CENPD-DM(CENPW-IM/3 Mar 88) (18) 1st End Mr. Brittain/fna/3714
SUBJECT: Approval to Acquire a Geographic Information Management System (GIS)

DA, North Pacific Division, Corps of Engineers, PO Box 2870, Portland, Oregon
97208-2870 25 March 1988

FOR: Commander, Walla Walla District, ATTN: CENPW-DM

Approval is granted to proceed with acquisition of a Geographic Information System (GIS). It is also requested that a quarterly progress report be furnished validating savings and evaluating the feasibility of implementing the system throughout CENPW, CENPP, and CENPS. Point of contact for GIS for CENPD is Mr. Frank McDonald, CENPD-PL-E.

FOR THE COMMANDER:

JAMES R. FRY
Colonel, Corps of Engineers
Deputy Commander

2 Encls
nc

DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT, CORPS OF ENGINEERS
201 NORTH THIRD AVENUE
WALLA WALLA, WASHINGTON 99362-1876

Reply To
Attention Of:

CENPW-IM (25-2) 3 March 1988

MEMORANDUM FOR: Commander, North Pacific Division, ATTN: Chief, Information Management Office

SUBJECT: Approval to Acquire a Geographic Information System (GIS)

1. References:

a. Memorandum, CENPW-IM, dated 23 November 1987, subject: same as above (Encl 1).

b. Memorandum, CENPD-IM, dated 23 December 1987, subject: same as above (Encl 2).

2. The report submitted by the HQNPD Streamlining Committee and approved by the Division Commander recommended that the Walla Walla District mission functions remain essentially unchanged. In accordance with reference 1.b., the District's Geographic Information System (GIS) Study has been reviewed for possible changes in workload and benefits that would occur because of streamlining. District streamlining will not affect the application of GIS and it is planned to proceed with the acquisition of the system as outlined in the study.

RICHARD M. ELY
LTC, CE
Acting Commander

2 Encls

DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT, CORPS OF ENGINEERS
201 NORTH THIRD AVENUE
WALLA WALLA, WASHINGTON 99362-1876

Reply To
Attention Of:

CENPW-IM (18-3a) 23 November 1987

MEMORANDUM FOR: Commander, North Pacific Division, ATTN: Chief, Information Management Office

SUBJECT: Approval to Acquire a Geographic Information System (GIS)

1. Enclosed is a copy of Walla Walla District's Geographic Information System (GIS) Study (Encl 1). This study focuses upon the requirements and costs for utilizing the computer sciences and associated technology for the planning and management of the District's geographically distributed resources such as vegetation, soils, hydrography, cultural resources, recreation facilities, etc., GIS is an extension of our Computer Aided Design and Drafting (CADD) functions into the land use and environmental areas using master planning techniques.

2. The study has been reviewed by the District's Information Management steering committee. The committee concurred that the District should proceed with the acquisition of a five-workstation GIS with phased implementation over a 4-year period. GIS applications are included in the technical specifications of the Corps-wide CADD contract under Master Planning. Because of the favorable pricing, ease of procurement, and assurance that GIS and CADD will be totally compatible, the GIS hardware and most of the software will be purchased from the Corps-wide CADD Contract DACW87-87-D-0092. A breakdown of GIS hardware and software costs by item and fiscal year are shown on Encl 2 and 3. The costs shown on the enclosures differ somewhat from the costs in the GIS study. The study costs were based upon estimates, whereas Encl 2 and 3 costs are based upon line-item prices from the Corps-wide CADD contract. PRIP funds have been requested and approved to purchase the GIS hardware that will be installed in FY 88. Fiscal year operating monies will be used to acquire the GIS software. The FY 88 installation of GIS hardware is part of the District's Automated Resource Master Plan (ARMP).

3. A summary of the GIS is on page 15, paragraph 9.0, of the enclosed study. As stated in the summary, completing the District's assessed GIS workload with modern technology, rather than manual methods, results in a savings to the District of approximately $1 million over the 7-year useful life of the system.

4. Request authority to procure 3 total GIS system with phased FY procurements of hardware .and software as shown on Enc1 2 and 3.

Total hardware cost is estimated to be $245,871 and total software costs will be $96,88. Purchases will be made by the Contracting Officer in accordance with applicable procurement directives.

FOR THE COMMANDER:

RICHARD M. ELY
LTC, CE
Deputy Commander

3 Encls . .

DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT, CORPS OF ENGINEERS
201 NORTH THIRD AVENUE
WALLA WALLA, WASHINGTON 99362-1876

Reply To
Attention Of:

CENPD-IM (25-5b) 23 December 1987

MEMORANDUM FOR: Commander, Walla Walla District, ATTN: Chief, Information Management Office

SUBJECT: Approval to Acquire a Geographic Information System (GIS)

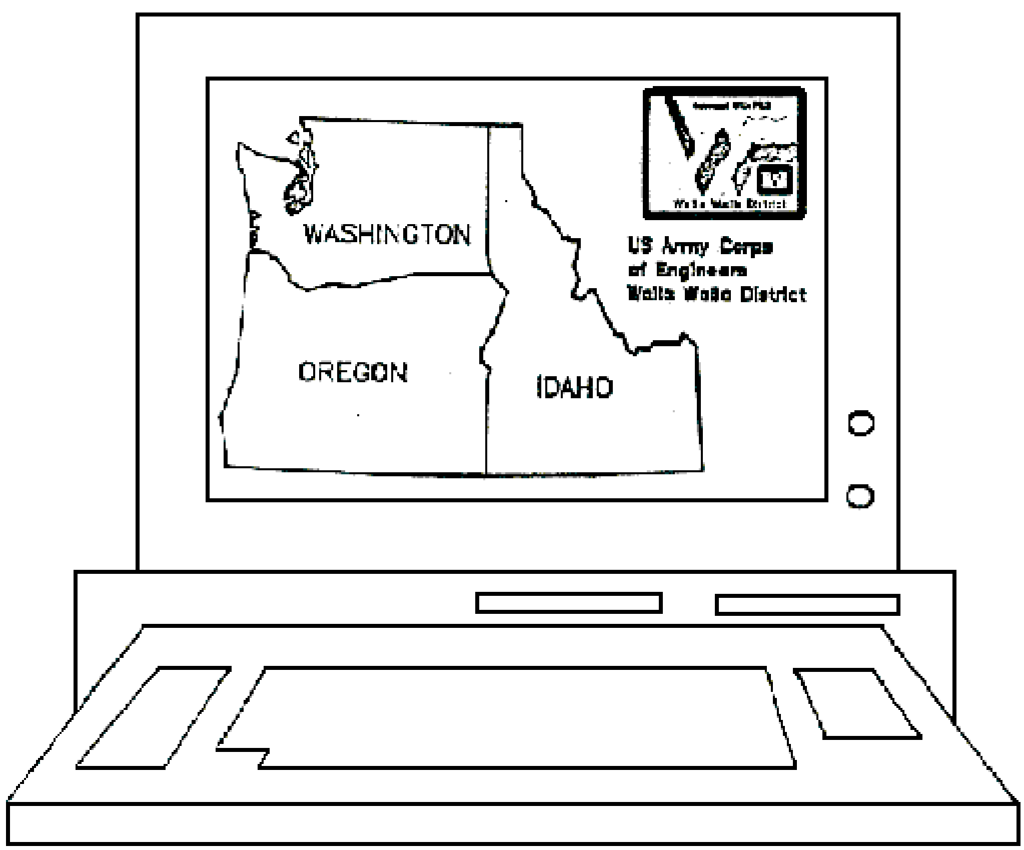
1. Refer to your memorandum, dated 23 November l987, subject as above.

2. Your request is approved subject to re-validation of benefits based on workload projections for CENPW resulting from the CENPD Streamlining Study. No GIS acquisitions should be made prior to completion of the study.

FOR THE COMMANDER:

JAMES R. FRY
Colonel, Corps of Engineers
Deputy Commander

Justification & Acquisition Plan
for
Walla Walla District
Geographic Information System
Computerized Map & Resource Analysis



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1. Background

1.1 General. The Walla Walla District is a Civil Works District established in 1948 to assume responsibility for the Snake River Watershed. Until the mid 70's, the workload consisted primarily of large dam project construction on the Snake and Columbia River systems. Since that time projects have gotten smaller and more emphasis has been put on Operations and Maintenance work. There is a greater need to manage water and lands and mitigate resource problems created by the construction years. Budgets and personnel to accomplish these important but different activities have been reduced to levels that make it necessary to utilize the most efficient methods available. The need to access and analyze natural resource data in a timely and efficient manner has become critical for those establishing policy, making decisions, and planning management activities.

The Corps manages and plans for the uses of geographically distributed natural resources such as vegetation, soils, recreational opportunities, and cultural resources. To locate and manage them, the Corps uses manually prepared maps and map overlays. These traditional methods are dependent upon personnel ceilings and/or project time frames to accomplish the tasks at hand. Also, some analysis are virtually impossible to accomplish using manual methods.

Possible alternatives to accomplish the workload include:

1. Increasing or reassigning personnel in required areas to complete planning and resource management tasks using the existing manual mapping and mapping analysis methods.

2. Providing automated map analysis capabilities for lands, resource management, and master planning specialists.

3. Continuing to forgo or postpone some of the work.

Increasing personnel is no longer a viable option for most managers in these days of stringent personnel ceilings. Reassigning personnel can sometimes be accomplished and with some efficiency if the workload for the reassigned is not just as large and critical as the other. However, with a smaller workforce being asked to accomplish the district workload, an effort must be made to increase their efficiency.

Work also cannot be postponed or forgone for long without potentially serious consequences occurring at some point. These might include environmental, budgetary, workforce level, sociological consequences brought on by internal and external reviews of our accomplishments.

Often, the amount of information we need to use surpasses our ability to manage it. An Automated Geographic Information System (GIS) can help solve this problem by allowing the resource manager to rapidly examine numerous alternatives and management options. The manager can recall information from the system
without depending solely on his own memory, (and which is never “lost”), and conduct analyses which were not possible using manual procedures.

A Geographic Information System (GIS) can provide the capability to analyze and interpret information for a broad range of resource management and master planning applications. It can be used to address significant questions in a variety of critical areas, and is a powerful analytical tool capable of handling a vast quantity of data in a timely, effective manner that allows for assessment of various alternatives.

A GIS stores, displays, retrieves, and analyzes spatial data (data located on the earth s surface). It is similar to other automated information systems except that it handles spatial data instead of just words and numbers. Since spatial data can be tied to specific geographic locations, the system can model or simulate land uses and resources values.

An automated GIS is more than a sophisticated filing system for maps. It is most valuable as an analytical tool to assist decision makers. Typical analyses performed are: calculation of area, overlaying and compositing, calculation of proximity. These types of analyses distinguish a GIS from simpler computer mapping systems. Most computer analyses of geographic data bases involve combinations of search, measurement, and data comparison.

GIS technology, under development for at least 20 years, has advanced substantially in the past 6 to 8 years. Although its subject matter is often simple, the computer systems required are complex and demand the latest advances in computer technology.

GIS technology can reduce the number and cost of maps needed in routine operations, while at the same time reducing the cost of analysis. The number of maps needed will be less because the comparisons between maps, compilation of map combinations, and analysis of map quantities (areas, for example), can be done inside the computer.

For many Corps activities a GIS could significantly reduce the need for manually drafted paper maps, replace many manual procedures, and provide the user with the latest information through a variety of displays. GIS 8 have the potential of being even more pervasive than our current manual mapping.

A GIS is not intended to make decisions. It is a tool the manager uses to help make decisions and leaves a clear, documented, and retraceable path from which those decisions are made. For more information on GIS operation see Appendix B.

1.2 Methodology

A GIS study team was brought together to look at the potential applications of GIS technology to the District workload. A needs assessment was done over a period of several weeks in the various district organizations to determine: Can GIS accomplish tasks in our organizations, would a GIS be more efficient than current methods, and what were the needs of the office in workload and equipment/software to accomplish them.

The results of the assessment were compiled by Information Management Office, Information Requirements and Planning (IRP) Branch, and are contained in Appendix A by primary organization. It is noteworthy that many organization tasks are simply not performed or performed rarely because of limited personnel in resource inventory and management and planning offices. Many tasks that are deemed too costly in terms of personnel time and effort could be done quickly and relatively easily on a GIS system.

The Information Management Office has reviewed a variety of possible GIS hardware and software options that are available and meet the basic needs of the District (based on GIS scoping committee). Software is most critical in developing a GIS system. The District GIS Committee has noted one software need that is unusual in comparison to many land/resource management systems. This is the need to integrate quickly and accurately lands and resource management data with design drawings developed in the engineering organizations. Several GIS systems available can accomplish this type of work, however, the ease with which it is accomplished differs by orders of magnitude. Systems differ widely in both host equipment, software functionality, and cost.

Several basic system configurations have been discussed. These include:

1. Large central CPU, 5 hi-resolution graphics terminals, pen plotter, large drafting digitizing table.
2. Moderate central CPU and/or file server, 5 hi-resolution graphics intelligent engineering workstations, pen plotter, large drafting digitizing table.
3. Micro based software with stand-alone micro citations and same plotter and digitizing equipment.
4. Mix of the above.

We are unaware, at this time, of any definitive HQUSACE specifications for GIS technologies. we have, therefore, attempted to contact experts that are current with the state-of-the-art in GIS systems for advice. One such source is the Topological Laboratory at Fort Belvoir, VA. One primary conclusion that we drew is that there is little in the way of fully functional (software) and fully capable (hardware) for microcomputers to perform according to the District's GIS needs.

Of the two central host options, we have come to the conclusion that the future technologies, both hardware and software, are moving toward the intelligent engineering workstations, with networking to a central CPU and/or file server. This configuration provides the maximum efficiency for CPU utilization, and maximum flexibility for end-users. It also provides flexibility for management to alter the course of system development in subsequent years as needs for GIS change or technology changes rapidly.

2.0 Decision-making Process.

2.1 Existing. The existing GIS process in the District is essentially a manual analysis of a composite resource (wildlife, vegetation, soils, etc.) or theme (proximity, combination of resources, etc.) maps. Landscapes architects, wildlife biologists, real estate specialists, other data map users and analyzers manually construct base maps, resource maps, and theme maps and then have the maps drafted 80 they can be reproduced. To analyze geographic data, the resource maps are hand evaluated by overlaying the resource maps and composite maps. This requires all maps under evaluation to be of the same scale. When new data is available or when there is more than one option, it is necessary to analyze the data by hand. Area and linear measurements are also calculated by manual means. Resource maps are updated manually as new information becomes available. After the resource maps are updated the composite maps also need to be revised manually. All of this is extremely labor extensive which limits the options that can be examined.

2.2 Proposed. A computerized GIS will automatically perform actions currently completed by hand plus other actions attainable only through automated methods. It will enter, store, analyze, and display digital map and map overlay thematic data layers to analyze proposed actions and alternatives for project development, master planning, habitat evaluation, and other mapping. It will include the ability to digitize maps and related spatial data, edit the digitized data easily, perform multiple layer map theme overlap with new map generation (incl. boolean operations on lines, points, polygons) and plot the desired map on a pen or raster plotter. The data for a base theme, or resource map of a particular location need to be entered just once. The data can be accessed by all users.

One of the Corps major tasks is to prepare planning documents to aid in making and implementing resource management decisions. The collection of baseline resource data for these planning documents has made it necessary to develop automated systems to store, analyze, and portray this data. The graphic displays for these planning efforts, however, are for the most part still manually generated and revised. All of these planning efforts require the use of maps, overlays, graphs, and charts, which are now produced manually. Revisions, updates, and additions, some of which are extensive, are also accomplished with more costly manual technique 5 .

3.0 District Workload Projections.

3.1 General.

The District GIS workload projections for the upcoming 7 years (the anticipated life cycle of ADP equipment) is based on the Districts continuing role change from construction works to the operation and management of the District projects. The analysis of the workload included Master Plans of the District's Civil projects, feasibility studies, resource inventory and location analysis, resource mapping, environmental assessments, flood projection, dam safety, survey monumentation, operational management planning, and editing of GIS data base.

3.2 Civil Works.

Each of the six District's projects scheduled for Master planning during the projected 7 years requires at least 5 man-years to complete manually. The larger projects will take considerably longer. During the formulation stage, input from various offices will be incorporated into the Master Plan. Once the Master Plan for a project is completed, the management and implementation of policies can occur using the Master Plan as a guide.

3.3 Other Works.

Walla Walla District has received some military projects for design and completion, and anticipate an increased workload during the projected years that will require Master Planning. Walla Walla District has also been designated as the General Support District to the Seattle District for mobilization planning and preparedness. In this role, the Walla Walla District has primary responsibility for major mobilization mission, GIS will be extremely helpful in accomplishing these tasks.

4.0 Equipment/Software Requirements.

Based on the anticipated utilization of the automated GIS, the following initial system configuration and training with later augmentation is determined necessary to meet the District s mission. See Charts 1.1-1.4 for a visual representation of the proposed configurations.

4.1 Hardware Configuration.

Description of equipment/service	Number by FY			
Hardware	88	89	90	91
Intelligent Graphic Work station	1	1	1	1
32-bit, 8Mb				
156 Mb Hard Disk	1	1	1	1
LAN Interface		3	1	1
Digitizing Table	1			
File/Plot Server		1		
32-bit, 16Mb				
156 Mb Hard Disk		5	2	
1600/6250 bpi, Mag. Tape w/c		1		
Floppy Disk		1		
LAN Interface		1		
Graphics Workstation		1		
Plotter, Pen 33" wide	1			
LAN		1		

4.2 Software Configuration.

Description of equipment/service	Number by FY			
Hardware	88	89	90	91
Intelligent Workstation				
UNIX with PC-DOS window	1	1	1	1
Plotter Interface	1	1	1	1
GIS Package	1	1	1	1
LAN Protocol		3	1	1
File/Plot Server				
Unit with PC-DOS window		1		
GIS (Input/Edit)		1		
LAN Protocol		1		

4.3 Training.

Description of equipment/service	Number by FY			
Hardware	88	89	90	91
Training				
GIS System Manager	2			
Workstation Operator (Standalone/On-line)	4	4	2	2
Computer Operator		3		
Program/Analyst		2		
Manual/Documentation				
Reference Manuals (sets)				
Workstation	1	2	1	1
File/Plot Server		1		
GIS User Manuals (sets)	4	4	2	2

4.4 Site Preparation.

Adequate space, power, and air conditioning to install and operate the proposed GIS system already exists to allow installation of the central processing system with only minor non-structural modifications.

The graphic workstations emit some heat and may require additional cooling to keep the temperature of the workstation area down to acceptable operating temperature.

Some site work is required to connect cables between workstations in a network.

4.5 Workstation Utilization.

The installation and implementation to a full district Geographic Information System (GIS) is planned to be a gradual phase-in process of equipment over four years as more data is entered into the system each year and becomes available to other GIS users. An initial configuration consisting of a standalone graphic workstation with a large digitizing table and a pen plotter to enter the base map and resource data necessary for analyzing and plotting various options in the development of a Master Plan for a district project. The second phase connects the original configuration, a graphic workstation, a standalone graphic workstation and a file/plot server with a 6250 bpi magnetic tape drive and 780 Mb disk storage to a local area network. The network and the file/plot server makes possible the sharing of data and the plotter between the workstations. The existing digitizer will connect to the new graphic workstation for direct data entry into the file server disks. The standalone workstations can access the file server through the network, download data from the server to the workstation, and process the data in the standalone mode. This configuration is the minimum operating system. The third phase will add an additional standalone workstation, if required, to the system and an additional 312 megabytes of disk storage to the file/plot server. The fourth phase will add an additional standalone workstation for project management and assistance. It will primarily be used by the GIS coordinator/manager for work on all projects and design and implementation of the more difficult analysis algorithms.

5.0 Production Goals and Costs.

5.1 Production Goals. Based on experiences of others and proposed projects, the production goals are established for the overall system (not discipline specific). The goals are considered attainable for the District are as follows:

FY Portion	Comparison Factor*
88	
1st 3 mo	.4
2nd 3 mo	1.0
3rd 3 mo	1.5
4th 3 mo	1.5
89	
1st 3 mo	2.0
Rest	2.0
90	
All	2.5
91	
All	2.5
92	
All	2.5-3.0

*Comparison factor is the ratio of amount of work that can be accomplished using the GIS system versus the amount that can be accomplished using present methods.

5.2 Hardware/Software Costs. The hardware and software costs were based on industry estimates and no allowance was made for GSA price agreements. The estimated costs for the 3-workstation system minimum configuration (phase 1 and phase 2) are $164,000 for the hardware and $47,500 for the software. The estimated costs for the 4-workstation configuration (minimum configuration plus phase 3) are $204,000 and $65,000. The estimated costs for the 5-workstation configuration (4-station configuration plus phase 4) are $233,000 and $82,500. See Figure 1.1 and Tables 1.5 through 1.9 for system cost details and for costs by Fiscal Year.

5.3 Maintenance Costs. Typically, the maintenance cost for the size of system proposed is approximately 10% of the total hardware cost per year, payable monthly. This cost is for work day maintenance not including weekends and holidays. Other than normal hours service is available but costs extra. Normal business hours are considered to be 0800 to 1700 hours, Monday through Friday. Responsible time is specified in the contract as needed, with more cost involved for faster response times.

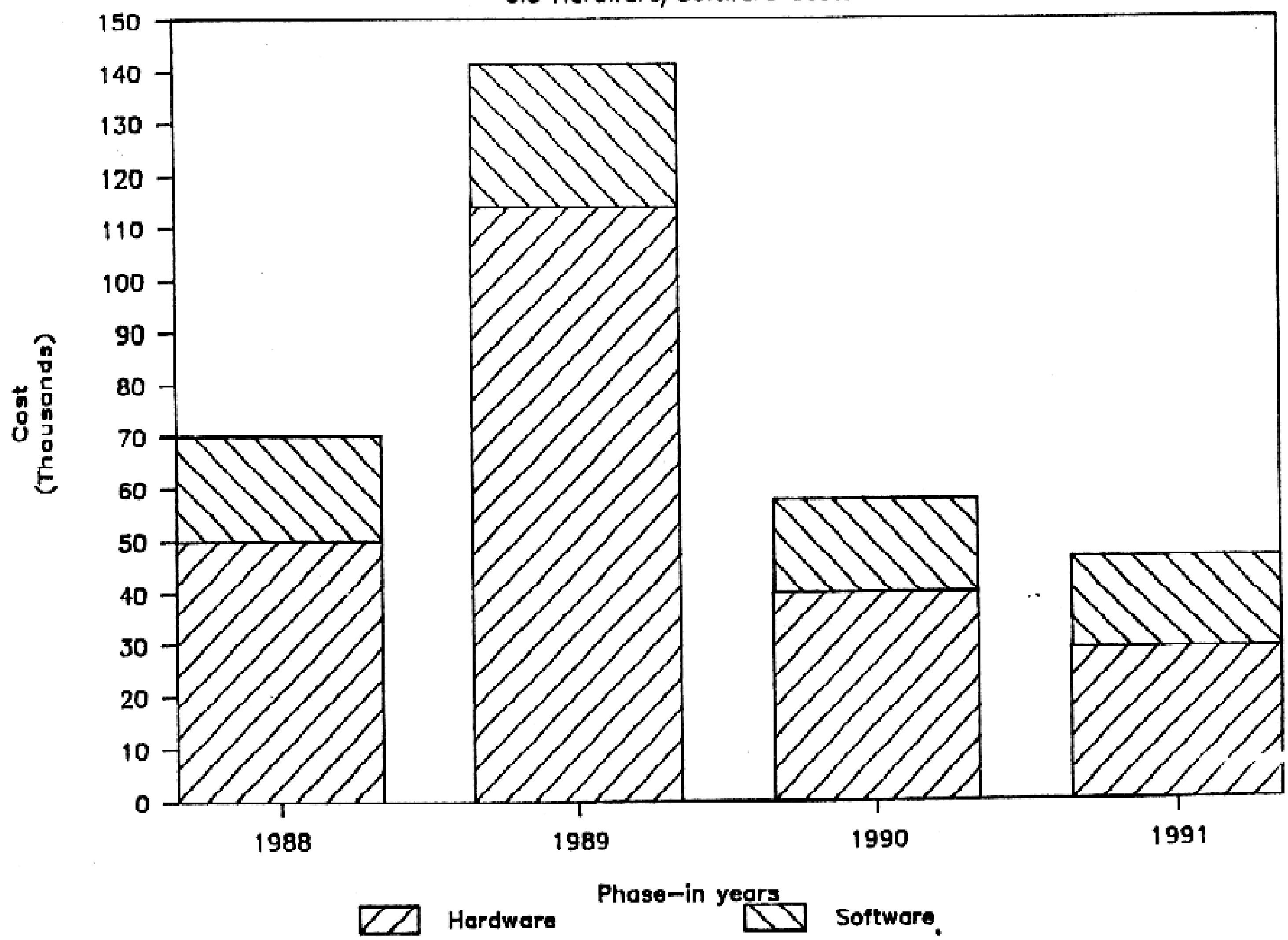
6.0 Intangible Considerations.

6.1 General.

There are many intangible, indirect, or unguantifiable benefits that result from implementation of a GIS system that are very difficult to express in quantifiable terms that are needed for a cost/benefit analysis. They are many of the things that make work easier and better and generally are expressed in terms of better quality.

Figure 1.1

GIS Hardware/Software Costs



6.2 Data Can Be Reviewed Prior To Printing.

Data themes can be reviewed prior to printing. Theme maps can be reviewed by the respective divisions doing a review process. This is impossible using the manually drafted method, due to the 5 to 10 sheets per data theme.

6.3 Extended Use of Mapped Data.

The Master Planning process takes several man years. A long period of time passes before the data themes are printed. The automated system would allow viewing of the themes and also allow the data to be used immediately. The data can be used by OCR, Engineering, Real Estate, and Planning Divisions in their work.

6.4 Ability to Analyze More Alternatives.

When generating alternatives manually, the amount of time required prohibits more than one plan. The use of an automated system will allow more than one alternative. This will allow the decision making process to be better documented and allow a wider range of views.

6.5 Common Framework for Analysis and Data Sharing.

The automated system would improve communication and coordination between personnel in the District, Project Offices, and NPD. A common framework will create data consistency and conformity, increase the productivity of specialists, and foster data sharing between disciplines and agencies.

6.6 Storage and Backup.

An automated system will require less storage space then paper maps. The option would be available to eliminate mylars used for reproduction. The ability will be available to store data on floppy disks and magnetic tape.

6.7 Work For Others.

Just as the CADD system and Digital Aerial Mapping, the GIS would be an additive tool in securing “Work For Others.”

7.0 Tangible Considerations.

7.1 General. Tangible considerations are discussed in terms of any project design and development whether it be Master Planning or project level implementations. The phases of any project are broken down and discussed according to advantages of GIS over manual methods and/or disadvantages.

7.2 Data Entry.

Initial automated data entry efforts are estimated to require 10 to 25 percent more time than comparable tasks accomplished with manual methods, if the information is not currently available. However, certain data may be available from other agencies on computer tape and can be entered directly into the system. For example, base map information (contours, cultural features, vegetation, cadastral) from 7.5 minute quads is available on computer tape from U.S. Geological Survey (USGS). Benefits between 40 and 60 percent will occur through time as more data are entered and stored in the system eliminating the requirement to draft and redraft maps and manually transfer information to other media such as clear mylar. Only the original maps need to be updated because certain maps are generated with the system. A large number of maps can be created without digitizing based on combinations of existing data such as land use alternatives, conflicts, and percent of slopes maps. Therefore, fewer data themes need to be digitized than manually drafted. Without a GIS system these maps would have to be manually drafted. Advances in technology such as scanning techniques for digitizing and interactive data editing, will further reduce the time required for data entry to zero resulting in substantial savings. Similar re-use of data for all applications after initial data entry will make the number of work months required for data entry negligible. Therefore, it is estimated that between 40 to 60 percent savings following the construction of a data base is very conservative for data entry.

7.3 Data Manipulation.

Manual methods for manipulating large amounts of data are very labor intensive and error prone, whereas using an automated GIS for retrieving, sorting, and reformatting information requires comparatively little time. Additionally automated methods become more efficient as the amount or complexity of data increases. Examples are computer generated percent of slope maps. Manually the percent of slope would have to be calculated by hand and re-drafted. If a new or more in depth breakdown of slope was later needed the process would have to done again by hand. In an automated mode, the task would involve entering a few commands at the screen. Again, the labor-intensive tasks are performed by the computer. The estimated time saving with automation is between 70 and 90 percent.

7.4 Data Analysis.

Benefits for performing analytical functions with automation are substantial. Time spent directing the computer to perform the labor-intensive tasks normally performed by people is minimal. The amount of time required to initiate automated analysis remains relatively constant, regardless of the size, complexity, or accuracy of the data and desired needs. In contrast, the time required to perform manual analysis increases rapidly with complexity, quantity, and accuracy (collectively or individually). The time savings i6 conservatively estimated to be 70 to 90 percent. In addition to generating geographic areas, the acreage of each mapped area is automatically produced. Examples of complex data sets include attractiveness, vulnerability, and compatibility mapping which are portions of the maps needed to construct a land use suitability map. In a manual mode the task would involve overlaying theme maps on a light table and hand tracing and final drafting.

7.5 Data Output.

Substantial benefits are evident with data output tasks. Manual methods involve drafting maps and/or composing tables and diagrams. These methods are labor intensive whereas the automated methods only require setting parameters for the desired output. The amount of benefits increase proportionately with the amount and complexity of data. Additionally, many products would not be and could not be produced because of the amount of time required with manual methods. Thus the time savings are estimated conservatively at 70 to 80 percent for generating output.

7.6 Data Import/Export.

Time savings associated with copying and transferring digital map data between locations are estimated at 60 to 70 percent of the time required to manually copy and transfer maps between physical locations and between varying scales. Other federal agencies are now using or in the process of obtaining GIS systems. Much information is now available from other agencies which can be used during a project. Recently the Washington Department of Game suggested that their evaluation data for Lower Snake River Compensation Plan be placed on State of Washington 8 GIS system. This data would be easily transfer to the Corps using an GIS system. The Walla Walla district would also be able to provide “work for others” and other agencies with data that we generate and use.

7.7 Improvement in Publication of Data.

Each data theme has an average of 5 to 10 sheets or layers. Each layer must be registered to the other very carefully. Manually this is only possible by registering one layer at a time to another. The manual method produces errors of misregistration that show up in printing. However, using an automated GIS system, all sheets can be viewed on one screen at one time using different colors or shading for each layer. The common registration framework for all data in the GIS eliminates mis-registration and improves printing. This will conservatively save 50 percent of the drafting time by reducing manual drafting problems, reducing map production time through plotters, and reducing the redrafting required after each map change.

7.8 Financial, Social and Ecological Benefits.

In addition to all the benefits listed above the GIS system will conservatively save approximately $20,000 annually for the Master Planning phases configured with 1 standalone workstation as shown in the FY-88 configuration proposal. This is based on the amount of time inputting, analyzing, updating, and outputting data under current scheduling and budgeting. The automated system will allow the Corps to better serve public needs and also help make decisions to provide better stewardship on the the resources the Corps is responsible.

7.9 Manpower Savings.

Manpower savings utilizing the automated GIS is estimated to be 60% of the existing manual methods. Currently the District work load to complete Master Planning, Operations Management Planning, and Real Estate and Engineering applications in the next seven years would require 806 work months. Current manpower ceilings will not support this. Work will have to be performed more efficiently or be forgone. An automated GIS would reduce the work months to 324, a 7 year goal attainable without increase in personnel. Summary of manpower savings is included in Tables 1.1 through 1.4.

7.10 Cost Savings.

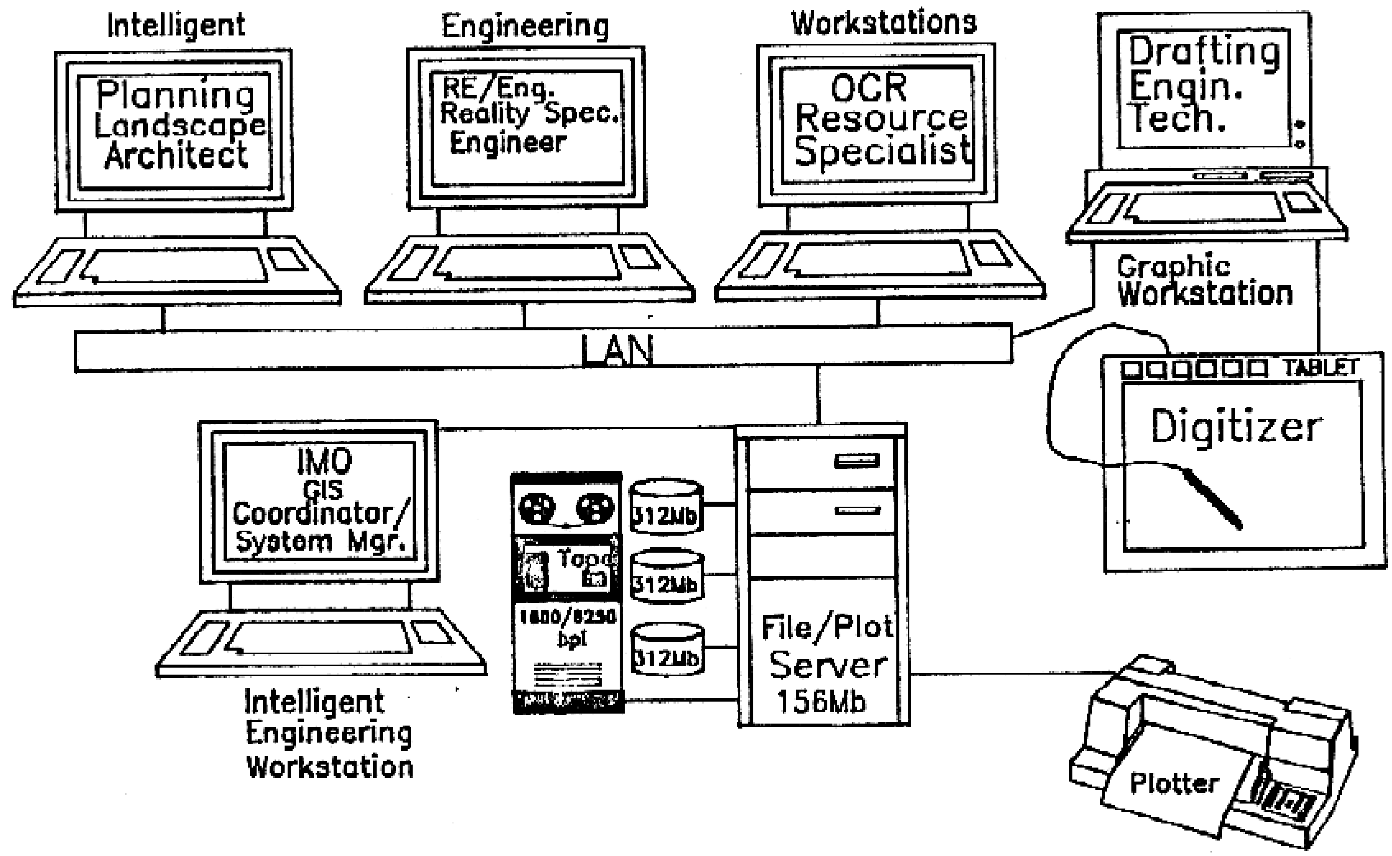
To determine the real dollar savings that could be realistically expected through the purchase of an automated GIS, an estimated cost for system purchase and software development was established for a minimum three workstation system, a four workstation system, and five workstation system. The annual maintenance agreements were estimated at 10% of the hardware costs and the entire system was amortized over a seven year period. The total operating costs of the three systems were compared separately with the cost of the existing manual methods and a projected savings for the system life were $946,285, $1,070,690, and $999,451 respectively. A summary of these costs are included in Tables 1.9 through 1.11.

8.0 Organizational Recommendations.

A proposed GIS system organization i8 described in the following Chart 1.0. The overall system project coordination/management is located in IMO to take advantage of existing GIS project expertise. Each workstation is located as shown in the Chart to accomplish priority workloads as considered by the GIS study team. The resource specialists utilizing the workstations remain in existing organizational channels. Data entry would be located in Drafting to maintain organizational/supervisory integrity with existing manual systems .

Chart 1.0

Geographic Information System
Equipment—Primary User Configuration



9.0 Summary

The present manual system of data storage, retrieval, display, and analysis is inadequate to handle the management issues and challenges facing land use planners today. The present planning system of base maps and overlays is incapable of displaying or comparing the various data layers at the same scale which is necessary for resolving issues such as forestry resource management, cultural resource management, recreation management, wildlife habitat and fisheries management and many others. Much of the resource inventory data is not readily available for decision making or multiple-use planning without major commitments of work months.

Implementation of an automated GIS will provide an efficient new tool for management of the public land resources. Data which was once rolled up on a map stuck in a corner or filed away in a storage cabinet and known only to a few will now be available for automated search, measurement, calculation, comparison, analysis, and display.

The goal of GIS is not to replace people. The goal is to make the existing work months and workforce more effective, efficient, and capable of manipulating the mass of information currently required to be analyzed for resource management decisions.

GIS technology can reduce the number and cost of hard copy and manually created map manuscripts used in routine operations, while at the same time reducing the cost of analysis. The number of map products needed will be less because the separations necessary to produce combinations can be stored and generated in an automated format on a computer.

GIS is being initially proposed for District-level Resource Management Planning. Many benefits from GIS are from the later uses of the data once it i8 captured. Doing the Master Plans in GIS would set the foundation for subsequent project and activity plans, planning amendments, Environmental Assessment (EA-6), special projects, land exchanges, monitoring, potential litigation, etc. requiring additions to the initial GIS hardware and software. A minimum configuration of 3 workstations is to be implemented in two phases with additional workstations to be added as needed.

A projected dollar savings over a seven year period of 3 workstation, 4 workstation, and 5 workstation configuration costs compared to the cost of existing manual methods are $946,285, $1,070,690, and $999,451 respectively.

Table 1.1

Comparison Of Labor Costs for Master Planning
Manual vs. GIS
Based on USGS Quadrangles
Labor Source - Planning Division

Project	No. Quads	Work Months Manual	Work Months GIS
McNary	19	100	40
Ice Harbor	12	60	24
Lower Monumental	10	60	24
Little Goose	12	60	24
Lower Granite	13	60	24
Dworshak	20	100	40
Luckv Peak(act. manual)	6	60	24
Total	92	500	200
Costs		$1,730,000	$692,000

Work month savings = 300.

1 work month = 173 hrs x 20.00 cost/hr = $3460
300 x $3460 = $1,038,000

Table 1.2

Comparison of Labor Costs
for
Operations Management Planning
Manual vs. GIS
Labor Source - OCR Division

Project	Work Months Manual	Work Months GIS
McNary	36	14
Ice Harbor	18	7
Lower Monumental	18	7
Little Goose	18	7
Lower Granite	18	7
Dworshak	36	15
Mill Creek	12	5
Lucky Peak	24	10
Total	180	72
Costs	$622,800	$249,120

Work month savings = 108.

1 work month = 173 hrs x 20.00 cost/hr = $3460
108 x $3460 = $373,680

Table 1.3

Comparison of Labor Costs
Manual vs. GIS
Labor Source - Real Estate Division

Project	Work Months Manual	GIS
McNary	12	5
Ice Harbor	12	5
Lower Monumental	12	5
Little Goose	12	5
Lower Granite	12	5
Dworshak	12	5
Mill Creek	12	5
Luckv Peak	12	5
Total	84	35
Costs	$218,400	$91,000

Work month savings = 49.

1 work month = 173 hrs x 15.00 cost/hr = $ 2600

49 x $2600 = $127,400

Table 1.4

Comparison of Labor Costs
for
Civil & Military Master Planning
Manual vs. GIS
Labor Source - Engineering Division

Project	Work Months Manual	GIS
Civil	24	10
Military	18	7
Total	42	17
Costs	$145,320	$58,820

Work month savings = 25

1 work month = 173 hrs x 20.00 cost/hr = $ 3460

25 x $3460 = $86,500

Table 1.5

GIS FY-88 Equipment
Configuration Proposal

Hardware

Stand-alone Color Engineering Workstation	$29,000
UNIX, PC-DOS compatibility desirable	
Digitizing table 36x48 backlit draft base	11,000
Plotter 4/16 pen line, color	10,000
Total	50,000
Software - GIS	15,000
Plot	5,000
Total	20,000
Grand Total	$70,000

Table 1.6

GIS FY-89 Equipment
Configuration Proposal

Hardware

Stand-alone Color Engineering Workstation	$29,000
Graphic Color Workstation (Input/Edit)	15,000
File/Plot Server 22,000	
312 Addnl Disk Storage - 2 @11,000 ea.	22,000
1600/6250 Tape Unit	16,000
LAN	10 000
Total	114;000
Software - GIS (Input/Edit)	5,000
GIS	15,000
LAN Protocol	7,500
Total	27,500
Grand Total	$141,500

Table 1.7

GIS FY-90 Equipment
Configuration Proposal
(Option 2)

Hardware

Standalone Color Engineering Workstation	$9,000
312 Mb Addnl Disk Storage	11,00
Total	40,000
Software - GIS	15,000
LAN Protocol	2,500
Total	17,500
Grand Total	57,500

Table 1.8

GIS FY-91 Equipment
Configuration Proposal
(Option 3)

Hardware	
Standalone Color Engineering Workstation	$29,000
Software - GIS	15,000
LAN	2,500
Total	17,500
Grand Total	46,500

Chart 1.1

Geographic Information System
FY—88 Equipment
Configuration Proposal

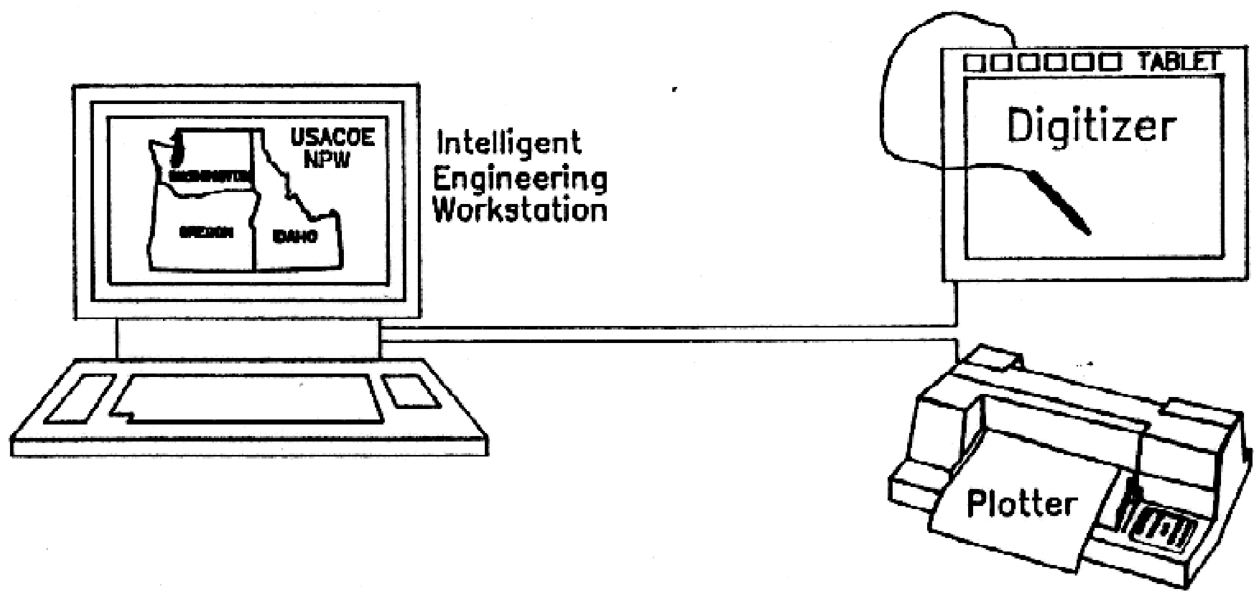


Chart 1.2

Geographic Information System FY-89 Equipment Configuration Proposal

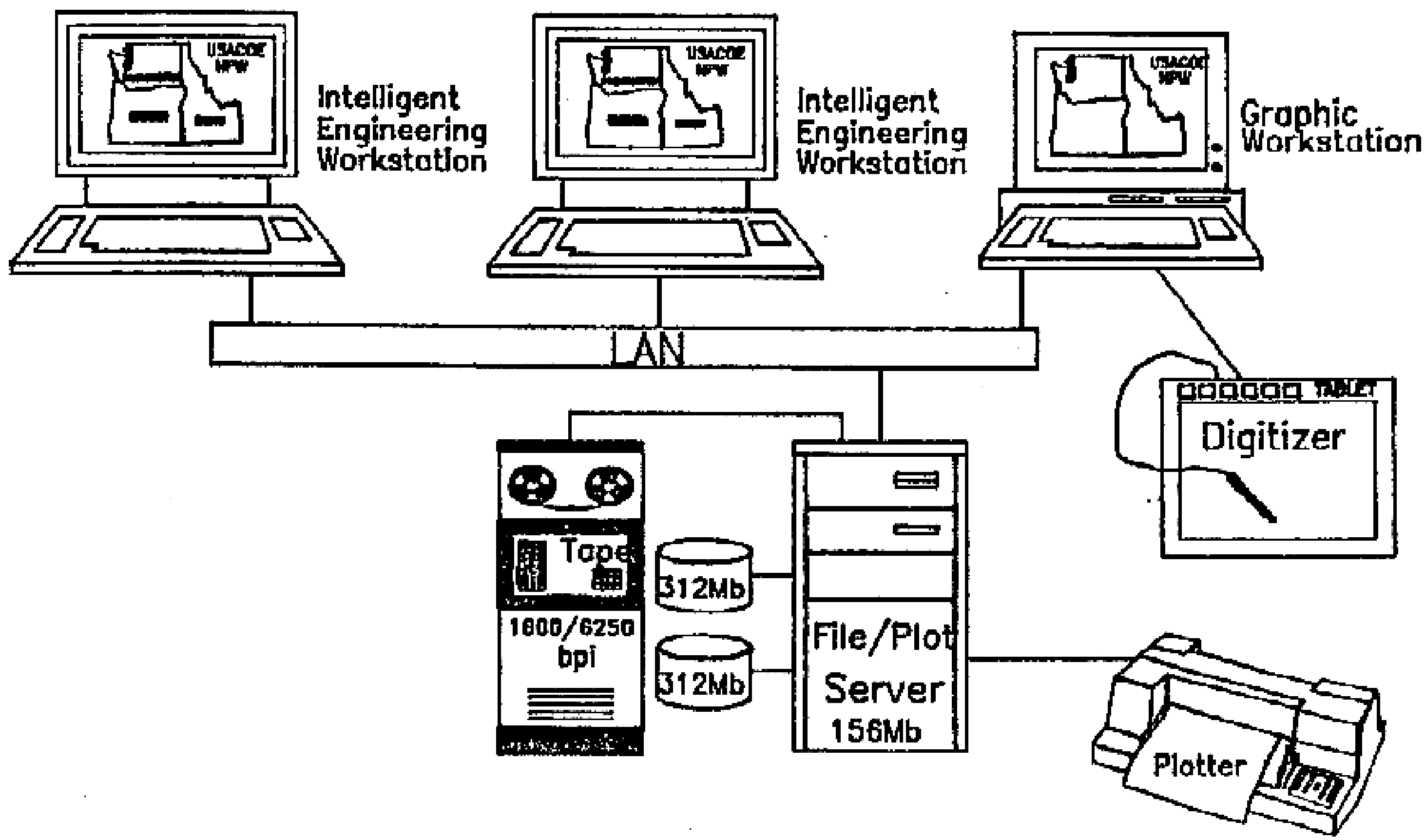


Chart 1.3

Geographic Information System
FY-90 Equipment
Configuration Proposal

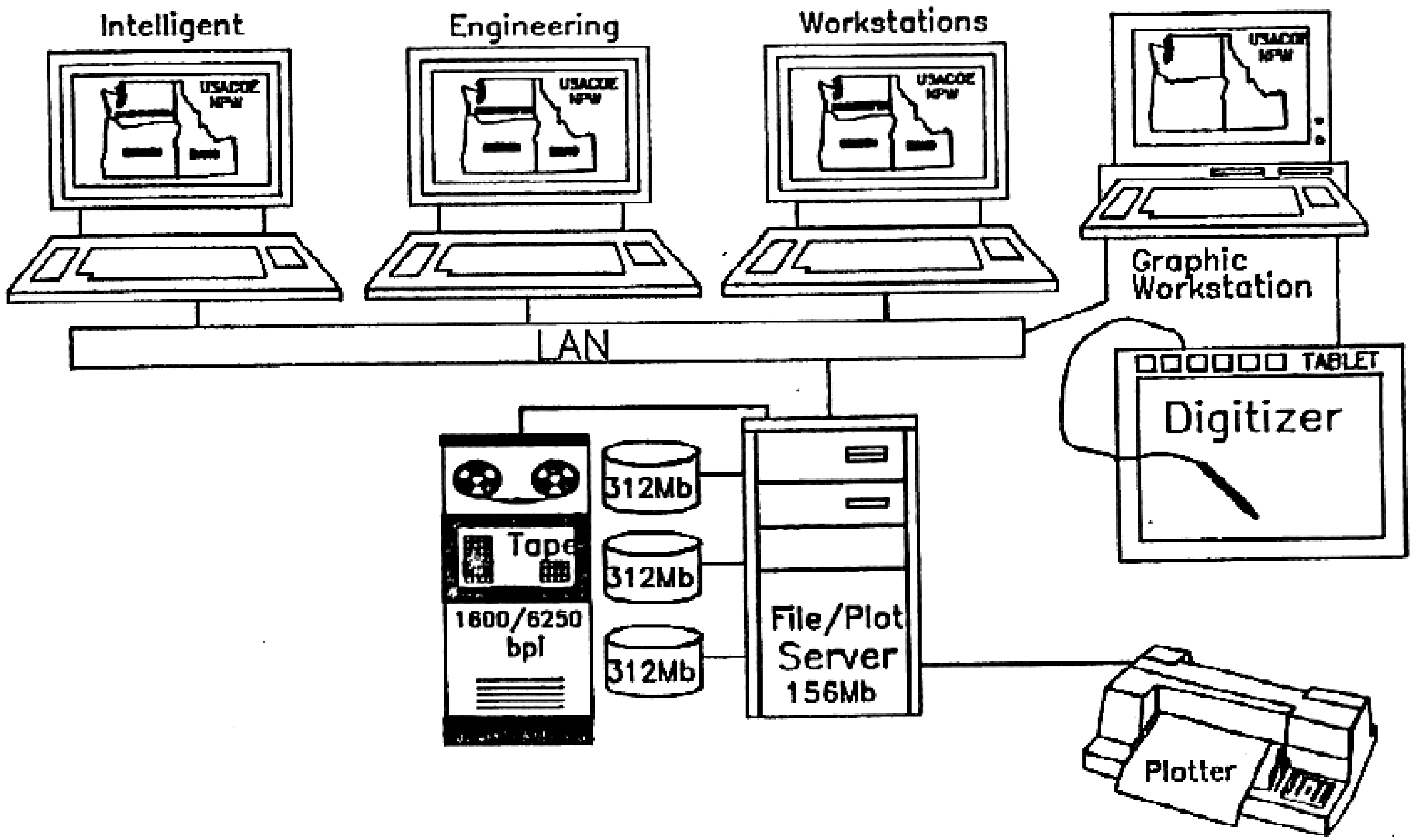


Chart 1.4

Geographic Information System
FY–91 Equipment
Configuration Proposal

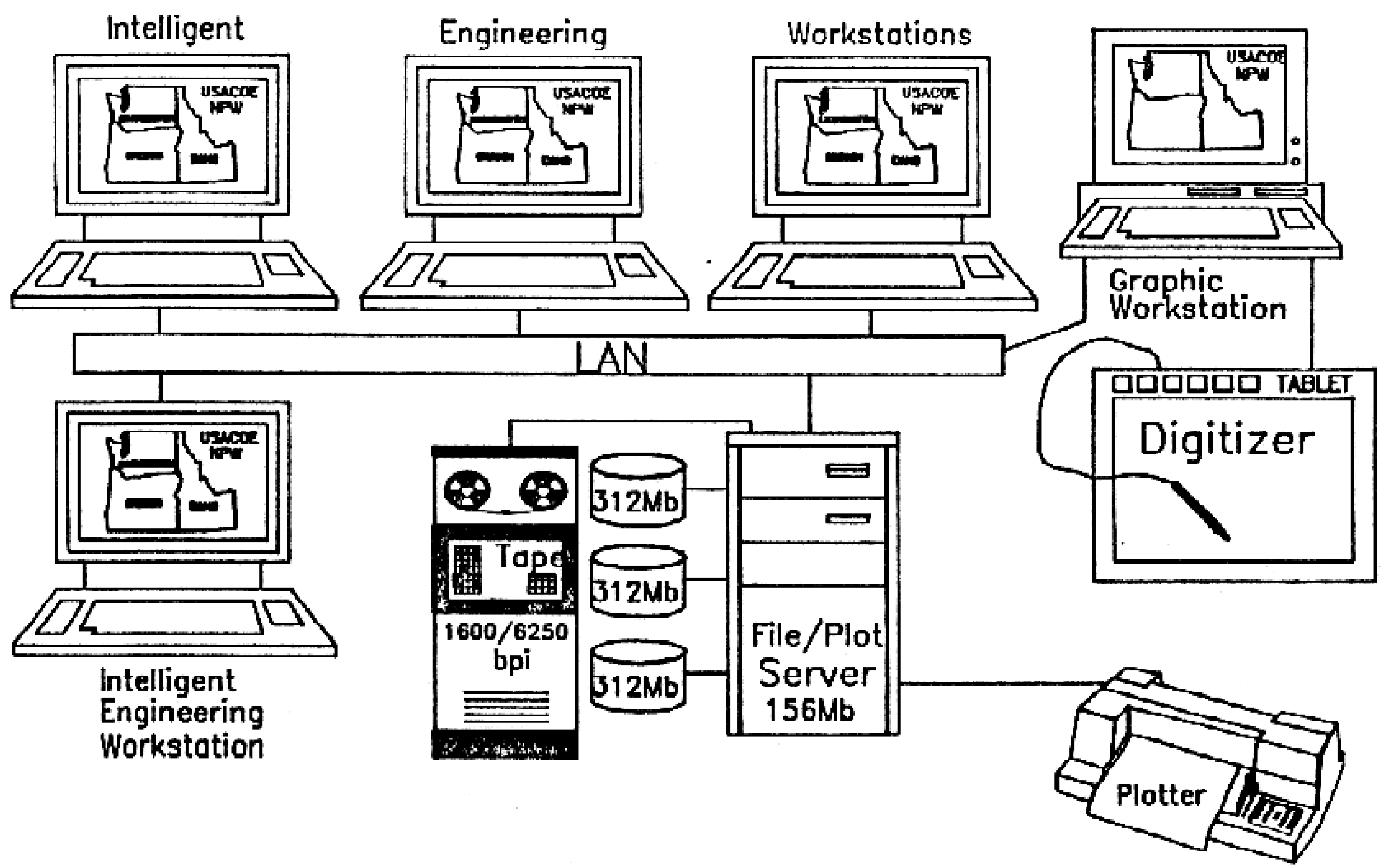


Table 1.9

Summary of GIS V6 Manual Costs
Five Workstation System
7-Year Useful System Life

Item	Avg. Annual Cost	System Life Cost
Hardware/Software	45,070	
Plant Inc.	2,330	
Insurance	1,747	
Maintenance	23,300	
ADP Support	17,000	
Total System Cost	89,447 x 7 yr =	626,129
Labor Cost (GIS)		1,090,940
Total system life cost		1,717,069
Total Labor Cost (Manual)		2,716,500
7 Year Savings		999,451

Total Hardware Cost =	233,000
Total Software Cost =	82,500
Total Cost =	415,500

*Amortized computer equipment in 7 years
*Mean Plant Inc. = tot. equip. cost x 1.07 - tot. equip. cost / 7
*Insurance = tot. equip. cost x .0075

See Figure 1.2 and 1.3.

Table 1.10

Summary of GIS vs Manual Costs
Four Workstation System
7-Year Useful System Life

Item	Avg. Annual Cost	System Life Cost
Hardware/Software	38,300	
Plant Inc.	2,040	
Insurance	1,530	
Maintenance	20,400	
ADP Support	17,000	
Total System Cost	79,270 x 7 yr=	554,890
Labor Cost (GIS)		1,090,940
Total system life cost		1,645,830
Total Labor Cost (Manual)		2,716,520
7 Year Savings		1,070,690

Total Hardware Cost =	204,000
Total Software Cost =	65,000
Total Cost =	269,000

*Amortized computer equipment in 7 years
*Mean Plant Inc. = tot. equip. Cost X 1. 07 - tot. equip. cost / 7
*Insurance = tot. equip. cost x .0075

See Figure 1.3.

Table 1.11

Summary of GIS V6 Manual Costs
Three Workstation System
7-Year Useful System Life

Item	Avg. Annual Cost	System Life Cost
Hardware/Software	30,215	
Plant Inc.	1,640	
Insurance	1,230	
Maintenance	16,400	
ADP Support	17,000	
Total System Cost	66,485 x 7 yr=	465,395
Labor Cost (GIS)		941,120
Total system life cost		1,406,515
Total Labor Cost (Manual)		2,352,800**
7 Year Savings		946,285

Total Hardware Cost = 164,000
Total Software Cost = 47,500
Total Cost = 211,500

**Real Estate and Engineering Labor Costs are not included.
* Amortized computer equipment in 7 years
* Mean Plant Inc. = tot. equip. cost x 1.07 - tot. equip. cost / 7
* Insurance = tot. equip. cost x .0075

See Figure 1.4 and 1.5.

Figure 1.2
Annual Cost Comparison, GIS vs Manual
5 Station Configuration

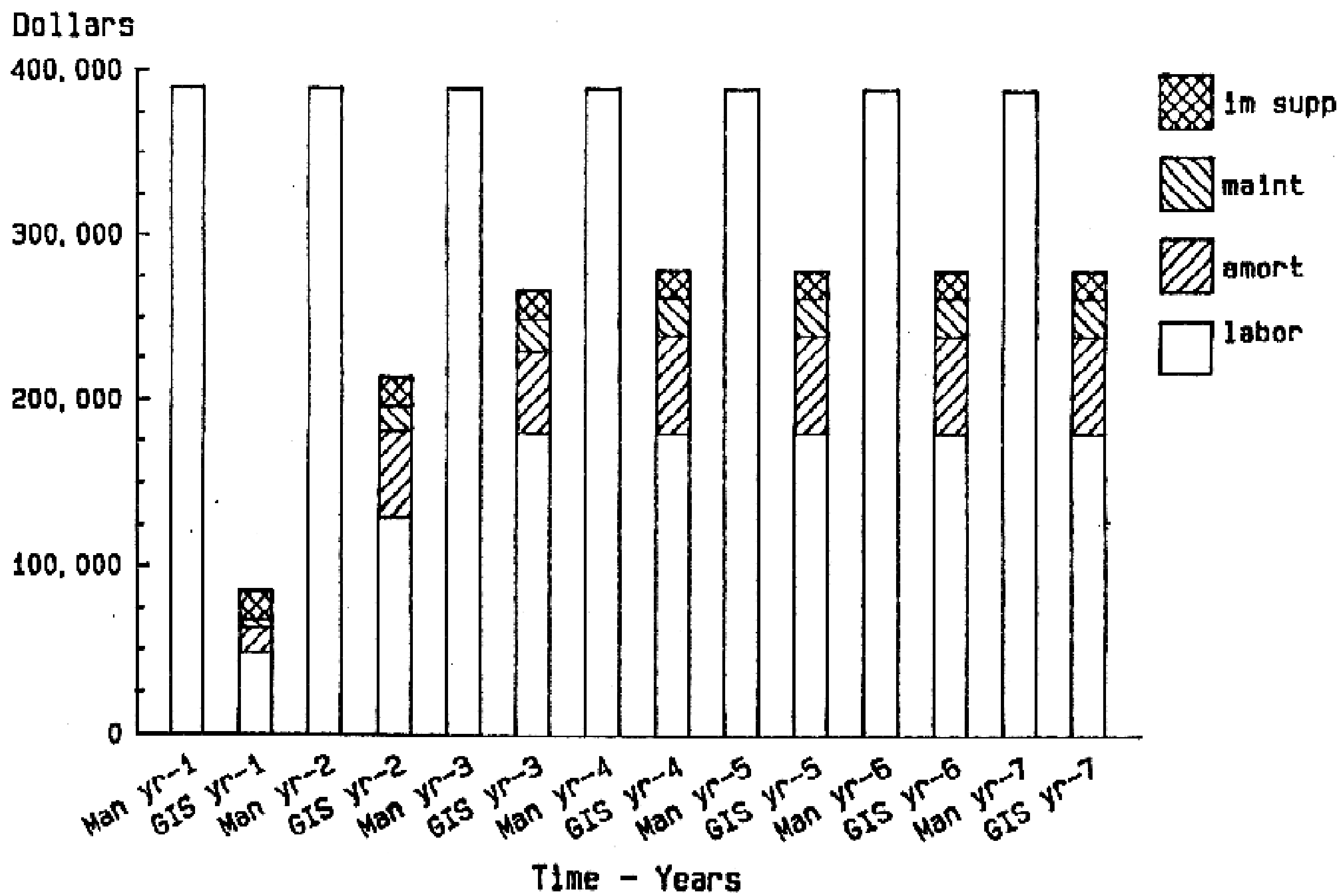


Figure 1.3

Project Cost GIS vs Manual

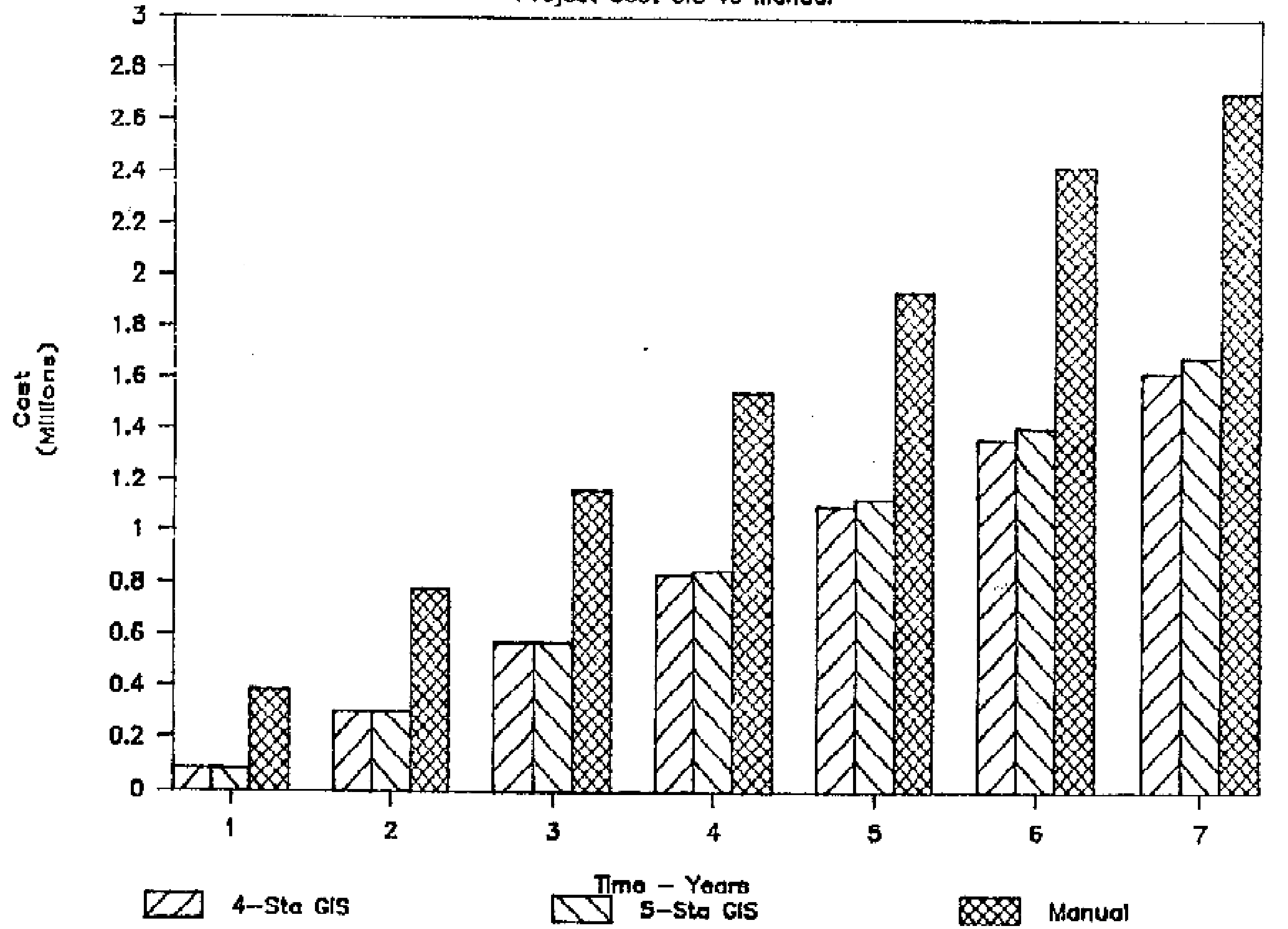
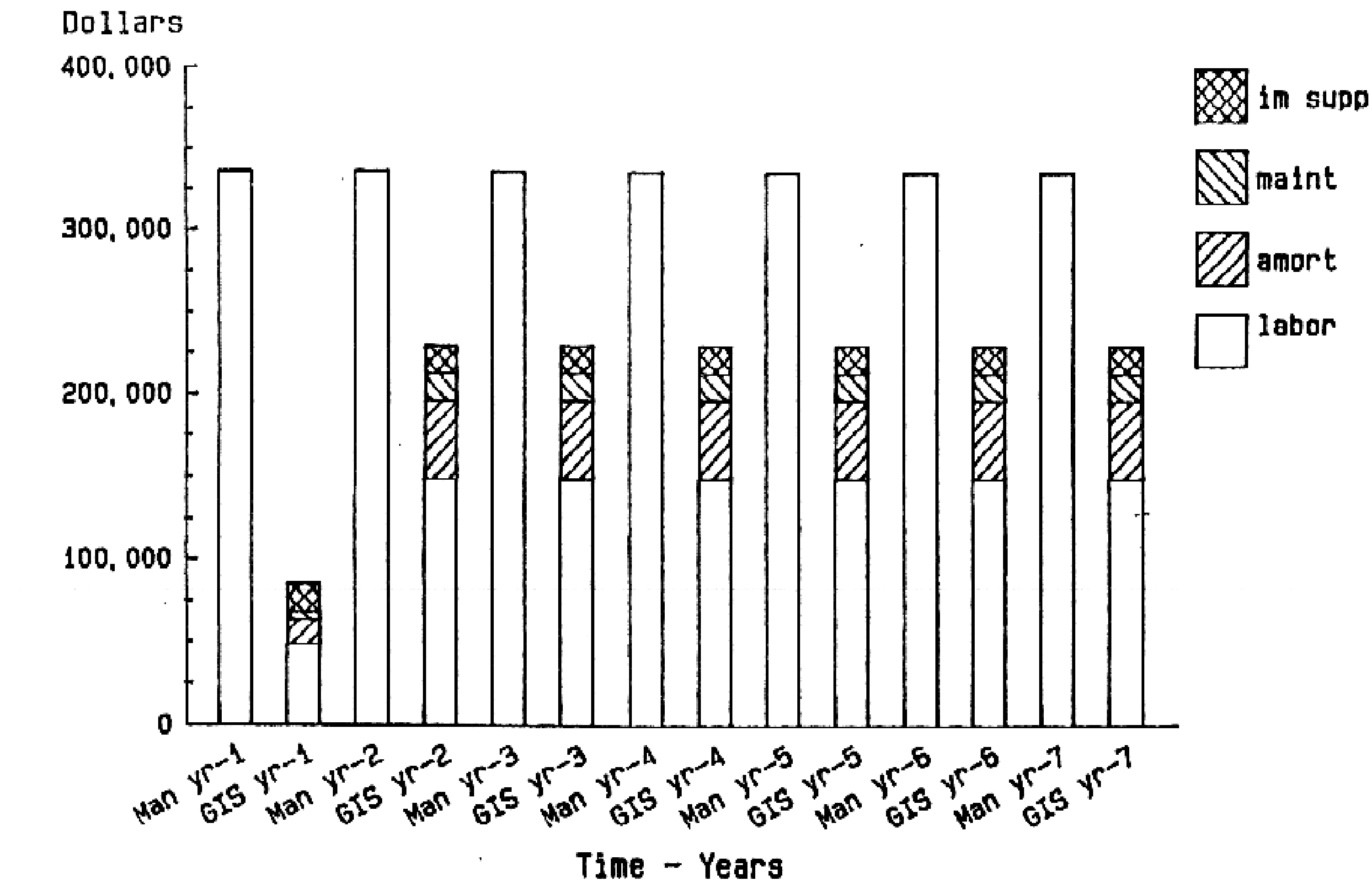
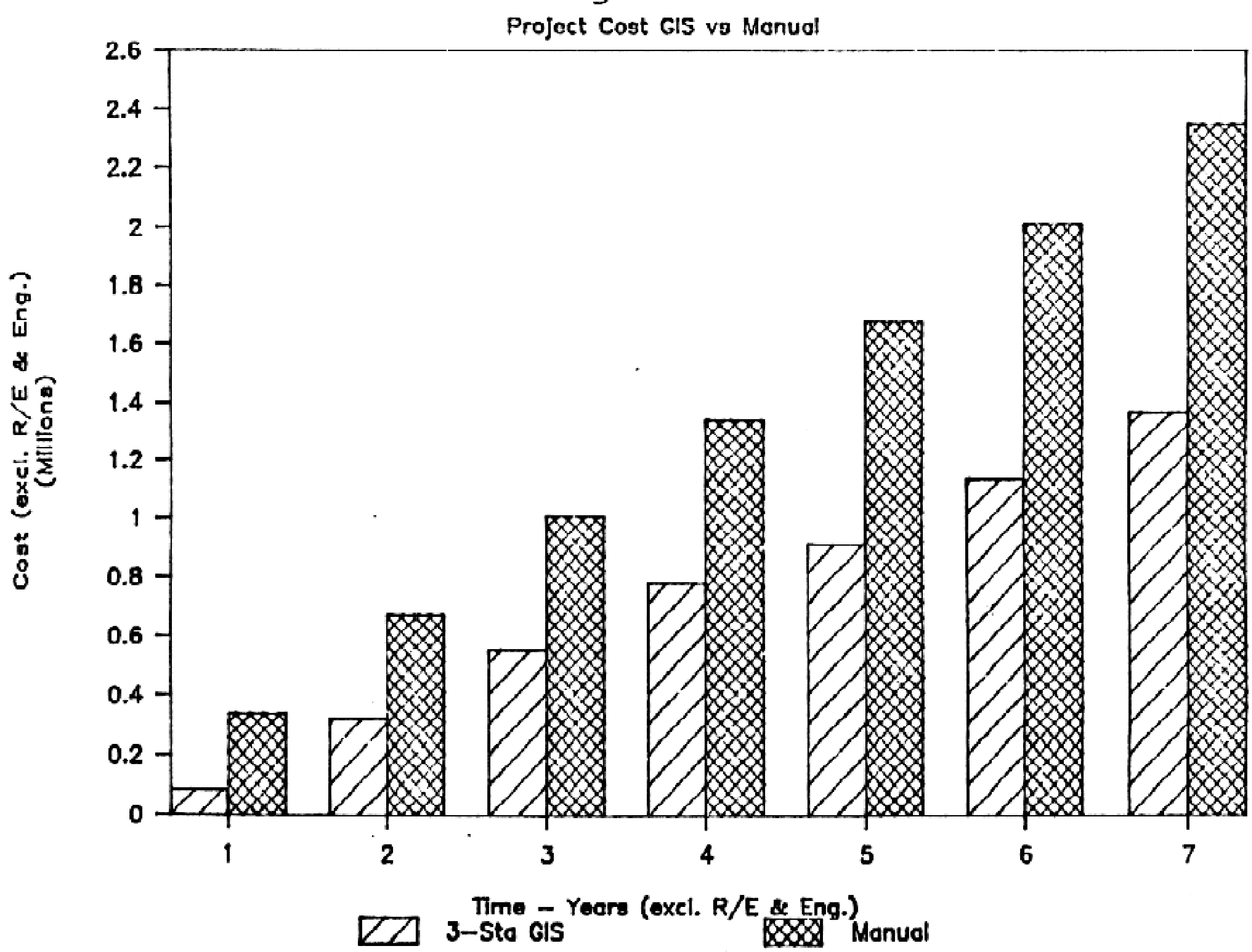


Figure 1.4
Annual Cost Comparison, GIS vs Manual
3 Station Configuration



R.E./Eng. Labor Not Incl.

Figure 1.5


Project Cost GIS vs Manual
Cost (excl. R/E & Eng.)
(Millions)
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
Time – Years (excl. R/E & Eng.)
3-Sta GIS
Manual