

A satellite view of Earth from space, showing the curvature of the planet and the blue oceans. The image is used as a background for the slide.

Geographic Information System (GIS)

What is GIS?

Think About Geography

What is Geography?

- Association of American Geographers' definition:
 - **Geography is the science of place and space**
- Merriam-Webster's definition:
 - **A science that deals with the description, distribution, and interaction of the diverse physical, biological, and cultural features of the earth's surface**

Think About Geography

Questions Geographers Ask

- Where is it located?
- Why is it located there?
- How and why are places different?
- How do people interact with their environment?

The answer to these questions is spatial data

History of Cartography

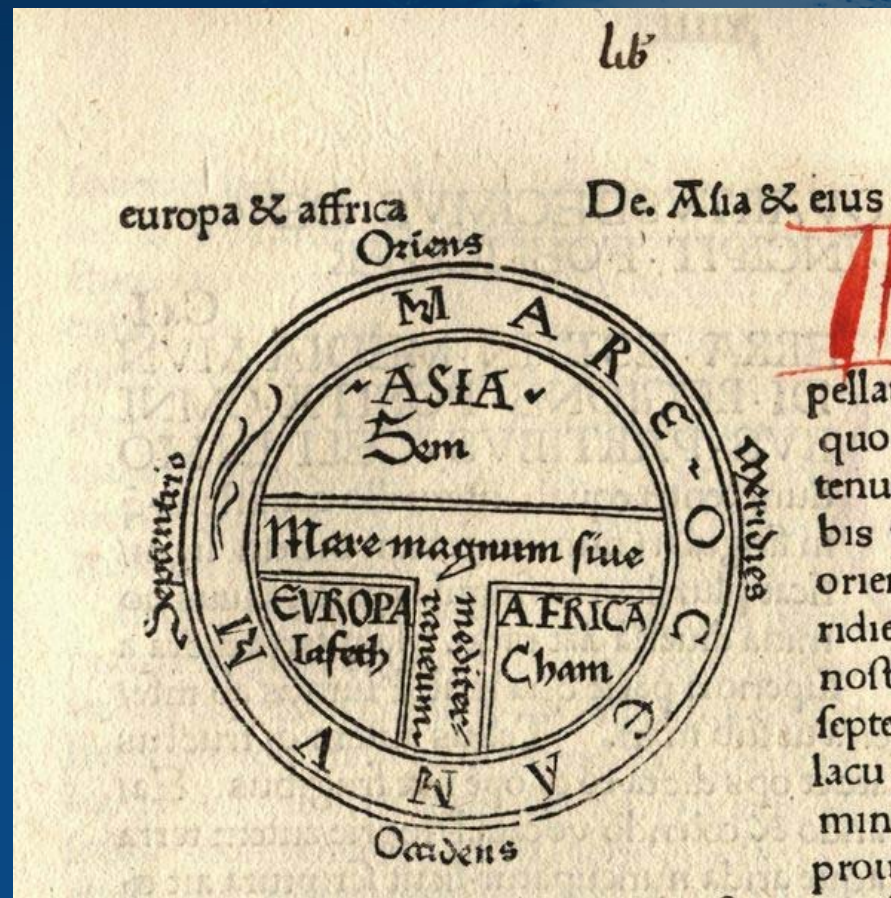
- The First Maps
 - Rock walls
 - Clay tablets
- Uses of Maps
 - Topographic
 - Celestial
 - Cosmographic



Picture of a cuneiform tablet from
<http://www.crystalinks.com/cuneiformtablets.html>

Early Maps of the World

Picture of a T-O map from [University of Texas, Foundations of Western European Cartography](#)



Exploring the World

Mercator map picture from [Encyclopedia Britannica](#)

http://www.britannica.com/EBchecked/topic-art/375638/6563/Globe-of-the-Earth-with-no-land-distortion-and-the#assembly=ur1 mercator map

PRINT E-MAIL SHARE Search Site SHOP BROWSE BLOG LOG IN Premium Membership - Free Trial

Mercator projection: globe of the Earth

1 of 4

©1994 Encyclopaedia Britannica, Inc.

(Left) Globe of the Earth with no land distortion and (right) the Mercator projection with increased land distortion, especially in the 60° to 90° latitudes

Many other projections are used, for example, the conic projection, drawn from a point...

• history of geometry (in geometry: Linear perspective) Encyclopaedia Britannica, Inc.

ABOUT US PRIVACY POLICY TERMS OF USE LEGAL NOTICES CONTACT US GAMES MORE

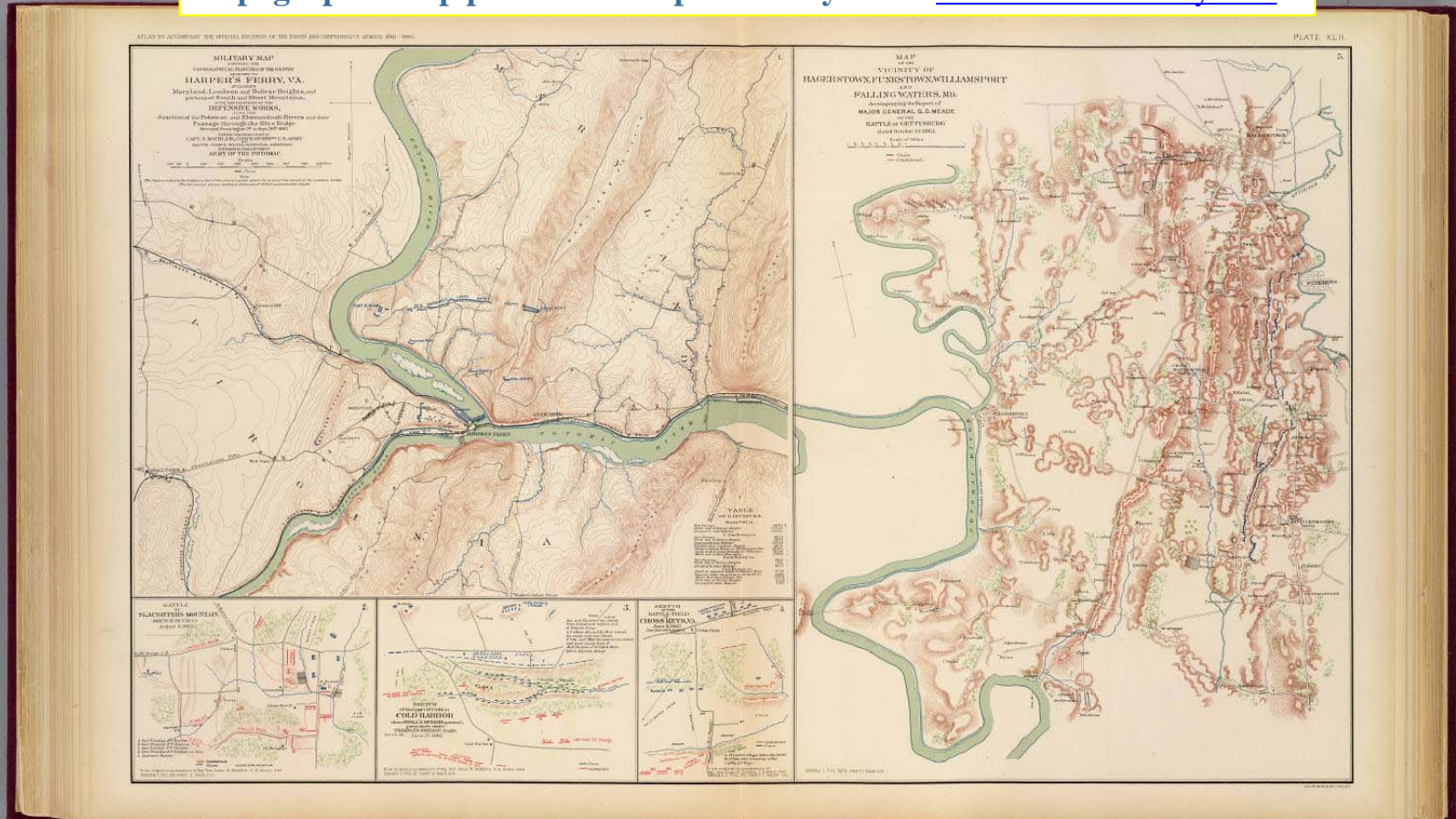
Done

start | In-box - Micr... | (Left) Globe... | Downloads | Information... | What is GIS... | analysis_qu... | GIS Day | Florida_Atr... | 3:53 PM

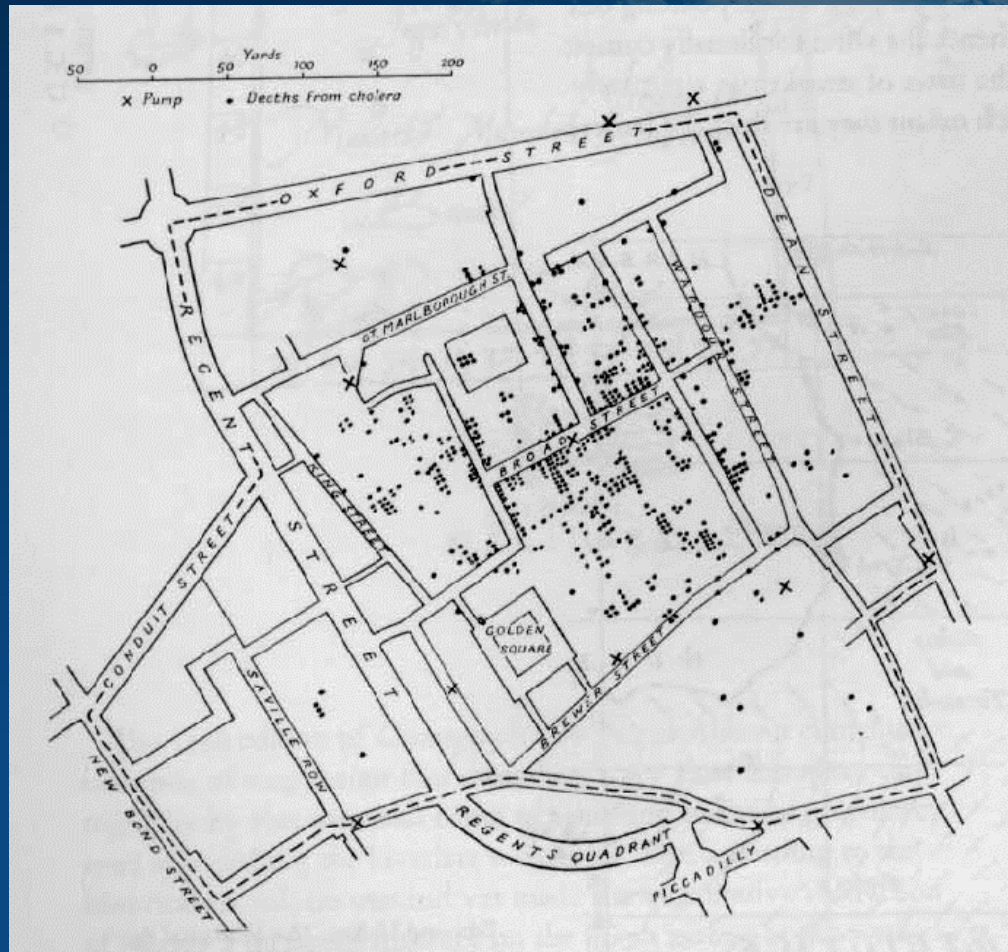
Armando Montelongo
FLIP AND GROW RICH
The #1 Real Estate Program in America
Click Here to get your copy
www.flipandgrowrich.com

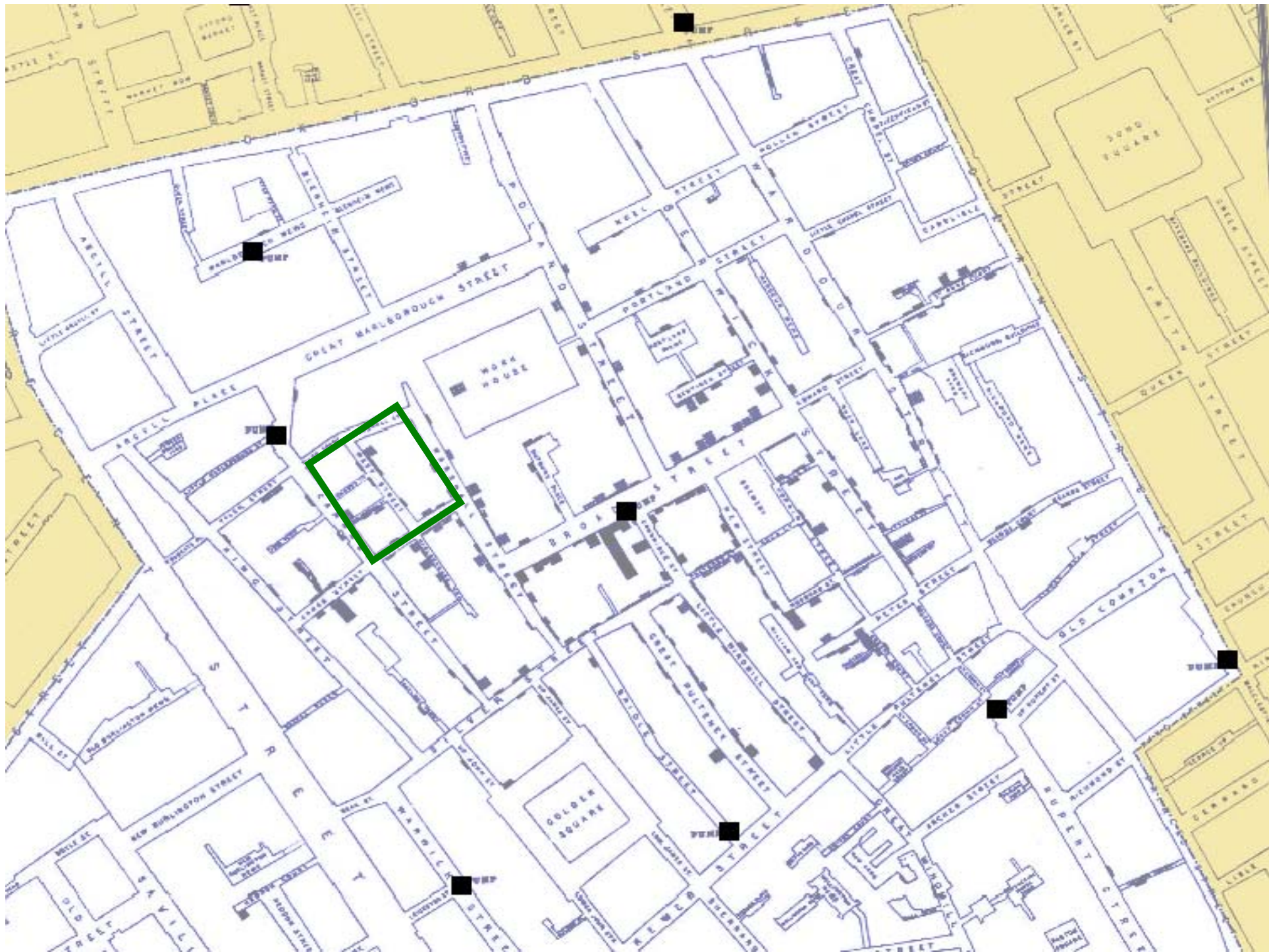
Maps at War

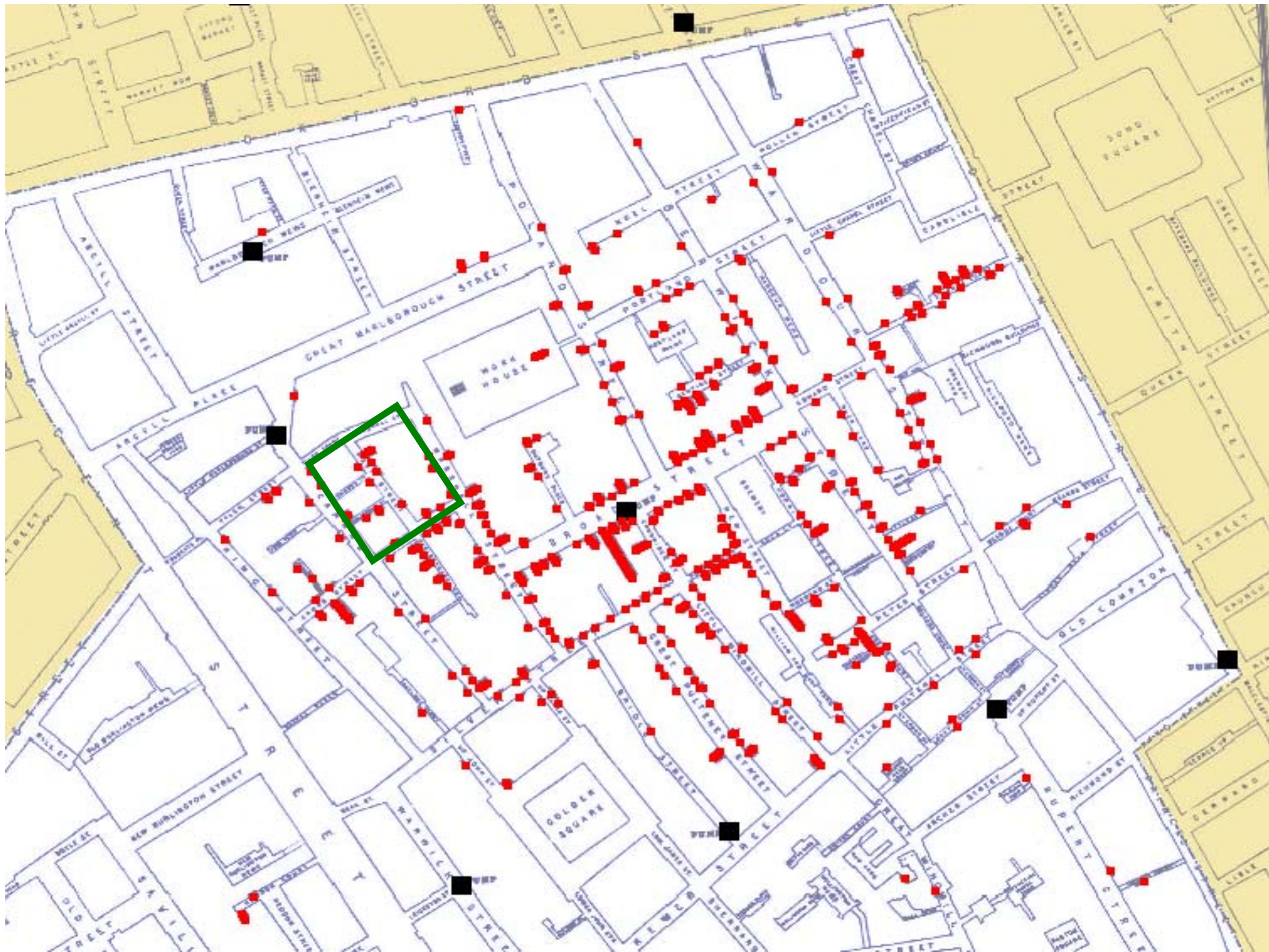
Topographic map picture of Harper's Ferry from www.DavidRumsey.com

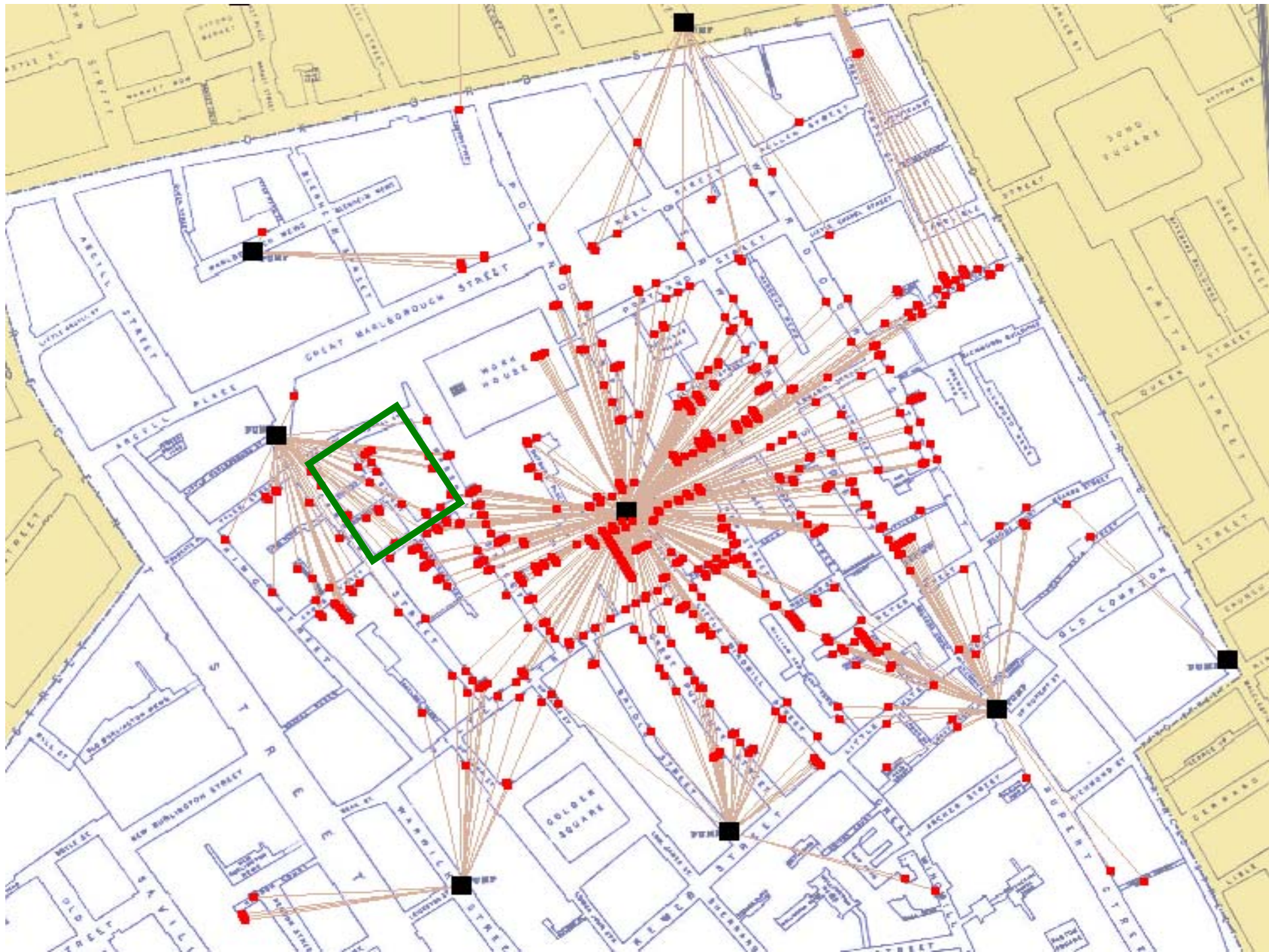


Linked information reveals patterns...









What is Spatial Data?

Location Data

- How Many? – What Kind? – Where?

Scale of Data

- Local to Global to Beyond

Data Presentation

- Words, Charts, Graphs, Tables, or Maps

Estimates are that **80%** of all data has a *spatial* component

- Data from most sciences can be analyzed spatially

Geographic Information Systems

A Definition of GIS

A Geographic Information System (GIS) links locational and attribute information and enables a person to visualize patterns, relationships, and trends. This process gives an entirely new perspective to data analysis that cannot be easily seen in a table or list format or on a paper map.

*Exploring data using GIS turns data into information
and knowledge*

Five Components of GIS

Hardware

The computer, peripherals, and sometimes servers on which the GIS operates

Software

Provides the functions and tools required to store, analyze, and display data

Data

Data is stored as vector, raster, or attribute data

Methods

The guidelines, specifications, standards, and procedures for collecting and analyzing data and applying GIS

People

GIS needs people to ask the questions; choose, collect, and analyze the data; and interpret the results

A Complete GIS

Visualization

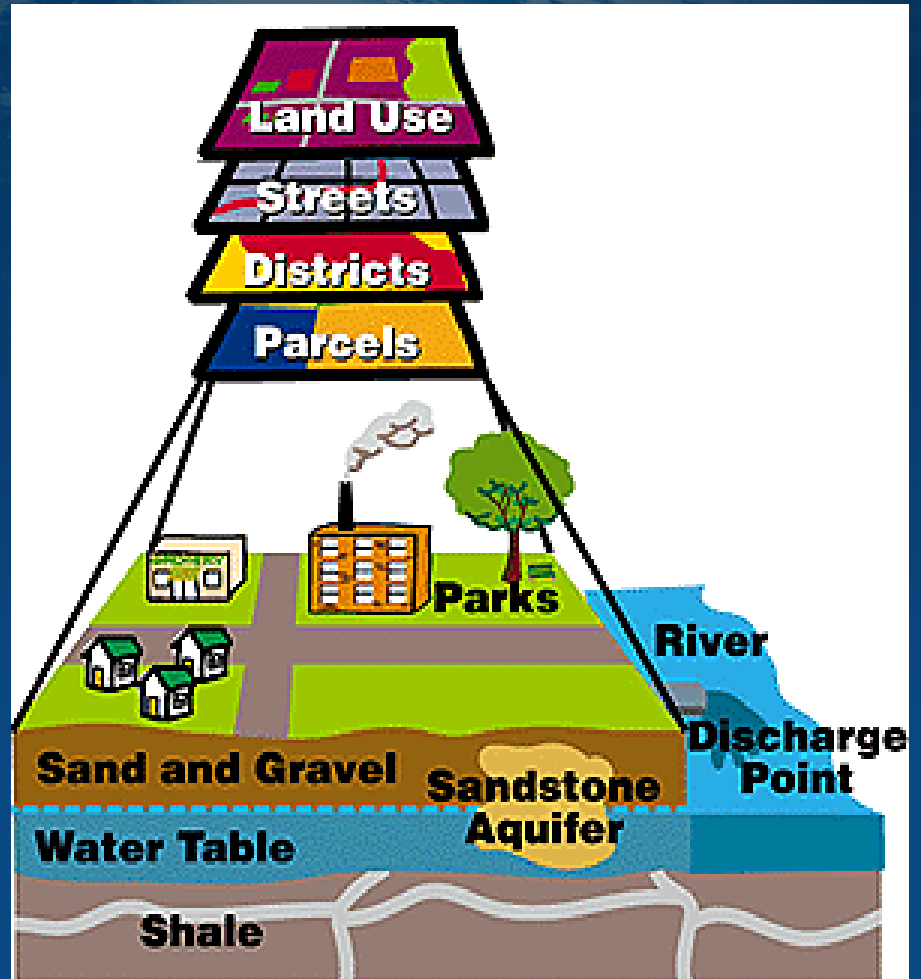
- *GIS as a tool to display spatial data as a map*

Database Management

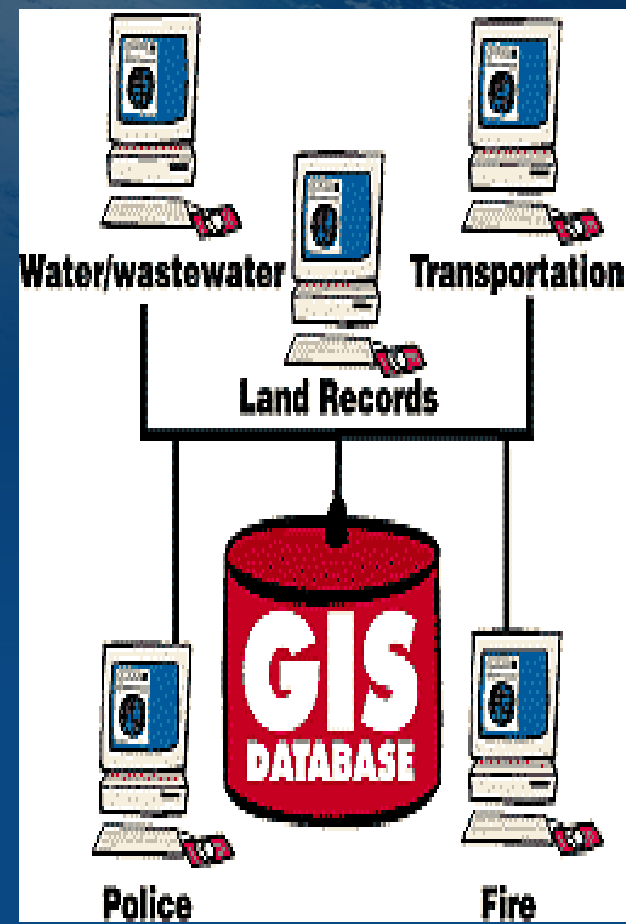
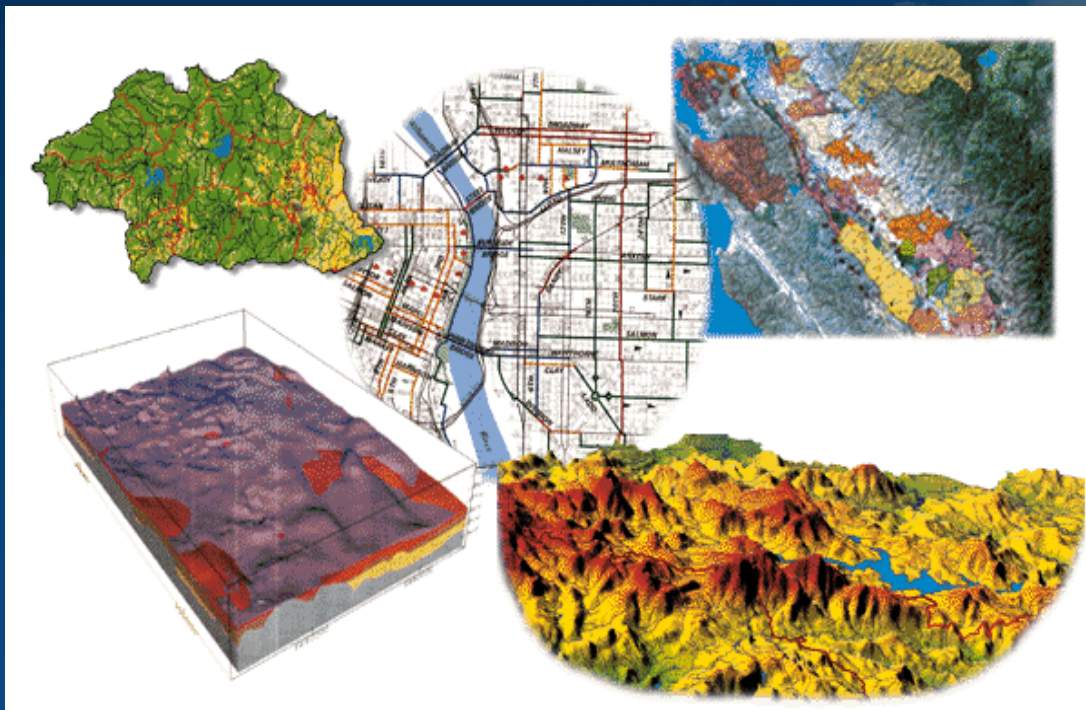
- *GIS as a tool to store and organize spatial data*

Spatial Analysis

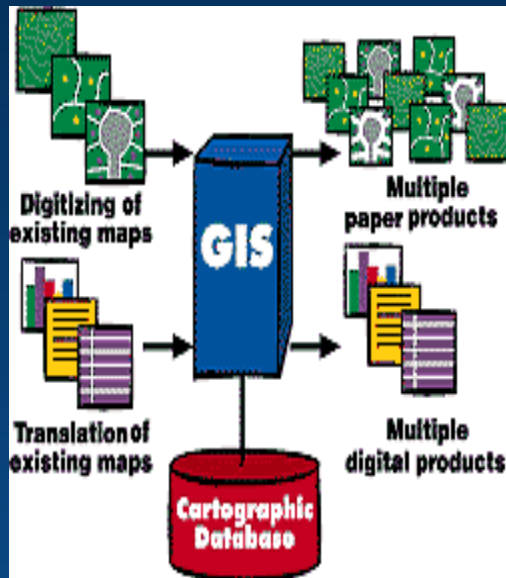
- *GIS as a tool to analyze and interpret spatial data*



GIS Combines Spatial Data From Many Sources



Sources of Spatial Data



Digitized and Scanned Maps

- Purchased, donated, free (Internet)
- Created by user

Databases

- Tables of data

GPS

- Global Positioning System
- Accurate locations

Field Sampling of Attributes

Remote Sensing and Aerial Photography

GIS stores and organizes spatial data in databases

Database

Not easy to interpret

Mammoth_Trails.mxd - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

1:550,009

Layers

Attributes of Cover types

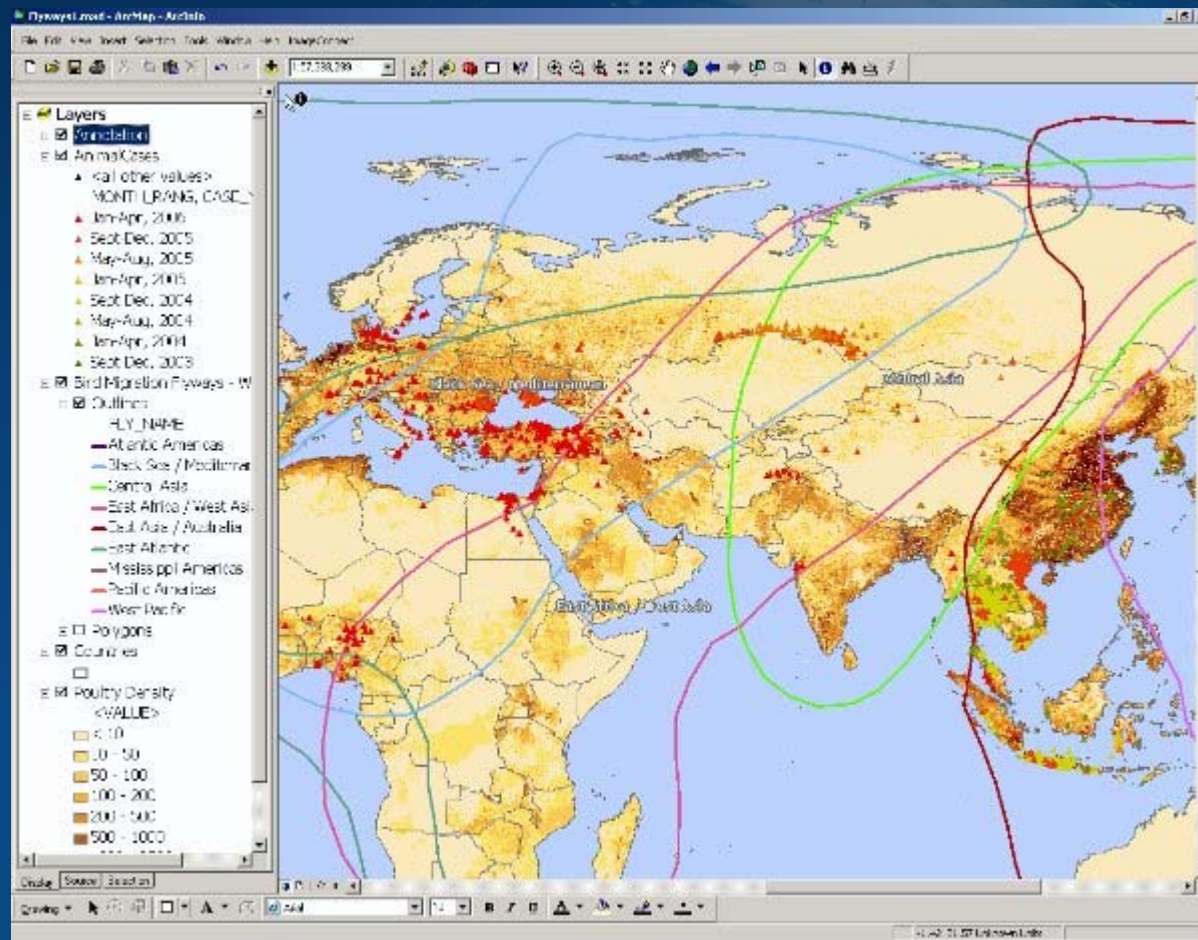
Rowid	VALUE*	COUNT	CATEGORY	NAME	GENERAL	GEN_COLORIAMES
0						
1	32829	1	lp1Ap	climax and post-disturbance lodgepole pine	Lodgepole Pine, climax	73
2	112846	2	wb0	post-disturbance whitebark pine	Whitebark Pine, post disturbance	119
3	40627	3	df0	post-disturbance Douglas-fir	Douglas Fir, post disturbance	89
4	9168	4	lp0/hf	post-disturbance lodgepole pine and non-forest	Lodgepole Pine, post disturbance	74
5	1001891	5	lp0	post-disturbance lodgepole pine	Lodgepole Pine, post disturbance	74
6	113548	6	lp	climax lodgepole pine	Lodgepole Pine, climax	73
7	456158	7	nf	non-forest	Nonforested	83
8	266440	8	lp3	late successional lodgepole pine	Lodgepole Pine, successional	67
9	24916	9	sf/hf	climax Engelmann spruce and subalpine fir and non-forest	Engelmann Spruce & Subalpine Fir, climax	40
10	84673	10	sf	climax Engelmann spruce and subalpine fir	Engelmann Spruce & Subalpine Fir, climax	40
11	152489	11	wb	climax whitebark pine	Whitebark Pine, climax	120
12	143906	12	wb/hf	climax whitebark pine and non-forest	Whitebark Pine, climax	120
13	1554	13	wb/df	climax whitebark pine and Douglas-fir	Whitebark Pine, climax	120
14	82	14	wb/sf	climax whitebark pine, Engelmann spruce and subalpine fir	Whitebark Pine, climax	120
15	459	15	df/hf	climax Douglas-fir and non-forest	Douglas Fir, climax	95
16	58471	16	df/hf	climax Douglas-fir and non-forest	Douglas Fir, climax	95
17	101603	17	df	climax Douglas-fir	Douglas Fir, climax	95
18	2535	18	lpAp3	climax and late successional lodgepole pine	Lodgepole Pine, climax	73
19	1179	19	lp/sf	pygmy lodgepole pine and Engelmann spruce/subalpine fir	Pygmy Lodgepole Pine	75
20	13646	20	lp3/hf	late successional lodgepole pine and non-forest	Lodgepole Pine, successional	67
21	36459	21	lpAp3	pygmy and late successional lodgepole pine	Pygmy Lodgepole Pine	75
22	5946	22	lp2Ap3	middle and late successional lodgepole pine	Lodgepole Pine, successional	67
23	6180	23	asp	aspen	Aspen	104
24	906	24	df1	early successional Douglas-fir	Douglas Fir, successional	88
25	110	25	wb1/hf	early successional whitebark pine and non-forest	Whitebark Pine, successional	122
26	21692	26	wb1	early successional whitebark pine	Whitebark Pine, successional	122
27	361	27	lp1/df	early successional lodgepole pine and climax Douglas-fir	Lodgepole Pine, climax	73
28	1188	28	lp1/hf	early successional lodgepole pine and non-forest	Lodgepole Pine, successional	67
29	160359	29	lp1	early successional lodgepole pine	Lodgepole Pine, successional	67
30	900	30	lp1Ap2	early and middle successional lodgepole pine	Lodgepole Pine, successional	67
31	76	31	lp2/df	middle successional lodgepole pine and climax Douglas-fir	Lodgepole Pine, successional	67
32	3950	32	lp2/hf	middle successional lodgepole pine and non-forest	Lodgepole Pine, successional	67
33	50090	33	lpAp2	middle and climax lodgepole pine	Lodgepole Pine, climax	73
34	1244	34	kh	krummholz	Krummholz	52
35	482591	35	lp2	middle successional lodgepole pine	Lodgepole Pine, successional	67
36	817	36	kh/hf	krummholz and non-forest	Krummholz	52
37	96	37	asp/hf	aspen and non-forest	Aspen	104
38	52	38	wb2	middle successional whitebark pine	Whitebark Pine, successional	122
39	57	39	lp	pygmy lodgepole pine	Pygmy Lodgepole Pine	75
40	163431	40	water	water	Water	56

Record: 1 | Show: All Selected | Records (0 out of 40 Selected) | Options

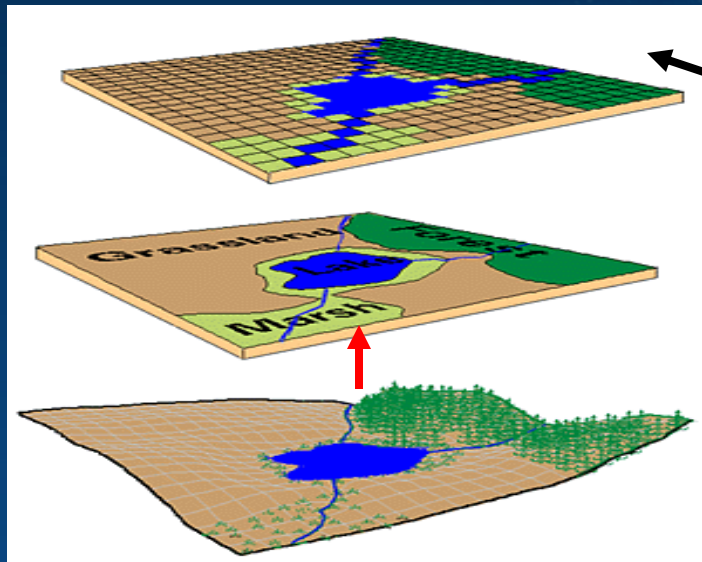
Display Source Selection

Drawing | Arial | 11 | 579628.497 4896386.687 Meters

Visualization *Worth a Thousand Words*



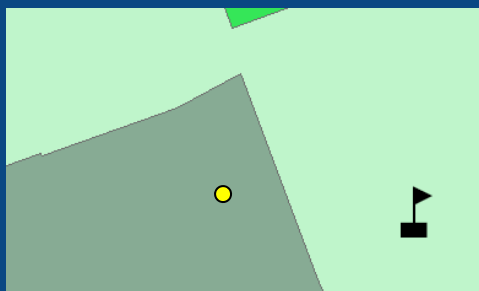
Two Ways to Visualize Data “The World” in GIS



Raster -- Grid

- “Pixels”
- A location and value
- Satellite images and aerial photos are already in this format

Real world

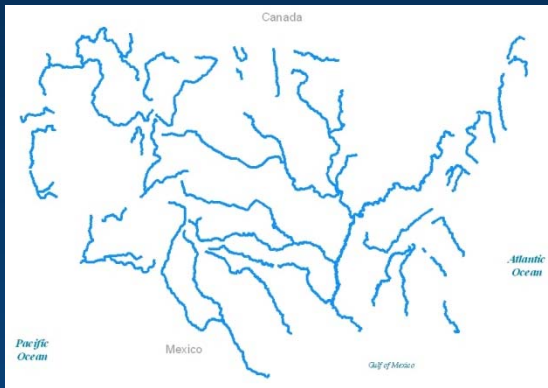


Vector -- Linear

- Points, lines, and polygons
- “Features” (house, lake, etc.)
- Attributes
 - size, type, length, etc.

Five Data Layers

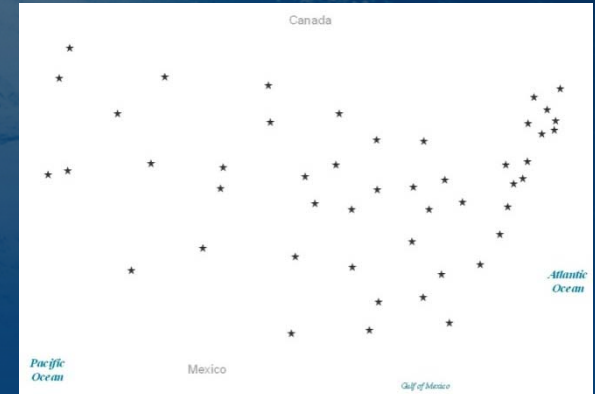
“Alike Features”



Rivers Layer



Lakes Layer



Capitals Layer



Roads Layer

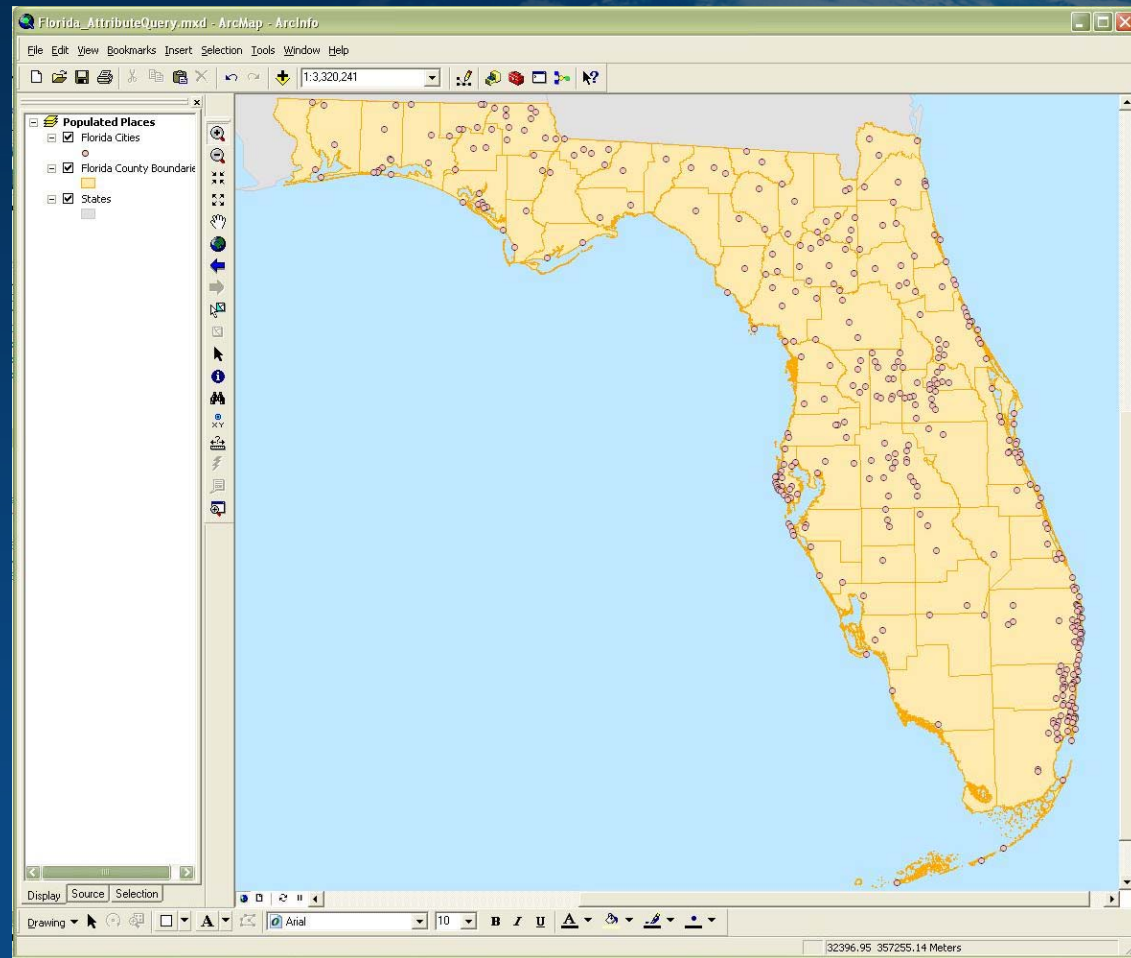


States Layer

- North America
 - Capital Cities
 - Interstate Highways
 - Rivers
 - Lakes
 - USA Boundary
 - State Boundaries
 - States
 - Neighboring Countries



Turning Data Into Information



“Spatial Analysis” -- Not Just a Map

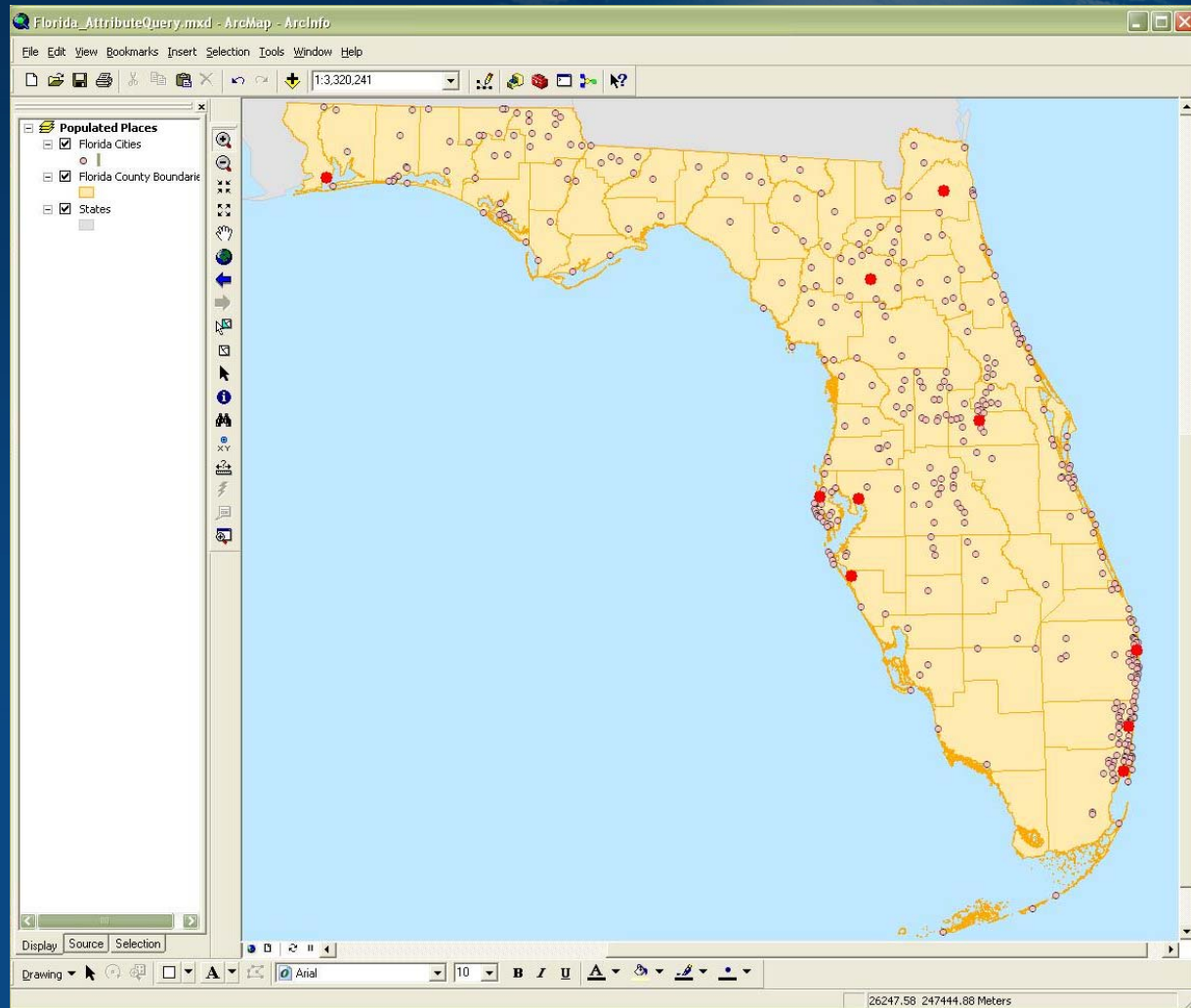
Asking a Question -- Interaction

The screenshot displays the ArcMap interface with a map of Florida. A 'Select By Attributes' dialog box is open, showing the following configuration:

- Layer: Florida Cities
- Method: Create a new selection
- Attributes: "OBJECTID", "FEATURE", "NAME", "POP_RANGE_", "POP_90", "POP_98"
- Operator: >
- Value: 50000
- SQL Statement: `SELECT * FROM Cities WHERE: "POP_98" > 50000`

The map shows 38 red dots representing the selected cities. The status bar at the bottom indicates 'Number of features selected: 38' and '29761.5 244809.44 Meters'.

Maps and Databases are Interactive



The Goal of GIS

The goal of GIS is to help people and companies do their work **better, faster, and cheaper** through

Visualization

- *GIS provides users with quicker, more accurate representations of spatial data*

Database Management

- *GIS makes it easier to keep the spatial data accurate and up to date*

Spatial Analysis

- *GIS helps users make more informed decisions*

Wherever Spatial Data Analysis Is Needed

Some Ways GIS is Used

Emergency Services

- Fire and Police

Environmental

- Monitoring and Modeling

Business

- Site Location, Delivery Systems

Industry

- Transportation, Communication, Mining, Pipelines, Healthcare

Government

- Local, State, Federal, Military

Education

- Research, Teaching Tool, Administration

Defense Management

Camp Swampy Facility Information System - Microsoft Internet Explorer

Camp Swampy

Marine Corps Base

Geographic Information Systems

Select a map set: Base Map

<< Back New Search

Facility Information

NFADB Data

Facility Number:	210770
Name:	MEDICAL-DENTAL CLINIC
Property Record Number:	205642
Housing:	N
Primary Use Code:	55010
Review Date:	1997-12-17
Action Type:	2

Facility Dimensions

Length:	220ft.
Height:	12ft.
Width:	115ft.
Area:	19916Sq. Ft.

Improvements

Year Built:	1966
Year Improved:	1993
Maintenance Group:	M00681

Facility Photos

View Photos

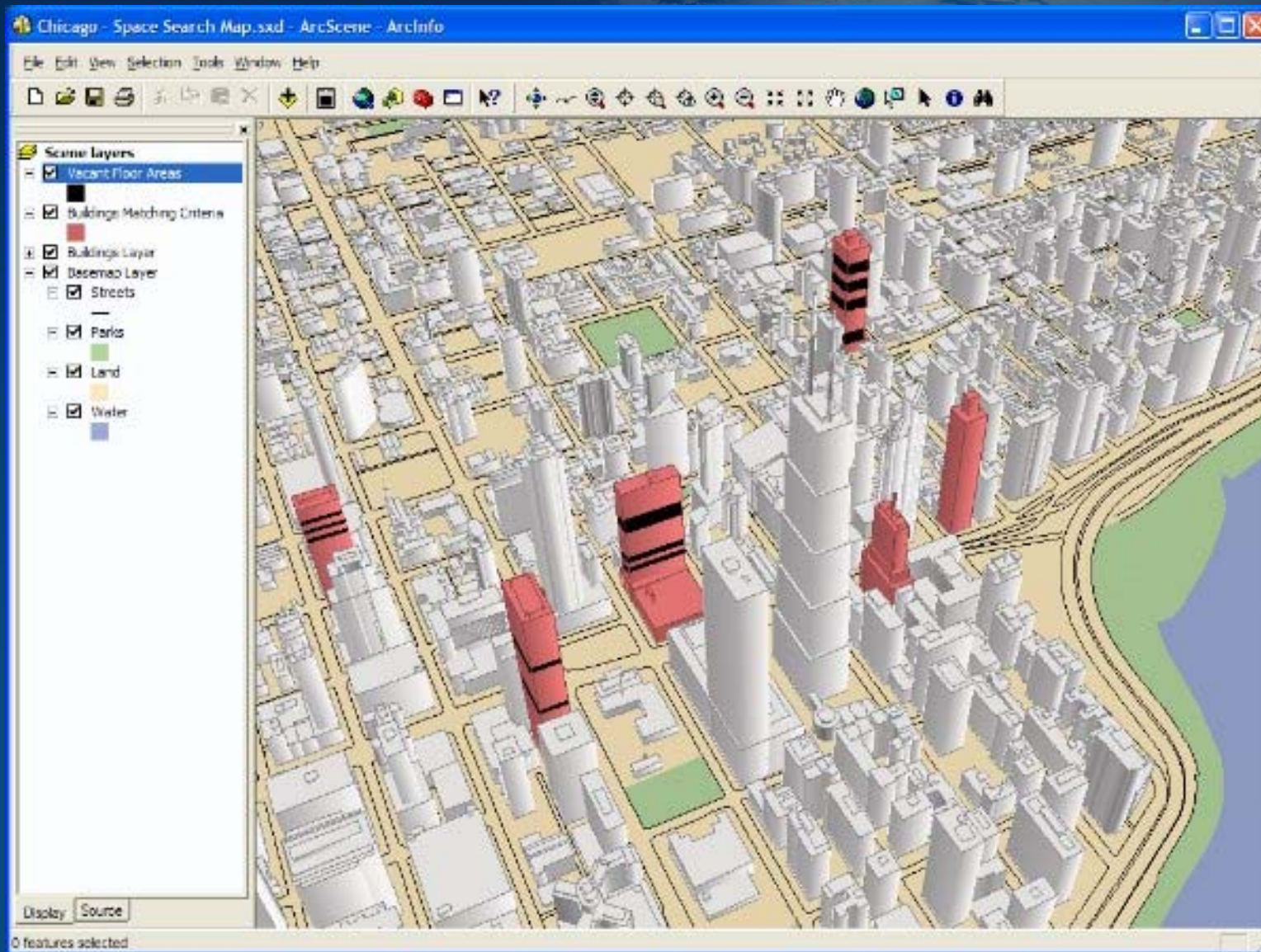
Camp Swampy GIS 2002

Active Map Tool: [Zoom In](#)

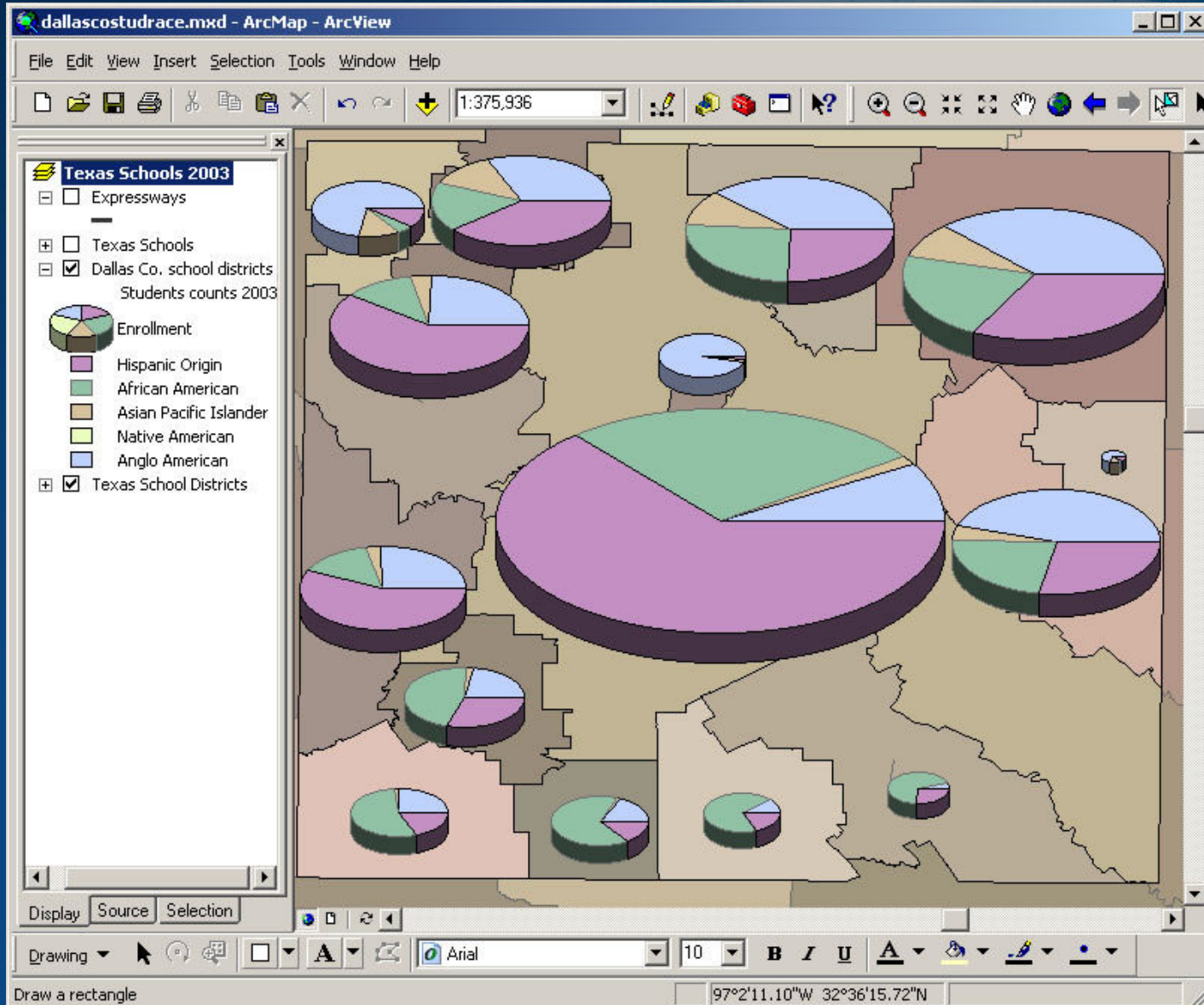
A GIS application designed by TAIC

TAIC ArcIMS Map Application Internet

Real Estate Management



Education

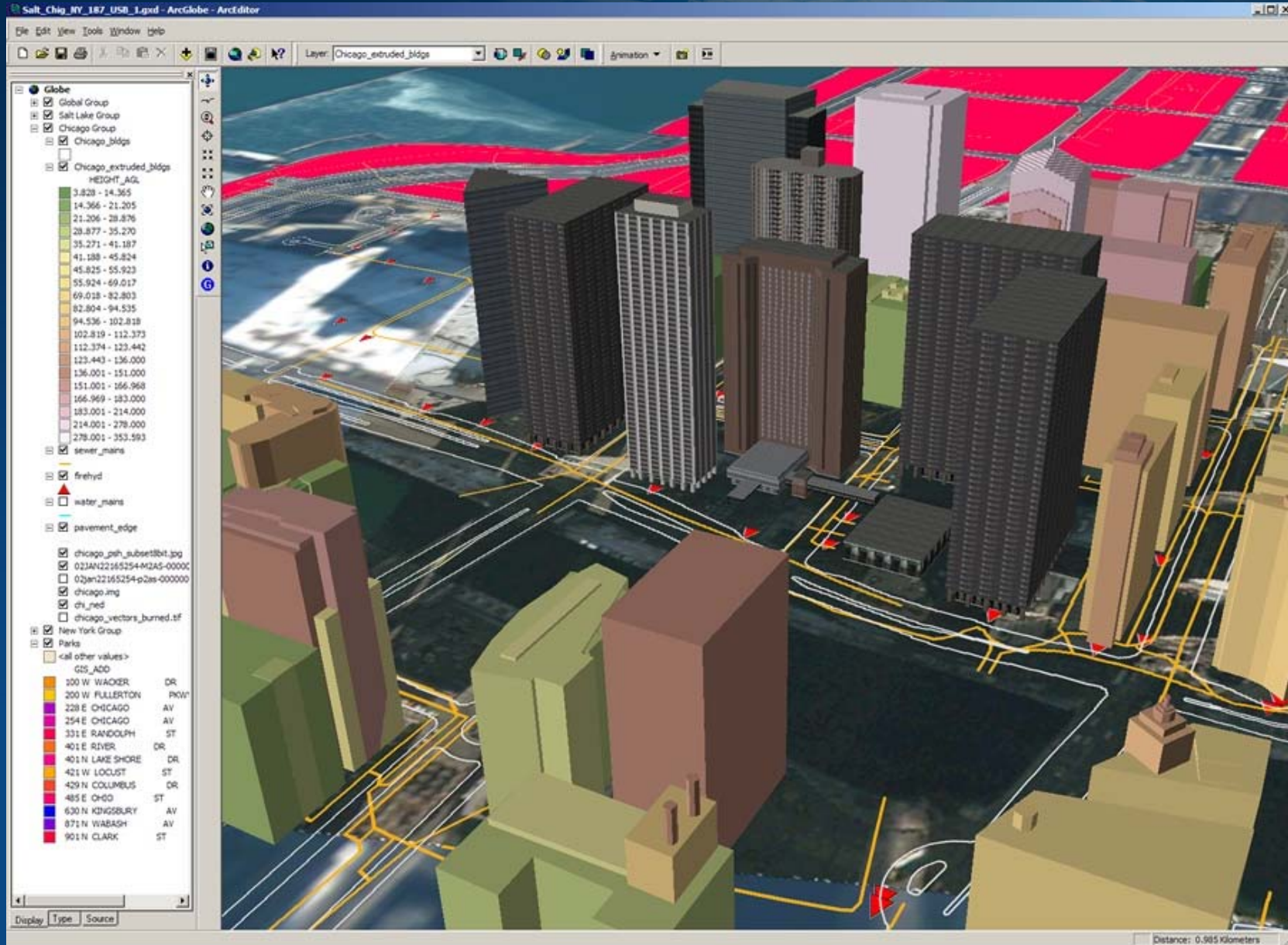


Utility Management

The screenshot displays a web-based utility management application. The main window is titled "Overview - Microsoft Internet Explorer" and shows a map of a residential area with utility lines overlaid. The interface includes several panels:

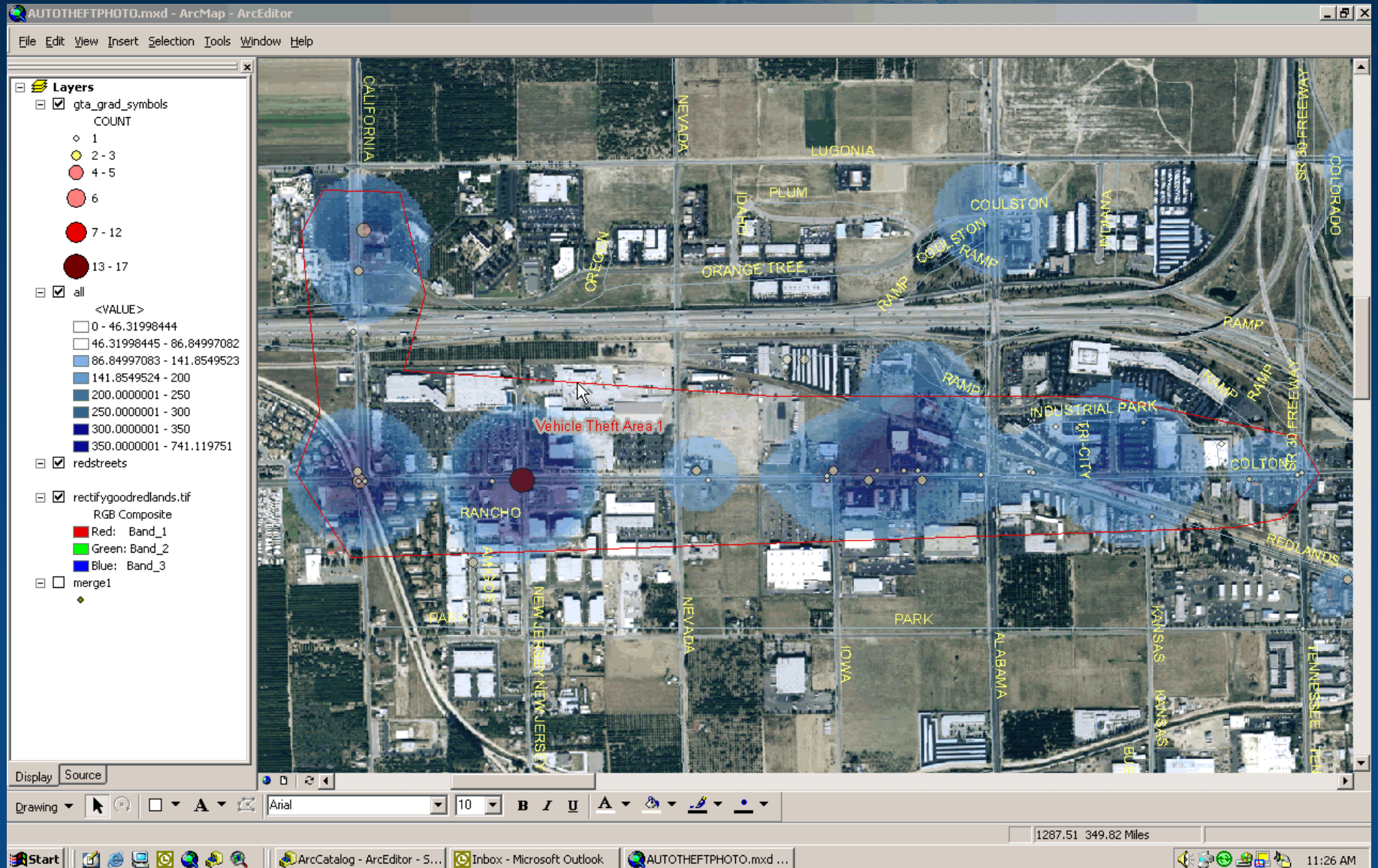
- Executive Viewer:** A top navigation bar with a search bar and user information.
- Tasks:** A list of actions such as "Query: Breaker", "Query: Work Order Status", "Query: Pole Inspection", "Query: Fault Inspection", "Query: Transformer Inspection", "Query: network Trace", "Create Report", and "Change Work Order".
- Results:** A tree view showing a hierarchy of utility components, including "Trace Components", "Meters (13)", "Switches (42)", "Transformers (1)", "Circuit Breakers (1)", "Siding (60)", "Secondary_OG (13)", "Secondary_OH (2)", "Primary_OH (2)", "Primary_OG (77)", "Query: Breaker (1)", and "Circuit Breaker (1)".
- Query: network Trace:** A control panel with options for "Add Flags & Barriers", "Set the Trace Type: Trace Downstream", "Display Layers" (Substations, Circuit Breakers, Switches, Control), and "Trace Settings" (Trace Indeterminate, Flow, Trace End Features Only).
- Map:** An aerial view of a street grid with utility lines in blue and red. Labeled streets include "ELEVENTH ST", "NINTH ST", "VINE ST", "JACK B CLARKE WY", and "SANTA FE AV".

Transportation Management

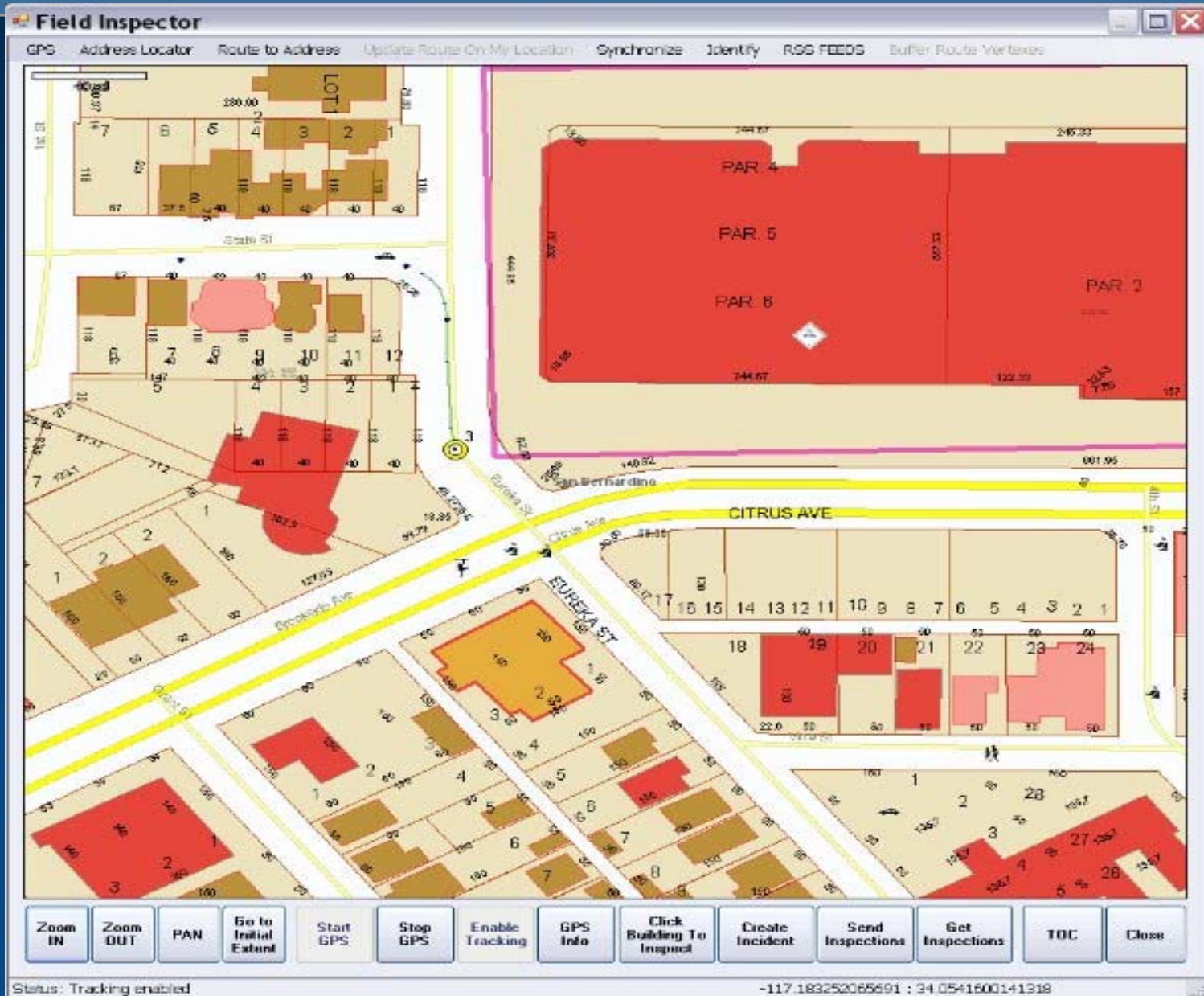


Distance: 0.985 Kilometers

Public Safety



Government



Hospital Facilities

Electronic Bed Board - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: http://www.mga.com/web/bedboardviewer.htm

Electronic Bed Board

Legend

Beds

- Nursery
- Private
- Semi
- Ward

Patients

- 20-bed
- Maternity
- Nursery
- Normal
- Patients

Gender

- Female
- Male

Isolation

- Pending Discharge

Availability

- Available
- Reserved

Negative Atmospheric Pressure Locations:

- 1415 3015
- 2000 2001
- 2002 2003
- 4004 4005

Statistics

	3W	3E	3SD	3BS	3ND	3NO	3SO	4ND	4SD	CCU	NSY	SCN
1001	MED	MED	MED	DIRTY	DIRTY	MED	CLEAN	MED	DIRTY	MED	DIRTY	SCN
1002	DIRTY	MED	MED	CLEAN	DIRTY	MED	MED	CLEAN	DIRTY	CAR	CLEAN	SCN
1003	DIRTY	MED	MED	CSS	CLEAN	MED	SUB	DIRTY	DIRTY	MED	CLEAN	SCN
1004	MED	CAR	MED	CSS	CLEAN	MED	MED	DIRTY	DIRTY	MED	CLEAN	DIRTY
1005	DIRTY	MED	MED	CSS	CLEAN	MED	CLEAN	DIRTY	DIRTY	MED	CLEAN	DIRTY
1006	DIRTY	DIRTY	DIRTY	CSS	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1007	CLEAN	MED	DIRTY	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1008	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1009	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1010	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1011	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1012	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1013	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1014	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1015	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1016	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1017	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1018	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1019	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1020	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1021	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1022	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1023	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1024	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1025	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1026	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1027	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1028	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1029	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1030	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1031	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1032	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1033	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1034	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1035	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1036	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1037	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1038	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1039	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1040	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1041	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1042	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1043	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY
1044	CLEAN	MED	MED	DIRTY	CLEAN	DIRTY	CLEAN	DIRTY	DIRTY	DIRTY	CLEAN	DIRTY

Copyright © 2001, Denver Regional Medical Center, Inc.

Map: 1716.21 - 1953.75 - Image: 564 - 383 - ScaleFactor: 3.0429196758017514

Local Intranet

ArcGIS

ArcGIS provides users with a *complete* GIS

- *Visualization*
- *Database Management*
- *Spatial Analysis*

ArcGIS offers more than just GIS software
offers GIS solutions.

The goal is to make users more successful

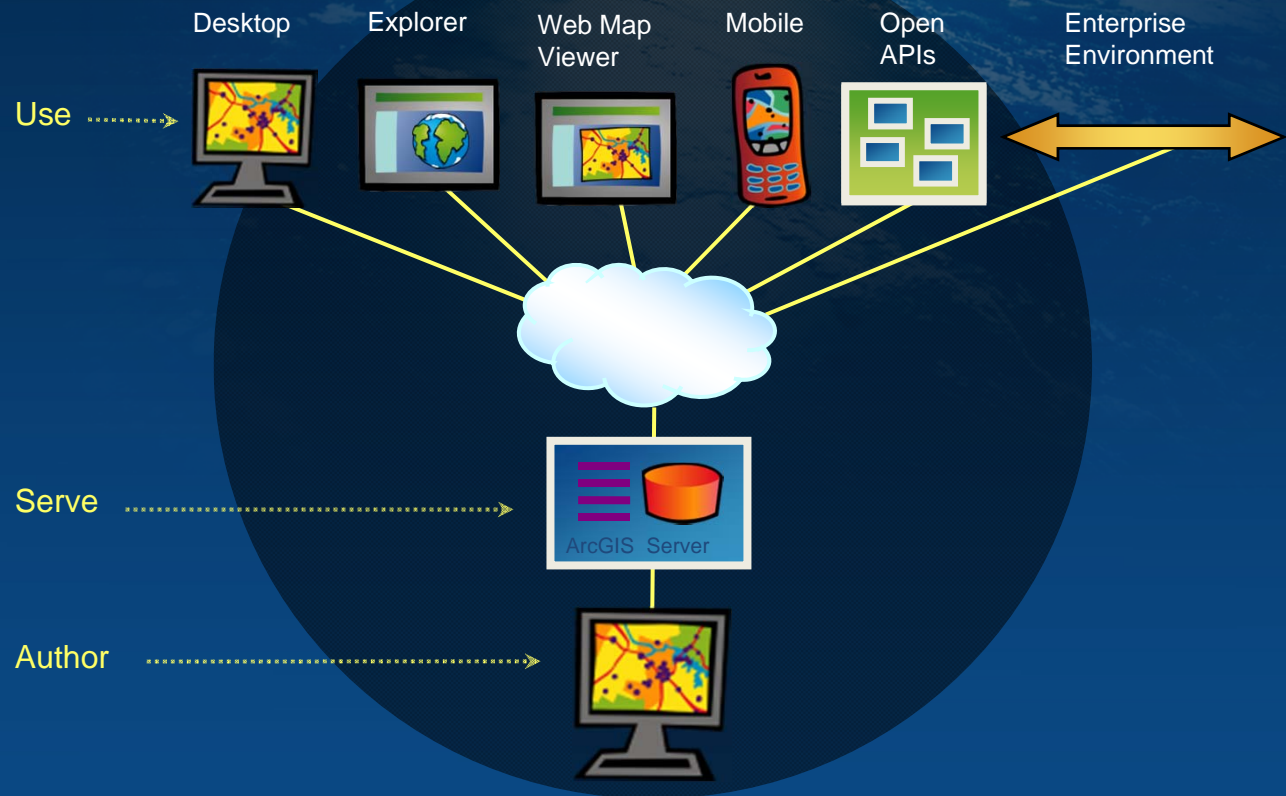
ArcGIS Family of Products



ArcGIS Server Platform

Author/Serve/Use

- Maps
- Data
- Models
- Globes
- Metadata



Making GIS Knowledge Available To Anyone . . .
. . . Integrates With Other Systems Via Standards

NCDOT IT GIS UNIT

NCDOT GIS Standards and Practices

As part of the North Carolina Department of Transportation's efforts to maximize the value of our investment in Geographic Information Systems (GIS), data management, and access to data, we have developed geospatial standards and practices. The purpose of these standards and practices is to provide users with necessary information about the data, to support improved linking of different data sets, and to better manage the Department's GIS investments.

NCDOT IT GIS UNIT

Visit our website at

<http://www.ncdot.org/it/gis/>

Email us at

www.gishelp@ncdot.gov