ATCHAFALAYA BASIN FLOODWAY SYSTEM
LOUISIANA PROJECT

ENVIRONMENTAL GEOGRAPHIC INFORMATION SYSTEM NEEDS INVENTORY AND ASSESSMENT

Contract No. FA4890-04-D0007
Delivery Order DJ01

Volume 1 of 2

Prepared for:

New Orleans District
U.S. Army Corps of Engineers
7400 Leake Ave.
New Orleans, LA 70118

Prepared by:

EarthTech
A tyco International Ltd. Company

Earth Tech, Inc.
536 Washington Avenue
New Orleans, LA 70130

GAEA ENGINEERING CONSULTANTS

GEC Gulf Engineers & Consultants

September 27, 2006

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List of Acronyms

ABFS	Atchafalaya Basin Floodway System
CEMVN	Corps of Engineers Mississippi Valley New Orleans
DEM	Digital Elevation Model
DEQ	Department of Environmental Quality (Louisiana)
DNR	Department of Natural Resources
DTM	Digital Terrain Model
DOQQs	Digital Ortho Quarter Quadrangles
EABPL	East Atchafalaya Basin Protection Levee
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GPS	Global Positioning Systems
LOSCO	Louisiana Oil Spill Coordinator's Office
LSU	Louisiana State University
UML	Unified Modeling Language
USGS	United States Geological Survey
USACE	United States Army Corps of Engineers
WABPL	West Atchafalaya Basin Protection Levee
WMU	Water Management Unit

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Charlie Fryling, Sierra Club
David Gisclair, Louisana Oil Spill Coordinator's Office
Lamar Hale, Corps of Engineers, New Orleans District
Stephen Hartley, U.S. Geological Survey
Larry Hartzog, Corps of Engineers, New Orleans District
Paul Hughbanks, Corps of Engineers, New Orleans District
Craig Johnson, Louisiana GIS Council
Farrell Jones, Louisiana State University
William Kelso, Louisiana State University
Neil Lalode, Corps of Engineers, Port Barre Field Office
Joel Lindsey, Comite Resources
David McDaniel, Corps of Engineers, New Orleans District
Richard Metcalf, Mid-Continent Oil and Gas
Jackie Mills, Louisiana State University
Jim Mitchell, Louisiana Department of Transportation and Development
Todd Moreau, Corps of Engineers, Port Barre Field Office
Pat O'Neil, U.S. Geological Survey
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EXECUTIVE SUMMARY

INTRODUCTION

This project (FA4890-04-D-0007 Task Order DJ01) has developed an inventory and assessment of watershed-based Geographic Information System (GIS) information for the Atchafalaya Basin. The Atchafalaya Basin Floodway System (ABFS) Project has two major, mutually supporting goals: to preserve the environmental values of the nation's largest river, cypress and tupelo swamps, their bayous and abundant water and land species, and to insure that the Lower Atchafalaya Basin can pass a flood of 1.5 million cubic feet per second as required by the Mississippi River and Tributaries Project. Today, over 25 projects are underway in the ABFS in pursuit of these goals.

Planning, construction, and operation of current and future ABFS projects require access to a wide range of geospatial data regarding physical, chemical, and biological characteristics of the basin. Examples are topography, water quality, hydrography, property ownership, recreation sites, public access locations, water levels, and flows. Over the years vast amounts of data have been generated by various public and private entities. These data reside in the GIS files of the Corps of Engineers Mississippi Valley New Orleans (CEMVN) as well as other agencies, state and local governments, and organizations.

The project location is the Lower ABFS, covering an area approximately 15 miles wide, and 65 miles long extending from the latitude of Krotz Springs, LA to the approximate latitude of Morgan City, LA.

PROJECT OBJECTIVES

In order to assist in accomplishing their planning, regulatory, implementation, and operations missions, the CEMVN and the other stakeholders in the Atchafalaya Basin need to have access to information (metadata) regarding all of the available watershed data including its current location, type, source, format, and spatial and temporal extent. Further, all of these data should be assembled and made accessible to the CEMVN and stakeholders in digital form through a centralized repository.

To support these goals, the objectives of this project are to:

1) Develop an inventory of the existing GIS data for the ABFS
2) Identify areas where additional data or data conversion is needed
3) Develop a Statement of Work for Creation of a GIS Repository of Watershed-Based Data

Study content and results are based on existing information provided by the Corps, individuals, groups, agencies, institutions, and other organizations combined with onsite visits and interviews conducted by Earth Tech. The objectives of this work are assimilation of metadata and development of a plan for

development of a data repository that will provide organization of existing and proposed data to support the ABFS project, and to assist the CEMVN in their planning processes. This task order identifies, recommends, and presents solutions to the Corps considering known constraints and opportunities based upon data, interviews, and other collected metadata.

Inventory and assessment of ABFS GIS data was accomplished through conducting numerous structured interviews of data holders and augmented with Internet research. Based on the findings of the inventory and assessment, a scope of work for development of an ABFS GIS Repository has been developed. The ABFS Repository Scope of Work is a separate deliverable for Task Order DJ01.

APPROACH

The project consisted of 5 Tasks:

Task 1- Develop List of Agencies/Organizations/Individuals to be Interviewed
Task 2- Create Interview Form
Task 3- Contact Persons to be Interviewed
Task 4- Conduct Interviews
Task 5- Tabulate and Analyze Results

RESULTS

A total of 46 persons participated in the interview process representing over 36 different agencies and organizations. During the interviews a wealth of information was gathered to support the project's data inventory and assessment objectives. For example, Figure ES-1 shows that GIS data in the ABFS are maintained in a variety of formats.

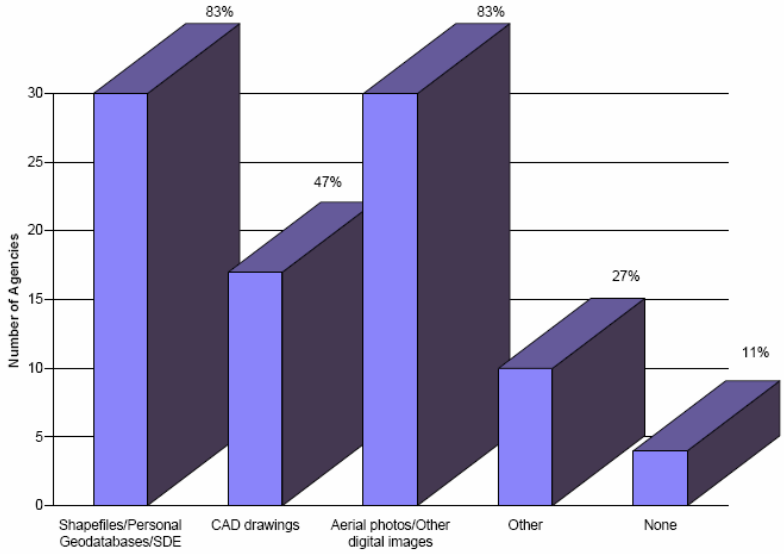


Figure ES-1: Formats of ABFS GIS data in use

The interview form included a metadata table (Table 1) to be completed by survey respondents. Information returned in the form of Table 1 was quite interesting. First, it became clear once the responses were combined, that many organizations have data that at least in name represents similar GIS content. Layers of topography, Digital Elevation Model/Digital Terrain Model (DEM/DTM), hydrography, and many others are represented by several organizations. Figure ES-2 summarizes the types of data layers maintained or used by the various agencies interviewed.

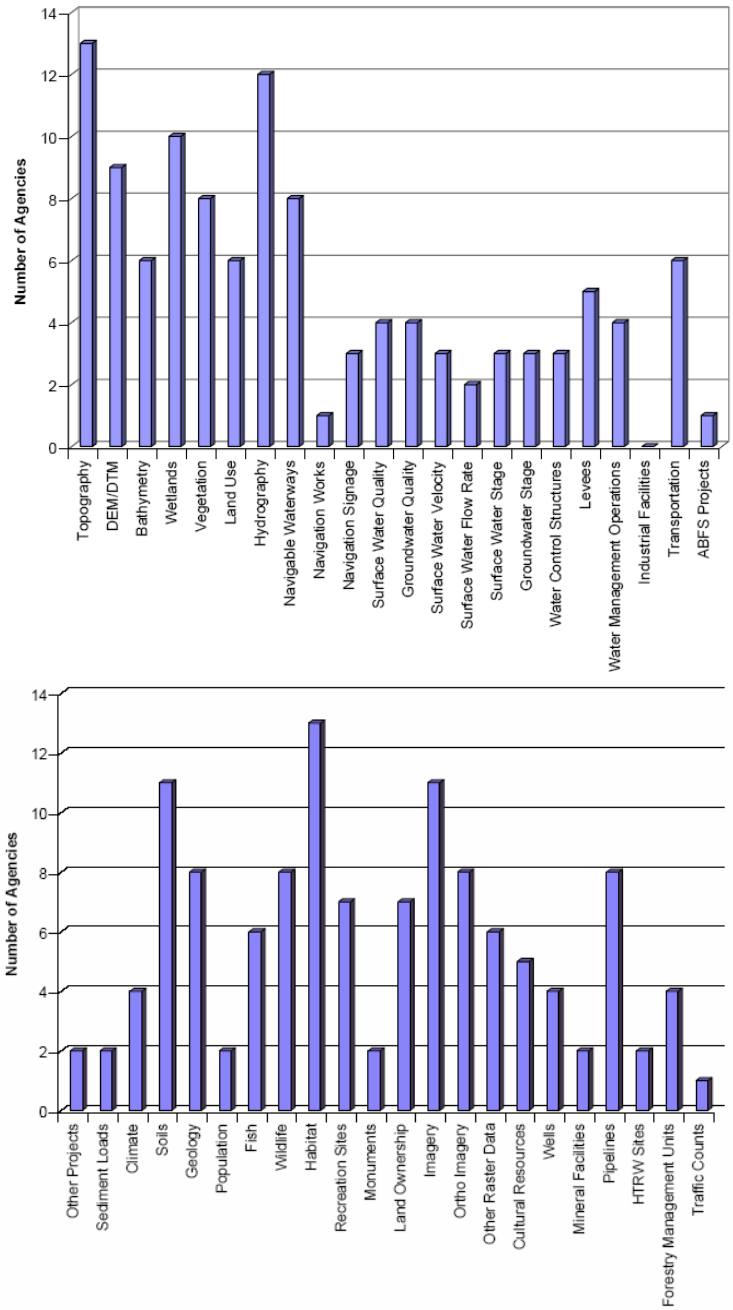


Figure ES-2: Number of agencies reporting specific data layers

Data Deficiencies- Historic black and white aerial photography was mentioned regularly as an important set of data that is not easily accessible or well organized. With work in the Lower ABFS putting so much emphasis on change detection and the dynamics of anthropogenic influences on the environment, a collection of consistent and high quality imagery for baseline analysis is of the utmost importance. There is also a need for an easily accessible data catalog of available GIS layers and associated data. Many users within specific agencies were confident that their particular organization had a wide variety of data available, but when asked for a data dictionary, they were not able to provide that information easily.

Opportunities for ABFS GIS Data Enhancement- Currently there are a number of accessible GIS data repositories as well as websites visualizing spatial data which serve the Louisiana GIS community. Sites hosted by the Department of Natural Resources (DNR), Department of Environmental Quality (DEQ), Louisiana State University (LSU), Federal Emergency Management Agency (FEMA), United States Geological Survey (USGS), and Louisiana Oil Spill Coordinator's Office (LOSCO) are more mature, and logically tend to have a focus on particular data sets, as opposed to spatial extents. Many users expressed an interest in having access to a site that combined the data from the other agencies but allowed the focus to be on the ABFS (or other "project" level spatial extent).

Nearly every interviewee commented that she/he used the DOQQs as their digital imagery. Many interviewees were interested in gaining access to digitized historical photographs. Where the focus is ecosystem assessment and restoration, the historical photos will help users document how areas have evolved over the decades.

Additionally, many of the interviewees wanted access to historical documents or more recent documents in digitized formats. They all understand that the older documents are at risk of being lost forever, especially after the losses from Katrina. More recent documents, such as levee information, are needed in digital form in order to perform queries on their status.

Other Issues/Observations- Overall, the respondents seemed very excited about this project and they were anxious to gain access to the GIS when it was completed. The degree of enthusiasm was dependent on how involved each person was with the ABFS project. Duplication of efforts seems to occur throughout the agencies interviewed in either developing or distributing GIS data. There was also some hesitation to share certain types of data that often could be helpful in the public domain, or at least shared within particular agencies. Limitations on data access could sometimes be explained by security concerns.

CONCLUSIONS

The findings of this study demonstrate a strong interest in organizing GIS data for ABFS specific purposes. It is unlikely that a casual user would have resources and time to research a variety of locations and clearinghouses to find data, sort through layers that appeared to be the same in many respects, load data into a viewing tool and then finally apply the data to their particular planning or design project. The amount of time required for such data extraction efforts can significantly delay and add to the cost of projects.

However, if there were a system which integrated data that had already been screened for use for particular purposes for a particular area, and the data contained in that system was the same data from the original source, users would find that efficient and useful. Current GIS technology exists that will allow development of such a "GeoWeb" and will allow applications for particular study areas to be created that serve specific business processes. Moreover, the technology exists that would allow particular GIS functions like buffering, overlays and other "geoprocessing" functions to be served to project-oriented users in a way that suits their specific data and analysis requirements.

RECOMMENDATIONS

Various categories of recommendations have been developed based on the findings of this investigation. They are summarized below.

A. Address Data Deficiencies

1. Scan and georeference historic aerial photographs into a digital library

2. Obtain or augment specific data types- public land surveys, water quality, sediment, levees and floodwalls, geologic profiles, soils, utilities, roadway access, construction project archives, wetlands, bathymetry, wells, pipelines, and hydrology.

3. Metadata- Develop the ability to review metadata for particular purposes on data served either by the CEMVN or others.

4. Other needs- Review existing layers, create layers for particular project purposes, and connect to layers that have already been served.

B. Develop an Environmental GIS Data Repository and Viewing Tool

1. Review existing and available data to isolate quality data layers of a particular thematic source (i.e., topography) for inclusion in the repository. Existing clearinghouses and repositories should be consulted for metadata details for their data sources. Once a GIS layer has been selected for inclusion in the ABFS repository, the source agency responsible for that layer's maintenance should be identified and encouraged to provide a direct connection to the layer via database or application level integration.

2. Copy layers not accessible via direct connection where permissible by their source agency. When collecting the initial copy of a particular layer, the recipient should note the source agency's metadata for update frequency and contact information. A data update plan should be developed by the recipient to request updates for each such layer from their source agency on the scheduled update.

3. Develop a geodatabase design for the maintenance and connection to each dataset. The design should be built to accept new data layers, attributes for features, or feature classes to minimize redundant effort should the data source change in the future. Use of a Unified Modeling Language (UML) tool such as Microsoft Visio will allow this "living" design to be updated easily when necessary.

4. Develop a viewing tool in a phased approach in order to provide user access to the repository. That is, basic GIS functions should be created to allow users to explore data selected specifically for the ABFS. Additional spatial analysis or reporting functions can be added as user demands increase. The lowest cost per user solution would be to provide access to the repository via an application that can be accessed with an Internet browser. Basic map navigation tools such as pan, zoom, query and a simple printing mechanism can be developed in early stages. As the release of ESRI's ArcGIS Explorer becomes available and is stabilized, additional display options will become available. It will be appropriate at that point to consider developing other spatial services or functions that can be accessed using the ArcGIS Explorer client software.

5. Deploy a public viewing tool separately from a "CEMVN only" viewing tool. As discussed below in Data Security, there may be a need to secure particular data sets from the general public. While both tools may share many of the same interface and functional components, the public version will contain a layer that has been approved for public consumption by the source agency for each layer.

C. Provide Data Security

1. Develop procedures for safe handling of certain data types. This is in addition to general network security issues. Data security and sensitivity is an important issue when dealing with GIS data distribution. Sensitive data such as pipelines, endangered and threatened species locations, and

cultural resources are easily abused and present a risk if distributed indiscriminately. At the same time, these data sets are often necessary to conduct legitimate research and consulting work. Some agencies responsible for development of these "sensitive" layers will not release them for general distribution and consider each data request on a case by case basis.

2. Develop a system to allow public users access to particular GIS data while maintaining a separate interface for more sensitive data sets or business processes. The systems can carry nearly identical interfaces to allow easy transfer of user knowledge from one system to another, but can be served in a fashion that prevents ineligible users from gaining access to sensitive information. The latter may be accomplished by placing the secure system inside a particular agency's firewall on their network, or may be deployed to the Internet in a secure manner requiring specific logon credentials.

D. Develop a Natural Disaster Plan

Data acquisition and availability proved to be a stumbling block during the initial phase of emergency response last hurricane season. GIS has played a major role in the recent hurricane response and recovery phases, and disaster management was still heavily on the minds of most of the individuals interviewed. A number of individuals suggested that the State Office of Emergency Preparedness and FEMA be consulted during this process. It would be responsible and prudent to give some thought to how this sort of clearinghouse might be utilized in the event of an emergency to distribute data to response agencies in a timely manner. In the wake of the hurricanes, many persons knew where the data were, but getting the data consolidated was quite an undertaking. In addition to the datasets made available on the site, it would be sensible to develop a disaster data bundle which could be made available in times of need. This bundle would not be comprised of any different datasets, but would have all of the data considered pertinent to emergency response (critical infrastructure, pipelines, levees, flood control structures, imagery, petrochemical activity locations, transportation, boat launches, etc.) in the ABFS compiled in one easily accessible file. This approach would minimize the amount of time and effort that emergency response volunteers and personnel would require to find datasets in the event of a disaster. This special emergency use geodatabase could be maintained regularly as a separate activity.

1. INTRODUCTION

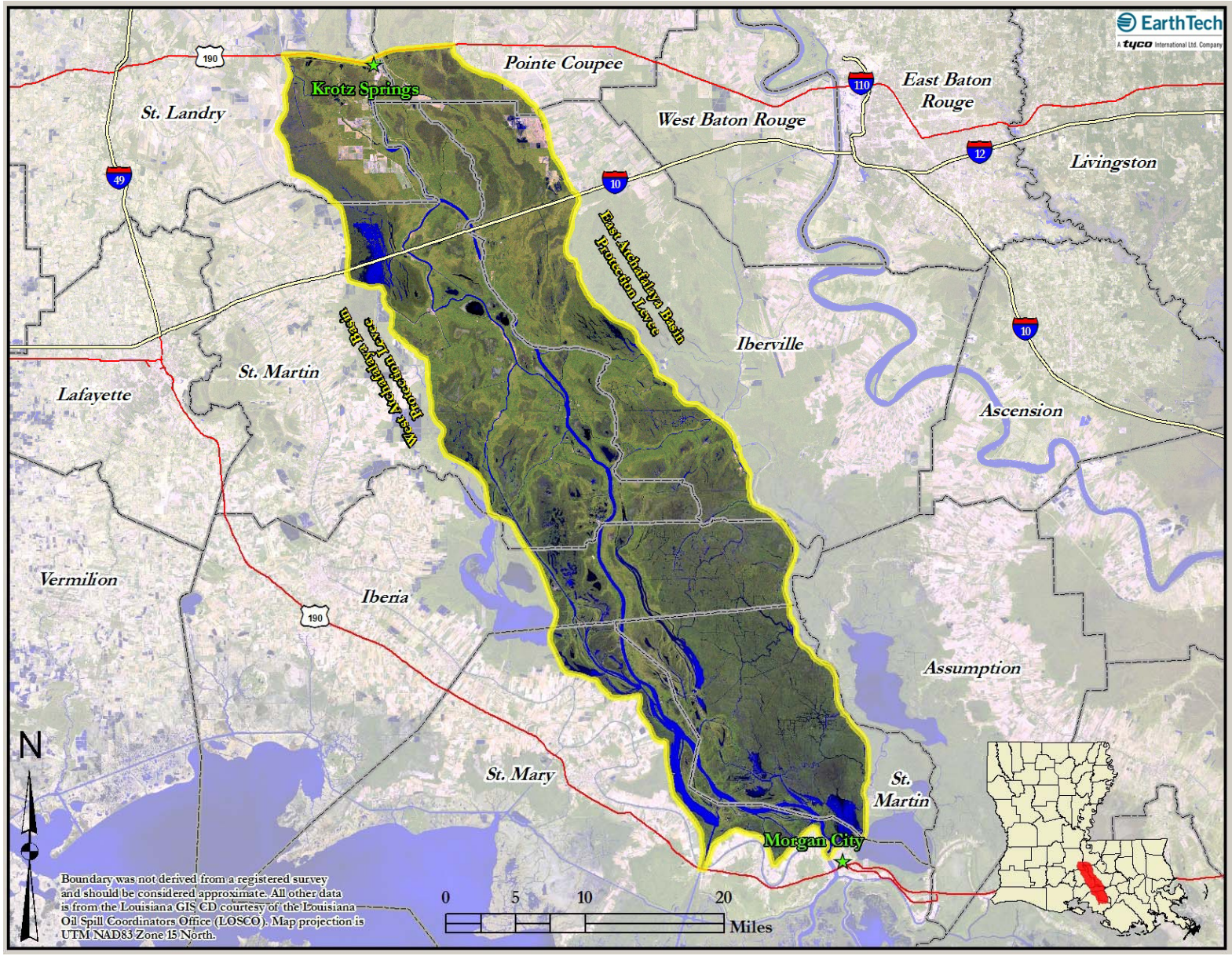
This project (FA4890-04-D-0007 Task Order DJ01) has developed an inventory and assessment of watershed-based GIS information for the Atchafalaya Basin.

The Chief of Engineers Report dated February 1983 recommended implementation of six Features in the Atchafalaya Basin Floodway System (ABFS). These features are: Public Access, Flood Control, Environmental Protection, Water Management Units (WMU), Recreation, and Canal Closure and Water Circulation within the ABFS. The ABFS Project has two major, mutually supporting goals: to preserve the environmental values of the nation's largest river, cypress and tupelo swamps, their bayous and abundant water and land species, and to insure that the Lower Atchafalaya Basin can pass a flood of 1.5 million cubic feet per second as required by the Mississippi River and Tributaries Project. Today, over 25 projects are underway in the ABFS in pursuit of these goals.

Study Area: The project location is the Lower ABFS, covering an area approximately 15 miles wide, and 65 miles long, extending from the latitude of Krotz Springs, LA to the approximate latitude of Morgan City, LA. Figure 1-1 shows the Study Area. The ABFS lies in part within Iberville, Iberia, Pointe Coupe, St. Martin, St. Mary, and St. Landry Parishes. The northern boundary of the project area is U.S. Highway 190; the western boundary is the West Atchafalaya Basin Protection Levee (WABPL), and the eastern boundary being the East Atchafalaya Basin Protection Levee (EABPL). The southern boundary is the U.S. 90 Highway Bridge crossing the Atchafalaya Basin Main Channel at Morgan City, LA.

Area within these limits is calculated at approximately 595,000 acres (930 sq/mi) composed mostly of sparsely inhabited woodland and wetland terrain. There is some agricultural use, commercial trapping, fishing, campsites, levees pasture. Interstate 10 (I-10), an elevated highway, is the only roadway traversing the project. Access within the area is via state highways, secondary roads, and navigable waters.

Figure 1: Atchafalaya Basin Floodway System Study Area



2. PROBLEM STATEMENT

Planning, construction, and operation of current and future ABFS projects require access to a wide range of geospatial data regarding physical, chemical, and biological characteristics of the ABFS. Examples are topography, water quality, hydrography, property ownership, recreation sites, public access locations, water levels, and flows. Over the years vast amounts of data have been generated by various public and private entities. These data reside in the GIS files of the CEMVN as well as other agencies, state and local governments, and organizations.

Project Objective: In order to assist in accomplishing their planning, regulatory, implementation, and operations missions, the CEMVN and the other stakeholders in the Atchafalaya Basin need to have access to information (metadata) regarding all of the available watershed data, including its current location, type, source, format, and spatial and temporal extent. Further, all of these data should be assembled and made accessible to the CEMVN and stakeholders in digital form through a centralized repository.

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3. METHODOLOGY

Inventory and assessment of ABFS GIS data was accomplished through conducting numerous structured interviews of data holders and augmented with Internet research. Based on the findings of the inventory and assessment, a scope of work for development of an ABFS GIS Repository has been developed. *The ABFS Repository Scope of Work is a separate deliverable for Task Order DJ01*.

Tasks performed for the inventory and assessment are listed below and described in the following paragraphs.

Task 1 - Develop List of Agencies/Organizations/Individuals to be Interviewed
Task 2 - Create Interview Form
Task 3 - Contact Persons to be Interviewed
Task 4 - Conduct Interviews
Task 5 - Tabulate and Analyze Results

Task 1 - Develop List of Agencies/Organizations/Individuals to be Interviewed

Earth Tech and the CEMVN Project Manager developed a list of agencies and organizations to be interviewed. The list focused on agencies and organizations that were likely to collect, store, or use ABFS watershed data. A key person to be interviewed (contact person) was identified for each agency or organization.

Task 2 - Create Interview Form

An interview form was developed to obtain consistent and complete information during the interview process. The details of this interview form are discussed in Section 4.A of this report. Along with the interview form, a Microsoft Excel based spreadsheet for collection of GIS metadata entitled "Table 1-GIS Metadata in the Lower Atchafalaya Basin Floodway System" was also developed for collecting information about the GIS layers that a particular organization might possess. Respondents were provided instructions that they were welcome to add data types to Table 1 should the initial list of layers provided not include a data type that they possess.

The goals of the interview form were first to standardize the questions asked of each interviewee and secondly to standardize the responses as from the wide variety of interviewees. It is important to note this wide variety of interviewees. The range of agencies and respondents spanned from very GIS-oriented professionals to casual users of GIS in non-GIS centered disciplines.

The form was structured to permit the creation of a spreadsheet or database of the response data. A blank copy of Table 1 was provided to interviewees prior to the interview listing various data types being sought by the project team. The interview form included the following sections:

- Contact Information for Person(s) Interviewed
- Organizational Information
- Computers/Servers
- GIS Software
- GIS Data
- Other Questions/Comments

The complete package sent to potential contact persons included a Letter of Introduction from the CEMVN Senior Project Manager and a sheet of Instructions for Respondent from the Earth Tech Project Manager. Appendix A contains the interview form and associated documentation sent to potential contact persons.

Task 3 - Contact Persons to be Interviewed

A telephone call was placed to each potential contact person to schedule an interview and arrange for e-mail transmittal of the interview package (Appendix A). As is normally the case with such surveys, several potential contact persons were not responsive or provided the name of another person in their organization who was more suited to be the contact person. Contact persons for some organizations could not be identified. Following repeated attempts to reach the potential contact person via telephone or e-mail, those that were non-responsive or otherwise unavailable were dropped from the interview list. Based upon the responsive contacts, a final list of persons to be interviewed was prepared and submitted to the CEMVN project manager for approval. Appendix B is the list of persons that were interviewed.

Task 4 - Conduct Interviews

Personal interviews were conducted by one or more representatives from the Earth Tech Team. The person(s) conducting the interviews was/were specialists in GIS, information technology, and/or water resources. The interview form provided the agenda for the interview session and was filled out to the extent possible. Table 1 was either filled out during the interview or was submitted later by the agency/organization contact person. Some group interviews were conducted where multiple agencies/organizations or departments within agencies/organizations were represented. This was done where the contact persons were co-located or had related responsibilities. In a few cases, scheduling a personal interview was impossible due to schedule constraints and a telephone interview was conducted.

Task 5 - Tabulate and Analyze Results

The results of interviews were entered into a database and additional narrative was provided as necessary to document the findings. Where two Earth Tech Team members conducted the interview, the designated lead interviewer incorporated the notes and observations of the assistant interviewer. Table C-1 in Appendix C provides a summary of the GIS metadata (Table 1) available from the various agencies, the completed interview forms and related documentation. As is to be expected in a data survey, the format and extent of metadata provided by respondents in Table 1 varied widely. Some respondents closely followed the format of Table 1 and seemed to report most or all of the types of data available from their agency or organization. Others provided only an abbreviated response and may not have reported all of the types of data available. The GIS metadata summary in Appendix C combines these various responses.

Based upon the collected metadata in Table 1 and the interview discussions, the Earth Tech interview teams identified general data deficiencies (spatial and temporal coverages only) relative to ABFS goals and objectives. The interview team also identified problems and opportunities for enhancement of such ABFS data.

4. FINDINGS

A total of 46 persons participated in the interview process representing over 36 different agencies and organizations. Appendix B lists the names, affiliations, and contact information for all persons contacted. The second column indicates interview status as "completed" for those who were interviewed. A number of persons were not available for an interview or referred the interview team to another more suitable contact person. During the interviews a wealth of information was gathered to support the project's data inventory and assessment objectives. This section provides an overview of the responses to the interview form and the metadata provided. Based on the interviews, this section also discusses data deficiencies, opportunities for ABFS GIS data enhancement, and other issues/observations.

In general, the findings from the interview form followed along industry trends. Operating systems running some form of Microsoft Windows prevail in the ABFS user community along with use of ESRI GIS software. There are exceptions to these majorities. The growing trend in the information technology industry in general and the GIS industry specifically toward interoperable standards makes these exceptions less of a concern than they may have been just a few years ago.

4.1 INTERVIEW FORM RESULTS

These subsections provide a summary of results of the 44 interviews conducted as of August 29, 2006 and follow the headings of the interview form.

Computer Operating Systems: Figure 2 summarizes the responses regarding operating system and indicates that about 80% of those interviewed use Windows XP.

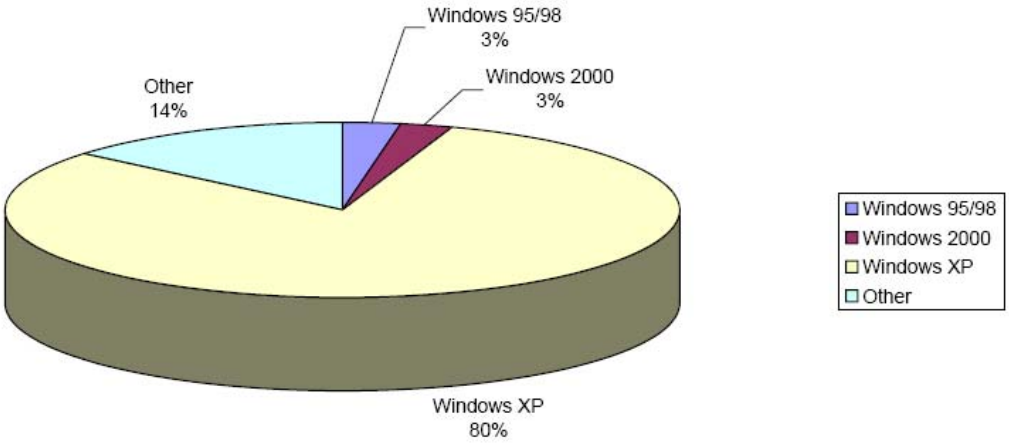

Figure 2: Percentages of various operating systems in use by respondents

GIS Software: Similar to operating systems, Figure 3 shows that the products developed by ESRI are used most frequently. Many of the respondents that use other GIS software also use ESRI products. Other products include Google Earth, Google Maps and ERDAS Imagine. There are some respondents that have not implemented any GIS software at all.

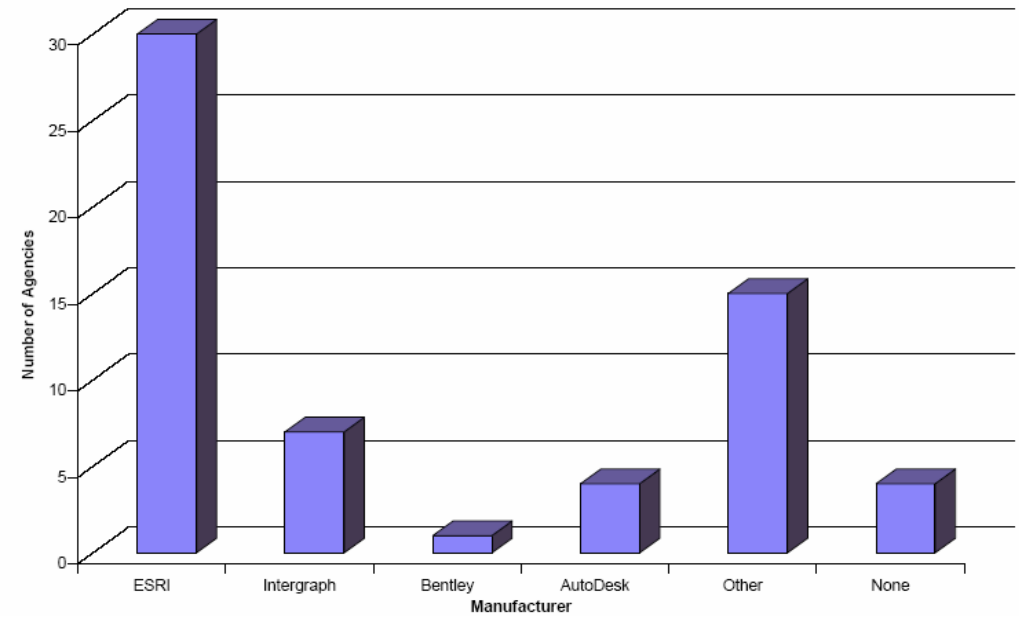

Figure 3: Number of respondents implementing various GIS software

GIS Data Formats: As shown on Figure 4, GIS data in the ABFS can be maintained in a variety of formats by today's interoperable software products. The team found that users in the ABFS most commonly store data in their software vendors' formats.

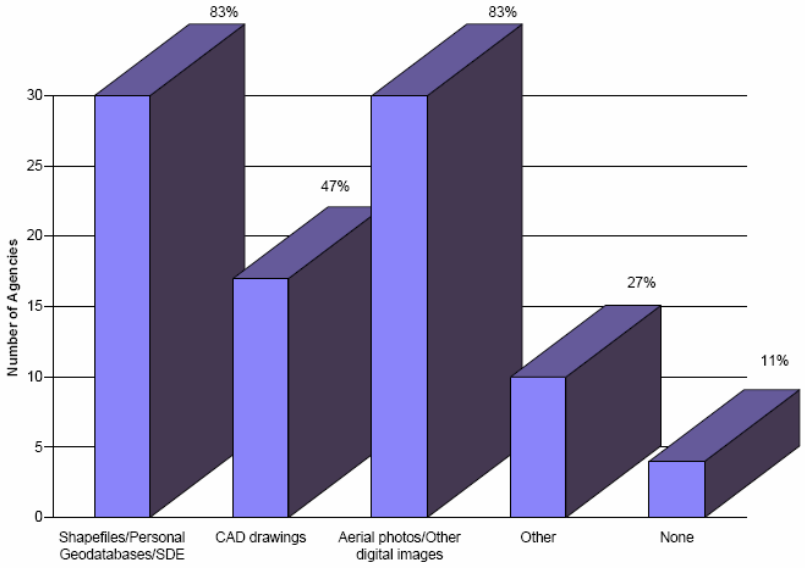

Figure 4: Formats of ABFS GIS data in use

Databases in Use: Users were asked what type of other data they might have stored in other databases or formats. The purpose of this question was to explore the potential for incorporating those other data sets as input to further attribute parts of GIS data sets that may already exist or potentially develop new data from those sources. Responses are summarized in Figure 5. Many of the respondents reported using some form of relational database, and there is a considerable amount of data stored in non-relational formats such as Microsoft Excel.

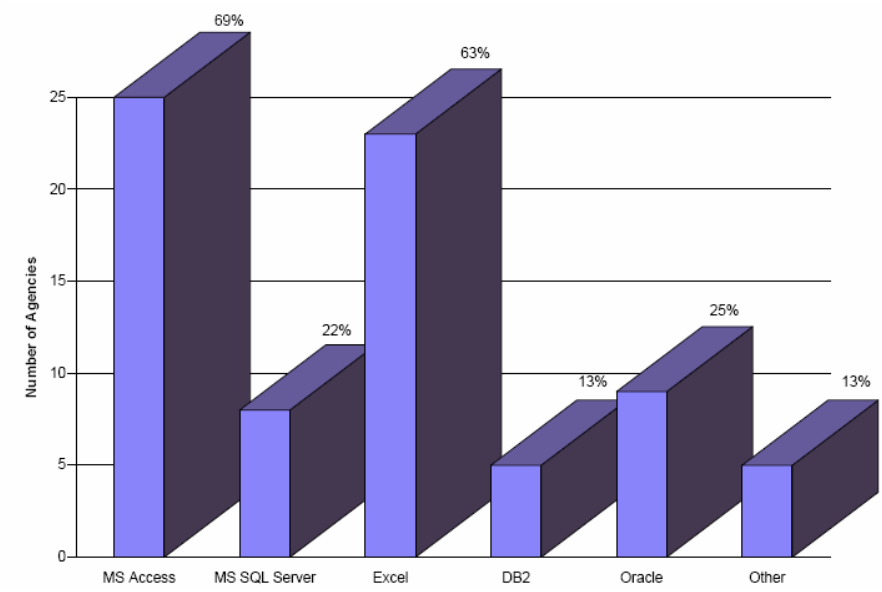

Figure 5: Types of databases in use for the ABFS

4.2 METADATA – TABLE 1

The information returned in the form of Table 1 was quite interesting. First, it became clear once the responses were combined, that many organizations have data that at least in name represents similar GIS content. Layers of topography, Digital Elevation Model/Digital Terrain Model (DEM/DTM), hydrography, and many others are represented by several organizations.

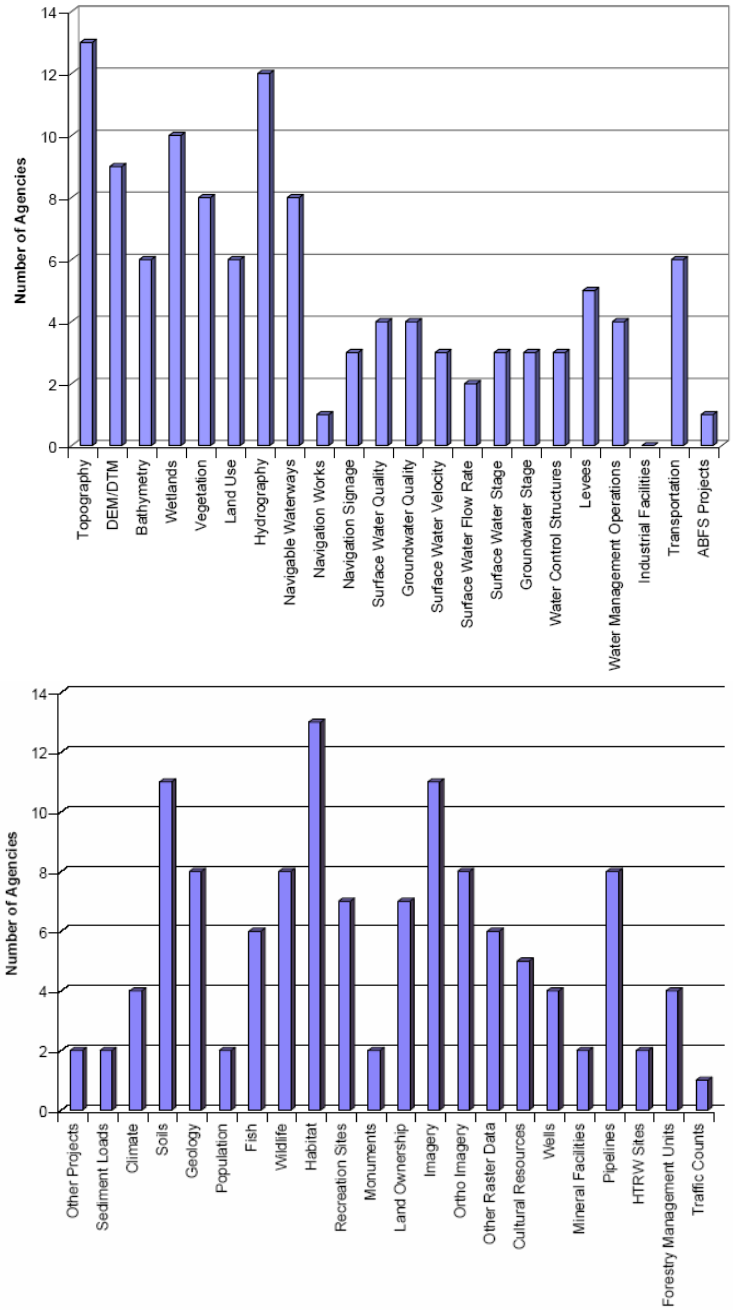

Figure 6: Number of agencies reporting specific data layers

Other information access points also exist. The majority of organizations interviewed for this study develop GIS data that is shared with others. A similar percentage of respondents reported regularly receiving GIS data from another organization.

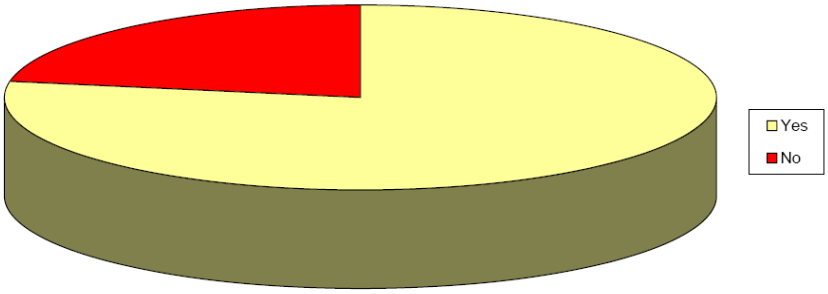

Figure 7: Percentage of organizations that share GIS data with others

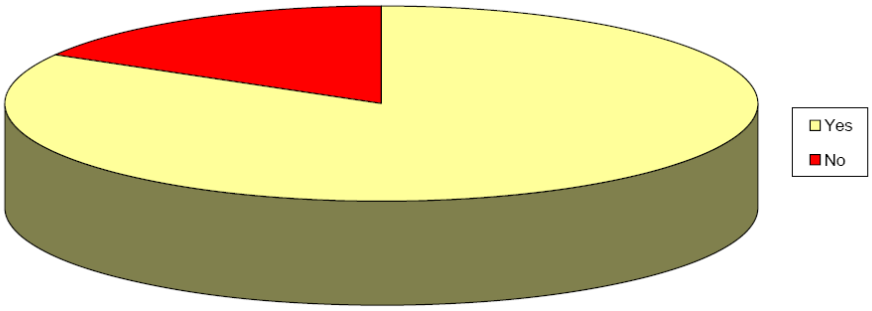

Figure 8: Percentage of organization that receive GIS data from others

4.3 DATA DEFICIENCIES

Despite the broad spectrum of agencies, private sector users, and university officials interviewed for this project, a number of common data issues and needs were revealed during dialogue regarding development of a GIS data repository for the ABFS.

The most pervasive of these issues was the need for coverage and accessibility of historic black and white aerial photography. This imagery was mentioned regularly as an important set of data that is not easily accessible or well organized. With work in the ABFS putting so much emphasis on change detection and the dynamics of anthropogenic influences on the environment, a collection of consistent and high quality imagery for baseline analysis is of the utmost importance. Most of the respondents would like to see the

imagery scanned into a digital library (georeferenced if possible), and thoroughly catalogued with a web based spatial index to aid research. Other common features considered to be incomplete or not readily available in this area include accurate public land survey data, water quality, sediment, levee and floodwalls, geologic profiles, soils, utilities, roadway access, construction project archives, wetlands, bathymetry, precise wells and pipeline data, as well as up-to-date hydrology data.

There is also a need for an easily accessible data catalog of available GIS layers and associated data. Many users within specific agencies were confident that their particular organization had a wide variety of data available, but when asked for a data dictionary, they were not able to provide that information easily. Few details were available on metadata from many of the organizations beyond the name and general content of a particular layer. Information on feature classes, attributes, coordinate systems, and update frequency for layers was either not available or not forthcoming in some instances.

4.4 OPPORTUNITIES FOR ABFS GIS DATA ENHANCEMENT

A robust and connected set of GIS technical users has resulted in widespread use of the same datasets in the regional GIS community. Many of the base map layers (both imagery and many vector layers) exist at several agencies in various forms, some from the same original source, though changes for a particular agency were commonly mentioned. There are several sources of GIS data that exist spatially within the ABFS. From a data perspective, these repositories could serve as substantial sources for a ABFS focused interface to the GIS data. Care would need to be given to not replicate functions unless they are specifically addressing a need for ABFS users. Currently, a casual user interested in GIS information regarding data availability within the ABFS boundary would need to connect with a more technically savvy GIS professional to find data that would interest them.

Currently there are a number of accessible GIS data repositories as well as websites visualizing spatial data which serve the Louisiana GIS community. Sites hosted by the Department of Natural Resources (DNR), Department of Environmental Quality (DEQ), Louisiana State University (LSU), Federal Emergency Management Agency (FEMA), United States Geological Survey (USGS), and Louisiana Oil Spill Coordinator's Office (LOSCO) are more mature, and logically tend to have a focus on particular data sets, as opposed to spatial extents. Many users expressed an interest in having access to a site that combined the data from the other agencies but allowed the focus to be on the ABFS (or other "project" level spatial extent).

Nearly every interviewee commented that she/he used the DOQQs as their digital imagery. With the exception of a CEMVN field office, the interviewees were interested in gaining access to digitized historical photographs. Where focus is ecosystem assessment and restoration, the historical photos will help users document how areas have evolved over the decades. The CEMVN field office is a management office versus a restoration office, and they were interested in frequently updated aerial

photos, annually if possible, to assist them in managing the lands for easements, logging, construction, etc.

Additionally, many of the interviewees wanted access to historical documents or more recent documents in digitized formats. They all understand that the older documents are at risk of being lost forever, especially after the losses from Katrina. More recent documents, such as levee information, are needed in digital form in order to perform queries on their status. Significant time and effort is put into performing hand calculations from information contained in books of design plates. Additionally, some Corps offices were concerned with not having or finding data that had been previously collected in their project areas. Many of those data are filed away with people not knowing where the data are currently located. Project budgets pay for recollecting data that already exist because people do not know where those data are or because they do not know that such data have already been collected.

4.5 OTHER ISSUES/OBSERVATIONS

Overall, the respondents seemed very excited about this project and they were anxious to gain access to the GIS when it was completed. The degree of enthusiasm was dependent on how involved each person was with the ABFS project. Those who worked on it consistently, both as part of USACE and as outside agencies, had many suggestions and significant data to add to the system. Those that were only tangentially associated with the project were less interested and had little or nothing to contribute to populating the data. The format and details of their available data were also dependent on their involvement. Some already had their data in database format, while others possessed written notes or had personal knowledge not in written form.

There does appear to be some duplication of efforts throughout the agencies interviewed in either developing or distributing GIS data. There was also some hesitation to share some types of data that often could be helpful in the public domain, or at least shared within particular agencies. Limitations on data access could sometimes be explained by security concerns. Unnecessary limiting of access to data can cause another agency needing that data to turn to other sources and/or spend significant budget for collection of redundant data.

5. CONCLUSIONS

The findings of this study demonstrate a strong interest in organizing GIS data for ABFS specific purposes. While there are a number of Louisiana repositories and interfaces available for accessing ABFS GIS data, they contain only portions of the available data, require considerable GIS technical capabilities to understand and access the data and to select the particular components that might pertain to a particular use in the ABFS.

There appears to be considerable data redundancy throughout the GIS community as surveyed. As described earlier, many agencies list the same data layers or similar (in name) data layers. This implies that multiple copies of what is or at least may have begun as the same data set are maintained separately by different organizations for differing purposes. Certainly recent technological developments have improved that process, but prior to selecting a data set, a casual user would need to have some knowledge of these various copies to be able to make a decision of which layer to use.

It is unlikely that a casual user would have resources and time to research a variety of locations and clearinghouses to find data, sort through layers that appeared to be the same in many respects, load data into a viewing tool and then finally apply the data to their particular planning or design project. The amount of time required for such data extraction efforts can significantly delay and add to the cost of projects.

However, if there were a system which integrated data that had already been screened for use for certain purposes for a particular area, and the data contained in that system were the same data from the original source, users would find that efficient and useful. Current GIS technology exists that will allow development of such a “GeoWeb” and will allow applications for particular study areas to be created that serve specific business processes. Moreover, the technology exists that allows particular GIS functions like buffering, overlays and other “geoprocessing” functions to be served to project-oriented users in a way that suits their specific data and analysis requirements.

One need only look to a service like Google Earth for a perfect example. Several respondents mentioned that they were using a professional version of Google Earth or were at least familiar with the free version from use at home. Google Earth integrates multiple layers of information (served remotely), GIS processing functions on particular data sets (routing, proximity functions, etc.) and allows the user to integrate or create other data from their local computing environment or other input such as global positioning systems (GPS) and the like. The interface is easily understood and users can quickly become familiar and adept with complex operations. ESRI will soon be releasing a free data viewing and geoprocessing integration client product carrying the ArcGIS Explorer name. This application provides a Google Earth like interface and base map data, but also allows GIS professionals to integrate existing GIS

data served via ArcIMS, ArcSDE or geoprocessing functions served via ArcGIS Server for consumption by users within their agency, or to the rest of the world via the Internet if they so choose.

6. RECOMMENDATIONS

Various categories of recommendations have been developed based on the findings of this investigation. They are summarized below.

6.1 ADDRESSING DATA DEFICIENCIES

1. Scan and georeference historic aerial photographs- most of the users interviewed would like to see the imagery scanned into a digital library (georeferenced if possible), and thoroughly catalogued with a web based spatial index to aid research.
2. Obtain or augment specific data types- public land surveys, water quality, sediment, levees and floodwalls, geologic profiles, soils, utilities, roadway access, construction project archives, wetlands, bathymetry, wells, pipelines, and hydrology.
3. Metadata: Develop the ability to review metadata for particular purposes on data served either by the CEMVN or others.
4. Other needs- Review of existing layers, creation of some layers for particular project purposes, and connecting to layers that have already been served.

6.2 ENVIRONMENTAL GIS DATA REPOSITORY AND VIEWING TOOL

- A thorough review of existing and available data should be performed to isolate quality data layers of a particular thematic source (i.e., topography) for inclusion in the repository. Existing clearinghouses and repositories should be consulted for metadata details for their data sources. Once a GIS layer has been selected for inclusion in the ABFS repository, the source agency responsible for that layer's maintenance should be identified and encouraged to provide a direct connection to the layer via database or application level integration.

- Layers not accessible via direct connection should be copied where permissible by their source agency. When collecting the initial copy of a particular layer, the recipient should note the source agency's metadata for update frequency and contact information. A data update plan should be developed by the recipient to request updates for each such layer from their source agency on the scheduled update.

- A geodatabase design can then be developed for the maintenance and connection to each dataset. The design should be built to accept new data layers, attributes for features, or feature classes to minimize redundant effort should data sources change in the future. Use of a Unified Modeling Language (UML) tool such as Microsoft Visio will allow this "living" design to be updated easily when necessary.

- In order to provide user access to the repository, a viewing tool should be developed in a phased approach. That is, basic GIS functions should be created to allow users to explore data selected specifically for the ABFS, and additional spatial analysis or reporting functions can be added as user demands increase. The lowest cost per user solution would be to provide access to the repository via an application that can be accessed with an Internet browser. Basic map navigation tools such as pan, zoom, query and a simple printing mechanism can be developed in early stages. As the release of ESRI's ArcGIS Explorer becomes available and is stabilized, additional display options will become available. It will be appropriate at that point to consider developing other spatial services or functions that can be accessed using the ArcGIS Explorer client software.

- As discussed below in Data Security, there may be a need to secure particular data sets from the general public. It is recommended that a public viewing tool be deployed separately from a "CEMVN only" viewing tool. While both tools may share many of the same interface and functional components, the public version will contain a layer that has been approved for public consumption by the source agency for each layer.

6.3 DATA SECURITY

- In addition to general network security issues, consideration must be given to the safe handling of certain data types. Data security and sensitivity is an important issue when dealing with GIS data distribution. Sensitive data such as pipelines, endangered and threatened species locations, and cultural resources are easily abused and present a risk if distributed indiscriminately. At the same time, these data sets are often necessary to conduct legitimate research and consulting work. Some agencies responsible for development of these "sensitive" layers will not release them for general distribution and consider each data request on a case by case basis.

- To work around this issue, a recommended approach would be to develop a system to allow public users access to particular GIS data while maintaining a separate interface for more sensitive data sets or business processes. The systems can carry nearly identical interfaces to allow easy transfer of user knowledge from one system to another, but can be served in a fashion that prevents ineligible users from gaining access to sensitive information. The latter may be accomplished by placing the secure system inside a particular agency's firewall on their network, or may be deployed to the Internet in a secure manner requiring specific logon credentials.

6.4 NATURAL DISASTER PLAN

Data acquisition and availability proved to be a stumbling block during the initial phase of emergency response last hurricane season. GIS has played a major role in the recent hurricane response and recovery phases, and disaster management was still heavily on the minds of most of the individuals interviewed. A

number of individuals suggested that the State Office of Emergency Preparedness and FEMA be consulted during this process. It would be responsible and prudent to give some thought to how this sort of clearinghouse might be utilized in the event of an emergency to distribute data to response agencies in a timely manner. In the wake of the hurricanes, many persons knew where the data was, but getting it consolidated was quite an undertaking. In addition to the datasets made available on the site, it would be sensible to develop a disaster data bundle which could be made available in times of need. This bundle would not be comprised of any different datasets, but would have all of the data considered pertinent to emergency response (critical infrastructure, pipelines, levees, flood control structures, imagery, petrochemical activity locations, transportation, boat launches, etc.) in the ABFS compiled in one easily accessible file. This approach would minimize the amount of time and effort that emergency response volunteers and personnel would require to find datasets in the event of a disaster. This special emergency use geodatabase could be maintained regularly as a separate activity.

APPENDIX A
QUESTIONNAIRE

APPENDIX B
LIST OF CANDIDATES AND PARTICIPANTS

APPENDIX C
INTERVIEW DOCUMENTATION