

# MANAGING WATER RESOURCES DATA WITH LIMITED RESOURCES

**Mark Stiles**  
**Yazoo Mississippi Delta Joint Water Management District**  
**Merigold, MS**

## INTRODUCTION

The Yazoo Mississippi Delta Joint Water Management District is a local governing authority that encompasses all or part of 17 counties in Northwest Mississippi. The district is concerned with both water quality and quantity issues in the Delta. One of the main functions of the district is the permitting of all water use points. A permitted water use point is any well with a casing diameter of 6 inches or greater or any surface water withdrawal. The Delta currently has approximately 80 percent of all permitted water use points in the state (Figure 1).

The text data associated with each water use permit are placed in a relational database management system. The boundaries of the land that the water is applied to are recorded on USGS 7.5 minute quads. Altogether, this data lends itself to incorporation into a Geographic Information System (GIS). A decision was made to start evaluating GIS packages, purchase the desired package, and begin using GIS to have a better management tool for the permitting process. Over the past two years, approximately 25 percent of the district's computer equipment and software budget have been disbursed with GIS capabilities in mind (Table 1).

In evaluating various packages of hardware and software the following criteria were used:

- Due to the high cost of non-PC machines, the GIS should be able to run on a PC.
- The GIS should be able to provide a direct link to the permitting database. (Foxpro)
- The GIS should allow for a transfer of data to and from established GIS systems across platforms. (ex. PC to Sun)
- The GIS should be easy to use in order to get the data into a workable form as quickly as possible.
- The GIS should allow for customizable menus to automate repetitive tasks.
- The GIS should allow for multiple layers of data to be displayed at once.
- The GIS should allow for editing of these layers.
- The GIS should allow fundamental geographic searches. (buffered, radial)

- The GIS should be able to receive input from industry standard input devices. (Calcomp digitizer)
- The GIS should drive industry standard output devices (HP Laserjet, Calcomp Plotter)

Several visits to existing GIS sites were made to determine the generally accepted setup for a GIS. This was done for several reasons: first, to ensure that any decision made would be in compliance with other sites for seamless sharing of data and second, to benefit from the experience of other agencies in the purchase and use of various geographic information systems.

After evaluating several packages and making calls to several vendors, a decision to purchase Mapinfo for DOS was made. This package met most of the criteria established for evaluating the various geographic information systems at a price of \$995.00.

One of the immediate benefits of obtaining Mapinfo was that the entire permitting database could now be spatially displayed in-house. Previously recorded errors in coordinates that would have been hard to distinguish with traditional database searches were now obvious with the visual display. Also, filters could be applied to display just the type of permit that the user wanted (for instance, display all the irrigation wells in Leflore county or display the wells with a casing diameter greater than 12 inches in a particular area). These are standard database filters that could be performed in dBase or Foxpro, but the added advantage of visualizing the results gives more meaning to the searches.

The source data for the textual part of the permit was received in an ASCII dump from MARIS. The data was then placed into a Foxpro relational database. The land boundaries, generally crop fields or catfish ponds, associated with the permits were not in electronic form. The boundaries had been placed on 7.5 minute quadrangle maps. Thus, the decision was made to purchase a Calcomp digitizer so the job of digitizing approximately 13,500 boundaries from 145 quad maps could begin. Seven layers of data per county for the Delta counties were purchased from MARIS to be used as background data in digitizing the boundaries. The boundaries were digitized directly into Mapinfo with the

permit number attached as an attribute to each polygon (Figure 3).

The update from Mapinfo for DOS to Mapinfo for Windows was chosen for several reasons: 1) the Windows version allowed for buffered searches that are sometimes instrumental in preplanning for a project, 2) the Windows version was designed to be easy to use for first time GIS users, and 3) the Windows version allowed for the placement of the GIS data into other existing applications already in use by the district such as word processors and desk top publishers.

In addition to being a vital part of the permitting process, Mapinfo is used for other projects as well. For a project on the Sunflower River in the fall of 1992 to supply water to increase the base flow, Mapinfo was used to determine where all the irrigation wells within a 1/4 mile buffer of the Sunflower River or its major tributaries were located (Figure 4). Once these wells were located, a quick report was generated listing the name, address, and phone number of the various landowners. These landowners were then contacted by the staff for participation in the project. This procedure saved days of preliminary field work using conventional methods. For the past two years, GIS has also played an instrumental role in the district's Catfish water use project. A database was created in Foxpro to produce a randomly generated list of wells that are used for aquaculture. These wells were then plotted on a map to check the dispersal of the wells selected throughout the Delta. Mapinfo is also used in site evaluation for pump tests. Wells are plotted for the area of the Delta in which the pump test is to take place. Then the wells are checked for proximity to roads, streams, and other wells. This saves time by not having to drive through an entire project area hoping to spot wells that meet the criteria for pump tests.

Another PC based GIS that the district uses is IDRISI. IDRISI is a raster based microcomputer GIS developed by Clark University. At a cost of \$179.00, this GIS provides a lot of power for the dollar. IDRISI is planned to be used in conjunction with Mapinfo. The district plans to take satellite imagery and overlay the vector data from Mapinfo to determine crop type for each digitized polygon in the database for a particular season. It is recognized that due to crop rotation these images will change from year to year. Also, IDRISI can be used for small watershed delineations that are to be used in some of the water quality projects with the Soil Conservation Service (SCS).

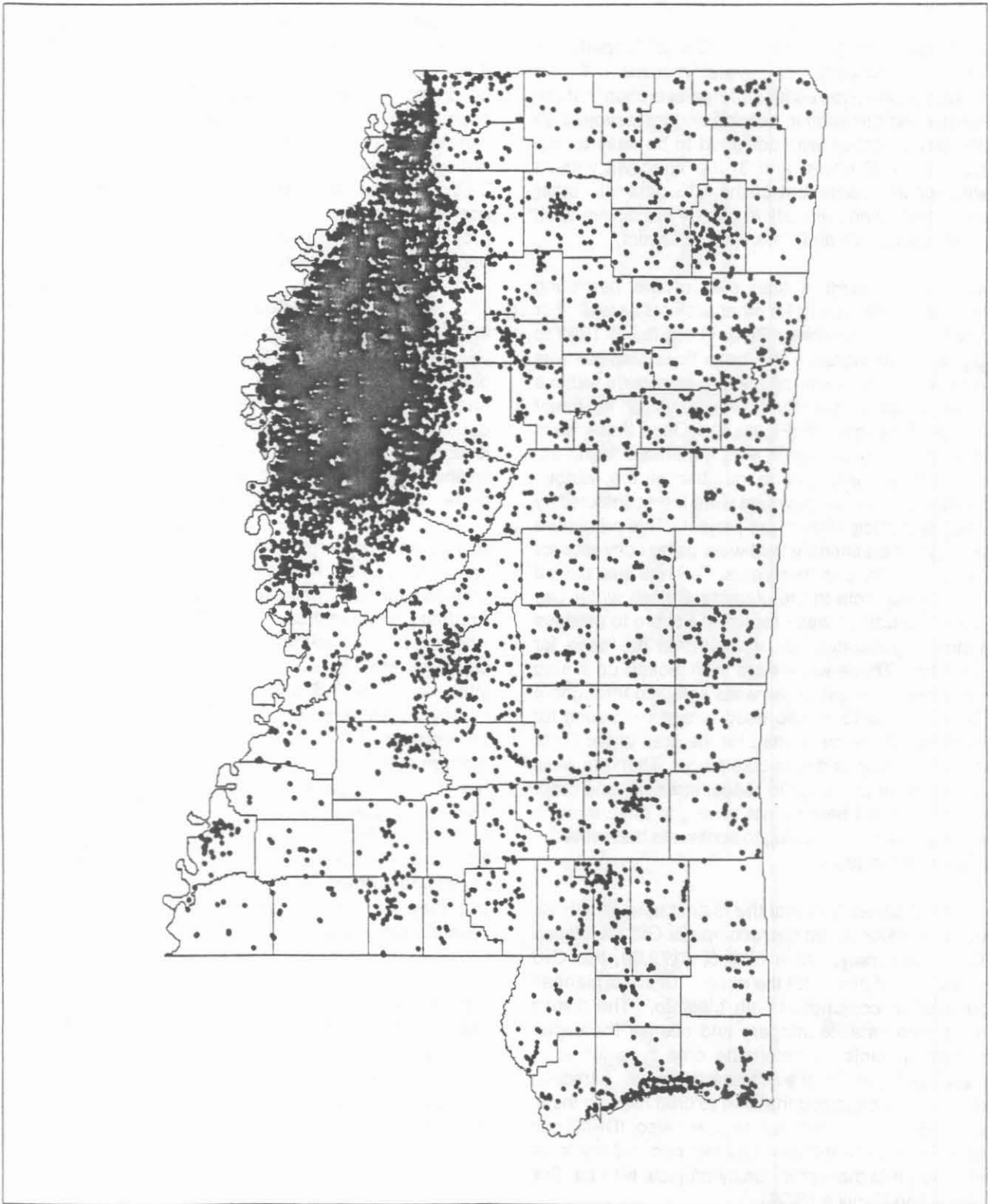
Currently the district's GIS capabilities are provided to the staff through a network. The district is now running a combination of Novell NetWare 3.11 and Microsoft

Windows for Workgroups. This setup provides for traditional networking capabilities with Novell and peer-to-peer networking capabilities with Windows for Workgroups. The peer-to-peer networking capability is easily managed on all the computers. It is not uncommon to share the resources of four computers at once when doing GIS work with this method. For example, a user, while running the GIS locally, can retrieve county coverages from the file server, retrieve a GPS file from another computer, and use the printer connected to another computer. It is felt that this provides for the highest and most secure production possible with the lowest cost.

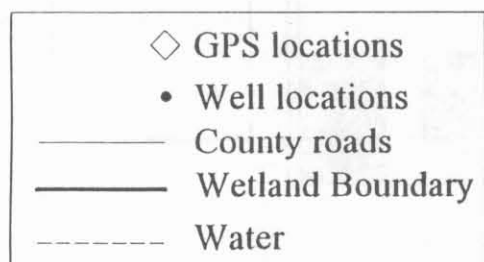
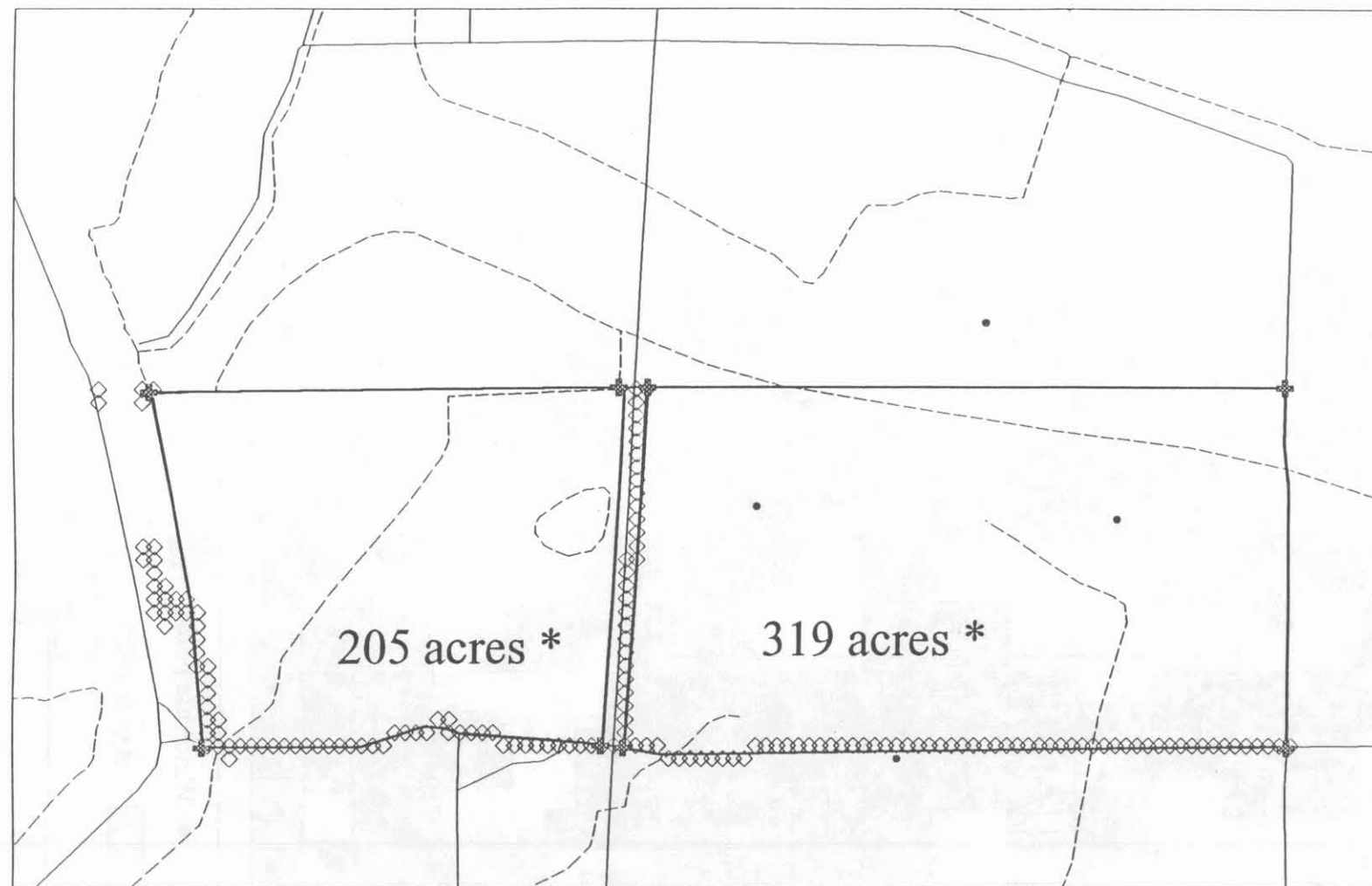
The district is now developing a procedure to incorporate data derived from a Global Positioning System (GPS) into the GIS (Figure 2). One of the district's plans is to use the GPS to correct any known errors in coordinates that exist in the district's databases. Also, the district plans to use the GPS for locating sites to be used in water quality monitoring, wellhead protection, rowcrop water use, or any other project in which accurate locations are important.

A purchase that is planned in the future is a program called ARC-Link. At a cost of \$495.00, this program provides for the translation of data from Mapinfo to Arc-Info and vice versa. This is a great way for people who don't have Arc-Info expertise to process the data off their Arc-Info system through an easy to use interface. The GIS data that is in Arc-Info could be quickly transferred through ARC-Link to the desktop of an end user who wants to display, edit, and query data through a GIS. The main advantage that this process has over other packages, such as Arc-View, is cost. Even if a purchase of Mapinfo was necessary in addition to ARC-Link, the total cost would only be \$1490.00. The plan for ARC-Link is to have the ability to provide current Arc-Info users with data in a format that they will not have to import or convert. This will promote more data sharing among users.

In conclusion, the GIS capabilities that have been developed at the Yazoo Mississippi Delta Joint Water Management District would more often than not fit most people's GIS needs. Once the district's GIS needs were determined and the various options evaluated, it was quickly deduced that those needs could be met at a much lower cost than many existing GIS sites.



**FIGURE 1.**  
**PERMITTED WATER USE POINTS**



\* Acreages calculated by GIS

**FIGURE 2.**  
**GPS Locations**  
**Placed in Mapinfo**

Scale: 1 in = 0.641 mi



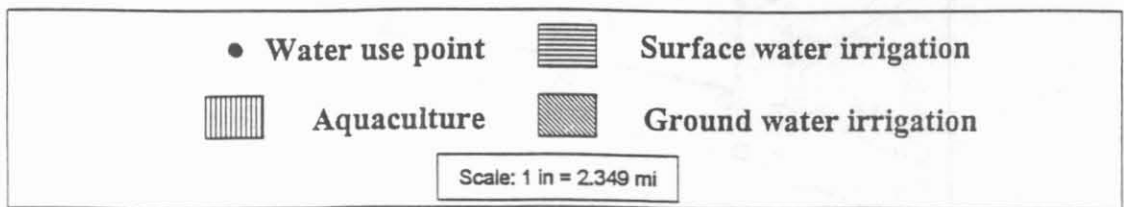


FIGURE 3.  
3 DIGITIZED LAYERS FOR THE BROOKS QUAD

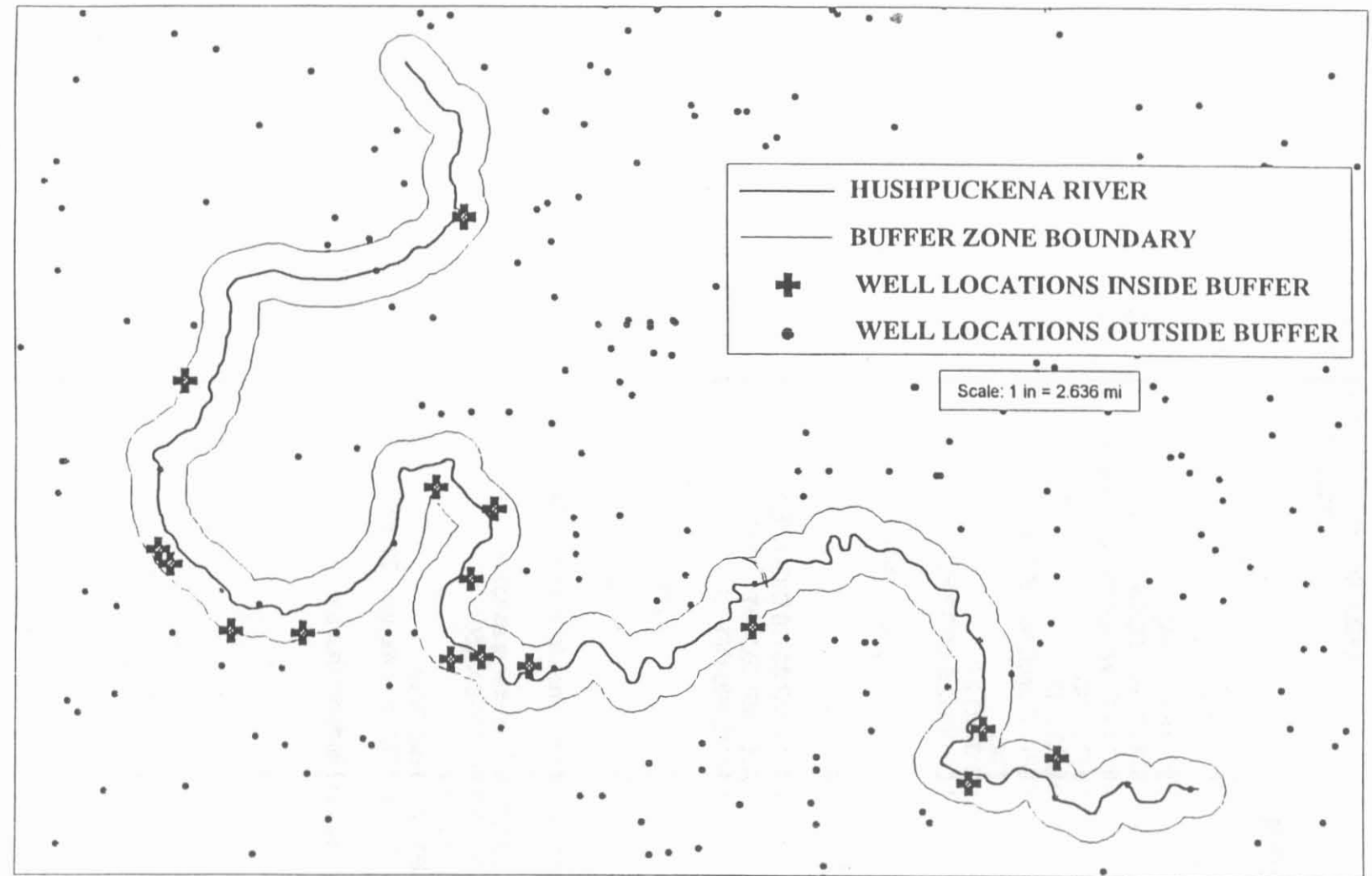


FIGURE 4.  
1/4 MILE BUFFER SEARCH FOR WELLS ALONG THE HUSHPUCKENA RIVER

Table 1.

Expenditures for GIS specific applications  
over a two year period

| <u>YEAR</u> | <u>ITEM</u>               | <u>PRICE</u>  | <u>TOTALS</u> |
|-------------|---------------------------|---------------|---------------|
| Software:   |                           |               |               |
| 1           | MAPINFO (DOS)             | 995.00        |               |
| 2           | MAPINFO (WINDOWS UPGRADE) | 179.00        |               |
| 2           | MAPINFO (WINDOWS UPGRADE) | 95.00         |               |
| 2           | MAPBASIC                  | 795.00        |               |
| 1           | AUTOCAD                   | 2195.00       |               |
| 1           | ELECTRONIC MAPS (MARIS)   | 1890.00       |               |
| 2           | IDRISI                    | 289.00        |               |
| 1           | FOXPRO 2.0                | 455.00* ***   |               |
| 2           | FOXPRO2.5 UPGRADE         | 99.00***      |               |
| Subtotal:   |                           |               | 6992.00       |
| Hardware:   |                           |               |               |
| 1           | CALCOMP 33360 DIGITIZER   | 1820.00       |               |
| 2           | CALCOMP 2024D/PLOTTER     | 3883.00       |               |
|             | STANDARD OFFICE COMPUTER  | 2700.00** *** |               |
| Subtotal:   |                           |               | 8403.00       |
| Total:      |                           |               | \$15395.00    |

\* Foxpro can now be obtained for approximately \$300.00

\*\* Standard Office Computer is as follows

486 DX 33 or 486 DX2/50

8 MB Ram

300 + MB Hard Drive

14" Super VGA color monitor .28 dpi

\*\*\* Applications or Hardware that are used for other purposes besides GIS.