Systems Support line item is not an annual maintenance figure, but rather software upgrades averaged as an annual amount of $700.00 per server per year, which totals a $2,100 annual cost. The Novell software support line item has no cost directly against the GIS enterprise, mainly because all GIS users would generally use other Novell servers to conduct their business activities, which would make that maintenance an operating cost of business. The Microsoft Desktop Support costs for all workstation clients were also documented as a no-cost item because personnel would have had a workstation to perform their duties even without GIS functionality available.

The majority of the costs for software are with the ESRI maintenance fees, which total $82,994. These costs support ArcSDE, ArcIMS, and ArcGIS applications. The remainder of the application support costs is for database quality control review and database storage applications.

## 2.4 Other Enterprise Costs

In addition to annual hardware and software costs, there are other costs associated with providing the enterprise GIS. These costs are given in the section below.

### 2.4.1 Annual Enterprise GIS (OIT) Personnel Costs

Personnel within OIT are responsible for maintaining the enterprise system and databases. Support personnel also help with hardware and network issues related to the enterprise GIS. The table below summarizes the costs associated with these activities.

| OIT Technical GIS Personnel | Percentage of Time Dedicated to GIS | Annual Cost |
|---|---|---|
| 2 Programmers | 95% | $129,178 |
| 1 Database Administrator | 80% | $60,324 |
| 1 Business Analyst | 25% | $19,642 |
| 1 PMO Resource | 95% | $57,950 |
| | **Subtotal:** | **$267,094** |
| Overhead / Fringe factor: | | 31.45% |
| | **Total Annual Administrative Cost (w/ Fringe):** | **$351,096** |

**Table 13 – Annual OIT Technical GIS Personnel Costs**

| OIT Database Maintenance Personnel | Annual Cost |
|---|---|
| 5 GIS Technicians (8840 resource hours) | $165,007 |
| **Subtotal:** | **$165,007** |
| Overhead / Fringe factor: | 31.45% |
| **Total Annual Personnel (OIT) Cost (w/ Fringe):** | **$216,901** |

**Table 14 – Annual OIT Database Maintenance Personnel Costs**

| OIT Support Personnel | Annual Cost |
|---|---|
| Desktop | $15,980 |
| NSU | $40,800 |
| Administrative | $3,646 |
| **Total Annual OIT Support Personnel Cost:** | **$60,426** |

**Table 15 – Annual OIT Support Personnel Costs**

The OIT technical GIS personnel associated with the enterprise GIS amount to approximately three full-time employee equivalents. The cost for these personnel is $351,096, including a 31.45% overhead cost. Five OIT GIS technicians are involved with database maintenance activities, totaling 8,840 resource hours or $216,902 with a 31.45% overhead cost.

The total cost for OIT support personnel is $60,426. The OIT support personnel provide various levels of support to the GIS enterprise, including the Network Services Unit (NSU) providing Windows and Novell server support for maintenance (upgrades and patches), Desktop Unit providing workstation rollouts and support, and the Administrative Unit providing requisition and invoicing support for GIS projects and capital budget.

The total annual cost for all resources dedicated to maintaining the enterprise GIS is $628,423.

### 2.4.2 Annual Training Costs

Training is given to GIS users throughout the County to educate personnel on GIS software and data that is provided by the enterprise. The costs of these activities are given in the table below:

| Training | Specifications and Cost Basis | Annual Cost |
|---|---|---|
| ArcGIS External Training | 1 class per year (10 OIT staff) | $15,000 |
| ArcGIS Inhouse Training | 2 classes per year (28 total students) | $21,000 |
| Data Query ArcGIS Training | 3 classes per year (48 total students) | $1,761 |
| Oracle | 1 class every 2 years for OIT DBA | $600 |
| InHouse GroupWise | Introduction & Advanced for 14 students | $500 |
| Other | Communications & Sexual Harassment | $0 |
| ESRI National Conference | 3 OIT staff x $1850 each | $5,550 |
| TUGIS Conference | 9 OIT staff x $200 each | $1,800 |
| | **Total Annual Training Costs:** | **$46,211** |

**Table 16 – Annual Training Costs**

A significant amount of money is spent providing training for the ArcGIS software package. External training provided outside of the County totals $15,000, while internal training for ArcGIS totals $21,000. The remainder of the costs is for conferences and smaller software packages. The total annual training cost for the enterprise GIS is $46,211.

### 2.4.3 Annual Administrative Supply Costs

The OIT department is responsible for the enterprise GIS system; therefore, a portion of its annual administrative supplies and service costs are allocated to the enterprise GIS costs. The costs associated with providing this service are given in the table below:

| Administrative Supplies | Annual Cost |
|---|---|
| Administrative Costs – FedEx, CD/DVDs, Postage, Phone Service | $1,000 |
| Plotting / Printing Supplies | |
| Ink | $770 |
| Print Heads | $193 |
| Paper (Plotters / Printers) | $1,890 |
| **Total Annual Supplies Costs:** | **$3,853** |

**Table 17 – Annual Administrative Supplies Costs**

Administrative costs related to the GIS enterprise include professional society subscriptions, phone usage, printing, and shipping costs. These annual costs total $3,853.

### 2.4.4 Annual Enterprise GIS Capital Costs

The enterprise GIS capital costs have been documented to account for the scheduled purchases of enterprise databases. The capital costs represent maintenance commodity fees that the County pays to vendors providing GIS services for development of the following databases: orthophotography, planimetric, LiDAR and contours. To provide an accurate representation of the annual capital costs, the costs for each enterprise database have been annualized based on the database update frequency.

| Enterprise Database | Database Cost | Database Update Frequency | Annual Cost (Based on lifecycle) |
|---|---|---|---|
| Orthophotography Database | $375,000 | 3 year cycle | $125,000 |
| Planimetric Database (Buildings, Roads, Hydrology) | $351,000 | 3 year cycle | $117,000 |
| Topographic (Contours / LiDAR) | $300,000 | 10 year cycle | $30,000 |
| | | | |
| **Total Annual Enterprise GIS Capital Cost:** | | | **$272,000** |

**Table 18 – Annual Enterprise GIS Capital Costs**

### 2.4.5 Distribution of Enterprise Costs to Agencies

The operating and capital annual costs for the GIS enterprise have been proportionately distributed to all agencies participating in the GIS Strategic Business Plan study based on the number of GIS database user accounts in the system for each agency. The number of users was identified by counting the number of ArcSDE accounts for each agency in October 2006. This number of users was compared to the total number of GIS database user accounts in the County to calculate a percentage of total users. Based on this percentage, a factor of the annual operating and capital costs for the County GIS enterprise were allocated to each agency. For agencies with no GIS users in ArcSDE, 0.5 of a user, or 0.23% of the total users, has been given as a factor to associate some of the costs with every agency.

| Agency | # of Users | % of Total Users | Factor of Operating Cost | Factor of Capital Cost | Factor of Total Cost |
|---|---|---|---|---|---|
| DEPRM | 50 | 22.52% | $193,630.00 | $61,261.26 | $254,891.26 |
| PDM | 30 | 13.51% | $116,178.00 | $36,756.76 | $152,934.76 |
| DPW | 59 | 26.58% | $228,483.40 | $72,288.29 | $300,771.69 |
| DED | 1 | 0.45% | $3,872.60 | $1,225.23 | $5,097.83 |
| DRP | 5 | 2.25% | $19,363.00 | $6,126.13 | $25,489.13 |
| OCC | 4 | 1.80% | $15,490.40 | $4,900.90 | $20,391.30 |
| OP | 25 | 11.26% | $96,815.00 | $30,630.63 | $127,445.63 |
| Fire | 3 | 1.35% | $11,617.80 | $3,675.68 | $15,293.48 |
| Health | 1 | 0.45% | $3,872.60 | $1,225.23 | $5,097.83 |
| Police | 11 | 4.95% | $42,598.60 | $13,477.48 | $56,076.08 |
| 911 | 3 | 1.35% | $11,617.80 | $3,675.68 | $15,293.48 |
| Executive Office | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| HR | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| Auditor's Office | 2.5 | 1.13% | $9,681.50 | $3,063.06 | $12,744.56 |
| Aging | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| Corrections | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| OET | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| OBF | 1.5 | 0.68% | $5,808.90 | $1,837.84 | $7,646.74 |
| OIT | 13 | 5.86% | $50,343.80 | $15,927.93 | $66,271.73 |
| Law Office | 3 | 1.35% | $11,617.80 | $3,675.68 | $15,293.48 |
| LMB | 3 | 1.35% | $11,617.80 | $3,675.68 | $15,293.48 |
| Peoples Council | 1 | 0.45% | $3,872.60 | $1,225.23 | $5,097.83 |
| Board of Elections | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| Liquor Board | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| Sheriff | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| Social Services | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| State's Attorney | 1 | 0.45% | $3,872.60 | $1,225.23 | $5,097.83 |
| Board of Appeals | 0.5 | 0.23% | $1,936.30 | $612.61 | $2,548.91 |
| **Totals:** | **222** | **100.00%** | **$859,717** | **$272,000** | **$1,131,717** |

**Table 19 – Distribution of Enterprise Costs to Agencies**

# 3 Assessment of Public Access Program

Baltimore County makes much of its GIS information available to the public. This takes the form of information provided through the County's website such as static maps and other static information (e.g., forms, reports, etc.); interactive GIS maps provided via the MyNeighborhood series of ArcIMS applications; and other web-based applications. In addition to providing information through the web, the County makes GIS data layers available to the public, using a fee structure established according to administrative policy and License Agreements that prescribe what the licensee may and may not do with the information and products.

## 3.1 Static Maps

Static maps are published map products that are available for downloading and printing. Generally, these maps are found in reports and publications, or presented at public meetings. Some of the maps are intended for viewing only. The viewable maps vary in size from 11x17 inches to 36x54 inches. All maps are in Adobe .pdf format. The County provides numerous static maps and/or map series to the public through numerous County agencies. Additionally, several agencies also provide lists of locations with links to MapQuest that provide on-line mapping and driving directions. The static maps provided by individual agencies are summarized in the individual agency chapters. OIT's Web Services group assists agencies in posting information on the County's web pages, and the individual agencies are responsible for the content of those pages.

The County's static maps are quite popular, and the Static Maps main page ranks among the top 400 County web pages based on web visits. The summary statistics for 2006 are shown in the table below.

| Rank | Website Pages | Visits |
|---|---|---|
| 305 | **Static Maps:** http://www.baltimorecountyonline.info/Agencies/infotech/geographic_information_systems/static_maps/index.html | 2,952 |

**Table 20 – Static Maps Web Visit Statistics**

### 3.1.1 Assessment of Static Maps

Static maps posted on the County's website are too numerous to enumerate, and there is no central source to see a listing of all available maps. It appears that templates are used within agencies, but not necessarily across agencies. Most maps include basic map essentials such as a title, legend, north arrow, and scale. The use of logos varies – some use a county logo, others use an agency logo. Some static maps include locator maps, but many do not. Some static maps do not include information about the date of the map and/or the source and date of the data used to make the map.

### 3.1.2 Static Map Recommendations

The following recommendations are provided regarding the County's static maps:

**Opportunity #1: Map Presentation and Standardization**
Further standardization of static map products produced by the various County agencies is recommended. It is also recommended that information about the date of the map and the source(s) of the data used to make the map be included.

**Opportunity #2: Consolidation of Static Maps into a Single Web Page**
Since many static maps are available and generally accessible through individual agency web pages, it is recommended that a listing of all available static maps from the Static Maps Web Page be provided. The listing should include the following:

- A thumbnail view
- Map title
- Map date
- Created by (agency)
- Theme keyword
- File size
- A link to the PDF file

## 3.2 Interactive Maps

### 3.2.1 MyNeigborhood Web Applications

The County's series of MyNeighborhood ArcIMS applications allows the user to display and query map data, and perform certain functions such as zooming, panning, identifying, etc. MyNeighborhood assists the user to:

- Determine where a feature is located
- Provide more information about the feature (name, address, etc.)
- Analyze relationships with other features

All of the MyNeighborhood applications are similar in look and feel, and all share the same base map data, which is the same data contained in the County's GIS databases. MyNeighborhood was designed to provide citizens access to the same data used by County personnel. However, each MyNeighborhood application is tailored to a specific set of data and was built with a specific user in mind.

The following MyNeighborhood applications are currently available:

**MyNeighborhood: Commercial Revitalization**
MyNeighborhood: Commercial Revitalization provides location and general information about zoning designations in the County. My Neighborhood: Commercial Revitalization allows the user to determine if a property is within a Commercial Revitalization District and find property information

(Maryland Department of Assessment and Taxation Data) for any County property.

**My Neighborhood: Draft Bicycle Plan**
My Neighborhood: Draft Bicycle Plan allows users to display map data pertaining to the Baltimore County Pedestrian and Bicycle Access Plan. The "Recommended Improvement Types" display theme shows each road segment or area studied with its project number. Clicking on the project number with the Identify Tool will open a new window with information about the project, including its name, location, recommended improvement, potential funding source, and time frame for implementation.

The recommended improvements are based on a Bicycle Level of Comfort (BLOC) analysis. BLOC is a rating of how comfortable or safe a bicyclist feels according to varying roadway conditions such as paving width, speed limit, and traffic level. An "A" rating reflects the best conditions and "F" reflects the worst conditions. You can select the "Existing Bicycle Level of Comfort" display theme to see a road segment's rating based on its existing condition. By selecting the "Proposed Bicycle Level of Comfort" display theme, you will see the rating that could be achieved if the recommended improvements are made.

**My Neighborhood: Enterprise Zones**
My Neighborhood: Enterprise Zones allows the user to determine if a property is within a Baltimore County Enterprise Zone and find property information (Maryland Department of Assessment and Taxation Data) for any County property.

**My Neighborhood: Facilities**
My Neighborhood: Facilities provides location and general information about facilities in the County. General information provided about a particular facility may include facility name, address, contact information, and links to a site-specific website. For example, My Neighborhood: Facilities shows the location of fire stations, police stations, schools, libraries, and senior centers.

**My Neighborhood: Historic**
My Neighborhood: Historic provides location and general information about historic properties and districts in the County. The user can select a countywide map and zoom in to see more detail in specific areas; view aerial photography; create a map for a specific address; and, by using the "identify" tool, click on map locations to access a narrative report (sometimes with a photo) about the historic resource.

**My Neighborhood: Planimetric/Topographic**
My Neighborhood: Planimetric/Topographic provide users access to portions of the County's planimetric/topographic map database, cadastral (property) database, and imagery for the County. The cadastral theme includes a detailed report containing owner, location, legal description, value, and transfer information. The available features include buildings, roads, railroads, hydrology (streams, ponds, reservoirs, etc.), cross-county power transmission lines, elevation data (contours), and property. My Neighborhood: Planimetric/Topographic allows the user to determine the elevation of a location, provide more information about a property, and analyze relationships with other features.

**My Neighborhood: Zoning**
My Neighborhood: Zoning assists the user in determining what the zoning is for a localized area, provides more information about the zoning designation, and analyzes the zoning designation in relationship to surrounding areas.

Several of the MyNeigborhood applications rank among the top 400 County web pages based on web visits. These include the MyNeigborhood: Zoning and MyNeighborhood: Facilities applications. The summary statistics for 2006 are shown in the table below.

| 2006 Summary Statistics | Visits | % of Total County Website Visits: |
|---|---|---|
| MyNeighborhood Zoning | 54,658 | 0.74% |
| MyNeighborhood Facilities | 27,511 | 0.37% |
| **Total Hits:** | 82,169 | 1.12% |

**Table 21 – MyNeighborhood Web Visit Summary Statistics**

### 3.2.2 Assessment of MyNeighborhood Web Applications

MyNeighborhood provides useful information to the public about selected programs or data themes. The MyNeighborhood sites are standardized in their layout and design and most have similar functionality (e.g., locate an address, zoom in, zoom out, pan, identify, go to previous view, view legend, and print). They also all allow the user to toggle data themes and identify themes.

However, it is unclear from the content how decisions are made about what becomes a MyNeighborhood application. For example, it is unclear why there is a MyNeighborhood application for bicycle plans for a portion of the County and not one for environmental concerns, recreation sites, or health care treatment centers, to name a few other themes that might be of interest to the public. It is also unclear why Find Tile and Community Crime are not considered MyNeighborhood applications.

The MyNeighborhood sites could be given more prominence from the County home page and from other relevant departmental pages. Compared to other local jurisdictions and the counties compared in the Industry Research assessment, Baltimore County's interactive maps are somewhat less prominent than most. The most direct way to find a MyNeighborhood site is from the Find County Facilities menu on the home page, but if the user wants other MyNeighborhood sites (e.g., Plan/Topo), additional steps are required. By contrast, the Howard County home page contains a tab for Maps with a menu that takes the user directly to the interactive maps page where the user can choose how to view the map.

| Clicks to Map | | | | |
|---|---|---|---|---|
| **Baltimore County** | **Howard County** | **Montgomery County** | **King County, WA** | **Mecklenburg County, NC** |
| 2-4 | 3 | 6 | 3 | 3 |

**Table 22 – Clicks to Interactive Maps**

Additionally, the content of the MyNeighborhood main page may not be as up-to-date as could be desired. For instance, the MyNeighborhood: Zoning says it includes the 2004 Comprehensive Zoning Map Process (CZMP), but does not seem to include anything about CZMP. It appears that the 2004 CZMP data may have been removed, but the MyNeighborhood main page may not have been updated to reflect this change.

### 3.2.3 MyNeighborhood Recommendations

The following recommendations are provided regarding the County's MyNeigborhood web pages:

**Opportunity 1: Increase MyNeighborhood Web Presence**
Maps in general and MyNeighborhood in particular should be more prominent on the County's web pages. Ideally, a link from the home page to Maps should take users to a way to find a listing of all of the available static maps, interactive maps, and custom map products and data. Additional links to the MyNeighborhood main page should be made from other relevant pages as well. These would include the Interactive Maps page, the GIS Home Page, each agency that is responsible for one of the themes, and other main pages with keywords that are included in MyNeighborhood (e.g., zoning commission [Zoning], landmarks preservation commission [Historic]). The MyNeighborhood: Facilities application needs links from all of the agencies that participate in the Facilities layers: Fire, Police, Social Services, Community College, Public Schools, Library, etc.

**Opportunity 2: Increase Instructions for End Users**
The MyNeighborhood pages need an entry on the Directions Page telling the user how to view the entire County by leaving the address box blank.

**Opportunity 3: Consolidate and Rewrite MyNeighborhood Application Suite**
The current MyNeighborhood applications as well as the other non-MyNeighbhorhood ArcIMS web-based mapping applications should be consolidated

into a smaller number of related applications. Currently, the content-specific applications available to end users are cumbersome and require users to utilize separate stovepipe applications for Commercial Revitalization, Bicycle Plan, Enterprise Zones, Facilities, Historic, Planimetric/Topographic, and Zoning. Additionally, Baltimore County is maintaining many ArcIMS application implementations, which is cumbersome from a maintenance perspective. This consolidation would provide a uniform presentation of data, functionality, and all web-based applications under the branding of MyNeighborhood.

The recommended consolidation approach is to develop the following MyNeighborhood applications:

- **MyNeighborhood: Land Development** – This would include the existing MyNeighborhood: Zoning, Historic, Enterprise Zones, and Commercial Revitalization and add information about Renaissance Opportunity Areas and FEMA DFIRM Flood Zones to combine information about properties. CZMP information could also be included, as well as areas with environmental restrictions when the appropriate data layers are available. Links to FEMA's website where LOMRs are posted should also be provided.
- **MyNeighborhood: Services** – This would include the existing MyNeighborhood: Facilities features leveraging the detailed information in the Facilities geodatabase about all facilities in Baltimore County.
- **MyNeighborhood: Recreation** – This would include Parks, Trails, Recreation Centers, Golf Courses, Playgrounds, Tennis Courts, and Fitness Centers.
- **MyNeighborhood: Public Safety** – This would include the existing web-based applications of Community Crime Profile and Rural Water, along with a Fire-related incident reporting application.
- **MyNeighborhood: Public Access** – This would include the existing web-based application of Find Tile, and would provide all the grids and indexes necessary for users to determine areas of interest. This site could also prove to be the gateway for serving the data to the public, should the GIS datasets and information be put into the public domain.

The County should review the usability of the website redesign to adequately provide functionality and data for the user community. A cross-section of the County users should participate in the usability study to obtain an accurate assessment of the proposed application design. In addition, the County should investigate the use of alternative software solutions for the MyNeighborhood redesign, including the current ArcIMS platform and ArcGIS Server.

Some direct benefits of redesigning the MyNeighborhood suite of applications include:

- Decreased maintenance hours for application programmers that currently maintain 11 different applications.
- Decreased implementation hours for creating additional layers and reports for additional content areas. Currently, a typical MyNeighborhood application implementation may require 250 application programmer hours, whereas with a consolidated suite of applications that are expandable for new layers and reports, a new content area could be enabled in approximately 40 hours.

### 3.2.4 Other Web-Based Applications

Baltimore County has developed a number of other web-based GIS applications that are provided to the public via the County's website. These include the following:

**Community Crime Profile Main Page**
Community Crime Profile is an ArcIMS application designed to provide summary crime statistics for a mapped area encompassing a radius of 1/2 mile from a given location of interest. The summary crime statistics reflect a year-to-date average covering the most recent three-year period. Crime statistics are presented as averages to compensate for variations in reported crime that typically occur for small geographic areas. The summary crime statistics are reported by Baltimore County Police to the FBI in accordance with Uniform Crime Reporting (UCR) guidelines. Uniform Crime Report statistics are derived from information contained on offense and arrest reports.

**Find Tile**
FindTile is an ArcIMS application designed to assist in the determination of which data tiles are in an area of interest. The application contains the orthophoto and planimetric roads base maps. FindTile has address matching functionality to allow users to narrow their search to a particular area.

FindTile contains the following grids and indexes:

- 200 Scale
- 600 Scale
- Key Sheet
- Position Sheet
- CD Images
- VARGIS Images
- ADC Index

**Rural Water**
In conjunction with the Fire Department, an ArcIMS site was developed to present locations of rural water sites (e.g., ponds, pools, reservoirs, etc.) that could be used to help fight a fire in remote areas where fire hydrants may not

be readily available. However, this application was developed using an out-of-date dataset and does not appear to be currently available to the public.

**Land Survey Control Points**
Baltimore County government provides online access to the public information maintained in its records. The data provided through this website is the same information available from the Department of Public Works, Land Survey Division Office. Survey Control is an ArcIMS application that provides location and general information about control points in the County.

Survey Control assists the user to:

- Find survey control points
- Provide more information about survey control points
- Submit conditional information about survey controls

Unlike other County web-based mapping applications, access to the Survey Control ArcIMS application is restricted to registered users. The web application allows those with proper access rights to manage the recovery condition reports.

**Voter Mapping Application "Where Do I Vote"**
The Baltimore County Board of Elections provides an ArcIMS online polling place locator to help citizens identify their polling place as well as their councilmanic, legislative, and congressional districts. Citizens are directed to MapQuest for directions to their local Precinct and Polling Place.

Several of the County's non-MyNeighborhood ArcIMS applications pages rank among the top 400 County web pages based on web visits. These include the Interactive Maps main page as well as the Community Crime Profile site. The summary statistics for 2006 are shown in the table below.

| Rank | Website Pages | Visits |
|---|---|---|
| 110 | **CrimeStat:** http://www.baltimorecountyonline.info/Agencies/infotech/geographic_information_systems/interactive_maps/ccpMain.html | 7,216 |

**Table 23 – Other Web-Based Maps Web Visit Statistics**

### 3.2.5 Assessment of Other Web-Based Applications

The County has enabled a registration function for the Survey Control site in order to ensure that any users entering records into the database are identified and not submitted as anonymous. A registration function is not required for access to any other County ArcIMS site. To improve usability and understanding, the disclaimer page should tell users about the need to register, why, whether registration is free, etc. Additionally, the Survey Control site is difficult to find unless one is persistent in looking for it and searches on "Survey."

Many County web pages take the user to MapQuest to find a map to a facility or service location. Once the Facilities Geodatabase is finalized and completed, the County should consider more use of the Facilities data in an ArcIMS site in addition to providing the MapQuest links for driving directions, etc.

The Community Crime Profile application needs instructions for first-time users. We recommend adding the crime area boundaries as a default layer, so users can see those boundaries before they select an address or box.

The Rural Water site was developed using an out-of-date dataset and does not appear to be currently available to the public.

### 3.2.6 Web-Based Application Recommendations

The following recommendations are provided regarding the county's other web-based mapping applications:

**Opportunity 1: Consolidate Web-Based Applications into MyNeighborhood**
As noted above, the County's ArcIMS sites should be re-grouped, combined, and further standardized, so there is no distinction between the MyNeighborhood and other ArcIMS sites.

**Opportunity 2: Increase Instructions for End Users**
Additional information and instructions for use should be provided for the Community Crime Profile and Survey sites.

## 3.3 Public Access Data Requests

Baltimore County provides public access to the County's GIS maps, data, and services. This fee-based program is designed to provide printed copies of published maps, access to the digital data, and services for the creation of custom products based on customer specifications. Digital data is available in several standard GIS and computer-aided drafting and design (CADD) export formats to support multiple uses, including shapefiles, .e00, and .dxf. Services are available to create custom products using the County's available data. All customers obtaining products are required to sign a License Agreement for GIS Data. GIS maps and data are given to consultants at no cost for use in design projects if the projects are County, State, or Federal projects.

The following common products and services are provided by Baltimore County GIS through the public access program.

| Product Name | Standard Product Layers |
|---|---|
| LiDAR | 1st & Last Returns<br>Bare Earth<br>Gridded Bare Earth<br>Intensity Imagery<br>DTM (MassPoints & Breaklines) |
| Planimetric/Topographic | Examples:<br>Buildings<br>Roads<br>Hydrology<br>Contours |
| Orthophotography | Orthophotos<br>Raw Scans<br>Photo Centers |
| Cadastral (Property) | TaxParcel<br>Simultaneous Conveyance<br>Simultaneous Conveyance First Division<br>Boundary<br>Encumbrance<br>Annotation |
| Large Scale County-Wide | Street Centerlines<br>Zoning<br>ZipCodes<br>Administrative Layers<br>- Census Boundaries<br>- Political Districts |
| Small Scale County-Wide | Examples:<br>Regional Planning Districts<br>School Districts<br>Traffic Analysis Zones<br>Basic Services |
| **Services** | **Description** |
| Custom Service | Analysis<br>Map Production |

**Table 24 – Public Access Products**

The following is a summary of data requests filled by the County, including the type of requester, value of the data, and the number of tiles or products provided. It should be noted that the trend in data requests has been decreasing in the last few years, perhaps because larger requesters may have received all of the data they will need until the next County

update of the orthophotography, elevation data, or planimetric data. The table below presents statistics on data requests from FY2002 through FY2006.

| Year | Total Count | Public | Internal | Total Revenue | Free | % Free | Paid | % Paid |
|---|---|---|---|---|---|---|---|---|
| FY02 | 1,343 | 1,161 | 182 | $372,017 | $298,510 | 80% | $73,507 | 20% |
| FY03 | 926 | 721 | 205 | $1,057,142 | $920,205 | 87% | $136,937 | 13% |
| FY04 | 1,029 | 815 | 214 | $2,288,410 | $2,151,033 | 94% | $137,377 | 6% |
| FY05 | 928 | 758 | 170 | $1,720,491 | $1,575,122 | 92% | $145,369 | 8% |
| FY06 | 761 | 611 | 150 | $1,908,785 | $1,784,599 | 93% | $124,186 | 7% |
| **Total** | **4,987** | **4,066** | **921** | **$7,346,845** | **$6,729,469** | **92%** | **$617,376** | **8%** |

**Table 25 – Historic Data Requests**

### 3.3.1 Public Access Data Fees

The following fee structure for data requests, set by Administrative Policy, went into effect on December 27, 2005. Regarding the fee structure, it should be noted that:

- Prices are per tile or published product.
- Additional copies of the paper map are available for $10.00 each.
- Countywide datasets can be purchased at a 20% discount.
- Digital data is available in .dxf, .e00, and shapefile format.
- Unrestricted Use License must be a countywide purchase with no option for per tile.
- Renewal fee is 20% of the entire database cost per update for unrestricted license use.

| Products – Restricted Use | Price (Per Tile) |
|---|---|
| LiDAR (4 tiles) | $90 |
| Planimetric/Topographic | $90 |
| Orthophoto | $80 |
| Cadastral (Property) | $140 |
| Large Scale Countywide | $150 |
| Small Scale Countywide | $85 |
| **Products – Unrestricted Use** | **Price (Countywide Dataset)** |
| LiDAR | $15,048 |
| Planimetric/Topographic | $60,192 |
| Orthophoto | $53,504 |
| Cadastral (Property) | $13,104 |
| Large Scale Countywide | $1,500 |
| Renewal Fee | 20% Current Fee |
| **Services** | **Price** |
| Custom Service | $25/hour + Product(s) |

**Table 26 – Public Access Fees**

### 3.3.2 License Agreements

All customers obtaining products are required to sign a License Agreement for GIS Data. The County has two types of License Agreements: one for Restricted Use and one for Unrestricted Use. The Restricted Use License Agreement data can be purchased by tile and prohibits the licensee from providing the requested data to anyone not included in the License Agreement and from deriving revenue from the data or products created from the data. Under the terms of the Unrestricted Use License Agreement, the licensee can use the data only for purposes described to the County, but the sale of derived products is not prohibited. However, the County can require the licensee to provide the County access to any products derived from the County's data. Customers receive a 20% discount on countywide planimetric, orthophotography, or cadastral data regardless of the licensing type.

### 3.3.3 Assessment of Public Access Program

The Code of Maryland Regulations (COMAR) Title 10 Governmental Procedures, Subtitle 9 Automated Mapping – Geographic Information Systems allows governments to adopt fees to make products available and to cover the cost of providing said products or services.

Baltimore County provides a large amount of data to customers at no cost for use on government projects, primarily to contractors doing work for Baltimore County. The free data requests make up 80% to 94% of the value of the products provided. Additionally, free requests have increased and fees collected have declined over the past few years. Fees could reasonably be expected to go up again when new enterprise data layers (e.g., orthos, planimetrics, or LiDAR) are updated. However, requests for the same data that are filled at no cost would also be expected to go up as well.

The current effort that the County expends on providing services for the fee-based public access service is approximately one Full Time Equivalent (FTE) or $43,380. Based on revenues for FY06, this means the County earned $80,806 that year in sales of data. This does not begin to cover the costs for data creation of even a single enterprise data layer. And it could be argued that the time spent filling data requests is time taken away from other database development or maintenance activities. However, charging a fee for data does reduce frivolous requests for data.

Of the counties reviewed in the Industry Research chapter of this document, both charged for GIS data and did not put it in the public domain. However, as shown in the table below, there were significant differences in the cost structures of these counties and other nearby Maryland counties in relation to Baltimore County.

| GIS Data Cost Comparisons | | | | | | |
|---|---|---|---|---|---|---|
| **Dataset** | **Baltimore County** | **Harford County** | **Howard County** | **M-NCPPC Montgomery County** | **King County, WA** | **Mecklenburg County, NC** |
| Planimetric/ Topographic | $60,192 | $0 | $100 | $118,800 | $110 | $300 |
| Orthophoto | $53,504 | $0 | $200 | Not for sale | $260 | $200 |
| Cadastral (Property) | $13,104 | $0 | $100 | $59,400 | $110 | $250 |
| **All Three Datasets** | **$126,800** | **$0** | **$400** | **$178,200** | **$480** | **$750** |

**Table 27– GIS Digital Data Cost Comparisons**

With the exception of Montgomery County, MD (data provided through the Maryland-National Capital Park and Planning Commission, each of the critical enterprise datasets provided by Baltimore County is sold at a rate far and above the rates charged by other reviewed counties. Although our industry research does not lean towards putting data in the public realm, as a best practice, Baltimore County should at least consider charging fees for data that are within the reach of the general public, as many other counties have done.

Requiring users to sign a license agreement for access to Baltimore County data is a relatively common practice among local governments. However, not all counties have a two-tier system for restricted and unrestricted use. To date, the County has had only one sale of unrestricted use data for the cadastral dataset. The use of license agreements affords the County some protection against having their data copied and passed to others without their knowledge. And the license agreement can be tailored to suit specific needs, allowing the County to participate in Memorandums of Understanding involving data sharing with other agencies such as FEMA and the U.S. Geological Survey (USGS).

There are some arguments currently being made in GIS publications and journals that if licensing restrictions are removed, more data will be developed that fits a county's base map, which will ultimately benefit the County. However, it is unclear if this would be the case for Baltimore County. The data most likely to directly benefit the County is created by consultants working on design or development projects, and they already receive data at no cost, although they must still request the data and sign a license agreement. However, placing the County data in the public domain for unrestricted download would reduce the time the County would need to spend providing data to requesters. The recurring customers, who account for 75% of the fee-based business, would likely take advantage of the ability to download data. A few requesters would still be likely to require custom services. Additionally, placing the data in the public domain could encourage development of and updates to data that would benefit the County and its citizens.

### 3.3.4 Public Access Recommendations

The following recommendations are provided regarding the County's public access program:

**Opportunity 1: Improve On-line information regarding Public Access Program**
Additional information should be provided on-line regarding the datasets that are available, including prices and links to metadata about the datasets.

**Opportunity 2: Release County GIS Data to the Public Domain**
The County should consider posting all of its data on-line for download at no charge. The advantages to this would be as follows:

- The County's liability for data quality would be limited.
- Time spent filling data requests would be significantly reduced from the current allocation of approximately one FTE annually. Also, there would be a reduction in the time spent coordinating requests for fee-based products between agencies, thereby saving additional hours by agency staff. These resource hours could be allocated to project tasks and other database maintenance activities.
- The County would increase its ability to participate in more partnerships for data sharing and cooperative efforts. Some of the partnership opportunities include the following:
    - The statewide orthophotography program, whereby the County could reduce its costs for countywide imagery. The County has already agreed to share its LiDAR data for use in rectifying the State's imagery.
    - The proposed statewide road centerline project, whereby the County might be able to share its data in exchange for regional datasets that would benefit many agencies.
    - The FEMA Digital Flood Insurance Rate Map (DFIRM) Cooperating Technical Program (CTP), whereby the County already provided its base map data for use on FEMA's floodplain maps in exchange for GIS data of the floodplains. As a result of this current initiative, the Roads and Hydrology layers are already in the public domain.
- By providing the data to routing companies, such as TeleAtlas and NavTech, the overall quality of services provided by their databases would improve, thus benefiting the County constituents. The data provided by these companies supports operations of MapQuest, On-Start, AAA, TomTom, UPS, and FedEx.

**Opportunity 3: Digital On-line Download of GIS Datasets**
If the County chooses to take this approach of making its GIS data available for download, we recommend incorporating the data download functions into an interactive web mapping application, such as MyNeighborhood: Public Access, that would allow users to identify an area of interest, view the data, and then download it. Large datasets such as orthophotography or LiDAR data would be downloadable by tile. Smaller datasets could be made downloadable as countywide data layers.

# 4 Industry Research and Comparison of Online Mapping Applications

## 4.1 Industry Research Overview

As part of the GIS Strategic Business Plan, an industry research study was conducted to compare Baltimore County's GIS implementation to other counties of similar size, population, and characteristics. The industry research was conducted to identify best practices, as well as compare and contrast the details of the organization structure, GIS utilization, hardware, software, and databases between Baltimore County, MD, and the other counties. The industry research also provided a review of the online web-enabled applications provided each County.

## 4.2 Introduction

The industry research study compared Baltimore County, MD, to King County, WA, and Charlotte/Mecklenburg County, NC. King County, WA, and Charlotte/Mecklenburg County, NC, were selected for review because of the similar geographic size and population, and the similar implementation of an enterprise GIS.

### 4.2.1 County Characteristics and Composition

***Baltimore County, MD,*** is a suburban county with a population of 780,821 as of 2004. The County covers a geographic area of approximately 640 square miles. It does not contain the City of Baltimore, which separated in 1851.

***King County, WA*****,** is the largest county in Washington and the 12$^{th}$ largest in the nation with a population of 1,737,034 according to the 2000 U.S. Census. The County, covering an area of 2,307 square miles, is home to Seattle, the largest city in the State. Two thirds of the County's population lives in the suburbs, leaving only one third living in Seattle. King County ranks as one of the top 100 wealthiest counties in the nation.

***Mecklenburg County, NC*****,** has an area of 546 square miles and a population of 827,445, making it the most populous county in the State. It contains the City of Charlotte, the largest city in the State. Almost 75% or 610,949 of the County's residents live in the city, making it the 20$^{th}$ largest in the United States.

### 4.2.2 Methodology

The participants providing information to support the industry research survey included King County GIS Center Manager, George Horning, and Mecklenburg County Application Lead, Todd Williams. The research was conducted using a five-part survey focusing on GIS organization and utilization, enterprise databases, database development, public access and external partnerships, and lastly GIS software and applications. After results of the survey were compiled into a consolidated document, the information was reviewed to identify any gaps and the survey participants were contacted for further follow-up questions. Please see Appendix P for responses to these surveys. In addition to the survey, an in-depth

analysis of online mapping applications was performed examining the functionality, data availability provided, and the prominence of GIS mapping content on the individual counties' main website.

### 4.2.3 Additional Reference Information

Also included in this report is the document titled Palm Beach County GIS Best Management Practices Comparable County GIS Program Summaries. This document compares five geographically diverse counties (Palm Beach County, FL, Johnson County, KS, Kern County, CA, Orange County, FL, and Mecklenburg County, NC) compiled in 2006. The document compares the background, leadership, human resources, information analysis, strategic planning, operations, customer satisfaction, and self-assessments of each of the five counties. This reference document is provided as additional industry research conducted under a different framework than the current study concerning Baltimore County. It can be found in Appendix R.

## 4.3 Organization Structure and GIS Utilization

### 4.3.1 King County, WA

***King County GIS (KCGIS) Center Organization Structure***

The King County GIS (KCGIS) Center is an internal service fund (internal service funds account for activities that provide goods and services to other departments or agencies on a cost reimbursement basis) organizationally structured under the Department of Natural Resources and Parks and supports the entire County with GIS services. Although it operates independently, the center has its own financial fund, and an organizational structure separate from the Department of Natural Resources and Parks. A complete organizational chart detailing GIS use throughout the County is located in Appendix S.

The Center is divided into three different operations units: Enterprise Services, Client Services, and Matrixed Staff Services. Each operations unit is assigned project managers and GIS professionals, although staff is often shared across business units as the need arises. A finance and marketing manager and an office manager provide assistance to the KCGIS Center manager.

| KCGIS Center Operations Units | |
|---|---|
| **Operations Unit** | **Role in Organization** |
| **Enterprise Services** | Manages the KCGIS Center and the County's enterprise GIS. |
| **Client Services** | Provides consulting, data sales, and training activities. |
| **Matrixed Staff** | Performs various GIS data maintenance and analysis. Matrixed staff are employees of both the KCGIS Center and other departments (such as transportation) simultaneously. |

**Table 28– KCGIS Center Operation Units**

***KCGIS Services***
The GIS staff provides expertise in areas that include mapping, analysis, programming, data development, and consulting. Approximately 75% of the organization's efforts are applied to analytical processing and analysis, leaving only 25% dedicated to mapping functions. In addition, KCGIS Center Client Services performs a variety of GIS services for a fee for both internal and external clients. These services include:

- Custom GIS projects and consulting
- Custom cartography
- King County GIS data sales
- Custom data and imagery sales
- Training

The fees collected for these types of services allow the KCGIS Center to recuperate approximately 1/6th of its annual operating costs (almost $700,000). The majority of this revenue comes from consulting services.

***Committees and Leadership Oversight***
The KCGIS Center has a dedicated GIS Manager who is responsible for the overall operation of the Center. The GIS Manager serves as a member of the **GIS Technical Committee.** The GIS Technical Committee, which helps set the standards and practices for the County's enterprise GIS, consists of representatives from all agencies.

King County's GIS activities are managed by the KCGIS Center. The **KCGIS Oversight Committee** provides leadership and guidance to the KCGIS Center programs. The Oversight Committee responsibilities include, but are not limited to, the following:

- Reviewing and approving the annual operations and maintenance plan.
- Reviewing and approving standards for policy, technical direction, standards, and best practices as recommended by the KCGIS Technical Committee.
- Reviewing and approving the KCGIS Center's annual budget.

***Financial and Strategic Planning***
The KCGIS Center's annual operating budget for 2007 is 4.2 million dollars with funds coming from over 35 sources. Very little funding comes from capital budgets. Financial information dating back to 2004 can also be found online at http://www.metrokc.gov/gis/kb/Content/KCGISCenter_Finances.htm.

A GIS operation and maintenance plan is produced annually and serves as the GIS strategic plan. This document is produced using input from all agencies on the GIS Technical Committee. A copy of this plan (and all plans dating back to 2002) can be found at http://www.metrokc.gov/gis/kb/content/oandm.htm.

### 4.3.2 Mecklenburg County, NC

***Mecklenburg County Geospatial Information Services Organization Structure***
Mecklenburg County's GIS activities are managed by the County's Geospatial Information Services department. Their main purpose is to provide GIS application development and database management services to the County's enterprise. By operating as a consolidated service group, the Geospatial Information Services department is able to effectively deliver services to their customers. The department is broken down into three primary divisions and two focus areas:

- Mapping and Project Services (Division)
- GIS Technology Solutions (Division)
- Land Records and Addressing (Division)
- Program Support Services (Focus Area)
- Strategic Planning (Focus Area)

***Mecklenburg Geospatial Information Services***
The majority of all GIS activities are conducted within the Geospatial Information Services department by their staff members. The GIS activities that are performed outside the department are primarily limited to mapping support and data maintenance. Within the department, approximately 40% of activities are directed towards mapping functions while the remaining 60% are spent performing spatial analysis and application development.

***Committees and Leadership Oversight***
Each division has its own dedicated GIS Manager or Supervisor with the primary responsibility to oversee the Geospatial Information Services department's day-to-day operations. Mecklenburg County has an **Executive Steering Committee,** which oversees the actions of the department. This committee contains high level managers from the many County agencies, including the following:

- Parks and Recreation
- Libraries
- Sheriff's Office
- Department of Social Services
- Land Use and Environmental Services Agency (LUESA)
- Charlotte Mecklenburg Schools (CMS)

In addition, the County has an **Executive Stakeholder Group** comprised of three primary stakeholders:

- Land Use and Environmental Services Agency
- Information Services and Technology Department
- County Manager's Office (E-Gov Services)

***Financial and Strategic Planning***
Mecklenburg County has a fully developed strategic plan that is managed and maintained, and undergoes a review every three years. Every year the plan is amended based on GIS technology need requests received from other departments. Funding for activities are justified based on the needs of the particular project being undertaken.

### 4.3.3 Relevance to Baltimore County

***Organization Structure***
The Baltimore County Office of Information Technology's Business Applications Unit has a Land Management/GIS unit that is responsible for providing centralized GIS support and management to the enterprise. Baltimore County's GIS implementation benefits from several advantages of having the GIS group positioned inside of OIT, including access to many skilled IT resources, standardized processes, Systems Development Life Cycle (SDLC), IT leadership, and project management to effectively manage and support the GIS technology program. While the central GIS support is provided from the Land Management/GIS unit, there are data maintenance activities for various layers distributed among several County agencies. Both King and Mecklenburg Counties have a separate GIS department.

***GIS Services***
The majority of the GIS work performed by Baltimore County staff is focused on mapping rather than analysis activities. While both Mecklenburg and King County estimate that analysis comprises 60% to 75% of all County GIS activities, Baltimore County's analysis activities are estimated at only 20%. This 80% mapping/ 20% analysis ratio suggests that Baltimore County's GIS resources are not fully being utilized.

***Committees and Leadership Oversight***
Unlike both Mecklenburg County and King County, Baltimore County does not have a GIS Manager whose role is to oversee all County GIS operations and coordinate with other County agencies. In addition, each division (Mecklenburg County) or operating unit (King County) has its own manager who oversees and directs the operations of that division or unit.

King County and Baltimore County both have a GIS-centric oversight committee, which helps foster the flow of information between the participating agencies. This forum provides an opportunity for the participants to receive information about the various GIS technologies and projects being utilized throughout the County. In addition, King County has an OIT Steering Committee (similar to the Executive Steering Committee found in Mecklenburg County) that reviews and approves IT-related projects and proposals. Approved projects and proposals are then forwarded to the Project Review Committee, which makes the final funding approval (again this is similar to Mecklenburg's Executive Stakeholder Group).

***Financial and Strategic Planning***
Both King and Mecklenburg Counties have strategic plans that are updated on a regular basis. The KCGIS Center's operation and maintenance plan is created yearly, while King County's plan is created every three years with annual updates. Baltimore County should adopt a long-term plan for regular updates and reviews to the GIS Strategic Business Plan after implementation.

## 4.4 Enterprise Databases, Geodatabase Technology, and Database Development

### 4.4.1 King County, WA

***Enterprise Databases and Layers***
The KCGIS Center maintains a large enterprise database comprised of over 200 different data layers. Some of the enterprise data layers include:

- Orthophotography/Imagery
- Topography
- LiDAR
- Street Centerline/Addresses
- Cadastral (Property)
- Census

The KCGIS Center's extensive data catalog is available for review, upon request.

***Database Maintenance and Standards***
Data layers are produced and maintained by employees throughout the organization by KCGIS Center and non-Center employees. For example, parcels are maintained by Assessments (non-KCGIS Center employees), and street centerlines are maintained by Transit (matrixed KCGS Center employees). The GIS Technical Committee ensures that proper data standards and procedures are being followed during the creation and maintenance of these data layers. Along with other layer maintenance, the enterprise orthophotography will be acquired and processed on a two-year cycle, beginning in 2007.

***Database Environment***
The KCGIS Center uses ArcSDE for its spatial data server and Microsoft SQL Server for its relational database management system. Currently, only the parcels are edited in a versioned, multi-user environment within ArcSDE. This system is just beginning to be implemented with other layers such as hydrography and street centerlines. Both KCGIS Center and non-Center County employees have the ability to edit the ArcSDE database as granted by the database administrator.

Different layers within the enterprise database participate in shared topologies. An example of this would be between King County's property and easement layers.

Parcel data would be edited outside of the KCGIS Center by the Department of Assessments, while the easements layer would be updated by KCGIS Center staff.

### 4.4.2 Mecklenburg County, NC

***Enterprise Databases and Layers***

Mecklenburg County maintains an extensive enterprise database consisting of approximately 100 data layers. Some of these enterprise layers include:

- Orthophotography/Imagery
- Planimetric/Topography
- LiDAR
- Street Centerlines/Addresses
- Cadastral (Property)
- Census

Mecklenburg County's list of available data layers can be viewed online at http://www.charmeck.org/Departments/Geospatial+Information+Services/GIS+Data+Store/availdata.htm.

***Database Maintenance and Standards***

Versioned multi-user editing occurs in multiple databases. In addition, the new Integrated Parcel Maintenance System will also run in a multi-user editing environment. The only agency outside of the GIS department that edits any of the data in ArcSDE is the Board of Elections. Almost all editing of the data is handled within the GIS Services Group. Within the GIS department, the GIS Land Records and Addressing Division and Mapping and Project Services Division are responsible for the accuracy and maintenance of the databases.

Along with other layer maintenance, the enterprise orthophotography will be acquired and processed every 2 years. The most recent aerial photography was flown in 2004, while the planimetric data was collected in 1997 and topographic data was collected in 2002. Historic imagery is also available dating back to 1966.

***Database Environment***

The Mecklenburg County GIS department uses ArcSDE as its spatial data server and Microsoft SQL Server as its relational database management system. The County implements shared topologies across its enterprise database layers; however, since all editing of these layers is done within the GIS Department, the same staff are maintaining and editing all of the layers. If there are features that participate in a shared topology, those features are edited at the same time.

### 4.4.3 Relevance to Baltimore County

***Enterprise Databases and Layers***

Like Mecklenburg County and King County, Baltimore County also maintains an extensive enterprise database including many of the same layers, such as orthophotography, planimetric, topography, LiDAR, street centerlines, cadastral and

census data. Baltimore County and King County have the largest number of data layers available with 274 and 273 respectively. Mecklenburg County has 91 data layers currently available.

***Database Maintenance and Standards***
In King County and Mecklenburg County, orthophotography is now being collected on a two-year cycle, while in Baltimore County orthophotography is being collected on a three-year cycle, as is planimetric data. LiDAR and contours are updated every 10 years. In King County and Mecklenburg County, the GIS organizations have a large amount of control over the maintenance of enterprise data layers. In Baltimore County, layers are edited by employees throughout the agencies, and there can be difficulties communicating and enforcing the data standards established by the Office of Information Technology.

***Database Environment***
Like both Mecklenburg and King County, Baltimore County uses ESRI GIS software products, but uses Oracle as its relational database management system. Baltimore County is also similar to both King and Mecklenburg Counties as it maintains an enterprise GIS with layers that share topology and are edited by multiple users. Baltimore County has more agencies involved in maintaining these layers than either King or Mecklenburg County.

## 4.5 Public Access and External Partnerships

### 4.5.1 King County, WA

***General Data Products and Fee Structure***
The KCGIS Center provides access to enterprise data for a fee. The price for their "Standard Data Disk" is $220 and contains dozens of layers, including countywide parcel data. In addition to the "Standard Data Disk," custom data orders can also be made. Imagery requests are billed at the same rate as custom data requests, resulting in a $260 cost for countywide digital orthophotography.

The data provided on this "Standard Data Disk" includes layers from the following categories:

- Administration (Administrative Boundaries)
- Census Data
- District Boundaries
- Environmental
- Hydrology
- Natural Resources
- Planning
- Political Boundaries
- Property
- Public Safety
- Recreation
- Survey

- Transportation
- Utilities

***Licensing and Service Fees***
Custom data orders are billed at a rate of $85 per hour with a three-hour minimum plus materials cost. All data is sold as restricted use and is accompanied by a standard disclaimer.

***Partnerships***
The KCGIS Center participates in external partnerships with the following Federal agencies:

- Currently working with FEMA to perform floodplain mapping.
- A partnership exists with the USGS to jointly acquire aerial photography.

### 4.5.2 Mecklenburg County, NC

***General Data Products and Fee Structure***
Mecklenburg County provides GIS data to the public for a fee. The GIS department has multiple data CD products that sell for anywhere from $50 (for survey controls) to $300 (for 2002 digital topography). In addition, they offer a "Mix and Match Layer" CD for $100 that allows the customer to pick and choose their own layers (excluding complete tax parcel or orthophotography). Available data include layers in the following categories:

- Boundaries
- Building Permits
- Facilities
- County Infrastructure
- Physical Environment

***Licensing and Service Fees***
Custom mapping is also provided at a rate of $40 per hour, plus material costs. All data sold requires the user to sign a license agreement.

***Partnerships***
Mecklenburg County GIS participates in external partnership with FEMA to produce floodplain maps.

### 4.5.3 Relevance to Baltimore County

***General Data Products and Fee Structure***
Baltimore County provides GIS data to the public for various prices. The data costs for Baltimore County are, by far, the highest of the three counties. See Table 29 for a breakdown of Baltimore County's GIS data costs and Table 30 for a comparison of data costs for all three counties. Baltimore County does not offer a bundled CD containing a "standard" set of countywide data, since every data commodity has specific and distinct pricing.

| Baltimore County Countywide Digital Dataset Costs | | | | | |
|---|---|---|---|---|---|
| **Dataset** | **Tiles** | **Cost Per Tile** | **Subtotal** | **20% Discount for Countywide** | **Total Cost** |
| Planimetric/ Topographic | 836 | $90 | $75,240 | - $15,048 | $60,192 |
| Orthophotography | 836 | $80 | $66,880 | - $13,376 | $53,504 |
| Cadastral (Property) | 117 | $140 | $16,380 | - $3,276 | $13,104 |
| **Total Cost for Three Digital Datasets** | | | | | **$126,800** |

**Table 29– Baltimore County Countywide Digital Dataset Costs**

| Countywide Digital Dataset Cost Comparison | | | |
|---|---|---|---|
| **Dataset** | **Baltimore County Cost** | **King County, WA Cost** | **Mecklenburg, NC Cost** |
| Planimetric/ Topographic | $60,192 | $110 | $300 |
| Orthophotography | $53,504 | $260 | $200 |
| Cadastral (Property) | $13,104 | $110 | $250 |
| **All Three Datasets** | **$126,800** | **$480** | **$750** |

**Table 30– Countywide Digital Dataset Cost Comparison**

***Licensing and Service Fees***
Baltimore County's standard data licensing agreement is the most detailed and thorough of any of the three counties, and Baltimore County is the only County of the three that will sell its data for unrestricted use (for countywide data only). The pricing for Baltimore County's custom services and analysis is the least expensive of the three counties, with a price of only $25 per hour.

***Partnerships***
Baltimore County engages in more external partnerships than either Mecklenburg County or King County. While all three counties have partnerships with FEMA for floodplain mapping, Baltimore County also maintains partnerships with USGS and various other statewide programs.

## 4.6 GIS Software and Applications

### 4.6.1 King County, WA

***Software***
The KCGIS Center primarily uses the ESRI suite of products for its GIS software needs. The following GIS software products are currently being used by the Center:

- ArcGIS
- ArcGIS Server (in the beginning phases)
- ArcSDE
- ArcIMS

- ArcPad (very little usage, as the Center does not currently support any field activities using ArcPad)

***Custom Application Development***
The KCGIS Center has developed numerous applications supporting both global programs and activities, in addition to specific business processes. The applications that have had the greatest impact are the web-based mapping tools: iMap and Parcel Viewer. Both applications are used hundreds of times a day by County employees in numerous agencies. The largest benefit of these programs has been seen in the following departments:

- Permitting
- Appraisal
- Natural Resources
- Planning

***GIS Integrated Applications***
Currently, the only enterprise application that is fully integrated with GIS is the land management system (which includes permitting, inspections, and development management). Emergency management has been partially integrated with GIS technology in that the Emergency Operations Center has been equipped with a GIS-capable computer that is staffed by a KCGIS Center employee during a disaster event.

### 4.6.2 Mecklenburg County, NC

***Software***
Mecklenburg County GIS primarily uses the ESRI suite of products in addition to open-source GIS software. Software used by the department includes:

- ArcGIS
- ArcSDE
- ArcIMS
- ArcPad
- Php GIS (open source)
- Postgre SQL (open source)
- PostGIS (open source)

In addition to the open source GIS software listed above, the department also uses applications and protocols that facilitate the integration of non-GIS applications with GIS software (using service-oriented architectures). The department will begin implementing ArcGIS Server in the near future.

***Custom Application Development***
The GIS department provides custom applications to the County, both for global applications and business processes. Most applications are developed within the department. The two largest users of these applications are Park and Recreation, and Property Assessment. The two applications that have had the most positive impact on business practices within the County are POLARIS (Parcel Ownership Land Records

Information System) and the Address Information Center. POLARIS is a web-mapping service that has provided most of the information necessary to make land development decisions. This includes parcel mapping, ownership, property values, aerial photos, flood data, watershed data, and sales analysis. The Address Information Center provides a one-stop shop for customers to acquire data on property information, traffic, garbage collection, parks, libraries, flood data, voting information, school assignments, and crime information.

***GIS Integrated Applications***
The Mecklenburg County GIS department also has enterprise applications integrated with GIS technology in two key areas:

- Infrastructure Management – through EDMS (Environmental Database Management System)
- Land Management – with GIS Mapping Extension to remote POSSE System

### 4.6.3 Relevance to Baltimore County

***Software***
Like both Mecklenburg County and King County, Baltimore County uses the standard set of ESRI software products. However, Baltimore County does not use open source software for development.

***Custom Application Development***
Baltimore County has implemented several applications that have been developed for use by either internal or external users. The My Neighborhood web-mapping applications and Data Query application have had the greatest impact on County processes. Both applications are used hundreds of times a day by people in various County agencies in addition to County residents. The County has also produced a fair number of quality control and production tools that are used often by Baltimore County employees. While the tools and applications that have been developed have had a great impact, Baltimore County does not seem to have the same focus on application development as found in King and Mecklenburg Counties.

***GIS Integrated Applications***
Baltimore County is the only county out of the three being compared that does not have a land management system. Baltimore County has an established infrastructure management system (CASSWORKS) that is integrated with GIS.

## 4.7 Summary of Organization Structure and GIS Utilization

Baltimore County is both similar to, and different from, King and Mecklenburg Counties in many ways as regards the utilization of GIS. Some key differences in areas where Baltimore can be a model for other counties are provided in the table below.

| Category | Baltimore County Best Practices |
|---|---|
| Databases | The regular collection of planimetric data (three-year cycle) |
| Applications | GIS-integrated infrastructure management system (CASSWORKS) |
| Public Access | The lowest prices for custom mapping and data services |
| Licensing | The unrestricted license for data available only for the purchase of countywide data |
| Partnerships | Extensive use of external partnerships |

**Table 31 – Baltimore County Best Practices**

There are also many areas where all three counties are following industry best practices. These areas include:

| Category | Best Practices Across all Three Counties |
|---|---|
| Organization | The use of both GIS oversight, and technical and steering committees to help guide the operations of County GIS operations |
| Software | The use of ESRI products for the Counties' GIS software solutions |
| Public Access | A wide variety of GIS datasets available for public access, usage, and purchase. |
| Licensing | The practice of requiring a signed license agreement/disclaimer (for most cases) |
| Databases | The implementation of a highly structured, well designed enterprise database with topologies and relationships spanning across multiple layers. |

**Table 32 – Best Practices across All Three Counties**

The following are the key items that have been identified as best practices by the enterprise GIS of King and Mecklenburg Counties and that present an opportunity for improvement by Baltimore County:

| Category | Baltimore County Potential Opportunities for Improvement |
|---|---|
| Organization | Hire a GIS Manager to manage the GIS program and enterprise operations |
| Databases | Improve control and quality of GIS database maintenance by limiting enterprise database editing to a core group of centralized staff. |
| Databases | Update orthophotography on a two-year cycle rather than a three-year cycle |
| Applications | Implement a GIS-integrated land management system |
| Applications | Adopt an application development strategy to provide custom tools to support business process improvement with GIS |
| Personnel | Improve utilization of key staff by focusing their skill sets on spatial analysis rather than mapping activities |

| Category | Baltimore County Potential Opportunities for Improvement |
|---|---|
| Public Access | The reduction of public access fees for orthophotography, Planimetric/ topographic and cadastral data |

**Table 33 – Baltimore County Potential Opportunities for Improvement**

While not all of the items listed above can be implemented by Baltimore County, they should be examined for current or future feasibility.

## 4.8 Online Mapping Application Analysis

### 4.8.1 Introduction

The following is a comparison of online mapping applications for Baltimore County, MD, King County, WA, and Mecklenburg County, NC. Each application is analyzed in terms of data availability, functionality, and prominence on the County's main website. Because of the large number of applications with varying levels of functionality available through Mecklenburg County's website, the main analysis will be focused on:

- POLARIS (Property Ownership Land Records Information System) application – Mecklenburg County
- iMap application – King County
- My Neighborhood applications – Baltimore County

## 4.9 Online Mapping Data Availability

### 4.9.1 King County, WA

King County's online mapping functions are divided between two applications: iMap and Parcel Viewer. This analysis will focus on the iMap application because it is the more robust of the two applications.

Through iMap, users have access to many layers of data. The County has provided 11 separate map sets that contain different data groupings. The available map sets are as follows:

- General
- Groundwater Program
- Hydrographic Information
- Levy Rates and Districts
- King County Parks
- Noxious Weed Locations
- Property Information
- Sensitive Areas
- Shoreline Master Program
- Storm Water
- WRIA Habitat Projects

Within each map set are data layers particularly relevant to the subject in addition to much of the data that can be found in the General map set. The General map set has 37 separate layers, including aerial photography.

### 4.9.2 Mecklenburg County, NC

Mecklenburg County's online GIS mapping functions are divided into 14 separate mapping applications. The available mapping applications are as follows:

- POLARIS
- Address Information Center
- Air Quality Sites
- Economic Development
- E-Mapper
- Flood Zone Application
- Healthy Communities
- Map & Go
- The Park Locator
- Student Assignment Express
- Voter Information Express
- Surface Water GIS
- Well Information System

The POLARIS application contains 30 separate layers including aerial photography. These layers consist of base map information along with layers relevant to land management.

### 4.9.3 Baltimore County, MD

Baltimore County's online mapping functions are divided between seven separate My Neighborhood applications. These applications are as follows:

- Commercial Revitalization
- Eastern County Bicycle Plan
- Enterprise Zones
- Facilities
- Historic
- Planimetric/Topographic
- Zoning

The Planimetric/Topographic My Neighborhood application has the most data layers, with 12 available.

## 4.10 Online Mapping Functionality

### 4.10.1 King County, WA

King County's iMap application maintains a high level of functionality, giving users a good deal of control over the datasets that can be viewed. Users are able to search by:

- Parcel number
- Condo name
- Address

The application allows the user to switch between map sets on the fly without having to exit the application. In addition, users are able to toggle on and off the layers they wish to display. Users are able to pan, zoom, print, buffer features, and measure distance. The application also allows for the entering of a manual map scale and the ability to change map units. One of the more unique features is the ability to select a parcel, which then contains a hyperlink to the Tax Assessors report and district report for that parcel. Also, from the district report there is link that will automatically open iMap and zoom to the target property.

### 4.10.2 Mecklenburg County, NC

Mecklenburg County's POLARIS application is a highly functional application allowing multiple types of searches and analysis. POLARIS allows users to search by:

- Property Owner
- Address
- Parcel ID
- Road intersection

In addition, the analysis functions allow users to filter results on many factors including the following:

- Jurisdiction
- Neighborhood code
- Political jurisdiction
- Acreage
- Value range
- Sale dates
- Use type
- Square footage

Also, users are able to zoom, pan, print, toggle layers, identify feature attributes for multiple layers, identify parcel information, and measure distances and areas.

### 4.10.3 Baltimore County, MD

Baltimore County's My Neighborhood applications allow users to search by address. In addition, users are able to pan, zoom, print, and toggle a limited number of display layers. They are also able to identify layer attributes. In order to switch applications, users must open a new instance of My Neighborhood.

## 4.11 Prominence of GIS on County's Website

### 4.11.1 King County, WA

For King County, GIS is easily accessible from the main County website, although it does not have a prominent place on the main page. The GIS website can be accessed with one mouse click from multiple menus for non-GIS service lines (such as Property or Online Services). It requires three mouse clicks to launch iMap from the County's main web page.

### 4.11.2 Mecklenburg County, NC

On Mecklenburg County's website, GIS is easily accessible from the main County website and holds a prominent position on the front page. It is featured as one of six options on the top of the page, grouped with such important functions such as 311 Requests and the County's Events Calendar. The GIS Department's website can be accessed in one mouse click from the main webpage. To launch the majority of the online mapping applications, three mouse clicks are required.

### 4.11.3 Baltimore County, MD

For Baltimore County, GIS is accessible from the County's main webpage. However, as with King County, it does not play a prominent role. Users must look though a number of service lines before they are able to access the GIS web page. To launch any of the My Neighborhood applications requires four mouse clicks. This extra mouse click is caused by the disclaimer the users must agree to before launching the application.

## 4.12 Summary of Online Mapping Applications

The three counties examined for this study have varying online mapping capabilities and interfaces. Mecklenburg County's POLARIS has the most unique functions and is also more integrated with non-GIS databases. Overall, Mecklenburg County has many mapping applications, each with its own interface and functionality.

| Online Mapping Applications<br>Overall Summary Assessment - By Category Classifications | | |
|---|---|---|
| **Category / County** | **Limited** | **Extensive** |
| **Online Mapping Functionality** | | |
| Baltimore County | X | |
| Mecklenburg County | | X |
| King County | | X |
| **Online Mapping Data Availability** | | |
| Baltimore County | X | |
| Mecklenburg County | | X |
| King County | | X |
| **Prominence of GIS on County's Website** | | |
| Baltimore County | X | |
| Mecklenburg County | | X |
| King County | X | |

**Table 34 – Online Mapping Applications - Overall Summary Assessment**

King County's iMap also maintains a high level of functionality with an interface that would look familiar to any GIS user. Many of the functions that Baltimore County and Mecklenburg County separate into multiple applications are combined into one iMap application. Baltimore County's applications offer less functionality and control than the other counties; however, each My Neighborhood application is uniform, having the same interface and level of control for each one. Overall, GIS has the most prominent on Mecklenburg County's website, with King and Baltimore Counties being equal in that respect.

Based on the comparisons to Mecklenburg and King Counties' online mapping systems, recommendations have been made to address the deficiencies found in Baltimore County's My Neighborhood applications. Such recommendations include a restructuring of the My Neighborhood suite that will consolidate the mapping services, provide a higher level of functionality, and increase the online visibility of these applications. For more information on these recommendations, please see Volume 2, Section 3.2.3 (Public Access: My Neighborhood Recommendations).

# 5 Overall Assessment of GIS Utilization

## 5.1 Analysis of Layer Utilization

The analysis of layer utilization with the Baltimore County GIS provides an overview of current GIS data utilization across the enterprise and provides a summary of improvements that could be made through enhancement or development of new data layers to better serve the County agencies.

### 5.1.1 Data Utilization

Baltimore County supports its agencies' GIS needs by providing numerous countywide GIS databases and data layers stored in an enterprise system composed of various hardware, software, and network configurations. This system hosts a majority of the data provided to the enterprise and all of the applications and mapping services, and is critical to the services provided to the public and County agencies. The architecture of this system is discussed in more detail in section 2.1of this document.

***Enterprise Data Layers***

Several enterprise GIS databases that have been identified as critical to the functioning of all County agencies are updated based on a lifecycle previously established as part of a maintenance plan. For these select layers, the County contracts with vendors using capital funds for the purpose of updating the databases. The enterprise databases regularly updated by a contracted vendor are:

- Orthophotography,
- Planimetric,
- LiDAR, and
- Contours.

These enterprise layers are the most widely used datasets among the agencies reviewed in the County. They are either generic enough to be used for a multitude of varying business processes, or represent features that are an integral part of the business that the County conducts. The datasets are often used as source information for creating additional datasets, to check the accuracy of other datasets, or to support other datasets with spatial information through database links.

| Enterprise Layer | Description and General Usage |
|---|---|
| Orthophotography | The orthophotography dataset is a remotely sensed multispectral raster dataset, or digital aerial photography, that has been orthorectified to the ground. This dataset is important for understanding the location of cultural and physical features of the landscape in the County and is used for many activities as a reference for location and as source for data compilation. |
| Planimetric | The planimetric dataset is a set of feature classes created to represent buildings, roads, and hydrology within Baltimore County. These features have been captured from elevation data and orthophotography, and are |

| Enterprise Layer | Description and General Usage |
|---|---|
| | generally used for cartographic purposes and as a base map for other data. |
| Topographic (Contours, LiDAR) | The topographic data include elevation data captured as contours and LiDAR mass points and breaklines. These data allow for a three-dimensional representation of the surface of the County. These data are used to determine elevation heights for specific features, model surfaces in three-dimensions, and analyze slope and aspect of the landscape. These are also used to correctly position orthophotography and planimetric data. |

**Table 35 – Vendor Maintained Enterprise Layers – Usage and Descriptions**

In addition to the GIS databases listed above that require vendor support for maintenance, OIT maintains or shares maintenance responsibilities for several other enterprise GIS databases. These databases include the Facilities and Cadastral geodatabases, as well as a set of Grid layers described below.

| Enterprise Layer | Description and General Usage |
|---|---|
| Facilities Geodatabase | The Facilities Geodatabase includes the Street Centerlines, Address Points, and Master Street Name data used by all County applications that use geocoding as core functionality. It also includes detailed information about all Facilities located within the County. It is the primary database supporting the 911 call center and many other requirements of agencies throughout the County. |
| Cadastral Geodatabase | The Cadastral Geodatabase includes the Tax Parcels, Simultaneous Conveyance (SimCon), and Simultaneous Conveyance First Division (SimConFirstDiv) datasets. Cadastral features include parcels, lots, right-of-ways, and subdivision boundaries. Also included in the Cadastral Geodatabase are the Landuse, Encumbrance (county-owned right-of-ways), and Restrictions (environmental restrictions) datasets, all of which are based on parcels and are currently maintained by the responsible agency. |
| Grids | Various grids or tiling systems used for items such as the orthophotos, planimetric and topographic data, cadastral data, scanned images, and the commonly referred to ADC map books. |

**Table 36 – OIT Maintained Enterprise Layers - Usage and Descriptions**

***Enterprise Database Maintenance***

The County enterprise GIS databases are managed in a distributed editing environment, where multiple agencies have editing privileges. Maintenance responsibility lies with the subject matter expert for a given database or data layer. Some databases are maintained by only one agency and others are maintained by multiple agencies. Where databases are maintained by multiple agencies, OIT is responsible for working with agency staff to reconcile editing inconsistencies.

The diagram below shows the primary ArcSDE geodatabases maintained by the County with the agency maintenance responsibilities identified on each database.

This diagram depicts only the primary SDE geodatabases, does not include layers stored on the Novell GIS drive, and is not all-inclusive. However, it illustrates the shared editing environment showing how different agencies may perform editing and maintenance activities in different components of the same database. For example, in the Cadastral database, PDM maintains the Encumbrance ROW layer along with standard Cadastral data; OP maintains Landuse (attributes on TaxParcel); DEPRM maintains a parcel-based Restrictions Layer; and OIT maintains overall Cadastral topology and database management.

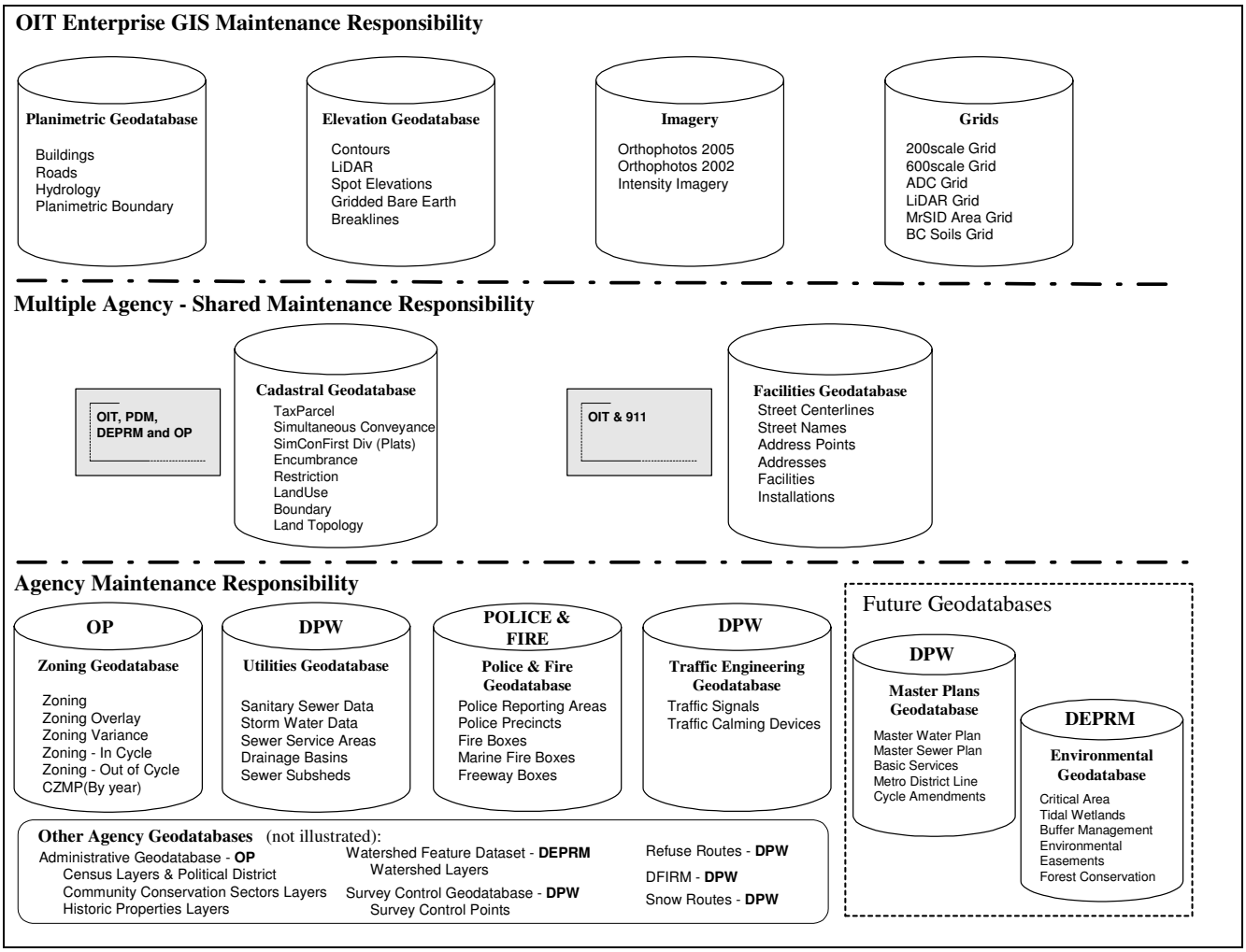


**Figure 2 – Enterprise GIS Maintenance Responsibility**

As illustrated in Figure 3 above, the County has a significant number of enterprise databases and geodatabases, along with many layers on the GIS Novell server (not shown in the figure). The data utilization assessment was completed by initially compiling a complete data inventory of production GIS layers available in Baltimore County. Once the inventory was established, the utilization analysis mapped agency programs to each data layer to indicate which layers were required to complete the business processes. Consolidating all the agency-specific program information about

data layers and analyzing the countywide utilization of each layer concluded the data utilization assessment. The goal of the data utilization assessment is to identify data layers where the utilization is maximized by the County to ensure the GIS enterprise is adequately supporting those important layers, while also looking for opportunities for improvement or inefficiently utilized layers.

***Data Layer Inventory and Utilization Information***

As identified and documented in this study, the County currently manages 274 data layers throughout the various agencies. This includes all of the enterprise databases and data layers actively maintained by the various agencies even if they are not yet shared across the enterprise. It does not necessarily include one-use datasets created by agencies for specific projects that will not be re-used. All 274 data layers maintained by Baltimore County are shown in the table below in order of their use by programs. The Enterprise Data layers are listed in bold. Agency specific data layers that are not currently available to all agencies are listed in red.

| Dataset | Used By Number of Programs |
|---|---|
| **Roads** | 80 |
| **Orthophoto (2005)** | 74 |
| **Buildings** | 73 |
| **Street Centerlines** | 72 |
| County Boundary | 70 |
| **Tax Parcel** | 68 |
| **AddressPoints (View)** | 65 |
| Streams and Ponds | 65 |
| **Street Centerlines (View)** | 60 |
| **Hydrology** | 59 |
| **Contours** | 53 |
| **Orthophoto (2002)** | 53 |
| **Facilities** | 50 |
| Urban Rural Demarcation Line (URDL) | 44 |
| Zoning | 44 |
| Wetlands | 43 |
| Publicly Owned Land | 42 |
| Railroads | 42 |
| Reservoir | 40 |
| Councilmanic Districts (2002) | 39 |
| County Facilities | 39 |
| Flood Insurance Maps (FEMA) | 39 |
| Parcel Based Landuse | 38 |
| Zip Codes | 37 |
| Zoning - 1999 | 36 |

| Dataset | Used By Number of Programs |
|---|---|
| Government Lands | 35 |
| Index Grid - ADC Map | 34 |
| Storm Water Management Facilities | 34 |
| Zoning Overlay Districts | 34 |
| Capital Projects | 32 |
| Soils | 32 |
| Stormwater (Geodatabase) | 32 |
| Transmission Lines | 32 |
| Watersheds - Major | 32 |
| Development Plans | 31 |
| Election Districts | 31 |
| Light Rail | 31 |
| Hydrologic Facilities | 30 |
| Land Use 2002 | 30 |
| Master Plan - Water | 30 |
| Sewer | 30 |
| Wetlands - NWI | 30 |
| Basic Services - Transportation (Intersections) | 29 |
| **Census Blocks (2000)** | 29 |
| **Census Tracts (2000)** | 29 |
| Index Grid - 600 Scale | 29 |
| Master Plan - Sewer | 29 |
| Metro Railroad | 29 |
| Subwatersheds | 29 |
| Tree Cover | 29 |
| Chesapeake Bay Critical Area | 28 |
| Conservation Easements | 28 |
| Legislative Districts (2002) | 28 |
| Parks and Recreation | 28 |
| Taxmaps (Images) | 28 |
| **Census Block Groups (2000)** | 27 |
| Impervious Polygons | 27 |
| Metropolitan District Line | 27 |
| Spot Elevations | 27 |
| Schools—Point Location | 26 |
| Agricultural Preservation | 25 |
| County Historic Districts | 25 |
| Digital Elevation Models | 25 |
| Easement | 25 |

| Dataset | Used By Number of Programs |
|---|---|
| Landfills | 25 |
| Police Stations | 25 |
| Traffic Analysis Zones | 25 |
| Trails - Walkways | 25 |
| Wetlands - Special Area Management | 25 |
| **Orthophoto (2001)** | 24 |
| Police Precincts | 24 |
| Trails | 24 |
| Tree Rows | 24 |
| Basic Services - Water | 23 |
| **Census Designated Place (2000)** | 23 |
| Community Plans | 22 |
| Geology | 22 |
| **Orthophoto (1998)** | 22 |
| **Orthophoto (2000)** | 22 |
| Athletic Fields | 21 |
| Bridges | 21 |
| **Census Blocks (1990)** | 21 |
| Fire Stations | 21 |
| **Orthophoto (1995)** | 21 |
| **Orthophoto (1996)** | 21 |
| **Orthophoto (1997)** | 21 |
| Police Reporting Areas | 21 |
| Pumping Stations | 21 |
| Regional Planning Districts | 21 |
| Rural Legacy | 21 |
| Sewer Service Areas | 21 |
| State Legislative District | 21 |
| Wooded | 21 |
| Bulkheads | 20 |
| Business Parks | 20 |
| **Census Block Groups (1990)** | 20 |
| **Census Tracts (1990)** | 20 |
| Fire Hydrants | 20 |
| Golf Courses | 20 |
| Hydrologic Stream Order | 20 |
| Land Use 1997 | 20 |
| Land Use 1998 | 20 |
| Landuse | 20 |

| Dataset | Used By Number of Programs |
|---|---|
| Playgrounds | 20 |
| Right of Way (LACQ) | 20 |
| Basic Services | 19 |
| Community Associations | 19 |
| Historic Districts | 19 |
| Index Grid - 200 Scale (BCMD) | 19 |
| Land Use 1994 | 19 |
| Congressional Districts (2002) | 18 |
| Land Management Areas | 18 |
| Orchards | 18 |
| Buffers with forest cover-1996 | 17 |
| **Census Designated Place (1990)** | 17 |
| Commercial Revitalization Districts | 17 |
| Enterprise Zones | 17 |
| Index Grid - 200 Scale (MCS) | 17 |
| Key Sheets | 17 |
| Park Points | 17 |
| Renaissance Opportunity Areas | 17 |
| School Districts - Elementary | 17 |
| School Districts - High | 17 |
| School Districts - Middle | 17 |
| Basic Services -Sewer | 16 |
| Cell Towers | 16 |
| Post Offices | 16 |
| Proposed Land Use | 16 |
| Solid Waste Facilities | 16 |
| Cemetery | 15 |
| CZMP Zoning Issues (2000) | 15 |
| Health Centers | 15 |
| Monitoring—Various Programs | 15 |
| Movie Theaters | 15 |
| Pipelines | 15 |
| Priority Funding Areas | 15 |
| Soil Type | 15 |
| Traffic Calming | 15 |
| Abandoned Railroads | 14 |
| Commercial Pools | 14 |
| Communication Towers | 14 |
| CZMP Zoning Issues (1996) | 14 |

| Dataset | Used By Number of Programs |
|---|---|
| Fire Stations Boundary | 14 |
| Forest Conservation Management Areas | 14 |
| National Register Historic Districts | 14 |
| PAL Centers | 14 |
| **SimCon** | 14 |
| **SimConFrstDiv** | 14 |
| Traffic Signals | 14 |
| Discharge Permits | 13 |
| Fire Boxes | 13 |
| Out Fall—Major Drainage Areas | 13 |
| Out Fall—Minor | 13 |
| Restriction | 13 |
| Sewer Subsheds | 13 |
| Sewer Treatment Plants | 13 |
| Traffic Signal and Calming Layers | 13 |
| Cell Tower Sectors | 12 |
| Design Review Panel Areas | 12 |
| Floodwalls | 12 |
| Forest – 1996 Image Polys | 12 |
| Greenways | 12 |
| Junkyards | 12 |
| Quarries | 12 |
| Sewer Relief Points | 12 |
| Stormwater Management Facility Drainage Areas | 12 |
| BCMD Grid | 11 |
| Billiard Clubs (View) | 11 |
| Community Conservation Sectors | 11 |
| Dams | 11 |
| Forest Corridors | 11 |
| Freeway Boxes | 11 |
| Health Permits | 11 |
| Index Grid - Phase I | 11 |
| Index Grid - Phase II | 11 |
| Index Grid - Phase III | 11 |
| Racetracks | 11 |
| Stream Buffer | 11 |
| Emergency Service Area | 10 |
| Highway Districts | 10 |
| Mutual Aid Boundaries | 10 |

| Dataset | Used By Number of Programs |
|---|---|
| Refuse Collection Routes | 10 |
| Rights-of-Way Inception Instances | 10 |
| Use Class - Streams | 10 |
| African American Survey Districts | 9 |
| Cycle Amends Water | 9 |
| Field Lawns | 9 |
| Fire Battalion Boundary | 9 |
| **Installations** | 9 |
| Marine Fire Boxes | 9 |
| Multiple Ecological Use Forest Model | 9 |
| Save Our Streams (SOS)—Monitoring Sites | 9 |
| Skating Rinks | 9 |
| Cycle Amends Sewer | 8 |
| Index Grid - VARGIS Orthophoto (1998) | 8 |
| Index Grid - VARGIS Orthophoto (2000) | 8 |
| Orthophoto Quarter Quads - 1994 | 8 |
| Sanitary Sewer Overflow | 8 |
| Tennis Courts | 8 |
| Position Sheet Grid | 7 |
| Power Stations | 7 |
| Sheriff Boundaries | 7 |
| Water Plats | 7 |
| Forest Harvest | 6 |
| Parole and Probation Residence Locations | 6 |
| Polling Places | 6 |
| Recreation and Parks Council Boundaries | 6 |
| Scenic Routes | 6 |
| Snow Plow Routes | 6 |
| Department of Correction Releases | 5 |
| Forest Cover – 1996 & 2000 | 5 |
| Index Grid - MrSID Tiles | 5 |
| Regional Road Centerline (City and surrounding jurisdictions) | 5 |
| Rural Waters | 5 |
| Sand & Gravel Pits | 5 |
| Flow Monitors | 4 |
| Permits | 4 |
| Police Posts | 4 |
| SCADA Sensors | 4 |
| Submerged Aquatic Vegetation | 4 |

| Dataset | Used By Number of Programs |
|---|---|
| Arrest Data | 3 |
| Calls for Service | 3 |
| Liquor Store License Locations | 3 |
| Offense Data | 3 |
| Scenic Overlooks | 3 |
| Soil Map Index | 3 |
| Soils—Natural Soil Groups | 3 |
| Strategic Planning Areas | 3 |
| Synagogues | 3 |
| Tactical Crime Locations | 3 |
| USGS Quadrangle Index Grid | 3 |
| USGS Quadrangles (Images) | 3 |
| Victimization | 3 |
| Buffered School Addresses | 2 |
| **Encumbrance** | 2 |
| Fast Food Locations | 2 |
| Health Centers (Health Dept) | 2 |
| Historical Aerial Photos | 2 |
| Jacksonville | 2 |
| Points of Interest | 2 |
| Police Business Patrol Initiative Areas (BPI) | 2 |
| Police CSAFE Areas | 2 |
| Rain Gauges | 2 |
| Regional Data (MapInfo) | 2 |
| Registered Child Sex Offenders | 2 |
| Registered Sex Offenders | 2 |
| Residential Building Activity | 2 |
| Sensitive Locations | 2 |
| Traffic Stop Data | 2 |
| Trails as obtained in FD or from other agencies | 2 |
| Buoys | 1 |
| DUI Arrest Locations | 1 |
| Field Investigation Reports | 1 |
| Green Schools | 1 |
| Hospital Emergency Center Boundaries | 1 |
| Mask—County Satellite Images | 1 |
| Motor Vehicle Theft Recovery Locations | 1 |
| Police Public Safety Initiative Areas (PSI) | 1 |
| Population Forecasts | 1 |

| Dataset | Used By Number of Programs |
|---|---|
| Potential Targets | 1 |
| Road - Stream Crossings | 1 |
| Satellite Image—1990 | 1 |
| Satellite Image—1990—Bands 3,4,5 | 1 |
| Satellite Image—1996—Bands 3,4,5 | 1 |
| School Districts (MapInfo) | 1 |
| Storm Surge data from USACE | 1 |
| Survey Control (Benchmarks) | 1 |
| Traffic Accident Locations | 1 |
| USGS Streams Gages | 1 |
| Warrants | 1 |
| LiDAR Bare Earth | 0 |
| LiDAR First-Last Returns | 0 |
| LiDAR Gridded Bare Earth | 0 |
| LiDAR Intensity Imagery | 0 |

**Table 37 – Data Layer Utilization by Program**

***Data Layer Utilization Assessment***

After a thorough review of the countywide GIS data layer utilization, it was determined that 98% of all Baltimore County GIS data layers that are supported, maintained, or procured are actively used by at least one of the 91 programs evaluated in this study. The GIS data layer utilization assessment identified 4 layers out of 274 total layers that were not being utilized by a program. The 4 layers were all LiDAR deliverables that were initially used to generate an updated 2-foot contour topography layer, but have yet to be effectively integrated into the programs and activities of the County agencies.

As would be expected, the largest numbers of programs are utilizing the base map layers, including most of the Enterprise data layers. Many programs were identified as consistently utilizing the layers providing functionality for geocoding operations (Street Centerlines) and address locations (AddressPoints). The most heavily used thematic layers include those that show zoning, wetlands, publicly owned land, County facilities, floodplains, and land use.

The largest number of programs utilizing the enterprise GIS databases funded through capital expenditures includes Orthophotography, Planimetric, and Topographic. Six of the ten most-used datasets are included in this category. These data layers are needed by virtually all agencies to support their programs and activities. Since these datasets support so many of the activities that have proven benefits to the County, a continued long-term commitment should be made by the County to update these datasets.

The other enterprise GIS databases, including Facilities and Cadastral, also have a high degree of utilization by many programs. Four of the ten-most-used datasets are included in this category including the layers used for geocoding (Street Centerlines) and locating addresses (AddressPoints). The County has allocated significant resources to developing and maintaining these databases and they are vital to the operations of all agencies and must be kept current. The 911 Center operations depend on the completeness, currency, and accuracy of the Facilities Geodatabase.

***Data Utilization – Areas of Improvement***

Both the Facilities and Cadastral geodatabases need to be completed. Once complete, an agency-wide assessment of business processes that could be enhanced by their use should be performed. Consideration should also be given to future enhancements of the road centerlines to support route mapping and a broad rollout of a point-based geocoding using the AddressPoints layer.

Among the enterprise databases there are a few data layers that are under utilized. The Encumbrance data layer is not heavily used compared to other Enterprise layers, probably because it is not yet complete. Since the dataset is not complete, additional research of hardcopy plats is often required, increasing the amount of time required to retrieve this information. Completing this dataset will reduce the amount of time researching these source documents and provide a central location that all of the information about these features can be stored and retrieved. This layer will provide benefits to the activities in several agencies, including PDM, OP, DRP, and DPW.

The LiDAR Bare Earth, First-Last Returns, Gridded Bare Earth, and Intensity Imagery are also not heavily used. In fact, no agencies reported their use on any programs, although these datasets were used to compile an updated 2-foot contour database. These are very large datasets that require specialized software and experience to make use of them effectively. These data were initially created to support the development of the contours data layer. However, several agencies could make use of data derived from these LiDAR datasets. LiDAR-derived products such as hydro-enforced DEMs, DTMs, TINs, and hillshades could be used to support virtually every water-related DEPRM program. DEPRM and OP also noted a need for slope data and Police and OP noted a need for building heights, both of which could be derived from the LiDAR data.

***ArcSDE Data Utilization Metrics***

The County performed a separate analysis of the ArcSDE system by numbers of times a data layer was selected by users over a two-month period of time from October 23, 2006 to December 22, 2006. It should be noted, that this analysis did not compare exactly the same data layers as listed above. It did not include any Census data from 1990 or the 2000 Census Tract data. This analysis did include annotation layers and geocoding operations that were not included in the assessment of layers by program.

The 33 most frequently used data layers are listed below. The results show a similarly high usage of Enterprise base data layers, lower usage of Census data, and higher

usage of Encumbrance data. Note that in this analysis, the Encumbrance layer was the 100th most used layer, with 74 SDE connections, while only the top 33 layers are listed here. These results also indicate a similarly high use of layers used for geocoding. The most utilized thematic layers were zoning, sewer, and plats and subdivisions.

| Layer Name | SDE Data Use |
|---|---|
| Orthophotos | 5717 |
| VW_TAXPARCEL | 2339 |
| LAYER_FILE | 2205 |
| CLINE | 2081 |
| ZONING | 2062 |
| ZONING_DETAIL | 1636 |
| N_77_EDESC (Sewer) | 1625 |
| N_77_ESTATUS (Sewer) | 1625 |
| N_77_ETOPO (Sewer) | 1625 |
| N_77_FLODIR (Sewer) | 1625 |
| N_77_JDESC (Sewer) | 1625 |
| N_77_JSTATUS (Sewer) | 1625 |
| N_77_JTOPO (Sewer) | 1625 |
| N_77_JTOPO2 (Sewer) | 1625 |
| N_77_PROPS (Sewer) | 1625 |
| ROADS_POLY | 1448 |
| HYDROLOGY_LINE | 1444 |
| ROAD_CLINE_ANNO | 1412 |
| COUNTY_BOUNDARY | 1361 |
| GRID_200SCALE | 1227 |
| CONTOURS | 1218 |
| ALIAS | 1183 |
| View_ADDRESS | 1132 |
| View_CENTERLINE | 1063 |
| GC_ALSS908 (Geocoding) | 877 |
| GC_SS2330 (Geocoding) | 876 |
| SSFITTING (Sewer) | 855 |
| ROAD_LINE | 847 |
| HYDROLOGY_POLY | 841 |
| DOMAIN_DETAIL | 785 |
| SIMCONFIRSTDIVISION | 749 |
| CONTOUR_ANNO | 601 |
| CENTERLINE | 534 |

**Table 38 – Selected SDE Data Layer Use**

Also note, the count does not indicate the number of queries performed on the data layer or the number of times the information was used in maps, but rather is a count of

distinct connections to the ArcSDE database. In some instances, GIS users may keep the same connection for several workdays without termination, while continually working with the GIS layers. However, this still provides a general assessment of layer utilization through the County's enterprise database server.

### 5.1.2 Data Maintenance Process Improvements

During the course of this study, several improvements to data layers were identified that would benefit multiple agencies within the County. The following improvements are recommended for implementation:

**Data Standards and Procedures**

More formally documented data standards and procedures should be developed to identify the requirements for metadata, data maintenance, data accuracy, topology rules, and data storage. This would apply to enterprise data layers and all countywide data layers developed within agencies.

***Storage of All Datasets in ArcSDE.***

Several datasets are stored on local drives within the agencies. In some cases, this is because the data is still not complete or the bureau responsible for it does not want it to be more widely available until it is deemed more reliable. However, to the extent possible, all non-sensitive GIS data layers should be migrated to the enterprise ArcSDE database provided by OIT, in order to provide proper backup procedures, allow for the data to be accessed by the enterprise, and eliminate possible duplication of data. If connectivity issues prevent a direct connection (e.g., DRP and Police), the databases could be uploaded to the enterprise server on a regular cycle to support information sharing between agencies.

***Avoid Static Duplication and Customization of Datasets***

Some agencies have made copies of SDE data layers so that they can add additional attributes. These new attributes should be submitted to OIT for consideration and possible integration with the master enterprise dataset. This would allow the data to be shared throughout the enterprise, duplication (and disconnection, where one dataset is modified spatially, but not the other) to be eliminated, and maintenance to be consolidated.

**Database Management and Shared Geodatabases Editing Environments**

When necessary, OIT staff manages the database edits made by other County agencies, working with the agencies to reconcile editing conflicts by multiple users. For instance, four different agencies perform editing and maintenance of different components of the Cadastral database, including PDM, OP, DEPRM, and OIT.

With this evolved situation of distributed editing among multiple agencies, there are both pros and cons. The topological structure of the data is essential for maintaining data integrity, and distributing maintenance responsibility to the agency subject matter experts for each layer allows key staff to focus specifically on their respective layer.

However, OIT is responsible for coordination of the editing activities across the various agencies, which can be quite time consuming. The complexity of the topology rules and the number of layers participating in the topology can make it difficult for new or inexperienced editors to fully understand and maintain the proper topological relationships. Baltimore County should examine opportunities to streamline the database maintenance operations to improve processes and procedures, along with the completeness, currency, and timeliness of all databases.

**Sensitive Data Security Plan**
The Department of Health is privy to sensitive information about patients and other clients that must be safeguarded by law, specifically under the provisions of the Health Insurance Portability and Accountability Act (HIPAA) of 1996 as well as confidentiality agreements with the State. The agency is aware of these requirements and understands that much of their data must not be placed on the County's servers. The Police Department maintains data that include names and addresses of victims, persons charged with crimes, individuals released from the Department of Corrections, individuals on parole or probation, and locations of warrants.

***Develop a Sensitive Data Security Plan***
The County should develop a long-term plan for safeguarding its sensitive GIS data holdings and assess the considerations on the GIS architecture. A standard set of operating procedures, developed in conjunction with the OIT Security leadership, will enable GIS to be used as a strategic tool with sensitive data, while ensuring the information is safeguarded and protected against unauthorized access and misuse.

### 5.1.3 Database and Layer Opportunities and Improvements

A number of opportunities for improvements and enhancements to existing data layers for spatial accuracy, additional attributes, and spatially enabling databases were identified in the individual agency chapters. The following details identify two key opportunities for data layer improvements:

**Encumbrance Right of Way Dataset**
An Encumbrance Right of Way (ROW) dataset is currently being developed by PDM to support the needs of agencies such as PDM, DPW, DRP, and OP. This dataset consists of a point dataset representing the location of ROW features held by the County and a polygon feature class that shows the boundaries of these features. PDM has been working on the development of this feature class for approximately four years, and it is not yet complete. The County should evaluate what support could be provided to PDM to expedite the completion of this data layer.

**Regional Data**
The Health, 911, Police, and Fire Departments all have needs for regional base map datasets that extend beyond the County boundaries. The Health Department has purchased data from the Baltimore Metropolitan Council (BMC) in MapInfo format. The Fire and Police Departments have also purchased similar data from BMC in ESRI

format. Other agencies, including Aging, OSS, and Corrections could also make use of regional base map data. The County should investigate a way to make this regional data available across the enterprise for use by multiple agencies. This may involve purchasing data from BMC with a multi-user license, joining the statewide road centerline initiative, or exploring data sharing with other local jurisdictions. The opportunities to improve the most frequently used existing data layers are shown in the table below.

| Dataset | Used By Number of Programs | Agency(s) that would Benefit | Dataset Description | Description of Need |
|---|---|---|---|---|
| Zoning | 44 | OP<br>PDM<br>People's Counsel | Zoning of each property that is updated with each change to the zoning data during CZMP, Cycle and Out-of-Cycle Zoning Hearings. | Add zoning case history data. |
| Wetlands | 43 | DEPRM<br>OCC | Small scale wetlands data | Improve spatial accuracy. |
| Publicly Owned Land | 42 | DEPRM<br>DPW<br>DRP<br>PDM | Last updated in 1994. Properties were digitized from 1:7,200 tax maps. Includes property ownership information. | Improve spatial accuracy. Should be aligned to Cadastral layers. |
| Storm Water Management Facilities | 34 | DEPRM<br>DPW | Point locations for stormwater management facility | Add a link to scanned as-builts. |
| Soils | 32 | DEPRM | Polygons delineating the USDA soil survey mapping units | Improve spatial accuracy. |
| Stormwater (Geodatabase) | 32 | DEPRM<br>DPW<br>Fire | Locations of storm drainage features. | Improve spatial accuracy. Add storm drain locations and retention ponds. |
| Development Plans | 31 | DEPRM<br>DPW<br>OP<br>PDM | Boundaries of Development Areas | Contains new developments only. Add historical developments, concept plans, and proposed projects. Should be maintained by PDM. |
| Basic Services - Transportation (Intersections) | 29 | DEPRM<br>DPW<br>OP | Used to study deficient areas for Transportation, Water, and Sewer. | Improve spatial accuracy (underway). |
| Tree Cover | 29 | DEPRM | Several versions and dates. Images are based on Landsat Satellite interpretation. Smoothing was performed to remove scattered pixels and emphasize the larger clusters of forest. | Improve spatial accuracy. |

| Dataset | Used By Number of Programs | Agency(s) that would Benefit | Dataset Description | Description of Need |
|---|---|---|---|---|
| Chesapeake Bay Critical Area | 28 | DEPRM | Polygons and lines representing the Chesapeake Bay Critical Area, which is defined as the area within 1,000 feet of the mean high tide line as defined by 1972 aerial photographs. | Improve spatial accuracy and currency. |
| Trails | 24 | DRP<br>Fire | Centerlines of bike/hike trails in the County | Improve spatial accuracy and currency. |
| Basic Services - Water | 23 | DEPRM<br>DPW<br>OP | Used to study deficient areas for Transportation, Water, and Sewer. | Improve spatial accuracy (underway). |
| Bridges | 21 | DPW | Point locations of County-owned bridges. | Replace with dataset compiled by DPW using GPS once verification against orthophotos is completed. |
| Fire Hydrants | 20 | DED<br>DPW<br>FD | Originally created from low accuracy sources, in process of updating to improve spatial accuracy. | Improve spatial accuracy. |
| Right of Way (LACQ) | 20 | DPW<br>DRP<br>PDM | Location of each of the County-owned right-of-ways, represented as polygons | Complete this dataset. |
| Basic Services | 19 | DEPRM<br>DPW<br>OP | Used to study deficient areas for Transportation, Water, and Sewer. | Improve spatial accuracy (underway). |
| Park Points | 17 | DRP | Location of each of the County-owned and maintained parks | Add information about park assets and customer complaints. |
| Basic Services - Sewer | 16 | DEPRM<br>DPW<br>OP | Used to study deficient areas for Transportation, Water, and Sewer. | Improve spatial accuracy (underway). |

**Table 39 – Data Layer Opportunities**

### 5.1.4 Overall Data Utilization Assessment and Recommendations

Baltimore County is currently utilizing approximately 98% of all supported, purchased, and maintained GIS databases and layers. The GIS data layer utilization assessment identified 4 layers out of 274 total layers that were not being utilized by a program. The 4 layers were all LiDAR deliverables that were initially used to generate an updated 2-foot contour topography layer, but have yet to be effectively integrated into the programs and activities of the County agencies.

The largest numbers of programs are utilizing the base map layers, including most of the Enterprise data layers (Orthophotography, Planimetric, and Topographic). Many programs were identified as consistently utilizing the layers providing functionality for geocoding operations (Street Centerlines) and address locations (AddressPoints). The most heavily used thematic layers include those that show zoning, wetlands, publicly owned land, County facilities, floodplains, and land use.

The following recommendations are provided regarding overall data utilization:

**Opportunity #1: Long-Term Funding Commitment for Enterprise Data**
The agency programs in Baltimore County utilize the enterprise Orthophotography, Planimetric, and Topographic databases effectively and consistently. These data layers are needed by virtually all agencies to support their programs and activities. Since these datasets support so many of the activities that have proven benefits to the County, a continued long-term commitment should be made to update these datasets.

**Opportunity #2: Improve Utilization of LiDAR Data**
The County's LiDAR data should be used to create additional datasets that would benefit multiple agencies. LiDAR-derived products such as hydro-enforced Digital Elevation Models (DEMs), Digital Terrain Models (DTMs), Triangulated Irregular Networks (TINs), and hillshades could be used to support virtually every water-related DEPRM program. DEPRM and OP also noted a need for slope data, and Police and OP noted a need for building heights, both of which could be derived from the LiDAR data.

**Opportunity #3: Complete the Encumbrance Right of Way Dataset**
An Encumbrance Right of Way dataset is currently being developed by PDM to support the needs of agencies such as PDM, DPW, DRP, and OP. This dataset consists of a point dataset that shows the location of ROW features held by the County, as well as a polygon feature class that shows the boundaries of these features. This dataset should be completed and the availability should be publicized to all agencies to attempt to improve utilization of this important database layer.

**Opportunity #4: Complete the Cadastral Geodatabase**
The Cadastral Geodatabase needs to be completed, specifically the Encumbrance and Easements (Right of Way) data layers. Currently, additional research of hardcopy plats is often required, increasing the amount of time required to retrieve this

information. Completing these datasets will reduce the amount of time researching these source documents and provide a central location where all of the information about these features can be stored and retrieved. Consideration should be given to consolidation of resources or other means of providing the needed support to speed up the completion of these data layers.

**Opportunity #5: Leverage Facilities Geodatabase**
Once the Field Verification of the Facilities Geodatabase is complete, an agency-wide assessment of business processes that could be enhanced by its use should be performed, especially focused on the enhanced functionality of a point-based geocoding service. A comprehensive Maintenance Plan also needs to be created to ensure that the data is updated accurately, correctly, and in a timely manner.

**Opportunity #6: Storage of All Data in ArcSDE**
All data layers actively maintained by the various agencies should be stored in ArcSDE so they can be accessed and used by all County users. Currently, quite a number of datasets are stored on local drives within the agencies. In some cases, this is because the data are still not complete or the bureau responsible for it does not want it to be more widely available until it is deemed more reliable. Many of these data layers could benefit other agencies if they were available through ArcSDE. By publishing all complete and documented data layers to ArcSDE, the utilization and sharing of the layers will improve due to availability to the user community.

## 5.2 Analysis of Application Utilization

The analysis of application utilization with the Baltimore County GIS provides an overview of current utilization of available GIS applications across the enterprise and provides a summary of improvements that could be made through acquiring, upgrading, or developing new custom applications to better serve the County agencies.

### 5.2.1 Standard Application Utilization

Baltimore County supports its agencies' GIS software needs by providing a suite of application software that is available for use by all agency programs and activities. The primary GIS software supported by Baltimore County is ESRI's ArcGIS software for maintaining databases.

A comprehensive list of software used by the County is as follows:

- ArcSDE 9.0 Service Pack 3 [Ora3]
- ArcGIS 9.0 Service Pack 3 [ArcMap, ArcCatalog, ArcToolbox]
- ArcIMS 9.0

In addition to the ESRI software suite, Baltimore County also provides a set of customized applications and other off-the-shelf software packages to support GIS software requirements of the user community.

***Application Inventory and Utilization information***

The following table summarizes the standard GIS applications currently used by the Baltimore County agency programs (see Appendix V for the complete listing of programs and applications):

| Application | Number of Programs Using |
|---|---|
| ArcGIS (Standard) | 79 |
| ArcGIS Data Query | 24 |
| ESRI Extensions | 19 |
| ArcIMS | 18 |
| ArcIMS MyNeighborhood | 13 |
| MapInfo | 10 |
| microDATA GIS | 8 |
| CASS WORKS & CASSView | 6 |
| CrimeStat | 5 |
| ArcPad | 2 |
| CAMEO | 2 |
| GeoDa | 2 |
| Google Earth | 2 |
| InfoWorks | 2 |
| MapQuest | 2 |
| Phone Data | 1 |

**Table 40 – Application Utilization by Program**

In general, Baltimore County agency programs are maximizing utilization of the applications and software provided by the GIS enterprise. Specifically, the ArcGIS standard software and Data Query customized desktop application are the most utilized software tools in the GIS suite. ArcGIS standard is used by 87% of the agency programs (79 of 91 programs) and accounts for 54% of all SDE logins. ArcGIS standard is the primary GIS software application provided by the County. It is also the most robust, providing strong analytical tools, and such high use across the agencies and programs indicates the agencies are using GIS at a relatively high level. Data Query, the customized easy-to-use interface also provides users with access to the ArcGIS tools. Data Query is used by 26% of the agency programs (24 of 91 programs) and accounts for 25% of the SDE logins.

In order to accurately assess the application utilization, it is important to evaluate all agencies countywide and identify if there are any key agencies that are not effectively accessing and utilizing the primary GIS software provided by Baltimore County. All agencies using at least one of the GIS applications provided by the County are shown in the table below. An “X” indicates that at least one of the agency’s programs uses that application. For a few of the miscellaneous cluster 4 agencies that rely on OIT for some of their GIS support, the table also notes which application is used by OIT to provide that support.

| Primary GIS Application Utilization By Agency | | | | | |
|---|---|---|---|---|---|
| **Agency** | **ArcGIS Standard** | **Data Query** | **ESRI Extensions** | **ArcIMS** | **MapInfo** |
| 911 Center | X | X | | X | |
| Aging | | | | | X |
| Auditor | X | | | | |
| DED | X | X | | X | |
| DEPRM | X | X | X | X | |
| DPW | X | X | X | X | |
| DRP | X | | X | | |
| Elections | Via OIT | | | X | |
| Fire | X | X | | X | |
| Health | X | | | | X |
| Law | Via OIT | | | X | |
| OBF | X | | | | |
| OCC | X | | | | |
| OIT | X | X | X | X | |
| OP | X | | X | X | X |
| PDM | X | X | | X | |
| People's Counsel | Via OIT | | | X | |
| Police | X | | X | X | X |
| State's Attorney | Via OIT | | | | |

**Table 41 – Primary GIS Application Utilization by Agency**

As can be seen from this analysis, ArcGIS standard is used by all but one of the agencies (the exception being the Department of Aging, which uses MapInfo) to support the GIS needs of its programs. The ArcIMS applications are used by 63% of the agencies (12 of 19 agencies). Many users take advantage of the ArcIMS applications since these can be made available on almost any computer and provide simple tools for spatial analysis and map viewing. Data Query and ESRI Extensions are used by 32% of the agencies (6 of 19). Only one agency is using MapInfo as its primary GIS software package, and it is being used infrequently to perform geocoding, which could also be performed using Data Query. The Department of Aging should be encouraged to make the transition to the GIS software provided by the County for its future GIS needs.

***Standard Application Utilization – Detailed Analysis***

Another way of examining application use is by how frequently users log into them. A summary of SDE logins by application is provided in the following table. Note that the count of logins represents a count of distinct connections to the ArcSDE database over a two-month period from October 23, 2006, to December 22, 2006. In some instances, GIS users may keep the same connection for several workdays without termination, while continually working with the GIS layers.

| Application | Total SDE Logins |
|---|---|
| ArcGIS | 10,953 |
| Data Query | 4,986 |
| ArcIMS | 2,422 |
| CASS View | 1,156 |
| Productivity Tools | 837 |
| **Total** | **20,354** |

**Table 42 – Application Utilization by SDE Logins**

Most agencies have taken advantage of the applications provided by OIT and are using them effectively. For each of the applications listed in the table above, a brief description of its most prominent use(s) is provided below. A few additional applications used in specific agencies not listed in the table above are also described.

| Application | Description and General Usage |
|---|---|
| ArcGIS (Standard) | ArcGIS version 9.0, service pack 3 (SP3) is the current County standard that is deployed throughout the various agencies. It is the primary GIS application used by all agencies and by 79 of the 91 programs.<br><br>Throughout the agencies, the GIS specialists take advantage of ArcGIS, which provides an ample GIS toolset for conducting the most complex analysis and editing available within the County. ArcGIS is accessed to connect to ArcSDE more than any other GIS application used within the County. ArcGIS accounts for 54% of SDE logins. |
| ArcGIS Data Query | Data Query is a customized application that loads County data into an MXD with pre-set symbology and provides some custom toolbars for use by County staff. Data Query also provides plotting tools and a mail merge function. Many agencies and 24 of the 91 programs use Data Query. Data Query accounts for 25% of SDE logins.<br><br>The latest version of Data Query has recently been released and training classes were conducted. Several agencies, most notably DEPRM and DPW were using a customized .MXD that was developed in advance of the Data Query application but indicated they would implement use of Data Query once they received training. The Fire Department and DRP indicated that they do not use Data Query due to connectivity issues. |

| Application | Description and General Usage |
|---|---|
| ESRI Extensions | ESRI Extensions are used by 19 of the 91 programs and by six agencies. County staff use the following ESRI ArcGIS extensions: Spatial Analyst, 3D Analyst, Network Analyst, and AutoBound. Business Analyst was used previously as well, but that license appears to have expired.<br><br>ESRI Extensions are used extensively by DEPRM and to a lesser degree by DPW, DRP, OCC, OP, and the Police Department. Several DEPRM programs rely on ArcGIS extensions such as Spatial Analyst and 3D Analyst. DPW uses Spatial Analyst and 3D Analyst to perform some of its Consent Decree activities. The Police Department uses Spatial Analyst to produce kernel density, surface maps to identify crime hot spots, and Network Analyst to identify potential travel routes of offenders. |
| ArcIMS and MyNeighborhood | The County has developed a series of ArcIMS applications that allow the user to display and query map data, and perform certain functions such as zooming, panning, identifying, etc. The ArcIMS sites provide access to the same County GIS data that are available to users via ArcGIS, but require only a Web browser. The ArcIMS sites include Community Crime Profile, Find Tile, Land Survey Control Points, Rural Water, and the Voter Mapping Application. An ArcIMS application called Property Search was also specifically launched for DEPRM. The MyNeighborhood sites include Commercial Revitalization, Draft Bicycle Plans, Enterprise Zones, Facilities, Historic, Planimetric/Topographic, and Zoning.<br><br>The County ArcIMS applications are used by most agencies and by 19 of the 91 programs. Many users take advantage of the less robust ArcIMS applications provided by the County, since these can be made available on almost any computer and provide simple tools for spatial analysis and map viewing. They are ideal for use at the County's field offices, such as the highways, traffic, and building services field offices. ArcIMS accounts for 12% of all SDE logins, representing internal County users. |
| MapInfo | MapInfo software is utilized by ten programs within Health, Police, OP, and Aging. In part, agency personnel use MapInfo because of long-term familiarity and ease of use. However, it is not supported by the enterprise, and some County datasets are being duplicated in MapInfo format. These agencies should try to incorporate the Data Query or standard ArcGIS applications into their business processes as at least a supplementary software package, if not a total replacement. Although MapInfo does provide several relatively insignificant benefits, these are outweighed by the expert training, support, and data provided by OIT for the ArcGIS software package. |

| Application | Description and General Usage |
|---|---|
| microDATA GIS | MicroDATA is used by eight programs in 911. MicroDATA GIS is an Enhanced 911-capable software package that is integrated into the 911 CAD system and provides mapping functionality to locate 911 callers (Landline or Cell phones) using GIS data layers and address information. There is an additional need for the current microDATA GIS application to be upgraded to take advantage of ESRI's ArcGIS 9.2 data model. This will enable the County's enterprise GIS data within the Facilities Geodatabase to be used seamlessly and will incorporate the functionality currently provided by the CAD application. |
| CASS WORKS & CASSView | CASSView is used by six programs within DPW. DPW is the only agency, to date, to have access to CASS WORKS and CASSView. CASS WORKS is a work order management system that is integrated with the CASSView map interface. Together they provide access to GIS layers and spatial query / proximity and geocoding functionality for analysis. Several programs require the use of CASS WORKS and/or CASSView, notably those involving tracking citizen inquiries about problems related to storm drains and sanitary sewer service. The Bureau of Utilities and the Bureau of Engineering, Storm Drain Design, are currently using CASS WORKS and CASSView. CASSView accounts for 6% of all SDE logins. |
| CrimeStat | The Police Department uses CrimeStat to produce Nearest Neighbor Hierarchical Cluster routines on different types of crime data. A surface is produced and compiled on a map that is used to visualize where hotspots of different types of crime are. CrimeStat's Journey to Crime routine is also used to construct a probability surface of the area that represents the activity space of a criminal. This surface is mapped with relevant basemap data, in order to understand the area in which the offender could be located. |
| ArcPad | DEPRM uses ArcPad for field survey activities related to identification of areas of submerged aquatic vegetation and for planning and monitoring the results of the community reforestation program. |
| CAMEO | Computer Aided Management of Emergency Operations (CAMEO) is used by two programs in the Fire Department. CAMEO software is provided by the EPA and NOAA for managing chemical incidents. CAMEO includes a chemical database as well as GIS mapping capabilities and plume modeling. |
| GeoDa | The Police Department uses GeoDa, a free software application developed at the University of Illinois designed to implement techniques for exploratory spatial data analysis (ESDA) on lattice data (points and polygons). It provides a graphical interface to methods of descriptive spatial data analysis, such as spatial autocorrelation statistics, as well as basic spatial regression functionality. The latest version contains several new features such as a cartogram, a refined map movie, parallel coordinate plot, 3D visualization, conditional plots (and maps), and spatial regression. |

| Application | Description and General Usage |
|---|---|
| Google Earth | Google Earth is used by two programs in the Fire Department as well as by other agencies. Google Earth is primarily used for on-line viewing of imagery. |
| InfoWorks | InfoWorks is used by two programs in DPW. The Bureau of Engineering and Construction Inspection is using InfoWorks for hydrologic modeling of sewersheds. InfoWorks modeling software is used to create 3D dynamic models of each sewershed. The County's GIS data are the model inputs. Using InfoWorks, running a model on a sewershed takes hours instead of weeks. Additionally, it would not be possible to meet the Consent Decree requirements without InfoWorks (and hence without GIS). |
| MapQuest | MapQuest is used by two programs in the Fire Department, primarily for Emergency Operations Center support and to estimate drive-times from fire stations to various locations with a Firebox. The Department of Aging makes use of MapQuest to find directions to clients' homes and for determining routing. The county's website also makes use of MapQuest to provide users with maps and driving directions to facilities for which an address is posted (e.g., animal control facilities, health centers, WIC [women, infants, and children] clinics, family planning clinics, community mental health centers, etc.). |
| Phone Data | The Fire Department uses Phone Data in its EOC support activities. |
| CoStar | DED makes use of CoStar, a subscription-based industrial access locator, similar to the Multiple Listing Service (MLS), to identify the locations of features requested by customers. |
| SketchUp | OP uses Google SketchUp to create, view, and modify 3D forms. It allows users to pop up 3D buildings and integrate them with base map imagery and other data. |
| MaintStar | DRP uses MaintStar for maintenance of its assets. Each asset is contained within the MaintStar application as a site or piece of equipment. Within this activity, work orders, which are assigned to maintenance personnel, are created for each maintenance activity. MaintStar has a spatial component that could be taken advantage of to map and analyze complaints and to support maintenance activities by helping distribute maintenance work among teams and planning the best routes for completing maintenance activities. |
| ArcView 3.2 | OP uses the ArcView 3.2 extension AutoBound to perform redistricting activities. PDM's Lacquire is an ArcView 3.2 application. Other agencies besides OP have needs for redistricting (e.g., Fire, Police). The County should consider implementing the Districting for ArcGIS extension, which is a no-cost extension, to support these needs. The Lacquire program, used to extract property owner information from parcels that overlay ROWs, should be upgraded to ArcGIS 9.x |

**Table 43 – Application Utilization and General Usage Descriptions**

***Application Utilization – Areas of Improvement***
A few agencies are not effectively using the provided applications and could improve utilization with guidance and assistance. Here is a synopsis of the Application Utilization issues by agency:

| Agency(s) | Areas of Improvement for Application Utilization |
|---|---|
| Fire | Uses GIS applications to a lesser degree than expected because they are still relying heavily on paper map products in each of the emergency vehicles. If GIS-enabled laptop computers were available in each of the emergency vehicles, GIS usage among this department would dramatically increase. The new users would need to be supported with a custom application, somewhat like Data Query to help them make the transition from paper to GIS. |
| PDM<br>OP | Programs are relying on ArcView 3.2 for some GIS functionality. A complete migration to the current support County version of ESRI software is recommended. |
| OP<br>Health<br>Police<br>Aging | Programs are relying on MapInfo for some GIS functionality. Applications that are dependent on this software package may need to be replaced with newer applications written for ArcGIS 9.x. Users should be provided with additional training to make the transition from a familiar software package to the County's ArcGIS tools if needed. |
| DRP<br>Fire | Network connectivity and speed have been identified as an obstacle to utilizing the applications and database provided by the County enterprise. |

**Table 44 – Areas of Improvement for Application Utilization**

### 5.2.2 Custom Application Utilization

OIT develops, implements, and supports custom applications for the Baltimore County Enterprise. This includes developing and maintaining integrated applications, ArcGIS productivity toolbars, and Desktop ArcGIS applications. OIT application development support includes managing upgrades and the development environment. OIT staff provides technical support and solutions for any problems that occur with the custom applications they develop.

The custom applications developed by OIT include the following:

***Database Maintenance Productivity Tools***
A series of database productivity tools have been developed to automate workflow, simplify processes, enhance editing, perform QC, track user activities, and synchronize data within the enterprise databases. The tools have streamlined operations and improved maintenance processes. The tools are used primarily by the database maintenance staff within the agencies and OIT to streamline the database editing process and procedures. Together, the production tools account for 4% of SDE application logins.

| Productivity Tool | Description |
|---|---|
| Domain Editor Tool | The Domain Editor tool simplifies the process for uploading and updating tables in a database. |
| Map Discrepancy Tool | The Map Discrepancy tool provides an interface for different agencies to report discrepancies between physical property and the database map. This tool automates the work flow and tracks user activities. |
| Cadastral Tools | The Cadastral tools are collected into a custom ArcGIS toolset designed to enhance the editing and QC of cadastral layers. |
| Facilities Application Tools | The Facilities Application tools are customized forms and tools designed to assist in the management of the Facilities geodatabase. |
| Field Verification Scripts | The Field Verification scripts are a series of custom scripts designed to perform QC on the centerline data. |
| Quality Control Ortho Tools / Scripts | The QC Ortho tools are a set of custom scripts for performing Quality Control on orthophoto layers. |
| Utilities Editing Application | The Utilities Editing Application is a customized GIS productivity tool. |
| CASS WORKS to ArcSDE 9.0 Triggers | Oracle Triggers that synchronize ArcSDE BCDPW Sewer Data with CASS WORKS. |
| Lacquire | The "Lacquire" application was developed for PDM to extract property owner information from the parcels that overlaid potential ROWs. This application needs to be upgraded from ArcView 3.2 to ArcGIS 9.x. |
| Engineering Records | An ArcIMS site used by DPW Engineering Records staff to identify manhole numbers in the Sanitary Sewer layer and to research drawing numbers by feature location. |
| Master Road | The Master Road intranet application allows users to search for road name and range information. The application also manages the workflow for adding new road names and changing road names. |

**Table 45 – Database Maintenance Productivity Tools**

***Advanced Analytical Applications***

Developed for DEPRM, the Agricultural Preservation Program is a repeatable GIS modeling application that can be utilized annually to enable Baltimore County to optimize property purchase selections. The Annual Application Ranking and Optimization activity facilitates and largely automates the site selection process, providing an additional $400,000 worth of land preservation per year. This advanced, analytical GIS model provides legitimacy to the ranking and optimization process by generating defensible, consistent, and repeatable results. This is the County's most prominent example of a customized application with analytical capabilities and a significant utilization.

### 5.2.3 Application Improvements and Opportunities

The most significant application opportunities for new development and implementation opportunities are listed below.

**Implement CASS WORKS and CASSView for Additional Bureaus and Agencies**
CASS WORKS and CASSView should be implemented for the Highways, Solid Waste, and Traffic Engineering departments within DPW to help manage the volume of customer service requests and work orders these bureaus receive. The Bureau of Utilities and the Bureau of Engineering, Storm Drain Design, have demonstrated how well CASS WORKS and CASSView are working for them, and other bureaus within DPW are looking forward to taking advantage of their functionality to help them meet their own and their constituents' needs. DRP could also utilize a system such as CASS WORKS to enable the agency to spatially track complaints received about property and assets owned by the agency.

**Develop Activity-Specific Applications**
In general, GIS has been introduced into County agencies to handle ancillary issues of business processes, such as creating maps or to answer simple geographic questions such as geocoding; however; GIS has not been fully incorporated into business processes to handle more complex issues including providing spatial components to existing databases and offering solutions to unique spatial problems that cannot be met with Commercial Off The Shelf (COTS) GIS applications. The County should work to develop small, activity- or program-specific applications that focus on the needs of individuals that cannot be met with COTS GIS applications.

**Develop an Advanced Geostatistical Application**
An application that allows for advanced spatial analysis and statistical reporting is needed by several of the agencies focusing on social issues with a geographic nature. The Department of Social Services and Local Management Board have fairly complex phenomena to analyze, with many variables that can influence action taken by the agency. Crime, income level, housing status, race, and other demographic variables can each be analyzed in a multivariate spatial fashion, in order to understand the variables that are more significant. This knowledge can help focus support and services on geographic areas with greater need.

Some additional opportunities for application development or improvements are detailed below. Additional application improvements and opportunities that would support individual agencies are described in each of the agency reports.

| Application | Description of Opportunity |
|---|---|
| Upgrade Lacquire | The "Lacquire" program, used by PDM to extract property owner information from the parcels that overlay potential ROWs, should be upgraded from ArcView 3.2 to ArcGIS 9.x. |
| Create a CZMP Toolbar | A new customized application to support the CZMP process for OP should be created to enhance this workflow and implemented to save time and improve the quality of the CZMP analysis and output. This new application would include six basic customized functions within ArcGIS to create a GIS-centric reporting/tracking tool. The functions would likely be managed through a series of buttons on a custom CZMP toolbar integrated into ArcGIS. |
| Upgrade microDATA GIS | When available from the vendor, 911 should upgrade its licenses of microDATA GIS to the next generation of the software. This upgrade will take advantage of ESRI's ArcGIS 9.2 data model. It should also enable the County's enterprise GIS data, particularly the Facilities Geodatabase, to be used seamlessly. |
| Automated Drainage Area Calculations | Drainage area calculations could be automated in GIS through the use of ESRI's Spatial Analyst extension and/or use of the free statewide GIS Hydro application. |
| Redistricting Software | An application could be incorporated that automatically creates new boundaries based on some input data, decreasing the amount of time spent manually updating these district features. |
| Emergency Management Tools | An emergency management toolset could be developed to show the locations of hospitals, other facilities, critical infrastructure, and evacuation routes, and to help users locate the best sites for temporary shelters based on selected criteria. This application could offer tools to perform geocoding; analyze properties impacted by flooding; and help manage post-event activities by providing tools to allow the user to note the locations of obstacles, note which roads have been cleared of debris, and identify areas in need of emergency water, ice, and other critical supplies. |
| Route Mapping | An application could be incorporated that would identify the optimum route, taking into account user-specified criteria. Note that this would require a road centerline data layer that can support routing |

**Table 46 – Additional Opportunities for Application Development and Improvement**

### 5.2.4 Future Application Development Strategies

Using a similar concept to that used in the development of the "generic" use Data Query application and the general use MyNeighborhood suite, the County should consider a similar approach to developing applications that will support multiple agency business processes. One example of such an application would be one that would allow users to query data specific to their business processes. This querying capability could include both spatial and attribute queries, so users can ask questions such as:

- What councilmanic district is an address in?
- How many voters are within a precinct?
- How many developments have been built in the past ten years?
- How many robberies have occurred within five blocks of a house?
- How many picnic tables are there within a specific park facility?
- How many seniors are outside walking distance of mass transportation routes?

The tool could allow users to specify what type of data they are interested in analyzing, and what type of question they would like to ask. This would allow the tool to be robust, while at the same time supporting queries specific to individual agencies' business processes, without significant upfront development costs. The application would analyze any datasets stored in ArcSDE having a spatial component (e.g., address).

### 5.2.5 Overall Application Utilization Assessment and Recommendations

In general, Baltimore County agency programs are maximizing utilization of the applications and software provided by the GIS enterprise. Specifically, the ArcGIS standard software and Data Query customized desktop application are the most utilized software tools in the GIS suite. ArcIMS is also used by most agencies when a lightweight application that can be run with only a web browser is needed. Most agencies have taken advantage of the applications provided by Baltimore County and are using them effectively. Continued support by the County in providing access to these applications is essential to realizing the benefits provided by their use. This support includes support of the ESRI maintenance agreement as well as custom application development and maintenance.

The ESRI Extensions – Spatial Analyst, 3D Analyst, and Network Analyst – are used extensively by DEPRM and to a lesser degree by other agencies (e.g., DPW, DRP, OCC, OP, and Police) for complex GIS analyses. CASS WORKS and CASS View are used only within DPW, but are used by numerous programs to manage citizen inquiries and work orders related to storm drain and sanitary sewer problems and to comply with the Consent Decree requirements.

A few agencies are not using the provided applications effectively and could improve utilization, including Fire, Health, and Aging. Fire is still relying heavily on paper map products in each emergency vehicle and faces network connectivity issues that hinder data and application use. Health and Aging are using MapInfo for many of

their GIS processes and thus are not able to effectively use the available County GIS data.

The following recommendations are provided regarding overall application utilization:

**Opportunity #1: Decrease Reliance on Unsupported Software**
MapInfo and ArcView 3.2, two software packages that are not supported by the enterprise, are being used to support several business processes within several agencies. The agency should try to incorporate the Data Query or standard ArcGIS applications into these activities as a supplementary software package, if not a total replacement. Although MapInfo does provide several relatively insignificant benefits, these are outweighed by the expert training, support, and data provided by OIT for the ArcGIS software package.

**Opportunity #2: Upgrade microDATA GIS**
When available from the vendor, 911 should upgrade its licenses of microDATA GIS to the next generation of the software. This upgrade will take advantage of ESRI's ArcGIS 9.2 data model. It should also enable the County's enterprise GIS data, particularly the Facilities Geodatabase, to be used seamlessly.

**Opportunity #3: Implement CASS WORKS and CASSView**
CASS WORKS and CASSView should be implemented for additional bureaus within DPW, including the Highways, Solid Waste, and Traffic departments, to help them manage the volume of customer service requests and work orders that these bureaus receive.

**Opportunity #4: Prioritize and Develop Activity-Specific Applications**
In general, GIS has been introduced into County agencies to handle ancillary issues of business processes, such as creating maps or to answer simple geographic questions such as geocoding; however; GIS has not been fully incorporated into business processes to handle more complex issues including providing spatial components to existing databases and offering solutions to unique spatial problems that cannot be met with Commercial Off The Shelf (COTS) GIS applications. The County should work to develop small, activity- or program-specific applications that focus on the needs of individuals that cannot be met with COTS GIS applications.

## 5.3 Analysis of GIS Utilization in Baltimore County

The analysis of GIS technology utilization in Baltimore County provides an overview of GIS use within the County agencies, GIS training, GIS personnel, communication, and GIS use within the business processes in each of the County agencies.

### 5.3.1 Agency GIS Utilization

There is a wide range of GIS use within the agencies within Baltimore County. Several agencies, notably DEPRM, DPW, OIT, OP, and Police, have been using GIS for many years, maintain key enterprise datasets, and are strong users. Some of the smaller agencies have also made good use of GIS, even though they do not have large numbers of users. These include DED, DRP, and OCC.

The 911 Center is relatively new to using GIS and has specialized needs related to their business processes and operations, which will require additional investments to expand GIS utilization within the agency. Fire is relatively new to using GIS as well, but should work to leverage training and databases provided to improve operations within the agency. The Fire department could be a pilot project to develop a GIS improvement plan that identifies key business processes and explores how GIS can enhance current operations. During implementation of the plan, the agency should document progress in attaining GIS utilization goals to justify the additional resources needed (staffing, hardware, mobile technology, and data) to further expand GIS.

PDM and Health are under-utilizing GIS and stand to gain the most from introducing GIS to their business processes. The smaller agencies interviewed in Cluster 4 are for the most part not using GIS but have few requirements for its use.

The following section provides a summary of GIS use within the County agencies.

**911** – Baltimore County is required to comply with the Phase II Wireless E911 requirements to receive funding from the Emergency Number Systems Board. GIS has been integrated into the 911 business operations to support these requirements. GIS is used by all of the 911 Center operators in the form of the microDATA GIS software. The 911 Center is the primary agency responsible for performing database maintenance on the Facilities Geodatabase, one of the main enterprise databases. The 911 training program focuses on use of the systems needed to perform 911 Center duties, not on County GIS applications. When microDATA is upgraded to ArcGIS 9.2, this agency should invest in additional training for its staff so they can take advantage of additional County data layers.

**Aging** – MapInfo is used occasionally within the agency to make maps. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS for additional business processes.

**Auditor** – GIS is used to determine what councilmanic district an address is in. This agency has some business processes that could benefit from GIS but does not have

enough capacity or need to use GIS daily. It should continue to rely on OIT support for its GIS analysis needs.

**Budget & Finance** – This agency relies on OIT for GIS support. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should continue to rely on OIT support for its GIS analysis needs.

**Corrections** – GIS is not used within the agency. This agency has some business processes that could benefit from GIS. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS for its relevant business processes.

**DED** – GIS is being used by all of the programs within DED to support decision-making and to create GIS products on a daily basis. The DED interviewees noted that the County would not be competitive in this field without GIS. DED could benefit from additional GIS training and from additional GIS applications that are specific to economic development business processes.

**DEPRM** – GIS has excellent concentration within DEPRM programs. Nearly every aspect of the department's operation relies heavily on GIS data, applications, and/or products to operate efficiently, support decision-making, enhance business processes, and communicate with stakeholders. GIS is required in order for DEPRM to comply with several environmental mandates. DEPRM has invested in applications specific to its environmental activities, and these have provided significant benefits to the agency.

**DPW** – DPW has a long history of GIS use throughout the agency and probably has the most GIS users of any County agency. In fact, before GIS was used throughout the County, DPW was a champion for expanding GIS use countywide. GIS is effectively used across DPW programs.

Baltimore County is under a Consent Decree required by MDE/EPA. The use of GIS is mandated by the Consent Decree, and most phases of the decree necessitate using a GIS and associated databases to accomplish the requirements. Not meeting the numerous deadlines and requirements will result in substantial financial penalties levied upon the County.

**DRP** – GIS has a moderate use within DRP, serving most of the activities and business processes within the agency in a basic manner. GIS is being used effectively to provide spatial analysis, mapping needs, resource management, and service planning and development. DRP could benefit from additional GIS data and applications that would allow more effective management of County park assets.

**Elections** – This agency uses MyNeighborhood for some research of address locations and relies on OIT for additional GIS support. This agency has some

business processes that could benefit from GIS. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS for its relevant business processes.

**Executive Office** – GIS is not used within the agency. This agency has some business processes that could benefit from GIS. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS for its relevant business processes.

**Fire** – GIS has a moderate use within the Fire Department. There are relatively few users within the agency compared to the total number of personnel. The department is still relying heavily on paper map products in each of the emergency vehicles. The GIS users within the Fire Department appear to be relatively efficient in their current use of GIS, but spend a lot of their time producing and updating the paper map products. The agency should develop a GIS improvement plan that identifies key business processes and how GIS can enhance current operations, and during implementation of the plan the agency should document progress towards GIS utilization goals to justify the needs for additional resources (including staffing, hardware, mobile technology, and data) that would allow increased use of GIS.

**Health** – GIS has a relatively limited use with the Department of Health and has only recently begun to be incorporated into a few programs within the agency. There has been an increase in GIS activities, but there does not appear to be a formal plan for rolling out the system to users, training personnel, or incorporating GIS into business processes. The Department of Health needs a GIS champion who can develop a comprehensive plan for incorporating GIS into more of its business processes.

The Department of Health has a number of bureaus that do not use GIS at all, even though their activities involve spatially locating their constituents and resources. These additional bureaus could gain future benefits from the use of GIS. GIS should be more fully integrated into activities within the agency, providing additional benefits to users and customers.

**Human Resources** – GIS is not used within the agency. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should rely on OIT support for its GIS analysis needs.

**Law** – This agency uses MyNeighborhood for some research of transactions but mainly relies on OIT for GIS support. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should continue to rely on OIT support for its GIS analysis needs.

**Liquor Board** – GIS is not used within the agency. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should rely on OIT support for its GIS analysis needs.

**Local Management Board** – This agency relies on other agencies for GIS support. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS on its own and for additional business processes.

**OCC** – GIS is used across OCC programs and for most activities. GIS is used as a tool to support decision-making and to create GIS map products. However, OCC could use GIS more effectively, since OCC currently relies heavily on OP to provide GIS analytical and mapping support. OCC should attempt to participate more fully in on-site GIS activities involved with Urban Design Assistance Team (UDAT) Charrettes realizing the benefits of the investments in training.

**OIT** – GIS is used and/or supported throughout most of OIT's units. Many units touch GIS in one way or another, whether through direct support of the GIS by the Business Applications Unit, maintenance of the networks supporting its distribution throughout the County by the Network and Systems Management Unit, or GIS training provided through the Computer Training Center within the Customer Support Services Unit. Database Administration of the County's GIS licenses and databases ensures that they can be deployed throughout all County agencies. Managing user accounts and privileges ensures users have access to the data they need, but that users cannot harm sensitive data.

Despite its significant use and widespread support within OIT, there are areas within OIT that could further benefit from increased use of GIS, including the Network and Systems Management Unit and the Electronic Services Radio Communications Group.

**OP** – GIS is being used effectively by all of the programs within OP. Additionally, OP maintains some of the key enterprise Cadastral data layers. The OP staff appears to have appreciation for the power of GIS to support their mission and acknowledge that they could not effectively perform all of their current activities without it. GIS is also used on-site during the UDAT Charrettes and is a key ingredient ensuring the success of these intensive sessions.

**PDM** – GIS has a relatively limited use with PDM and has only recently begun to be incorporated into most of the programs within the agency. PDM is using GIS within several business processes, but not to the extent that GIS can be utilized to improve operations. PDM does not have a comprehensive plan for incorporating GIS into business processes, which is represented by the lack of direction the agency has for GIS to support activities and the ad-hoc implementation of existing GIS into business processes.

GIS can be more fully integrated into activities within the agency, providing additional benefits to users and customers. A comprehensive review of PDM's business processes is needed. Additionally, a land management system to incorporate GIS into development reviews, which involve 20 agencies across the County, would benefit the entire County.

**People's Counsel** – This agency uses MyNeighborhood for some research of zoning but mainly relies on OIT for GIS support. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should continue to rely on OIT support for its GIS analysis needs.

**Police** – GIS is being used extensively within the Police Department to support divisions throughout the agency in a variety of mapping and spatial analysis needs. These GIS-related activities often involve complex modeling, investigation, and analysis that have positioned the agency as one of the most sophisticated and competent users within the County and have gained the agency recognition across the country. Personnel appear to be adequately trained to handle the various requests from the agency, datasets are being effectively developed and incorporated into activities, and COTS software and customized applications are being used to support mapping and analysis. There has been significant investment in GIS within the agency that has greatly incorporated the system into most of the business processes within the agency.

**Sheriff** – GIS is not used within the agency. This agency has some business processes that could benefit from GIS. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS for its relevant business processes.

**Social Services** – This agency relies on other agencies for GIS support. This agency should receive the County GIS applications and additional GIS training, and it should begin to use GIS on its own and for additional business processes.

**State's Attorney** – This agency relies on OIT for GIS support. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should continue to rely on OIT support for its GIS analysis needs.

**Workforce Development** – GIS is not used within the agency. This agency has some business processes that could benefit from GIS but does not have enough capacity or need to use GIS daily. It should continue to rely on OIT support for its GIS analysis needs.

### 5.3.2 GIS Training

Most of the County agencies have taken advantage of the GIS training through the OIT Computer Training Center (CTC), sending one or more staff members for training. However, most agencies could benefit from additional staff receiving training. In fact, one of the most frequently heard recommendations provided by staff members during the interviews was for additional training opportunities.

Additional training on GIS data and applications should be specific to each agency's programs. This training would include an overview of how applications can be used to support business processes and data that could be useful to activities. In many

cases, this training should be preceded with a business process analysis, in order to determine how data and applications could be used and what gaps exist in GIS knowledge. Any further investment in training should be followed through with skill reinforcement and usage of the system to ensure the skills are transferred from the classroom to the business activity performed. Additionally, agencies should be encouraged to transfer knowledge among users through the use of brown-bag seminars where users train other users on agency-specific tasks or show how they solved a unique challenge.

The following table shows a breakdown of CTC training courses provided from 1997 to 2007, including details about the levels of training and the number of staff that have received training at that level. Note that individuals who have attended multiple training classes are listed only once, and the highest level of training attained is reported for each individual.

| Agency | Basic Training (Data Query, ArcView) | Mid-Level (ArcGIS Intro) | Advanced (ArcGIS 8x or higher) |
|---|---|---|---|
| 911 | 0 | 0 | 1 |
| DED | 2 | 0 | 2 |
| DEPRM | 46 | 2 | 9 |
| DPW | 21 | 8 | 26 |
| DRP | 8 | 1 | 3 |
| Fire | 1 | 0 | 6 |
| Health | 2 | 0 | 1 |
| OCC | 2 | 0 | 2 |
| OIT | 10 | 1 | 32 |
| OP | 13 | 4 | 9 |
| PDM | 28 | 2 | 14 |
| Police | 7 | 4 | 10 |
| Misc # 4 | 45 | 2 | 10 |
| **Total** | **185** | **24** | **125** |

**Table 47 – GIS Training Summary from 1997 to 2007**

Overall, the agencies with long-term commitment to GIS use, including DEPRM, DPW, OIT, OP, and Police are well trained and have a number of users with advanced training. DED, 911, Health, and OCC have few trained users and could benefit from additional staff training. DRP and Fire have staff and training commensurate with their current needs, although Fire should focus on utilizing the advanced skills obtained in the advanced GIS classes to improve GIS utilization within the department. PDM appears to have received a lot of training that has not been put to use within the agency.

### 5.3.3 GIS Personnel

Within the Baltimore County agencies, there is a wide range of GIS staff skill levels and use. A knowledgeable team of GIS staff may support some agencies while other agencies rely on a single GIS point-of-contact that may not be able to fill all of the agency's needs.

A summary of current GIS oversight committee members, database maintenance staff, SDE users, and SDE logins, by agency, is provided in the following table. Only agencies that participate or use GIS are included. Note that the count of SDE users includes only users who logged in under their own name. It does not include the many users who logged in or access GIS through Data Query, ArcIMS, or the production tools (e.g., Map Discrepancy, Facility Application, etc.), so it is not a representation of the total number of SDE utilization by agency users. The number of logins represents a count of distinct connections to the ArcSDE database over a two-month period from October 23, 2006, to December 22, 2006. In some instances, GIS users may keep the same connection for several workdays without termination, while continually working with the GIS layers.

This summary provides a pattern of staff utilization and indicates which agencies are most actively utilizing the enterprise GIS, executing the most GIS maintenance responsibilities, and make the most use of the GIS tools provided.

| Agency | Oversight Committee Members | Database Maintenance Staff | Total SDE Accounts | SDE Users Active (10/23 – 12/22) | Total SDE Logins (10/23 – 12/22) |
|---|---|---|---|---|---|
| OIT | 8 | 5 | 13 | 13 | 2661 |
| OP | 1 | 7 | 25 | 17 | 2648 |
| DEPRM | 1 | 2 | 50 | 19 | 2337 |
| DPW | 1 | 8 | 59 | 14 | 1967 |
| DRP | 1 | 1 | 6 | 6 | 266 |
| PDM | 1 | 1 | 30 | 4 | 194 |
| 911 | 1 | 1 | 3 | 1 | 165 |
| DED | 1 | 1 | 1 | 3 | 89 |
| Fire | 1 | 2 | 3 | 3 | 59 |
| Health | 1 | 1 | 1 | 1 | 27 |
| OCC | 1 | 0 | 4 | 2 | 4 |
| Police | 2 | 11 | 11 | 2 | 2 |
| Elections | 1 | 0 | 0 | Not reported | Not reported |

**Table 48 – Agency Personnel Summary and SDE Utilization Statistics**

An analysis of GIS personnel by agency reflects similar results to the training analysis. DPW, DEPRM, OIT, OP, and Police have the most GIS personnel who make the most use of the GIS data and applications provided. These agencies contain dedicated GIS staff responsible for database maintenance and GIS analysis, and they provide GIS support to other agency staff. The connection counts for Police are

indicative of the network connection issue, which limits their capability of connecting directly to the ArcSDE databases. Also, DEPRM and DPW have many GIS users who connect to the server using ArcIMS, which is not captured in the metrics, and the 911 statistics do not account for all end users connecting through microDATA GIS.

PDM, DRP, 911, Health, and DED are each primarily supported by one full-time GIS staff member who performs database maintenance as well as provides GIS support to the agency. These agencies are under supported compared to their needs and future potential use of GIS.

All agencies should seek to improve the utilization of the advanced resources and GIS skills sets by encouraging general GIS users to handle simple GIS tasks, such as creating maps, in order to free up the GIS specialists and analysts for more complex tasks.

Incorporation of GIS requirements into hiring practices would also benefit most agencies. Job descriptions should include GIS skills as appropriate. As candidates are recruited and positions are filled, GIS skills should be included in the evaluation process. Hiring new staff members that possess GIS skills in addition to subject matter expertise will infuse GIS into the agencies and reduce the need to rely on on-the-job training to provide these skills.

### 5.3.4 Communication

The communication of information related to the utilization of GIS technology is critical to ensuring the agencies are aware of applications, databases, and other resources available as part of the Baltimore County GIS enterprise. The types of communication, formal and informal, are both critical to ensure maximum utilization of the resources, as well as to avoid inefficiencies and duplications of effort. The ability for user agencies in the GIS community to communicate regularly about GIS initiatives, uses, and needs is important to ensure that synergies between business processes are realized.

***Formal Communication about GIS Enterprise***

Formal coordination among all of the Baltimore County agencies occurs through a number of forums. These forums, which are facilitated by OIT, include the following:

**GIS Oversight Committee** – This group meets monthly and is chaired by the OIT Business Applications, Business Analyst - Land Management, and GIS. The meeting is a gathering of liaisons from the various agencies. Discussions about the project status, current activities in the agencies, and information sharing are the focus of this group. Minutes are published and posted on the web. Attendance is inconsistent, and the communication from the meeting to the liaisons' users is generally not a refined process.

**Information Technology Advisory Committee** – The Information Technology Advisory Committee (ITAC) was formed to provide the County

with effective and efficient information technology systems and services that support delivery of quality government. Robert Stradling, Director of OIT, chairs the ITAC, and representatives from the following agencies sit on the committee:

- Administrative Office
- Aging
- Budget and Finance
- Circuit Court
- Community Conservation
- Corrections
- Economic Development
- Environmental Protection and Resource Management
- Fire
- Health
- Law
- Libraries
- OIT Managers
- Planning
- Permits and Development Management
- Police
- Public Schools
- Public Works
- Recreation and Parks
- Sheriff
- Social Services
- Workforce Development

The ITAC meets monthly and reviews major projects. This forum provides opportunities for sharing information about GIS Enterprise Technology and status on a monthly basis to help facilitate integration and ensure the technology is visible to County agencies and management.

***Informal Communication between Agencies***

To some degree, it appears communication between agencies follows paths already in use. Communication is strong between agencies where it is required for daily operations (i.e., between 911, Fire, and Police) or where there is a clear need for collaboration in areas of shared responsibility (i.e., between OP and DEPRM on planning and zoning activities and between DEPRM and DPW on environmental issues involving infrastructure). All agencies can communicate with OIT about resources and services available through the GIS Service lab.

***Communication – Areas of Improvement***

Despite the formal means of communication available for sharing information about GIS resources and needs, there is a need for additional communication between agencies, especially regarding resource needs, including needed data layers or applications. The lack of information has resulted in duplicated efforts in data creation or purchase, and can also result in under utilization of GIS data layers when users are unaware of their content.

**Opportunity #1: GIS Program Manager**

Currently, OIT coordinates with the various agencies to prioritize requests for GIS resources. However, they are not in a position to research the business processes of each agency. OIT also does not have the capacity to proactively expand GIS technology to agencies that have not requested support. The addition of a GIS Program Manager, with a well-defined role that includes

proactive coordination with the agencies, would bridge this gap. The GIS Program Manager would be responsible for coordinating with agencies to understand their business processes and be able to offer recommendations as to how GIS might be able to support those activities. The GIS Program Manager would also have the support of GIS programmers and technicians within the GIS unit to develop applications and datasets for the individual agencies.

**Opportunity #2: Agency GIS Champions**
The GIS user agencies do not necessarily have a designated liaison to act as a point-of-contact for personnel within the agency and outside of the agency for GIS needs. Designating a GIS Champion within each agency would formalize that role and improve communication within and between agencies. The GIS Champion would be a member of the GIS Committee and would be responsible for communication of the agency's GIS needs as well as for bringing information back to the agency about available resources.

**Opportunity #3: Improvement of Network Connectivity Speed**
A few agencies (DRP, Fire, and Police) noted that the speed of the computer network was hindering their ability to access GIS data stored on the network, resulting in their not using some of the provided tools (e.g., Data Query) and copying or creating data locally for use. The WAN used to connect the Public Safety Building to the enterprise ArcSDE database should be increased to allow for faster communication between the Fire and Police Departments and OIT. This will allow for personnel to use the data services provided by the County (instead of performing data dumps periodically), as well as more easily edit and post data that has been created within the department.

These three improvements would lead to improved communication between agencies and would result in increases in GIS utilization. In addition, requests for GIS support, in the form of new data creation and custom application development would also likely increase. As users become more aware of the power of GIS, they will ask for more data and tools.

***Public Outreach***
The County's public access programs are described in section 3. The County provides a large number of static maps to the public, as well as a number of interactive mapping applications, and makes its GIS data available by request.

Communication with the public through these means should also be improved. The MyNeighborhood on-line mapping applications should be consolidated, and they should provide more flexibility. Additional links to the on-line mapping applications from various County web pages are also needed. A listing of all available static maps and data layers should be provided. County agencies should be encouraged to identify additional areas where mapping could enhance the content they provide to the benefit of their constituencies.

### 5.3.5 Business Processes

GIS integration into the business processes of Baltimore County agencies is the key to continuing to realize additional annual benefits of the technology, and it may provide overall better operations and performance for key agencies.

***Overall Assessment of GIS and Business Processes***

In general, GIS is used effectively by most County agencies, with a few notable exceptions – PDM and Health. Within PDM and Health, GIS has been incorporated into few business processes. The system and associated applications have not been applied to a number of programs and activities within the two agencies even though the activities involve functions that could be well served through use of GIS. Where GIS has been incorporated, it is used as a tool, not as a system. The programs within PDM and Health that have included GIS in their business processes have used it only in a superficial manner. GIS has been introduced to handle ancillary issues of a small number of business processes, such as creating maps to show to customers or to answer simple geographic questions such as those involving geocoding. However, GIS has not been fully incorporated into business processes to handle more complex issues such as providing spatial components to existing databases and offering solutions to unique spatial problems.

To a lesser degree, Fire and 911, both relatively new users of the County's enterprise GIS, have not realized the full benefits GIS could provide to their business processes. Additionally, within the agencies in Cluster 4, GIS is being used only modestly if at all, due primarily to the limited concentration on spatial events. A few agencies are utilizing the capabilities of other agencies to obtain maps or to perform spatial analyses. The Board of Elections, Department of Aging, Department of Corrections, and Local Management Board have moderate to high potential to benefit from the expansion of GIS within their agency and processes.

However, across all County agencies, for the most part GIS is still used most frequently for looking up address locations, viewing data, and making maps. While these are valuable activities and GIS clearly improves the speed and accuracy with which these functions can be done, they do not take full advantage of the power of GIS to perform more complex spatial analyses.

***Key Opportunities for Business Process Improvements with GIS***

The following opportunities for business process improvements using GIS are provided for the four agencies identified above:

***Department of Permits and Development Management (PDM)***

Within PDM, only three programs (Development Plans Review, Development Management, and Real Estate Services) have introduced GIS into most of their business processes. Zoning Review has added GIS capability to a few business processes. The Building Permits Review, Code Inspection and Enforcement, and Permit and License Processing programs have no GIS usage and rely on

hardcopy drawings and conduct site visits instead of using GIS. Appendix B provides additional details about the opportunities for increased use of GIS within PDM's business processes.

The programs within PDM that do use GIS use it primarily to look up addresses and identify existing conditions within a property or development (e.g., zoning, utilities, slope, etc.), identify surrounding properties, plot maps, and help assign addresses. There is ample opportunity for PDM to link existing databases (e.g., the permits database and project database) to GIS data layers for spatial representation. Additionally, development of a digital plan review process would benefit multiple agencies within the County, not just PDM.

In addition to the improved utilization of GIS within PDM, there is a distinct opportunity to implement a Land Management application. A Land Management application will provide GIS integration, along with process automation for the entire code enforcement, permitting, zoning, and development management set of business processes. Additionally, there are several data layers that PDM should develop and maintain that would benefit the Land Management process, including County-Owned Property, ROWs, and Easements. Appendix B provides additional details about the opportunities for increased use of GIS within the Department of Permits and Development Management (PDM)

***Health Department***

Within the Department of Health, only Administrative Support Services and the Bureau of Substance Abuse have introduced GIS into their business processes. Additional bureaus within the agency could gain future benefits from the use of GIS. The Bureau of Disease Control could benefit from increased use of GIS to study epidemiological phenomena and to spatially analyze animal control issues. The bureaus that provide public health services could benefit from the use of GIS to spatially manage casework, determine where patients are and what services or treatment centers are nearby, and identify areas in need of increased services, to name a few opportunities. Appendix J provides additional details about the opportunities for increased use of GIS within the Department of Health's business processes.

Within the Department of Health, GIS is primarily used for geocoding events (e.g., births, deaths, locations of diseased animals or persons, and locations of persons seeking treatment) and for preparing maps and charts for reports and publication. Systematically increasing the use of GIS and building it into daily practice for epidemiological analyses and performing routing to optimize travel for caseworkers and patients are areas where GIS could be better utilized within Health. As these analyses increase, additional opportunities for data collection and maintenance will undoubtedly be identified.

***Fire Department***
Fire is relatively new to using GIS, and the department has a moderate level of opportunity to employ GIS technology into their business processes to improve operations. Additional resources may be required before the Fire department can expand GIS utilization throughout the organization. Fire has relatively few users within the agency compared to the total number of personnel, especially when considering the field operations. The department is still relying heavily on paper map products in each of the emergency vehicles. The GIS users within the Fire Department appear to be relatively efficient in their current use of GIS, but spend a lot of their time producing and updating the paper map products. The agency should develop a GIS improvement plan that identifies key business processes and how GIS can enhance current operations. During implementation of the plan, the agency should document progress towards GIS utilization goals to justify the needs for additional resources (including staffing, hardware, mobile technology, and data) that would allow further increased use of GIS.

***911 Center***
The 911 Center has specialized needs related to their business processes and operations, which will require additional investments to expand GIS utilization within the agency. The Center will benefit from generating their business geofile, along with enhanced AVL (automatic vehicle location) supported by GIS. GIS is used by all of the 911 center operators in the form of the microDATA GIS software.

***Summary of GIS and Business Processes by Agency***
A summary of business processes and key activities that currently utilize GIS technology are provided for each agency:

| Agency | Business Processes |
|---|---|
| 911 | GIS is used within 911 to:<br>• Create hardcopy maps used for training 911 call center operators;<br>• Locate cell hone callers using e911 microDATA GIS software;<br>• Perform geocoding activities using Address Points, Street Centerlines, and adjacent County data;<br>• Communicate with callers about proximity and surroundings based on the map;<br>• Automatically update the Master Street Address Guide (MSAG), 911 Geofile, and Intersection File used by CAD; and<br>• Help update and maintain an all-inclusive Hazards file that can be accessed by Police and Fire Dispatchers as well as 911 call takers. |
| Aging | GIS is used to make maps and perform geocoding. In addition, 15,000 senior center client addresses are geocoded every 3-4 years. |
| Auditor | GIS is used to determine what councilmanic district an address is in. |

| Agency | Business Processes |
|---|---|
| Budget & Finance | GIS is used to create maps to show the locations of properties and the inherent landscape characteristics and relationships with other properties. |
| Corrections | GIS is not used within the agency. |
| DED | GIS is used within DED to:<br>• Perform spatial analyses;<br>• Create project-specific maps;<br>• Supplement reports;<br>• Create web pages that provide information to the public;<br>• Prepare marketing materials;<br>• Prepare targeted mailing lists;<br>• Perform database maintenance; and<br>• Support policy development and capital program recommendations. |
| DEPRM | GIS is used within DEPRM to:<br>• Perform spatial analyses;<br>• Create project-specific maps;<br>• Supplement reports;<br>• Prepare outreach and educational materials, both hardcopy and web-based;<br>• Provide information to citizens and other County agencies;<br>• Provide public access data;<br>• Access web-based applications to support programs and activities;<br>• Develop GIS-based decision support tools and set policy using said tools for protection of environmental resources;<br>• Perform database maintenance;<br>• Integrate with GPS data;<br>• Facilitate field visits and site inspection;<br>• Track program progress; and<br>• Support management and inspection of publicly owned stormwater management facilities within the County. |

| Agency | Business Processes |
|---|---|
| DPW | GIS is used within DPW to:<br>• Call up GIS data on-screen to respond to a customer complaint;<br>• Determine ownership of a property;<br>• Locate an address and perform analysis of its proximity to, or eligibility for, a County service (e.g., water and sewer service, alley reconstruction, sidewalk addition, in/out floodplain determinations, etc.), and its appropriate assessment for billing purposes;<br>• Prepare maps for use by field crews;<br>• Prepare maps for use in a public forum;<br>• Prepare maps for the County Council (e.g., Basic Services and Master Plan maps);<br>• Prepare maps required by County Code or COMAR;<br>• Prepare maps for use in the EOC;<br>• Provide public access data;<br>• Export data to a CADD format to serve as the base map for engineering design;<br>• Perform database maintenance activities supporting the entire agency and/or County;<br>• Perform spatial analyses needed to fulfill all Consent Decree requirements<br>• Manage trash collection routes and recycling functions; and<br>• Perform spatial analyses in support of the bridge inspection program. |
| DRP | GIS is used within DRP to:<br>• Export data to a CADD format to serve as the base map for parkland engineering and design projects;<br>• Prepare maps needed for permits and/or approval processes;<br>• Prepare site maps for planning new park services;<br>• Manage park maintenance activities including mowing;<br>• Perform spatial analyses needed for site selection and acquisition;<br>• Research complaints;<br>• Communicate with field crews;<br>• Perform parkland needs analyses;<br>• Prepare maps for fliers, brochures, and public presentations;<br>• Supplement reports; and<br>• Prepare outreach and educational materials, both hardcopy and web-based. |
| Elections | ArcGIS is used by OIT to provide Elections maps required by the State of Maryland. MyNeighborhood is used to verify addresses and minimize site visits required to investigate proximity of voter residence to precinct boundaries. |
| Executive Office | GIS is not used within the agency. |

| Agency | Business Processes |
|---|---|
| Fire | GIS is used with the Fire Department to:<br>• Provide on-site GIS support at the EOC;<br>• Create pre-made maps for use in the EOC;<br>• Maintain and produce data that facilitate large-scale emergency management;<br>• Collect data;<br>• Create map books for use in all emergency apparatus;<br>• Support grant applications;<br>• Perform analyses of and generate reports on incidents;<br>• Perform analyses to support deploying people and apparatus to emergencies; and<br>• Support policy development and capital program recommendations. |
| Health | GIS is used with the Department of Health to:<br>• Geocode births and perform analysis on impacts of births to school districts;<br>• Geocode deaths and perform analysis on cancer clusters.<br>• Perform disaster planning and response activities;<br>• Map health care facilities;<br>• Analyze outbreaks of diseases including tracking data (e.g., standing pools of water, dead birds, etc.) and modeling mosquito spray swaths;<br>• Make maps to support various bureaus within the department, as requested;<br>• Make maps to support Grant Applications and Annual Reports; and<br>• Track and trend substance abuse patient data. |
| Human Resources | GIS is not used within the agency. |
| Law | Maps produced by OIT are occasionally used as evidence for property/boundary disputes or to aid in location reference. The MyNeighborhood web mapping application is used to research legal transactions that are in negotiations and for preparation of legal documents. |
| Liquor Board | GIS is not used within the agency. |
| Local Management Board | GIS is not used within the agency. |

| Agency | Business Processes |
|---|---|
| OCC | GIS is used within OCC to:<br>• Perform spatial analyses;<br>• Create project-specific maps;<br>• Supplement reports;<br>• Prepare targeted mailing lists;<br>• Create web pages that provide information to the public;<br>• Prepare outreach materials and public presentation;<br>• Support policy development, capital program recommendations, and grant application packages; and<br>• Review options, prepare data to support decision-making, present options, etc., on-site during the UDAT Charrette. |
| OIT | GIS is used within OIT to:<br>• Develop custom applications for use by Baltimore County agencies to simplify processes, improve workflow, enhance QC procedures, and streamline operations;<br>• Create MyNeighborhood web mapping applications used by the public through the County's website;<br>• Create ArcIMS web mapping applications used by Baltimore County agencies through the Internet/Intranet;<br>• Maintain enterprise GIS data layers;<br>• Enforce topology among data layers that require it;<br>• Provide support to the EOC through on-site, real-time mapping and geocoding;<br>• Develop plume modeling;<br>• Develop HURREVAC modeling;<br>• Develop storm surge modeling;<br>• Create disaster recovery scenarios;<br>• Back-up the County's main GIS data layers;<br>• Provide public access data; and<br>• Develop ancillary data layers from the County's LiDAR datasets. |

| Agency | Business Processes |
|---|---|
| OP | GIS is used within OP to:<br>• Perform spatial analyses needed to assure that County Council districts are re-apportioned appropriately when new Census data are released;<br>• Prepare targeted mailing lists;<br>• Create project-specific maps;<br>• Supplement reports, manuals, and handbooks;<br>• Create web pages that provide information to the public;<br>• Create public presentations;<br>• Review options, prepare data to support decision-making, present options, etc., on-site during UDAT Charrettes;<br>• Provide information to citizens and other County agencies; and<br>• Perform database maintenance. |
| PDM | GIS is used within PDM to:<br>• Create project-specific maps;<br>• Call up GIS data on-screen;<br>• Determine ownership of a property;<br>• Find streets and assign new street numbers;<br>• Locate an address and perform analyses of its councilmanic district, proximity to flood plains, slope, and existing utilities;<br>• Locate a proposed development and assess its existing conditions compared to the proposed development plan; and<br>• Perform database maintenance. |
| People's Counsel | Maps are viewed and printed from the MyNeighborhood web application, which are used to show the zoning of a location. OIT also uses GIS to create maps showing the zoning of a location and its supporting basemap reference information. |

| Agency | Business Processes |
|---|---|
| Police | GIS is used within the Police Department to:<br>• Map the locations of various types of accidents and associated data, in order to analyze patterns and series of these phenomena;<br>• Define communities targeted for CSAFE funding by State government;<br>• Support the map and data needs of the Command and Control center when critical events occur;<br>• Support the map and data needs of the Homeland Security department;<br>• Analyze the current capabilities of enforcement and determine where resources may need to be allocated;<br>• Understand the spatial distribution of crimes throughout the communities of the County, in order to help distribute resources effectively; and<br>• Analyze the geographic nature of traffic stops, in order to help ensure that these stops are being conducted justly. |
| Sheriff's Office | GIS is not used within the agency. |
| Social Services | GIS is not used within the agency. |
| State's Attorney | Maps are used in court cases as supporting evidence or to illustrate a geographic issue. Some ways these maps are used include:<br>• Showing distance between items or locations,<br>• Support testimony given by an officer or witness,<br>• Explanation of the crime, and<br>• Understanding the crime scenario in spatial terms. |
| Workforce Development | GIS is not used within the agency. |

**Table 49 – Summary of Business Processes by Agency**

## 5.4 Overall Summary of GIS Utilization

The following summary of GIS utilization within the Baltimore County GIS provides a synopsis of current utilization of GIS technology, GIS databases, and GIS applications across the enterprise.

| Category | Overall Utilization Classification |
|---|---|
| **Data Utilization** | Baltimore County agencies are maximizing the utilization of GIS database that are currently being supported and maintained, at a rate of 98% utilization. In general, the enterprise database layers were rated as the most utilized layers followed by key thematic and geocoding layers.<br><br>A few key areas of improvement and opportunities were identified that will continue to ensure a high utilization rate, along with improving the utilization of some specific layers that are perceived as currently under utilized. |
| **Application Utilization** | Baltimore County agencies are maximizing the utilization of the primary ESRI software suite, along with the Data Query desktop application provided by the GIS enterprise for the GIS end users. In addition, some agencies have customized GIS applications, GIS integrated applications, and a few activity-specific applications that are adequately facilitating the utilization of GIS.<br><br>A few key areas of opportunities were identified that will continue to ensure an increasing utilization rate for the general types of GIS applications. |
| **GIS Utilization** | Most Baltimore County agencies are effectively utilizing GIS technology with a few notable exceptions – PDM and Health. Also, Fire and 911 both offer opportunities to integrate the GIS technology further into their business processes. A few agencies were identified as having limited GIS integration potential and may not be using the tools.<br><br>In general, GIS is used most frequently for looking up address locations, viewing data, and making maps. While these are valuable activities and GIS clearly improves these processes, the agencies do not take full advantage of the power of GIS to perform more complex spatial analyses.<br><br>A few key areas of opportunities were identified that will continue to ensure GIS utilization and integration improves, including improving communications, focusing on the inefficiencies, and developing GIS improvement plans to maximize overall utilization and streamline the agency operations. |

**Table 50 – Summary of GIS Utilization**