TOWN OF DEDHAM, MASSACHUSETTS

Town Of Dedham

GIS Needs Assistance and Implementation Plan

June 30, 1997

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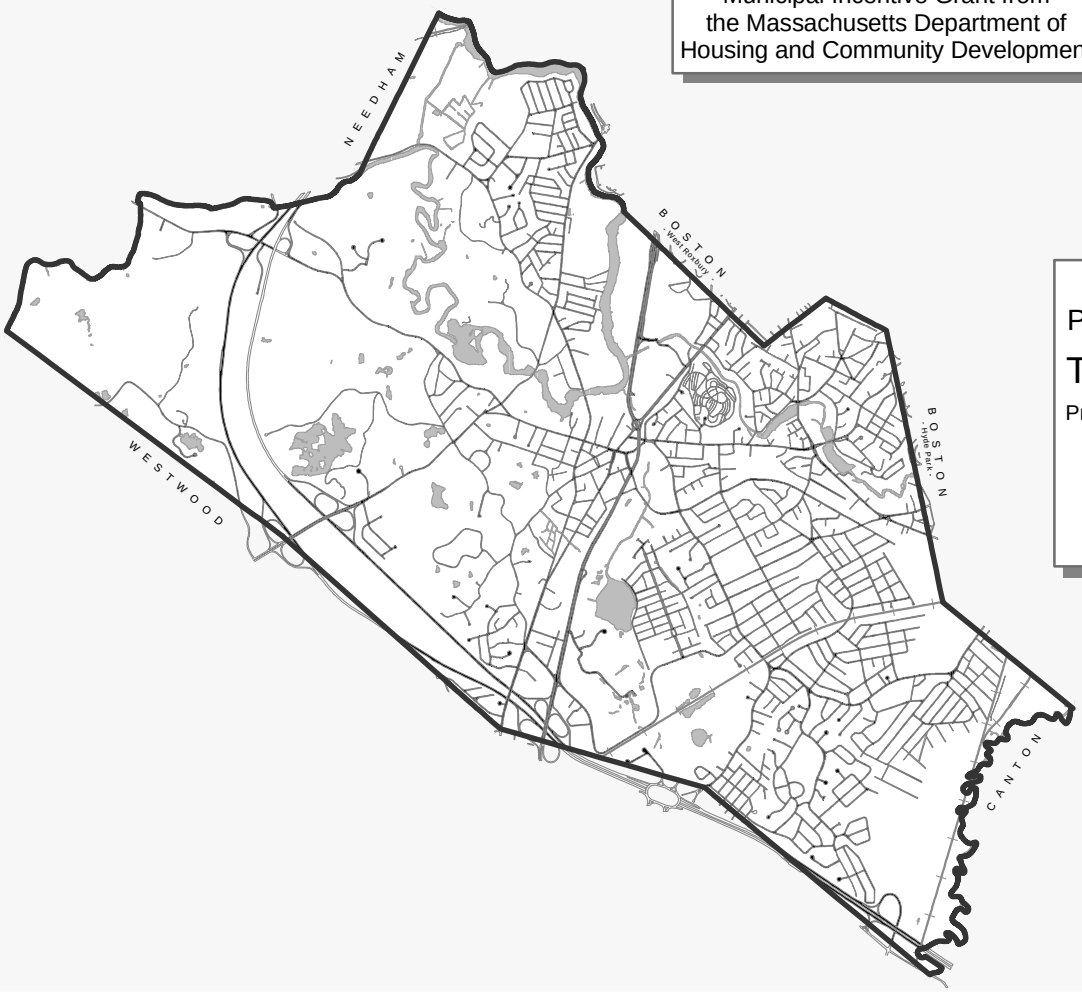


Prepared for:

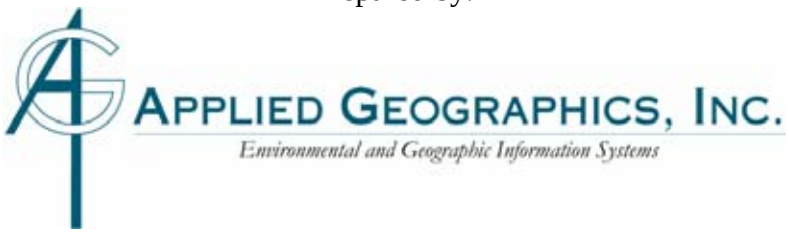
Town Of Dedham

Prepared by:

Town of Dedham, Massachusetts

GIS Needs Assessment
and
Implementation Plan

Prepared by:



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Principal Author: Linda Bischoff

Technical Assistance from: Michael Terner

The author would like to acknowledge the cooperation and input provided by the Town of Dedham personnel. The comments provided to AGI upon review of the draft documents were particularly valuable in producing the final report.

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Executive Summary

I. Overview of GIS

Geographic Information Systems (GIS) are being implemented in more and more municipalities all over the world. The combination of graphic data, linked to attribute or data base information, makes it an ideal technology for managing a geographic area, such as a town or city. Advancements in technology have made varying levels of GIS technology and sophistication more affordable and accessible to smaller organizations.

GIS stores separate types of data on separate layers, and the information in those layers is described by attribute data. For instance, parcels in a town are stored on a separate layer from buildings, and these layers are registered with one another. Each parcel is linked to a data base record which may contain such items as owner's name, land use, and appraised value. Buildings can be shown in the GIS or mapped with the parcels, but the buildings also can be linked to their own data base, which may indicate the square footage of the building, what businesses are located within it, or whether hazardous materials are stored there. These layers and other thematic data are registered to a land base map, comprised of roads, hydrography, wetlands, and other natural and cultural features.

The needs assessment and implementation plan conducted for the Town of Dedham were designed to recommend the data layers and related attribute data necessary for GIS, options for a GIS system configuration, and the procurements and activities that will lead to the implementation of a municipal GIS suitable to the Town of Dedham.

II. Major Findings and Implementation Recommendations for the Town of Dedham

The following sections summarize the need for GIS in the Town of Dedham and AGI's major recommendations for implementing a GIS program in the Town. This information is based on information from interviews with 18 Town departments. These interviews were conducted by Linda Bischoff of AGI during April, 1997.

1. The Town must review and select a base mapping option.

The Town lacks an accurate, comprehensive base map in any format. The Town's various thematic maps differ widely in scale and quality and none are suited to use as a GIS base. Therefore, the Town must evaluate different base mapping options, ranging from a highly detailed new aerial photography base mapping project to using less detailed, existing digital data. The highly detailed map is more desirable, but significantly more costly. The options for less detailed mapping (smaller scale) decline in cost from larger scale to smaller scale.

2. Dedham should continue to pursue overall computer system upgrades to provide a more favorable environment and configuration for townwide GIS.

The Town of Dedham contracted for a study, concurrent with the GIS Needs Assessment, for evaluation and recommendations on the Town's overall computer systems. Part of the recommendations from that study, conducted by Melanson Heath & Associates, call for substantial upgrades to the networking of departments and the level of PCs in the different offices. While the DPW, Assessor, Finance Committee, and Conservation Commission have machines able to efficiently run GIS (though they lack networking among one another), a more widely deployed GIS will rely on a comprehensive networking configuration as well as more powerful machines at the desktop. AGI suggests that the recommendations in the Melanson Heath Report be evaluated and implemented to the extent feasible, and that Dedham coordinate GIS implementation in conjunction with system upgrades.

3. Dedham should evaluate staffing options for GIS and the feasibility of hiring a full-time GIS administrator.

Staffing for GIS has been addressed in a variety of ways from community to community. Sometimes a full-time or part-time GIS administrator is hired or a position for MIS/GIS is created. In other communities existing staff shift some of their responsibility to GIS activities, with consultant support. Another possible scenario is for Dedham to outsource most or all GIS maintenance and operation. The level of staffing selected will drive the type of GIS configuration and the types of applications that can be accomplished in-house. To achieve a widely deployed and highly utilized GIS in the Town, AGI recommends that Dedham retain strong GIS consultant support for 2 - 3 years, and prepare to hire a full- or part-time GIS administrator in the second or third year of implementation.

4. The Town should establish and maintain a GIS Development Committee.

The Town has set up a preliminary GIS committee involved in reviewing the needs assessment and further evaluating GIS plans. This group should serve as the core of a GIS Development Committee, and preferably be organized as a subset of an overall Information Services Committee, as recommended in the Melanson Heath report. The GIS Development Committee should provide ongoing review and prioritization of GIS activities, including data and applications development, training, and system upgrades. This committee should review budget considerations, evaluate the level of GIS activity, and establish directives for continuing expansion of the GIS program.

5. The Town should pursue a comprehensive, detailed approach to the construction of the parcel, sewer, and drain data layers.

The parcels are a fundamental municipal data layer and should therefore be made as accurate and comprehensive as possible when compiled for GIS. Dedham's existing parcel maps are in poor condition, difficult to read, and of questionable accuracy. AGI

recommends that the parcels be researched and recompiled from deeds and plans into a new, more accurate base map, rather than digitized as-is from the existing manuscripts.

In addition, Dedham does not have sufficient mapping of its sewer and drain infrastructures, and lacks sources of information from which to compile them. Given the cost of upkeep of these aging infrastructure systems, the uncertainty in the accuracy of MWRA rates to the Town based on discharge to the interceptors, and the EPA's 2005 Charles River Mandate requiring the Town to establish accurate drain mapping, AGI recommends that a comprehensive sewer and drain field survey be conducted to build useful and accurate infrastructure data layers. The field survey can be greatly enhanced by aerial photography capture of the street infrastructure, if new aerial photography is pursued as a base mapping option.

6. AGI highly recommends the evaluation and implementation of a permit tracking system as part of systems development.

The permitting information about parcels is one of the fundamental attribute data layers in a municipality, and automating permits will add another dimension to the utility of GIS in Dedham for a variety of departments. The GIS Development Committee should address this requirement as soon as possible and integrate it with overall systems planning and the GIS Implementation Plan.

7. GIS Implementation should be phased in and GIS needs continually reevaluated.

Implementing GIS successfully carries significant initial cost outlays, continuous planning, appropriate training, and ongoing maintenance. Municipal GIS have proven most successful when phased in over a period of 3-5 years, in order to spread costs out and to make the operational transition to GIS. AGI has recommended a 3-year implementation schedule for Dedham that can be extended over a longer period of time if that proves to be more feasible. It must be noted that after initial implementation, during which the majority of data layers are developed and departments adopt GIS technology into their workflow, GIS continues to grow as data layers are added, technology changes, and municipal issues arise. Changing circumstances will require that GIS needs are reviewed periodically, and new near-term initiatives for GIS development are established by the Town.

Part 1:
Town of Dedham GIS Needs Assessment

Introduction

The following sections describe the GIS needs of the individual departments within the Town of Dedham. Each department has separate sections, as follows:

- **Responsibilities and GIS Overview**: A brief synopsis of the department's duties and how GIS might relate to them.

- **Current Computer Configuration**: Lists key hardware, software and peripherals that might be integrated into or replaced by GIS.

- **GIS Data Requirements**: Data specifically needed by that department; general data requirements are shown in the matrix in Table 1.

- **GIS Application Requirements**: The applications are presented in rough order of priority. The determination of priority is a function of both the cost of development of the application (and any associated data) and the benefits that the application will deliver to the department. In addition, each application is described as having a **high, medium** or **low** level of effort to develop.

- **Other GIS Issues**: Miscellaneous GIS-related issues that are not easily described under other categories, or that require special consideration.

- **Summary**: A summarizing statement about the departments need for GIS.

The Needs Assessment should be considered the comprehensive "wish list" of data and applications. This wish list is presented as a summary of AGI's interviews with Town personnel. It does not contain specific recommendations or procedures. Rather, Part 2 of this document, the Implementation Plan, should be considered the near term "do-list" for GIS development and spells out priority recommendations for GIS implementation. The particular data development initiatives recommended for the near term are described in that document. Other initiatives described herein are not necessarily addressed as priority applications in the Implementation Plan, but may be identified for future development after the initial GIS is in place and returning benefits to the Town.

1. Assessing

Ray Briggs: Director of Assessing

1.1 Responsibilities and GIS Overview

The assessing department maintains the property maps and owner information, assigns addresses, assesses taxes and maintains the tax roll, and provides information about property to both the public and other Town departments. In Dedham, the Assessor also acts as the system administrator. As the maintainer of the Assessor's data, one of the primary data layers for any Town, and as the acting system administrator, the Assessor will be very involved in developing, using, and supporting GIS.

1.2 Current computer configuration

1 Pentium 100 Server, 500 Mbytes Hard Drive, 8 mg RAM
6 PCs 486 60mhz, 8 mg RAM, networked together
Vision Appraisal package
CEI Municipal Accounts Tracking System: tax billing component
Networked with the Tax Collector

1.3 GIS Data Requirements

Please see Table 1.

Assessor's Maps: The assessor's maps in the Town of Dedham are in poor condition and of questionable accuracy. Most of the maps are of unknown scale, and have been reduced and enlarged to fit four maps on a standard D-sized sheet, printed on mylar by Avis Airmaps. The maps have been updated, but mostly by hand, and are therefore difficult to read. There are approximately 10,000 parcels.

1.4 GIS Application Requirements

1.4.1 Tax Assessment Support

Having access to digital maps and data base linkages to the maps will help the Assessor in assessing property values based on features as well as comparable sales. For example, the Assessor will be able to easily create a map that shows all of the home sales in the previous year color coded by price of sale. In this manner, the Assessor can ascertain certain trends in home sales which will impact the valuation of a particular property. Level of Effort: **LOW**

Also, high quality GIS maps that show both the property configuration and the layout of buildings on the property can help the Assessor make valuation determinations. For example, land value is related to the amount of frontage a property has as well as the general shape of the land (i.e. a long thin parcel vs. a

square parcel), both characteristics which a map shows well. GIS will facilitate the Assessor's ability to quickly access mapped information. Level of Effort: **MEDIUM**

1.4.2 Abutter's notifications

The Assessor's office generates abutter's notifications for departments in the Town. A GIS is a perfect tool for automatically creating an extremely accurate abutters notification list. Level of Effort: **LOW**

1.4.3 Support for Abatement Procedures for Tax Assessment Reduction

Several of the criteria which underlay tax abatement requests, such as the presence of wetlands or miscalculated property values based on "comps", could be accurately mapped in the GIS. If this information were in the GIS, the Assessor could readily obtain preliminary information on the validity of an abatement request based on mapped criteria, as well as process the request with further use of GIS. Level of Effort: **LOW**

1.4.4 Townwide thematic mapping

The GIS would allow the Assessor to create a limitless variety of Town-wide, parcel based thematic maps. These maps would both help the Assessor's activities and also answer public requests for information. Examples of pertinent thematic maps include:

Exempt property map	Commercial property map
Apartments map	Vacant property map
Home sales map	Home style (e.g. ranches, colonials) map
Sewered vs. Septic	Property values map

Level of Effort: **MEDIUM**

1.4.5 Parcel area validation

Sometimes discrepancies in parcel area "creep" into the Assessor's database. Once the parcel maps are automated it will be possible to use the GIS to directly measure parcel areas. While this measured area will not be legally binding, it can be used as a basis for comparison to the area listed in the Assessor's data base system. Large discrepancies in "measured area" vs. "data base area" might imply the need for deed research to clarify the situation.

Other communities that have undertaken such projects have reported having taxable areas increased. Such an increase generally raises the valuation of a property and can result in new tax revenue. Over time, this type of deed research can result in data quality improvements to both the maps and the Assessor's data base. Level of Effort: **MEDIUM**

1.4.6 Assistance in Inspections and Integration with Building Permitting

The Assessor inspects properties on a 3, 4, or 5 year cycle. The inspections are done map by map; however, the Assessor has a keen interest in integrating building permit status into his inspection planning. This would allow him to more effectively schedule important and timely inspections, instead of keeping all properties on a regular inspection schedule that may delay much-needed actions.

Other permitting information that would be helpful in inspections would be maps of all new homes, all major renovations, and all new buildings. Level of Effort: **MEDIUM**

1.4.7 Public access to Assessor's information

The GIS could potentially provide automated access to the map sets. The public could browse the maps gaining access to areas of interest either by typing in addresses or using the mouse. Once they had a map they liked, they could be charged a small fee to print it out. In the future, it might even be possible, as other towns have done, to allow a more sophisticated GIS data access that might facilitate the ability of the public to search out "home sale comps" using a combination of spatial and data base criteria. The Assessor has stated that he would not like a sketch of the house available to the public, in order to protect homeowners from public access to very detailed property information. Level of Effort: **LOW**

1.4.8 Proliferation of Parcel Changes to Town Personnel

The Assessor is responsible for ensuring that the Town Clerk, Board of Health, Police Department, and DPW are apprised of parcel changes, subdivisions, and owner changes. Having the centralized GIS database will enable each of these departments to simply access the GIS to view the changes.

1.5 Other GIS Issues

- **Parcel Automation**: As the caretaker of one of the most widely used data sets in the Town, the Assessor is likely to be one of the first departments to implement GIS. However, automating the parcels may be expensive due to their condition. The Assessor is in favor of automating a sampling of the parcels (if a new aerial photography project is undertaken) to determine whether to automate them "as is" or to re-research the deeds and compile the parcels.

1.6 Summary

The Assessor has a significant need for GIS and automated data. The Assessor ultimately wants to bring data base maintenance in-house, and is in favor of hiring a GIS administrator. In addition, the Assessor will continue to be a key figure in systems upgrades and supports a new flight and base mapping project. These factors place the Assessor at the center of the GIS and systems initiatives and he should continue a leadership role in implementing Dedham's GIS.

2. BUILDING

Vincent DeVirgilio: Building Commissioner
Bob McKinnon: Plumbing & Gas Inspector
Paul Riordan: Wiring Inspector

2.1 Responsibilities and GIS Overview

The Building Department issues Building Permits, inspects the work done on the basis of these permits, and issues Certificates of Occupancy. The office also handles plumbing and electrical permitting and inspections. Most of the data is not automated, but it is fairly well organized and accessible, and dates back to 1942. The building personnel do a great deal of data exchange and have interaction with other Town departments, particularly the Assessor and the Board of Health. The GIS would provide the environment to centralize data for all departments, and could interface well with an automated permitting system.

2.2 Current computer configuration

4 Stand Alone 486 PCs; FormTool is sometimes used to generate a hard-copy permit

2.3 GIS Data Requirements

In addition to the data layers list in Table 1, the Building Commissioner often must interpret the zoning code, as well as view the zoning map in determining whether to issue a permit for a particular activity. The office also needs access to the historic district maps.

Nearly all the permit data is in hard-copy format. Open permits are kept in a notebook in the office; closed permits and Certificates of Occupancy are stored in the vault. These data could be recorded in a data base, or scanned and linked to a parcel, on an as-needed basis, gradually building a permit history for each parcel.

2.4 GIS Application Requirements

2.4.1 Zoning enforcement

The Building Commissioner has stated that 60% of the work in the office involves zoning issues. This ranges from basing permits on the zoning of a parcel to issuing letters to violators of zoning ordinances. The zoning map is in reasonable condition, but needs some updating. Integrating a correct zoning map with parcels in the GIS would allow the department to quickly check the zoning of a parcel, to record violations in a data base to be linked to the parcels and mapped, and update the zoning on a regular basis. Level of Effort: **LOW**

2.4.2 Confirmation of basic buildability criteria

The Building Dept. would benefit from an automated system in GIS that would allow it to easily confirm whether a particular parcel meets spatial criteria outlined in the building permit process. Examples of spatial criteria include zoning, historic district, aquifer protection district, floodplains and wetlands. This application would allow the Building Dept. to type in an address (or use the mouse to point at a parcel) and the system would automatically determine whether the parcel met all spatial criteria. In this manner the Building Dept. could gain instantaneous access to information describing the buildability of an applicant's project, and whether any special processes (e.g. historic district guidelines) will need to be followed. Level of Effort: **LOW**

2.4.3 Permit distribution mapping

Currently, the department keeps open permits in a notebook. If this were automated and linked to the parcel map, maps showing the location of people who are currently in the building permit process could be created to assist the Building Dept. in deploying inspectors for the current workload, and for projecting future workloads. Level of Effort: **LOW**

2.5 Other GIS Issues

- **Implementation of Permit-Tracking**: The Building Department has one of the strongest needs for GIS data in the Town. However, the most basic of the department's activities - issuing permits and inspecting properties - is currently being maintained manually. The department has almost no automated activities. This limits the applicability of GIS except screening a permit property for geographic compliance. The building department should seriously look at the options for automating permit tracking. There are a number of permit tracking systems that interface well with GIS and would not only assist the building department, but make the data more accessible to other departments (e.g. public works and assessing). Recommending the system is beyond the scope of this study, but should be moved on quickly in order to maximize GIS use. Because the manual data is so well organized, the data could be moved into a system relatively easily.

2.6 Summary

The Building Inspector needs access to nearly all data layers that a GIS generally accommodates in a Town. However, the access is mostly view, query, and mapping, as opposed to robust analysis. The Building Inspector's primary responsibilities would be to maintain the permit tracking information and ensure that it is linked through the GIS to other users.

3. Town Clerk

Geri Pacheco: Town Clerk

3.1 Responsibilities and GIS Overview

The Town Clerk's main activities include issuing a variety of licenses, maintaining the voter registration lists, and assuring that zoning changes are approved by the attorney general's office. There are very few GIS interactive applications that the office would need. However, through services such as giving out Town maps to citizens, serving as one repository of the zoning map, and maintaining the voting district map, the clerk has stressed a dire need for a new accurate base map onto which these themes could be mapped.

3.2 Current computer configuration

Stand alone Compaq 486 PCs

3.3 GIS Data Requirements

The Town Clerk's office has very little need for access to the GIS data base on a "working" basis, but there are a number of hard copy maps that need to be replaced and could be more easily generated and updated if included in a GIS. These include:

- Election Districts Map
- Street Map: 90 street names were changed in the past year as a result of the E-911 project. These changes must be incorporated onto a new official Town map.
- Zoning Map

3.4 GIS Application Requirements

3.4.1 Redistricting

In the year 2000, the Town will redistrict its voting precincts. By combining census data with an accurate base map, redistricting can be done automatically by population counts. Alternatively maps with census and other pertinent information could be generated that would allow appropriate "manual" redistricting. Level of Effort: **MEDIUM**

3.5 Other GIS Issues

The Clerk's Office is unlikely to perform robust GIS applications or their own hardcopy map development. It is likely that the Clerk's office would depend on support staff or consultants for map production.

3.6 Summary

The Town Clerk's office does not have an urgent or substantial need for GIS. However, as noted above, they need access to accurate and consistent hard copy thematic maps.

4. Town Administrator

William Griffin: Town Administrator

4.1 Responsibilities and GIS Overview

The Town Administrator has oversight responsibilities for all departments and is involved with most issues the Town faces. On a daily basis, the Town Administrator's office is often the first point of contact for public inquiries. Usually, the office refers the caller to the appropriate office. However, some questions could be answered if they had view and query access to digital graphic and tabular data.

4.2 Current computer configuration

1 486 PC

4.3 GIS Data Requirements

Please see Table 1. Nearly all Town data and conditions would be useful to the Town Administrator's office, particularly for complaint tracking and response.

4.4 GIS Application Requirements

4.4.1 Public Notification

The Town Administrator's Office generates public notifications for public hearings. Depending on the nature of the case, these are sent to residents abutting or in the area of a target location. These cases may include siting liquor licenses or evaluating whether certain types of activities are permitted in a zone. The GIS can automatically generate lists for abutters within a certain distance or for a user-defined group. **MEDIUM**

4.4.2 Licensing/Land Use Activities

In issuing licenses, particularly liquor licenses, the Town Administrator would like to review establishments' proximity to churches, schools, and other land uses. The GIS could also show the distribution of certain types of businesses in order to more geographically distribute vendor licenses. The Town Administrator used the location of used car lots as an example in this interview. Level of Effort: **LOW**

4.4.3 Complaint Tracking

The Town Administrator's office would like to be able to more closely track areas with construction, sidewalk damage, traffic, or signage problems. The Office generally gets multiple calls about particular areas when one of these conditions occurs. Tracking them through a GIS would allow the office to prepare statements, prepare to handle calls, or notify residents in advance. The Office could also participate in planning construction activities in order to not concentrate too many "problems" in one area. Level of Effort: **MEDIUM**

4.5 Other GIS Issues

- **GIS Support**: The Town Administrator recognizes the need for computer systems upgrade, mapping, and GIS. He believes that these upgrades are financially feasible for the next five years. The Town Administrator should work closely with Town employees and the various consultants hired to review GIS and townwide systems to properly prioritize system implementation.

4.6 Summary

Though the Town Administrator has identified some uses for GIS, it is not likely that the personnel in the office would be frequent users of GIS. A simple view and query station, which accessed data by address or owner, or where a thematic map (e.g. landuse) could be drawn simply by selecting an area, would be the most appropriate uses for GIS. Production of high-quality, hard-copy maps, and other analyses would be better undertaken by GIS staff, if hired, or outsourced to a consultant.

5. Conservation Commission

Michael Cuneo: Conservation Consultant

5.1 Responsibilities and GIS Overview

The Conservation Commission assists the Town in the building permitting process by making determinations on the environmental constraints on project sites. Such constraints include wetlands and floodplains. The Commission also responds to preliminary public inquiries about whether a particular piece of land is buildable.

5.2 Current Computer Configuration

Pentium 166 MHz ,16Mg RAM running AutoCAD, stand alone

5.3 GIS Data Requirements

In addition to the data sets described in Table 1, the Conservation Commission would benefit from access to the following data:

- **Floodplains data:** The conservation department has very little faith in the FEMA Flood Insurance Rate Maps (FIRM). Mr. Cuneo would prefer to delineate the floodplains himself using contours at 1' intervals, if available.

- **Digital Orthophotographs**: The Conservation Office uses hard copies of the state's 1:6,000 digital orthophotographs. These are available in digital format and should be obtained for integration to GIS.

- **Sewers and Septic Systems**: These locations have significant impact on buildability and the location of developments, as well as the plans for septic or connection to sewer. The Town must also anticipate sewer system expansion when new developments are proposed.

- **Underground Storage Tanks/Hazardous Waste Sites:** In addition to evaluating buildability, the conservation consultant is charged with ensuring the Town complies to appropriate environmental mandates, such as developing an effective stormwater policy and adhering to the Rivers Act. These activities would be facilitated by viewing the location of underground storage tanks in relation to sewers, septic systems, floodplains, etc.

5.4 GIS Application Requirements

5.4.1 Determining environmental constraints

The Conservation Consultant is required to make determinations on the suitability of a site for proposed development. The site is evaluated for proximity to wetlands, floodplains, and drainage basins. The commission currently uses paper maps and construction plans to make initial determinations (and to decide whether a site visit is necessary). The GIS would greatly enhance the ability to simultaneously use floodplain, wetland, zoning, building footprint, and parcel data. These data layers can be overlaid on-screen for a quick visual analysis of the development site. If construction plans are submitted in digital format, they too can be scaled and overlaid on the environmental data. Level of Effort: **LOW**

5.4.2 Townwide environmental analysis

The environmental constraints and impacts for development projects can be analyzed on a Town-wide basis using GIS, as well. Cumulative impacts from many small projects can be mapped and quantified for an entire area. This would provide a greater level of sophistication for environmental reviews. Level of Effort: **MEDIUM**

5.4.3 Delineating Watersheds/Drainage Basins

The Conservation Consultant could delineate major and minor drainage basins throughout the Town if appropriate base mapping were available in the GIS. Level of Effort: **MEDIUM**

5.4.4 Calculating drainage

The conservation commission could use more accurate area calculations generated by GIS to interface with a hydraulic modeling system currently in use. This allows checking of drainage features to ensure that they are designed appropriately to comply with stormwater policies and capacities. Level of effort: **MEDIUM**

5.5 Other GIS Issues

- Permit Tracking: The conservation officer would benefit by a networked permit tracking system (see discussion on building department).

5.6 Summary

The Conservation Commission recognizes a need for new mapping and GIS. If the mapping were accurate enough (1" = 40' or better, and 1' contours), the conservation officer could generate some data layers himself. Mr. Cuneo has a strong background in computers and CAD, and would be a likely candidate for a CAD-based GIS or robust desktop GIS.

6. Finance Committee

Greg Barnes: Finance/Management Assistant

6.1 Responsibilities and GIS Overview

The Finance Committee Department is responsible for providing administrative assistance to the Finance Committee and Capital Expenditures Committee and undertaking special projects for the Town Administrator and Committees. Duties include compilation, analysis, and presentation of budget and personnel information; publication of the Finance Committee report and recommendations books for use in Town Meeting; and providing the Finance Committee and Capital Expenditures Committee with information on relevant Town Meeting articles. In general, the department demonstrates some need for regular access to geographic data, as noted below, and supports GIS strongly and would like the ability to make maps, particularly for presentation support.

6.2 Current Computer Configuration

Zeos Pentium 90 MHz, 32 Mg RAM, stand alone

6.3 GIS Data Requirements

See Matrix.

6.4 GIS Application Requirements

6.4.1 Research/Analysis Support for Town Issues

The Finance/Management Assistant, in providing administrative support to the Finance Committee and other town entities, could utilize GIS to support the research, analysis, and presentation of any number of town issues. Some of the information to be accessed might be zoning, demographics, and land valuation patterns. The GIS could help in forecasting revenues and expenditures, to be considered as part of overall town planning to establish baseline economic indicators in the town. Most of these analyses could be conducted with view and query access through a desktop linkage.

6.4.2 Committee View and Query Access to Town-wide data base

During Finance Committee Meetings, a variety of unexpected issues may come up. The Finance/Management Assistant would like to have immediate access to

areas of Town by address, owner, or a user defined limit to deal with questions and issues that arise for finance committee matters.

6.5 Other GIS Issues

- **Fire Walls:** Finance expressed concern that the appropriate fire walls are established during GIS implementation. This would be addressed during a data base design, beyond the scope of this project.

6.6 Summary

Though finance committee applications are not a high priority, it would benefit the Town to involve them in GIS development and direction/planning. Mr. Barnes shows a strong knowledge of computer technology and the benefits of GIS and would provide valuable input to developing GIS.

7. Fire Department

Robert Cullinane: Fire Chief

7.1 Responsibilities and GIS Overview

The Fire Department must dispatch vehicles to fires and other emergencies throughout the Town of Dedham. To do this in an expeditious manner, the department must have ready access to data related to the location of streets, addresses, and hydrants. The dispatching operations have been combined with Police dispatching, and are not located in the Fire Department. There are three response districts in the Town.

Automated data would be helpful in expediting dispatching, with a side benefit of simply having the ability to archive, easily update, and map data.

7.2 Current Computer Configuration

- 1 486, 1 386
- Cameo: Limited Use

7.3 GIS Data Requirements

In addition to the data sets described in the Matrix, the Fire Department would benefit from access to the following data:

- **Fire alarm box locations:** The Town maintains a network of fire alarm boxes. These boxes have a reflector that shows the number of feet to the nearest hydrant. These should be automated as a point data set in the GIS.

- **Hydrant locations**: If the Town is reflown, hydrants can be captured from the photography to make a digital point layer. If not, the location of the fire alarm boxes could aid in developing a digital layer of hydrants.

- **Underground Storage Tank Information**: USTs, permits for their removal, and licenses to have them are kept in manual files. This data could be automated and linked to parcel data to create an archive and updatable data base.

For near-term archive and update purposes, these data could be put into a standard data base, such as DBASE or even a spreadsheet. Later, they can be integrated with the GIS.

7.4 GIS Application Requirements

7.4.1 Assistance in dispatching

The Fire Department's dispatching data, consisting primarily of the running card, contains the address, hazardous material status, and the nearest hydrant. These cards are pulled during dispatch and the information given to the fireman before leaving or via radio en route to the site. Directions to an emergency are usually known by the drivers. The GIS would allow a dispatcher to type in an address and display the incident location on a digital version of the parcel map when a call comes in. The map could be linked to a digital version of the running card, as well as linked to assessor's information. Other information that could be linked: the location of USTs, hazardous materials (and type), photos of the house or plans of the property, and a variety of information available from the CAMA system. Residential information such as locations of residences with elderly, disabled, or young children would be helpful in response.

If mobile data terminals are installed, this data could be accessible right in the cab of the fire truck. Level of Effort: **MEDIUM**

7.4.2 Incident mapping

The fire incidents can be mapped to show patterns of fire, potentially indicating arson or areas where fire prevention/education could be increased. This may also help in ensuring that fire response districts are delineated most efficiently. Level of Effort: **LOW**

7.4.3 Inspection Mapping

The Fire Chief performs inspections for smoke detector compliance upon sales or refinancing of houses. Occasionally, the fire department performs an installation as a "special project". These inspections could be mapped to assist the Chief in scheduling inspections. Level of effort**: LOW.**

7.5 Other GIS Issues

- **E911:** E-911 has been implemented in Dedham. Integrating GIS with E-911 would further enhance the information available for dispatching.

- **Data Automation**: Although the data is organized, it is in manual format and fire department data such as running cards, USTs, and hazardous waste must be automated before it can be accessed through GIS.

7.6 Summary

The Fire Department is not directly in charge of its emergency dispatching, so developing GIS-based dispatching applications would require further coordination with the Police Department. This is not currently a high priority, particularly because dispatching is working fairly well. As more and more automated data is put in place, and GIS is implemented, dispatching support can be addressed. Fire department data automation can begin in the meantime.

8. Board of Health

Frank Scurti: Health Director

8.1 Responsibilities and GIS Overview

The Board of Health issues permits for dumpsters, restaurants, retail, funeral homes, swimming pools and septic systems. The BOH does not issue a permit until building and occupancy permits have been issued and approved. Thus, the BOH has frequent interaction with the building and conservation departments. A new housing inspector will also join the BOH in the summer of 1997.

8.2 Current computer configuration

1 286, 1 386, and 1 Pentium, 133 MHz, 1.2GB hard drive

8.3 GIS Data Requirements

In addition to data sets listed in Table 1, the BOH needs:

- **Location of dumpsters and dumpster permits**: These data can be accessed in GIS either as an attribute of a parcel or as its own point coverage.

- **Location of septics and cesspools**: For permitting and determining environmental impact.

- **Aquifer District**: This information is available from the Dedham-Westwood Water Company. The location of the district would aid in permitting activities that may potentially leach harmful substances.

8.4 GIS Application Requirements

8.4.1 Septic System permitting and inspection

Septic Systems are concentrated in one area of Town. The BOH needs to know their proximity to waterways, wetlands, and adjacent lot lines. Soil types would also aid in this application. This will aid in permitting, as well as identifying

existing septics that currently are in violation, or where a combination of septics may be posing environmental threats. Title V status should also be tracked. Level of Effort: **MEDIUM**

8.4.2 Use permitting

GIS would allow the BOH to view permits of certain types of activities in proximity to one another, as well as to natural features which may be threatened. In addition, if a permit tracking system were implemented (see the discussion on the building department), the BOH could easily access the status of other permits before issuing his. Level of Effort: **LOW**

8.5 Other GIS Issues

A permit tracking system was identified as a high priority by the BOH. It would be most beneficial if integrated with a GIS.

Some data that were identified as priority data sets by the BOH, such as the location of dumpsters and dumpster permits, would have to be automated from existing data bases, and supplemented with field collection.

8.6 Summary

The need for a permit tracking system and the fact that the BOH does most of its work on a parcel basis, suggests a strong need for GIS and to be networked with other departments in Town. The BOH should have a desktop view and query station customized to the BOH's specific applications.

9. Parks & Recreation Department

Anthony Mucciaccio: Parks & Recreation Director

9.1 Responsibilities and GIS Overview

The Recreation Department provides and sponsors indoor and outdoor recreational activities for Dedham citizens. In addition to maintaining the 75 acres of Town parkland, the department also maintains and uses the Oakdale, Riverdale, Capen and GreenLodge school parks, as well as the Dedham High School football field. The department has a cooperative relationship with the school department to coordinate activities on school fields.

9.2 Current computer configuration

1 486 PC

9.3 GIS Data Requirements

The Parks and Recreation Department currently has 3 townwide maps showing recreation areas, and approximately 6-8 maps showing individual parks. The locations are fairly accurate; however, the boundaries of properties are unclear. A new base and parcel mapping effort would greatly benefit this department and serve as a base for new accurate maps. Please see Table 1 for general data requirements.

9.4 GIS Application Requirements

9.4.1 Outreach Programs

Accessing census data would enable the Town to plan recreation outreach programs based on the distribution of age levels in the Town. Mapping the census data using the GIS would enhance these activities by aiding the Town in locating outreach efforts, as well as locating the activity for optimum accessibility. Adding traffic information and public transportation could add another dimension to the outreach planning. Level of Effort: **LOW**

9.4.2 Major Activities Planning

The Parks and Recreation Department sponsors a number of town wide activities that could be more efficiently planned using GIS. These planning efforts could be undertaken jointly with the police department. Some of these activities include:

- 4th of July Road Race
- Dedham Recreation Day
- Flag Day Parade

Level of effort: **MEDIUM**

9.4.3 Facilities Maintenance

The department could use GIS for maintenance tracking of its facilities (see Section 12.4.3). and work in conjunction with the school department in maintenance of shared facilities. Level of Effort: **MEDIUM**

9.5 Other GIS Issues

- **Staffing:** The Parks and Recreation Department lacks staff to be able to significantly integrate GIS into its activities. However, the availability of hard-copy maps and access to GIS data through a highly-customized interface could bring a moderate level of GIS to the department.

9.6 Summary

A likely scenario for GIS use by this department would be hard copy maps and on-screen viewing of recreational facilities. Special projects, such as planning a new Town event, or a focused outreach program, should be undertaken by a GIS specialist in the Town or a consultant.

10. Planning Department

Arthur Noonan: Town Planner

10.1 Responsibilities and GIS Overview

The Planning Board has responsibility for reviewing Subdivision Plans, Site Plans, and Parking Plans. These reviews involve establishing zoning compliance, the provision of adequate infrastructure, and ownership data. These review activities require interaction with the Assessor, Conservation Commission, Public Works, and other municipal departments. The Planning Board also monitors requests for zoning variances and special permits. The Planner is responsible for ensuring the update of the zoning map. The Planner also participates in various other activities, such as updating the Open Space Plan, locating state and local facilities, monitoring demographic data, and applying for state and federal grants.

10.2 Current Computer Configuration

One 486 and one 386, not networked

10.3 GIS Data Requirements

In addition to the data sets described in Matrix, the Planning Department would benefit from GIS access to the following data:

- **MDC/other owned lands**
- **Areas of Critical Environmental Concern**
- **Zoning subset plans:** Dedham's zoning is recorded in 50 - 60 1" = 40' scale plans that show accurate measurements of zoning lines. This would provide the most accurate zoning once integrated into a GIS.

10.4 GIS Application Requirements

10.4.1 Review of development proposals

The primary GIS application of the Planning Department would be the review of proposed development projects. The GIS would allow the Planner to quickly check zoning classification and other information against the proposed plan. The Planner would also be able to visualize the environmental constraints on the parcel, such as floodplains and wetlands. Level of Effort: **LOW**

10.4.2 Abutters notifications

The Planner must have abutter's notifications generated either by the assessor's office or the planning office for Public hearings. The GIS would allow the Planner to automatically create an extremely accurate abutters notification list without involving the Assessor. Level of Effort: **LOW**

10.4.3 Generate display maps

The Planner could generate display maps in support of a number of activities that must be reviewed by Town boards and other groups of people. For instance, zoning variance requests could be visualized using the GIS, likely facilitating the decision process. When locating sites for development (examples include siting a jail and the juvenile court) maps could orient decision-makers to the appropriateness, scale, and scope of a proposed development. A strength of GIS is the ability to easily generate custom maps for a specific location. The user can zoom in to a specific area; turn on/off various features map themes such as streets, zoning, parcels, and wetlands; use labels, arrows, and symbology to designate features of interest based on characteristics contained in associated databases (e.g. color-code the different zoning classifications); and generate ancillary graphics such as north arrows, scale bars, titles, legends, and logos. If the plans are submitted in digital format, it would even be possible to scale and overlay the plans on the digital map of the site. Level of Effort: **MEDIUM**.

10.4.4 Support of grant applications and reporting functions

The Planner sometimes applies for Mass. Dept. of Housing and Community Development (DHCD) grants. The ability to map demographic distribution, as well as charts and graphs based on the demographics, would enhance the application as well as help the Planner understand the problems to be addressed. In addition, these grants and other governmental programs require reporting from the Town, and the GIS could be used to generate graphics and statistics for reporting. **MEDIUM**

10.5 Summary

The Planner's work would be facilitated by any new mapping and GIS integration undertaken by the Town. He would be well served by access to a simple customized mapping and query interface.

11. Police Department

Dennis Teehan: Police Chief

11.1 Responsibilities and GIS Overview

The Police Department responds to emergency calls, investigates crime cases, patrols the Town, and maintains safety at community affairs such as festivals and parades. Police, Medical, and Fire Dispatching are run from the police station.

11.2 Current computer configuration

The Police Chief has stated that there is a "lack" of PCs to access for GIS and other programs. Currently, PAMETS is run for crime tracking and reporting. However, this is not linked to maps and generates only statistical reports.

An upgrade to an ALPHA server is planned.

11.3 GIS Data Requirements

Predominantly, on a day-to-day basis, the Police need access to most data that would be traditionally available through the GIS, including property ownership, locations of sewer lines, houses, utility poles, etc. In addition to the data listed in Table 1, the police department data requirements include the following that could be added as attributes to parcels:

Location of Sex Offenders: State Law now requires that police notify residents within a one mile radius of the residence of a registered sex offender (someone who has been convicted or released, or is on probation for a sexual crime). These data are available from a state data base and each entry is rated 1, 2, or 3, with 3 indicating the most severe crime.

Location of Residents with Gun Permits: Pistol permit data should be linked with parcels for dispatching purposes. This would warn police that guns may be present at a particular address. Currently, the address itself flashes when called up by a dispatcher. If GIS is integrated, pistol permits could be an attribute of parcels.

Patrol Routes: Automated patrol routes would allow easy review and update.

Voting Precincts: The voting precincts (see the discussion of the Town Clerk) would be valuable to view, particularly in terms of crime statistics and police patrolling.

11.4 GIS Application Requirements

11.4.1 Sex Offender Notification

The GIS can automatically generate a radius around a parcel where a sex offender lives. When linked with the assessor's data, a mailing list can be automatically created to aid in notification. The sex offender information could also be integrated into dispatching information. Level of Effort: **LOW**

11.4.2 UCR (Uniform Crime Reporting) and NIBRS (National Incident-Based Reporting System)

PAMETS generates statistics that can meet these reporting requirements. The reports could be enhanced by mapping the crime statistics. Not only would this make the statistics more meaningful, but it may serve to enhance crime analysis by the Town (see Section 11.4.5). Level of Effort: **MEDIUM**

11.4.3 Dispatch Support

The Police Chief feels that dispatching is done fairly well, but that additional information available through GIS would be helpful. If a new flyover and base mapping were conducted, the dispatcher could have access to a variety of information to communicate to the respondent, such as cross streets, fences, property layout, ponds, and building locations. This could be integrated with gun permits, sex offenders, call history, and location of elderly or disabled residents for a more comprehensive view of a property. Level of Effort: **MEDIUM**

11.4.4 Raid Planning/Warrant Serving

In some cases, it is very beneficial if the Police Dept. has foreknowledge of the conditions of a property that it is approaching. For example, it is useful to know whether a building is single or multi-family, or whether there are out-buildings and whether the property is fenced. A new base mapping effort could have this amount of detail and will also allow the Police Dept. to directly tap into the Assessor's data base in order to determine parcel attributes such as number of floors, number of bedrooms, etc. Thus, officers scheduled to serve a warrant or planning a raid can have ready access to information that describes the property they will be visiting. Level of Effort: **MEDIUM**

11.4.5 Incident Mapping

A historic record of incidents is kept in PAMETS. Having these data accessible would enable the police to perform incident mapping. Maps showing house robberies, for instance, may show patterns indicating that patrols should be increased. Mapping accidents may help police pinpoint dangerous intersections or other areas to be improved. Incidents can also be mapped by sector cars, aiding the review of patrol patterns. Level of Effort: **LOW**

11.4.6 Crime Watch Support

There are a number of neighborhood crime watch areas in Dedham, partially organized and supported by the police. Accurate mapping would be useful in helping police delineate crime-watch neighborhoods and locate crime-watch contacts. The maps would also be helpful to the citizens in the neighborhood itself to identify crime "spots" and record incidents that will allow them to warn residents of potential risk. Level of Effort: **LOW**

11.4.7 Determination of Drug-Free Zones

The GIS can generate a radius around a given location, identifying features or parcels lying within. A radius could be digitally generated around schools for a specific distance which would show locations where drug offenses are more severely punished. Level of Effort: **LOW**

11.4.8 Parade Routing/Special Events Planning

The GIS could have the capability to produce large format color maps with details showing every street, building and fence. Such maps can be used to support the planning and deployment of personnel at special events such as parades or festivals. Level of Effort: **LOW**

11.5 Other GIS Issues

- **Data Integration**: A live interface between GIS and PAMETS is likely difficult to establish. A routine for outputting data from PAMETS to be mapped in GIS would have to be developed (such as into ASCII or DBASE to be linked to the GIS). The link, e.g. address, map/lot/block, or name, must be identified to facilitate the output and linkage.

11.6 Summary

Primarily, the Police Department would only need view and query access to most of the data; hard copy maps could be generated periodically by GIS support staff at Town hall or though consultant services. Alternatively, the maps could be generated through a user-friendly system designed for the police that would require some development costs, but little training. Police deployment of GIS will rely greatly on system upgrades and computer training for police.

12. Public Works

Paul Keane: Commissioner of Public Works

12.1 Responsibilities and GIS Overview

The DPW has a number of responsibilities, including but not limited to:

- Maintaining Town-owned roads and sidewalks
- Pavement Management
- Traffic Markings and Signage
- Traffic Signals
- Street Shade Trees and Roadside Vegetation Management
- Street Sweeping
- Maintenance of Selected Public Grounds and facilities
- Storm Response
  - -Snow Plowing, Removal, Ice Control
  - -Flooding Response
  - -Tree Removal/Pruning
- Sanitary Sewerage System Maintenance
- Storm Drainage System Maintenance
- Management & Maintenance of Village and Brookdale Cemeteries
  - -Burials
  - -Record Keeping
  - -Grounds Maintenance
  - -Space Needs Planning
- DPW, Animal Control, and Council on Aging Vehicle Maintenance

Garbage pickup and recycling pickup is coordinated by the DPW but contracted out. Water is provided by the Dedham/Westwood Water District. Local sewers empty into MWRA interceptors at metered connections. The sewer house connections are the responsibility of the homeowners, though the DPW has established a protocol to collect this data when services are performed at an address.

12.2 Current computer configuration

1 Pentium 166Mhz, 32 Mg RAM, 2.1Gbyte Hard Drive
1 Pentium 100Mhz, 16 Mg RAM
On order: 1 Pentium 200, 64 Mg RAM

12.3 GIS Data Requirements

Maps: The DPW has copies of most of the maps available for the Town. They are inaccurate, inconsistent, and incomplete, and of varying scales. They include:

- MWRA-generated community sewers map
- Hundreds of Sewer Plans (not as-builts) at 1" - 40' from Pilling Engineering Company
- Zoning Map from Woodard & Curran (see section on Planning)

Sewer Infrastructure: One of the DPW's significant ongoing projects/concerns is the sewer system. The infrastructure is old and failing and the Town does not know the complete extent of the system. The system has not been sufficiently mapped; the MWRA community map is inaccurate and there is a lack of as-built plans. There are plans from the 1930s, but do not often represent the built configuration.

The sewer repair activities, and the time needed to locate sewers to conduct those repairs, result in significant expense. Mapping the sewers is a first critical step in locating the sewers. Expenses can be reduced, and qualitative benefits can be realized in a number of ways:

- Accurately mapped sewers can be located quickly, reducing repair time
- Accurately mapped and inventoried sewers can aid in planning replacement and preventive maintenance, reducing repair costs as well as increasing service reliability
- Improved sewers (once located through mapping) allow for increased health and environmental protection measures

In addition, the Town is assessed MWRA fees based on metered connections (there are also private connections, billed to the town, who bills the customer). The Town may be able to cut its MWRA billings if problems in the system, such as unauthorized discharge, are located and corrected. Since water billing is based on the MWRA metering, some savings may be realized here as well. While GIS can aid in some of this analysis, the first step is to make the data available.

Currently, the DPW is locating manholes and sewers with the use of underground television funded with a grant from MWRA. However, the whole Town is not being covered as of yet.

Drain Infrastructure: The Town faces similar problems with the drain infrastructure, which is inadequately mapped and needs repair and maintenance. The drain system also may affect the MWRA rates in that damaged storm drains may leak into sewers, driving up the sewage volume metered by the MWRA, and for which MWRA bills water use to the Town.

Other important data that is lacking:

- Water system manholes
- Outfalls to the Charles River
- Location of Septic Systems
- Street lights, signage, and traffic signals
- Location of Town-owned buildings
- 1’ contours: Because the Town is primarily flat, 1’ contour intervals would serve better than 2’ contour intervals

Much of the data discussed in this section could be obtained through an accurate aerial photography flyover, preferably resulting in 1” = 40’ accuracy or better. However, more accurately locating the drain and sewer infrastructure (especially the elevation), as well as collecting useful information about the structures, will require field survey, whether or not a flight is conducted. A flight could cut down the cost of the field survey by providing the basic structure locations to which crews would be dispatched to collect more information.

12.4 GIS Application Requirements

12.4.1 Reduce Survey Contracting Fees

The DPW spends approximately $80,000 - $100,000 annually on survey work simply to establish accurate street layouts and locations in support of special projects. Having accurate data readily available in digital format would reduce these expenditures immensely. Digital files or as-built plans could be included in bid documents and released to contractors for the project. Level of Effort: **LOW**

12.4.2 Management of sewer/drain maintenance

The GIS could provide the arena for a much more active sewer/drain maintenance program. As noted above, this data must first be captured. Once in the system, maintenance can be tracked and planned more efficiently. The mileage of lining could be calculated (and costs estimated for the next construction season), and repairs, additions, and changes could be recorded in the GIS as part of a comprehensive, centralized data base for infrastructure management. Level of Effort: **LOW**

12.4.3 Building Maintenance

The DPW is responsible for the maintenance of the DPW buildings at 55 River St. and the Brookdale cemetery. The DPW also maintains internal equipment such as boilers. Many of the other departments are responsible for their own facilities or share responsibility for maintenance. Though not strictly a DPW function, mapping this data would enable the DPW and other departments to track each property and review what maintenance procedures must be performed, the construction underway, and to plan changes to facilities. This type of data base could be linked to parcel or building data in a GIS, effectively serving as a

facilities management system. Facilities could also be represented in a separate management package that can interface with the GIS. Level of Effort: **MEDIUM**

12.4.4 Emergency Storm Response

The DPW is responsible for several aspects of storm response as listed above in Section 12.1. The following are some GIS applications/capabilities that would benefit the DPW in their execution.

- **Snow Plow Routing**: As noted above, the DPW is responsible for a number of services which they track by hardcopy, colored maps. An example is snow plowing. The GIS could be used to more efficiently design these routes by providing more accurate road mileage and the designation of Town and state-owned streets. These factors can be calculated for each driving route in the Town, and be recalculated each time there is a change in route or with the addition of a subdivision. In this way, the routes can be continually evaluated for their efficiency and workload. Hard copy maps can also be provided to drivers. Level of Effort: **LOW**

- **Identification of Street Jurisdiction:** Coding streets in the GIS according to owner (e.g. local, state, federal, private) will greatly aid in planning required emergency response from the Town as well as coordination with other responding entities.

- **Location of elderly, disabled persons, etc**.: Emergency preparedness and response would be aided by a data base of persons who may need special assistance in evacuation or other activities in response to an emergency. The residences of these persons could be highlighted in response to a simply GIS query. This data base would also be helpful to Police and Fire. Level of Effort: **MEDIUM**

12.4.5 Pavement Management

GIS can be used as, or integrated with, a Pavement Management Systems(PMS) and used to inventory the conditions of the roads. In a PMS, detailed information on surface type and surface condition are stored in addition to other information such as number of lanes and the presence/absence of drainage. These attributes can be stored in the GIS, or, preferably, an off-the-shelf package with specific PMS functionality can be used for the attribute data and accessed by the GIS. The GIS user could issue a query such as “show me all paved roads where the condition is poor”. Not only would a map be created, but the system could quantify the length of the roads. This type of information can be used to support the DPW’s work planning and capital improvement budgeting activities. Level of Effort: **LOW**

12.4.6 Traffic Control and Signage Maintenance

Traffic Control Maintenance includes maintaining traffic lights, street signs, and road/parking striping. The GIS could be used to support these activities in a number of ways, including:

- Identifying structures not maintained by the Town
- Scheduling traffic light checks based on geographic location and other field activities taking place in the same area.
- Keeping an inventory of the location and type of all street signs and tracking their maintenance. This would include the reason for the maintenance, including accidents and vandalism that might indicate either traffic problems to be addressed or an area that may need different equipment/security.

Level of Effort: **MEDIUM**

12.4.7 Cemetery Management

Cemetery expansion is a current issue facing the Town. The cemetery was flown at an accuracy of 1" = 20' last year. The current area is nearly out of room for additional graves; the Town may need to look elsewhere for additional space. An accurate townwide map would greatly aid in this procedure, and the GIS could be used to identify vacant land, its owners, and the accurate area. GIS could also aid in determining amounts of sod and fertilizer that need to be ordered for each summer season, by providing acreage calculations.

As part of the management, GIS could assist in tracking grave ownership and locations and the availability of grave lots within the cemetery. This detailed information could also aid in providing the public with genealogical and historical information.
Level of Effort: **MEDIUM**

12.5 Other GIS Issues

- **Related Technology**: The DPW has needs for other technology to interface with or be used in GIS development and map maintenance. These include GPS for more accurately locating features and real time dispatch management of work crews; a Pavement Management System; and further use of CAD to integrate new plans or as-builts into the GIS. The DPW should also review the need for scanning data to link to the vector data layers in GIS. However, the scanning consideration should be delayed until more fundamental decisions about obtaining a base map and the extent of GIS use are made.

12.6 Summary

While the DPW has many potential uses for GIS, the overriding need in this department is an accurate base map. Since this will be the foundation of the GIS, the base map issue

must be addressed before GIS is implemented in any department. The DPW will be a primary data user and will help provide data to the system, as well. As such, they should take the lead in determining how the base map will be established. The Town currently has the Boston Edison digital data, but it is becoming outdated and its scale of 1" = 100' has not provided the details that the DPW requires. DPW's preferred option would be to obtain a highly accurate, new base map at a scale of at least 1" = 40'.

13. Schools

Eugene Negrone: Assistant Superintendent/Business

13.1 Responsibilities and GIS Overview

The department operates 7 schools: 5 elementary, 1 middle school, and 1 high school. School Busing, which is provided for free to kindergarten students and for students in grades 1-6 who live more than 2 miles from school, and is provided for a fee to higher grades, is contracted out. Due to an increase in younger students, 4 more buses will be added to the transportation system. As shifts in population occur, or schools reach maximum capacities, some grades are reassigned to different buildings to adjust assignments to building capacities.

13.2 Current computer configuration

2 486 PCs

13.3 GIS Data Requirements

The school department is primarily interested in census data to project school enrollments. In addition, the school requires an accurate street base map to provide to its bussing contractor.

13.4 GIS Application Requirements

13.4.1 School Redistricting

School redistricting is done very occasionally, the last being done in 1982. However, the department could use GIS to check the districts against populations and perform simple visual checks for practicality. Level of Effort: **LOW**

13.4.2 Student Reassignments

As population shifts occur, entire grades must sometimes be moved from one school building to another. For instance, in the past year, the 6th grade was moved from the elementary schools to the middle school, and the 8th was moved to the high school to accommodate growing numbers of elementary age schoolchildren. The GIS could be used to test student reassignment scenarios, and to develop and visualize these reassignments against expected population trends (available through census data) and the current school bus routing. Level of Effort: **LOW**

13.4.3 School Bus Routing

This application is a lower priority, since busing is contracted out, and the school department is confident in the contractor's ability to optimize routes. However, optimal school bus routing could be aided with the use of a GIS, particularly with a third party package designed for school bus routing. This application would be dependent upon securing an accurate base map, having traffic information about streets, and integrating school enrollment data. Level of Effort: **HIGH**

13.5 Other GIS Issues

NA

13.6 Summary

School GIS applications are not a pressing need and would not require frequent GIS use. The applications discussed above could be provided on an as-needed basis by a GIS consultant or a Dedham GIS manager. Currently, the school department will not be targeted as a priority GIS user.

14. Treasurer

Frank Geishecker: Treasurer
Donna Bowse: Assistant Treasurer

14.1 Responsibilities and GIS Overview

The Treasurer receives and disburses money for the Town, including payroll and vendor payables. The Treasurer also invests remaining funds. Delinquent taxes are reported to the Treasurer by the Tax Collector to be collected or placed under lien. The Treasurer has limited need for GIS, as discussed below.

14.2 Current computer configuration

Arlington Data, networked with the Comptroller. Lotus spreadsheet on 486 PC.

14.3 GIS Data Requirements

The Treasurer has very little need for geographic data, except when reviewing or inspecting liened properties. Most Town data layers can be helpful in tax lien cases. Please see Table 1.

14.4 GIS Application Requirements

14.4.1 Mapping of Tax Liens

Mapping tax liens and delinquent taxes can assist the Treasurer in estimating Town tax income. Also, when tax liens are mapped with other data layers, parcels that may be of "permanent" interest (i.e. ownership taken over) to the Town can be identified for further exploration. Level of Effort: **LOW**.

14.5 Other GIS Issues

NA

14.6 Summary

The Treasurer's office would not be the site of a GIS workstation. On a very occasional basis, the Treasurer would be served by high-quality hard-copy output, generated by an in-house GIS specialist or a consultant.

15. Tax Collector

Robert Cihak: Tax Collector

15.1 Responsibilities and GIS Overview

The Tax Collector calculates all bills and collects receivables. The primary interest in GIS is in relation to sewer billing. Potential applications are discussed below.

15.2 Current computer configuration

CEI, networked with the Assessor

15.3 GIS Data Requirements

The Tax Collector's main geographic data needs are for sewered and septic properties. The Tax Collector is responsible for collecting the tax used to pay the MWRA bill, and knowing these properties enhances the assignment of sewer rates for Dedham customers. This activity would also be aided by accessing building and well permits on-line.

15.4 GIS Application Requirements

15.4.1 Mapping Sewers, Septic Systems, and Well Permits

Identifying these areas can serve multiple uses:

- Identify properties with sewer service but aren't being billed.
- Ensure that properties with septics are being billed fairly (and identified for inspection)
- Identify properties with wells that are sewered to ensure they are billed for sewer service.

Level of effort: **MEDIUM**

15.5 Other GIS Issues

NA

15.6 Summary

The Tax collector, like the Treasurer, would not be the site of a GIS workstation. The collector would be served by high-quality or analysis, as discussed in 13.4.1, generated by an in-house GIS specialist or a consultant.

16. Council on Aging

JoAnn Mucciaccio: Director of Council on Aging

16.1 Responsibilities and GIS Overview

The council on aging provides services and advocates for benefits for senior citizens. Most of the seniors are located at 3 senior complexes and transportation to and from these locations is planned on a daily basis. The council also coordinates meals-on-wheels. There are potential GIS applications but they are of very low priority.

16.2 Current computer configuration

2 386 or lower PCs

16.3 GIS Data Requirements

Please see Table 1.

16.4 GIS Application Requirements

16.4.1 Transportation Planning

GIS could be used in transportation planning (taking people to the doctor, grocery, etc. and coordinating meals-on-wheels routes). This would require an accurate street map and the ability to type in destination addresses in order to visually assess the best routes. Since the Council's activities are fairly efficient and organized currently, it would be "overkill" to provide them with a routing package that interfaces with GIS. The transportation planning could be conducted with the aid of a desktop GIS. Barring that, a reliable hard-copy map would be almost as helpful as an active GIS. Level of Effort: **LOW**

16.5 Other GIS Issues

The Council on Aging would benefit from the assessor's data to ascertain individual's eligibility for services. Obtaining the Assessor's data does not require GIS (it could be a simple tabular data base query), but it could be done in a GIS environment.

Census data, again not requiring GIS, but could be accessed via GIS, would assist in projecting senior needs in the coming years. This would aid in service and facility planning.

16.6 Summary

The Council on Aging is run fairly efficiently without the use of maps or GIS. While GIS could certainly enhance some of the activities, the Council could be served by simple network access to the assessor's data base.

17. Town Comptroller

Mary Shea: Comptroller

17.1 Responsibilities and GIS Overview

The Comptroller reviews, manages, and reports on the Town's finances, including retirement funds, insurance, salaries, and a breakdown of expenditures by department. This is not a geography-based job and does not require integration of GIS.

17.2 Current computer configuration

Arlington Data; networked with the Treasurer.

17.3 GIS Data Requirements

NA

17.4 GIS Application Requirements

NA

17.5 Other GIS Issues

NA

17.6 Summary

No GIS applications were identified for the Comptroller.

18. Veterans' Services

Joe Grella: Veterans' and Worker's Compensation Agent

18.1 Responsibilities and GIS Overview

Veterans' Services administers worker's compensation and evaluates the Town's affirmative action goals, policies, and implementation regarding veterans. No GIS applications were identified by either the consultant or Mr. Grella.

18.2 Current computer configuration

Gateway 2000 486 with Lotus 1-2-3 and Word Perfect.

18.3 GIS Data Requirements

NA

18.4 GIS Application Requirements

NA

18.5 Other GIS Issues

NA

18.6 Summary

The veteran's services department has little or no need for access to GIS data and is not targeted for GIS implementation.

Table 1

Town of Dedham: Basic Graphic GIS Data Set Requirements Matrix

Data Layer	Recommended Data Source	Assess-ing	Building	Town Clerk	Town Administrator	Conser-vation	Finance	Fire	Health	Parks & Recreation	Planning	Police	DPW	Schools	Treasurer	Tax Collector	Council Aging	Comptroller	Veterans' Services
Base Map																			
Edge of pavement	New Flight or BECo	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Street centerline	Edge of Pavement	x					x	x		x		x	x	x			x		
Building footprints	New Flight or BECo	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		
Back of sidewalk	New Flight or BECo	x	x		x	x	x	x	x		x	x	x	x					
1 ft. contours	New Flight	x	x			x	x		x	x	x	x	x		x				
Manholes/Catchbasins	New Flight or Field Survey							x		x	x	x	x						
Fences/walls	New Flight or Field Survey	x	x			x	x	x	x	x	x	x	x						
Scanned aerials or Digital Orthophotos	State 1:5000 DOs or New Flight	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		
Hydrants	New Flight or Field Survey	x	x		x		x	x	x	x	x	x	x	x					
Wetlands	State 1:5000 DOs, or New Flight and Site Survey	x	x				x		x		x	x	x						
Parcels	Deeds & Plans/Assessor's Maps	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Drain System	New Flight, Field Survey, and existing as-builts	x	x		x	x	x	x	x	x	x	x	x	x	x	x			
Sewer system	New Flight, Field Survey, and existing as-builts	x	x		x	x	x	x	x	x	x	x	x	x	x	x			
Zoning	Town Zoning Map and Plans	x	x		x	x	x	x	x	x	x	x	x	x	x	x			
Floodplains (FEMA)	FEMA's Flood Insurance Rate Maps (FIRM) or delineated from 1' contours	x	x			x	x		x	x	x		x	x	x	x			

x Shaded entries represent a requirement for that data set

This is not an all inclusive list of data sets. Other data sets required by individual departments and of less general use, are described in the body of the Needs Assessment.

Part 2:
Town of Dedham GIS Implementation Plan

Overview

The Town of Dedham is currently reviewing its town computer systems. As part of this overall effort, but as a separate project, Applied Geographics performed a GIS needs assessment. This section of the report sets out AGI's recommendations on implementing GIS in Dedham based on the findings of the needs assessment.

1. Strategic Decisions

There are three issues that must be addressed in Dedham before embarking on GIS development: base mapping, system upgrades, and GIS staffing.

- **Base Mapping**
  The greatest obstacle to implementing GIS in Dedham is the lack of an accurate and uniform base map. As data collection and conversion can be as much as 75% of total GIS implementation costs, obtaining the base map is a serious consideration that requires careful planning and budgeting. The costs and advantages of developing a base map from aerial photography or existing sources (such as the Boston Edison Company base map), must be compared and balanced with budget projections.

- **GIS Staffing**
  Despite the fact that GIS are becoming more user-friendly and moving to the desktop, GIS remains a complex technology that requires staff commitment for success. Even in a community the size of Dedham, GIS will require the commitment of at least one staff person who works on GIS the majority of his or her time. While many town personnel will ***use*** the GIS, the GIS staff are required to maintain the technology, maintain the integrity and currency of the GIS data base, develop applications and perform high-end, special projects that require the GIS. This serious commitment can be fulfilled by a new hire, or an existing employee with a commitment of at least 60% of his/her time to GIS. Alternatively, Dedham could elect to outsource GIS data base management and maintenance and other highly technical GIS functions on an as-needed basis.

- **System Upgrades**
  The third issue is the priority of upgrading the town's overall computer systems, installing more networking, and system administration. Clearly, GIS is part of the overall system, but it may have a lower priority than other applications in the Town. GIS is likely to be more successful if planned into a comprehensive, networked system that has proper support personnel. AGI recommends that this plan be put into place before the full-scale acquisition of GIS equipment is pursued.

1.1 Base Mapping

The base map can be envisioned as the representation of basic, visible geography within the Town. The base map contains such layers as the edge of pavement (roads), hydrography (streams and ponds), and building roofprints. Generally, the base map is created from aerial photography and has well defined parameters that indicate the accuracy of the data (and the uses for which they are appropriate).

The base map is the foundation upon which all other data layers will be built. Thus, the more accurate and complete the base map, the more accurate and useful the thematic data layers (sewers, parcels, etc.) that are registered to it. The most preferable approach to base mapping is to develop a highly accurate and detailed base map from low altitude aerial photography. However, the more accurate the mapping, the more costly the base map. AGI recommends that Dedham pursue the most accurate mapping option that the budget will allow. The options for obtaining a base map are discussed below and are listed from most accurate to least accurate.

1.1.1 New Aerial Photography and Base Mapping

New aerial photography would provide the most up-to-date base map for the GIS. It is a costly undertaking, but the quality and currency of the data are worth the investment. The GIS base map will be used long into the future and literally serves as the foundation of the system. The scale and accuracy of the base mapping dictates the type of GIS applications that may be pursued using that base.

Developing planimetric base maps from aerial photos is a highly technical process. Technical issues and resultant map products are described in the following sections.

1.1.1.1 Scale of Fly-over and Planimetric Mapping

There are two standard scales of planimetric base mapping that are used for municipal mapping purposes: 1" = 100' and 1" = 40'. In either case, the planimetric mapping is *derived* from aerial photography that is captured at a different scale. In all cases, the aerial photography is accompanied by ground control surveys that allow accurate collection of data from the photographs (see below) and tie the data to accurately surveyed real world coordinates (e.g. State Plane coordinates).

For ground control, selected points on the landscape are surveyed for their real-world horizontal (x,y) coordinates, and can also be surveyed for their elevation (vertical control). "Full" horizontal and vertical control refers to collecting enough data to generate not only planimetric data but also elevation data such as contours. If contours are not required, full horizontal, but only limited vertical, control may be collected.

In general, the larger the scale of mapping (more detailed), the more accurate the resulting data and the more costly the data are to develop. Thus, 40-scale mapping is more accurate, and more expensive, than 100-scale mapping.

Most municipal users of GIS are satisfied with 100-scale mapping; however, engineering applications and some DPW infrastructure work requires 40-scale mapping. For example, creating construction design documents from the GIS data base might require 40-scale mapping. As discussed above, the photography taken to create 40-scale mapping will provide greater visual detail for base map compilation.

1.1.1.2 Planimetric Layers

Once the fly-over is conducted, the photogrammetrists integrate the ground control measurements and perform fully analytical aerial triangulation (FAAT) that densifies the control points throughout the Town. FAAT also corrects the coordinates to account for the curvature of the earth, flight irregularities, and the topography of the landscape. Once the FAAT is completed, the photographs are interpreted and visible features from the photographs are converted into digital data. Depending on the scale of the fly-over and the desired planimetric data, there are different types of features that can be captured.

The following table provides an example of what types of features can be captured during a planimetric mapping process at various scales. This table shows the major layers of potential interest to Dedham (this list is not exhaustive).

Layer	Captured @ 100-scale	Captured @ 40-scale
Edge of pavement	yes	yes
Street centerlines	yes	yes
Back of sidewalk	yes	yes
Building footprints/roofprints	yes	yes
Hydrography	yes	yes
Driveways/parking areas	yes	yes
Retaining walls	yes	yes
Hedges	yes	yes
Fences	yes	yes
Manholes	70-90%	90% +
Catch basins	70-90%	90% +
Fire hydrants	70-90%	90% +
Utility poles	yes	yes
Trees	yes	yes
Athletic fields	yes	yes

There is an incremental cost associated with each individual layer selected for planimetric data capture. The price estimates presented in the spreadsheet in Table 3 are based on a "typical" selection of planimetric layers, such as those listed in the table above.

1.1.1.3 Topographic Contours

Another important product that can be derived from aerial photography is topographic contours. Contour elevations generally have a vertical accuracy of 1/2 the contour interval (i.e., 1' for 2-foot contours).

The Dedham departments that utilize contours would be best served by 1' contour intervals because the terrain is very flat. If full horizontal and vertical ground control is completed prior to the flyover, topographic contours can be produced from a basic fly-over in a subsequent year after the fly-over and planimetric mapping has been completed. Thus, it is feasible to fund the ground control, fly-over, and planimetric mapping in one year, and then complete topographic contours at a more favorable time.

1.1.1.4 Digital Orthophotos

A third important product that can be derived from the aerial photography is a digital orthophoto (DO). Simply stated, a digital orthophoto is a high resolution digital rendition of the actual aerial photograph that has been rectified to account for the curvature of the earth and topography. A digital orthophoto can be used as a backdrop for vector (lines and points) planimetric data and clearly shows such features as cars, vegetation areas, built structures and footpaths. Because the DO provides a photo-realistic image of the landscape, most communities that specify DO are also specifying that the fly-over be performed in color so that color DO can be produced.

Digital orthophotos are generally produced at the planimetric mapping scale (e.g. 100-scale for 1" = 100' base mapping). Like contours, DO requires that more extensive ground control be conducted prior to the fly-over. Also like contours, DO can be completed *after* the planimetric mapping is completed, and potentially in another fiscal year.

1.1.1.5 Alternatives to Digital Orthophotos

It is possible to create an aerial photographic backdrop without the use of digital orthophotography. This process would involve scanning the uncorrected aerial photographs and then registering them to a base map (presumably the new digital planimetric base) in a "quick and dirty" fashion within GIS software. This process would simply add georeference to the images so that they would roughly overlay with planimetry.

This process would **not** remove the distortions in the photos that result from the curvature of the earth and topography. The scanned images would be roughly aligned with the planimetric base map, but the overlay would not be perfect (e.g., some building outlines might be slightly offset from the planimetric version). Also, the quality of the plots derived from this lower cost approach might be lower than those derived from true DO, depending on the scanner that was used.

Still, this type of photographic backdrop can be useful for visualizing the landscape in association with vector GIS data. This method is also significantly less costly than

producing true DO and these products could even be produced in-house. If the budget does not permit the creation of DO, this option could be considered and prototyped in a low cost pilot project. This option would also raise disk space issues since the data will be in raster format.

1.1.2 Boston Edison Company Base Data

The base map data developed by BECo is at a scale of 1" = 100' (an accuracy of +/- 1') and was developed in 1992, based on a 1991 flyover. It contains basic planimetry, e.g. streets, buildings, hydrography, etc., as discussed in the previous section. Many towns are using this base map on which to base their GIS, including Stoneham, Arlington, and Natick. The Dedham DPW has already obtained the BECo data, but has used it very little.

A weakness is that the BECo base map is becoming outdated, especially since new development has occurred in Dedham since 1992. Another drawback to the BECo data is that it does not contain the locational accuracy desired by the DPW, as shown by some engineering contracts let by the DPW to a local firm. It also lacks robust thematic content. For example, infrastructure information (manholes, utility poles, etc.) that would help in developing infrastructure data layers - sewer and drain infrastructure being a high priority - are not sufficient. Other useful layers such as fences, wetlands, sidewalks, and vegetated areas that would be developed in a new flyover are absent from the BECo data.

The BECo data is an inexpensive way for the Town to get into GIS and it is available immediately through a licensing agreement with BECo. (Conducting a new flyover can take more than a year until the data is ready.) The scale is sufficient for conducting deed and parcel research and overlaying schematic infrastructure information.

Also, the base map could be supplemented and updated by field survey or new aerial photography to locate manholes (with accuracy to 1'), other street furniture and new features such as buildings or road changes. The supplemental data could provide for 2' contours (not 1'). A supplemental flyover would be far less costly than developing new data from a flyover. The BECo data could also be used in the interim until new base mapping is available.

A scale of 1" = 100' is of sufficient accuracy for recompilation of parcels and locating utility infrastructure for mapping purposes. It does not allow for the production of engineering design and construction drawings.

1.1.3 Commonwealth Gas Company Data

This base map was originally developed in April of 1990, with field updates and edits around ComGas infrastructure to 1994 for Dedham. The scale of the base map is roughly 1" = 200' (an accuracy of +/- 2 - 2.5'). It also contains basic planimetry with a lower capture rate on some features than the BECo data.

This map is also becoming outdated, and its horizontal accuracy is much lower than the BECo data. The infrastructure data is limited, as with the BECo data.

The ComGas base map is also an inexpensive alternative. It is currently being used - with mixed success, depending on the project - by the Dedham-Westwood Water District, but the water service data is not automated onto it. Their licensing agreement does allow Dedham to obtain and use the data at no cost.

Like the BECo data, this data could be updated via field survey or supplemental flyover. The supplemental work could be designed to provide 2' or 5' contours. The parcels could be recompiled onto this base, although without the accuracy afforded by the previous options. In general, the availability of the BECo data makes ComGas a far less desirable option.

1.1.4 MassGIS/CTPS Data

MassGIS has a variety of data that covers Dedham. This includes 1" = 2000' roads, hydrography, land use, and other themes. The Commonwealth is also developing statewide digital orthophotography at a scale of approximately 1" = 410' (with an accuracy of about 6.5'), with ½ meter pixel resolution. The pixel resolution refers to the cell size and ground coverage of the cell, but is not related to the accuracy of the data.

The Central Transportation Planning Staff of the Massachusetts Highway Department is integrating this orthophotography with its own statewide data base, developed from 1:100,000 digital line graphs. During highway projects, field crews are submitting updates for missing or changed roads to be integrated to this base map, but these updates are no more positionally accurate than the base they are entered on. Although the map is current, its scale remains significantly less accurate than the options discussed above.

Any of these state data sets are sufficient for planning purposes, but are not of a scale sufficient to locate utility infrastructure or to serve as construction document bases. Since these are overriding concerns in Dedham, these data are not as desirable as data of a more accurate scale.

Base Mapping Recommendations for Dedham

A major problem facing the town right now is the MWRA service rates, which are based on input to the sewer system. Since the town does not know the extent and condition of its sewer and drain system, it is difficult to investigate how and if improper drainage, leaks, and unauthorized dumping are affecting the high MWRA service rate. An accurate flyover and base map would allow for better mapping of drainage, infrastructure, and other related data that could be analyzed in light of this problem.

Another factor affecting base mapping decisions is the Environmental Protection Agency's 2005 Charles River Mandate, which requires that Dedham map its street

drainage system. Since there is a lack of drainage plans available, any base mapping effort that included capture of street infrastructure would be most beneficial.

If budget allows, AGI recommends that 1" = 40' base mapping be pursued with a flight scale of between 1" = 300' to 1" = 400'. This would result in a very accurate base map and provide details on infrastructure location that would aid in drain and sewer mapping. It would also allow for the development of contours with an interval of 1'. This scale would also cut down on some of the field work being conducted by the Town to simply locate features. The topography and/or digital orthophotography could be obtained simultaneously or subsequently, depending on approved budgets.

If the budget does not allow for this first option, AGI recommends obtaining the BECo data and then updating them with a supplemental 100-scale flyover.

1.2 Staffing Issues

As discussed previously, successful municipal GIS requires staff commitment for use, data maintenance, and system administration. There are a variety of approaches for addressing this issue, ranging from hiring a full-time GIS administrator to completely outsourcing all support. And no matter who is doing the GIS technical work, there should be a body within the town that oversees activities, sets priorities, and generally steers GIS program initiatives.

1.2.1 GIS Development Committee

AGI recommends that a GIS steering or development committee be initiated to focus on GIS issues and projects. There is currently a group that has been put together in Dedham to review this GIS Needs Analysis, and those core people would be good candidates to continue as a GIS steering committee. If an Information Services Committee (ISC) is instituted, as recommended in the Melanson Heath report (a study performed this year which contains recommendations on upgrading the Town's overall information systems), the GIS committee should be structured as a subcommittee, or at least maintain very close ties with the ISC. Even though AGI is putting forth comprehensive recommendations herein, this report cannot possibly account for funding, personnel, and priority changes over time. These should be addressed by Town personnel, with a continuing first hand understanding of what transpires in the Town. This group should focus on the coordination of GIS efforts among the various departments and building a strong constituency to support these efforts. This group is also a vital forum where issues such as prioritization of implementation activities can be addressed.

1.2.2 GIS Administration/Management

The GIS administration duties can be handled by one lead person (a GIS administrator) or a combination of part-time staff and consultant assistance. Some of the duties include not only technical GIS services, but also to serve as a point of contact for GIS inquiries from both within the Town, and from the private sector and GIS contractors/vendors. While implementation and data delivery are proceeding, the GIS administrator will be primarily

responsible for managing the contracts and guiding the implementation. The different staffing options are discussed below.

1.2.2.1 Full Time GIS Administrator

Many towns are finding that GIS is becoming so heavily used that it requires its own staff person. While generally larger communities have full time administrators, smaller towns are using this approach, as well. The cities of Cambridge and Newton have full-time GIS administrators, and Wellesley (pop. 26,000) and Yarmouth (pop. 21,000) do, as well. Hiring the full-time administrator is more a function of how extensively GIS is to be deployed, and its anticipated funding levels, rather than the size of the town.

If a GIS Administrator is hired, he/she should be viewed as an interdepartmental resource, (though potentially housed in a particular department) and should split his/her time between 1) overall GIS system and data base maintenance, 2) map making and applications development on behalf of other Town departments (e.g., Building, Planning, Police) and 3) assisting users. This person will be the lead problem solver and system developer for the Town. It will be helpful if this person has expertise with related technologies such as relational data base management systems or image processing.

A full time GIS Manager's salary generally ranges between $40,000 - $55,000 per year.

1.2.2.2 Part or Half-time GIS Administrator

Successful GIS programs have also been managed through a part-time dedication to GIS, with consultant support when needed. In many communities, a highly interested staff person takes on the GIS support and administration, but relies on consultant assistance for special projects, intensive application development, data update, or technical support on an as-needed basis. A variation on this idea is a staff person who splits his/her time between MIS management and GIS administration. In addition to GIS, this individual provides general system administration, ensures that the server and network are running, performs backups, and oversees contracts and procurements. The town of Northborough (pop. 15,000) recently hired a GIS/MIS administrator who performs the majority of GIS work, but who retains consultant services for support. The Town of Stoneham (pop. 22,000) is also hiring this type of employee.

1.2.2.3 Outsourcing GIS Administration

Another feasible approach that is not yet widely adopted is to outsource all GIS administration activities (as well as data maintenance and technical support). In this scenario, a consultant would be used on a weekly or monthly basis to provide technical assistance, applications development, project management, and other GIS administration duties. The Town would likely contract with the consultant for 300-400 hours per year at a rate of $50 - $80 per hour, depending on the task. The consultant would ensure that the data base was updated and accessible to end users, develop easy-to-use applications for the end users, and perform special projects that require more intense GIS technical knowledge. The City of Newton outsourced all GIS administration for the first 2.5 years of the program, eventually hiring a full-time administrator.

1.2.3 Other GIS Staff

1.2.3.1 Departmental Technical Staff

It is perfectly appropriate for departments that have more intensive GIS needs to develop their own departmental GIS staff who would work in coordination with the GIS Manager. As implementation proceeds, more technical knowledge may be required among Dedham staff to meet the rising demand for GIS applications. It is likely that departments may require more assistance than the GIS administrator can provide alone. Each department accessing GIS could elect to have a main point person to coordinate with the GIS Manager, and to develop GIS in his/her own department to the extent permitted by time and technical knowledge. It is not uncommon that "power users" within individual departments develop more advanced GIS skills.

1.2.3.2 End User GIS Staff

One of the principal goals of a GIS implementation is to make pertinent information more readily available to a wide range of professionals working within Town government and to the general public. People within Dedham should not need to rely on a "GIS professional" to provide simple access to data and maps. These end-users will be accessing GIS using easy to use desktop tools.

The current state of most desktop software allows for customization and ease of use so that access to GIS data can be provided with relatively small amounts of training (i.e., less than one day). Under this scenario, the GIS professional staff (the GIS Administrator, GIS technical staff, and/or GIS consultant) will set up a desk top system with appropriate data and applications to allow the type of data access that a particular end-user (e.g. the Town Administrator or Building Inspector).

Staffing Recommendations for Dedham

Dedham is not likely to move ahead with hiring a full-time GIS administrator in the near future. In fact, AGI would recommend that the plans for the overall town system and administration be formulated more clearly before addressing GIS staff hires. Ultimately, we believe that Dedham will be well-served by a full time or half-time GIS administrator.

Until that time, AGI recommends that GIS administration be outsourced. The level of this interim outsourcing will be roughly the same no matter which of the base mapping options are selected. Contract management and implementation services would be necessary for obtaining a new flyover, in any case, and if an existing base map is selected, the Town will need to contract for implementation, application development, and training.

Once GIS is established in Dedham, in approximately 2 - 3 years, and other townwide systems have been addressed, the Town can reevaluate its need for a full-time administrator or opt to continue outsourcing.

1.3 System Upgrades

GIS is no longer a stand alone application requiring special equipment or networking. It has evolved to a stage where it is one application integrated with many other applications necessary to municipal government. The Town is conducting a concurrent study (with Melanson Heath & Co.) to comprehensively evaluate the computer systems and make recommendations on upgrading the system. It is important that a commitment to upgrade the computer systems be made before attempting to adopt GIS technology, since many of the current PCs in the Town would provide mediocre performance, at best, if equipped with GIS.

Generally, the recommendations made in the Melanson Heath study are well-suited to implementing GIS. The report's immediate recommendations for obtaining new PCs and upgrading existing ones, installing the townwide network, and purchasing a server will create a solid foundation for integrating and deploying GIS.

1.3.1 Operating Systems

The specific GIS packages purchased will in part be based on the operating systems existing and installed on upgrades. However, most manufacturers have different versions of GIS products that run under different operating systems. The Melanson Heath report recommends an Intel-based system, which is appropriate for GIS. Even if a UNIX server were selected, a GIS configuration could be accommodated on this operating system, as well, or GIS would be focused on the Intel desktop.

1.3.2 PC Upgrades

Current PC technology that is most suited to running a desktop GIS is a Pentium 200 with 32Mgs RAM. The DPW, Assessor and Conservation each have machines nearing or of this magnitude. Although some desktop GIS run on slower machines (such as a 486), the performance is not as efficient. Upgrades implemented in Dedham over the coming years should be at least to Pentium level. Hardware becomes more powerful and less expensive over time, so faster machines may be obtainable as upgrades progress.

1.3.3 Networking

GIS, as an application on the network, can be networked via the Town's cable system, as recommended by Melanson Heath. Like the operating systems, GIS can run under a variety of networking options, so if a different network is installed townwide, GIS will still be deployable.

System Recommendations for Dedham

Dedham should adopt as many of the recommendations for PC upgrades as possible from the Melanson Heath report to facilitate townwide GIS. GIS will be most successful if planned into this overall network as an integral part of the town's computerization. As noted above, in the short-term, desktop GIS can be installed in the DPW, Assessor's office and the Conservation Commission on existing systems, and further deployed as a function of system upgrades and/or priority of other applications.

2. GIS Hardware and Software Acquisition & Configuration

There are a number of GIS packages on the market that are suitable for use in Dedham. Purchase of at least 1 GIS seat should be concurrent with obtaining a base map (If BECo is selected, or used as an interim base, a desktop package should be purchased at that time). Hardware and software should only be purchased when needed, because technology generally becomes less expensive and has more functionality with each new generation.

2.1 System Selection

There are two general levels of GIS software that a municipality requires: 1) **high end GIS** software for advanced data editing, analysis and high quality cartography, and 2) **desktop GIS** for primary data access and query to a GIS data base as well as simple analysis and cartographic output. In general, a high end capacity is needed for the GIS administrator or other personnel who perform GIS tasks for the majority of their time, and a much larger number of desktop GIS workstations is required for the many users across the Town departments.

2.1.1 High End GIS Software

Currently, the DPW and Conservation use AutoCAD to produce detailed drawings. There are GIS packages that are based on and use AutoCAD, creating a robust GIS that allows data update, maintenance, cartography, and analysis. These include such packages as Environmental Systems Research Institute's (ESRI) ArcCAD and Autodesk Corporation's AutoCAD Map. AutoCAD World, a more advanced GIS from Autodesk, uses AutoCAD data but does not require the program to run.

There are other robust packages that do not run on CAD, such as ARC/INFO for UNIX or WindowsNT, Bentley Microstation, and Intergraph MGE. These generally have more functionality than CAD-based packages, but are substantially more expensive.

2.1.2 Desktop GIS Access

Aside from the central GIS operation a number of departments in the Town require some view, query, analysis, and mapmaking capability. These can be provided by desktop GIS "clients", which access the central data base (or copy thereof). Examples of these software packages include ESRI's ArcView, Intergraph Corporation's GeoMedia, as well as MapInfo and Maptitude. Generally, these packages allow mapmaking, query, and limited analysis, but don't have as much functionality as a CAD-based GIS or robust package such as ARC/INFO. However, as each new version of these desktop packages is released, more and more functionality becomes available.

2.1.3 Peripheral Equipment

Fully configured GIS systems include several important peripheral devices beyond GIS workstations and software. These devices include plotters, digitizers and scanners.

2.1.3.1 Plotters and Printers

Once GIS becomes operational in the Town, it will be necessary to obtain plotters and printers to output hard-copy maps and reports. Initially, the Town should obtain a state-of-the-art, large format color inkjet plotter such as a Hewlett-Packard 750C. This plotter may be placed in Town Hall or DPW. Ideally, two plotters could be purchased, and one plotter could be placed in each location.

In addition, GIS output on 8.5"x11" pages is also very effective. Small format color printers can be an effective means of giving GIS output capabilities to other offices away from the large plotter, such as the School or Police Department. These small format printers use inkjet technology and are reasonably priced.

2.1.3.2 Digitizer

If the Town will maintain and update the data in-house (as opposed to contracting out data update), a large format digitizing table may be needed for creating digital linework based on existing hard copy maps. This e-sized digitizer can be purchased in the second year of implementation, and can be used in data automation projects from that time on.

2.1.3.3 Scanners

Scanners have increasingly become an integral part of a fully operational GIS environment. Scanners are used for both creating GIS accessible raster data (e.g. a scanned deed) and creating raster images that will be used as a template to create vector GIS products through the process of heads-up digitizing. A small scanner is currently on order for the Town that could be utilized for small documents. Larger scanning projects are not a high priority in the Town.

Recommendations on Hardware and Software

The appropriate GIS configuration is partially dependent on the staffing approach taken by the Town. A full time administrator could support the implementation of a robust GIS. Although the version of CAD in place in the town is not the most current, the CAD operating knowledge could be built upon with a CAD-based GIS. If a new DPW hire (which is planned), is able to devote at least 50% of his/her time to GIS, he/she could perform GIS tasks on the CAD-based GIS. Other personnel who have operated CAD could gain a modest knowledge of the GIS package and provide support. This configuration should include a digitizer, acquired within the first two years, and at least one large scale plotter.

If a full or part-time GIS administrator is not hired, the town would be better served by purchasing desktop systems, scheduled with system upgrades. If outsourcing is permanently pursued, it would be more cost-effective to maintain desktop systems and have more complicated GIS tasks done by the contractor on the contractor's machines.

Based on current equipment, a CAD-based GIS or desktop could be installed in the DPW and a copy of the data placed on the Assessor's machine with a desktop package. Those

networked with the assessor could have access to the data base via a desktop package; further access to the GIS could expand with networking and system upgrades.

In short, if proper support personnel are in place, AGI recommends that a central CAD-based GIS (or more robust system) be purchased, as well as a digitizer and two plotters, with desktop GIS providing access to all departments. If GIS administration is to be contracted out, the Town should implement desktop packages and one or two large format plotters.

3. Data Development Plan

Data base development is the largest single cost in GIS implementation. Given these large expenditures, it is critical that the initial data automation be high quality so that it can serve as a strong foundation for future GIS development. The following will describe the key data layers that are recommended to be developed by Dedham. These layers would be developed to be registered and compatible with the base mapping option selected by the Town. The suggested sources, options, and methodologies for developing these layers are also described.

3.1 Parcel Mapping

As noted previously, the parcel maps are of varying scales and condition, and most are difficult to read. AGI strongly recommends that new deed and parcel research be conducted and new maps produced. The parcels can be compiled with reference to the selected base map.

If an existing base is used in the interim before obtaining a detailed flyover, AGI recommends that parcels be automated as-is into that base. This will provide lower accuracy parcels in the short term, but will provide the potential for thematic mapping and data base integration as the town becomes familiar with GIS technology. When the flyover is pursued, the parcels then can be researched using the new, more accurate base.

3.1.1 Automating the Parcels

Automating the parcels themselves into a useable GIS data layer will involve the following steps:

1. In deed research, parcel lines are developed by reading the deeds and plotting them through coordinate geometry on the accurate base map. The parcels must be registered so that parcel lines do not cross buildings, fence locations are used as parcel lines (where appropriate) and generally “match” land features that are pertinent to the lot lines. This also involves ensuring that all parcels fall within edge of pavement “blocks.” During parcel research, inconsistencies between the assessor’s records and the parcels are rectified. If the parcels are compiled onto hard-copy maps, the lines must then be automated. Some vendors use “soft-copy”, i.e. the compilation is done digitally from the outset.

2. Coding of the parcels with the appropriate map and lot number that will allow GIS integration with the Assessor's records currently stored in the Vision software. Initially, this integration will likely be an ASCII file output that is translated into the GIS. If the Vision software eventually migrates to a SQL platform, the linkage can be real-time.

3.1.2 Annotation Automation/Capture

The following data should be captured as annotation and/or attributes when the parcels are automated.

- Lot ID number
- Area of the lot
- Dimensions of property boundaries

Information describing the first two annotations is also stored in the Assessor's data base. Thus, these annotations can be automatically placed on the map by using the GIS software to generate labels directly from the assessor's data base.

3.2 Municipal Infrastructure Mapping

While the base map and parcels make up the primary foundation of the GIS data base, there are several other thematic data layers which are important and prioritized for data development. First and foremost, these include utility infrastructure.

Town-maintained utility infrastructure includes sewers and drains. However, other infrastructure such as water lines (maintained by the Dedham-Westwood Water District) and gas mains (primarily Boston Gas) are also of keen interest to most departments, because they affect development, specific street improvement projects, and facilitate identification of problems.

In Dedham, it is becoming extremely important to have an accurate drain and sewer system map. Since they are town-maintained, automating the sewer and drain should take priority over the other services.

3.2.1 Sewer and Drain System

Currently, the DPW is conducting a video inventory of the sewer system, but only for a limited portion of the Town (about 1/5). The video will reveal manholes and sewer connections for the area of town in which it is used. The video is equipped with a measuring device that allows calculation of pipe lengths, angles, locations, etc. This data can be converted to GIS and produce graphic lines representing the pipes, and the nodes can represent the manholes. The Town is also trying to receive more funding to continue this process in more areas. The majority of the town must be captured in some other way.

AGI recommends that Dedham conduct a full sewer and drain system field survey. This could be aided by photogrammetric capture of manholes if a new flyover is conducted.

3.2.1.1 Sewer and Drain System Survey

To conduct the field survey, crews would be deployed throughout the Town to find the sewer and drain infrastructure. Infrastructure features would be surveyed by conventional methods or GPS to accurately capture their elevation and x,y coordinates. The crews would also "pop" manhole covers to determine directionality, connectivity, and to take measurements inside the structure. Please see below for the specific attributes that would be captured during the survey.

3.2.1.2 Photogrammetric Capture of Manholes

If a new flyover is conducted, sewer and drain manholes should be captured as a data layer. To distinguish the sewer manholes from the drain manholes would require a field survey either to pre-mark each type so they can be seen in the photographs, or to assign manhole type to them in the GIS after the mapping has been completed. The manholes can be used to "connect the dots" in the GIS to produce the lines representing sewer pipes and drain pipes. This would greatly save time in the sewer and drain survey by establishing the location of the system, so the crews could go directly to the structures and obtain the needed information.

3.2.1.3 Sewer System Attributes

The following should be captured as sewer pipe attributes:

- Diameter
- Material (where available from plans or field research)
- Upstream and downstream invert
- Upstream and downstream manhole ID

The following should be captured as attributes for the manholes:

- ID number
- Outflow invert elevation

3.2.1.4 Drainage System Attributes

Field survey will be required to develop the recommended attribute information, as follows:

- Pipe diameter
- Pipe material
- Upstream and downstream manhole IDs
- Upstream and downstream inverts

The following should be captured as attributes for the manholes:

- Rim elevation
- ID number

- Outflow invert elevation

Sewer and drain pipes should also be given IDs (perhaps based on the from- and to-manhole IDs, or address) to establish a cross referencing system for future sewer plans, as well as existing sewer plans that the Town could scan (see 3.2.1.5). Directionality should be encoded as well.

3.2.1.5 Scanned Sewer/Drain System Information

GIS can be used to access scanned images of plans and documents stored in the GIS data base. For instance, the user could point to a sewer pipe and have the 40-scale plan for that pipe appear on the screen. The scanning process involves two steps. First, the original document must be scanned into a digital file. Second, an index of all scanned files must be made that links the image to the appropriate segment(s) of pipe or parcel. Once this index is created, it can be used by the GIS to automatically locate the appropriate image. In this manner, a user could point to feature using the mouse, and the GIS would automatically retrieve and display the appropriate scanned image. House connection drawings can also be scanned and linked, when available.

AGI does not recommend that scanning existing sewer and drain system plans be given a high priority since they are incomplete and often do not show the as-built configuration. However, the Town may consider scanning a selected set of 40-scale drawings that may be particularly useful, and/or implement a new policy of scanning as-builts from the current day forward, or requiring them to be submitted in digital format. The pipe's ID number would then be assigned to the plan to enable digital cross-referencing and access. Scanning and access to scanned images is an independent application, thus this capability could be added to the GIS at any point in the future. Given that developing the sewer system will be a lengthy process, AGI recommends that scanning considerations be delayed until year three or four of implementation.

3.3 Thematic Data Layers

The following is a discussion of recommended thematic layers that should be automated into GIS. It is not an exhaustive list. GIS data development is an activity that continues throughout the entire duration of GIS implementation and operation. Certain thematic layers may be needed to complete special studies that were not envisioned in the initial stages of implementation and during the needs assessment. The following describes priority data development projects that Dedham should pursue as defined during this study.

Some of these activities could be undertaken by in-house GIS personnel or funded as part of specific projects by particular Town departments.

3.3.1 Zoning

AGI recommends that Dedham delay the zoning map until the parcels are automated. There is a usable zoning map currently in existence that can serve until the parcels have

been automated. At that time, the more detailed zoning plans can be automated to overlay the appropriate parcel lines. Upon completion, the zoning can be automated.

3.3.2 Wetlands

While some wetlands can be obtained from a fly-over, these will not be completely comprehensive nor will they have attributes describing the type of wetland. Site surveys and wetland delineations will often still be required.

The Commonwealth of Massachusetts is delineating and coding wetlands from color infrared photography onto digital orthophotographs. While the scale is 1:5000 (approximately 1" = 410'), this data will be useful to obtain as a basic wetlands layer but also for wetland type. Approximately 60% of the land area for Dedham already exists in digital format, and should be obtained by the Town. The Town currently uses the hard-copy version of these data.

3.3.3 FEMA FIRM Floodplain Maps

The Federal Emergency Management Agency (FEMA) creates and disseminates the flood insurance rate maps (FIRM). All of Dedham is available in automated format. In general, the horizontal accuracy on the most accurate FIRM maps (their accuracy varies) is only to within +/- 7-10 feet. A better product could be derived from using a more accurate topography layer (such as would be provided from a new flyover) and use the zone contour intervals published by FEMA.

The Conservation Consultant has stated that he would delineate flood zones using 1' contour lines. If the acquisition of contours is delayed, it would be useful to have the FEMA data in the interim.

3.3.4 Precincts

The voting precincts are on a hardcopy map in the clerk's office. These should be automated, and run through an editing procedure by the Town to ensure that the interpretation to the new base map is correct. Whenever possible and appropriate, these precinct lines should be added coincident with parcels, hydrography, streets, etc. This data layer will be helpful to many other Town employees, who can track activities according to precinct (e.g. prepare a map showing the distribution of sidewalk betterments by precinct).

3.4 Attribute Data Development Issues

One of the most powerful attribute data sets is the assessor's CAMA data (see Section 3.1). When linked to the parcels, this makes a variety of data available to many users. Another parcel-based data set of high priority is the status of permits. AGI highly recommends the evaluation and implementation of a **permit tracking system**. Permitting is a fundamental activity that is parcel-based and many departments activities are dependent upon knowing permit status of a property. Digitally supported permitting will enhance GIS use and internal data sharing immensely. There are a number of commercial packages, some with built-in GIS integration capabilities. The computer

steering committee and GIS Development Committee should address this requirement as soon as possible and integrate it with the MIS Master Plan and the GIS Implementation Plan.

3.5 Data Base Design & Documentation

It is critical that before GIS implementation is begun, a data base design be developed to ensure that data is stored most efficiently and is captured by contractors or in-house personnel in a manner to facilitate GIS access. The data base design includes data layer specification, which describes:

- What features (points, lines, polygons) should be present in each data set
- Which fields of attribute data should be present in each data set (including specifying the field name)
- What values are allowable in each field of attribute data
- General specification for coordinate system, projection, topological structure

Overall, the data base should be designed with the following factors in mind:

- Providing flexibility so that the database structure and/or coverage specification can be easily altered at a later date, if required.
- Creating an efficient and effective structure that will facilitate the process of performing quality assurance and quality (QA/QC) control on the data.
- Properly structuring the data so that they can be efficiently used for applications within the selected software.

Part of the data base design should include data documentation. Many efforts are underway across the country at both a federal and state level to document data uniformly to facilitate the identification of GIS data. Not only will standard documentation help the Town to track and understand the utility of its data base, but it will help the Town participate in data sharing initiatives with other agencies and individuals.

4. Application Development

Many GIS software packages can be considered tool boxes of GIS capabilities that allow users to tackle a wide array of potential applications. These tools can be programmed to be used by people with little knowledge of the software. In some cases, third party packages (e.g. permit tracking) can be added on top of a GIS software package to add specific functionality and increase usability for a particular application area. In other cases, this enhanced functionality and usability can be programmed by internal GIS staff or can be contracted out for custom programming. The ability to have easy-to-use GIS

tools is critical for allowing the GIS to gain acceptance within Town government and to allow the quick realization of benefits while internal staff climb the GIS learning curve.

In general, the smaller and more focused the task, the easier-to-use an application can be, and the less costly it is to develop. Dedham should have these applications developed soon after digital data becomes available. For rapid deployment of GIS, Dedham can buy third-party applications or use a consultant to develop some or all of the applications. Further application development can be taken on by Dedham staff or purchased after training. Many of the applications to be developed can be identified and prioritized from the needs assessment.

4.1 General-Use Applications

In the initial implementation stages, the following general-use applications have been selected based on a combination of intensity of need, magnitude of payback for using GIS, and relative cost of application development. These are easy-to-use applications designed to initiate users to GIS, as well as to perform a few specific functions. The following list should not be considered an exhaustive list -- many others can also be identified:

- *Flexible hard copy creation.* This would use macros and a menu interface that allows the desktop user to generate standard hard copy products from the GIS data base. An example would be to produce a printout of an Assessor's map or a figure to support a public meeting.

- *Abutter notification.* This would create an abutters list to any property within Dedham at a user-defined distance. An advanced application could actually produce mailing labels and provide the user with greater flexibility in specifying how abutters should be identified (e.g., variable radius or user defined shape).

- *General purpose viewer interface.* This application would be developed on a desktop tool and would allow all Town staff view access to both the graphic and tabular data base. Such an application could be modified and simplified so that the capabilities could be offered to the general public on a "counter top terminal" in an office like the Assessor's or Clerk's. Basic functions would include selective display of layers, zoom and pan capability, and access to a limited set of Assessor's information.

4.2 Departmental Applications

Applications can be developed based on the descriptions given in the needs assessment and the rate at which departments become operational with GIS. Further priority of these should be determined by the steering committee as implementation gets underway. AGI has recommended a sufficient budget for application development for the coming years, but has not specified which applications it will be used for.

5. GIS Training

If Dedham hires a new GIS Manager, he/she should already possess strong software skills in the selected software, as well as other applications, such as Intra/Internet technologies and data base query and development tools. Unlike five years ago, there is an increasing pool of people who have had academic and professional training and experience with GIS tools.

The following will focus on the types of training that should be provided to existing staff who will be accessing the GIS. Depending on the person, and the rate of implementation in Dedham, an individual user may take one, or all of the courses described below.

Desktop GIS Training:
A 1-2 day course that focuses on in-depth use of the selected desktop software. This course describes how to create applications from raw data and more advanced display and analysis options. This training should be obtained by personnel in all departments identified for desktop use.

CAD-base GIS Training:
A 3-5 day course that focuses on the selected CAD-based software. This course would describe the data model and basic use of the software. This course can either be acquired from the vendor or it can be provided by a third party who customizes the training to Dedham's needs. This course should be obtained by the individuals primarily responsible for data maintenance (if any).

6. Operational Implementation

Implementing GIS is more than obtaining data, software, and performing GIS analysis. Other issues must be addressed in the scheduling of implementation and to continue support of the GIS program. This section discusses several issues key to municipal GIS success.

6.1 Departmental Implementation Priorities and Incremental GIS Development

From a financial and management standpoint, GIS are most successful when developed over time. This includes not only data development, but the rate at which equipment and software are purchased to provide departmental access. Providing access must also be supported by training. AGI's recommended priorities for making GIS operational in each department are discussed below.

6.1.1 Initial GIS

As previously discussed, the DPW, the Assessor, and the Conservation Commission have machines powerful enough to sufficiently house GIS. These three departments should have the initial desktop GIS package installed, and have access to the GIS data base when obtained. A high-end GIS, if obtained, should be installed in the DPW, but could potentially be moved to an MIS department (if created).

6.1.2 Future GIS

GIS acquisition will depend in part on the system upgrades installed as a part of the MIS master plan. AGI has developed a prioritization of the departments for acquiring GIS, but this may be changed depending upon system upgrades and other unforeseen circumstances. The remaining departments, aside from the DPW, Assessor, and Conservation, are ranked in order of priority to begin GIS access:

- Planning
- Building/BOH
- Town Administrator/Finance
- Police/Fire
- Parks & Recreation
- School
- Treasurer/Tax Collector

Dedham may ultimately require several copies of a view and query or desktop GIS and one central CAD-based GIS. The full configuration should be pursued over time, and Dedham should only make up-front investments in GIS hardware, software, and training for the few departments that will be prepared to use the software in the near term. In general, the price of GIS equipment and software is decreasing over time while the power of these systems is increasing. Thus, it is in the Town's interest to purchase only the equipment that is immediately needed. Next year's machine will be more powerful and less costly.

6.2 Use of Consultants

Expectations are very high in the early phases of GIS implementation. Municipalities can spend years studying GIS and then further years fighting for funding and waiting for the hardware, software, and data to be delivered. In general, there is a long list of promises that have been made and great pent-up demand for GIS products and applications. In some cases these expectations go unmet as newly appointed or hired GIS staff struggle to learn the software and the data.

Use of GIS consultants, particularly early in the GIS implementation, can be an effective way of meeting some of this demand and helping new staff learn operational GIS skills. A consultant's mastery of the software can lead to very time efficient execution of early projects. Building a successful track record and being able to meet the expectations of the Town are critical elements of a successful GIS implementation.

AGI recommends that Dedham fund GIS Implementation Support consulting services for up to three years. The consultant would be available to address the following types of tasks:

- Coordination with Town GIS staff and contractors that are delivering software, equipment and/or data to the Town.

- Initial system installation and deployment.
- GIS staff training and assistance in early system management tasks.
- Initial application development and system customization (see Section 4).
- Ability to provide efficient support and problem solving for ad hoc projects and to build rapid prototypes to test new application ideas.
- Assistance in methodological development of data maintenance policies and procedures.

6.3 Ongoing System Maintenance

Once a GIS is implemented and becomes an operational unit within the Town, there are certain ongoing expenses that should be planned for and budgeted. The following synopsizes some of these expenses.

6.3.1 Software Maintenance

Most GIS software packages have a software maintenance contract option. In general, it is advisable to enter into one of these contracts. These contracts typically entitle the licensee to technical support, software upgrades, and admission to national user

conferences. Annual maintenance for typical desktop and CAD-based products ranges form $400 - $700.

6.3.2 Technology Refreshment

GIS is a high end computer application. As such, it benefits from the most modern technology. Computer technology, especially desktop systems, have a very rapid rate of advancement. One year of time often represents a generational change in computer capabilities. Overall the trend is that more power costs less money over time. Given this, periodic re-investments in computers should be budgeted. Having more powerful equipment means that basic GIS functions will be completed quicker thereby saving staff time.

Dedham may want to consider planning for the replacement of the most used GIS equipment approximately every two years. The old equipment need not be discarded; rather it can matriculate to other personnel who have less of a need for state-of-the-art performance. While the specifics of how technology refreshment will take place may be difficult to determine at present, the purchase of GIS equipment cannot be considered a one-time buy. Over time, re-investments will prove both cost effective and advantageous (i.e., save staff time, provide new capabilities, and improve performance).

6.3.3 Supplies

An operational GIS will require a certain volume of GIS-specific supplies. The most important of these supplies are paper, mylar, and ink cartridges for the plotter. In addition, items such as floppy disks and computer tapes are important to facilitate data transfer and backup. This should be figured as part of an operational expenditure for GIS maintenance.

7. GIS Implementation Budget & Timeline

This study discusses the full range of GIS implementation options for Dedham. The actual implementation will depend largely on the funds that are made available. GIS implementation budget figures are presented in the spreadsheets included in Tables 2-3.

Table 2 presents a comprehensive listing of all of the items discussed in this implementation plan. This spreadsheet presents item-by-item costs.

Table 3 summarizes budget requirements for a three year period, based on full implementation with a new flyover. These estimates are based on the mid - to high range estimates from Table 2, and include deed and parcel research.

Dedham has many options for GIS implementation. The tables presented herein represent reasonable estimates based on current information. As funding levels become more clear, this plan can be adapted for Dedham's internal priorities and to fit an available budget. This document is designed to be flexible and to allow Dedham to change priorities over time, while still having a basic guide for implementation.

Table 2 : Town of Dedham GIS Implementation Line Item Budget Estimates

Prepared by: Applied Geographics, Inc.

E Q U I P M E N T	**Low Estimate**
Desktop GIS (per seat)	$500
CAD-based GIS (per seat)	$2,500
WindowsNT or UNIX-based GIS	
Small format color PostScript printer	$2,000
Large format color Inkjet Plotter	$8,000
Large format scanner	$10,000
Equipment Sub-total	**$23,000**

D A T A	
1" = 40' (300' flight scale) Photogrammetric Base Mapping*	
Fly-over	$15,000
Ground control/FAAT	$30,000
Planimetric mapping	$90,000
1 ft. contours (optional)	$75,000
Digital orthophotos (optional)	$50,000
1" = 40' scale Photogrammetry Sub-total*	**$260,000**
Parcel Mapping (10,000 parcels) (range represents digitization vs. research)	$50,000
Sewer/Drain System Mapping (w/o additional field work)	$35,000
Additional Field Work/Attribute collection	$19,200
Zoning layer registered to new base map	$8,000
Wetlands (State data)	$200
FEMA floodplains	$600
Precinct layer registered to new base map	$600
DPW route maps	$600
Non-flyover Data Sub-TOTAL***	**$114,200**
S T A F F, C O N S U L T I N G, M A I N T E N A N C E	
GIS System Manager staff position (per year)	$45,000
Staff training	$7,000
Implementation consulting (per year for 3 years)	$12,000
Application development (per year for 3 years)	$10,000
Software maintenance (per year)	$1,800
Supplies (plotter, etc.)	$3,000
Staff, consulting, maintenance Sub-Total (1 year)	**$78,800**

*Totals for 1" = 100' base mapping would be around 1/2 of these costs.

**It is not uncommon for bids for flyover projects to range dramatically.

***A flyover and BECo update would range from $70,000 - $100,000.

Table 3

Dedham GIS Implementation: Recommended 3 - Year Budget/Options

***Does not include salaries (except GIS Manager) or hardware costs**

It should be noted that these prices represent budget estimates. Actual prices may be a function of vendor responses to competitive solicitations.

Cost Estimates based on middle - to - high estimates for line items from Table 2.

Item	FY99 Number	FY99 Units	FY99 Cost	FY99 Total	FY2000 Number	FY2000 Units	FY2000 Cost	FY2000 Total	FY2001 Number	FY2001 Units	FY2001 Cost	FY2001 Total	3 Year TOTAL
Photogrammetric Base map													
Fly-over & planimetric mapping (300' flyover)				$175,000.00				$150,000.00					
1 ft. topography												$100,000.00	
Scanned registered aerials								$20,000.00					
TOTAL photogrammetric				**$175,000.00**				**$170,000.00**				**$100,000.00**	**$445,000.00**
BECo Base Map													
Integrate BECo data				$760.00									
Update BECo w/ 100-scale flyover				$25,000.00				$50,000.00					
(does not include topography)													
TOTAL BECo				**$25,760.00**				**$50,000.00**					**$75,760.00**
Thematic Data													
Parcels	5000	parcels	$15.00	$75,000.00	5000	parcels	$15.00	$75,000.00					
Sewer/drain system				$50,000.00				$50,000.00					
Zoning								$9,000.00					
Floodplains (FEMA)								$800.00					
Precincts								$900.00					
DPW Route Maps								$800.00					
Wetlands								$200.00					
TOTAL Thematic Data				**$125,000.00**				**$136,700.00**				**$0.00**	**$261,700.00**
Equipment													
GIS-Desktop	2		$1,000.00	$2,000.00	3		$1,000.00	$3,000.00	3		$1,000.00	$3,000.00	
GIS-CAD	1		$2,500.00	$2,500.00									
New large format plotter	1		$8,000.00	$8,000.00	1		$8,000.00	$8,000.00					
New color PostScript printer					1		$2,000.00	$2,000.00	1		$2,000.00	$2,000.00	
Large Format Scanner									1		#########	$10,000.00	
TOTAL Equipment				**$12,500.00**				**$13,000.00**				**$15,000.00**	**$40,500.00**
New Staff													
GIS Manager				$0.00				$50,000.00				$50,000.00	
TOTAL New Staff				**$0.00**				**$50,000.00**				**$50,000.00**	**$100,000.00**
Consulting													
Implementation assistance/system management				$15,000.00				$25,000.00				$15,000.00	
Training				$4,000.00				$7,000.00				$4,000.00	
Application development				$10,000.00				$10,000.00				$10,000.00	
TOTAL Consulting				**$29,000.00**				**$42,000.00**				**$29,000.00**	**$100,000.00**
GRAND TOTAL w/40-scale mapping*				**$316,500.00**				**$411,700.00**				**$194,000.00**	**$922,200.00**
GRAND TOTAL w/ BECo				**$167,260.00**				**$241,700.00**				**$94,000.00**	**$502,960.00**
GRAND TOTAL w/BECo & Update				**$192,260.00**				**$291,700.00**				**$94,000.00**	**$577,960.00**

*Includes $25,000 reduction on water/sewer due to aerial capture of manholes.