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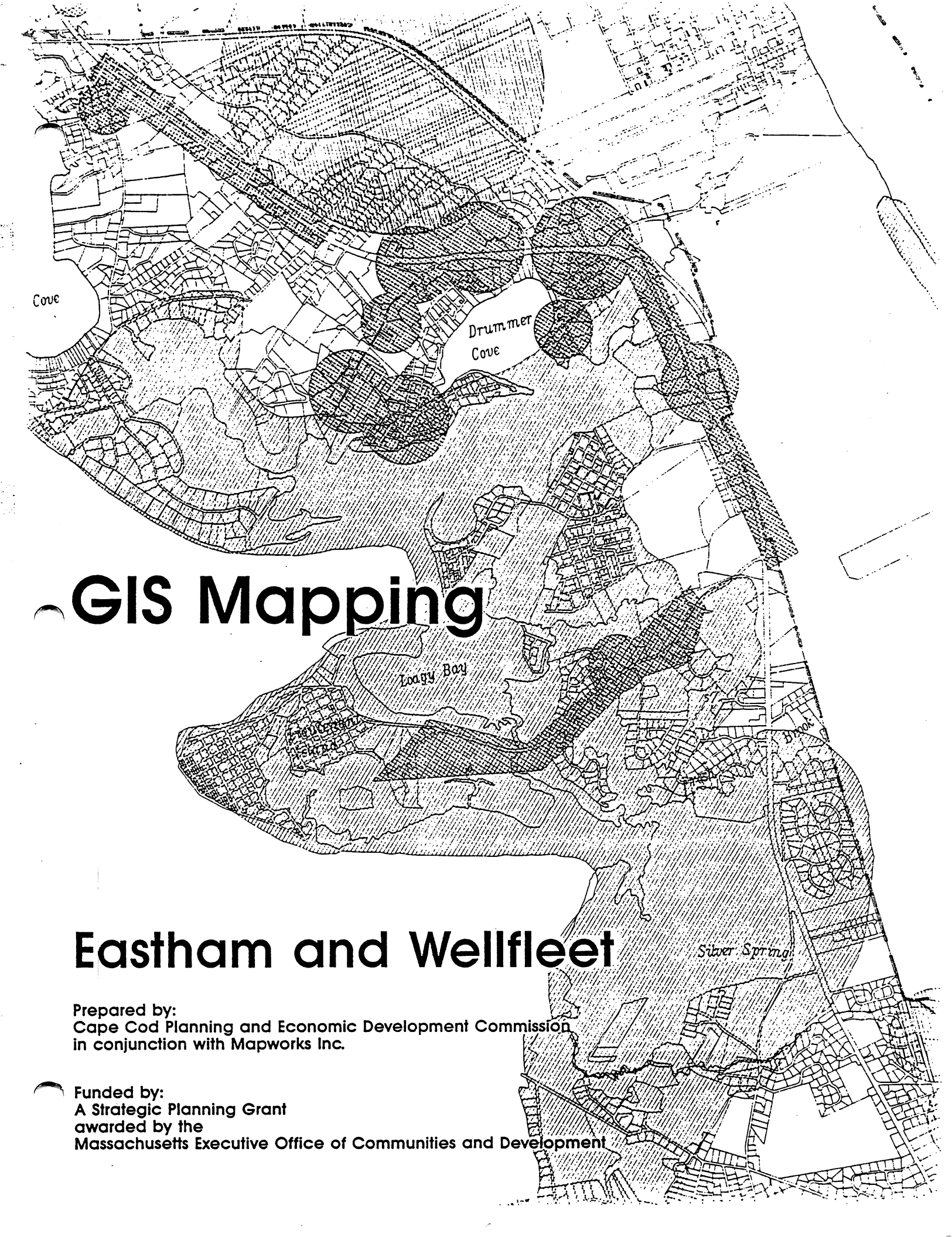
CCPEDC
IS NOW
THE CAPE COD COMMISSION

Thank you for your recent request for a copy of the Cape Cod Planning and Economic Development Commission/Executive Office of Communities and Development report of 1989 entitled "GIS Mapping". The enclosed report contains information about how the EOCD project was set up, the types of equipment and training that was aobtained for CCPEDC's GIS, and problems encountered. The warnings and solutions could be helpful to others starting an ARC/INFO GIS.

We hope that you find this information useful.



GIS Mapping

Eastham and Wellfleet

Prepared by:
Cape Cod Planning and Economic Development Commission
in conjunction with Mapworks Inc.

Funded by:
A Strategic Planning Grant
awarded by the
Massachusetts Executive Office of Communities and Development

With this pilot mapping project in the towns of Eastham and Wellfleet, the Cape Cod Planning and Economic Development Commission, funded through a Strategic Planning Grant awarded by the Massachusetts Executive Office of Communities and Development, set up and demonstrated an in-house Geographic Information System (GIS).

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The State of Mapping on Cape Cod

The Cape Cod Planning and Economic Development Commission (CCPEDC) applied to the Executive Office of Communities and Development's (EOCD) Strategic Planning Program (SPP) for a grant to support the process of developing a Geographic Information System (GIS) to do regional mapping for the Commission. The regional mapping system is expected to facilitate CCPEDC in carrying out its land use management and housing planning responsibilities and goals. CCPEDC had been pursuing the development of GIS capabilities with technical assistance from the U.S. Environmental Protection Agency, U.S. Geological Survey, CCPEDC Mapping Committee, and local officials. Goals have centered on addressing both local and regional mapping needs.

At the present time, mapping quality and scale vary widely both among Cape Cod towns and within the mapping resources of each town. Establishing consistency on the local level would greatly encourage regional communication on important land use and growth issues. It would also allow for the building of a consistent regional geographic data base that could serve the county as well as the towns.

The GIS Pilot Project was formulated in part based on the existence of maps recently produced without the assistance of a computer. These pin registered base maps and overlays form a 'Mechanical GIS'. The products consist of a composite assessors parcel map as the base for various environmental and land use overlays at 1": 600' scale format. They have been produced for at least seven of the fifteen Cape towns. These products were produced over the past two and a half years, and most were funded through EOCD Strategic Planning Grants. Funded projects included the Four Towns Strategic Planning Program for Affordable Housing in Barnstable, Brewster, Eastham and Harwich. There was also a grant to design a Land Use Data Inventory and mapping system for managing Chatham's housing and growth needs.

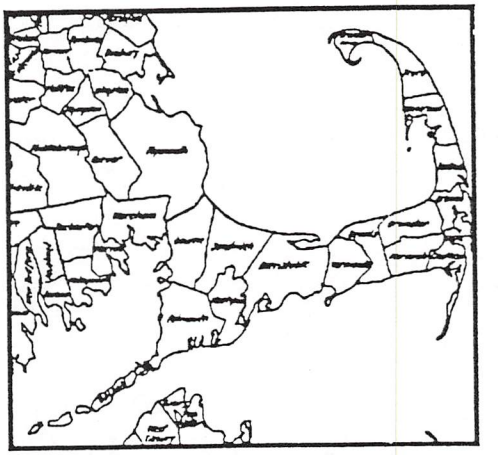
The use of this EOCD resource for the GIS Pilot Project demonstrates the utility and continuity of the Strategic Planning Program on Cape Cod. As further evidence of the regional cooperation that the Strategic Planning Program has fostered, the members of the Cape Cod Mapping Committee

(initially formed by the Association for the Preservation of Cape Cod (APCC) and now under CCPEDC) encouraged the use of the 1":600' scale format for further 'Mechanical GIS' mapping projects. This was partly as a result of the Four-Towns Project. When the Truro Conservation Commission needed a composite assessors parcel map with overlays for their open space plan, they decided to request the 1":600' scale format in order to have their maps compatible with adjoining towns. Regional cooperation is also evident by a study underway by The Friends of Pleasant Bay, a private non-profit group. Their study of town to town zoning inconsistencies, is taking advantage of the EOCD Project maps. They are funding a project in Orleans that when added to the Four Towns information for Brewster, and Harwich and the EOCD Chatham study, will provide full coverage of the Pleasant Bay Study Area that falls in those four towns. The end product will be a composite assessors parcel base for the Pleasant Bay area with zoning, land use and other overlays.

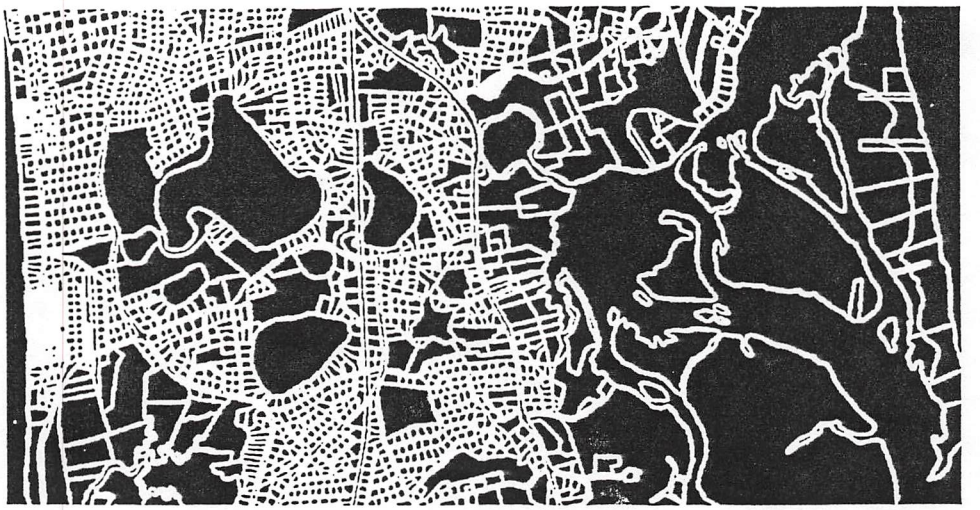
The Commission

The GIS maps generated through this project are the first of their kind for Barnstable County. The Cape Cod Planning and Economic Development Commission hopes to produce maps similar to those produced for Eastham and Wellfleet for the remaining thirteen Cape towns in the future. The lessons that are learned through this project will be indispensible to these mapping efforts.

The Commission has been engaged for the past year in drafting and refining a new piece of legislation which proposes to form a regional regulatory authority called the Cape Cod Commission. When ultimately voted into law by the State legislature, the Act will give broad regional planning and regulatory powers to the newly formed Commission. The Commission will be required to develop a Regional Policy Plan for Cape Cod in its first year with assistance from local planning committees. Regional mapping will be an essential component of the Commission's planning effort. The Commission will have the power to designate Districts of Critical Planning Concern to conserve natural, historical and cultural areas and to protect water quality. It will also address the provision of adequate capital facilities, including transportation and waste disposal. Further, the Commission will review Developments of Regional Impact, which because of their nature and size, have greater-that-local impact. The Commission would also assist local communities in preparing Local Comprehensive Plans if they choose to do so.



The Project in Summary



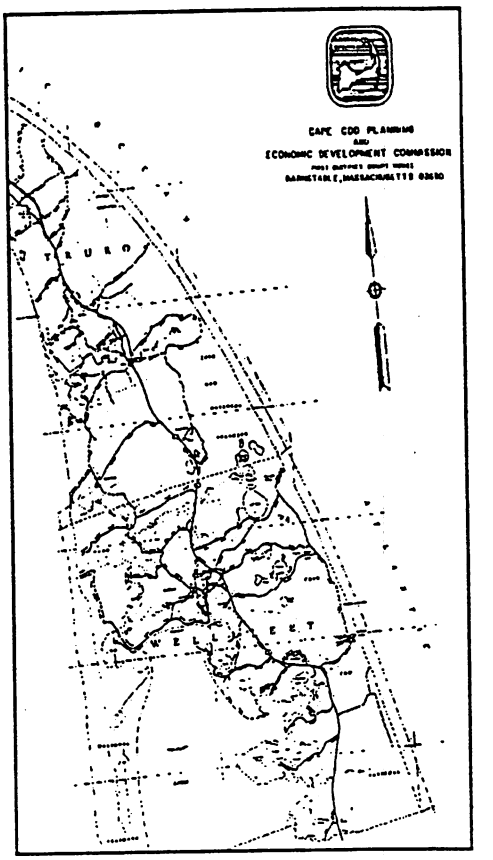
This project was funded through a Strategic Planning Grant awarded by the Massachusetts Executive Office of Communities and Development. CCPEDC was awarded a grant by EOCD for $45,000 to carry out a pilot GIS project with a cash match of up to $49,600 for the purchase of equipment and software. The first component of the project, as proposed in the grant application, was to test the relative costs and advantages of digitizing from different source data to create computer base maps. This was to be done by digitizing the base and overlay maps of a 'mechanical GIS' for one town and comparing that experience, together with the effort to produce the 'mechanical GIS', to the effort of compiling a digital geographic data base directly from various source maps for another town. The most expedient and cost effective method of digitizing base data can then be applied to the other Cape Cod communities in the future.

The main difference in these two approaches is that in one case, the 'mechanical GIS' provides a set of pin registered bases and overlay maps all at the same scale with at least one common coordinate system. This allows for the digitizing of the whole town as one piece (or several, depending on the scale of the base map and overlays and the size of the town and digitizing table). The person doing the digitizing can work through the maps without having to be concerned with multiple sheets, scales, and edge matching (a particular problem in the case of the assessors parcels maps). In the other approach, the source maps are digitized, sheet by sheet for all sheets, at their various existing scales. Edge matching in this case must be done at the digitizer or interactively at the computer after the completion of digitizing. All sheets have to be spliced together,with the computer software, to make a town composite after digitizing is complete.

The second component of the project involved the development of a series of GIS map products. These were produced once the base information had been input into the system. The base information consisted of the digitized base maps and a series of source data maps. The third component consists of producing a series of derived analytical maps. These include environmental sensitivity, cultural/historical sensitivity and housing opportunity maps. Such maps will assist the towns in determining the specific locations of these resources. This component will support the District of Critical Planning Concern element of the proposed Cape Cod Commission Act.

In order to fulfill the requirements of the first component of the grant application, the comparison of digitizing from the existing 'Mechanical GIS' to digitizing directly from the source maps; two towns had to be selected. The towns of Eastham and Wellfleet were chosen for several reasons. Eastham had an existing 'Mechanical GIS' from the Four-Towns Project. (at a scale of 1":600') and thus fit that requirement. In addition, some GIS work had been done for Eastham under the Cape Cod Aquifer Management Project (CCAMP). This was a demonstration of GIS for Groundwater protection in Eastham and Barnstable. CCAMP was undertaken by the U.S. Environmental Protection Agency, Region I; U.S. Geological Survey, Massachusetts District Office; Massachusetts Dept. of Environmental Quality Engineering and CCPEDC.

Wellfleet, comparable in size and make up to Eastham, had little in the way of any major mapping effort. The two towns are also adjacent, facilitating logistics and giving an added bonus of doing some border area studies of zoning inconsistencies, at a later date. In addition, the two towns recently hired Walter Stratton as a joint planner, through an EOCD Incentive Aid Grant. This demonstrated an existing cooperative effort between the towns which would enable them, through Mr. Stratton, to express many of their common concerns and needs. It was felt that this arrangement would make him invaluable in providing the Consultant and CCPEDC staff access to necessary base information and resource data for both towns. Both towns have also demonstrated a strong interest in affordable housing initiatives and would be able to apply the GIS tool in pursuing environmentally acceptable projects. For Eastham, this is the next logical step in continuing and expanding on its Four-Towns Project experience.



Procedures

An important goal of the Cape Cod Pilot GIS Project was to build a system that will ultimately be able to serve three different levels of government. That is, it will serve the towns at the first level and the CCPEDC region (Barnstable County) on the second level. Lastly the State GIS program would benefit greatly from the use of project data.

This is a bottom up approach and rests on the philosophy that it is preferable to aggregate data from finer detail to coarser detail than it is to disaggregate data to finer detail. Aggregation is a generalization process to remove some of the detail and give a more understandable picture of a larger area That is, if one starts with parcel (lot) based data, it is easier and more accurate to aggregate that to larger area units than to try to disaggregate down to the parcel level. In fact, it would be almost impossible, or at least prohibitive in terms of effort to attempt the latter. By way of example, starting with parcel-based data, it is relatively easy to aggregate that to the block or census tract level. However, without the parcel bounds, disaggregating block or census tract information to the parcel level would be an approximation at best, based on average parcel size and number of parcels, for example. Keep in mind that the parcel detail once captured remains available, whereas disaggregating to a level of more detail when those details have not already been captured results in an approximation.

Data Acquisition

An important first step in such a project is obtaining the various map source information for the towns. The following source maps were used for this project:

SOURCE MAPS USED IN GIS PROJECT

MAP	SOURCE	DATE	SCALE	BASE	MEDIA
EASTHAM:					
Assessor	Mapworks	1988	1:7200	Parcel	mylar
Zoning	Mapworks	1988	1:7200	Assessors	mylar
Wetlands	Mapworks	1988	1:7200	Orthophoto	mylar
Species habitat	Mapworks	1988	1:7200	USGS	mylar
ACEC	MCZM	1987	1:25000	USGS	paper
WELLFLEET:					
Assessor	Town	1989	1:2400	Orthophoto	mylar
Zoning	Town	1987	1:2400	Orthophoto	paper
Wetlands	DEM	1982	1:5000	Orthophoto	vellum/paper
Species habitat	MHC	1989	1:25000	USGS	paper
BOTH TOWNS:					
Historic districts	MHC	1989	1:25000	USGS	paper
Archaeology	MHC	1989	1:25000	USGS	paper
Scenic landscape	DEM	1982	1:25000	USGS	paper

MCZM-Massachusetts Coastal Zone Management
DEM-Department of Environmental Management
MHC-Massachusetts Historical Commission

Map Accuracy

Historically, map sources such as those listed above have been accepted as reasonably accurate and users have been fairly satisfied and accepting of , if not happy with, them on their own. The process of overlaying maps from sources of different scales and on different base maps, while extremely useful, brings to one's attention any discrepancies and differences in the source maps. The accuracy of the source maps is an important area to be considered in the process of constructing a GIS. There are at least 5 kinds of accuracy to be considered when creating a GIS. These are degrees of accuracy found in the Attribute Data Base or in the Geographic Data Base. Attribute Data refers to that information which is collected or generated and stored in a data base for each parcel or other geographic unit that exists in the Geographic Data Base. Examples of parcel attribute data would be the information that town assessors collect for each parcel of land. This would include such things as map and parcel numbers, acreage, assessed value, owner's name or the 3 digit State Land Use Codes. Examples of geographic unit attribute data would be the information for each soil unit on a soils map. This includes soil type, slope, and depth to groundwater.

ACCURACY CONSIDERATIONS

1. **Attribute Data Base - Content.**
   Missing or wrong information if nominal or ordinal data.
   Inaccurate to some degree or wrong if beyond established thresholds if interval/ratio data.
2. **Attribute Data Base - Topological Accuracy (integrity).**
   The linkage or one to one correspondence between each item in the attribute data base and each item in the geographic data base (point, line or area/polygon) must be developed and maintained.
3. **Geographic Data Base. - Presence or Absence.**
   Presence - wrong item present in the geographic data base that should not be there.
   Absence - Missing item absent from geographic data base that should be there.
4. **Geographic Data Base - Positional Accuracy.**
   Precise geographic location of points and lines
   Inaccurate to some degree or wrong if beyond established thresholds.
5. **Geographic Data Base - Topological Accuracy.**
   Polygon closure is critical to the GIS geographic data structure.
   (this is important, but is not a critical issue for Mechanical GIS systems)

Due to budget constraints, staffing and the nature of the the project, this study was able to deal with only the most essential accuracy problems. The five accuracy types listed in the accompanying table were dealt with as follows:

ATTRIBUTES DATA BASE:

● **Data:**

Missing or wrong information was corrected where possible.

Issues of interval(ratio) accuracy were not addressed.

For example, an effort was made to insure correct categories of land use (nominal data), but time was not taken to rectify parcel acreages (interval data).

● **Topology:**

The linkage between the geographic and attribute data bases was carefully maintained since it is critical to the functioning of the GIS.

GEOGRAPHIC DATA BASE:

● **Presence & Absence:**

Care was taken to ensure accuracy by adding in any missing features and removing any extraneous features.

● **Topology:**

Polygon closure was carefully maintained in order to ensure proper function of the GIS.

● **Positional Accuracy:** While the budget and staffing constraints of this project required that the available resource maps be accepted as accurate, two main types of positional rectification were carried out. One was positional accuracy within a source map and one was positional accuracy between source maps when the same data layer appeared on more than one source, such as ponds and lakes.

● **Positional Accuracy Within A Source Map.**

This was most critical on the assessors parcel map when sheets had to be edge matched. This was a project issue only for Wellfleet since it had already been dealt with, to the extent possible, when Eastham's 'Mechanical GIS' had been developed for the Four-Towns Project. When edge matching the Wellfleet assessors maps during the digitizing process, roads and parcel boundaries were adjusted by using 'cartographic licence' ("best line based on all information available"). This most often involved correcting for topological inaccuracies to maintain line network integrity (connectivity) and to assure polygon closure on the parcels.

● **Positional Accuracy Between Data Layers:**

This issue was easier to deal with and only occurred in certain cases such as ponds. As is generally the case, a data layer is only digitized once. The decision therefore became which source map should be used for a particular data layer. The decision process is fairly straight forward; selecting what is deemed the most accurate source from which to digitize. The decision is based on considerations such as the following criteria:

- Age and condition of the map
- Presence of geographical reference (coordinate system such as State Plane, Latitude & Longitude or U.T.M.).
- Presence of a scale.
- Overall level of detail.
- Completeness of the subject matter of interest.
- Accuracy, by measurement, comparison or summation.

● **Topological Accuracy Between Data Layers:**

This can be more important than positional accuracy. For example, when a zoning boundary cuts through a parcel, its relationship to the parcel can be more critical than its own position.

Cosmetic adjustments (aesthetic accuracy) to the 'Mechanical GIS' becomes Topological (integrity) accuracy to the GIS. These adjustments may be critical, particularly to the GIS topological data structure. It should be noted however, that they can be positionally less accurate. This situation can arise when edge matching polygons on two contiguous assessors parcel maps. The GIS topological data structure demands that all polygons be closed on themselves, just as in the closing of a surveyor's meets and bounds. The surveyor, however has an established degree of tolerance established for a particular survey, while the GIS requires that there must be

absolute closure. This required closure has the potential of introducing greater positional inaccuracy than previously existed. The 'Mechanical GIS' sneaks around this problem because closure is not critical to it and while what can be considered an aesthetic accuracy problem for it (true positional accuracy not withstanding)becomes a problem of basic accuracy to the GIS. With the 'Mechanical GIS' there is no digital topological structure that must have its integrity maintained.

In summary, the critical accuracies for a GIS for most town and regional planning purposes are:
- Attribute Data Base Content
- Attribute Data Base Topology
- Geographic Data Base Topology

These are the accuracies that are most important to maintain. Fortunately they are frequently the easiest to correct. A good source of additional comments on accuracy in a GIS context for mapping on Cape Cod is the CCAMP Report of September 1988 (EPA 901/3-88005).

Accuracy vs. Cost

While it goes without saying, the goal is always to have the most accurate data possible and to be continually increasing the accuracy of what is available. The level of required accuracy depends mainly on the particular use of a set of data. Unfortunately there is seldom the luxury of having perfect data. Time constraints, money and staff are all items that put limits on our efforts of gathering that perfect data or even significantly increasing the accuracy of a set of available data. The prudent approach is to do the best with what is available, rather than abandoning all effort.

For many town and regional planning needs, highly accurate data as would be desired for a project such as the CCAMP Aquifer Management Project, is not necessary. A Study of that nature, which monitors the movements of groundwater from potential pollutant sites toward well sites, requires highly accurate point data. However, many parcel based planning studies do not require such highly accurate positional data, and can be carried out reasonably well by digitizing existing assessors parcel maps. Build-out Studies and many zoning studies and land use studies are examples. The crucial thing is to have as accurate as possible attribute (tabular) data which is key to these kinds of studies, and live with any positional inaccuracies of the geographic data base (updating or replacing these with more accurate data when time and effort allow). Any effort available for checking, proofing and updating the data should go into the attribute data first.

Accuracy was an issue as a function of the scale at which the maps were digitized. As a rule of thumb, more accurate digitizing can and will be done from a larger scale map than a smaller scale map. One obvious underlying assumption is that the larger scale map is more accurate than the smaller (this isn't necessarily always the case). While it was faster and easier to digitize the parcel base and overlays for Eastham at 1":600', the quality of the end product doesn't necessarily warrant this approach for the parcel base map. The main advantage was the relative ease by which the composite parcel base could be digitized. The whole town of Eastham could be put up on the digitizer at once, avoiding the edge matching of individual parcel maps on the computer . This greatly facilitated digitizing and the continuity of the work process.

However, the quality of the line work on the parcel maps suffered when digitized at 1":600' for Eastham as opposed to the 1":200' of most of the assessors source maps for Wellfleet. This is particularly evident when a larger scale map (such as 1":200') is plotted from the 1":600' digitizing. What happens is that curved lines are approximated by straight line segments. The tendency is for the digitizing operator to use a minimum segment length somewhat regardless of the scale

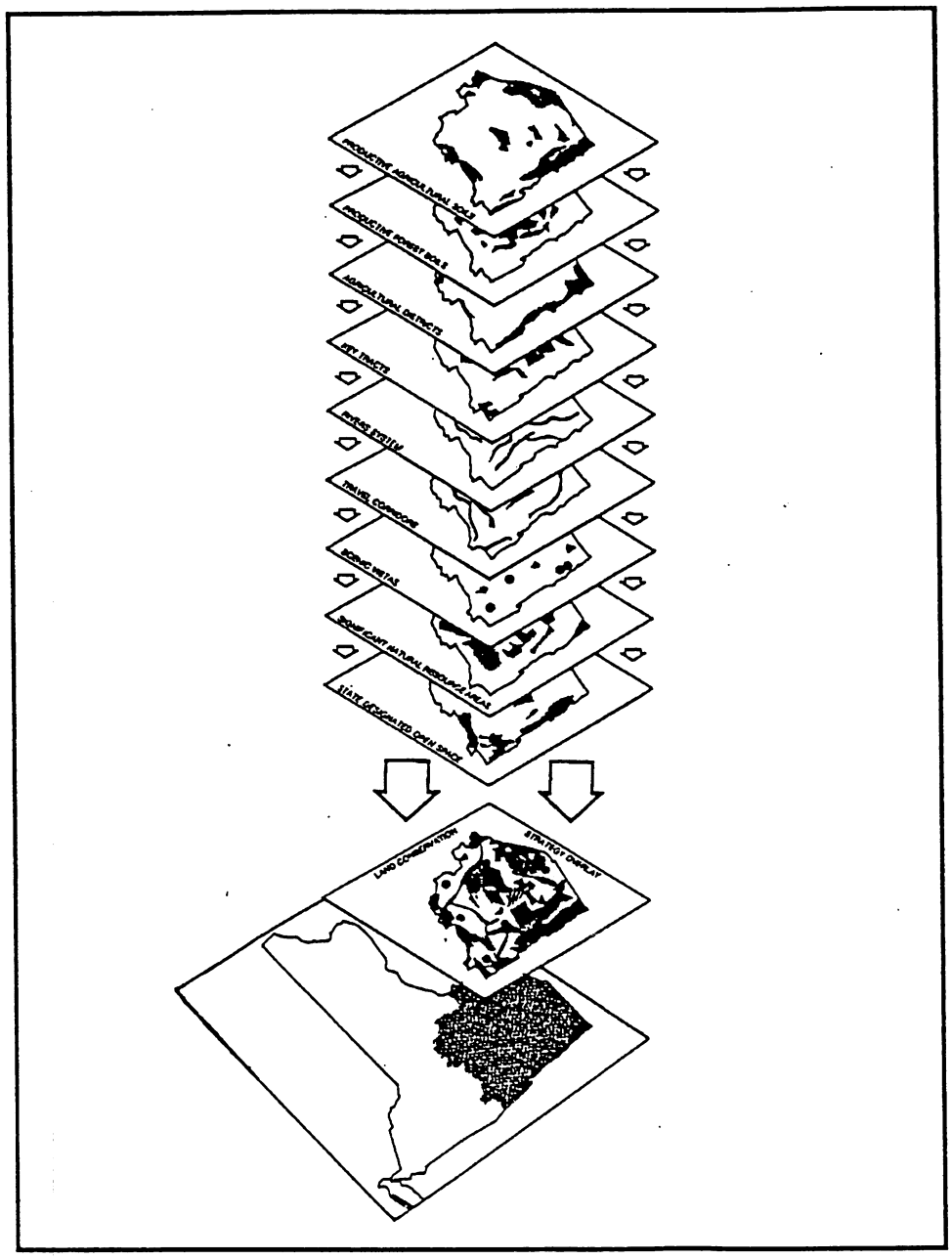
somewhat regardless of the scale of the source map being digitized. This produces a better approximation of curved lines when they are digitized at a larger scale. The problem becomes evident when the maps are enlarged photographically or plotted at a scale larger than that at which they were digitized. For example, plotting the Eastham parcels at the scale of the Town's assessors maps, 1": 200', the quality difference in the line work will be evident by overlaying the 1" to 200' plot with the original. One place the difference can be detected is where slightly curved lines on the 1":200' original will be digitized as straight lines from the 1":600' composite. This will give a quality difference both in accuracy and aesthetics. The accuracy differences should be relatively minor but none the less there. The aesthetic differences will be hard to detect except where the map is plotted back at the assessors scale or something approaching that.

The accuracy difference is not significant enough to affect the function of the GIS. The decision as to which scale to digitize at will need to be based on aesthetic considerations, use that the maps will be put to and the level of accuracy desired. The latter will translate into ease and speed of digitizing effort which translates into cost. If a composite parcel map is available, it can be used if the quality is acceptable. On the other hand, if a composite is not available, or if it is very out of date, the the assessors maps should be used rather than first producing a mechanical assessors composite for digitizing.

There is little quality difference that can be discerned on the thematic overlays between digitizing from 1":600' composite or from the source maps. In many cases the thematic sources maps are at a smaller scale and have been enlarged to the 1":600' size. Thus there is little if anything to gain by digitizing at the source scale. Conversely there is little or anything to lose by digitizing at the 1":600' composite scale. For most of the thematic overlays, if they exist as composites for the whole town, it is probably fine to use them as there will be little loss of quality.

It took approximately twenty percent more effort to produce the Wellfleet geographical data base from the source maps over producing the Eastham data base from the 1":600' 'mechanical GIS.'

Map Products



A variety of maps have been prepared during the project for the towns of Eastham and Wellfleet. In summary, they are the following:

- **Base Maps:**

Composite Assessors Parcel Map

- **Thematic Map Overlays (digitized):**

1. Zoning
2. Prime Agricultural Soils and Existing Farm Land (digitized only)
3. Wetlands (including restricted) and Open Water
5. Historic Districts and Generalized Archaeological Sites
6. Designated Scenic Landscapes (1981 DEM Inventory)
7. Protected Open Space
8. Areas of Critical Environmental Concern

- **Analytical Maps (derived):**

1. Land Use
2. Environmental Sensitivity (no build or restriction zones).
3. Cultural/Historic Sensitivity
4. Housing Opportunities (optimal locations for higher density housing)
5. Screening for.Potential 'Districts of Critical Planning Concern'
6. Build-Out Analysis According to Zoning
7. Potential Public Water Supply Sites

These maps will be in two forms:

- **Digital** - residing in the two computer data bases.

1. Geographic Data Base: Contains the digitized coordinates for points and lines along with the identifiers for points, lines and areas.
2. Attributes Data Base: Contains the corresponding indentifiers for points, lines and areas and all of the information associated with each of these.

- **Paper** - These are the plotted/printed versions of the maps stored in the GIS data bases.

The Base Maps

The Base Map for each town is a composite (mosaic) of the entire town. It is produced from the splicing together of the individual Town Assessors Parcel Maps for both Eastham and Wellfleet.

Eastham was digitized from a 1":600' composite assessors map from the Four Towns Project. It consisted of a 42"x60" sheet size. The original Assessors maps had no geographic reference system in the form of a coordinate system or graticule. Geographic reference was picked up by an overlay with a composite USGS Topographic map of Eastham at the same scale of 1":600'. The USGS composite, another product of the Four Towns Project, had been produced by splicing enlarged mylar photographic copies of the USGS 1:25,000 Topographic Quadrangle maps of Orleans and Wellfleet (the two quads covering Eastham) together. Blackline mylar contact photographic copies of the USGS's original negatives (for producing the quads) were photographed to obtain negatives to enlarge to the 1":600' scale. The USGS quad composite for Eastham was then punched for pin registration. The Assessors maps had been photographically reduced to 1":600' from the original mylars at 1":200'. The mylar reductions were mosaicked, edge matched and spliced together. A contact printed mylar was made of the composite. This was then registered with the U.S.G.S composite and punched for pin registration. Once this was accomplished, the geographic references on the USGS quads could be transferred to the Assessors base map. These references are the State Plane Coordinate System, Latitude & Longitude and UTM systems.

Wellfleet was digitized from the original mylar assessors maps. These consist of parcel boundaries drafted on to an orthophoto base. These maps are at scales of 1":100' and 1":50'. Each map was individually digitized and edge matched to its neighbors. This was done at the digitizer as part of the initial digitizing, rather than interactively at the computer later. This had the advantage of increasing accuracy and eased decision making. Fortunately, the maps had overlap so that the orthophoto base could be used as a guide to edge matching the line work. Whether the edge matching is performed at the digitizer, as for Wellfleet, or interactively at the computer after digitizing all of the sheets, both approaches require that the individual sheets be 'stitched' on the computer to make a composite map of the town. This process of splicing the sources maps with the computer software is very similar to the photo-mechanical process used for Eastham. In that case, the photo reduction process reduces any 'errors' just before the physical splicing process. With Wellfleet, the maps are digitized at full scale but then digitally reduced by the computer.

The Thematic Map Overlays

The previously listed source maps for each town were digitized to create thematic map overlays. These were used in the following combinations to produce the derived analytical maps.

1. **Environmental Sensitivity**
   Overlays:
   - Wetlands
   - ACEC (Eastham only)
   - Zones of contribution to wells
   - Rare and endangered species habitat
   - Cape Cod National Seashore

2. **Cultural Sensitivity**
   Overlays:
   - High and moderate archaeological sensitivity
   - Potential and designated historic districts

3. **Potential Districts of Critical Planning Concern (DCPC)**
   Overlays:
   - Rare and endangered species habitat
   - Zones of contribution to wells
   - Potential historic districts

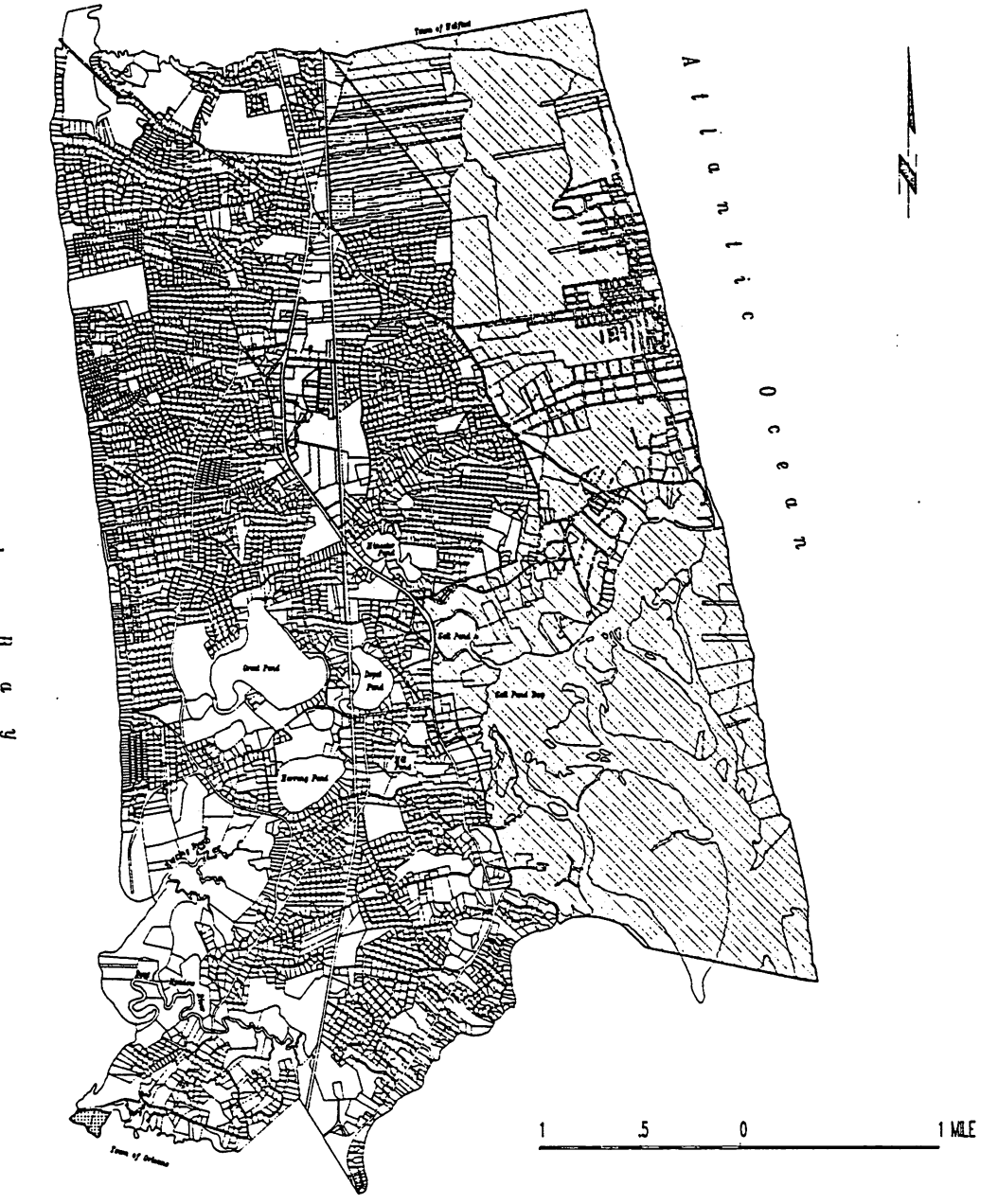
4. **Screening for Potential Public Water Supply Sites**
   Overlays:
   - Land use
   - Wetlands

5. **Land Use**

6. **Build-out Analysis According to Zoning**
   Overlays:
   - Land use
   - Zoning

7. **Housing Opportunities**
   Overlays:
   - Wetlands buffered 100 feet
   - Zones of contribution to wells
   - Cape Cod National Seashore boundary
   - Existing commercial parcels buffered 1500 feet
   - Vacant developable residential parcels > 2 acres, in & out of buffer

The five maps on the following pages are examples of the thematic maps generated by the project.



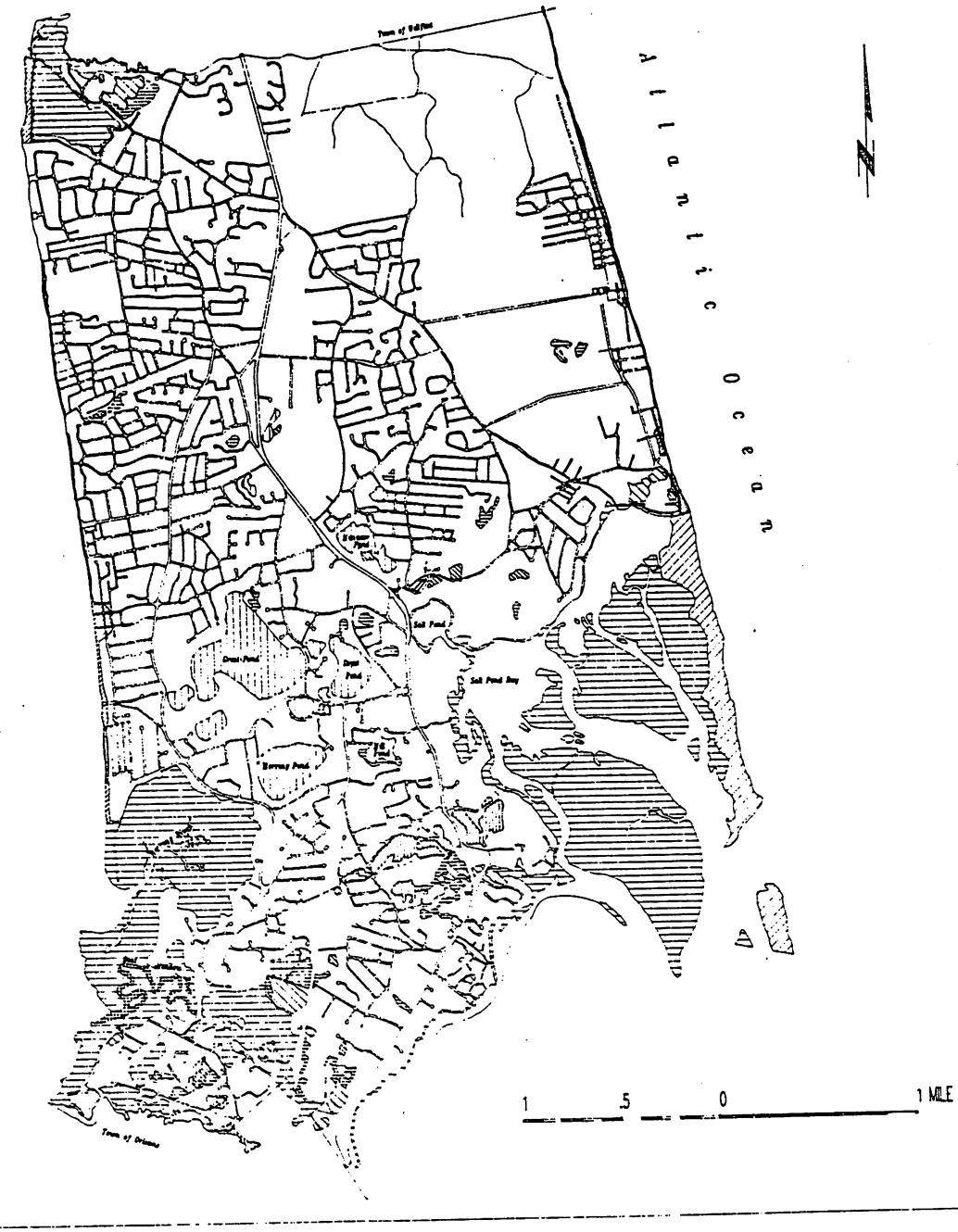
Zoning Map - Eastham, Massachusetts

Zoning Districts

- A - Residential
- B - Marina-related
- C - Industrial
- D - Retail Sales and/or Service
- E - Residential and Limited Commercial
- F - Cape Cod National Seashore
- G - Water Resources Protection
- Old Town Centre Historic District

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:
Zoning: Eastham Zoning By-laws and Sign Code and Zoning Map, April 13, 1988
Parcels: Mapworks-1987, scale 1:7200, from Eastham Assessors Maps



Wetlands - Eastham, Massachusetts

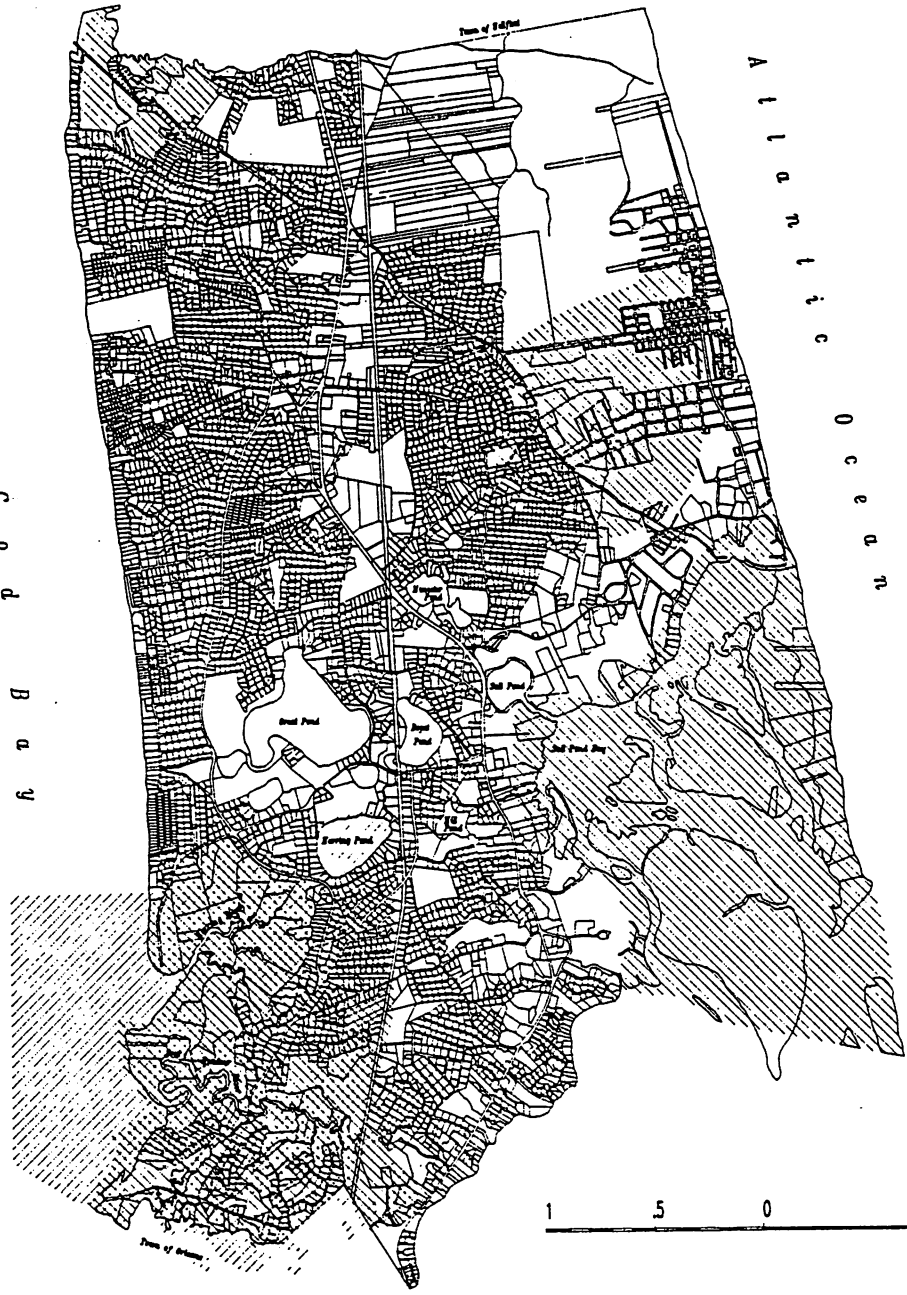
Coastal Wetlands
- Beach
- Dune
- Salt Marsh
- Sea Cliff
- Tidal Flat

Inland Wetlands
- Deep Marsh
- Shallow Fresh Marsh
- Shrub Swamp
- Wooded Swamp
- Cranberry Bog
- Pond
- Upland

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:

Wetlands: Mapworks-1987, scale 1:7200, from DEM Wetlands Restriction Maps
Roads: Mapworks-1987, scale 1:7200, from Eastham Assessor's Maps



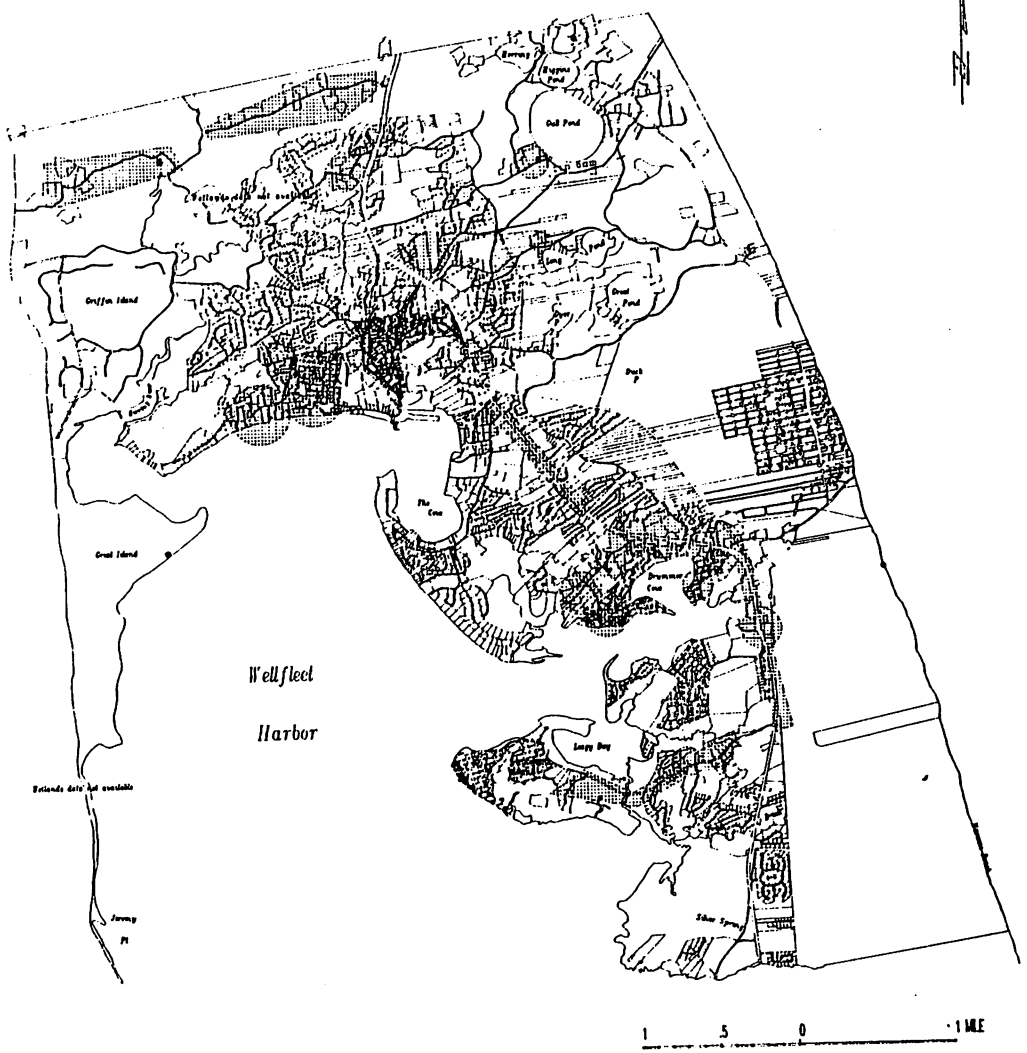
Rare and Endangered Species Habitat and Areas of Critical Environmental Concern
Eastham, Massachusetts

Rare & Endangered Species Habitat

Areas of Critical Environmental Concern (ACEC)

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:
Rare Species Habitat: Mapworks-1987, 1:7200 from Massachusetts Natural Heritage Program
ACEC: Mass. Coastal Zone Management, ACEC Site Summaries and Regulations, 1987
PARCELS: MAPWORKS-1987, 1:7200, from Eastham Assessor Maps



HISTORICAL RESOURCES
WELLFLEET, MASSACHUSETTS

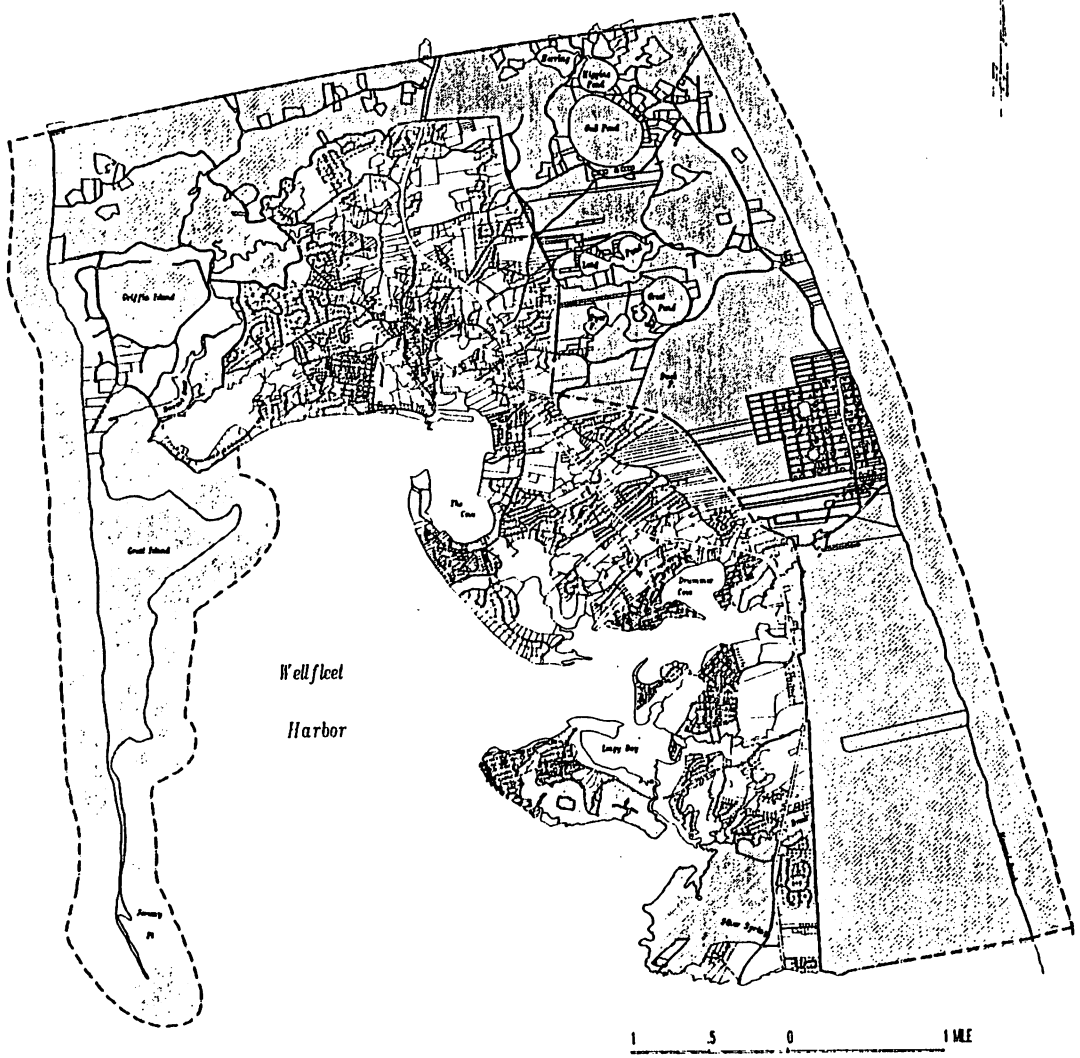
Designated on State Register of Historic Places

Eligible for Register

DATA SOURCES:

PARCELS: Wellfleet Assessor Maps, 1:2400, 1:1200

HISTORIC RESOURCES: Massachusetts Historical Commission, on USGS topographic quads



Protected Open Space
Wellfleet, Massachusetts

Protected Open Space

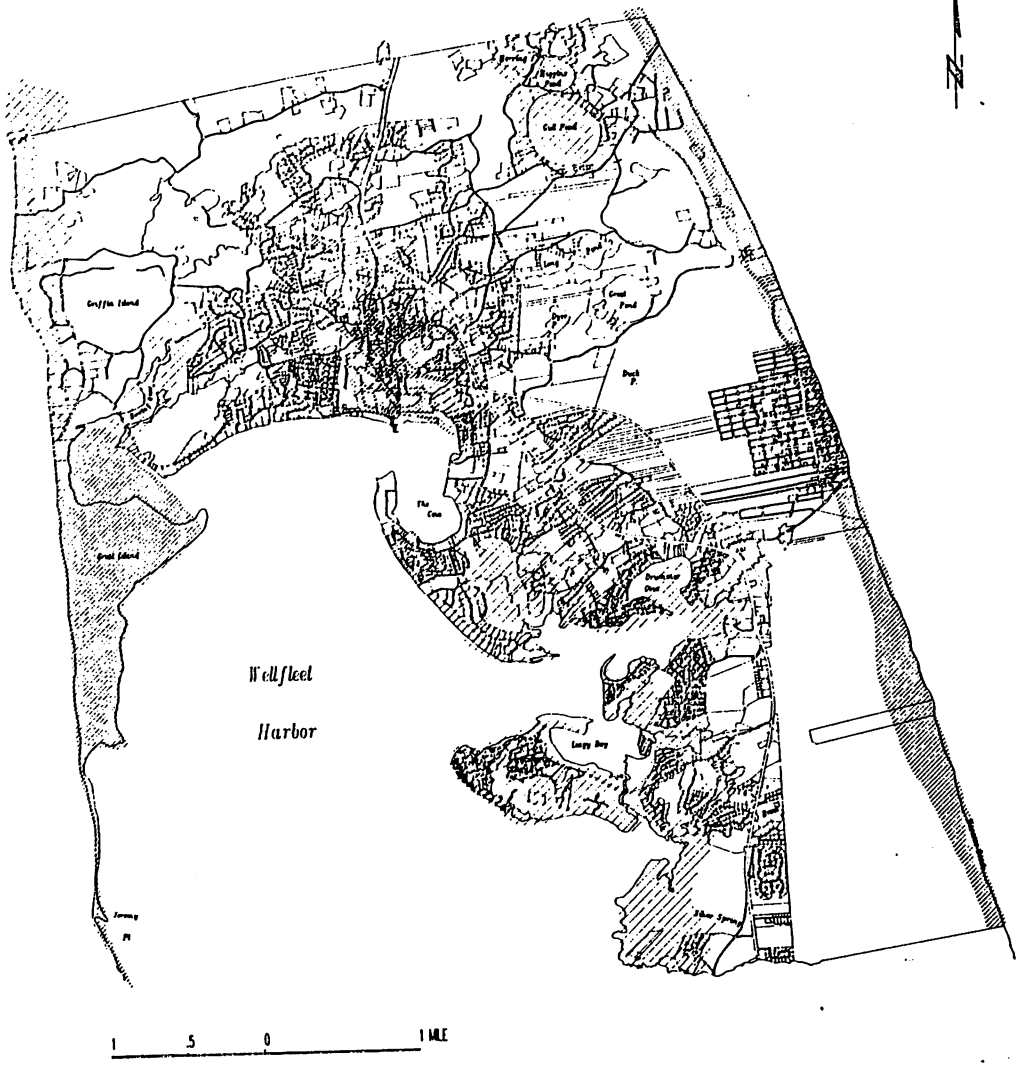
Cape Cod National Seashore

MAP NOTES:

Open space within the town of Wellfleet consists of parcels owned by conservation organizations such as the Wellfleet Conservation Trust, the Massachusetts Audubon Society, and the town itself, as well as land within the Cape Cod National Seashore, which is under the jurisdiction of the National Park Service. Many parcels within the Seashore are privately-owned or town-owned. Data on these parcels was not collected.

DATA SOURCES:

LAND USE: Wellfleet Assessors Office
PARCELS: Wellfleet Assessor Maps, scale 1:2400, and 1:1200
SEASHORE: Wellfleet Assessor Maps and USGS topographic quadrangle at 1:25000



SCENIC LANDSCAPES

WELLFLEET, MASSACHUSETTS

- Distinctive Landscape
- Noteworthy Landscape
- Common Landscape

DATA SOURCES:

SCENIC LANDSCAPE: Massachusetts Landscape Inventory, Dept. of Environmental Management, 1982, from 1:25000 quads

ROADS: Wellfleet Assessor Maps, 1:2400 & 1:1200

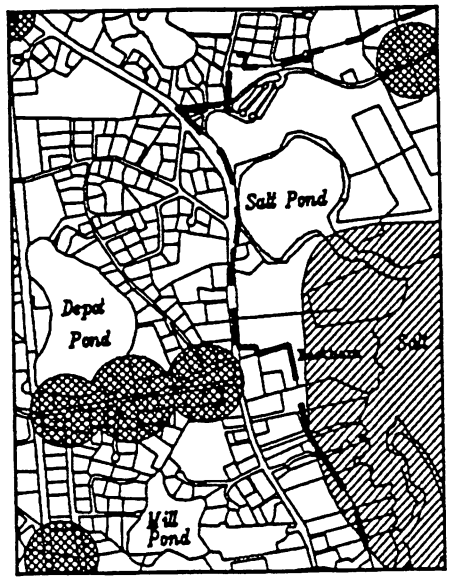
The Derived Analytical Maps

The derived analytical maps were produced by overlaying and manipulating the data layers of the thematic maps and the attribute information as described below. The purpose of the following analytical maps was to demonstrate the power and capabilities of the GIS once the databases are in place (geographic and attribute). The analytical processes used here represent a few possibilities of many that exist. The following maps are intended to be a first step.

The GIS technology offers some unique capabilities of data manipulation or combination beyond the basic query of the attribute database, to produce different thematic maps. Two of the more useful capabilities are "buffering" and "polygon (area) overlay."

In "buffering," zones can be identified around the perimeter of areas, out from points, or along lines. Examples of these would be the 100-foot buffer around a wetland, the 400-foot and 1/2-mile radius around a public water supply well, and the zoning set back from a road or a power line right-of-way easement.

With "polygon overlay," the capability exists to overlay two or more sets of map information to show such things as where they exist alone, where none is present, or where all exist. For instance, one can ask "Show all the vacant developable residential parcels that have wetlands and those that do not." The resulting map will be produced from merging the wetlands polygons with the parcels polygons and querying the attribute database for zoning and development information. It will show all vacant developable residential parcels which contain wetlands.



Environmental Sensitivity:

The Environmental Sensitivities in Wellfleet include wetlands, rare and endangered species habitat, and the Department of Environmental Protection's interim one-half mile buffer around public water-supply wells. Two of these wells are merely theoretical, and are the result of analysis to screen for potential public water-supply sites in Wellfleet. The third well has been sited by the town and is currently being installed. DEP interim one-half mile buffers were used in the absence of calculated zones of contribution.

The Eastham map contains slightly different elements. In this map, environmentally sensitive areas include wetlands, the ACEC, rare and endangered species habitat, and potential Drinking Water Supply Districts. The Drinking Water Supply Districts refer to the zones of contribution (850 foot radius) around potential public water-supply wells that were delineated during the CCAMP study (1988).

PURPOSE: Identify environmentally sensitive areas within town.

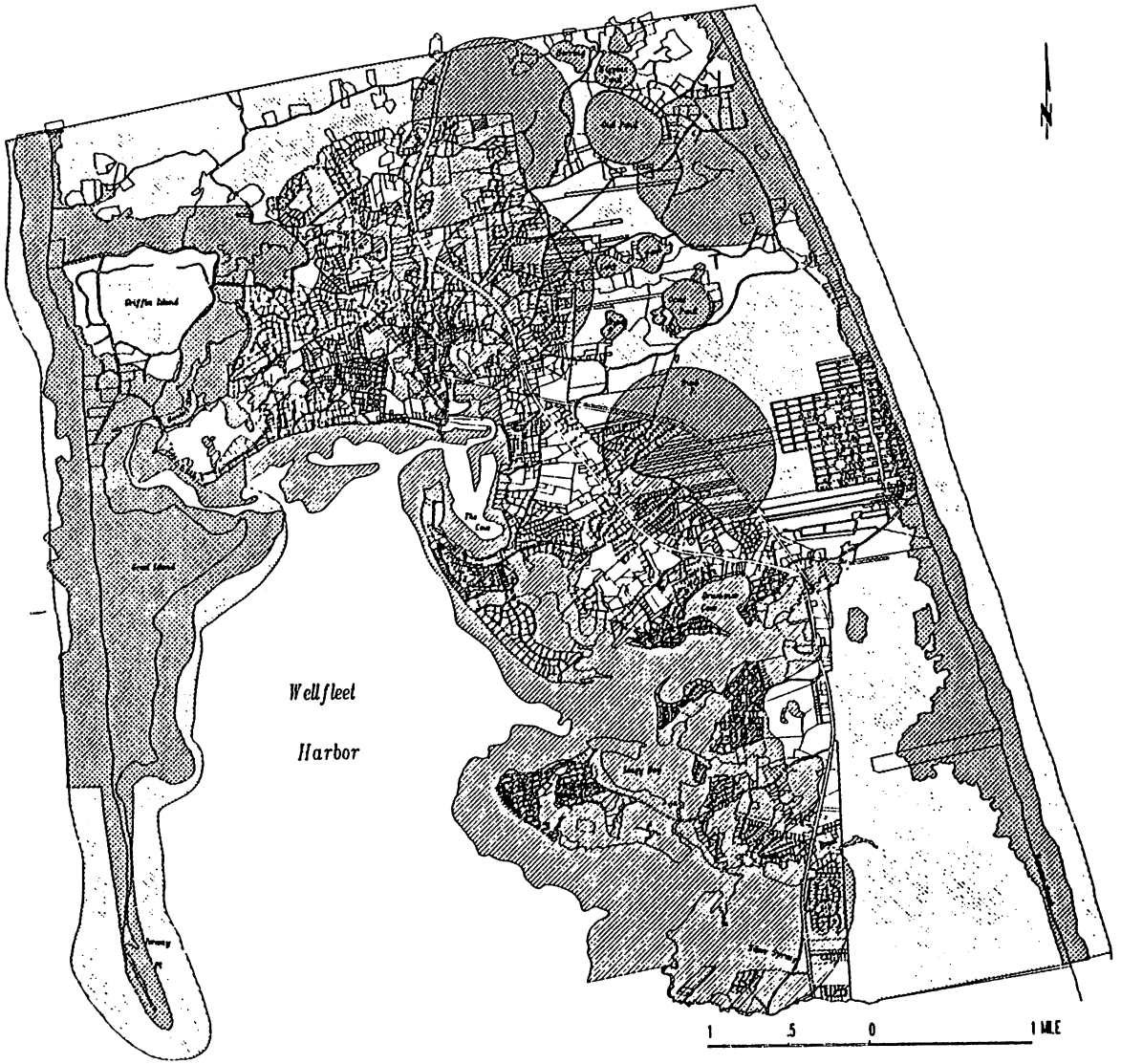
GIS STEPS

1. Identify sensitive areas:
    - -wetlands
    - -Areas of Critical Environmental Concern (ACEC, Eastham only)
    - -zones of contribution to public wells
    - -rare and endangered species habitat
2. Identify Cape Cod National Seashore (CCNS)
    - -Boundary & non-CCNS parcels

RESULT: Map showing environmentally sensitive and otherwise undevelopable land within the town.

POSSIBLE APPLICATIONS:

1. Certain areas could be identified as "no build" or might have strict performance standards applied to them to preserve critical resources
2. Further factors for detailed site assessment before development might be identified
3. Map information could be used to identify a linked open space network through the towns



ENVIRONMENTAL SENSITIVITY

WELLFLEET, MASSACHUSETTS

▨ Environmentally sensitive areas

▭ Cape Cod National Seashore

MAP NOTES:

Environmentally sensitive areas include wetlands, Drinking Water Supply Districts (land within the Zone of Contribution (859 foot radius) around potential public water supply wells delineated in the "CCAMP" study, 1988), Eastham's ACEC, and rare and endangered species habitat.

This map has been produced as a demonstration of a geographic information system's potential applications. Depicted boundaries are approximate and are intended for planning purposes only. This map is not intended to be used for legal purposes.

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:

Parcels: Wellfleet Assessor Maps
Wetlands: DEM Wetland Restriction Maps, 1:5000
Rare Habitat: Mass. Natural Heritage Program
from USGS 1:25000 Topographic Quadrangles
National Seashore Boundary: Wellfleet Assessor Maps

Impact of Development on Cultural Resources

The Cultural Sensitivity map shows the historic and archaeological resources within each town, along with the vacant developable parcels. Sensitive archaeological areas are mapped for this project according to the proximity of the area to freshwater or marine-related ecosystems. High sensitivity areas are within 300 meters (1000 feet), moderate sensitivity areas are between 300 and 600 meters, and low sensitivity areas are more than 600 meters from the nearest freshwater or marine-related ecosystem. These zones have been identified by the State Archaeologist at the Massachusetts Historical Commission (MHC). Historic Districts include properties that are eligible for the State Register of Historic Places. They are general areas chosen during "windshield" surveys done by the MHC to locate properties of historic significance.

Parcels that are vacant and developable have the greatest potential to impact cultural resources. The corresponding land use codes are 130, 131, 390, and 391. For a detailed description of each code, refer to "Guidelines for Classification and Taxation of Property According to Use," 1987, by the Massachusetts Department of Revenue, Division of Local Services, Bureau of Local Assessment.

PURPOSE: Identify culturally sensitive areas within both towns.

GIS STEPS

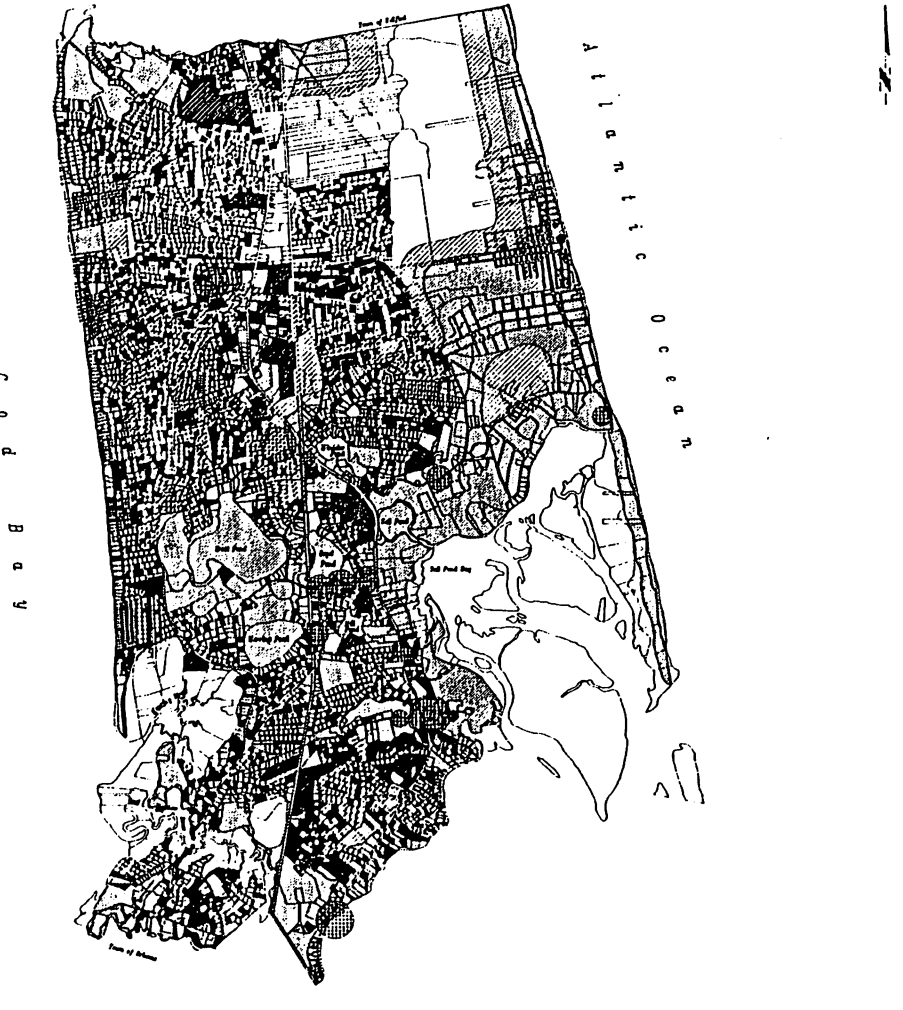
1. Identify areas of high and moderate archaeological sensitivity
2. Identify eligible and designated historic districts
3. Identify vacant developable parcels

RESULT: Map showing culturally sensitive areas and potential threats posed by developable parcels.

POSSIBLE APPLICATIONS:

1. A design review process could be implemented to ensure that new development is consistent with buildings in identified historic areas.

IMPACT OF POTENTIAL DEVELOPMENT ON CULTURAL RESOURCES EASTHAM, MASSACHUSETTS



- Vacant Developable Parcels

CULTURAL RESOURCES

Archaeological Sensitivity

- High
- Moderate
- Low

Historic Districts

- Designated
- Eligible

MAP NOTES

Parcel land-uses are represented by the Massachusetts three-digit land-use codes. Land-uses that are vacant and developable have the greatest potential to impact cultural resources. Land-use codes are subject to field verification. Vacant developable codes include 130, 131, 395, and 391. For a detailed description of each code, please refer to "Guidelines for Classification and Taxation of Property According to Use," 1985, by the Massachusetts Department of Revenue, Division of Local Services, Bureau of Local Assessment.

Archaeological sensitivities are mapped here according to the proximity of the area to freshwater or marine-related ecosystems. High sensitivity areas are within 300 meters (1000 feet), moderate sensitivity areas are between 300 and 600 meters, and low sensitivity areas are over 600 feet from the nearest freshwater or marine-related ecosystem.

Historic Districts include eligible historic properties, and are general areas chosen during Massachusetts Historical Commission "windshield" surveys to locate properties with historic significance.

This map has been produced as a demonstration of a geographic information system's potential applications. Depicted boundaries are approximate and are intended for planning purposes only. This map is not intended to be used for legal purposes.

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:

Archaeology and History: Massachusetts Historical Commission, on 1:25000 quads
Parcels: Eastham Assessors Map, 1720G by Mapworks, 1987
Landuse: Eastham Assessors Office, 1989

Potential Districts of Critical Planning Concern

Potential Districts of Critical Planning Concern were chosen from sensitive areas in the towns. Three types of districts were chosen: Ecological Resource District, Cultural Resource District, and Drinking Water Supply District. Designation as a potential DCPC is not intended to prohibit development within an area

Potential Ecological Resource Districts are made up of rare and endangered species habitat as sampled by the Massachusetts Natural Heritage Program. Potential Cultural Resource Districts include Massachusetts Historical Commission (MHC) potential historic districts, which are areas that are eligible for the State Register of Historic Places. These areas were chosen during MHC "windshield" surveys to locate properties with historic significance. Potential Drinking Water Supply Districts include land within the zone of contribution to potential public water-supply wells.

PURPOSE: Screen town resources for potential Districts of Critical Planning Concern.

GIS STEPS

1. Determine sensitive resources:
    -Rare and endangered species habitat
    -Zones of contribution to public wells
    -Eligible historic districts
2. Identify Cape Cod National Seashore as already protected land

RESULT: Map showing potential Ecological, Cultural, and Drinking Water Resource Districts of Critical Planning Concern

POTENTIAL APPLICATIONS:

1. Areas could be identified where development should be restricted to the types and density which would not adversely effect the resource.

SCREENING FOR POTENTIAL DISTRICTS OF CRITICAL PLANNING CONCERN (DCPC)

WELLFLEET, MASSACHUSETTS

DISTRICTS

- Drinking Water Supply
- Cultural Resources
- Ecological Resources
- Cape Cod National Seashore

MAP NOTES:

A DCPC DOES NOT PROHIBIT DEVELOPMENT within it. It is an area which requires special regulations to guide the type and manner of development due to its historical or environmental sensitivity.

In this example, Drinking Water Supply Districts include land within the DEP interim one-half mile buffer around planned and potential public water supply sites. The two potential public water supply sites were chosen based on the availability of large developable parcels greater than five acres in area and other factors.

Cultural Resource Districts include Massachusetts Historic Commission eligible historic districts areas chosen during MHC "windshield" surveys to locate properties with historic significance.

Potential Ecological Resource Districts are a representative sample of "Rare and Endangered Species Habitat" as defined by the Massachusetts Natural Heritage Program.

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Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES

Parcels: Wellfleet Assessor maps 1:1200, 1:2400, updated through 1989
Historic Districts: Massachusetts Historical Commission on 1:25000 USGS Topographic Quadrangles
Rare Habitat: Massachusetts Natural Heritage Program on 1:25000 USGS Topographic Quadrangles
National Seashore Boundary: Wellfleet Assessor Maps and USGS Topographic Quadrangle

Potential Public Water Supply Sites

This analysis was performed in order to find potential water resource areas which would be sensitive to development, and should be protected. The resulting Wellhead Protection Area or temporary zone of contribution was used in both the environmental sensitivity scenario and the potential DCPC scenario.

PURPOSE: Identify potential public water-supply sites in Wellfleet and delineate DEP interim one-half mile buffer.

CRITERIA

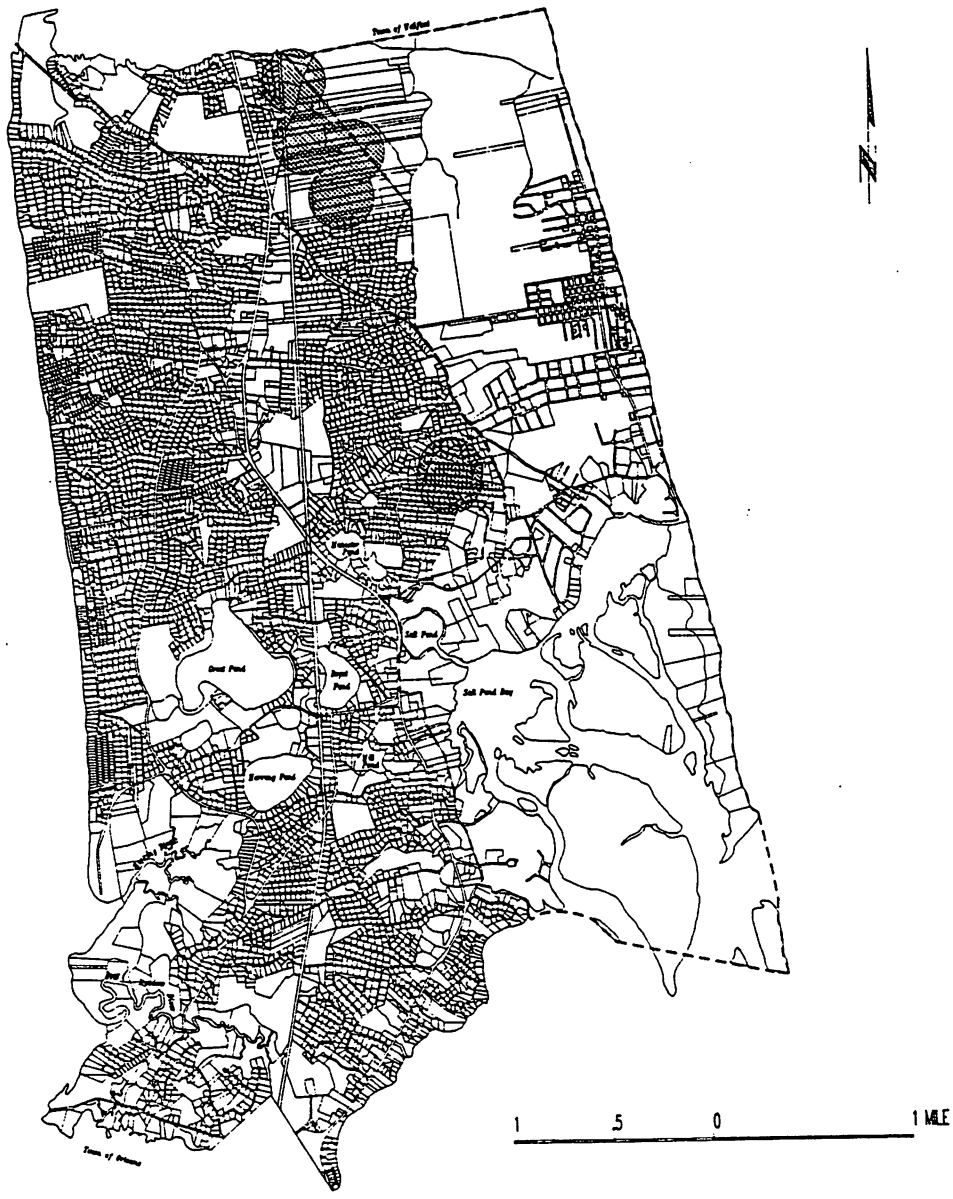
-Within 5-foot groundwater contour
-Greater than 150 feet from a wetland resource area
-Greater than 400 feet from commercial land uses and major transportation routes
-Situated on town-owned parcel of at least 5 acres
-Not within the Cape Cod National Seashore

GIS STEPS

1. Start with parcel base map
2. Overlay groundwater contours
3. Buffer wetlands 150 feet
4. Buffer commercial parcels, landfill, and US Route 6 400 feet
5. Identify town-owned parcels of at least 5 acres
6. Identify Cape Cod National Seashore and eliminate from consideration
7. Place theoretical wells within selected parcels and buffer points 2640 feet (DEP interim one-half mile Wellhead Protection Area)

RESULT: Map showing sites suitable for public water-supply development and the respective interim Wellhead Protection Area.

1. Identified areas may be protected for future water supply for use as needed



POTENTIAL PUBLIC WATER-SUPPLY SITES
EASTHAM, MASSACHUSETTS

Calculated Zone of Contribution to Potential Well

Cape Cod National Seashore

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:

WELL SITES: Cape Cod Aquifer Management Project, 1988

PARCELS: MAPWORKS-1987, 1:7200, from Eastham Assessor Maps

Build-Out Analysis According To Zoning

The Build-Out maps depict existing land use, zoning districts, and developable parcels within each zoning district. Developable parcels are shaded according to their respective zoning districts to show build-out potential.

PURPOSE: Perform a build-out analysis according to current zoning.

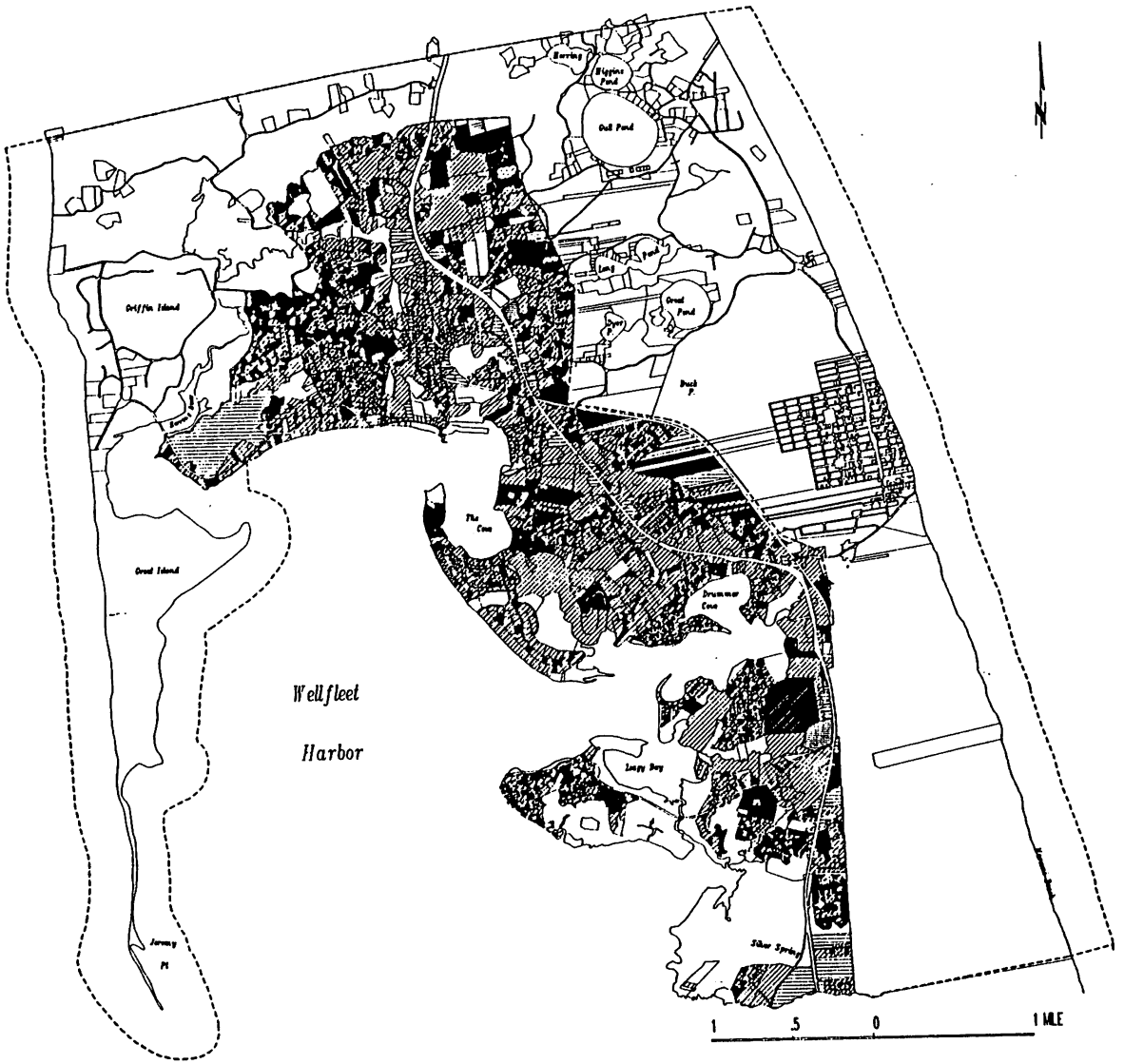
GIS STEPS

1. Create land use map from assessors base
2. Identify vacant developable parcels
3. Overlay zoning districts

RESULT: Map showing current land use and potential land use changes (build-out) according to current zoning.

POTENTIAL APPLICATIONS:

1. Future population and its effect on town services may be determined through this process. If the complete build out of existing zoning is deemed too severe, this analysis tool may inform the town of where and how growth limitations and down zoning should occur.
2. Discrepancies between actual land use and zoning as a result of granted variances may be identifed.



BUILD-OUT ACCORDING TO ZONING
WELLFLEET, MASSACHUSETTS

EXISTING LAND USE

- Residential
- Commercial
- Industrial
- Other Land uses
  (open space, tax-exempt, and undevelopable land)

POTENTIAL LAND USE

- Residential
- Commercial
- Industrial
- Cape Cod National Seashore

MAP NOTES

Parcel land-uses are categorized from the Massachusetts three-digit tax code. Land-use codes are subject to field verification.

To illustrate build-out, vacant developable parcels have been shaded according to their respective tax codes. These codes are designed to reflect the zoning district in which the parcel is located.

This map has been produced as a demonstration of a geographic information system's potential applications. Depicted boundaries are approximate and are intended for planning purposes only. This map is not intended to be used for legal purposes.

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:

Parcels: Wellfleet Assessors Map
Landuse: Wellfleet Assessors Office
Zoning: Wellfleet zoning map

Screening for Optimal Locations for Affordable Housing

The purpose of the Housing Opportunities analysis was to locate vacant developable parcels of a suitable size for housing that are within walking distance from commercial areas and services. In this way, optimal locations for affordable housing can be identified. Both Housing Opportunities maps show vacant developable parcels of at least two acres that fall both within 1500 feet of commercial parcels and those further away from commercial parcels. Also shown for reference are the existing commercial parcels. Other data that would have been considered if available include public transportation routes, topography, sewer hookup and proximity to other town services.

PURPOSE: Identify areas suitable for affordable housing.

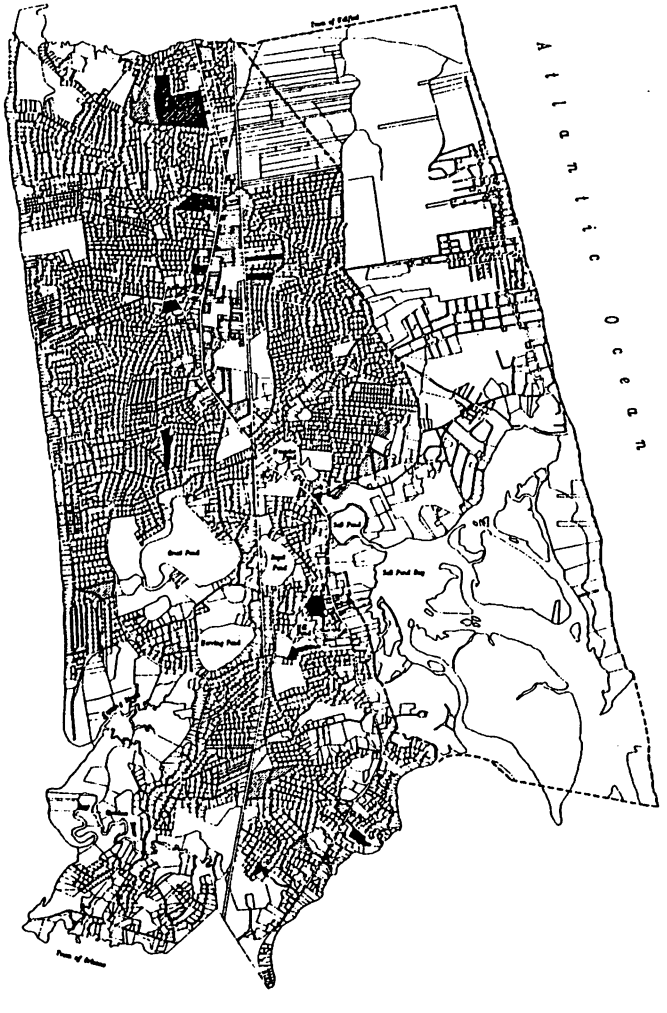
CRITERIA:
-vacant developable parcel of at least 2 acres in area
-within 1500 feet of commercial areas
-greater than 1500 feet from a commercial area
-not in the following sensitive or restricted areas:
    -within 100 feet of a wetland resource area
    -within the zone of contribution to public well
    -within the Cape Cod National Seashore park

GIS STEPS

1. Assessors' base map of town
2. Buffer wetlands 100 feet. and eliminate from consideration
3. Identify and eliminate zones of contribution to public wells
4. Identify and eliminate area within Cape Cod National Seashore
5. Identify vacant developable-to-residential parcels of at least 2 acres in area
6. Buffer existing commercial parcels 1500 feet

RESULT: Map showing available parcels meeting criteria for affordable housing.

POSSIBLE APPLICATIONS:
1. Areas identified as suitable for affordable housing could be upzonec and become part of a transfer of development right program to preserve



SCREENING FOR OPTIMAL LOCATIONS FOR AFFORDABLE HOUSING EASTHAM, MASSACHUSETTS

- Primary Locations
- Secondary Locations
- Commercial and Town Services
- Cape Cod National Seashore

SCREENING STEPS:

Residential parcels that are vacant and developable (land-use codes 130 and 131) and are two acres or larger were chosen as potential sites.

Environmentally sensitive areas including wetlands, land within the Zone of Contribution (850 foot radius) around potential public water supply wells delineated in the "CCAMP" study (1988), and Eastham's ACEC, were eliminated as possible choices for affordable housing.

Out of the chosen suitable parcels, "Primary Locations" for affordable housing were considered to be within a 1500 foot walking distance of existing commercial or town services. The "Secondary Locations" are outside this distance.

MAP NOTES

Parcel land-uses are represented by the Massachusetts three-digit land-use codes. Land-use codes are subject to field verification. For a detailed description of each code, please refer to "Guidelines for Classification and Taxation of Property According to Use," 1987, by the Massachusetts Department of Revenue, Division of Local Services, Bureau of Local Assessment.

This map has been produced as a demonstration of a geographic information system's potential applications. Depicted boundaries are approximate and are intended for planning purposes only. This map is not intended to be used for legal purposes.

Produced by the Cape Cod Planning and Economic Development Commission with funding from the Executive office of Communities and Development's Strategic Planning Program. June, 1989

DATA SOURCES:

Landuse: Eastham Assessor's Office
Parcels: MAPWORKS, Eastham Assessors maps 1:7200, 1988
Zones of Contribution: Cape Cod Aquifer Management Project, 1988
Wetlands: MAPWORKS, 1988 1:7200 from DEM Wetlands Restriction Maps, 1:5000
Area of Critical Environmental Concern (ACEC): Massachusetts Coastal Zone Management site summaries and regulations
National Seashore boundary: Eastham Assessor Maps

Accomplishments

The most basic accomplishment of this project is the maps. These maps are the result of one of the more important benefits of the GIS effort. The project has enabled these two towns to get all of their existing source maps to a common scale. They can now change the scale of these maps as necessary and overlay any combination of the digitized data layers as well as create data layers from the assessors data base and query the system with 'what if' type questions. A variety of new analytical maps can now be produced.

There have been other significant outcomes as well. Of primary importance are the computerized assessors maps that are now linked to the assessors data base in both towns. While both towns have recently automated their assessing process, they are inconvenienced by having only one set of paper maps with the new parcel (lot) numbers shown. CCPEDC can now produce those maps for the towns on mylars with the new numbers along with such information as acreage and street number. They can be produced with the digital state land use codes, or color coded by land use groups. Additionally the GIS offers the opportunity to streamline and thus speed up the process of updating the assessors maps. This can now be done on a much more frequent basis with paper or mylar maps plotted at any scale for any section of town with very fast turn around. The assessors data base can be updated very quickly with computer files from the towns' assessors office.

These parcel based maps also have the potential of becoming invaluable tools to the Town Planners and Planning Boards as they ask the 'what if' type questions about land use, zoning, and growth. They can similarly be used for Open Space Plans, by showing existing open space and by helping to identify parcels for protection. The overlaying of thematic map layers and the ability to generate analytical maps opens up the opportunity to look at relationships among town resources and infrastructures to aid decision making by all town boards; Planning, Conservation, Affordable Housing and Water Supply. Inconsistencies between current zoning, land use and resource areas can be examined on an on-going basis as maps and data layers are updated. This project has also been invaluable to CCPEDC as it looks to its future mapping needs as related to regional planning issues and the mandates of the Cape Cod Commission Act.

Overall there seems to be little or no question about the utility of the GIS and its benefits, once the system is in place and operational. 'System' refers not only to the computer hardware but to the geographical and attribute data bases as well. Questions for the future are primarily concerned with continuity. Can the towns afford the GIS, and can CCPEDC provide them with an accessible service? Can more data layers be added, and how soon? How fast can CCPEDC get assessors data and other map resources on the system for other towns? Given these type of questions, it appears that the utility of the GIS approach is already thoroughly accepted.

The primary obstacle of concern is that of cost. However, it must be realized that the one-time start up cost of system hardware and software installation, and training, has already been covered by this study. Future costs will involve only data entry, editing, manipulation and map composition work. With more experience, the efficiency of those processes will surely improve, resulting in further cost reductions.

For the first time, the towns and region are beginning to assemble a set of consistent parcel based maps over a large range of data that can be readily updated and accessed. These maps will provide an invaluable resource to both the towns and the regional planning agency, as this unique region seeks to balance human and environmental needs as it plans for the future.

Appendix

Appendix

HARDWARE PURCHASED FOR PROJECT:

COMPAQ 386/25 megahertz DESKPRO computer with math co-processor, 110 megabyte hard disk, 1.2 megabyte floppy drive, and a 135 megabyte tape cartridge drive for the backup system.

COMPAQ Video Graphics Color Monitor model 420.

CALCOMP 9100 Digitizer with 36" by 48" working surface.

Hewlett Packard Draftmaster II plotter for up to 36" by 48" plots.

Hewlett Packard Paintjet color printer for 8 1/2 " by 11 " plots and for printing text.

SOFTWARE PURCHASED FOR THE PROJECT:

pc ARC/INFO by Environmental Systems Research Institute, Redlands, California, including these programs:

- pc ARCEDIT
- pc ARCPLOT
- pc OVERLAY
- pc ARC/INFO Starter Kit
- pc INFO (HENCO Software)

SYTOS backup software (SYTRON Corporation, Marlboro, MA)

Microsoft Corporation's MS-DOS Version 3.3 (Licensed by COMPAQ Computer)

ADDITIONAL COSTS:

Printer Driver Software
Plotter Driver Software
Plotter and printer paper, pens, ink, and other supplies
Connection cables and adapters
Backup tapes
Floppy diskettes
Purchase of computerized data or "coverages" (on diskette)
Training provided by Camp Dresser and McKee, Inc.

Time Spent on Each Aspect of the Project

The GIS Mapping Project was divided into two major parts -- Eastham and Wellfleet. Twelve maps or overlays were produced for each town. These were divided into three parts -- the assessors parcel base map, the thematic map overlays, and the analytical maps.

The map production (GIS) portion of the project for the two towns required approximately 1500 hours. About 70% of that time could be assigned to the two towns specifically, the other 30% was taken up by such things as system set up, training, problem solving, data acquisition, research, planning, and system backup. Of the 70%, approximately 33% of the time was spent on Eastham and 37% on Wellfleet. This was expected because Eastham, for the most part, was digitized from the existing "Mechanical GIS." Another factor to keep in mind here is that Eastham has 6000 parcels and Wellfleet 4000 parcels.

Eastham required about 225 hours or 15% of the total time to produce the assessors parcel base. Factoring in time to produce the Eastham "Mechanical GIS" these numbers are more realistically 265 hours and 18%. Wellfleet required about 24% of the total time or 365 hours to produce its assessors parcel base. Factoring in the difference in number of parcels could increase this 6% difference to 9 or 10%.

The five thematic map overlays for each town required about 15 hours each or 150 hours total (10% of the effort). The six analytical maps in each town required about 25 hours each or 300 hours total (20% of the effort).

Acknowledgements

Massachusetts Executive Office of Communities and Development:
Kathleen Bartolini, Director, Office for Local and Regional Planning
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Walter Stratton, Town Planner, Eastham and Wellfleet
Marie Dunham, Wellfleet Assessor
Frances Coco, Eastham Assessor
Eastham and Wellfleet Boards of Selectmen

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Jim Killian and Herbert Olsen

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Mark Robinson, Executive Director, Compact of Cape Cod Conservation Trusts, Inc.

Mapworks, Inc.:
Linda Bischoff, Eliza McClennen and Monica Price

Cape Cod Planning and Economic Development Commission staff:
Gabrielle Belfit, Hydrologist

Barnstable County Commissioners and Finance Advisory Board

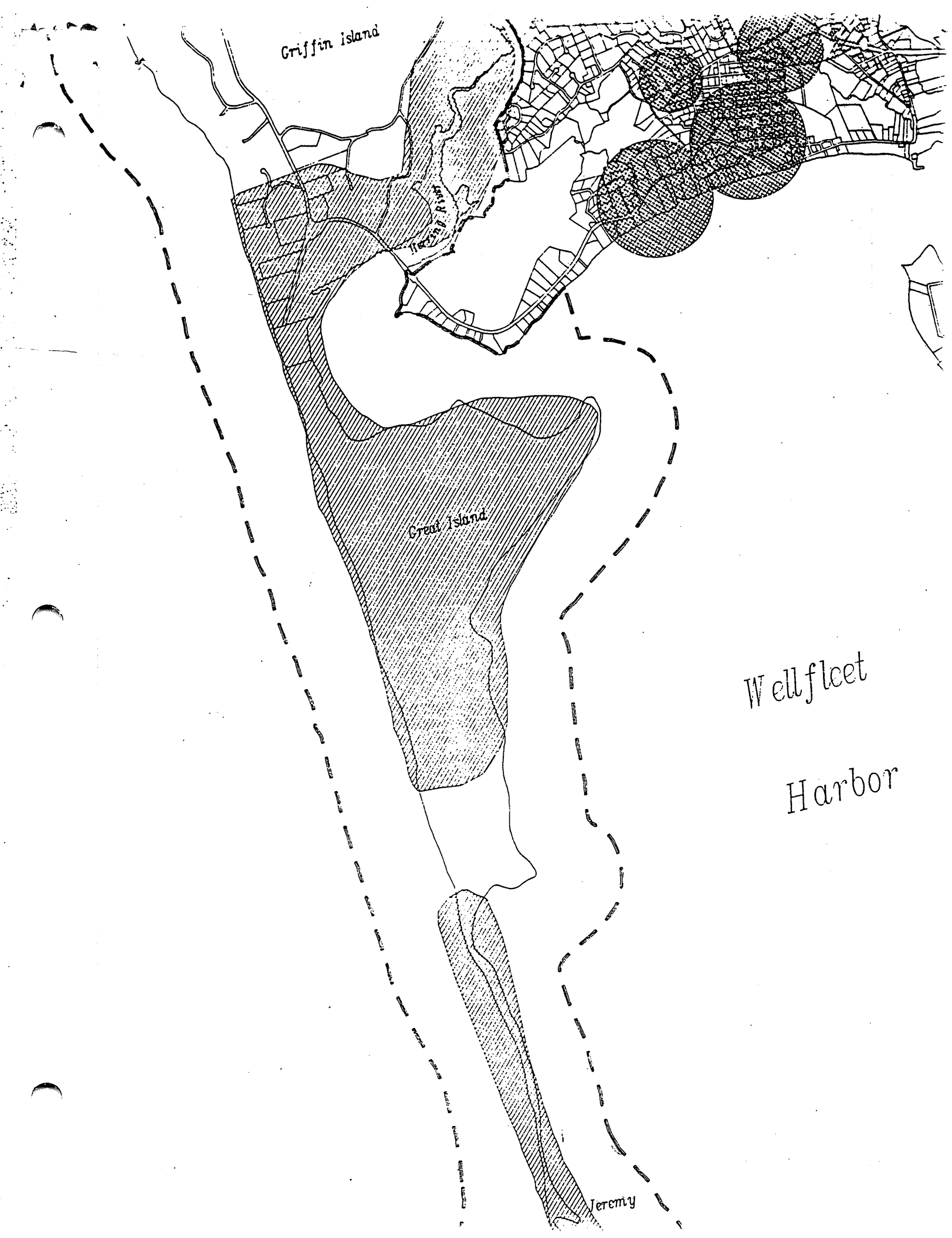
MassGIS:
Michael Terner and David Weaver

Richard Topier, Massachusetts Executive Office of Environmental Affairs

Mathew MacIver, Kimball Chase/Coler & Colantonio, Inc.

Gile Beye, Camp Dresser and McKee, Inc.

pc Arc/Info Technical Support Staff, Environmental Systems Research Institute


Griffin Island
Herring River
Great Island
Wellfleet
Harbor
Jeremy