Evaluating the APA Prototype: Prospects for Providing Cheaper, Faster, and Better Services to APA's Customers

A Research Report

CTG.APA-015

Center for Technology in Government
University at Albany / SUNY

1. Summary of Findings and Recommendations to APA

1.1 Evaluation Findings

Services and Data to Support Services

- Three distinct data groups need to be planned for, some of which involve one-time acquisition costs and some of which should be acquired "as the system grows."

- Overall system functionality can be defined by eleven functions. Each of these functions may be acquired at increasing levels of system complexity and greater cost. This analysis examines two packages of technology and data--"limited" and "expanded" systems.

- APA's customers conduct sixteen different transaction types. The most important types of work shift dramatically if importance is measured by frequency of customer contact as opposed to intensity of staff time.

Prospects for Cheaper, Faster, and Better Service

- The limited system will reduce the mean customer turn-around time by 74%. The expanded system will reduce the mean customer turn-around time by 78%. Most of this reduction is due to expedited responses to phone inquiries.

- The limited system will have a one time cost of $523,000 plus annual operating costs of $60,000 per year. Gross annual personnel savings are estimated to be $144,000 per year.

- The expanded system will have an estimated one time cost of $847,000 plus annual operating costs of $120,000 per year. Gross annual personnel savings are estimated to be $258,000 per year. For the expanded system, $220,000 of the one time costs will be in data conversion costs. Most data conversion will be conducted over time and the costs subsumed in the annual salary of a new data manager.

- A fully implemented system will enable APA to offer important new products and to enhance the quality of existing services.

- APA will accrue maximum benefit from a full system when the implementation of new technology is accompanied by a careful reengineering of existing work processes. Many of the potential benefits of reengineering can be obtained now without the implementation of any new technology.

- System benefits will remain high well into the future and one time acquisition costs will fall, improving the benefit to cost ratios of this system to improve dramatically over time.

1.2 Recommendations

- APA should pursue a gradual and evolutionary system development strategy to take advantage of falling technology prices, advancing technical capabilities, and growing availability of data in digital form. This strategy will maximize the benefits and reduce both the costs and the risks of a new system based on a rapidly evolving technology.

- A system development strategy should support first those functions that contribute most to improvements in productivity and customer responsiveness.

- APA should conduct a more thorough analysis of its work processes and priorities. Our analysis suggests that substantial improvements in customer turn-around time can come from a reexamination of work priorities for the agency as a whole.

- Continued partnering and resource sharing in data creation efforts will reduce the total costs of data acquisition and further increase coordination, communication, and cooperation with other government entities.

2. Objectives of the APA Project

The Center for Technology in Government worked with the Adirondack Park Agency to improve service provided to the agency's customers. Government, businesses, and the public all need information for permits before they can proceed with development projects or make other decisions regarding the 3.6 million acres of private lands within the Park. The project was designed to prototype, demonstrate, and evaluate a rapid document and map retrieval system for all agency records related to real property. The system should allow agency staff to respond immediately to public inquiries that currently require extensive and time-consuming data search and retrieval and should eventually allow on-line remote access to essential agency information. Within this larger goal, the project team pursued four major objectives:

1. Create a prototype system which integrates geographic information, databases, and documents.

2. Convert existing agency data for use in the prototype and devise a data conversion strategy for populating a full system

3. Estimate the costs and performance characteristics of a full system

4. Identify and evaluate potential customer service improvements and extended benefits that a new system could provide.

The project evaluation summarized in this report addresses three of these objectives. It reviews data needs and data availability to inform a data development strategy for the future. It also presents an analysis of the costs and benefits which can be expected from implementation of a full system to support APA operations. Finally, the report discusses the potential improvements in internal operations, intergovernmental relations, and innovative initiatives that could be supported by an integrated information system.

3. Overview of the APA Prototype

The APA prototype was developed by CTG technical staff, APA technical staff and several corporate partners led by Computer Science Corporation. Development comprised two major activities:

1. Creation of an Integrated Geographic Information and Document System. This involved creation of a on-line access system that provided APA staff with access to geographic data, geographic analysis tools, and paper documents such as deeds and project files. The information in the system was keyed to property locations, owner information, and major transaction types. Given that no commercial off-the-shelf system offered this combination of functionality, the prototype entailed building a custom integration of a Geographic Information System (GIS) and a document management system.

2. Populating the System with Agency Data. The agency's existing electronic databases of geographic and record-oriented data needed to be modified to support the new on-line functions. In addition, paper- and microfilm-based documents were converted into electronic form and entered into the prototype database. It was not possible to create a database containing all necessary information for the entire Adirondack Park within the scope and resources of the project. Since APA wanted the prototype system to be data rich, comprehensive data was incorporated for one area of the park, rather than providing a more extensive coverage of partial data for a larger geographic area. Essex County was chosen as the prototype target, with two local regions (North Elba and Lake Placid) having the most complete data available.

In essence, the prototype made it possible to locate and integrate a variety of information pertaining to a specific location at a single workstation. Figure 1 illustrates how the prototype combines geographic information with database and document information for a particular land parcel.

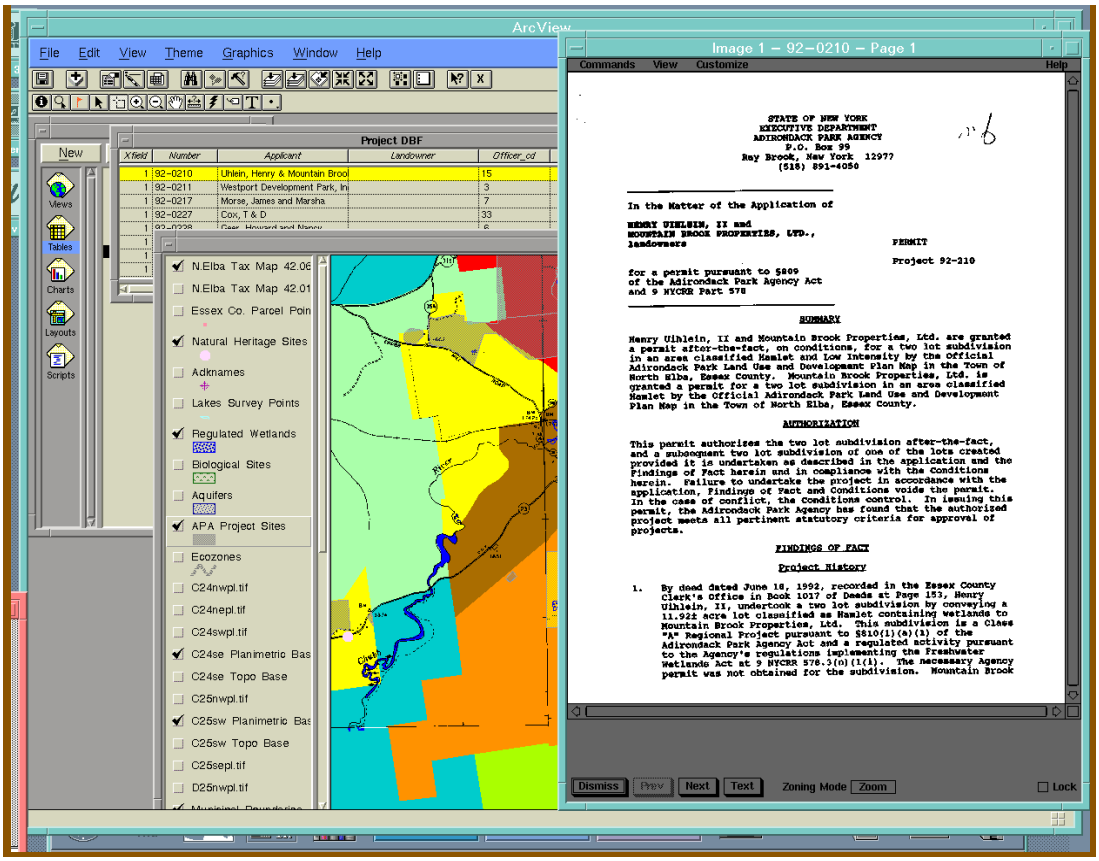

Figure 1
Sample Screen from the APA Prototype

A substantial number of technical issues were encountered and addressed during the prototype development process. These technical issues are described in Bloniarz, Miller, and Rich,

"Using Technology to Change Work: Technical Results from the APA Prototype," May 1995 (CTG.APA-014.)

4. CTG's Approach to Evaluating the APA Prototype

In order to evaluate how well the prototype and ultimately, a fully implemented system might meet the Agency's objectives, CTG used a multi-method approach to evaluation. As described below, seven related threads of activity and research were woven together to create the conclusions of this report. After an early benchmarking literature review, CTG activities focused on the creation and evaluation of an integrated GIS and document management system that was installed and tested during January and February 1995.

The evaluation efforts included modeling conferences, two surveys, and staff interviews. As indicated above, during February and March 1995, twenty-six APA staff were trained in the use of the prototype. Prior to the demonstration of the prototype, each staff member was asked to complete a one-page survey. Following the demonstration and training, a second survey was implemented and follow-up interviews were conducted by CTG staff. Additionally, the APA project team members as well as a number of additional APA staff participated in a series of three group modeling conferences between October 1994 and March 1995. The first and second of these conferences were designed to examine the cost and performance characteristics of a fully implemented system and the potential impacts of a full system on customer turn-around time. The third modeling conference was conducted to examine in detail the costs associated with creating or converting the various data types necessary to support a full system.

4.1 Literature Review

At the start of the project, CTG staff completed a literature review pertaining to Geographic Information Systems (GIS). This review included literature on GIS in general, similar application areas, and system design, development, and evaluation issues. The results, contained in Giguere's "Literature Review: Adirondack Park Agency" (CTG.APA-006), provided background for the evaluation work completed by the CTG team.

4.2 On-Site Prototype Installation, Testing, and Staff Training

During January and February 1995, an operational prototype system was migrated from CTG's Government Solutions lab to the offices of the APA. Technical staff at APA and CTG continued development of the prototype and data population efforts for the remainder of the test period. A team from CTG spent several days on-site training twenty-six APA staff members in groups of two or three. The prototype system contained data for a limited geographic region to support demonstration of the full system features and functionality. The training and materials provided an overview of how to access the data through a variety of

search mechanisms. These training sessions provided staff with "hands on" and “look and feel” of a potential future system. This experience allowed APA staff to be surveyed and interviewed concerning their perceptions of how a fully implemented system might affect their work.

4.3 User Survey and Interviews

Prior to the staff training, each of the APA staff participating in the evaluation was asked to complete a one-page survey designed to capture staff perceptions of the utility of a full system in the context of their work. This preliminary survey also contained questions to assess the respondents’ self-perceived level of computer skill and frequency of use of GIS. A second survey (containing 13 of the same questions) was implemented after the training and individual experimentation with the prototype to capture any changes in respondent perceptions. The second survey also contained several questions pertaining to experience with the prototype system itself. The results of the analysis of the pre- and post- training surveys of APA staff are fully described in Kelly and Hyde (CTG.APA -013) and are discussed briefly below.

In addition to the short closed-form surveys, CTG staff interviewed APA employees participating in the evaluation to further assess their reactions to the prototype and to gather feedback on potential extended benefits and quality improvements. The interviews were designed to elicit a wide range of input from APA staff about how a fully implemented system might change the quality of current services or how APA could offer enhanced or new services that are not now feasible. A full description of the potential extended benefits of a fully implemented system as obtained during the interview process is contained in Kelly and Hyde (CTG.APA-012, “Potential Quality Improvements and Extended Benefits of an Office Support System for the Adirondack Park Agency,” August 1995).

The interviews also gathered data to support other research activities. A draft list of Agency transaction types was derived from the interview data. This list was then modified by APA staff and used in the modeling conferences described below. Information was also was gathered on necessary data types to support these different transactions. These results were modified by APA staff and subsequently used during the modeling conferences and the data population exercises. The interview results pertaining to the development of transaction types and data categories are discussed in full in Kelly and Hyde (CTG.APA-008, “Preliminary Analysis of Interview Data,” March 1995)

4.4 Cost-Performance Modeling Conference

The first of three group model-building conferences took place in October, 1994. The purpose of this exercise was to model the potential costs and productivity benefits of a fully implemented system. At the time of the modeling conference, substantial progress had been made in the development of the prototype system. The conference was facilitated by CTG

staff and attended by the APA project team members representing all key areas of Agency transactions as well as staff responsible for Agency data and system development activities.

The conference elicited from the APA project team the costs of a new system in terms of hardware, software, data acquisition, and staff expenses including new staff who would be needed to maintain the system and its data layers. The conference also arrived at estimates of the potential savings of a fully operational system, mostly measured in terms of staff time saved. This conference examined savings associated with current APA services. It did not consider that the system might be able to provide the same services in a more timely fashion (estimated at a later modeling conference) nor the fact that higher quality or new services might be possible with the new system (captured in the staff interviews).

The October conference enabled APA managers to envision the system at various levels ranging from limited add-ons to the present way of doing business up to and including an extended system package supporting the full range of features envisioned by APA in its original proposal to CTG. Between these two extremes, Agency staff crafted two incremental system proposals that contained increasing levels of functionality and overall cost. For each level of system functionality, the managers specified what hardware, software, and data would be needed by both internal and external users. Eleven types of functionality were examined, including functions such as providing electronic access to base maps, identifying and associating non-map documents associated with a geographic location, automatic map preparation and printing, and archiving.

Additional analysis was required to complement and build upon the results of the first conference. For example, the estimates of staff time as well as the data acquisition costs needed additional attention and refinement. While this first conference sought to identify the benefits of a fully implemented system in terms of increased productivity, two additional facilitated exercises were conducted to further examine the costs of populating a fully implemented system with various data layers and to estimate potential changes in customer turn-around time. The methods used to conduct these conferences as well as the results of the first modeling conference are contained in Andersen, Kelly, and Rohrbaugh (CTG.APA-007, "Interim Report on the APA Cost Performance Model," November 1994).

4.5 Work Analysis and Customer Turn-Around Time Analysis

The second model building conference occurred in March after APA staff had been trained on the prototype system and had been interviewed and surveyed as described above. The second conference included virtually all those CTG and APA staff in attendance at the October conference. The conference focused on the analysis of potential impacts of a full system on customer turn-around time.

In order to conduct the analysis, it was first necessary to create a complete inventory of the customer transactions conducted by the Agency. Using the data collected in the earlier round of interviews as a starting point, APA staff defined sixteen transaction types which comprise the customer-oriented work of the Agency. For each of these transaction types, the number

per year, the average number of staff days required to complete that transaction, and the average customer waiting time were estimated. Staff were then able to estimate the average number of staff days and customer waiting days that could be saved for each type of transaction through a consideration of the steps, time associated with each of the steps, and the decrease in time expected from the various levels of system functionality and data population.

A preliminary analysis of the potential for improving customer-turnaround time without automation through process reengineering was also conducted during the second conference. It was concluded that reengineering efforts would result in a maximization of the benefits of full system implementation, and that reengineering without the implementation of new technology also offers potential improvements in customer responsiveness.

The results of this second modeling conference, particularly the more detailed estimates of staff time savings associated with full system implementation were integrated into the overall system cost and performance modeling effort.

4.6 Data Population Model

The third and final modeling conference was also held in March 1995 to determine the costs associated with acquiring the various data layers necessary to support different levels of system functionality.

This conference began with an identification of thirty-six different data sets that APA staff determined to be necessary to support a fully implemented system. Based on the results of CTG staff analysis of the interview data, three data categories were created based on frequency and order of use of the information. The three categories were then modified based on group consensus at the start of the conference: data group #1 comprises those data types necessary to complete a jurisdictional inquiry, data group #2 represents data to support additional routine agency transactions, and data group #3 represents more specialized and less used data sets that could be developed over time.

The conference focused on creating estimates for those data sets in data group #1 that need to be converted before the system could be made functional on an Agency-wide basis. This analysis identified nine data sets that needed to be converted on a one-time basis in order for a full system to become functional. The costs of converting these data sets ranged from a low of only $400 for data that was already available in a "clean" format from another agency and merely had to be loaded, to a high figure of $94,000 for a complex data set that had to be converted by APA.

The costs of populating a fully implemented system with the various data types were added to the overall system cost and performance model. The details of this third data modeling conference are contained in Andersen, Hyde, and Kelly (CTG.APA-007, "Interim Report on the APA Data Population Model," March 1995) as well as in Andersen, Kelly, Hyde, and Rohrbaugh (CTG.APA-009).

4.7 Synthesis of Time and Cost Estimates

The final step in deriving the costs and benefits as well as time impacts was to extract the most recent and best estimates from all of the modeling conferences and combine them into a single synthetic whole.

5. Working Faster: Work Analysis and Impact of System on Customer Turn-Around Time.

The section begins with an analysis of the jobs and tasks that comprise the APA's work. As the estimates of reduction in customer turn-around time assume the existence of a fully functional system, the analysis further presents an explicit set of assumptions about the types and levels of functionality that would be included in a fully implemented system, as well as a description the data types that would support each level of functionality. Finally, this section presents estimates of potential decreases in customer turnaround time associated with two levels of full system implementation. This analysis is completed for the eight most common transactions completed by APA.

5.1 Analysis of Types of Work at APA

The types of work conducted at APA can be viewed from two different perspectives. First, one can consider APA's workload from the point of view of its customers. In other words, what are the main tasks and transactions that comprise customers' waiting time? On the other hand, one can consider how the workload looks from the perspective of APA staff. In other words, what are the main tasks and transaction types that require most of the staff's time and attention? The identification of *major* types of work is dependent on the perspective being considered.

Table 1 shows the sixteen major categories of customer-oriented work transactions at APA in order of transaction frequency. In, this perspective, the external customer's view of the Agency, the major functions appear to be in high volume information dissemination activities ranging from simple phone inquiries to more complicated analyses which result in a determination of whether the Agency has jurisdiction over a given project. The top three transaction types by frequency are phone inquiries, (4,500 per year), jurisdictional inquiries or JIFs, (900 per year), and requests for maps (500 per year). Relatively low frequency transactions include economic development projects, (15 per year), environmental impact analyses (50 per year) and work on major project permits (160 per year).

Transaction Type	Number of Transactions Per Year
Phone Inquiries	4500
JIFs	900
Map Seeking	500
Administrative Research	500
Enforcements	400
Cartographic	300
Wetland Delineation	300
Minor Projects	240
Major Projects	160
Pre-application Reviews	100
Local Planning	270
240 referrals *.25 hours	
25-40 contacts * 2 hours	
DEC Referrals	300
Environmental Impact	50
State Lands	35
10 Simple UMP's	
4 Complex UMP's	
20 Inquiries	
1 Map Updates	
Public/Political Inquiries	30
Economic Development Projects	15

Table 1
Adirondack Park Agency
Major Categories of Customer Transactions by Annual Frequency

However, when the workload is ordered according to the proportion of total APA staff time spent on each transaction type, the picture of the agency's work looks quite different. Table 2 shows the same sixteen transaction types ordered by the total staff days spent per year.

Transaction Type	Total Staff Days Per Year Per Transaction	Number of Transactions Per Year	Average Staff Days Per Year Per Transaction	Average* Turnaround Time Per Transaction (Days)
Major Projects	4000	160	25.0	60
Enforcements	1700	400	4.3	
JIFs	1575	900	1.8	20
Minor Projects	1200	240	5.0	21
Cartographic	1200	300	4.0	
Admin. Research	536	500	1.1	30
Phone Inquiries	321	4500	0.1	3
Environmental Impact	225	50	4.5	
State Lands	230			
10 Simple UMP's	35	10	3.5	
4 Complex UMP's	140	4	35.0	
20 Inquiries	40	20	2.0	
1 Map Updates	15	1	15.0	
Public/Political Inquiries	120	30	4.0	5
Wetland Delineation	107	300	0.4	
Map Seeking	54	500	0.1	14
Pre-application Reviews	50	100	0.5	
Economic Development	30	15	2.0	
Local Planning	17			15
240 referrals *.25 hours	9	240	0.0	
25-40 contacts * 2 hours	8	30	0.3	
DEC Referrals	11	300	0.0	

Table 2
Adirondack Park Agency
Major Categories of Customer Transactions by Total Staff Days Per Year
with Turnaround Time and Frequency Data

For each transaction type, the total staff days per year was computed by multiplying the frequency of each type of transaction by the average number of full time staff work days required to complete a single transaction of that type. These estimates do not take into account the amount of time that a task may sit in a queue awaiting attention. As shown in Table 2, the three transaction types that consume the most staff time are work on major project permits (4,000 staff days per year), enforcement activities (1,700 staff days per year), and responding to JIFs (1,575 staff days per year). Phone inquiries, the activity which

represents the highest frequency is a relatively minor activity when considered in terms of staff time consumed, requiring only approximately 321 staff days per year.

This difference in perspective on APA's work has important implications for the agency and its objective of improving relationships with customers. If the agency organizes itself and its work processes to complete its major tasks (most of which are defined by statute) as expeditiously as possible, it may not be able to respond optimally to its most frequent citizen contacts. That is, the seemingly good idea of maximizing the internal work processes of the agency (Table 2's viewpoint) can lead to unacceptable turn-around time (as defined by Table 1's view).

The final column of Table 2 shows the estimates of turn-around time for eight of the sixteen transaction types. The various steps and time delays in each of the eight transaction types were discussed and analyzed in detail. These eight transaction types were selected based on the relative frequency of the transaction and the potential for that transaction to be improved by automation. Notice that the longest customer waits are associated with work on permits for major projects, estimated at 60 days while the shortest wait (3 days) is associated with routine phone inquiries.

5.2 System Options to Support Various Types of Work

An automated GIS and document management system could be configured to support one, several, or even most of APA's transaction types. The costs and benefits of a system designed to support one cluster of transactions would be different from a system designed to support a different set. Hence, estimating the costs, benefits, and other impacts of a fully implemented system requires that the scope of that system be clearly defined in terms of its functionality and level of data population. This section presents the assumed levels of functionality of two potential versions of a final system (one less expensive and less functional and other more expensive with more functions). The next section discusses the data requirements for the two versions.

Table 3 is a more detailed description of the functionality which comprises the levels of system functionality. The columns in Table 3 represent levels of functionality associated with the current primarily manual system, a minimal future system, and an expanded future system. The first eleven rows of Table 3 represent the basic types of functionality for each respective system. For example, the row labeled "Archiving" contains information on how the archiving function is handled under the current system as well as how it would be handled under the minimal and expanded future system options. Currently, archiving is accomplished both by manual filing of paper documents and by the use of microfiche. Under the minimal system, archiving would be accomplished with microfiche only. The expanded system envisions a fully electronic archiving function including document images in electronic format. The last two rows of Table 3 describe briefly what data is assumed to be associated with each level of system functionality. These two rows are described in more detail in the section immediately below.

Functions	Current System	Minimal System	Expanded System
Access to Base Maps/ Basic Hardware	Update some maps on a 2 year cycle/ Unix Station in 2 locations with land class real time	A limited DOS network with 5 access points 2 dedicated Unix stations (some queuing problems)	Eliminate queuing problems with DOS network plus 4 dedicated Unix stations Windows PC's on every professional desk
Identification of Related Documents	JIF, Enforcement, Wetlands, Project, pre-existing subdivisions indices, but no images in the system	Pull up JIF and project files and indices on a Park-wide basis	Integrated ORACLE system for permits and text on a Park-wide basis/Password protected security system for greater access
Review Documents for PSO Folders	Actual files	Images are sent to printer for hard copy file	Additional Development work with ability to scan in documents and document tracking - Electronic Files - Keep work in progress together as a package: collate archival folders
Map Preparation and Printing	Present Level of Cartographic Services	Color land use, topographical, and tax maps	Total of three color printers
Archiving	Manual and Microfiche	Microfiche only	Full electronic archiving of maps and document images
FAX Output	Manual	Manual	Computers with FAX cards
User Interface	Tax Map Lookups Existing Data Bases in different locations	Off-the-shelf interfaces developed with in-house support	APA staff more fully develop their own user interfaces-more in-house development work
Session Manager	None	None	An electronic visit/call log throughout building
Updating and Moving Documents Around	Manual	Limited cut and paste on clipboard	Update, correct, adjust, and cut & paste all documents/ critical dates can be tracked by the system
Modeling, Research, and Analysis	Word Searching/Index Searching	Adjacent mail addresses function added to the system	Revision "terrain" graphics, view shed definition, automatic calculation of distances, expert system prompting, GPS/Ecological lookup, extension of ecological look-up system
Management Functions	Activity Reports	Same as current	Customized tracking of work and scheduling

Table 3
Adirondack Park Agency
Proposed System Packages

5.3 Data Groups to Support Various Types of Work

CTG analysts used three discrete data groups to classify the types of data that might be added to each system package. Data group #1 contains the primary data sets necessary to support jurisdictional inquiries. Data group #2 contains those non-statutorily required data sets that APA staff use frequently. Data group #3 contains non-statutorily required data sets that staff use least often. The data layers included in each group are shown in Table 4.

Data Group 1 **Required for JIFs** **Most frequent use**	Tax maps Land Classification Wetlands Historic Project Site Hydography Designated Rivers Roads (including state highways) Elevations over 2000 ft.
Data Group 2 **Non-mandatory** **Frequent use**	Topography Natural heritage sites Water shed Aquifers Soils
Data Group 3 **Non-mandatory** **Infrequent use**	Historical JIF files HUD flood plains Historic ownership records (deeds) Protected species Historic preservation sites Adjacent landowners 3-D view Natural resources Visually sensitive areas Vacant commercial sites Demographics Sewers Historical enforcement records Power lines Biological diversity

Table 4
Adirondack Park Agency
Data Groups Needed to Populate a Future System

The purpose of grouping the data in this manner was to capture those data sets which, if available would support the largest proportion of staff transactions. The details associated with this portion of the analysis of the interview data can be found in Kelly and Hyde (CTGAPA-008) and in Andersen, Hyde, and Kelly (CTGAPA-009).

Table 5 illustrates the options for a future system which were evaluated during this project. The horizontal axis represents increasing levels of system functionality ranging from the current system through modest enhancements to a much expanded "full system" conceptualized by APA staff in October 1994. The vertical axis illustrates options that have increasingly more digitized data layers with data group #1 being the data necessary to make jurisdictional findings and data groups #2 and #3 including some less frequently used but technically important data sets. Going up the vertical axis in Table 5, the currently available data (a mixture of paper, microfiche, and electronic files) could be expanded to digitization of data group #1 up to digitization of all three data groups. For the purposes of the analyses reported here, we have analyzed the cells indicated as "minimal future system" and "expanded future system."

	Level of System Functionality		
Data Population Strategy	**Current Mostly Manual System**	**Automate Minimal Functionality**	**Automate Expanded Functionality**
Digitize Groups 1,2,3			Expanded Future System
Digitize Groups 1&2			
Digitize Group 1 only		Minimal Future System	
Current Mixture of Paper and Digitized Data	Baseline		

Table 5
Adirondack Park Agency
Conceptual Overview of System Functionality and Data Options

It is important to note that the system packages illustrated in Table 4 may not represent the best options for APA to implement in the near term or even in the long term. These options capture the assumptions that guided much of the prototype development and that underpinned all of the cost-benefit modeling as well as the estimates of customer turn-around time and

quality enhancements. However, learning that has taken place both during and after the CTG project suggests that another option - neither one of those illustrated in Table 3 - may be the best one for APA to pursue. This important distinction between the options chosen for analysis and the options that might be recommended for further development is an important one and is more fully discussed under section 9.0 below, as well as in the recommendations section of this report.

The following section presents the potential impacts on customer turn-around time that can result from the implementation of an automated GIS and document management system. More specifically, it shows how customer turn-around time be reduced for each transaction type for both a minimal and an expanded future system.

The analysis initially focused on eight transaction types that represent those areas where APA staff felt productivity and turn-around time improvements were most needed and where an automated system was expected to have the most impact. These eight transaction types represent approximately 6,800 of APA's total of 8,600 annual customer-focused transactions or about 80% of APA's work measured by frequency of transactions. When looked at in terms of work load for APA staff, these eight transaction types represent approximately 9,000 of APA 11,400 annual staff days -- again about 80% of APA's volume of work.

CTG conducted its analysis of potential turn-around time impacts after the prototype design, development, installation, and staff demonstration. Additionally, APA staff had received brief training on the prototype and had had an opportunity for further individual experimentation. The APA project team were assembled for a two day modeling conference, the primary objective of which was to estimate the potential effects of full system implementation on customer turn-around time. For each of the eight transaction types, CTG and APA staff examined the work flow details and discussed which, if any, of the associated sub-processes could be expedited with the use of a new system.

For most transaction types, strong consensus was reached about the potential turn-around time effects of the minimal and expanded systems. In the cases of dissension, the points of agreement and disagreement were diagnosed and analyzed in further detail, often with estimation and analysis of numerical models of sub-processes within the overall transaction type. In some cases, the team seemed very eager to embrace the technology and were optimistic about its impacts. For example, the estimates indicate that a fully functional minimal system could eliminate virtually all of the customer waiting time associated with phone inquiries. For other functions the team agreed that the determinants of customer delay were not among those that the system could support or facilitate, and hence, impact on customer turn-around time would be minimal. For example, most of the waiting time associated with major projects involves waiting for additional information from external sources or for in-house staff analysis. These sub-processes are expected to be affected minimally or not at all by an automated system. Optimistic as well as pessimistic estimates of turn-around time impacts have been included in the analysis due to differing perceptions of what the system would be and how it could affect work processes. Nevertheless, the CTG

staff who conducted the analysis believe that the aggregate results presented in Table 6 below, are sound estimates of the potential changes in turn-around time.

	Transactions Per Year	Base Turnaround Time (Days)	Limited System Time Saved		Expanded System Cumulative Time Saved	
			% Reduction	Days	% Reduction	Days
Transaction Type						
Major Projects	160	60	0.01	0.5	0.03	1.5
JIFs	900	20	0.25	5	0.40	8
Minor Projects	240	21	0.02	0.5	0.05	1
Phone Inquiries	4500	3	1.00	2.99	1.00	2.99
Public/Political Inquiries	30	5	0.10	0.5	0.20	1
Map Seeking	500	14	0.46	6.5	0.46	6.5
Local Planning Referrals	240	15	0.33	5	0.67	10
Resolved Enforcement(1)	200	90	0.06	5	0.17	15
Total Transactions	6770					
Avg. % Decrease (Weighted by number of transactions)			74%		78%	

*Limited System includes data set 1, Expanded System includes datasets 1-3
(1) One half of total enforcements are resolved in 90 days. Half remain unresolved

Table 6
Adirondack Park Agency
Reductions in Customer Turnaround Time
By Level of System Functionality* and Transaction Type

The rows in Table 6 contain data for the eight selected transactions types. For each transaction type, the first and second columns present the number of transactions per year and the base turn-around time -- the estimated average number of days that a customer waits under the current system. The table also presents the estimated number of days that would be eliminated if the minimal system were implemented with data group #1 as well as the associated percent reduction for each transaction type. The same data is also presented for the expanded system. For example, the current base waiting time for a JIF is estimated to be 20 days. The implementation of the limited system would reduce that time by five days or 25%, while the implementation of the expanded system would further reduce the waiting time by another three days or a total reduction of 40%. On average customers could expect a response within 15 days with the limited system and within 12 days with the expanded system.

This data represents the potential improvements in the delivery of service to APA's customers, one of the key objectives in the project. The largest percentages of turn-around time saved are associated with phone inquiries (close to 100%), local planning referrals (67%), map seeking (46%), and JIFs (40%). Transactions showing relatively low potential percent reduction in turn-around time include major project permits (3%), minor project permits (5%), and the resolution of enforcements (17%).

Two features of Table 6 deserve further attention -- (1) the interaction of reductions in turn-around time with existing work processes and (2) the effect of transaction volume on external perceptions of APA's performance. With respect to the interaction of turn-around with existing work practices, notice that the impact of both the limited and expanded systems on minor project permits and public or political inquiries are identical -- time savings of half a day for the limited system and a full day for the expanded system. However, these identical impacts in real terms translate into a 20% reduction for public and political inquiries and only a 5% reduction in turn-around time for minor project permits. This is because the base time to completion for public and political inquiries (5 days) is substantially less than that for minor projects (21 days). Therefore, waiting time and the potential impact of a new system on that waiting time is a complicated mixture of how APA organizes its internal priorities, how work processes flow through the agency, and the degree to which an automated system can address the causes for delay.

The second important feature implicit in Table 6 centers on simple volume effects. Phone inquiries are a key transaction type in this respect. An automated system can have dramatic effect on waiting time associated with phone inquiries (eliminating almost 100% of the total waiting time), and phone inquiries represent an exceedingly large proportion of total customer transaction. The 4500 phone inquiries indicated in Table 6 represent fully two thirds of the total annual volume of transactions analyzed. In short, if the relative waiting times associated with high volume transactions can be drastically shortened, as would be the case with phone inquiries, most citizen perceptions of agency responsiveness can be vastly improved.

To illustrate this point, if the mean percent reduction in turn-around time were to be computed from Table 6 weighted by the annual frequency for each transaction type, the expanded system would eliminate 78% of the citizen waiting time for APA action. The corresponding reduction in mean waiting time for the limited system is 74%. Note, however, that these rather dramatic effects can be attributed mostly to the ability to respond to phone inquiries much more quickly. Since phone inquiries are such a large fraction of APA's customer transactions, this seemingly simple improvement has a high degree of leverage.

5.5 Staff Training Needed to Support System Implementation

All of the expected improvements in service assumes an appropriate level of staff training will be conducted to support the use of a fully implemented system. The evaluation included a simplistic analysis of the level of need for such training. As indicated above, the preliminary survey contained two questions to assess the level of staff computer skill in general, and more specifically, the frequency of GIS use in day to day work.

The first question addressed the potential users' self-perceived levels of general computer skill. In total, 26 APA staff members responded to the first survey. One response was missing for the question on general computer skill level. The frequencies and proportional representations are shown in the table below.

	Frequency	**% of Total**
Never touched one before	0	0
Novice (used one or two packages)	11	44
Moderately skilled (proficient in one or two packages)	11	44
Highly skilled (multiple packages- 1 platform)	3	12
Highly Skilled (multiple platforms)	0	0
Total	25	100

Table 7
Self-Perceived Level General Computer Skills

As shown in Table 7, none of the respondents indicated that they had never used a computer. Of the 25 respondents, 44% indicated that they were novice users and had used one or two packages to some degree; another 44% indicated that they were quite proficient in several packages, while the remaining 12% indicated that they were highly skilled on one platform. None of the respondents indicated that they were highly skilled on more than one platform. Overall, the survey results indicate that only 12% of the respondents considered themselves highly skilled, while over half of the respondents considered themselves at least moderately skilled.

Also of interest was the perceived frequency of use of geographic information systems in the staff's day to day work activities. Table 8 shows that 36% had never used a geographic information system, while 20% used a GIS frequently for one or more activity.

	Frequency	% of Total
Never	9	36
Occasionally. One activity	11	44
Frequently- One Activity	1	4
Frequently- Multiple Activities	2	8
Daily Multiple Activities	2	8
Total	25	100

Table 8
Self-Reported Use of GIS in Day-to-Day Work

The data in tables 7 and 8 indicate that the need for staff training may be considerable depending on the expected degree of use associated with full system implementation.

6. Working Cheaper: Overall Costs and Benefits of a Full Scale GIS at APA

This section examines the costs associated with the acquisition of either the minimal or the expanded system including both system acquisition and annual costs associated with the maintenance and further development. Annual benefits are also estimated in terms of cost savings or cost avoidance that will accrue to APA as a result of system implementation. This section focuses on the potential reduction of costs associated with a system and does not consider possible quality effects of the new system, nor new products or services that might be available as a result of system implementation. These additional, less easily quantifiable, effects are discussed in Section 7. No attempt has been made to quantify the value of the faster customer turn-around times discussed in the previous section.

6.1 An Overall Cost Performance Model

Table 9 presents in summary form, the dollar costs and benefits associated with both the limited system and expanded systems. Costs include one-time system costs, one-time data acquisition costs, and annual expenditures for new staff needed to manage the computer system and maintain the data. Two types of annual savings are estimated--annual staff savings reflecting less staff effort to accomplish information management and data maintenance functions and other annual savings such as reduced paper, map acquisition costs, or travel costs.

	Dollar Costs (Thousands)					Dollar Benefits (Thousands)		
	One Time System Costs (1)	One Time Data Costs (2)	Total One Time Cost	Annual Staff Costs System Admin.	Annual Staff Costs Data Mgmnt.	Annual Staff Savings	Other Annual Savings	Total Annual Savings
Limited System with Data Group 1	$317	$206	$523	$30/yr.	$30/yr.	$142/yr.	$2/yr.	$144/yr.
Expanded System with Data Groups 1-3	$627	$220	$847	$60/yr.	$60/yr.	$237/yr.	$21/yr.	$258/yr.
(1) Includes Estimates for hardware, software, system development & staff training (2) For details see CTG.APA-009								

Table 9
Adirondack Park Agency Summary Of Annual and One-Time System Costs and Annual Savings

The first row of Table 9 presents the values of all these variables associated with the limited system. The second row presents the same values for the expanded system. The figures in the second row are cumulative including all costs associated with the limited system. For example, the one time cost associated with acquiring data for the limited system is approximately $206,000 reflecting only the one time costs associated with data group #1. The one time cost for all data groups is estimated at $220,000 implying that the marginal costs associated with acquiring data groups #2 and #3 is $14,000.

Most of the quantified system benefits are comprised of savings in staff time. The details of these staff savings are discussed below. The data costs summarized in the table are also discussed in a separate section of this report. The one time system costs were estimated primarily in the October cost-performance modeling conference, and the system costs comprise costs for hardware, software, system development, and staff training costs necessary to support the functionality as described in Table 3 above. The details of these one-time cost estimates are presented in more detail in Andersen, Kelly, and Rohrbaugh (CTGAPA-007).

It is important to remember that the two options analyzed in Table 9 represent only two of a number of potential options. Both of these options share the characteristic of acquiring and installing the whole system with its associated data sets all at once. More gradual, evolutionary system development strategies moving toward a fully functional pilot system and gradually adding data layers may be a more cautious and ultimately more cost-beneficial way to proceed with system development. Further discussion on "growing" the system over time and taking an evolutionary approach to data population can be found in section 9 below.

6.2 Changes in Staff Time Required for Various Tasks

Table 10 presents a summary of potential savings in staff time associated with both the limited and expanded systems. These time saving estimates are organized according to twelve of the sixteen customer-oriented transactions that make up APA's workload. Four transaction types were expected to experience only minor workload impacts associated with the automated system. These time saving estimates make up the bulk of the annual dollar savings associated with the system as displayed in Table 9 above.

	Transactions Per Year	Total Staff Days Per Year	Staff Days Saved Limited System	Cumulative Staff Days Saved Expanded System	
			Days	Days	% Reduction
Transaction Type					
Major Projects	160	4000	80	160	0.04
Enforcements	400	1700	N/A	68	0.04
JIFs	900	1575	394	520	0.33
Minor Projects	240	1200	120	240	0.20
Cartographic	300	1200	N/A	48	0.04
Administrative Research	500	536	N/A	70	0.13
Phone Inquiries	4500	321	129	129	0.40
Public/Political Inquiries	30	120	30	42	0.35
Wetland Delineation	300	107	N/A	8	0.07
Map Seeking	500	54	27	27	0.50
Pre-applications	100	50	10	10	0.20
Local Planning Referrals	270	17		2	0.12
All Other	400	496	N/A	N/A	N/A
Total	8600	11376	790	1324	
* Limited System includes data set 1, Expanded System includes datasets 1-3.					

Table 10
Adirondack Park Agency
Savings in Staff Time By Transaction Type
for Two Levels of System Functionality*

The column labeled “Total Staff Days Per Year” indicates the estimated total number of staff days that APA devotes per year to the indicated transaction type. The “Staff Days Saved” columns display estimates of how many days the limited and expanded systems would save, if implemented. For example, JIFs under the present system require an estimated 1575 days of APA staff time. If the limited system were to be implemented, 394 staff days could be saved. If the expanded system were installed, a total of 520 staff days could be saved or 33% of the total staff effort associated with the JIF’s.

Table 10 contains a number of interesting patterns. The areas where automation will probably have the least impact under current organization of work processes include major projects, enforcements, cartographic work, and wetlands delineation. Relatively high impact areas include responding to citizen requests for maps, responding to local planning requests, responding to phone inquiries, and responding to jurisdictional inquiries. Notice that in many cases the fraction of staff time being saved is considerably less than the fraction of turn-around time being saved by APA's customers (Table 6). For example, customers would experience almost a total elimination of waiting times for phone inquiries, but staff time savings would only be 40%. In this case, staff would still be spending much of the time responding to requests, but the system would allow staff to respond to most queries while the customer was on the phone, thereby eliminating customer waiting.

In total, the limited system would save APA an estimated 789 staff days per year. This amounts to approximately 3.3 FTE employees or 7% of the total effort associated with completing all sixteen transaction types analyzed by CTG. If the expanded system were implemented, APA could save an estimated total of 1322 days or about 5.5 FTE staff. This amounts to about 12% of the total effort associated with the sixteen transaction types analyzed by CTG.

6.3 Data Conversion and Maintenance Costs

Table 11 presents the summary costs associated with populating the system with data. These data were derived at the March modeling conferences and are more fully described in Kelly and Hyde (CTG.APA-008) and Andersen, Hyde, and Kelly (CTG.APA-009).

The March data modeling conference began with a detailed elicitation of the characteristics of all 28 data sets along with a description of what would be involved to acquire or convert each of the data sets. From this discussion, it became clear that some of the data conversion effort would have to take place over an extended period of time with a half-time or full time staff person being allocated to this purpose. However, before the system could become even minimally functional, an intensive one-time data conversion effort would have to be undertaken. All three data groups contained data sets that would require such one-time conversion. It is also important to note that APA already maintains a stand-alone GIS system and therefore, several of the data layers are already held by the Agency and need only minor changes for use in a new integrated system.

Table 11 further divides all of the basic data sets according to how and when the data would be need to added to the system. The first three rows represent types of data that would require up front conversion with associated one-time costs. These three types include data already held by the Agency, data that would require an additional one time conversion effort by APA, and special APA data projects that would add records as they become available.

Type of Data	Data Group #1	Cost	Data Group #2	Cost	Data Group #3	Cost
Up Front Data Conversion and Associated Costs						
Pre Populate- data ready now	Roads (including State Highways)	$6,500	Aquifers	$400	Protected species (from DEC)	$400
	Elevations Over 2500	$400	Natural Heritage Sites (from DEC)	$400	Biological Diversity/ 20/20 Sites	$400
	Warren County Soils	$400	Soils Meso- Base Maps			
Pre-Populate	Tax Maps	$60,000	Historic JIFs	$10,500		
One Time Conversion	Wetlands (6 Co.s)	$32,000				
By APA	Land Classification	$400				
	Hydrography	$400				
	Designated Rivers	$12,500				
	Historic Projects	$93,000				
Special APA Projects- add records as they become available.	Wetlands (Other Co.s)				Natural Resources/ Land Cover Visually Sensitive Aread	$400
Total $218,000		**$205,600**		**$11,300**		**$1200**

Type of Data	Data Group #1 Cost	Data Group #2 Cost	Data Group #3 Cost
Maintaining Data and Generating Routine Data Sets			
Maintain Pre-Populated	Data Prepared by APA	Data Prepared by APA	Data Prepared by APA
Data Sets	Data Prepared by Other Agencies	Data Prepared by Other Agencies	Data Prepared by Other Agencies
Add records as they are developed by APA's on-going use of the system	Present and Future Projects	Watersheds	
	Present and Future JIFs	Soils Project Sub-Studies	
Add records as they are developed by another agency.	New Hydrography--USGS	Topography--DEC	HUD Flood Plains--HUD
	Update on Roads--DOT	Natural Heritage Updates--DEC	Protected Species (DEC) Historic Preservation Sites--OPRHP) Demographics--DED? Vacant Commercial Sites (E&A) Sewers Power Lines NFRI
Unresolved at this time			Historic Ownership (Deeds)

Table 11
Adirondack Park Agency
Data Population Strategy with Summary Costs

The second class of data shown in Table 11 are those data sets that either require on-going maintenance or that should be acquired in the future through the routine operations of APA. All of the data sets in this second group should be maintained or acquired as part of the job description of the data manager that APA had identified as necessary to operate the system. Hence, three functions define the job description of the data manager--(1) maintain pre-populated data sets, (2) add records as they are developed by APA's on-going use of the system, and (3) add records as they are developed by other agencies.

In the March data modeling conferences the group estimated the costs of the one-time data conversion tasks. As part of that analysis, each data set was examined in detail. The group first listed the conversion tasks and then estimated the volume of work associated with each task. Appendices B through H of Andersen, Hyde, and Kelly (CTG,APA-009) present cost models for seven of the most important data sets in Table 11.

Table 11 provides the bottom lines from each of these cost sub-models into the column labeled "cost" for data groups 1, 2, and 3. Notice that for those types of data that require maintenance of existing data or the generation of data from routine administrative operations, the cost column is left blank. This does not imply that data maintenance has no associated costs. Rather, these costs are assumed to be picked up in the salary of the data manager. The cost figures in Table 11, therefore, represent one time costs associated with converting data into the system.

6.4 Assessment of Limitations and "Soft Spots" in Reported Cost and Benefit Figures

All of the cost and benefit figures reported in this section were taken directly from estimates provided by APA and CTG staff in the cost and performance modeling conferences held between October 1994 and March 1995. This section reflects briefly on the cost estimation process to assess which estimates seem to be the most "firm" and which may have "soft spots."

The benefit figures estimated directly from staff time savings are probably the most reliable of the figures presented. These figures were estimated twice through independent processes. In October, staff time savings were estimated by looking at a functional view of APA's work. The work analysis was essentially repeated in March when APA's workload was analyzed in terms of sixteen types of customer transactions. The March estimates came out slightly higher because many of the transactions captured small pieces of staff time that could be saved but were missed when broad functions were looked at in October. Additionally, much staff analysis in October and March focused on refining these estimates.

The one time cost figures have been checked several times. In addition, they are quite close to independent estimates of system costs prepared by APA staff in a prior budget request. If the one time system costs have a "soft spot," it is probably that they underestimate the training and staff development costs that will be associated with installing a new system.

The data costs reported in this section of the report are probably the least reliable of all of the reported cost estimates for several reasons. First, Table 11 indicates that most of the data sets in data groups #2 and #3 will be added to the system incrementally by the data manager. No attempt has been made in any of this analysis to determine if a half time data manager would in fact, be able to support the limited system, or if a full time data manager would be able to adequately support the expanded system. The data maintenance cost estimates may be low.

Table 11 also assumes that a number of the important data sets will become available from other sources and that they could be added to the system in two staff days. These costs would be much higher if the agencies responsible for providing that data were not able to provide the data in a format readily convertible to that required by the system.

7. Working Better: Reengineering and Other Extended Benefits and Products of the System

The previous two sections have analyzed the potential for an integrated GIS and document management system to enable APA to do its work more efficiently and to respond its customers more rapidly. This section discusses some of the ways that the system might help APA provide different, new and innovative, or better services and products to its customers.

7.1 Using GIS Technology to Redesign APA's work flow

The primary purpose of the cost-performance modeling conferences was to examine the primary costs and benefits of the limited and expanded system options. However, some of the data emerging from those conferences indicated that further analysis of the work processes associated with the Agency was needed in order to recognize the maximum benefits of automation or, alternatively, to achieve productivity benefits without the introduction of technology. For example, the staff time analysis indicated that the new system would probably save about 20 minutes out of the total 50 minutes that a staff member spends responding to an average phone inquiry (these time estimates include both time on the phone and time looking up information to prepare a response to the customer). However, this rather modest savings of 20 minutes of staff time per transaction was estimated to save an average customer three full days of waiting. Clearly, these information requests had to be stacked up somewhere waiting for handling, and knowing where work was queuing appeared to be key to understanding how to decrease waiting time.

In order to further examine these issues, CTG conducted a series of analyses that attempted to get at the question of how work organization can leverage relatively small staff savings into relatively large service improvements. Staff time was seen to be proportional to the rate at which work is completed (e.g., number of inquiries completed per hour or day). On the other hand, how long a customer waits is more closely related to the backlog of uncompleted work (e.g., the total number of inquiries waiting to be answered) plus the number of times a single transaction has to go into a waiting queue. By reorganizing work flow, a relatively small

increase in staff productivity can over time dramatically reduce work backlog, and in the long run have a dramatic and positive impact on customer waiting time.

In addition, by changing work flows between work units and individual work unit overall, customer response time can be greatly reduced. It appeared that some of the major improvements in customer turn around time might be accomplished by a simple reexamination of these work flow and priority issues even in the absence of labor-saving automation.

In order to begin to explore the possible impact of these work reengineering effects, CTG worked with APA to craft a simple work flow model that used the frequency and time numbers derived from the March conference to illustrate how a redesign of work flow and priorities might possibly impact on customer waiting times. This work began by drawing a flow diagram that traced the typical flow of three types of work through the agency (JIFs, minor projects, and enforcements). This flow diagram was a simple process map for these three transaction types.

Table 12 is a simplified spreadsheet derived from that process mapping exercise. The rows of this spreadsheet represent activities associated with these three activities. Each type of transaction calls upon seven functional areas within APA -- consult, expert advice, mapping, field work, research, writing, and administration. Activities associated with these seven functional areas are shows in the columns. The exact numbers in this spreadsheet were elicited rapidly from the group and are reasonably accurate but have not been verified.

	Consult		Expert Advice		Mapping		Field Work		Research		Writing		Admin	
	No.	Time (hrs)	No.	Time (hrs)	No.	Time (hrs)	No.	Time (hrs)	No.	Time (hrs)	No.	Time (hrs)	No.	Time (hrs)
JIF's														
900 per year	900	1	900	1	900	0.5	50	4	900	5	900	3	900	0.25
1.5-2 days\JIF			450	1										
Projects Minor														
240 per year	240	1	240	2	200	2	240	10	240	6	240	6	240	1
5 days\project	200	2	240	2	100	2	240	10					240	1
	160	2												
	120	2												
Enforcements														
400 per year	400	2	400	2	400	0.5	400	7.5	200	5	400	2.5	0	
4-4.5 days\enforcement	400	1	400	3			400	7.5						
	400	1												
Summary Statistics	2820	1.3	2630	1.6	1600	0.8	1330	8.3	1340	5.2	1540	3.3	1380	0.5

Table 12
Adirondack Park Agency
Center for Technology in Government
Examples of Process Mapping for Three APA Transactions

For each of the three transactions represented in the table, the number of transactions per year is indicated as well as the activities and the duration of those activities which comprise the complete transaction. For example, all 240 minor projects require a minimum of one hour of consult time. Of these, 200 require an additional two hour consult, 160 a third two hour consult, and 120 a fourth two hour consult. The rows indicate the discrete activities which make up the complete transaction while the columns present an overview of the annual work load for a given functional area. For example, for these transactions, the consult function over the course of a year will engage in a total of 2,820 activities with an average time on task of 1.3 hours. Notice that the total number of customer transactions in the consulting function example is only 1,540. This is the sum of the 900 JIFs, 240 Minor projects, and 400 Enforcements. The results show that the number of hours of consult time is nearly double the number of transactions that it supports. This indicates that a single transaction will have to queue up several times within the consult function, creating a lengthened waiting time for customers.

For this example, 2,820 discrete activities are required to perform 1,540 transactions suggesting that if APA used a simple sequential work process control, each transaction would, on average, have to queue up twice. Furthermore, individual work unit priorities will determine how long each type of transaction will take. If, for example, all functions give priority to JIF transactions, JIFs would have low waiting times and customer waiting times would fall to approach actual staff time (in the example 1.5 - 2 days). Similarly, if all units gave priority to minor projects, then the customer waiting time for these projects could approach the actual staff time of 5 days per project. This, of course, is dependent on the proportion of total waiting time that the Agency has control over. For example, for those waiting times associated with delays in procuring documents from external entities, changes in Agency priority will have no effect. If, on the other hand, each unit assigns priority at random or at its own discretion, then in great likelihood no transactions will have optimally low customer waiting times. In this example, allowing each function to assign its own priorities would lead to all transaction types having longer than optimal waiting times and no transaction type receiving expedited treatment.

Changing work priorities within a given unit will not change the amount of work that the unit faces nor the amount of work that the unit can complete in a single year. But paradoxically, customer waiting time can be decreased dramatically for some key transaction types even though the total work load within each functional area remains constant.

7.2 Reengineering Without Technological Support

Almost all of the insights related to the potential for reengineering work processes to speed up customer response time would be valid even if APA does not acquire any additional technology. Approximately two thirds of APA's customer contacts come in the form of phone inquiries with jurisdictional inquiries representing the second largest in transaction volume. If

APA set a working priority that all queries related to simple phone queries were to be answered by the end of business the day, the average customer waiting time could be cut from three days to one. This simple change would improve the response for 4500 customer transactions by two-thirds or two out of three days wait. That is, this simple change in agency-wide work priorities could improve dramatically about two-thirds of all of APA's customer-oriented transactions.

By assigning priority treatment to jurisdictional inquiries across all agency functions, it also seems likely that the relatively long time that customers wait for jurisdictional determinations could be similarly and dramatically improved. Notice that this is an issue relating to work priorities, not to overall staffing.

Undoubtedly, such a policy would delay other work in the Agency. Assume that all of the priority attention were to come at the expense of major project work. The already long delay on major project work would probably be lengthened by several days more as staff struggled to find time to answer phone calls more quickly and respond on a priority basis to JIF inquiries. This might be an acceptable trade-off for APA. Several hundred major projects would have their associated waiting extended from 60 days to, say, 65 while up to five thousand phone inquiries and jurisdictional inquiries could be handled in a more expedited fashion. This kind of rethinking and reorganization of work can take place in the absence of any new technology. However, it will require an agency-wide articulation of what types of work are to receive priority treatment. Work priorities cannot be set on a unit-by-unit basis. Of course, labor saving technologies could serve to combine process reengineering with staff time savings so that customer turn-around time savings could be accomplished without the difficult trade-off in other areas of agency performance.

7.3 The Potential for Enhanced Quality and New Products External Customers

If data layers were available for the entire park, then it seems very likely that the existence of either a limited or expanded system would allow APA to enhance the quality of existing products and provide new data products to its external customers. These effects are more fully discussed and analyzed in Hyde and Kelly, “Potential Quality Improvements and Extended Benefits of an Office Support System for the Adirondack Park Agency" (CTG.APA-012).

7.4 Potential Internal Quality Effects and Extended Benefits

Hyde and Kelly (CTG.APA-012) have also described a number of ways that the system could improve time management within APA, improve internal communication, and improve data quality and data management.

Several of the research methods used by the CTG evaluation staff sought to capture the potential extended benefits of a fully implemented system. The two surveys were designed to capture staff perceptions of a fully implemented system with respect to the work conducted at

the Agency. In addition, CTG staff interviewed 22 APA staff members to gather feedback on potential extended benefits and quality improvements from a fully automated system. The survey results indicated that staff believe a fully implemented system will improve the quality of service and communication both within and outside the Agency.

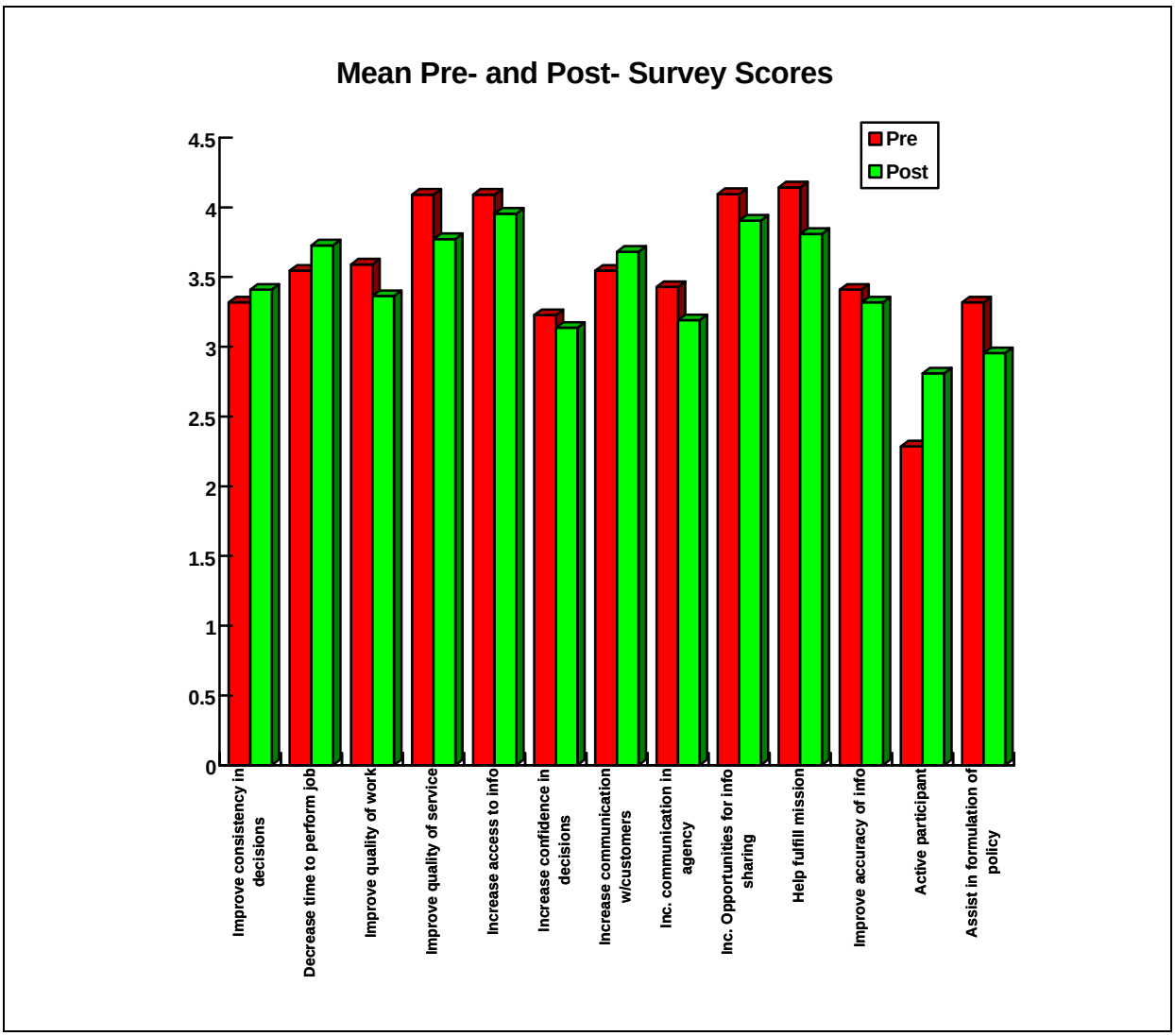

Figure 2
Pre and Post User Survey Results

As shown in Figure 2, APA staff believe that an integrated system will yield substantial benefit to the Agency. The survey responses were based on a five point scale with "1" equal to "strongly disagree" and "5" equal to "strongly agree." The data shown in the figure represents the mean score for each question for the pre and post surveys. The areas of greatest expected benefit include improving the quality of work, increasing access to information,

increasing opportunities for information sharing, and fulfilling the agency's overall mission. The average score for each of these questions was 3 or greater on the 5 point scale.

The results of the analysis also indicated that there was no significant change in staff perceptions about the utility of a system following staff interactions with the prototype. Perceived benefits remained at the same relatively high levels. It is interesting to note, however, that there was a statistically significant increase in agreement that staff were active participants in the project. The process of training and experimentation with the prototype system seems to have had a positive effect on the perceived level of staff involvement in overall system development. This data is presented in full in Kelly and Hyde, "Results from Pre- and Post- Surveys of APA Staff," CTG.APA-013.

After the prototype demonstration and a two-week experimentation period, 22 APA staff were interviewed about potential quality improvements and extended benefits. No attempt was made to reach consensus about the potential benefits or to match potential benefits to specific functions performed within the agency.

The benefits indicated by APA staff during the interviews were compiled, duplicate items were eliminated, and the resulting list was categorized into six types of benefits:

- improved communication with other government entities,
- improved facilities for decision-making and analysis,
- improved time management,
- improved internal communication,
- improved data quality and data management, and
- improved ability to conduct analyses to support economic development.

Improved communication with other government entities. Many APA staff indicated that an office support system and, in particular, the digital data needed to support the system, would enable them to communicate and work more effectively with other government agencies. Much of the work performed by APA staff is very closely linked to that of other state, federal, and local government entities. For example, many issues relevant to APA are also relevant to the New York State Departments of Environmental Conservation and Parks and Recreation. Additionally, local governments within the Park face many of the same issues and concerns as APA with respect to balancing land use and economic development with environmental protection. APA staff indicated that an automated system and the development of electronic data would enable them to foster and improve relationships with these other governments. Information created by APA could be more readily shared with other government entities with similar concerns and responsibilities. APA staff indicated that the process of creating and sharing new data could improve these relationships, many of which are currently strained. Many local governments striving to improve the economic climate within their towns, villages, and counties, perceive APA to be an obstacle to economic development. APA staff indicated that the system and the data needed to support the system would allow them to work more effectively with local governments toward a

common goal. Additionally, it would enable APA to provide expertise to local governments which do not the have the resources to conduct the types of analyses that APA staff conduct daily. Staff also thought APA would be able to assist local governments in the effective use of information for planning and decision-making.

In addition to providing increased communication and coordination with local governments, many staff said that the ready availability of data in digital format would provide a solid foundation for special studies and would greatly improve the agency's ability to respond to information requests.

Another aspect of the system is related to APA's ability to interact with and procure funds from the federal government. APA has successfully secured federal grants for specific studies such as a watershed analysis project for the Oswegatchie River Area. The existence of an automated system and the various data layers needed to support the system should further enhance the agency's ability to procure federal funding to examine issues of concern at the federal level. The existence of the data and the ability of APA staff to readily access and use this information should decrease the total costs of conducting special studies and allow more comprehensive analyses.

Several APA staff members thought that ideally, access to the agency's information could be made available to related state and local government agencies through the use of electronic networks. This network of information could be expanded to provide "one-stop shopping" for permits. For example, many individuals and businesses must deal with APA regulations as well as those of local governments and State agencies in order to undertake land development. The sharing of regulatory information would allow each agency to provide information about others' regulations to assist developers in a more comprehensive and coordinated way.

Improved decision-making and analysis. One of the largest areas of concern at the agency has been consistency in decision-making. Citizens have expressed concern about "surprises" in the agency's determinations. Land owners have indicated they expect consistent answers about land development. The need to address these issues was also noted in the "Report of the Task Force of Expediting Adirondack Park Agency Operations and Simplifying its Procedures," May 1994.

During the interviews, many APA staff indicated that the existence of an automated system would greatly improve consistency of responses. In particular, APA staff would be able to review all documents related to past decisions, including the maps that were used, legal determinations, and property history and characteristics to facilitate consistent decision-making. Under the current system, it is nearly impossible to access all of the documents related to past similar decisions of the agency. This is currently done by relying on the memory of APA staff who may have worked on related cases or by redoing past analyses in order to consider all the factors that led to a particular decision. This is, of course, highly resource intensive, and staff are often unable to incorporate past decisions into their current work. As consistency in advice and decision-making is a vital concern to the agency, many

staff saw this as an area where the an automated system would be of great benefit. The ability to readily access information related to past decisions will be key to improving customer service.

Many agency staff also indicated that the existence of electronic information for decision-making would help ensure that all relevant information would be used. Important factors would not be missed and errors would be reduced, improving the quality of decision-making.
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Further, additional types of analyses would be made feasible by the existence of the agency's information in electronic formats. For example, the agency would be in a better position to conduct time-series analyses, to examine "what-if" scenarios, and to examine cumulative effects of regulations and decisions. Additionally, the agency would be able to view the effects of decisions in one area of the Park on other affected areas. These types of analyses, while vital to the long-term success of the agency and the concerns of land owners in the Park, are very costly to conduct manually and are not often done under the current system.

Many of the decisions and actions of APA cannot be completed without site visits of the property or properties in question. Several staff members who conduct these site visits said that the existence of an automated system and ready access to relevant data help them better prepare for these site visits. Under the current process, APA staff, operating under time constraints, are often unable to obtain information pertaining to a property prior to their visits. On occasion, costly site visits are inadvertently repeated. This results in duplicative work which could be avoided through a system mechanism to track site visits and related on-site findings.

Improved time management. A large proportion of the staff work conducted at the agency goes through a two-stage process. The first part of the process is a jurisdictional inquiry initiated when a landowner, attorney, or realtor contacts the agency to determine whether the agency has jurisdiction over the proposed activities. An analysis must then be conducted by APA staff to provide this answer. If the agency does have jurisdiction, the second stage of the process, a project review, must be conducted to ensure that the proposed activities meet the relevant rules and regulations. Many activities undertaken in stage two are the same as those conducted during stage one. Many of the individuals interviewed said that these activities are often conducted twice, once during each stage. The proposed system would allow for the electronic sharing of results of the first stage so that they need not be repeated. Both stages of the analysis would be conducted using the same data, therefore increasing consistency across the work units and providing feedback to the staff conducting stage one work about additional data or considerations that could be included in future work.

Staff also indicated that the system would facilitate the generation of reports related to staff time spent on tasks, therefore enabling the agency to more effectively and efficiently allocate resources and plan for future work activities.

Improved internal communication. Many of the APA staff indicated that an automated system, in particular one that would allow for work flow management, would facilitate communication within the agency. Several of these improvements in communication were addressed in the above categories such as reducing the number of duplicative site visits. One other area of communication could be substantially improved through the use of an electronic phone log. Under the current process, land owners or their advocates would often shop around the agency seeking someone who would provide them with the answer they were looking for. At times, more than one staff member would be conducting analyses on the same piece of property. The sheer physical proximity of APA staff conducting this work provides some check on this form of duplication, but it is not foolproof. Many of the staff who deal directly with the public indicated that an electronic phone log, accessible to all staff, would prevent these duplications of effort. Additionally, a log would enable APA staff to direct communications to those individuals already familiar with a case, and therefore improve the quality and consistency of their customer interactions.

The proposed automated office support system was based on a network of PC's and UNIX-based work stations. Many of the potential improvements in communications relate to the network capabilities of information and document sharing as well as the electronic phone log. A networked system would also allow for the sharing of databases, decreasing the amount of oral communication necessary to support the agency's work activities. The networked environment should also facilitate communication about who is responsible for which cases, allowing new supporting documentation and information to flow to directly to the individuals conducting the work.

Improved data quality and data management. Many APA staff told the interviewers that a networked system would lead to improvements in data quality and data access. As mentioned above, a networked environment would allow for the sharing of documents and project files. Several staff members noted that at times, maps needed to conduct an analysis related to one project were in use by another staff member conducting another analysis. A networked environment would prevent delays in work related to these occurrences since both staff members could use the same maps at the same time.

A networked environment would also allow for ready access to databases. Under the current process, databases are maintained and housed on one computer. In order for staff to access these databases they must physically relocate. Again, the networked environment would save time and prevent queues and delays in obtaining relevant information for staff analyses. Additionally, updated versions of files and databases would be available in real time.

Issues related to archiving and records management could be addressed more easily with an automated system. As noted earlier, the ability to access historic records is a key issue related to improving service to APA's customers. Under the current process, completed project files are archived using 35mm film. However, the agency does not own or have ready access to a reader and is therefore creating archives in a format which cannot be accessed easily.

Staff members also felt that the system would allow for easier and more comprehensive report generation. Many of the agency's reports are currently created through a manual process. Due to resource constraints, it is often not possible to gather certain types of information about the agency's activities. For example, it may not be possible to compile data on the number of inquiries by type of projects (e.g., commercial development), without an enormous amount of manual work. This inability precludes the agency from systematically identifying trends or potential issues of concern.

Benefits Supporting Economic Development. Several individuals responsible for economic development activities conducted at APA were also interviewed. Many of the benefits discussed above are also relevant to APA's economic development activities. The agency's level of interest in economic development activities has varied over time with changes in agency leadership. Today, APA is trying to overcome its reputation for being anti-development. The agency's current leadership has made economic development a high priority. Many of the towns within the Park have lost industries and are finding it difficult to attract new business to their areas. In order for the towns to become viable, it is necessary for the agency to support the development of new business and to support those currently in existence. These activities must, of course, be balanced with the environmental concerns of the Park.

APA staff indicated that an automated office support system would provide an excellent tool to support a variety of the economic development activities conducted at the agency. For example, the system could pull together all of the relevant data for site location for a variety of different types of business and industry. APA staff would be able to use the system to select sites which meet all of the customer's needs as well as the those of the various regulatory bodies. Feasibility studies and other necessary analyses could be conducted in a much shorter period of time than under the current manual system. The system would also allow for more comprehensive analyses of the regional effects of business growth within the Park.

Economic development activities are also related to the benefits of data sharing within government. The data necessary to support the system would be of great use in economic development activities of the towns and villages within the Park. For example, digitized tax map data; the location of lakes, rivers, streams, wetlands and transportation networks; and a variety of other data types would allow for much more rapid analyses for determining ideal locations for business development. Toward this end, the agency has begun to share both digitized data and expertise with the local governments within the Park. Additionally, the agency has been partnering with such entities as Essex and Saratoga Counties, Niagara Mohawk, and Saratoga Economic Development Corporation to share in the development of tax map data. In these resource-sharing endeavors, both the costs and the benefits of the data creation accrue to all of the partners while the knowledge and expertise of the partners is also leveraged.

Local governments within the Park have expressed an interest in the use of spatial data and geographic information system to support their economic development activities. The results

of a strategic planning symposium sponsored by the Northern Saratoga County Economic Development Task Force indicated that a dialogue with the Adirondack Park Agency regarding economic development was a priority. The Task Force proposed that the four towns of Day, Hadley, Edinburg, and Corinth, as well as the Village of Corinth, collectively pursue participation and utilization of a geographic information system (Northern Saratoga County Economic Development Task Force, Preliminary Report, 1995). The ability to share both data and expertise should facilitate the development of such partnerships as the Agency and local governments work toward the common goal of balancing economic development with environmental concerns within the region.

8. The Dynamics of APA's Conversion from Paper-Based to Electronic Geographic Information

The "bottom line" analysis from this report indicates that APA can benefit greatly from a system similar to the one prototyped at CTG. The system can help APA provide the same services more cheaply, saving the equivalent of 3.3-5.5 FTEs. In addition, the system can help APA provide faster service to its customers. The average customer waiting time could be reduced by as much as 78%. The system can also help APA promote reengineering of internal work processes and development of a variety of positive relationships and enhanced services. However, the cost of acquiring and maintaining such a system is relatively high. CTG's analysis shows that it will take the system about six years to pay for itself out of staff and incidental savings (this estimate does not place a dollar value on faster and higher quality services). The estimated pay-back period is relatively long particularly in light of the evolving nature of the technology involved. Due to relatively high current technology prices and the likelihood that less expensive technology and data sets will soon become available, we recommend an evolutionary approach to system implementation focused on those aspects of the system that will yield short term productivity gains and improved responsiveness to customers.

Several expected changes in technology also support the case for an evolutionary system implementation approach. First, the system package prototyped and analyzed by CTG envisions a UNIX-based system that "pasted together" within UNIX shells a GIS system and a document indexing and imaging system. This strategy implies that the platforms necessary to drive this system are separate from the Windows based networks that APA plans to acquire to support its office automation. It seems likely that in the near future Windows-based software to support GIS will advance rapidly to the point where the machines that would support office automation and local area networking within APA could also support GIS, document imaging, and document indexing functions in an integrated environment. When this occurs, the marginal cost of acquiring the GIS and document management systems will drop dramatically, because these functions could be well supported in the "base" cost of providing windows based office automation.

The second important cost factor centers on acquiring and managing the data layers within the GIS. To illustrate the rapidly changing nature of costs associated with GIS data, return to two items in Table 9. At present APA has primary responsibility for maintaining wetlands data. The estimated costs for converting the existing wetlands data for half of the park is approximately $32,000. These costs are associated with scanning, cleaning, and vectorizing existing hard copy maps that were commissioned by APA. Notice that there are no marginal costs associated with creating the GIS layer for the wetlands maps that will be completed in the future. This is because APA will be acquiring this basic data in already digitized and vectorized form rather than in hard copy from the consultants who are completing the mapping. Once the world of wetlands mapping moves to a digital standard, the one time costs associated with converting data will vanish.

This example is especially clear because APA is the primary "owner" of wetlands data within the Park. Once APA converts to a digital standard, everyone else who needs to have wetland maps in digital form can get them at almost zero marginal cost. In the same way, once other agencies convert to digital standards, APA will also have very low marginal costs associated with acquiring their data layers. Notice that the marginal one time costs associated with data sets such as aquifers, natural heritage sites, protected species, and biological diversity sites are very low--about $400. This is because in the future APA expects that it will receive these data layers in immediately usable digital form from other agencies who are the primary owners of that data.

It seems quite likely that important data sets such as tax maps will become supported in digital form in the near future. When this happens, high costs such as the near $60,000 conversion cost for the tax maps will drop considerably and approach the marginal cost of $400 for uploading a clean data layer provided by another agency or jurisdiction. In the interim, cost sharing strategies (for example sharing the costs of scanning and vectorizing tax maps) could quickly cut the conversion costs for any given data set by half or more. APA has entered into two such resource sharing arrangements with Essex and Saratoga Counties to create digital tax maps and continues to develop additional partnerships in the development of tax map data. These partnerships should serve to substantially reduce the total costs of this particular data layer.

Given these trends, it seems likely that both the costs associated with hardware and software platforms to run the GIS and document retrieval system and the costs associated with data conversion and maintenance will drop dramatically in the near future. However, as these costs drop, the benefits will remain high. Over the next few years, the system analyzed in this report will become a better and better buy for APA to consider.

The key issue for APA is not *whether* it should convert to a fully digital approach to geographic and document data, but *when* it should convert. The annual benefits as estimated in this report will remain high well into the future, and it seems clear that they will outweigh the annual costs by a considerable margin. It also seems clear that one-time system acquisition and data conversion costs will continue to drop for the next several years at least.

An evolutionary strategy involving the gradual acquisition of selected data layers and a building block approach to hardware and software acquisition seems most likely to maximize benefits and minimize risks.

9. References

Andersen, David., Stephen Hyde, and Kristine Kelly, "Interim Report on the APA Data Population Model," March 29, 1995 CTG.APA-009.

Andersen, David, Kristine Kelly, Stephen Hyde, Peter Avery, Soonhee Kim, and John Rohrbaugh “Evaluating APA’s Prototype GIS System: Prospects for Providing Cheaper, Faster, and Better Services to APA’s Customers,” May, 1995 CTG.APA-016.

Andersen, David, Kristine Kelly, and John Rohrbaugh, "Interim Report on the APA Cost Performance Model," November 3, 1994 CTGAPA-007.

Bloniarz, Peter, Anne Miller, and Eliot Rich, “Using Technology to Change Work: Technical Results from the APA Prototype” May, 1995 CTG.APA-014.

Giguere, Mark, “Literature Review Adirondack Park Agency," June 24, 1994 CTG.APA-006.

Kelly, Kristine and Stephen Hyde, "Potential Quality Improvements and Extended Benefits of an Office Support System for the Adirondack Park Agency,” August, 1995, CTG.APA-012.

Kelly, Kristine and Stephen Hyde, "Preliminary Analysis of Interview Data," March 10,1995 CTG.APA-008.

Kelly, Kristine and Stephen Hyde, "Results from Pre and Post Surveys of APA Staff," March, 1995 CTG.APA-013.

10. List of Tables

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