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LOCATING AND MAPPING
CEMETERIES IN LOUDON
COUNTY, VIRGINIA

Scott Marshall Sizer

A thesis project submitted to the Eberly
College of Arts and Sciences at West
Virginia University in partial fulfillment of
the requirements for the degree of

Master of Arts
in
Geography

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Morgantown, West Virginia
1999

Keywords: Historical Preservation, GIS, County Government

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ABSTRACT

Locating and Mapping Cemeteries in Loudoun County, Virginia

Scott Marshall Sizer

Protecting smaller family-type cemeteries is a difficult task in a rapidly growing area. This paper investigates the ways in which Loudoun County, Virginia addressed cemetery protection concerns. Cemetery locational data was captured from a variety of sources and integrated into the county's geographic information system (GIS). The locational information was gathered through digitization and with a Global Positioning System (GPS). Once the cemetery locational information was in the GIS, it was then integrated into an existing land development process.

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LIST OF ABBREVIATIONS

GIS.	Geographic information systems
GPS	Global positioning satellites.
LHSCC	Loudoun County Historical Survey Cemetery Committee database
PDOP	Position Dilution of Precision. (A measure of GPS accuracy).
OMAGI	Loudoun County Office of Mapping and Geographic Information
USGS	United States Geological Survey quarter quad cemetery data
URISA	Urban and Regional Information Systems Association
WellPoll	Loudoun County's Wells & Pollution Sources GIS layer
WPA	Works Progress Administration of Virginia Historical Inventory

We request the Division of Historic Landmarks to study "the problem of small community, family-type cemeteries, which may have been neglected or abandoned and thus lost to future generations, and to determine the need for and appropriateness of state action in this area, including the establishment of maintenance responsibility, as well as locating and mapping the existence of such cemeteries under guidelines to be developed and, if necessary, funded by the Commonwealth." (Virginia State Senate Joint Resolution 177, 1989)

In 1989 Virginia's state historic preservation program was elevated to departmental status becoming the Department of Historic Resources. One of the first requests made of the new department was to examine state policy toward small, family-type cemeteries and suggest ways in which to protect these sites and improve their quality. The 1989 Virginia State Senate formalized this request with the passage of *Senate Resolution 177*. What has followed this request has been a somewhat stop-and-go approach to cemetery protection at the state level, with varying amounts of support to local level mapping efforts. This report covers the way in which one Virginia county, Loudoun, has approached the difficulties in locating and protecting cemeteries.

Cemetery Importance and Protection

"Tremendous demands face old burying grounds. In providing sanctuary for the dead they serve a sacred function. Their commemorative role is artistic; old cemeteries are sculpture gardens needing care befitting outdoor museums. Historically, burying grounds are large archives requiring careful conservation worthy of the rare and wondrous collections of our individual and collective pasts. Finally, cemeteries are scenic landscapes to be enjoyed and cared for as urban open space or rural parklands." (Boston Parks & Recreation 1989)

Cemeteries hold a special place in cultures (Boston Parks & Recreation 1989, Commonwealth of Virginia 1989). They contain concrete reminders of those who have lived and shaped the landscapes which we inhabit. The headstones cemeteries contain expose artistic styles and techniques of prior generations. The inscriptions hold a great deal of historic information, allowing us to observe the health of an area, the impact of war in an area, how wealthy a region was, and to trace genealogical roots to historic family properties, among many other uses. Cemeteries and the information they hold are some of the oldest demographic information recorded. These are a few of the reasons that make cemeteries important to cultural heritage.

Cemetery sites also have an expectance of permanence, in addition to their roles as cultural and archeological sites. Communities and families are not expected to

take their buried ancestors with them when they move away. Communities also do not plan to relocate cemetery sites which much frequency (Schwab 1995). Cemeteries are one land use that tends to remain fixed in the landscape, which is what gives them some of their attractive qualities as urban parks or scenic landscapes. Other land uses are built around cemeteries, and hopefully, try to blend with the cemetery landscape.

These landscapes are threatened in a real way from a variety of sources. The most susceptible cemeteries are the smaller, family-type cemeteries. These smaller, family-type cemeteries were usually established for a family unit on family owned property. Family cemeteries are more prevalent in rural agricultural areas where family holdings were large. In Northern Virginia, family cemeteries were more common prior to the 1890's when people began to be concerned about the long term maintenance of the smaller, family-type cemeteries (Fitts 1995). After the 1890's church cemeteries and community burial plots grew in popularity. The institutional nature behind these types of cemeteries gave a greater stability to the long term care of plots.

Smaller cemeteries are threatened from a variety of sources, among them neglect, poor maintenance, vandalism, and encroaching development pressures. These threats can all result in the loss of important historical and culturally significant information. To prevent the destruction of these sites, the Virginia State Code of Law has multiple articles pertaining to cemeteries and their protection.

The Virginia Code of Law allows for four separate criminal offenses in regards to cemetery destruction, as well as a variety of monetary fines and repair responsibilities for harming or moving cemeteries. The most severe criminal offense is a Class 4 felony, which applies to unlawful disinterment of a human body, or any part, which has been deposited in any burial place. This felony applies to developers who would bulldoze a cemetery or gravesite (Foote 1989).

The other three criminal offenses are Class 1 misdemeanors. These result from any of the following: destruction of objects within a cemetery or burial plot – including trees, shrubs, plants, or any ornaments placed on a lot in a cemetery; obstructing proper ingress or egress rights to any cemetery; and the destruction of any state archaeological sites, a status for which most cemeteries qualify. These criminal charges, along with their associated monetary fines, give localities the ability to aggressively protect cemetery locations. Unfortunately, it seems that these laws have been insufficiently enforced in Virginia. According to a state survey on cemetery protection there has been rampant destruction of cemeteries, primarily as a result of land development (Commonwealth of Virginia 1990).

Senate Document #31: The Problems of Small Community, Family-Type Cemeteries concluded that there were a variety of tasks that needed to be done in order to properly protect these smaller, family-type cemeteries. The first two recommendations were to, “create an official county register of cemeteries which could become an integral part of zoning and building permit procedures,” and to “properly locate and map known locations of cemeteries” (p 11). The need to include cemetery locations into the land development process is cited as key in their protection. This places the protection of cemeteries directly in the hands of planners through the land development process.

The Land Development Process

Land development for many areas of the country, particularly those which utilize zoning regulations, is a multi-layered, costly, and time-consuming activity. In Loudoun County there are two different county departments that deal solely with the development process, and many others that deal with development issues directly or indirectly. Land development is not an inexpensive task or one begun lightly.

There are many issues that planners take into account when reviewing land development applications; How does the project fit within the overall view of the area in the future? How will this plan impact public services, particularly health and educational services? What impact will it have on further growth? These are all questions that a planner must address on every project, with the amount of leeway a planner has on decision making limited by local legislation (Levy 1994). For purposes of this project, only the site evaluation process portion of land development review is immediately relevant.

One of the first tasks a planner must do when reviewing a land development application is to examine the site to be developed. The more drastic the possible change in land use the more thorough the land review process must be (Marsh 1991). Many times prior to the land development application process, the developer will review the property to determine what possibilities exist for land development and what restrictions exist on the land. Both parties, planners and developers, review information such as floodplain, soil structure, elevation and slope data, prior use, existing structure information, and zoning, among others before determining what courses of action may be taken on a piece of property. The results of these studies will determine what activities can occur on the land.

Determining if an area targeted for land use change contains gravesites or a cemetery is an important part of the land review process. Lawyers for developers have suggested that the “search of [cemeteries] must be undertaken early,” and

that “[developers] can never ignore the existence of a gravesite on [their] property” (Foote 1989). These concerns result from the legal and financial obligations that surround cemetery development. In order to understand the way in which planners undertake site evaluations, one needs to understand the tools that planners use in performing site evaluations. One of the most important tools that planners have begun to use recently is the geographic information system (GIS).

GIS and Planing

Geographic information systems were first developed in the late 1960’s and early 1970’s as a way to collect, store, display, and analyze spatial information via computers. Fundamentally GIS is based upon traditional techniques of overlaying layers of data upon one another. With all of the data layers registered to one another, it allows for equal comparison of different data types.

Much of the current planning methodology in site planning and review has been based upon the McHargian method (McHarg 1969). In this methodology, the planner gathers a variety of information such as soils, slope, ecological and historical resources, water resources, and others, to combine these “layers” over one another in a single location. In the site evaluation process, this information would be overlaid on the parcel(s) of land under review (Dueker and DeLacy 1990). Therefore, early on it appeared that GIS could become an important tool for planners to use in the site evaluation process.

Geographic information systems began to be introduced into planning departments in the latter half of the 1980’s. The commercial availability of GIS software and the decreasing cost of computer hardware needed to process and store data reached a point by the end of the 1980’s where it was feasible for planning departments to adopt GIS and begin to experiment with its use as a planning tool. In 1990 a former president of the Urban and Regional Information Systems Association (URISA) declared that GIS was a powerful tool in the land development process for developers and planners alike (Dueker and DeLacy 1990).

The American Planning Association, the premier professional planning organization in the United States, addressed the increased need for planners to understand GIS technology and its many uses via the 1991 *Planning Advisory Service (PAS)* publication (Wiggins and French). The *PAS* document was designed to explain GIS as a tool for planners and aid planning departments in needs assessments and GIS design for implementation. Wiggins and French reported six distinct benefits that GIS had for planning departments including; improving

public information, greater efficiency in updating maps, and the ability to monitor land development growth.

The discussion about the usefulness of GIS to planners seemed to be over by 1994 when it was reported that, “[GIS] acquisition by local governments, particularly planning departments, is wide spread” (Budic 1994). The need for GIS in county governments had become such an important issue that many states, including Virginia, created state-wide GIS coordinators who’s tasks include aiding counties in the adoption and implementation of GIS systems at the county level. Loudoun County, Virginia was one such county that adopted a geographic information system during the early years of GIS proliferation.

Loudoun County and GIS

Loudoun County is located in Northern Virginia, about 35 miles west of Washington, D.C. (see Figure 1). The population was 143,940 in 1998 and growing at an average rate of 8%. The county land area is approximately 520 square miles. The close proximity to Washington, D.C., Dulles International Airport, and a major corporate presence, including America Online, United Airlines, and MCI/Worldcom has produced enormous growth in the county over the past 20 years. It is this development pressure that endangers cemetery protection the most in Loudoun.

Prior to the development of the current mapping system, Loudoun County had 11 agencies that used some type of map in their activities. These agencies used over 25 different maps with scales ranging from 1”=200’ to 1”=2000’ derived from at least eight different non-corrected photo bases to document land-based activities (Weber 1990). The wide range of scales and accuracy made it extremely difficult for county staff to communicate and exchange spatial information.

In 1978 the Loudoun County Board of Supervisors saw the need for a uniform base map, and authorized the production of a county base map at a scale of 1”=200’ or 1:2400. This mapping project became the foundation for all other land information that would later be developed.

In 1986 the county adopted a GIS system, using ESRI’s ARC/INFO software package. The GIS system became functional in 1987, and development of major databases, and conversion of older databases began. Mapping responsibility has moved from a variety of departments since its inception and is currently housed in the Office of Mapping and Geographic Information (OMAGI).

Figure 1. Loudoun County Locational Map

Every year since 1988 the GIS has adopted new mapping responsibilities and data layers. It originally emphasized the capture of planimetric information produced via the base mapping program. The next priority for the system was the capture of cadastral information, including creating an entirely new approach by which to map parcel data. Duties increased again to include the regulation of street naming and addressing, which coincided with the countywide adoption of city style addressing. Use of the system and data layers have increased every year.

In 1993 the county's Inspector General found 19 different county government uses of the GIS, with the primary users being: Building and Development, Economic Development, Environmental Resources, Financial Services, and Planning. Since the IG's report, the value of GIS has only grown, in no small part due to the enormous growth of the county during the past 20 years.

Currently the Loudoun GIS houses 41 different layers of data. These layers range from cadastral data and address points, to ZIP code boundaries and floodplain areas. A great number of these data layers are available to the public via the LOGIS interface.

LOGIS is an elaborate program, based upon ARC/INFO's ArcPlot module, that allows for easy viewing of GIS data. The LOGIS system lets users search GIS data, view a variety of layers, and perform simple analytical functions. The LOGIS interface allows for the GIS data to be presented in an easy, understandable way with no knowledge of GIS programming.

The OMAGI staff train county staff and the public in the use of LOGIS. The training program explains the type of information available through the LOGIS

system and discusses possible uses for the data and LOGIS incorporation into work routines. The LOGIS interface and training program has greatly accelerated the use of GIS information by other county departments.

The same informational benefits available to county staff are also available to the public. The OMAGI office contains two terminals dedicated to public access, and three full time employees who's job is to handle public inquires. Many of the frequent users of the public terminals are people interested in buying and developing land. They range from the individual who is interested in buying a ¼ acre lot in a residential community, to an engineering firm working for a 400+ acre development project. Utilizing the LOGIS system and OMAGI staff, both of these users can perform an initial site evaluation. They are then able to see what types of features may effect development costs, or restrict them altogether. This way, the developer begins the process knowing what obstacles there may be to development, possibly speeding up the development process and saving money.

As previously mentioned, one of the primary users of the LOGIS system is the Department of Planning. This is particularly true during the site evaluation process. Planners use LOGIS to review a developer's concept or rezoning applications to double check the accuracy of the submitted documents. This portion of the plan review is designed to highlight potential problems and to make sure that the plan fits within the larger development plan for the county.

Later in the development process LOGIS is used again by planners in the Department of Building and Development for site plan plat review. This is used to evaluate potential impacts during the design and construction process. It also double checks the legality of design changes prior to construction.

By using the LOGIS system the Department of Planning and the Department of Building and Development can find a parcel which is under review for development, and then overlay any applicable data that the county may have on the property. Maps can quickly be created for reports, and the development process can proceed at a quicker pace.

Cemetery locations have been incorporated into the site evaluation process in LOGIS via the *Pollution and Wells* database. Virginia State law demands that a private well be located no closer than 50 or 100 feet away from a cemetery, with the distance dependant upon the class (size and volume) of the well. There had never been a concerted effort to capture all of the cemetery locations in Loudoun. County health specialists gathered a majority of the existing cemetery information in routine well site evaluations.

Due to severe development pressures and complaints of cemetery destruction, Loudoun conducted a comprehensive survey of cemetery locations. The task of the cemetery survey was threefold: locate and accurately map all of the known cemetery locations in Loudoun County, incorporate the cemetery information into the site review process, and present the information in such a way that the public could have access to it. The rest of this paper deals with the approaches taken by Loudoun to fulfill these tasks.

Cemetery Survey

Early in the cemetery survey design it was decided that the cemetery locations and data would be housed within the GIS system. Incorporating the cemetery locational information into the GIS would allow for it to be accessed through the LOGIS system. Since LOGIS is used in the site evaluation process and available to the public, its incorporation into the GIS would fulfill two of the cemetery survey goals. Integration into the GIS would place newly gathered cemetery information within the current site evaluation process and allow for public access.

Once the decision was made that the GIS would be the final destination of the cemetery information, the first tasks became to determine where cemeteries existed around the county, and to determine how to incorporate their locations accurately in the GIS. There have been many different approaches to gathering and integrating locational data into GIS's. Those explored and utilized in this project were digitization and global positioning satellites.

Data Foundations

Digitization is a technique used to translate analogue features, points, lines, or polygons, into digital features that are geographically registered (Johnston 1994). It is the primary way by which older geographical information, primarily kept on paper maps, is converted into usable GIS digital formats. While this process is labor intensive and requires base map preparation prior to digitization, it is usually the only way that previously collected data can be converted to digital GIS use.

While digitization is a technique used to integrate previously collected data, global positioning satellites can be used to capture new locational data. Global Positioning System (GPS) satellites are satellites that transmit signals to a GPS receiver on the ground. Through triangulation, very precise locational data can be collected. Moreover, this information is recorded digitally and can be downloaded directly into a GIS system. This approach can be much more accurate than digitization, but requires the GPS user to visit each location for which locational data is to be collected.

These two approaches, digitization and GPS, were the only ways that cemeteries were added into the Loudoun County GIS system. The methodologies for both approaches are covered later.

The role of LOGIS in the site evaluation process only goes so far. The cemetery information is used as a warning flag to tell planners and developers that there is a cemetery on a piece of property and where the cemetery is located. With this knowledge, the cemetery would then be surveyed and included on any legal description of the property, including the plat. Since the final use of the data would serve as a flag, it was decided that the cemetery locational information would be collected as point data, the center of the cemetery would be mapped. Precise mapping of the cemetery boundaries was unnecessary since the private sector would, if necessary, map it during land development.

Locational data would have to be integrated into the existing GIS. GPS and digitization would be the techniques used to input locational data into the GIS. Locational data would be collected as point features. These decisions created the foundation for the specific methodologies that would follow. This foundation was needed in order to integrate the four different data sources used to gather known cemetery location information.

Cemetery Data Sources

Four different data sources were used to collect cemetery locational data; Wells and Pollution Sources GIS layer (WellPoll), United States Geological Survey (USGS) topographical maps, Works Progress Administration cultural resources survey (WPA), and a database collected by the Loudoun County Historical Society's Cemetery Committee (LHSCC). These four databases were the primary source data from which cemetery locations were determined and entered into the GIS.

The locational information in each of these four databases was collected using different geographical approaches, utilizing different standards of accuracy and methodology. The most accurate database was the USGS while the most complete database was the LHSCC.

WellPoll

The WellPoll database was the Wells & Pollution Sources layer of the Loudoun County Geographic Information System. The layer is a collection of public and

private well sources as well as point pollution sources. It is a point feature database which contains all of the existing GIS data on cemetery locations. Eventually it was updated with all of the new cemetery locations discovered by the cemetery survey.

This layer had been previously produced through the digitization of older Loudoun County Department of Health maps. These maps kept track of any wells or pollution sources within the county. The pollution information was maintained by the Department of Health because of the impact that pollution has on ground water. Cemeteries were traditionally kept in this layer because of the pollution impact that they may have on ground water. Because of this potential for pollution, there are minimum distance requirements that wells must maintain from cemeteries.

County environmental specialists who encountered cemeteries in their well site review process created the original WellPoll maps. The county sends environmental specialists out in the field to review potential well and drainfield site locations. When environmental specialists would come across cemeteries in the field, they would record the location on a site map and then transfer the location to base maps kept in their office. These maps were then digitized in 1987 as part of the GIS conversion process, and these digitized point became the WellPoll database.

The accuracy of this database is lax due to the multiple times the location data was recorded. The data were marked on site maps in the field, usually using landmarks such as treebreaks, topography, and relative location to hydrographic features. These points were then transferred from the site maps, which could be from many different scales, onto the 1:2400 scale base maps kept in their office. These points were then digitized off of these paper maps into the GIS coverage. At every point of data collection and data transfer, error may be introduced. In this database the data has been transferred at least three times, and the material used to store the data historically, paper, can stretch and warp changing the locational accuracy over time.

In the WellPoll database every cemetery had been assigned a twelve digit unique identifier. This unique identifier ties the locational point to the attribute information that is carried in a separate table. This same format was adopted for all the other databases so that they could be integrated back into the WellPoll layer. Prior to the cemetery survey, the WellPoll layer contained 65 cemetery locations (see Figure 2).

Figure 2. Previously Mapped Cemetery Locations

USGS

The USGS database was gathered from cemetery data collected from the United States Geological Survey quarter quad topographic maps. These maps were produced from aerial photographs taken in the late 1970's and updated in the early 1980's. The aerial photographs were then interpreted and converted into 1:24,000 scale paper maps. This scale is ten times smaller than the county's base map scale

The time frame for these photos is not an issue given the early date of establishment for many of the family cemeteries in Loudoun. In addition, a review of permit records showed that no new cemetery businesses were established after the 1964.

Using the Geological Survey's Geographic Names Information System, a complete list of named cemeteries that were mapped on each of the quad sheets covering the county was obtained. Utilizing this complete list, and through quad map inspection, 80 cemeteries were identified as mapped on the quad maps.

Since the Geological Survey's maps have a high degree of accuracy, all 80 cemeteries were added to the database. Forty of these sites were already in the WellPoll database, the duplicate data would later be removed from the WellPoll layer and updated with the USGS points. This was done in order to upgrade the spatial accuracy and standardize data collection wherever possible.

The centers of the cemetery polygons were digitized in order to stay consistent with collection methodology. The points were digitized into a coverage which was created using the corners of each quad map to register the data. The results of the digitization can be seen in Figure 3

WPA

The Virginia Conservation Commission through the Division of History sponsored the Works Progress Administration of Virginia Historical Inventory Project (WPA). This project was a cultural resource inventory project undertaken in Virginia from 1934-39. The inventory documented historically or culturally significant resources including landscape features, buildings, and cemeteries. The inventory included information on a feature's name, owner, and historical significance.

For cemetery locations, the WPA recorded detailed directions to the site (although the directions made reference to landmarks and roads existing in the 1930's which complicated the process of finding them), transcriptions of tombstones, and any local history pertaining to the status of those buried within.

The WPA survey is an important historical resource as it gives us a picture of the county at the end of the 1930's when the county was completely agrarian. This database served as a source of primary information in locating cemeteries. Five new cemetery locations were uncovered from this data source and added to the database using GPS.

Figure 3. Cemeteries Mapped through USGS Digitization.

LHSCC

The Loudoun County Historical Society's Cemetery Committee database consisted of 150+ cemetery locations. These included many of the smaller family-type cemeteries which are non-identifiable by aerial photography. This database was collected through the vigorous work of the LHSCC members. Data were collected through first hand knowledge of LHSCC members, advertising requests for cemetery locations-via newspaper articles and the posting of flyers, and historical and genealogical research. This database was the most complete collection of cemetery data for Loudoun County.

The LHSCC database was originally created for genealogical purposes. A LHSCC member had visited many of the cemeteries in order to record important information about the cemetery, including the number of graves, names of the buried, and to photograph and transcribe legible headstones.

While the attribute data for each cemetery were complete, the locational data were not accurate. They had marked cemetery locations and names on a locally produced street atlas when the volunteers returned from their survey trips. With many of the cemetery locations on large rural parcels of land, the accuracy of the locations was generalized at best.

After the USGS data were digitized, they along with the WellPoll data were mapped. Ninety-eight of the 106 mapped cemetery locations matched the LHSCC database. Once this was done, there were 60 cemetery locations for which there were no digital locational data, five from the WPA and fifty-five from the LHSCC database.

These final 60 cemetery locations were mapped using GPS. All sixty remaining cemeteries were visited in the field. In many cases we had to ask neighbors as to the cemetery's whereabouts, or wander around abandoned fields reading the landscape for likely cemetery locations. Many times one of the LHSCC volunteers, Wynne Saffer, went out in the field to navigate us to cemetery locations that he had previously visited. Without the help of Mr. Saffer there would have been no way that this project would have been as complete.

The cemetery locations were then downloaded from the GPS receiver and went through rigorous post-processing to get the geographical accuracy to within two meters. These locations were then converted into an ArcInfo coverage and added into the GIS WellPoll layer (See Figure 4). For a detailed account of the GPS process see Appendix A.

Final Results

When all of the data were collected and integrated, the county had a total of 166 cemetery locations within the WellPoll database. 106 new cemetery locations had been "discovered", mapped, and added into the GIS system (See Figure 5).

These cemetery locations are now accessible through the LOGIS system and integrated into the site evaluation process. Developers and planners have increased access to site knowledge and are less likely to face development delays. In fact, the presence of one newly mapped cemetery greatly impacted the development path of a major site since the area where they had planned on clustering the development's drainfield sites contains a cemetery.

Figure 4. Cemetery Locations added through GPS.

In addition to greatly increasing the number of cemeteries in the GIS, this project has increased awareness of the importance of cemetery protection among county staff, and there has been a greater increase in the number of cemeteries being reported through field visits. This is primarily due to the fact that their location has been standardized and OMAGI has now become a collection site for cemetery knowledge and locational inquiries.

The Thomas Balsch Library, which is the county's historical and genealogical library and which houses the LHSCC data, has worked in conjunction with OMAGI to allow for an integration of the GIS and LHSCC databases. A portion of the LHSCC attribute data is kept on the GIS. While the complete list of cemetery information, including pictures and names of everyone buried in each location is kept at the Thomas Balch Library.

Figure 5. Countywide Map of Cemetery Locations

OMAGI has produced a 1":50,000' scale countywide map to display the location of cemeteries around the county for the library. This map should help genealogical researchers at the library. In addition, a viewer of selected GIS data is available on CD to browse at the library using ESRI's browser ArcExplorer. This allows users to create some smaller custom maps of the areas around particular cemeteries, if the countywide map is too generalized (see Appendix 3). It is hoped that in the future some of this cemetery data could be served through the WWW in order to advertise and aid genealogical research in the county.

As a result of the cemetery survey, the quality of cemetery locational data improved. There is now a way for the county to take a stronger position toward cemetery protection. With developers knowing the presence of cemetery locations on their property prior to development, the hope is that their presence can be dealt with in the design phase of development and not dealt with during the construction phase when the cost of work stoppage is greater and the

presence of heavy machinery makes it easier to destroy these historically and culturally significant sites.

Bibliography

- Boston Parks & Recreation Department. 1989. *The Boston Experience: A Manual for Historic Burying Grounds Preservation*.
- Budic, Zorica. 1994. Effectiveness of Geographic Information Systems in Local Planning. *Journal of American Planning* 60(2):244-263.
- Cohn, D'Vera, and Justin Blum. 1999. Loudoun Growth Ranks 3rd in U.S. *Washington Post* March 12, B1+
- Commonwealth of Virginia. 1990. *The Problems of Small Community Family-Type Cemeteries*. Senate Document 31. Richmond: GPO.
- _____. 1992. Private Well Regulations. Bureau of Sewage and Water Services, VR 355-34-100.
- Department Burial Regs. Adopted. 1992. Virginia Department of Historical Resources.
- Dueker, Kenneth and P. DeLacy. 1990. GIS in the Land Development Planning Process; Balancing the Needs of Land Use Planners and Real Estate Developers. *Journal of American Planning Association*. 56(3):483-491.
- Excutive Summary of Data. 1998. Office of Mapping and Geographic Information. Leesburg:Loudoun County.
- Fitts, Deborah. 1995. Cemetery Panel Needs Volunteers. *Loudoun Times-Mirror*. June 28, A15.
- Foote, John. 1989. What to do when you find graves. Memo produced for Hazel & Thomas, P.C.
- Heikkila, Eric. 1998. Gis is Dead; Long Live GIS! *Journal of American Planning Association* 64(3):356-366.
- Innes, Judith and D. Simpson. 1993. Implementing GIS for Planning; Lessons from the History of Technological Innovation. *Journal of American Planning Association* 59(2): 230-236.
- Johnston, R.J, ed. 1994. *Dictionary of Human Geography*. Oxford: Blackwell Publishers.
- Levine, Johnathon and J. Landis. 1989. Geographic Information Systems. For Local Planning. *Journal of American Planning Association*. 55(2):209-220.
- Levy, John. 1994. *Contemporary Urban Planning*. Englewood Cliffs: Prentice-Hall.

- Lober, Douglas. 1995. Resolving the Siting Impasse; Modeling Social and Environmental Locational Criteria with a Geographic Information System. *Journal of American Planning Association* 61(4):482-495.
- Marsh, William. 1991. *Landscape Planning*. New York: John Wiley & Sons.
- McHarg, Ian 1969. *Design with Nature*. New York: Natural History Press.
- Schriebstein, Bertrand. 1993. Loudoun County Geographic Information System IG Assessment. Leesburg, VA: Loudoun County.
- Schwab, Jim. 1995. Zoning for Eternity. *Zoning News* May.
- Stipek, L. and S. Wiles. 1990. Education and Continuing Education for Technical Staff, Administrators, and the Public: Essential Components of the Loudoun County, Virginia GIS. *Unpublished*
- Weber, Richard. 1990. LOGIS: Case Study of Geographic Information System Growth in Loudoun County, Virginia. *Presented to the ESRI ARC/INFO annual Users Group, Palm Springs, CA, May 14-18.*
- Wiggins, Lyna and S. French. 1991. *GIS: Assessing Your Needs and Choosing a System*. Planning Advisory Service Report: 433.

APPENDIX A:

GPS Procedures

Data Collection

The GPS unit used was a Trimble Pro XR/XRS with the DP1 datapad unit. A Position Dilution of Precision (PDOP) mask of 6 was set for the unit. This mask controlled the accuracy of the GPS data collection by only allowing point capture for PDOP values of less than six.

When starting GPS recording for the day, the first step was to create a rover file. The rover file holds all of the locational points collected. The nomenclature used for the file name was CEM(date in mm/dd). Ex: on Jan 26th the file name = CEM0126. Then the data dictionary used was CEM. The CEM data dictionary was set up to record specific data about the cemeteries, such as the unique id number. The data dictionary was created using Trimble's PathFinder Office software.

The most difficult portion of the GPS data collection was locating the cemetery sites. Many of the cemeteries that were mapped via GPS were very small family cemeteries. These cemeteries averaged five cemetery plots, and often-lacked headstones or fencing. In these cases it was much more productive to take a guide along who had been to the cemetery site.

Once the cemetery was located, the center of the cemetery was captured using the GPS unit. When the unit was activated, it began to search for satellites. Once the satellites were found, point collection could begin. When locational data was collected, the unit prompted the operator for the unique id number for each cemetery, its PCEM number.

Twenty locational readings were taken before data collection was stopped. This high number of readings contributes to high levels of accuracy. Once twenty locational readings were recorded the unit was deactivated, and the next cemetery location was searched out.

For all cemetery locations gathered in the same day, the same rover file was used.

Data Correction

Once data is collected, it must be corrected and converted into a useful format. This section covers how to correct the data, through post-processing, and export it into a format to produce an ArcInfo coverage. This procedure must be run on a PC that has the PathFinder Office software loaded.

Get the GPS key and datapad transfer cable.

Insert the datapad transfer cable into COM1.

Insert the GPS key into the large parallel port.

Plug transfer cable into the datapad.

On the PC, start PathFinder Office and open up the cemeteries Project.

On the datapad, select Data Transfer from the main menu.

On the PC, under the Utilities menu, select File Transfer.
Select which files to transfer by clicking on the file name and then Adding them.

Click Transfer, and wait for transfer process to end.

Close the Data Transfer window.

On datapad, press Clear to back up a menu, then select Data Capture
Delete the files transferred. Datapad use is now over.

On the PC, under the File menu, Open one of the transferred files.

In the Open File window, when you have selected a rover file to open, the program will display the beginning and ending time for the data collection in Universal Time (UTC). Record these times, they are necessary to collect base station data.

View Map of the opened file.

Transferred data files are in .ssf format. These files have not been geo-corrected. In order to geo-correct, post process, these files the proper base station files need to be collected.

Base station files are available, free of charge, at <ftp://ftp.evsgps.com/> . The format for these files are:

- basestation (x=Charlottesville)
- last number of year (9=1999)
- date in mm/dd (0126=July 26th)
- one hour block data corrects, in UTM (data collected @ 1pm = 13)

So if data collection occurred January 26th, 1999 from 1pm to 2:35 pm, the base station files needed would be x9012613 and x9012614. (More information is available at ftp://ftp.evsgps.com/EVS_READ.txt)

Select the base station files needed, and save them into the c:\cemetery\gps\base directory. Base station files are in a PKZip self extracting file format. Double click each file and it will self inflate itself. This must be done to the files prior to their use in geo-correction.

Open up PathFinder office.

Use cemetery as the Project to open.

From the Utilities menu, select Differential Correction.

Pick which .ssf files to correct, and autoselect base station files. You need to do a Quick Search. If all the base station files needed are found, click OK.

The Reference Position menu should now appear. This data is set from the base station files. If using the Charlottesville data the values should be:

Station Latitude = 38°02'26.77080N

Station Longitude = 78°28'42.22170W

Station Height = 98.47m

Antenna Height = 0m

If the values are correct, click OK. Click OK from the Differential Correction menu.

When the process is finished select Export from the Utilities menu. Select the .cor file to export (this is the corrected .ssf just created). Click OK

Exit Pathfinder Office

Coverage Production

Open an FTP link with the UNIX system. Navigate to
/proj/cemeteries/gps_export.

Create a new directory using the collection date as the directory name:
Ex: if data was collected January 26th the directory = 0126

Move all of the files from C:\cemetery\gps\export\ into the new UNIX directory.

Clean up. Delete all of the related files in C:\cemetery\gps
C:\cemetery\gps\base
C:\cemetery\gps\export

Done with PC use.

On the HP UNIX system, open up the cemetery.aml file in a text reader. This is the .aml which PathFinder Office wrote to create an ArcInfo coverage, but one modification needs to be done in order to retain attribute information. In the 4th section the pathname for the cemetery.pa file needs to be added:

Initially it reads: ADD FROM CEMETERY.PA

The pathname need to be in front of the file name. For Jan 26th =

ADD FROM /proj/cemeteries/gps_export/0126/CEMTERY.PA

Save the file and close.

Open a terminal from the new directory. The next list of commands will create the new coverage:

```
arc
&r cemetery
rename cemetery cem (mm/dd)
  Ex: for January 26th = rename cemetery cem0126
```

```
ae
ec cem(mm/dd)
de point
draw
ef point
sel all
```

List. This lists all of the attribute data for the points in the coverage. Verify that all of the Siteid values are in the proper format.

It should read PCEM-##-####. If not you can change the values using the calculate command.

```

save
quit
w ..
append cemgps2 point This command activate the APPEND module, it will
prompt you for the coverages to APPEND.
1st=cemgps
2nd=(newdirectory/cem(mm/dd) Ex. 0126/cem0126
3rd=end

ae
ec cemgps2
de point
draw. Double check to verify that new points were appended and attribute
data is correct. If so quit the ArcEdit module.

kill cemgps all
rename cemgps2 cemgps
quit out of Arc/Info
Remove the following files from /proj/cemteries/gps_export/(mmdd)
    cemetery.aml
    cemetery.gml
    cemetery.iml
    cemetery.pa
    cemetery.pts
    cemetery.sml
    cemetery.inf
    exp(mmdd).txt Ex. exp0126.txt

```

APPENDIX B:

Cemetery Attribute File

This file contains the publicly distributed attribute data for the collected cemetery information. This data was produced on May 1st, 1999, has not been updated.

Name	Type	Grave#	Earliest	Latest	Site-id
AFRICAN METHODIST EPISCOPAL	METHODIST	19	1890	1996	PCEM-60-0106
ALDIE PRESBYTERIAN	PRESBYTERIAN	4		1906	PCEM-98-0003
ALDRIGE	FAMILY	2	1837	1841	PCEM-98-0004
ALLEN	FAMILY	3	1820	1884	PCEM-98-0005
AMBLER	FAMILY	1	1912	1912	PCEM-98-0006
ARNOLD GROVE METHODIST	METHODIST	269	1836	1945	PCEM-71-0024
ASHBURN PRESBYTERIAN	PRESBYTERIAN	205	1848	1988	PCEM-67-0051
BALL	FAMILY	15	1800	1948	PCEM-87-0283
BALLS BLUFF NAT.					PCEM-98-0010
BAYLY	FAMILY	8	1795	1994	PCEM-68-0124
BEAVERS / SPENCE	FAMILY	5	1926	1949	PCEM-98-0012
BELMONT	FAMILY	3	1826	1843	PCEM-98-0205
BELMONT CHAPEL	EPISCOPAL	24	1846	1918	PCEM-88-0213
BELMONT SLAVE	FAMILY				PCEM-98-0014
BETHEL METHODIST EPISCOPAL	EPISCOPAL	136	1878	1948	PCEM-75-0127
BROAD RUN CHURCH	COMMUNITY	33	1826	1911	PCEM-98-0016
BUCKNER	FAMILY				PCEM-98-0017
CAGE HUTCHISON	FAMILY				PCEM-65-0201
CARR MAUSOLEUM	FAMILY	2	1967	1969	PCEM-98-0204
CARTER (CREDNAL)	FAMILY	17	1839	1956	PCEM81-0226
CARTER (NOTRE DAME)	FAMILY	9	1818	1942	PCEM-98-0021
CATOCTIN FREE CHURCH	COMMUNITY	125	1810	1933	PCEM-98-0022
CHINN (RT 50)	FAMILY	3	1799	1803	PCEM-98-0026
CHINN (RT 705)	FAMILY	8	1871	1919	PCEM-98-0027
CHURCH OF OUR SAVIOUR	EPISCOPAL	16	1932	1990	PCEM-98-0028
CITY HILLSBORO	COMMUNITY	564	1864	1948	PCEM-98-0029
CLEVELAND	FAMILY	3	1923	1928	PCEM-98-0030
COLLIER	FAMILY	4	1879	1879	PCEM-90-0129
COOKSVILLE	COMMUNITY	3	1883	1904	PCEM-98-0033
CRAVEN					PCEM-86-0083
CUNNINGHAM	FAMILY				PCEM-98-0035
DANIEL FARM	FAMILY				PCEM-98-0036
DENHAM	FAMILY	3	1833	1851	PCEM-98-0037
DINWIDDIE FARM	FAMILY	1	1864	1864	PCEM-98-0038

DISHMAN	FAMILY	2	1851	1851 PCEM-98-0039
DODD (STONELEIGH)	FAMILY			PCEM-98-0040
DULINKEENE	FAMILY	3	1880	1898 PCEM-98-0041
EBENEZER BAPTIST (OLD & NEW)	BAPTIST	1095	1793	1948 PCEM-68-0195
EBENEZER UNITED METHODIST	METHODIST	342	1864	1995 PCEM-72-0005
ELLZEY (MT MIDDLETON)	FAMILY	17	1796	1879 PCEM-80-0204
EMMANUEL EPISCOPAL	EPISCOPAL	111	1929	1997 PCEM-98-0047
ETCHER	FAMILY	6	1837	1881 PCEM-98-0048
FADELEY	FAMILY	5	1828	1964 PCEM-88-0620
FAIRFAX MEETING				PCEM-60-0134
FAIRLANE				PCEM-98-0050
FAITH CHAPEL PRESBYTERIAN	PRESBYTERIAN	62	1890	1952 PCEM-98-0051
FIRST BAPTIST	BAPTIST	52	1914	1988 PCEM-98-0052
FOUCHE	FAMILY	2	1900	1933 PCEM-98-0053
FOXCROFT	FAMILY	1	1969	1969 PCEM-98-0055
FOX'S GRAVEYARD	FAMILY	13	1796	1886 PCEM-50-0034
FREEMAN		4	1882	1931 PCEM84-0254
FURNACE MOUNTAIN PRESBYTERIAN	PRESBYTERIAN	21	1944	1954 PCEM-89-0128
GAINES/WOLF	FAMILY	2	1862	1862 PCEM-98-0059
GARRETT	FAMILY	1	1865	1865 PCEM-98-0060
GASKINS	FAMILY			PCEM-98-0061
GLEEDSVILLE	COMMUNITY	50	1902	1990 PCEM-98-0062
GLENLOCHE	FAMILY	1		PCEM-98-0063
GOOSE CREEK BURYING GROUND	QUAKER	1529	1781	1948 PCEM-80-0063
GRACE ANNEX METHODIST	METHODIST	318	1830	1996 PCEM-98-0065
GRAYSON	FAMILY	3	1835	1850 PCEM-75-0185
GROVE METHODIST MEETING	METHODIST	49	1848	1930 PCEM-98-0067
GRUBB	FAMILY	9	1821	1865 PCEM-67-0027
GULICK	FAMILY	4	1817	1858 PCEM-98-0069
GUM SPRING METHODIST	METHODIST	18	1816	1940 PCEM-98-0070
HAMPTON BREWER	FAMILY			PCEM-98-0071
HARMONY UNITED METHODIST	METHODIST	192	1837	1943 PCEM-98-0072
HEATER FAMILY GRAVEYARD	FAMILY	8	1825	1874 PCEM-98-0073
HENKLE	FAMILY	1	1816	1816 PCEM-98-0074
HILLSIDE				PCEM-98-0075
HIXSON	FAMILY	6	1812	1857 PCEM-92-0114
HOUCK CHURCH	COMMUNITY			PCEM-98-0077
INDIAN BURIAL MOUND				PCEM-98-0079
ISH	FAMILY	10	1842	1932 PCEM-98-0080
JACKSON	FAMILY	5	1958	1984 PCEM-98-0081
JENKINS	FAMILY	2	1930	1937 PCEM-98-0083
KETOCTIN BAPTIST	BAPTIST	683	1785	1954 PCEM-98-0084
KILGOUR / HUMMER	FAMILY			PCEM-98-0085
LAKEVIEW	COMMUNITY	760	1854	1957 PCEM-98-0086
LANE (FARMER'S DELIGHT)	FAMILY	1	1803	1803 PCEM-98-0087
LEE	FAMILY	18	1828	1868 PCEM-98-0088

LEESBURG PRESBYTERIAN	PRESBYTERIAN	146	1804	1905 PCEM-98-0089
LEITH	FAMILY	1		PCEM-98-0090
LLANGOLLAN @ AUXILLARY HOUSE	FAMILY			PCEM-98-0091
LOUDOUN HEIGHTS	COMMUNITY	23	1807	1910 PCEM-84-0005
LUCAS	FAMILY	10	1966	1997 PCEM-98-0203
LUNETTE	FAMILY	1	1862	1862 PCEM-98-0093
LYNN	FAMILY	1	1855	1855 PCEM-98-0094
LYON	FAMILY	2	1909	1909 PCEM-98-0095
LYON (BRAMBLETON)	FAMILY	21	1850	1913 PCEM-98-0096
MAFFETT	FAMILY	27	1842	1914 PCEM-86-0370
MANSFIELD	FAMILY	1	1798	1798 PCEM-98-0098
MATTHEW / JAMES	FAMILY	9	1883	1912 PCEM-79-0219
MCILHANY	FAMILY	18	1804	1842 PCEM-98-0100
MCKIM	FAMILY	6	1820	1912 PCEM-98-0101
MEMORIAL	COMMUNITY	916	1936	1997 PCEM-98-0102
MILLER/PAINTER PLACE				PCEM-98-0104
MOORE	FAMILY	14	1844	1909 PCEM-98-0105
MORAN	FAMILY	28	1871	1985 PCEM-50-0006
MOUNT	FAMILY	3	1823	1840 PCEM-98-0107
MOUNT HOPE BAPTIST CHURCH	BAPTIST	147	1857	1980 PCEM-62-0180
MOUNT OLIVE BAPTIST	BAPTIST	463	1882	1996 PCEM-98-0109
MOUNT OLIVET METHODIST	METHODIST	198	1878	1988 PCEM-72-0010
MOUNT PLEASANT BAPTIST	BAPTIST	34	1899	1975 PCEM-98-0111
MOUNT PLEASANT UNITED METH	METHODIST	207	1880	1954 PCEM-68-0090
MOUNT SINAI CHURCH / FINONA	COMMUNITY	8	1895	1921 PCEM-98-0113
MOUNT ZION COMMUNITY CEMETERY	COMMUNITY	419	1828	1995 PCEM-98-0114
MOUNT ZION OLD SCHOOL BAPTIST	BAPTIST	177	1853	1995 PCEM-98-0115
MOUNTAIN CHAPEL	FAMILY	18	1792	1901 PCEM-81-0203
MOUNTVILLE	FAMILY			PCEM-98-0117
MT. PLEASANT				PCEM-98-0200
NEW JERUSALEM	LUTHERAN	600	1794	1942 PCEM-63-0075
NEW VALLEY BAPTIST	BAPTIST	60	1806	1906 PCEM-92-0040
NEWMAN	FAMILY			PCEM-98-0206
NIXON	FAMILY	11	1790	1880 PCEM-98-0120
NORTH FORK REGULAR BAPTIST	BAPTIST	436	1812	1949 PCEM-77-0210
OAK GROVE				PCEM-59-0021
OLD ABEL	FAMILY	9	1804	1888 PCEM-88-0157
OLD BAPTIST	BAPTIST	46	1815	1859 PCEM-98-0124
OLD BETHESDA METHODIST EPISC	METH/EPIS	49	1818	1890 PCEM-98-0125
OLD DARNES	FAMILY	20	1821	1936 PCEM-98-0126
OLD EBENEZER M. E.	METH/EPIS	62	1836	1889 PCEM-72-0005
OLD EPISCOPAL	EPISCOPAL	135	1811	1947 PCEM-98-0128
OLD METHODIST	METHODIST	82	1777	1885 PCEM-98-0130
OLD STERLING	COMMUNITY	26	1870	1943 PCEM-58-0044
OLD STONE CHURCH				PCEM-98-0133
OLD WELBOURNE	FAMILY	50	1837	1993 PCEM-98-0134

ORRISON	FAMILY	2	1919	1919 PCEM-85-0214
PALMER	FAMILY	5	1882	1891 PCEM-98-0137
PANGLE	FAMILY			PCEM-98-0138
PLEASANT VALLEY	COMMUNITY	219	1913	1996 PCEM-67-0046
POTTS	FAMILY	143	1768	1942 PCEM-88-0177
POWELL	FAMILY	9	1841	1927 PCEM-98-0141
POWELL	FAMILY			PCEM-98-0142
PRIVATE (606&636)				PCEM-98-0078
PRIVATE (RTS 606 & 775)	FAMILY	5	1847	1917 PCEM-98-0143
PROSPERITY BAPTIST	BAPTIST	39	1907	1994 PCEM-68-0135
PROVIDENCE PRIMITIVE BAPTIST				PCEM-59-0098
REHOBETH METHODIST	METHODIST	211	1818	1937 PCEM-98-0147
RHODES	FAMILY			PCEM-98-0148
ROCK HILL	COMMUNITY	260	1899	1997 PCEM-98-0150
ROSE HILL FARM	FAMILY			PCEM-98-0151
RT 50				PCEM-98-0153
RT 621	FAMILY			PCEM-98-0154
RUNNYMEDE FARM				PCEM-98-0155
RUSK	FAMILY	5	1848	1931 PCEM-98-0156
RUST / MOSS	FAMILY	29	1840	189 PCEM-79-0281
RYAN UNITED METHODIST				PCEM-67-0051
SAFFER	FAMILY	18	1841	1939 PCEM-98-0159
SALEM METHODIST	METHODIST	99	1861	1951 PCEM-98-0160
SAUNDERS	FAMILY	7	1828	1852 PCEM-98-0161
SAUNDERS FAMILY (CAMP HIGH RD)	FAMILY	2	1851	1854 PCEM-98-0162
SECOND SHILOH CHURCH	BAPTIST	22	1951	1997 PCEM-98-0163
SHARON	COMMUNITY	1736		PCEM-98-0164
SHREVE	FAMILY	8	1820	1856 PCEM-98-0165
SHRYOCK	FAMILY	4	1823	1961 PCEM-98-0166
SKINNER	FAMILY	2	1835	1859 PCEM-98-0167
SKINNER / ODEN	FAMILY	5	1831	1850 PCEM-98-0168
SMITH	FAMILY	8	1932	1987 PCEM-98-0170
SOLON	COMMUNITY	682	1877	1996 PCEM-98-0171
SOUTH FORK MEETING	QUAKER	106	1790	1936 PCEM-98-0172
SOUTH RIDING	FAMILY			PCEM-98-0173
SPINKS CEMETERY	FAMILY	0		PCEM-98-0174
SPRINGWOOD				PCEM-98-0175
ST JAMES UNITED	LUTHERAN	403	1784	1953 PCEM-98-0176
ST PAUL LUTHERAN	LUTHERAN	257	1824	1987 PCEM-98-0177
STERLING CEMETERY	COMMUNITY	380	1906	1991 PCEM-78-0045
STONELEIGH	FAMILY			PCEM-98-0179
SUGARLAND RUN CHRUCH	EPISCOPAL			PCEM-98-0201
SYCOLINE	FAMILY			PCEM-98-0180
THROCKMORTON	FAMILY			PCEM-98-0181
THROCKMORTON	FAMILY	3	1838	1858 PCEM-98-0202
TIPPETT HILL	COMMUNITY	68	1908	1994 PCEM-98-0182

UMBAUGH	FAMILY	18	1871	1942 PCEM-60-0116
UNION CHURCH & GRAVEYARD	COMMUNITY	1	1959	1959 PCEM-98-0184
UNION LEESBURG	COMMUNITY	4466	1820	1948 PCEM-98-0185
UNION LOVETTSVILLE	COMMUNITY	1261	1831	1948 PCEM-98-0186
UNION WATERFORD	COMMUNITY	300	1832	1946 PCEM-60-0133
VALLEY CHURCH				PCEM-60-0116
WILLIAMS / BROWN	FAMILY			PCEM-98-0191
WILLISVILLE	COMMUNITY	10	1891	1905 PCEM-59-0177
WILSON	FAMILY			PCEM-98-0193
WILSON (MIDDLEBURG)	FAMILY	5	1834	1886 PCEM-80-0191

APPENDIX C:

ArcExplorer CD Description

Included with this document is a CD containing the information gathered through this research and additional information from the Loudoun County GIS.

The CD contains the program ArcExplorer, which is a shareware product distributed by ESRI to support their ArcInfo GIS and ArcView GIS software products. ArcExplorer is available free at: <http://www.esri.com/software/arcexplorer/index.html> although it has also been included on the included CD.

ArcExplorer is a GIS browser that allows users a range of GIS functionality. Included on the CD is a variety of data layers that will help the user to; perform quick searches of the cemetery data layer, produce maps at any scale, and locate cemeteries with accuracy.

The CD also includes such features as the major roads in Loudoun County, the larger rivers and streams, and town locations. These features are included in order to help the user produce useful maps and locate the cemeteries more easily.

In order to run the program you will need to install ArcExplorer on your CD. To do this run the *aeinst.exe* file.

Once the program has been installed and opened. A sample view has been assembled to allow viewers to quickly view and query the cemetery data. The help documents have been included and are very helpful in discovering all of the capabilities that ArcExplorer has to offer.

Scott Marshall Sizer

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Education

M.A Geography, May 1999
West Virginia University, Morgantown, WV
G.P.A. 3.6

B.A. Geography, May 1995
Certificate of Cartography, May 1995
Certificate of Environmental Management, May 1995
George Mason University, Fairfax, VA
G.P.A. in Geography 3.7, Overall G.P.A. 3.5

Skills

Experienced with many GIS software packages including: ArcInfo 6 and 7 for UNIX and Windows NT platforms, IDRISI, ArcView3 on UNIX and PC platforms and ERDAS Imagine.

Experience

Loudoun County, Cartographic Technician.

Responsibilities included GIS layer development, implementation, and maintenance. Developed maps and mapping procedures for other county departments. June 1998-present.

West Virginia University, Graduate Teaching Assistant.

Lab instructor for Introductory GIS class. Assisted with intermediate and advanced GIS classes. Lectured in large classes. Assisted instructors in creating quizzes and utilized spreadsheets for grading courses. September 1995-May 1997.

Science Applications International Corporation (SAIC), Spatial Data Technician. Performed heads-up digitizing on an in-house GIS. Data compiled was used for production of a world wide DEM. Scanned in topographic maps. Summer 1995.

Smithsonian Center for Research and Conservation, GIS Volunteer.

Designed training activities for ArcView2. Modules were used to train conservation groups in GIS environmental applications. Used ERDAS Imagine and SPOT imagery for rainforest deforestation rapid assessment. Summer 1995.