

MASS GIS NEWSLETTER

Massachusetts Geographic Information System

Fall 1987

Volume 11

EOEA GAINS GIS FUNDING AS PART OF DATA CENTER UPGRADE

The EOEA FY1988 budget contains a \$2,500,000 capital outlay to upgrade the EOEA Data Center at 20 Somerset St. The appropriation is the result of an EOEA Needs Study that was completed in August of 1987 by the consulting firm of Hayes-Mechling-Kleiman, Inc. and exhaustive planning work performed by the EOEA Data Policy Work Group.

There is an agency-wide consensus that the upgrade of Data Center is critically needed and overdue. The focus of the upgrade will be replacement of the current IBM mainframe with a distributed information network. Included in this network will be a large mini-computer for the Data Center and a moderate mini for DEQE (to be housed at 1 Winter St.)

The new distributed information network will provide a flexible, efficient computer environment for storing large databases and applying advanced software. The network may also host some initial GIS applications although it is not yet certain that the network will be capable of hosting a large state-wide GIS.

Included in the Data Processing Needs Study was a budget for spending the appropriation. GIS applications were noted to be of long-term 'strategic importance' to EOEA and \$300,000 was allocated to support their development.

The EOEA GIS Sub-committee has been meeting to plan the expenditure of these funds. Initial plans include reserving some money for GIS software procurement and using other funds as seed money for expanding the GIS database. The sub-committee is working to prioritize new data layer development and insure that all new data will fit current EOEA GIS data standards and be compatible with the developing MassGIS database.

USGS TACKLES SECOND GIS PROJECT

Over the past six months federal, state, and municipal agencies have cooperated on a special demonstration project, as part of the Cape Cod Aquifer Management Project (CCAMP), to build a geographic information system. The GIS is designed to demonstrate the assessment of risk to the quality of groundwater from potential contamination sources at public-water supply sites on Cape Cod.

The CCAMP GIS culminates a two-year effort by MDEQE, USEPA, USGS and the Cape Cod Planning and Economic Development Commission (CCPEDC) to collect hydrologic, geologic and environmental data which pertain to the technical and managerial aspects of groundwater protection.

Ten data layers cover all of Cape Cod and range from major roads at a scale of 1:190,000 to landfills at a scale of 1:25,000. Twenty additional data layers focus on the case study towns of Barnstable and Eastham and include Barnstable's parcel-based land-use at 1:7,200 and Eastham's wetlands at 1:5,000.

GIS technology gives CCAMP the capability to compile these diverse data sets from widely varying scales and sources into a coherent database. The GIS aids analysis by making it possible to overlay several data layers at once and to evaluate potential contamination sources, such as underground storage tanks, based on their characteristics and on their proximity to public-water supply sites.

The CCAMP GIS has demonstrated several scenarios to assess risk from ground water contamination and has begun the important process of familiarizing agencies with the potential of GIS technology. The data developed for this project could well form the core of a comprehensive Cape-wide GIS that could serve many planning purposes in the future.

LAND-USE MAPPING IN PROGRESS

Land-use data is fundamental for a wide variety of planning, and regulatory activities. Surprisingly, the most recent, Massachusetts-wide coverage was done in 1974 at the general scale of 1:250,000.

An ongoing project involving several agencies and Mass-GIS will produce new, digital, land use data at 1:25,000 for almost half of the communities in Massachusetts. The EOEI GIS Sub-committee is in the process of developing strategies to encourage completion of this work for the rest of the state.

Ongoing Project

The history of the ongoing project illustrates how other digital data layers can be produced by sharing resources and results.

The Mass Department of Public Works (MDPW) and the Metropolitan Area Planning Council (MAPC) need statistics on land use, and land-use change in 164 eastern Massachusetts communities for use with a growth prediction model. They originally planned to have the land-use mapping group at University of Massachusetts, Amherst photo-interpret the region and measure acreages of land uses in transportation zones through manual techniques.

Mass-GIS staff saw the photo-interpretation work as an opportunity to produce digital land-use data of potential use to a wide variety of projects beyond MDPW/MAPC. If digital data were available, GIS software could easily generate the land-use statistics MDPW/MAPC required for their model.

After several meetings and a demonstration MDPW, MAPC and the staff of Mass-GIS agreed to a benchmark test involving one community. The test was successful. MDPW, in the process of planning for a digital mapping system of their own, saw that future uses for the digital data clearly justified the additional 15% cost.

MDPW/MAPC have contracted with UMASS and currently production is underway for the digitization of land-use in 164 communities in eastern Massachusetts.

Procedure

The land-use mapping group at the Department of Forestry & Wildlife Management (DFWM) has been making land-use maps of Massachusetts since 1951. Their last statewide mapping was done in 1971. The land-use mapping group procured PC-ARC/INFO this year and is taking full advantage of GIS technology as they proceed with the 1985 land-use map.

The new 1985 map will be made by compositing two separate maps. First, a mylar, 1971 land-use map showing 21 land-use classes is compared to a 1985 color-infrared photograph by a photo-interpreter. A new 'land-use change map' is created from this comparison that shows only areas that have changed since 1971 and their new land-use class. Then, the change map and the 1971 land-use map are digitized by DFWM staff.

The two digitized maps are delivered to Mass-GIS on floppy disc. Mass-GIS uses the main-frame version of ARC/INFO to intersect the two maps into a composite. A program is then run which performs several operations on the data to convert square feet to acres and produce tabular reports for MDPW/MAPC showing acreages in each of the 21 land-uses for each transportation zone for both 1971 and 1985.

In return, Mass-GIS retains a copy of both the 1971 and 1985 land-use data for future USGS and EOEI applications.

EPA REGION I ENTERS THE GIS WORLD

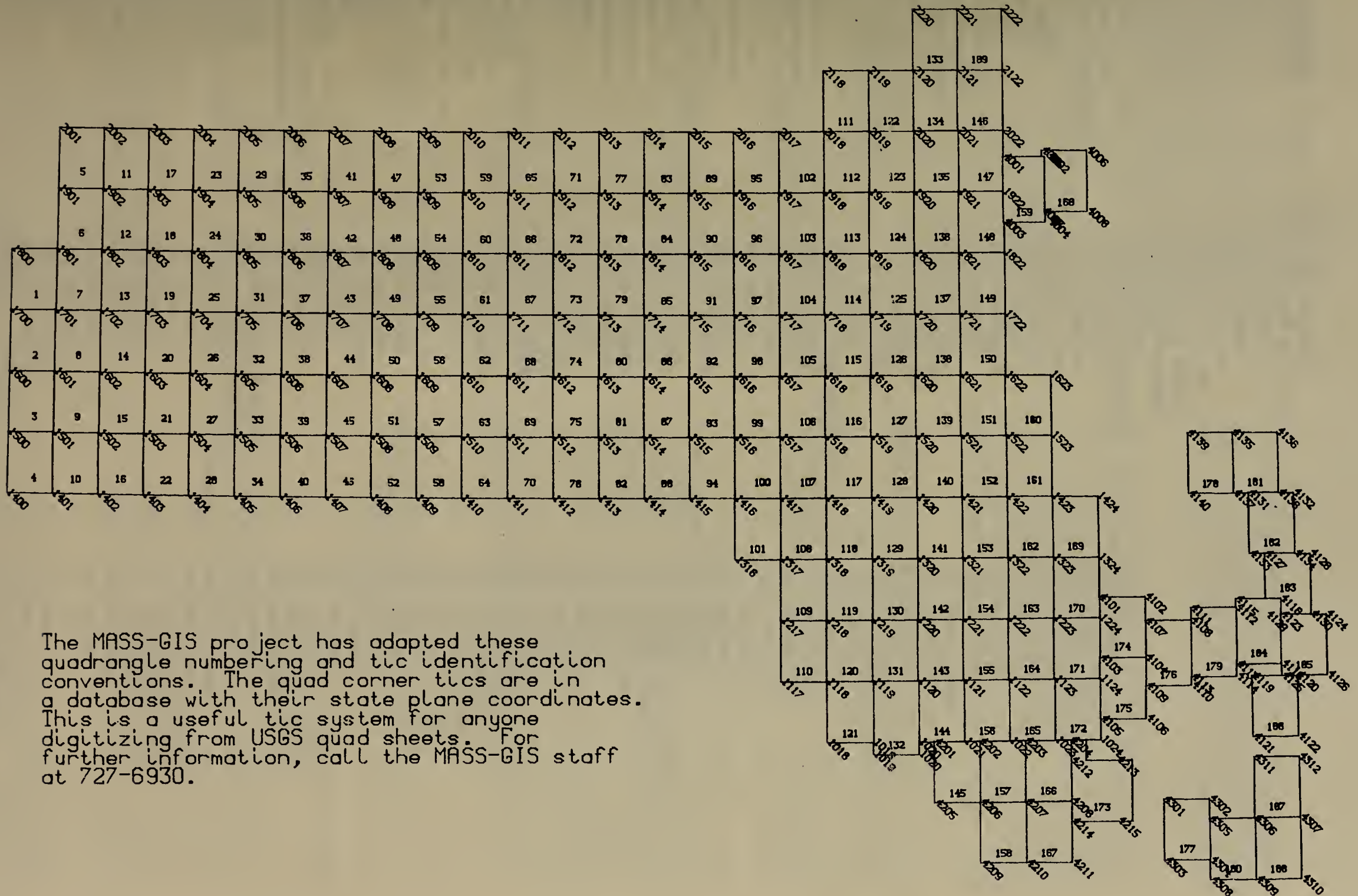
In November, 1987 USEPA, Region I will establish a GIS program through the purchase of hardware, software and the expansion of current facilities at the J. Edgar Hoover Federal Building, Boston. The New England region was chosen along with the Philadelphia and Kansas City offices to pilot study areas for GIS projects.

The GIS work area will include a PRIME 2755, CalComp 5835 Electrostatic Plotter, CalComp backlit digitizing pad, 4-pen ZE' plotter, Tektronix digitizing table, three Tektronix 4107 terminals, ten PC's running TGRAF-4107 terminal emulation software, Tektronix 4510 rasterizer, and a color graphics copier. The software includes ARC/INFO version 4.0, GRID/TOPO, Network, and TIN.

Massachusetts Quad Numbers and Corresponding Names

1 CANAAN	67 BARRE	133 EXETER
2 STATE LINE	68 NORTH BROOKFIELD	134 NEWBURYPORT WEST
3 EGREMONT	69 EAST BROOKFIELD	135 GEORGETOWN
4 BASHBISH FALLS	70 SOUTHBRIDGE	136 SALEM
5 BERLIN	71 ASHBURNHAM	137 LYNN
6 HANCOCK	72 GARDNER	138 HULL
7 PITTSFIELD WEST	73 WACHUSETT MTN	139 WEYMOUTH
8 STOCKBRIDGE	74 PAXTON	140 WHITMAN
9 GREAT BARRINGTON	75 LEICESTER	141 BRIDGEWATER
10 ASHLEY FALLS	76 WEBSTER	142 ASSAWOMPSET POND
11 WILLIAMSTOWN	77 ASHBY	143 NEW BEDFORD NORTH
12 CHESHIRE	78 FITCHBURG	144 NEW BEDFORD SOUTH
13 PITTSFIELD EAST	79 STERLING	145 CUTTYHUNK
14 EAST LEE	80 WORCESTER NORTH	146 NEWBURYPORT EAST
15 MONTEREY	81 WORCESTER SOUTH	147 IPSWICH
16 SOUTH SANDISFIELD	82 OXFORD	148 MARBLEHEAD NORTH
17 NORTH ADAMS	83 TOWNSEND	149 MARBLEHEAD SOUTH
18 WINDSOR	84 SHIRLEY	150 NANTASKET BEACH
19 PERU	85 CLINTON	151 COHASSET
20 BECKET	86 SHREWSBURY	152 HANOVER
21 OTIS	87 GRAFTON	153 PLYMPTON
22 TOLLAND CENTER	88 UXBRIDGE	154 SNIPATUIT POND
23 ROWE	89 PEPPERELL	155 MARION
24 PLAINFIELD	90 AYER	156 SCOTICUT NECK
25 WORTHINGTON	91 HUDSON	157 NAUSHON ISLAND
26 CHESTER	92 MARLBOROUGH	158 SQUIBNOCKET
27 BLANDFORD	93 MILFORD	159 GLOUCESTER
28 WEST GRANVILLE	94 BLACKSTONE	160 SCITUATE
29 HEATH	95 NASHUA SOUTH	161 DUXBURY
30 ASHFIELD	96 WESTFORD	162 PLYMOUTH
31 GOSHEN	97 MAYNARD	163 WAREHAM
32 WESTHAMPTON	98 FRAMINGHAM	164 ONSET
33 WORONOCO	99 HOLLISTON	165 WOODS HOLE
34 SOUTHWICK	100 FRANKLIN	166 VINEYARD HAVEN
35 COLRAIN	101 PAWTUCKET	167 TISBURY GREAT POND
36 SHELBURNE FALLS	102 LOWELL	168 ROCKPORT
37 WILLIAMSBURG	103 BILLERICA	169 MANOMET
38 EASTHAMPTON	104 CONCORD	170 SAGAMORE
39 MOUNT TOM	105 NATICK	171 POCASSET
40 WEST SPRINGFIELD	106 MEDFIELD	172 FALMOUTH
41 BERNARDSTON	107 WRENTHAM	173 EDGARTOWN
42 GREENFIELD	108 ATTLEBORO	174 SANDWICH
43 MT TOBY	109 EAST PROVIDENCE	175 COTUIT
44 MT HOLYOKE	110 BRISTOL	176 HYANNIS
45 SPRINGFIELD NORTH	111 SALEM DEPOT	177 TUCKERNUCK ISLAND
46 SPRINGFIELD SOUTH	112 LAWRENCE	178 PROVINCETOWN
47 NORTHFIELD	113 WILMINGTON	179 DENNIS
48 MILLERS FALLS	114 LEXINGTON	180 NANTUCKET
49 SHUTESBURY	115 NEWTON	181 NORTH TRURO
50 BELCHERTOWN	116 NORWOOD	182 WELLFLEET
51 LUDLOW	117 MANSFIELD	183 ORLEANS
52 HAMPDEN	118 NORTON	184 HARWICH
53 MT GRACE	119 SOMERSET	185 CHATHAM
54 ORANGE	120 FALL RIVER	186 MONOMOY POINT
55 QUABBIN RESERVOIR	121 TIVERTON	187 GREAT POINT
56 WINSOR DAM	122 HAVERHILL	188 SIASCONSET
57 PALMER	123 SOUTH GROVELAND	189 HAMPTON
58 MONSON	124 READING	
59 ROYALSTON	125 BOSTON NORTH	
60 ATHOL	126 BOSTON SOUTH	
61 PETERSHAM	127 BLUE HILLS	
62 WARE	128 BROCKTON	
63 WARREN	129 TAUNTON	
64 WALES	130 ASSONET	
65 WINCHENDON	131 FALL RIVER EAST	
66 TEMPLETON	132 WESTPORT	

STANDARDIZED USGS QUADRANGLE NUMBERS AND TIC-ID'S



The MASS-GIS project has adapted these quadrangle numbering and tic identification conventions. The quad corner tics are in a database with their state plane coordinates. This is a useful tic system for anyone digitizing from USGS quad sheets. For further information, call the MASS-GIS staff at 727-6930.

**DATA UPDATE:
MASS-GIS DATA LAYERS STATUS**

Political Boundaries: Both a detailed 1:25,000 scale layer and a generalized 1:190,000 layer of all communities are 100% complete.

Drainage Basins: Over 1700 sub-basins are being digitized from the USGS-WRD 1:24,000 manuscripts. This layer is 90% complete.

Surficial Geology: Sand and gravel deposits are being digitized from USGS-NMD 1:125,000 manuscripts. This layer is 35% complete.

Public Water Supplies, Waste Sources & EPA Facilities: These data layers are installed on the Mass-GIS system. Updates to the database are ongoing.

Transportation & Hydrography:
The linework for this crucial basemap data is produced by USGS-NMD at 1:100,000. The linework closely matches 1:25,000 quads. Editing is needed to edgematch and add attributes.
100% of the state has been acquired, 10% has been integrated into the GIS.

Elevation Data: Ten quadrangles of Digital Elevation Models (DEM's) have been procured showing elevations at 30 meter grid intervals.

Other Statewide Data in the Database

- The 1:250,000 1974 GIRAS land-use data: from the USGS National Mapping Division.
- The GEONAMES database containing over 10,000 geographic place names located on topographic quads: from USGS-NMD.
- The 1:250,000 Digital Terrain Models from the Defense Mapping Agency showing small-scale hypsography have been procured, although they are not currently integrated into the GIS.

Building on the foundation established through a joint USEPA/USGS/DEQE/CCPEDC project to explore GIS uses for the Cape Cod Aquifer Management Project (CCAMP), EPA will provide support for environmental projects throughout New England. Primary areas of interest for GIS applications are support for the Quincy Bay, Boston Harbor, and Massachusetts Bay projects.

STATE PLANE COORDINATES VS LATITUDE/LONGITUDE COORDINATES

All data layers in a GIS database should be stored in a common coordinate system to facilitate data registration (the ability of data to be easily overlaid with other data).

The MassGIS database is constructed in the Massachusetts State Plane Coordinate System (SPC). All points and lines from the various data layers have *x* and *y* coordinates which are stored as state plane feet. The Massachusetts SPC system was selected over the more familiar latitude/longitude system for four reasons:

- 1) SPC are easily stored as decimal numbers while lat/long are generally stored as degrees, minutes, and seconds.
- 2) Degrees are a *relative* unit of measurement. One degree of longitude has a different length at every different latitude. This fact proves difficult for the GIS to handle.
- 3) With SPC coordinates the GIS returns foot or square foot values from distance or area calculations. These units can easily be converted by the GIS to useful measurements such as, miles, kilometers, acres or hectares. If degrees were the coordinate unit then GIS distance or area calculations would be returned as degrees or square degrees. This is undesirable because of the relative nature of the degree.
- 4) It is extremely easy to convert lat/long values into SPC values using the GIS. Consequently, any data sets that currently use lat/long as coordinate reference may be incorporated into the GIS without difficulty. (It is understood that it is much easier, in most cases, to read lat/long values off of a quad than SPC. Database developers should not be discouraged from using lat/long or other standard coordinate systems (e.g. UTM) for their interpolation of point locations.)

SPC Quiz:

- 1) The Massachusetts SPC grid origin is in which state?
- 2) The SPC "X Max" value of appx. 1,029,000 ft. is located in which community?
- 3) The SPC "Y Max" value of appx. 755,000 ft. is located in which community?

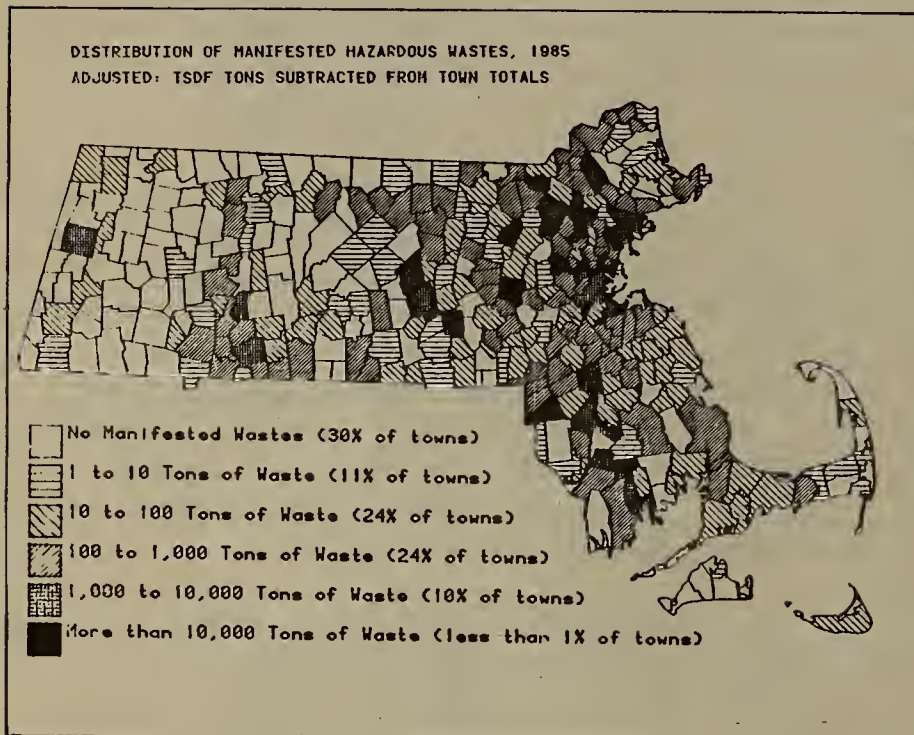
Answers: 1) New York 2) Chatham 3) Salisbury

KEEP THOSE FLOPPY DISCS COMING

Since the last newsletter the MassGIS Project has cooperated with several other state agencies to conduct small scale tests that involve bringing their data into the evolving GIS Database.

Department of Environmental Management: DEM Office of Safe Waste Management added three columns of 1985 data; tons of hazardous waste, number of hazardous waste generators and tons per generator; aggregated by community into the town database.

Department of Public Health: The Health Statistic Unit of the Cancer Registry added several columns of data regarding 'standard incidence ratios' of cancers to the town database.



MASS-GIS Project
80 Boylston Street Suite 955
Boston, Massachusetts, 02116
(617) 727-6930

Department of Food and Agriculture: The Agricultural Preservation Restriction (APR) program added number of acres of land in APR as well as number of APR's town to the town database.

UMass Water Resources Research Center: This group made available the extensive Ponds and Lakes and Streams and Rivers Information Systems (PALIS and SARIS) to the GIS. These databases provide excellent water chemistry attributes to the hydrography data layer.

UMass Department of Landscape Architecture and Regional Planning (LARP): This group has worked on a GIS that was developed in house for several years. The 'MAPLES' system has been used to conduct a study of the Connecticut River Greenway for DEM. Political boundary and land-use data from that study was successfully delivered to Mass-GIS and imaged on the ARC/INFO system. The complete database is forthcoming.

These exchanges were informal agreements whereby the data was delivered to the MassGIS project on a floppy disc and a derivative product, generally a shaded choroplethic map, was returned to the agency supplying the data.

If you have town based information or databases which contain coordinate reference (lat/long fields) and are interested in seeing your data imaged, call the MassGIS project at 727-6930.

2