

**Massachusetts Institute of Technology  
Department of Urban Studies and Planning**



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**11.204: Planning, Communication, and Digital Media  
Fall 2004**

**Recitation 9: Technical Tips for Project 2 Work**

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**1. Ortho Photo Button**

**Using ortho photo tool on ArcMap.**

With the MIT ortho tool, you can download a layer of ortho (aerial) photos automatically into your own map.

**How to install:**

1. Start ArcMap
2. Open "View" -> "Toolbars" in the main menu. Choose "MITOrthoTool."
3. Now you see a new button "Add Ortho Image" as a toolbar.

**How to add an ortho photo:**

1. Open a map document [the MIT Server\Data\Recitation9\Recitation9.mxd]
2. Click the "Add Ortho Image" button. Wait for a while until the image data is loaded. That's it!
3. If you need to reload (refresh) the map image, click the button again.

With this tool, you can create cool thematic maps embedded over an aerial photo, like an example shown below:



**Things to remember:**

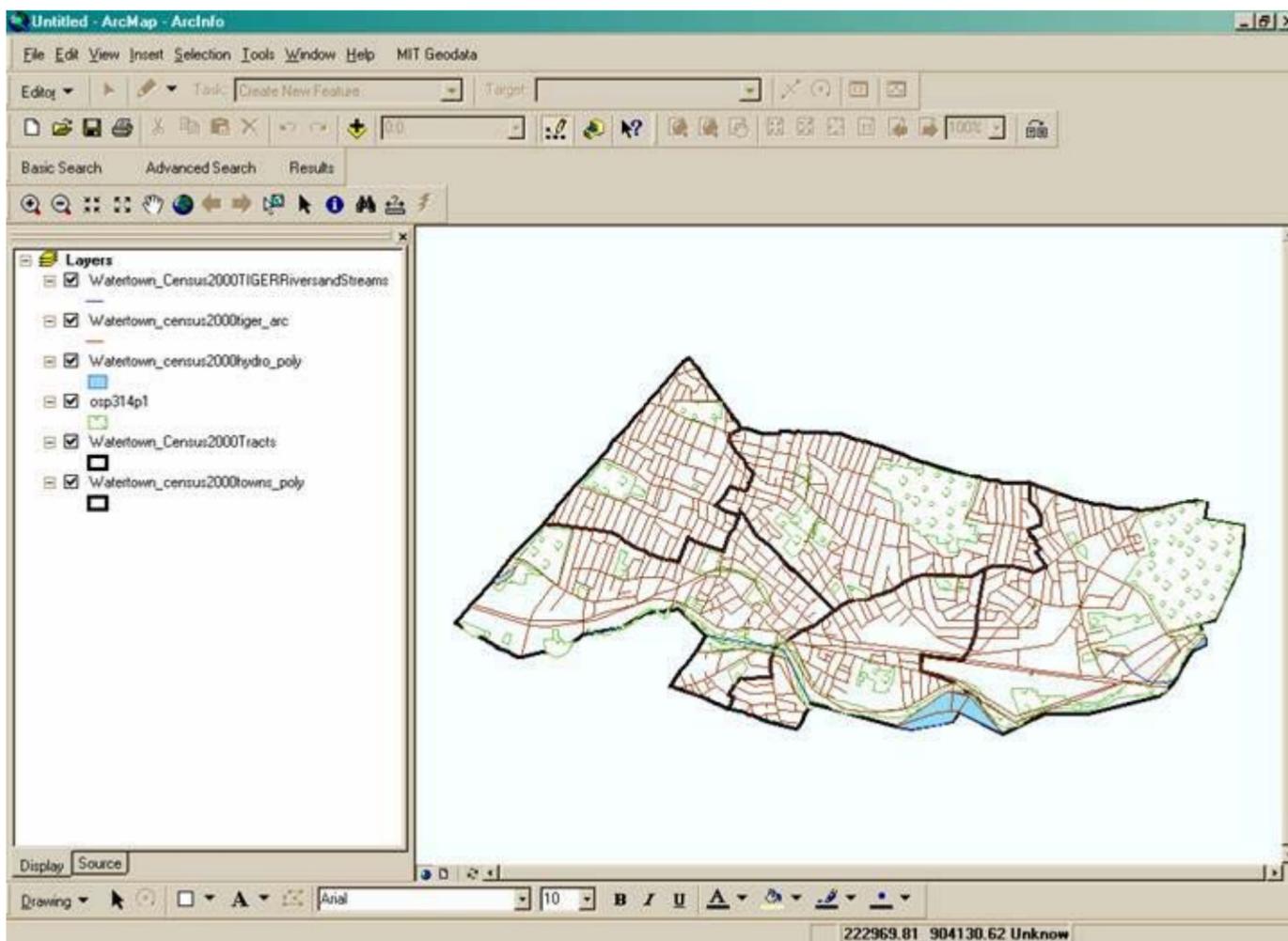
1. You need a map open in ArcMap before you add an orthophoto because the orthophoto tool chooses the correct orthophoto based on the coordinate system in your ArcMap dataframe.
2. As far as we know the MIT Orthophoto Tool can only add Massachusetts orthophotos which are restricted to the Boston Metropolitan Area. It does not work for other parts of the globe.

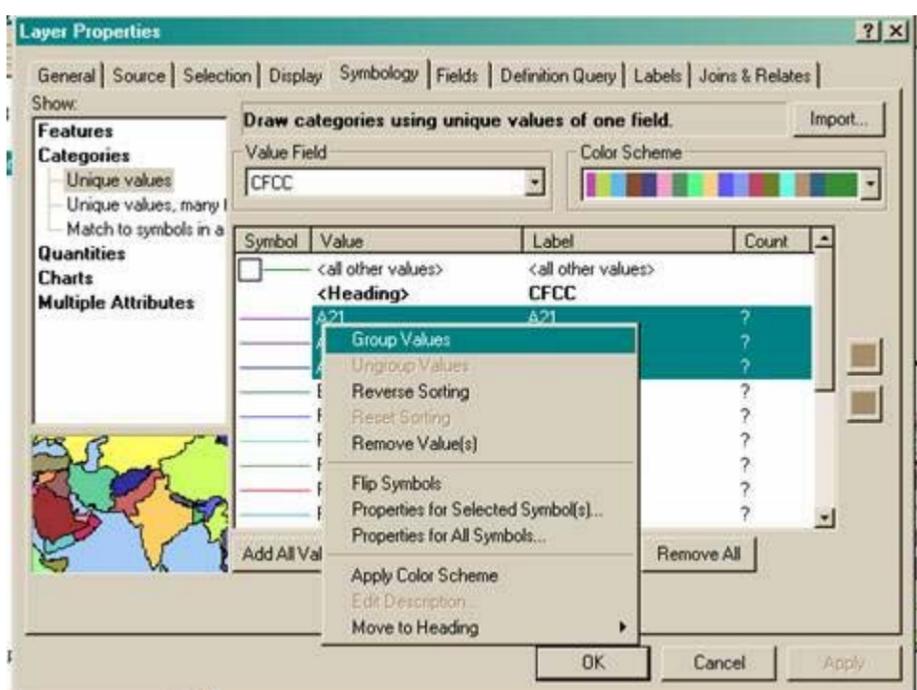
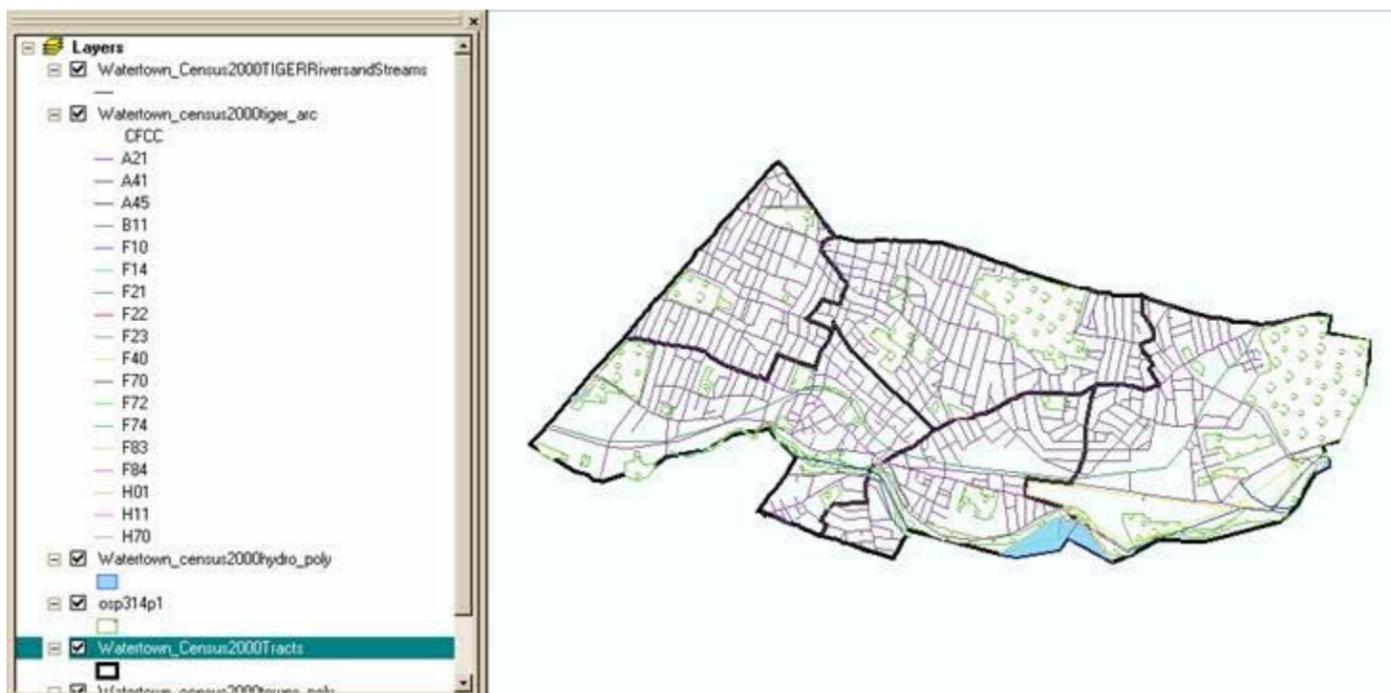
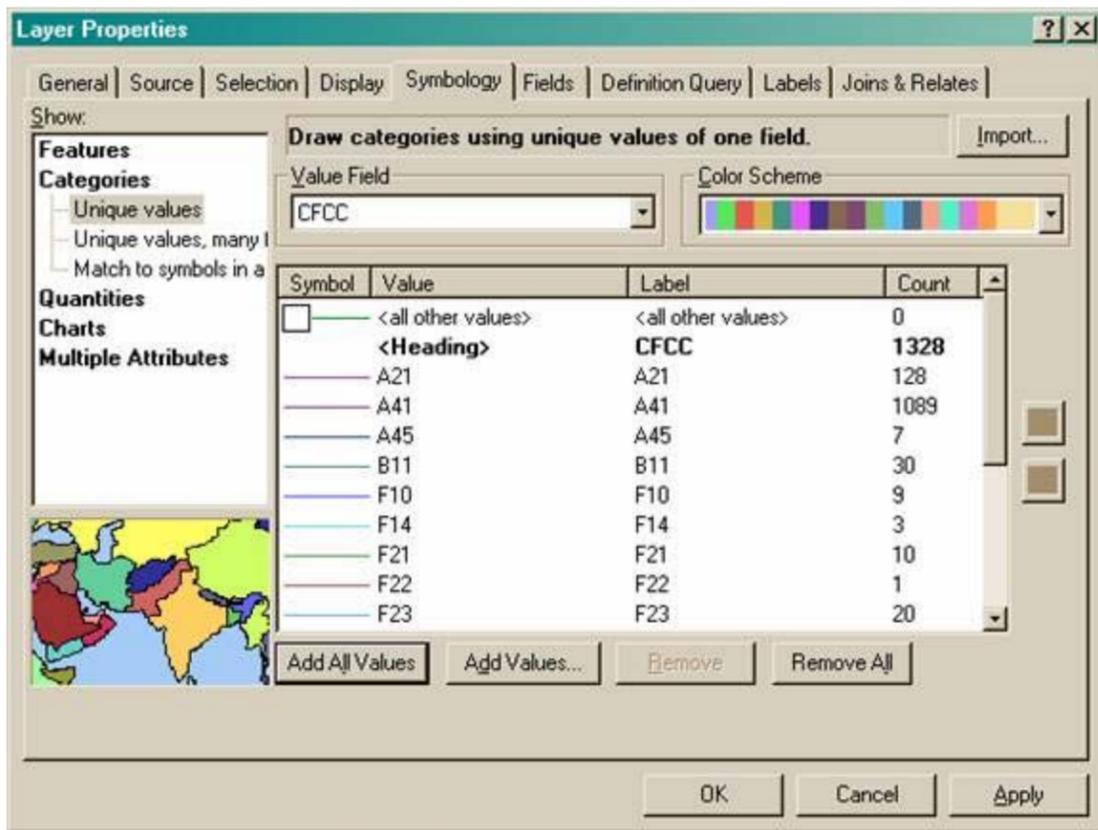
For more information about the ortho photo, visit <http://ortho.mit.edu/>.

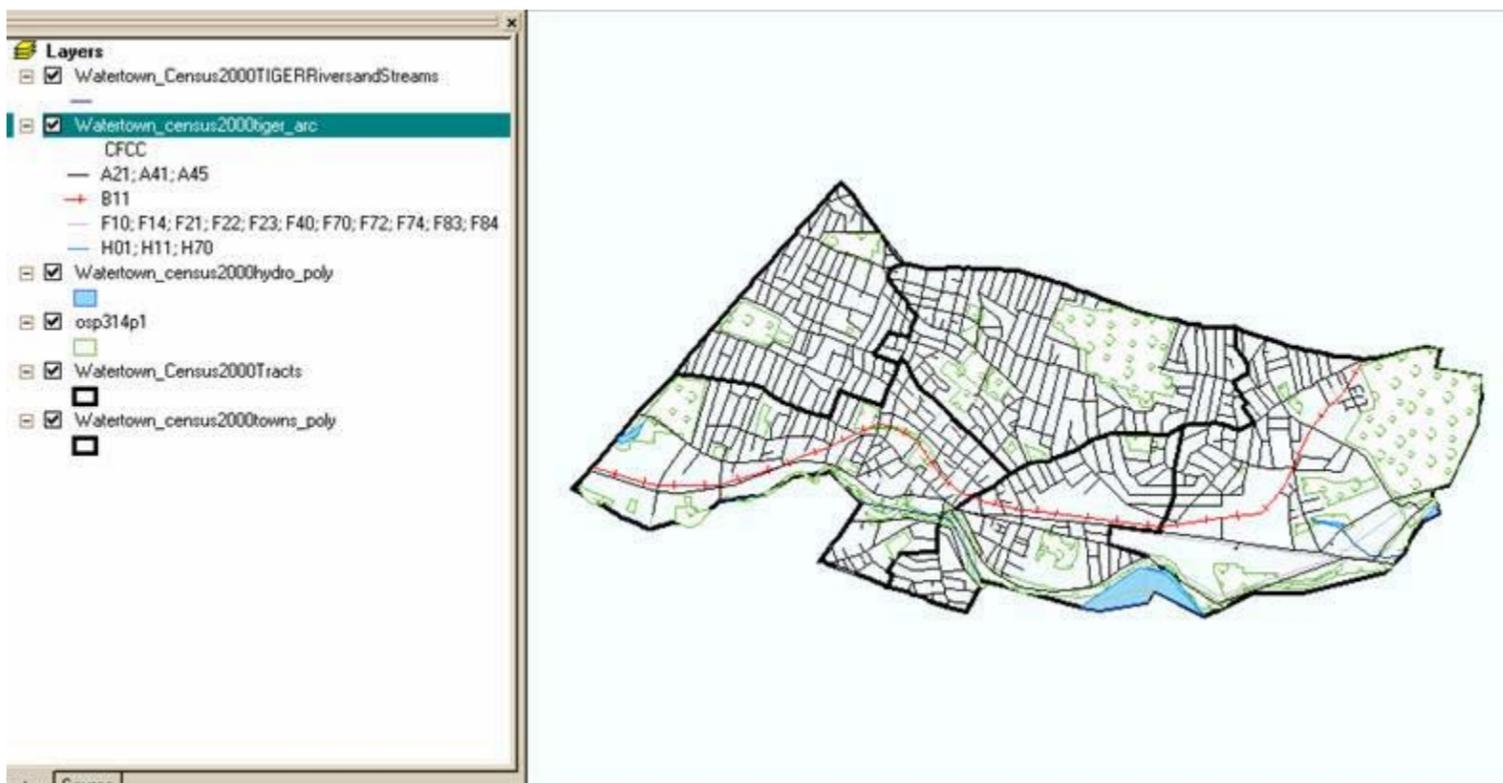
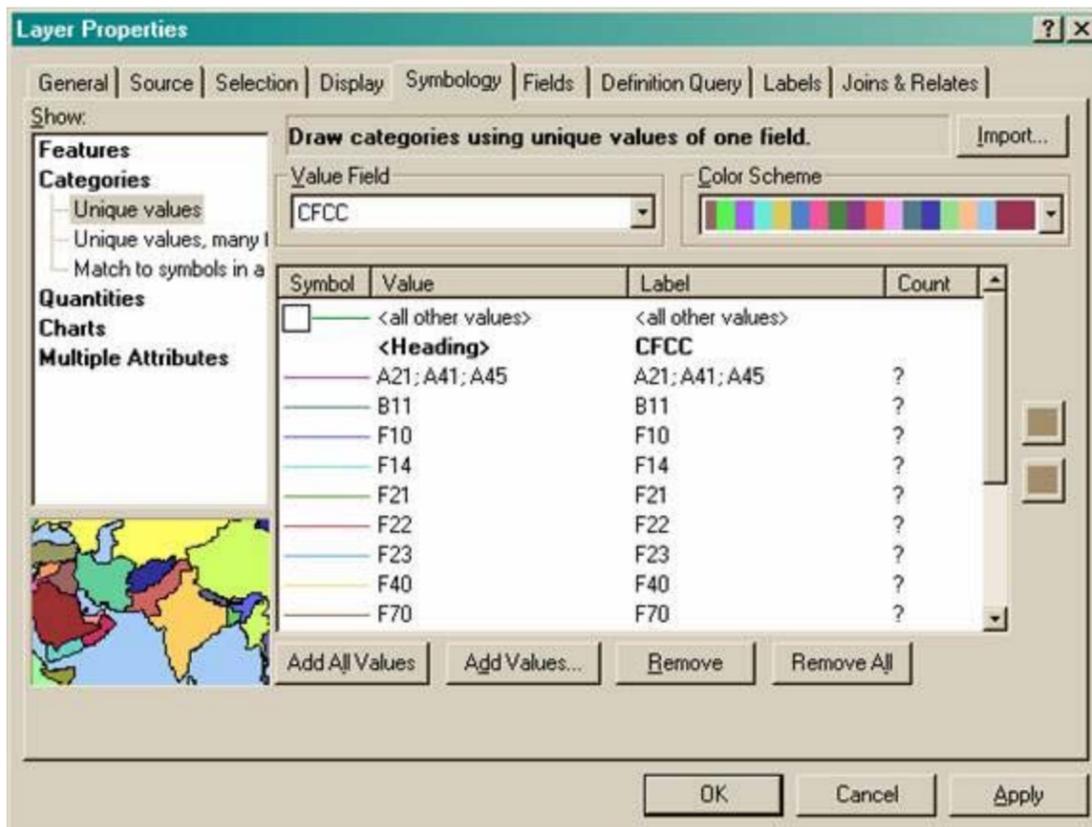
## 2. Group By

ArcMap allows you to group values of an attribute for display so you can categorize values of an attribute and assign one symbol to the category.

1. Open Map Document (Recitation9.mxd) in [the MIT Server\Data\Recitation9\Recitation9.mxd] and Activate the Watertown Data Frame.
2. Make the Watertown\_census2000tiger\_arc layer active by clicking on it.
3. Right-click and choose Properties and then select the Symbology tab.
4. In the Value Field box, scroll down to CFCC and hit the Add All Values button. Be sure to remove the checkmark in the box beside <all other values>.
5. Now if you look back at the Map Document, you will see multiple values underneath the Watertown\_census2000tiger\_arc layer. You should also notice that some of the values have a first letter in common, i.e. A, B, F, etc. This first letter is what we will use to group by.
6. Navigate back to the Symbology tab and using the Shift or Control key, select all the values that begin with "A" then right-click and choose Group Values. You should now see that all of the values that began with an A have been given the same symbol. You can now change the appearance of the symbol.
7. Repeat the same process for the remaining values in the Watertown\_census2000tiger\_arc layer.
8. After repeating the process, you should now see that Watertown\_census2000tiger\_arc layer has only 4 values displayed in the table of contents instead of 18 values. You can also change their names from A21, A41, A45 to Access Roads.





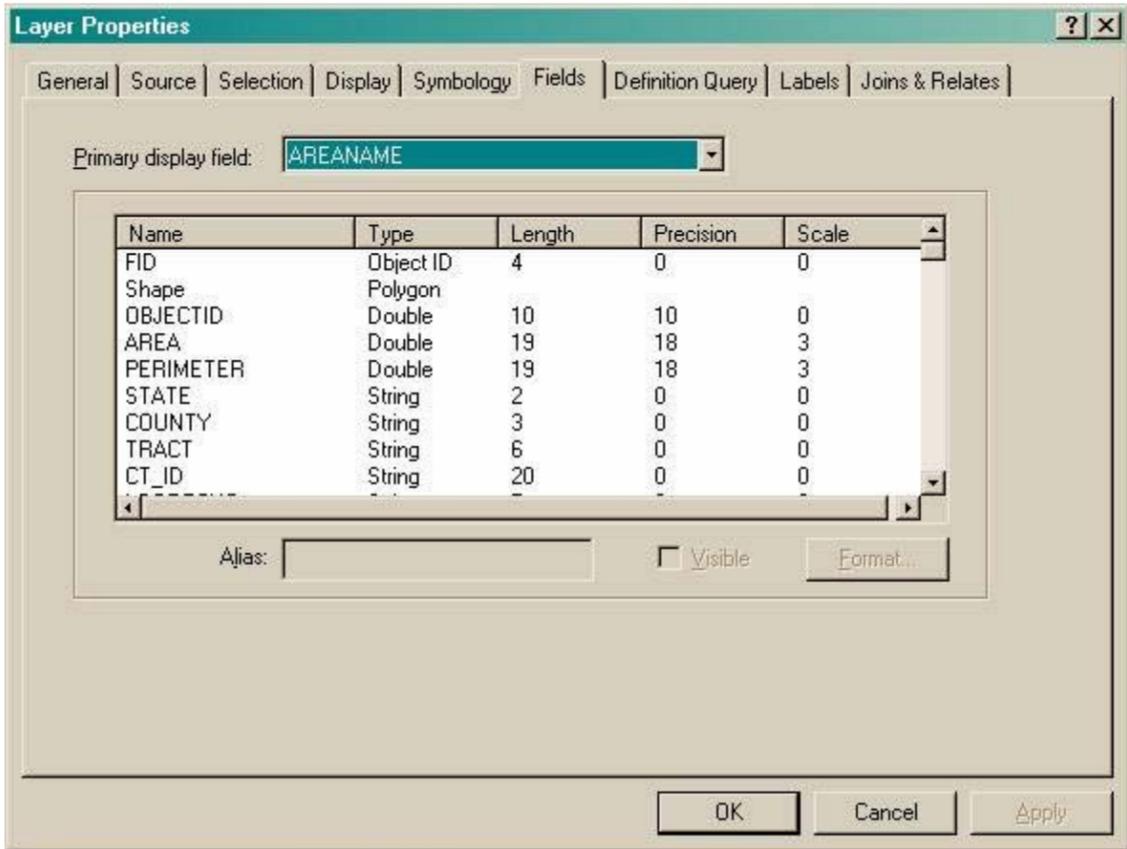


### 3. Creating Aliases for Attribute Field Names

You can change the census code names for fields to something understandable. Here's how to do it.

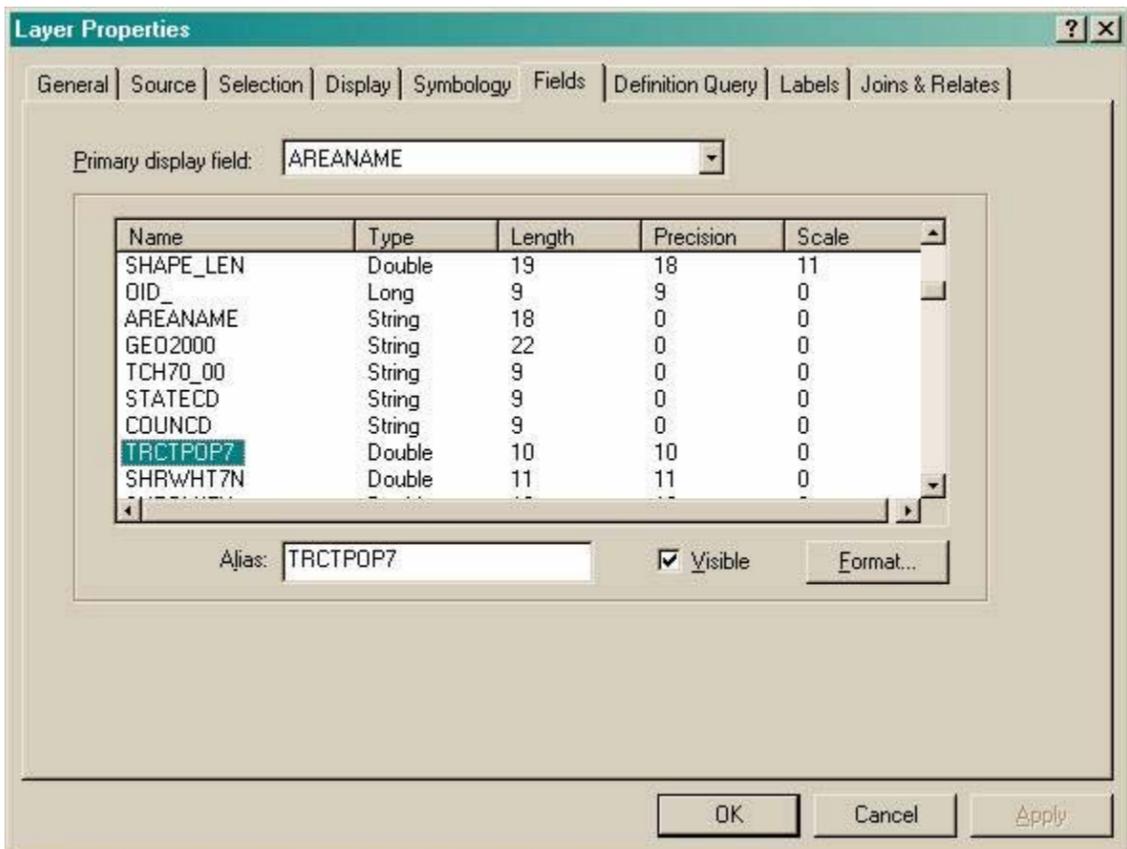
1. Right-click on the Watertown\_Census2000Tracts name in the table of contents.
2. Open Properties.
3. Click on the Fields tab.
4. Click on the name of the field you want to assign a new name to and type in the alias name in the "Alias:" box.
5. Click Apply.
6. Give TRCTPOP7, the alias "Total Population 1970."

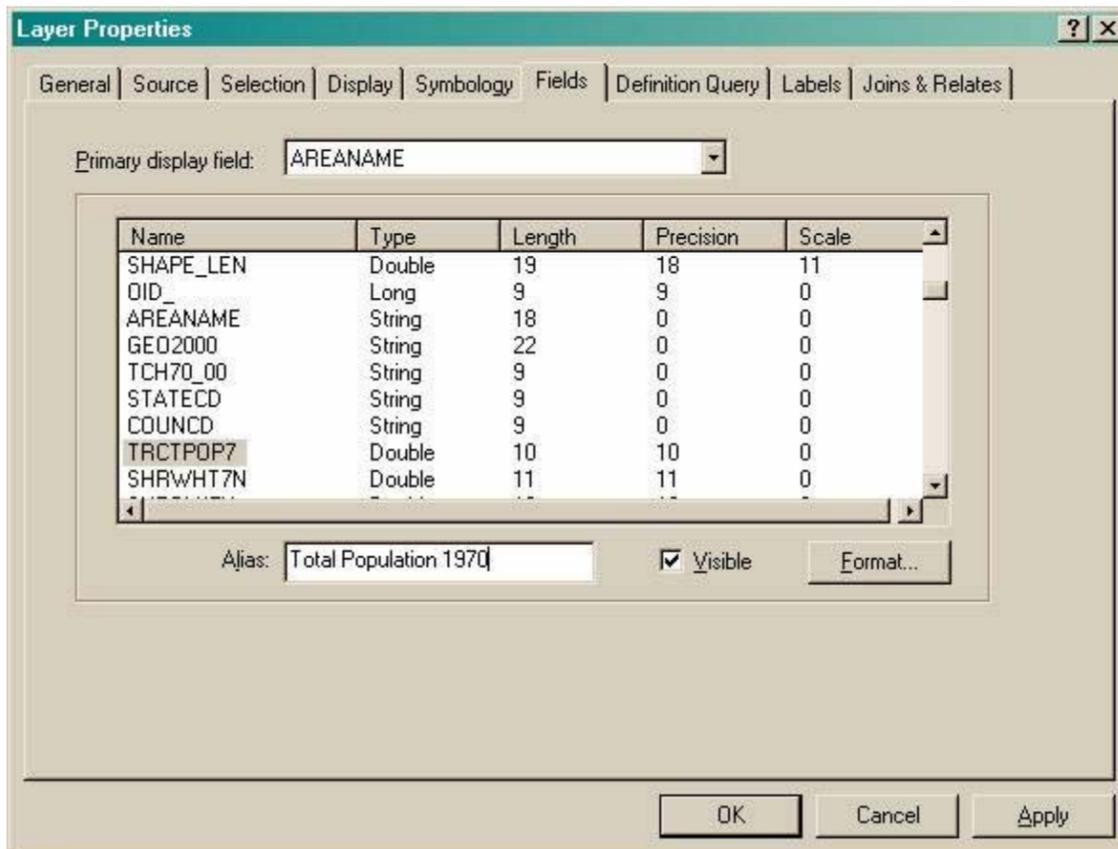
This process can be repeated for the other fields in the table using the Data Labels given in the Data Documentation Section of Project 2.



0Tracts

GEO2000	TCH70_00	STATECD	COUNCD	TRCTPOP7	SHRWHT7N
25017370200	0	25	017	10380	10285
25017370101	4	25	017	8222	8152
25017370102	4	25	017	7743	7677
25017370300	4	25	017	6577	6555
25017370400	4	25	017	6372	6325

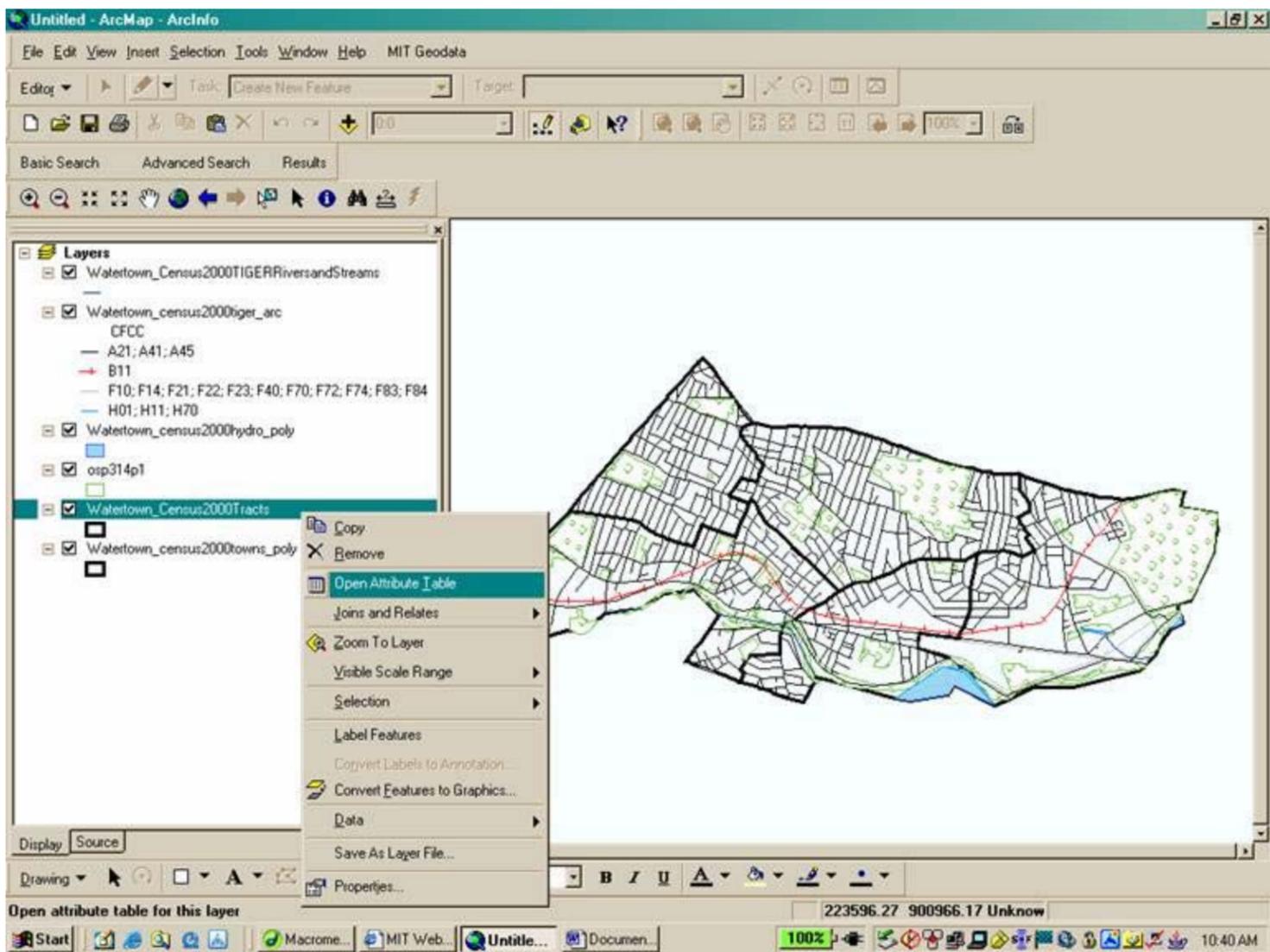




GEO2000	TCH70_00	STATECD	COUNCD	Total Population 1970	SHRWHT7N
25017370200	0	25	017	10380	10285
25017370101	4	25	017	8222	8152
25017370102	4	25	017	7743	7677
25017370300	4	25	017	6577	6555
25017370400	4	25	017	6372	6325

#### 4. Adding and Calculating New Fields in Attribute Table

1. Right click Watertown\_Census2000Tracts in the table of contents and click **Open Attribute Table**
2. Click anywhere on the Attributes of Watertown\_Census2000Tracts table , Click **Options** and **Add Field**.
3. In the Add Field Window, key in **PCNT\_POPCHG7080** as the Name, change the type to **Long Integer**, and click **OK**
  1. Message that name is too long appears, either accept the default name from ArcMap or try again. We'll try again with **PCTPOP7080**.
  2. With a type other than Long Integer, you have the option to set the Precision and Scale. Precision is the display width of the field, so how long should it be. Scale is the number of decimal places.
4. Scroll to the right in **Attributes of** Watertown\_Census2000Tracts, right click othe column heading for PCTPOP7080, click **Calculate Values**, and **Yes**.
  1. A warning message will appear telling you that you are making a change to the Table of Attributes without being in an editing mode.
  2. So if you make a mistake, then you have to delete the whole field and start over again.
  3. An alternative is to go to Editor-->Start Editing which is underneath the File menu.
  4. You can ignore the message about editing in different coordinate system. This would be an issue if our layers were based on different coordinate systems, but they are not for this project. So just click Start Editing.
5. In the **Field Calculator** box, we will be calculating the percentage population change between 1970 and 1980 census tracts. So the expression is  $(([\text{TRCTPOP8}]-[\text{TRCTPOP7}])/[\text{TRCTPOP7}])*100$ . Hit OK.
6. Now that the zeroes have been replaced with values, right click in the table and go to Clear Selection. If you are in editing mode, go to Editor-->Stop Editing. You will be prompted to save your edits.



Attributes of Watertown\_Census2000Tracts

FID	Shape*	OBJECTID	AREA	PERIMETER	STATE	COUNTY	TRACT	CT_ID	LOGREC	BLK_CC
0	Polygon	759	2385563.111	7430.78	25	017	370200	25017370200	0010751	
1	Polygon	757	1432749.701	5673.536	25	017	370101	25017370101	0010741	
2	Polygon	758	2302008.299	8919.315	25	017	370102	25017370102	0010746	
3	Polygon	760	3003815.022	8329.8	25	01			0010760	
4	Polygon	761	1656453.698	7538.057	25	01			0010768	

Record: 1 | Show: All Selected | Records (0 out of 5 Selected)

Attributes of Watertown\_Census2000Tracts

FID	Shape*	OBJECTID	AREA	PERIMETER	STATE	COUNTY	TRACT	CT_ID	LOGREC	BLK_CC
0	Polygon	759	2385563.111	7430.78	25	017	370200	25017370200	0010751	
1	Polygon	757	1432749.701	5673.536	25	017	370101	25017370101	0010741	
2	Polygon	758	2302008.299	8919.315	25	017	370102	25017370102	0010746	
3	Polygon	760	3003815.022	8329.8	25	017			0010760	
4	Polygon	761	1656453.698	7538.057	25	01			0010768	

Record: 1 | Show: All Selected | Records (0 out of 5 Selected)

**Add Field** [X]

Name:

Type:

Field Properties

Precision

OK Cancel

**Add Field** [X]

Name:

Type:

Field Properties

Precision

OK Cancel

**Invalid Field** [X]

The specified field name "PCNT\_POPCHG7080" is invalid because it is too long. Do you want to automatically rename the field to "PCNT\_POPCH"?

Yes No

**Attributes of Watertown\_Census2000Tracts** [X]

	OWNOCC0	BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
▶	1926	7	0	32	49	79	130	300	480	2525	0
	1638	0	28	53	243	149	300	773	635	740	0
	1197	17	55	118	296	381	298	556	384	997	0
	1101	9	10	101	519	223	161	220	329	1400	0
	1024	0	18	0	26	265	203	179	268	1452	0

Record: [Navigation] 1 [Navigation] Show: All Selected Records (0 out of 5 Selected.) Options

OWNOCCO	BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
1926	7	0	32	49	79	130	300	480	2525	0
1638	0	28	53	243	149	300	773	635	740	0
1197	17	55	118	296	381	298	556	384	997	0
1101	9	10	101	519	223	161	220	329	1400	0
1024	0	18	0	26	265	203	179	268	1452	0

Record: 0 Show: All Selected Records (0 out of 5 Selected.) Options

OWNOCCO	BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
1926	7	0	32	49	79	130	300	480	2525	0
1638	0	28	53	243	149	300	773	635	740	0
1197	17	55	118	296	381	298	556	384	997	0
1101	9	10	101	519	223	161	220	329	1400	0
1024	0	18	0	26	265	203	179	268	1452	0

Record: 0 Show: All Selected Records (0 out of 5 Selected.) Options

- Sort Ascending
- Sort Descending
- Summarize...
- Calculate Values...
- Statistics...
- Freeze/Unfreeze Column
- Delete Field

**Field Calculator**

You are about to do a calculate outside of an edit session. This method is faster than calculating in an edit session, but there is no way to undo your results once the calculation begins. Do you wish to continue?

Yes No

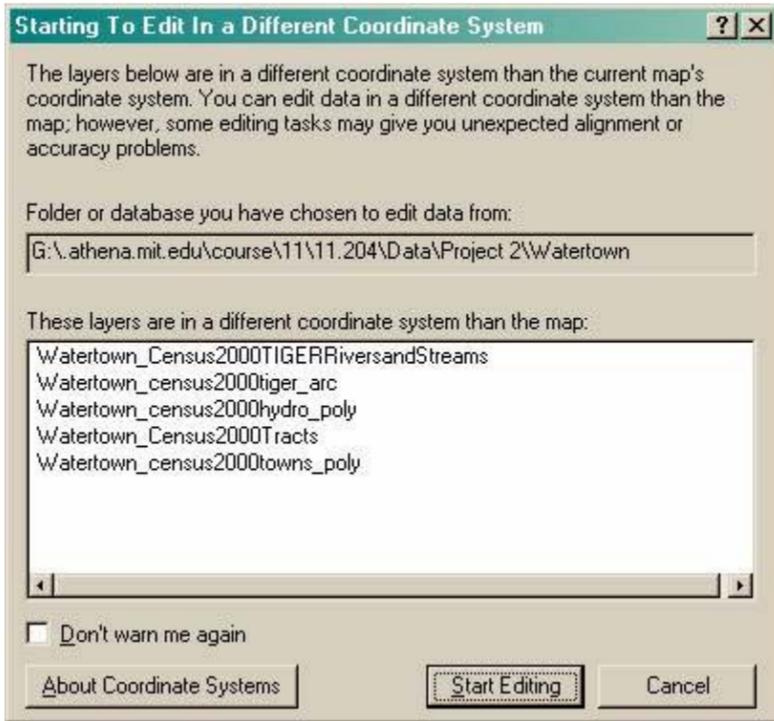
Untitled - ArcMap - ArcInfo

File Edit View Insert Selection Tools Window Help MIT Geodata

Editor Task: Create New Feature Target: [ ]

Start Editing  
Stop Editing  
Save Edits  
Move  
Split  
Divide  
Buffer  
Copy Parallel  
Merge  
Union  
Intersect  
Clip  
More Editing Tools  
Validate Features  
Snapping  
Options

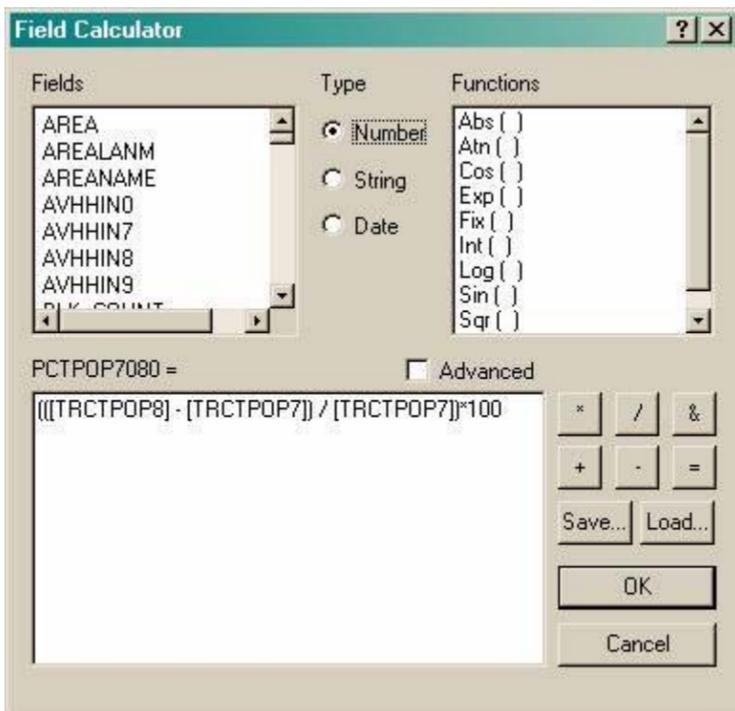
BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
7	0	32	49	79	130	300	480	2525	0
0	28	53	243	149	300	773	635	740	0
17	55	118	296	381	298	556	384	997	0
9	10	101	519	223	161	220	329	1400	0
0	18	0	26	265	203	179	268	1452	0



**Attributes of Watertown\_Census2000Tracts** [?] [X]

OWNOCC0	BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
1926	7	0	32	49	79	130	300	480	2525	0
1638	0	28	53	243	149	300	773	635	740	0
1197	17	55	118	296	381	298	556	384	997	0
1101	9	10	101	519	223	161	220	329	1400	0
1024	0	18	0	26	265	203	179	268	1452	0

Record: [0] Show: [All Selected] Records (0 out of 5 Selected) Options



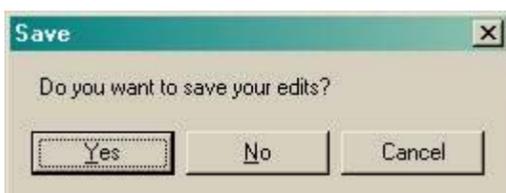
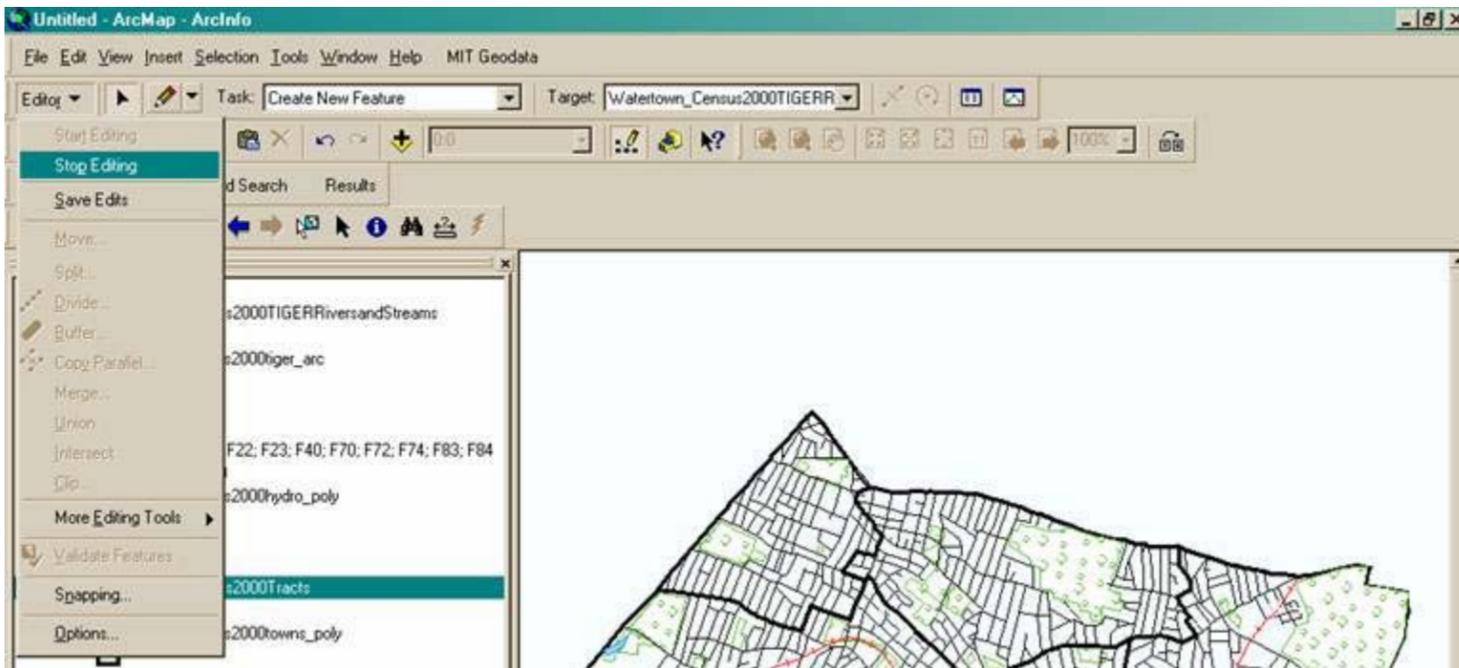
OWNOCCO	BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
1926	7	0	32	49	79	130	300	480	2525	-11
1638	0	28	53	243	149	300	773	635	740	-14
1197	17	55	118	296	381	298	556	384	997	-14
1101	9	10	101	519	223	161	220	329	1400	-15
1024	0	18	0	26	265	203	179	268	1452	-9

Record: 0 Show: All Selected Records (0 out of 5 Selected.) Options

OWNOCCO	BLTYR000	BLTYR980	BLTYR940	BLTYR890	BLTYR790	BLTYR690	BLTYR590	BLTYR490	BLTYR390	PCTPOP7080
1926	7	0	32	49	79	130	300	480	2525	-11
1638	0	28	53	243	149	300	773	635	740	-14
1197	17	55	118	296	381	298	556	384	997	-14
1101	9	10	101	519	223	161	220	329	1400	-15
1024	0	18	0	26	265	203	179	268	1452	-9

Record: 0 Show: All Selected Records (0 out of 5 Selected.) Options

- Find & Replace...
- Select By Attributes...
- Select All
- Clear Selection**
- Switch Selection
- Add Field...
- Related Tables
- Create Graph...
- Add Table to Layout
- Reload Cache
- Export...
- Appearance...

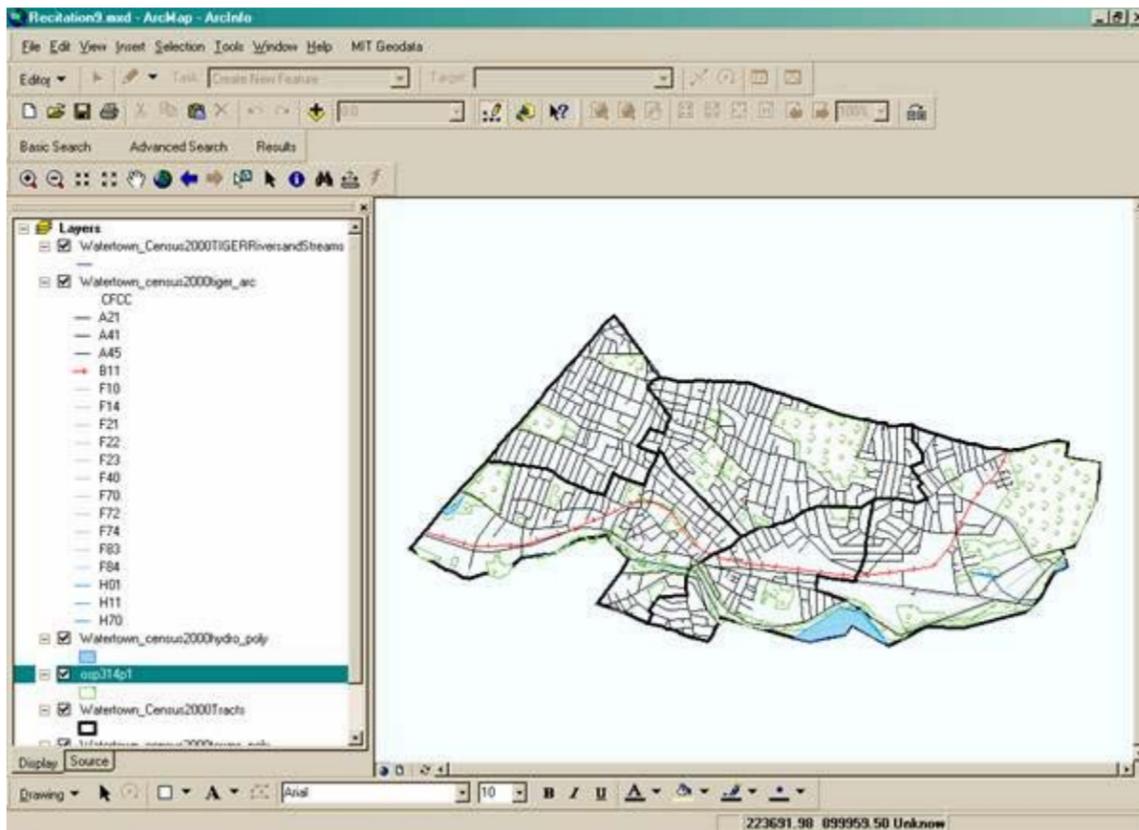


## 5. Using Select Options to Create New Spatial Data Layers

## 5.1 Use ArcMap's Select by Attributes Capabilities

Here you will use ArcMap's Select By Attributes function to create a layer of playgrounds in Watertown which was extracted from the Watertown Open Space layer.

1. Make the osp314p1 layer active and go to the Selection Menu and navigate to Select by Attributes.
2. A Select by Attributes Window will appear and this is where you enter your criteria for selecting the attributes that your new layer is based on.
3. In the Fields column (left hand column), scroll down to "SITE\_NAME" and highlight it, you will see in the righthand column called Unique Values, all the values for the SITE\_NAME attribute appear.
4. Because we want all the playgrounds in the layer, our criteria is based on looking for the word "PLAYGROUND" in any of the unique values. So our expression is "SITE\_NAME" LIKE '% PLAYGROUND' then hit APPLY. The percent symbol (%) acts a wildcard to select any instances of PLAYGROUND appearing in the SITE\_NAME attribute field.
5. Once you hit APPLY and CLOSE, you will see all of the open space polygons with "PLAYGROUND" in their SITE\_NAME highlighted in aqua. To turn them into a new layer, right click on osp314p1 layer and go to Data-->Export Data. You will then be prompted to save the layer to the appropriate location and add it to the data frame.
6. Be sure to go to Selection --> Clear Selected Features when you are done.



**Select By Attributes** [?] [X]

Query Wizard...

Layer: osp314p1

Method: Create a new selection

Fields: "FID", "AREA", "PERIMETER", "OSP\_", "OSP\_ID", "TOWN\_ID", "POLY\_ID", "COUNTY\_COD", "SCORP\_ID", "FEE\_OWNER"

Unique values: 0, 1, 2, 3, 4, 5, 6, 7, 8

SQL Info... Complete List

SELECT \* FROM osp314p1 WHERE:

Clear Verify Help Load... Save... Apply Close

**Select By Attributes** [?] [X]

Query Wizard...

Layer: osp314p1

Method: Create a new selection

Fields: "GRANTSTAT1", "GRANTPROG2", "GRANTSTAT2", "SITE\_NAME", "AREA\_ACRES", "ASSESS\_ACR", "DEED\_ACRES", "PROJ\_ID1", "PROJ\_ID2", "PROJ\_ID3"

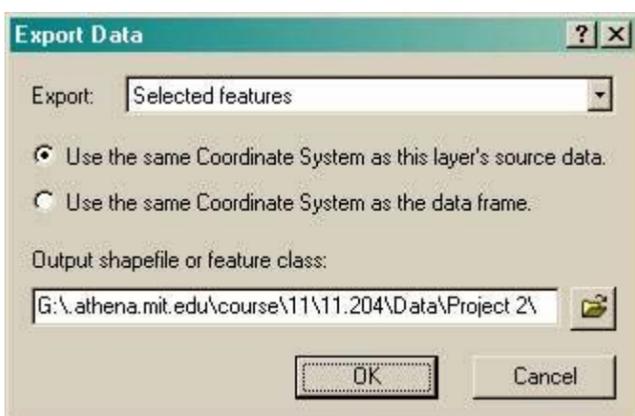
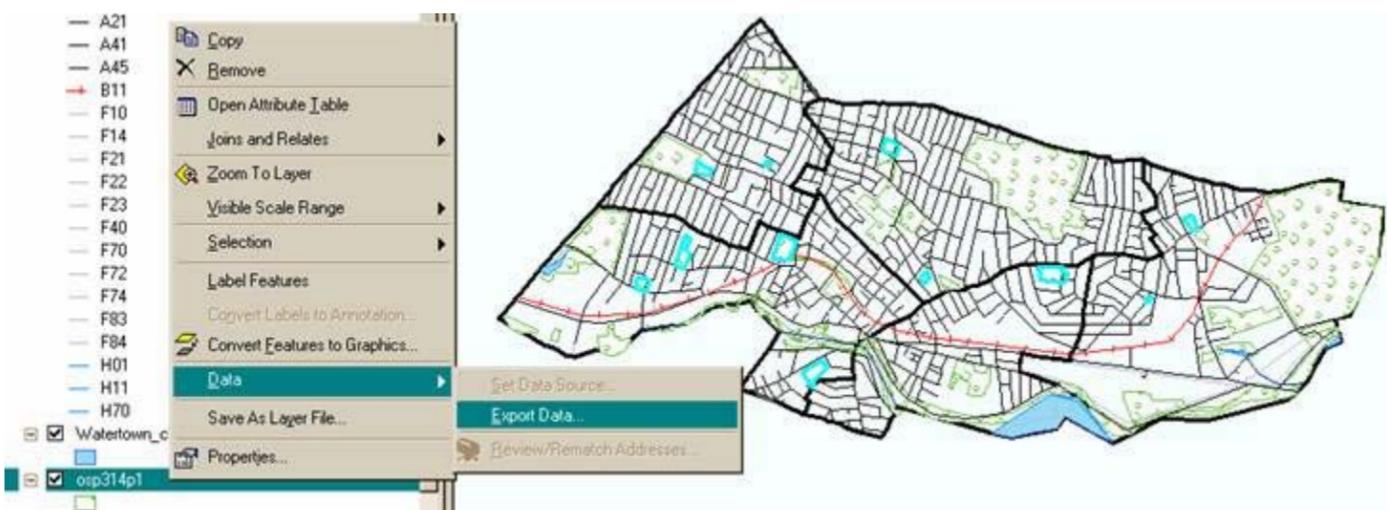
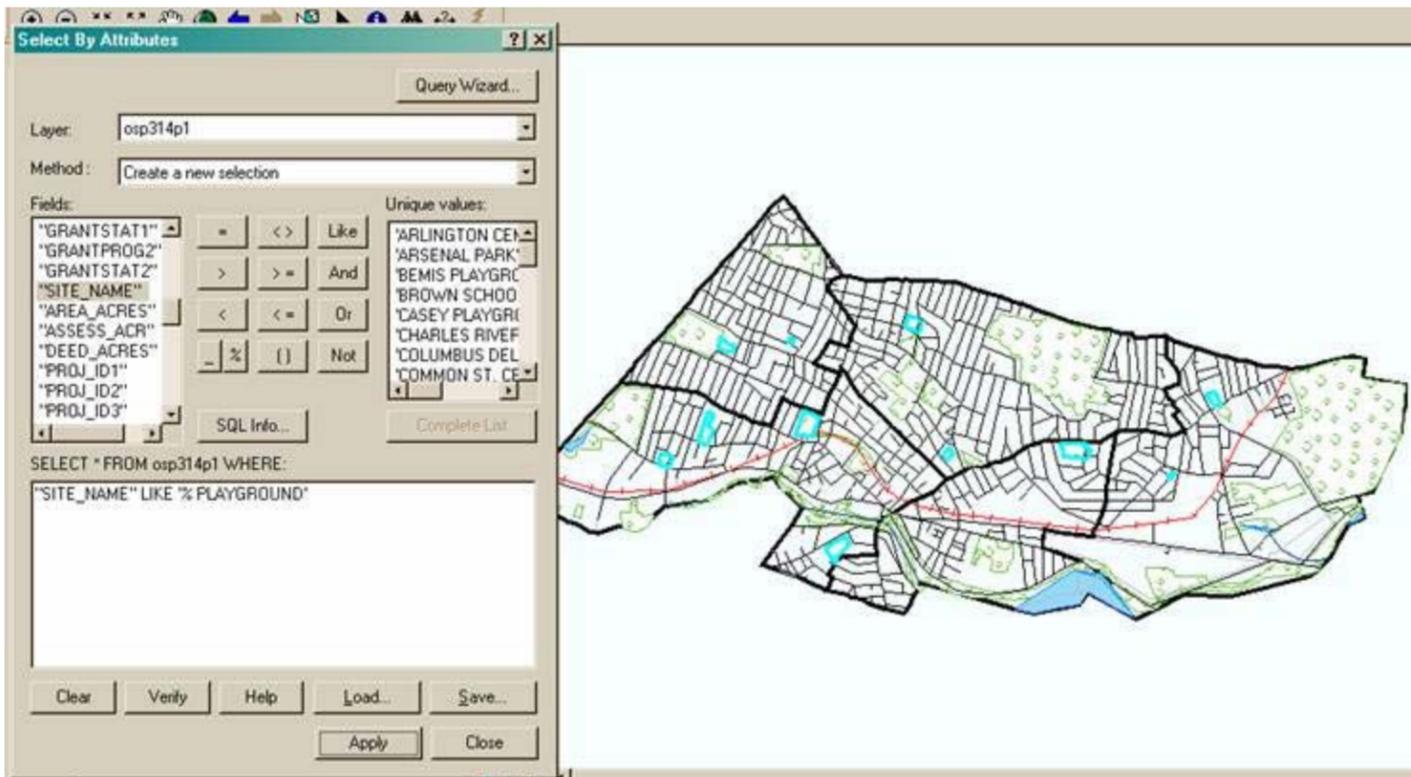
Unique values: 'ARLINGTON CEM', 'ARSENAL PARK', 'BEMIS PLAYGRC', 'BROWN SCHOO', 'CASEY PLAYGRI', 'CHARLES RIVEF', 'COLUMBUS DEL', 'COMMON ST. CE'

SQL Info... Complete List

SELECT \* FROM osp314p1 WHERE:

"SITE\_NAME" LIKE '% PLAYGROUND'

Clear Verify Help Load... Save... Apply Close

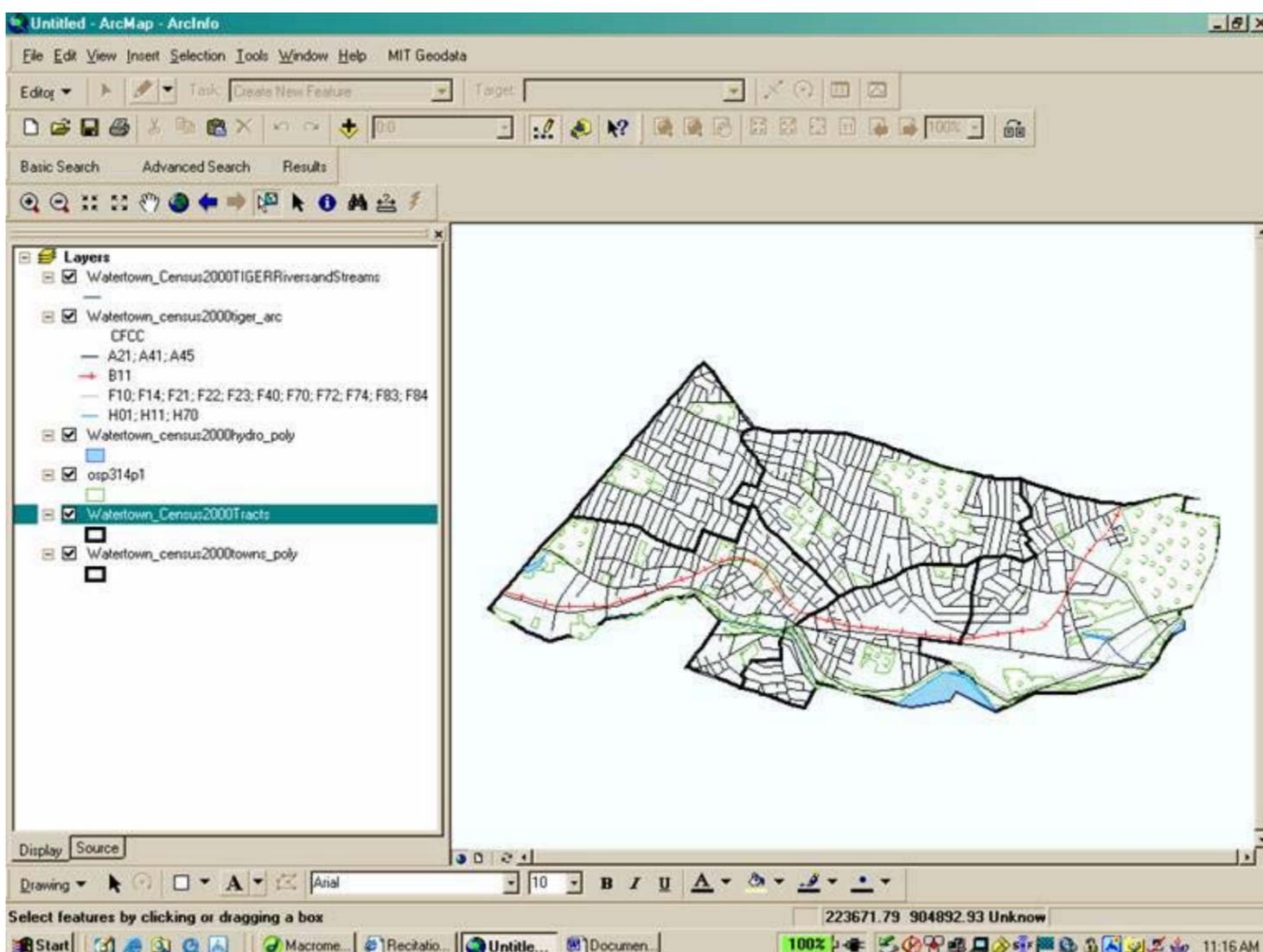
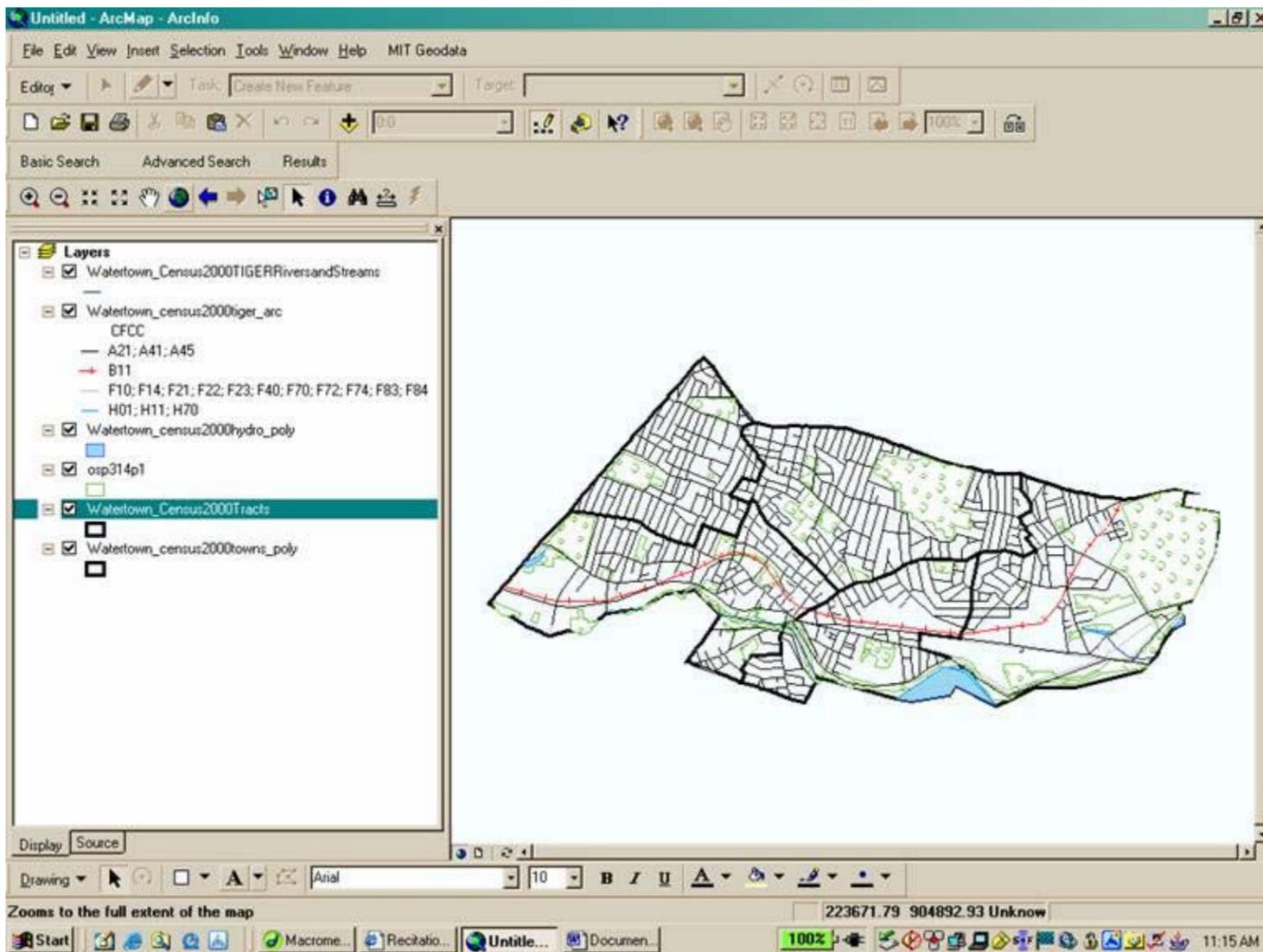


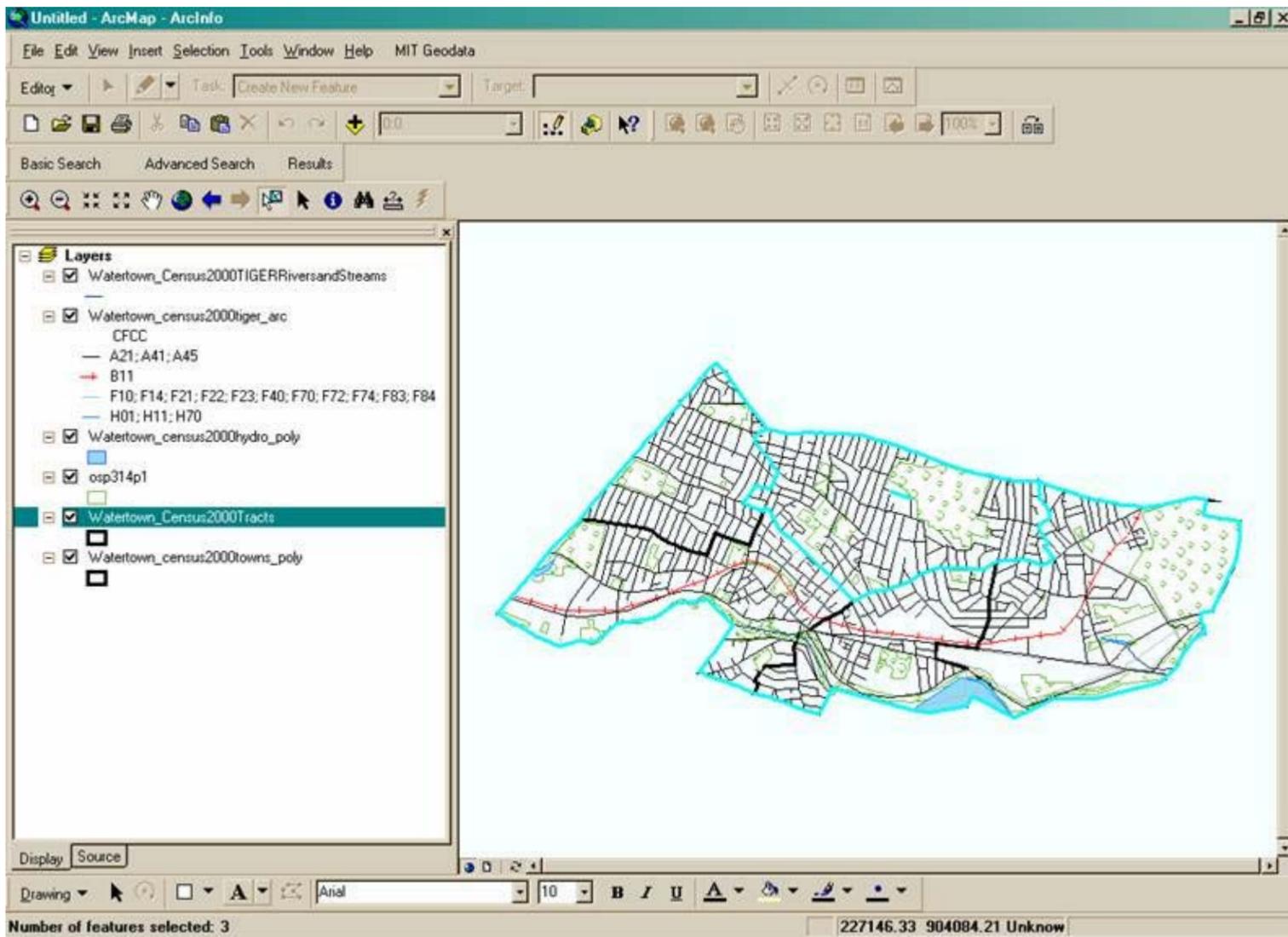
## 5.2 Use ArcMap's Select Tool Capabilities

"As a second approach to extracting features, if you can recognize the features you wish to clip by looking at the map, then you can use pointing and clicking on the map to select features, instead of building a query."

1. Make the Watertown\_Census2000Tracts layer active.
2. Click the Zoom to Full Extent icon (Picture of the Globe).
3. Click on the Select Feature tool icon (Picture of a white arrow beside a white and aqua square).
4. Click once inside the polygon feature for the census tract in Watertown of interest which in this case is the one with the highest Average Household Income in 2000 -- \$92,924. You should now see it highlighted in Aqua.
  1. If you have all of your layers turned on, you may see the aqua selection color extending beyond the your census tract of interest.

2. To double-check, you can either (1) open the attribute table and see that only the one census tract is highlighted in Aqua or (2) turn off all the layers until you have finished making your selections.
3. Once you have finished your selections, you can turn the other layers back on and you should see that the aqua color is now only attached to the single census tract.
5. In the table of contents, right click on the Watertown\_Census2000Tracts, click Data and click Export Data.
6. Save the output shapefile.
7. Click OK and Yes to add the layer to the map.
8. Make sure you clear the selectable features -- Selection Menu--> Clear Selected Features.



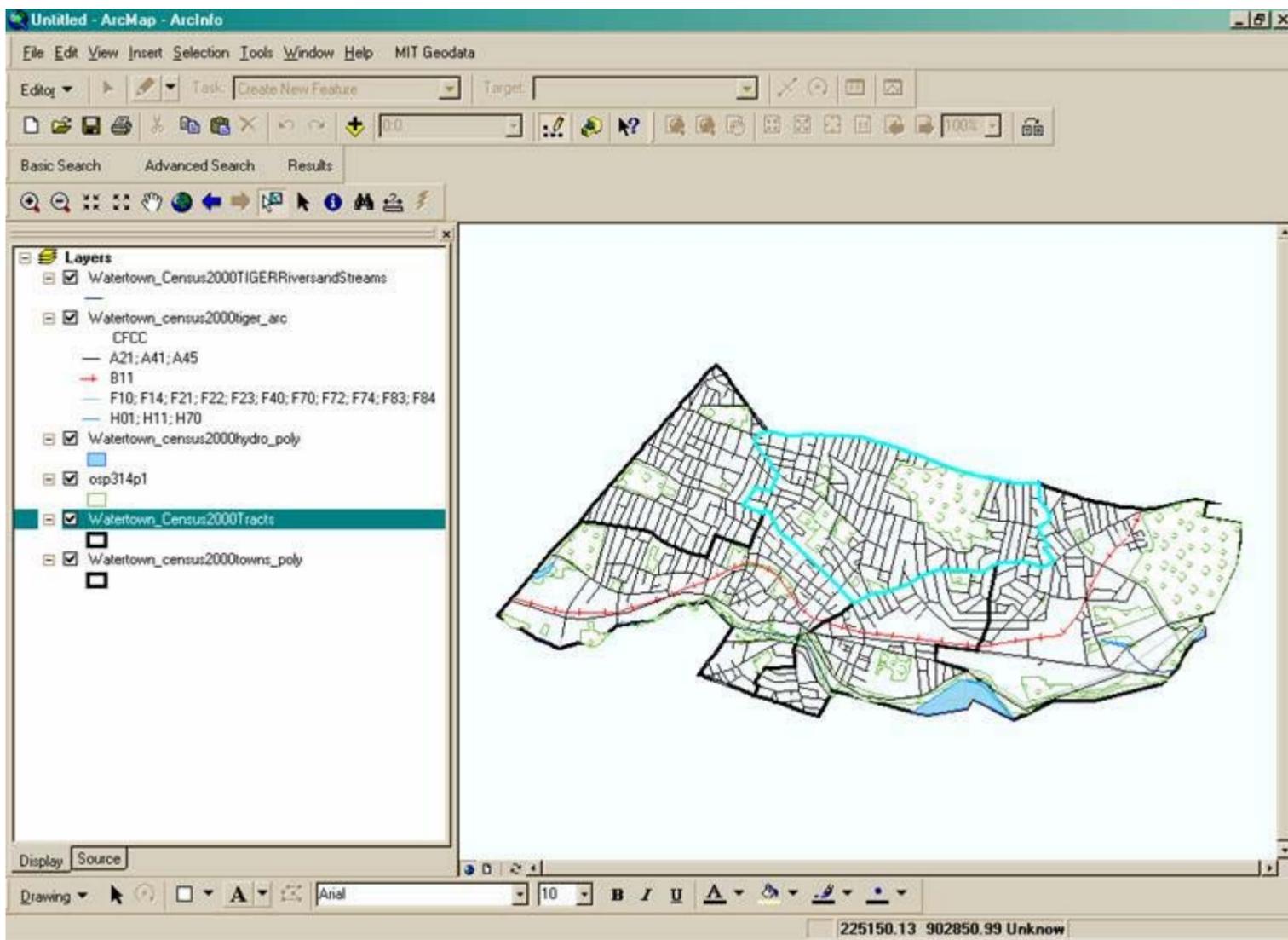
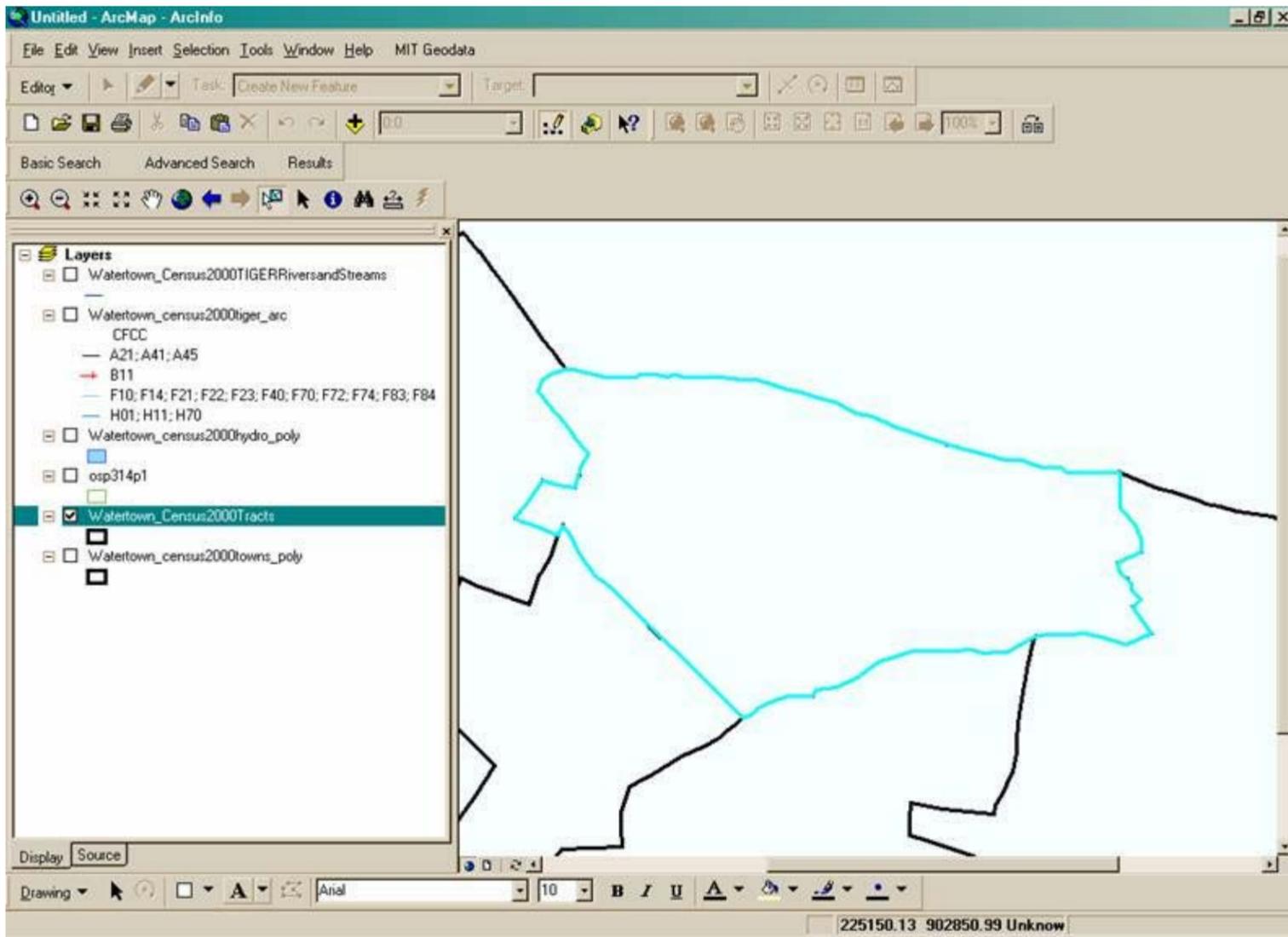


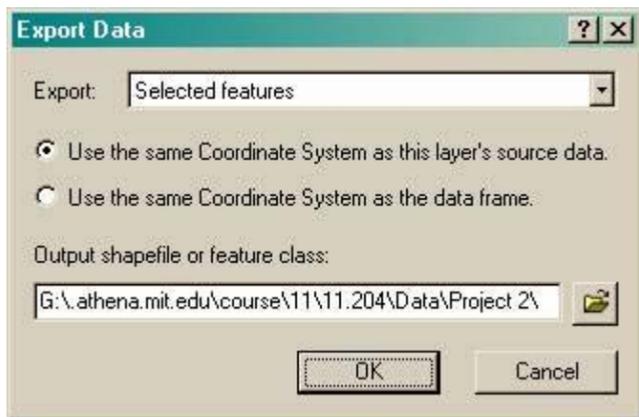
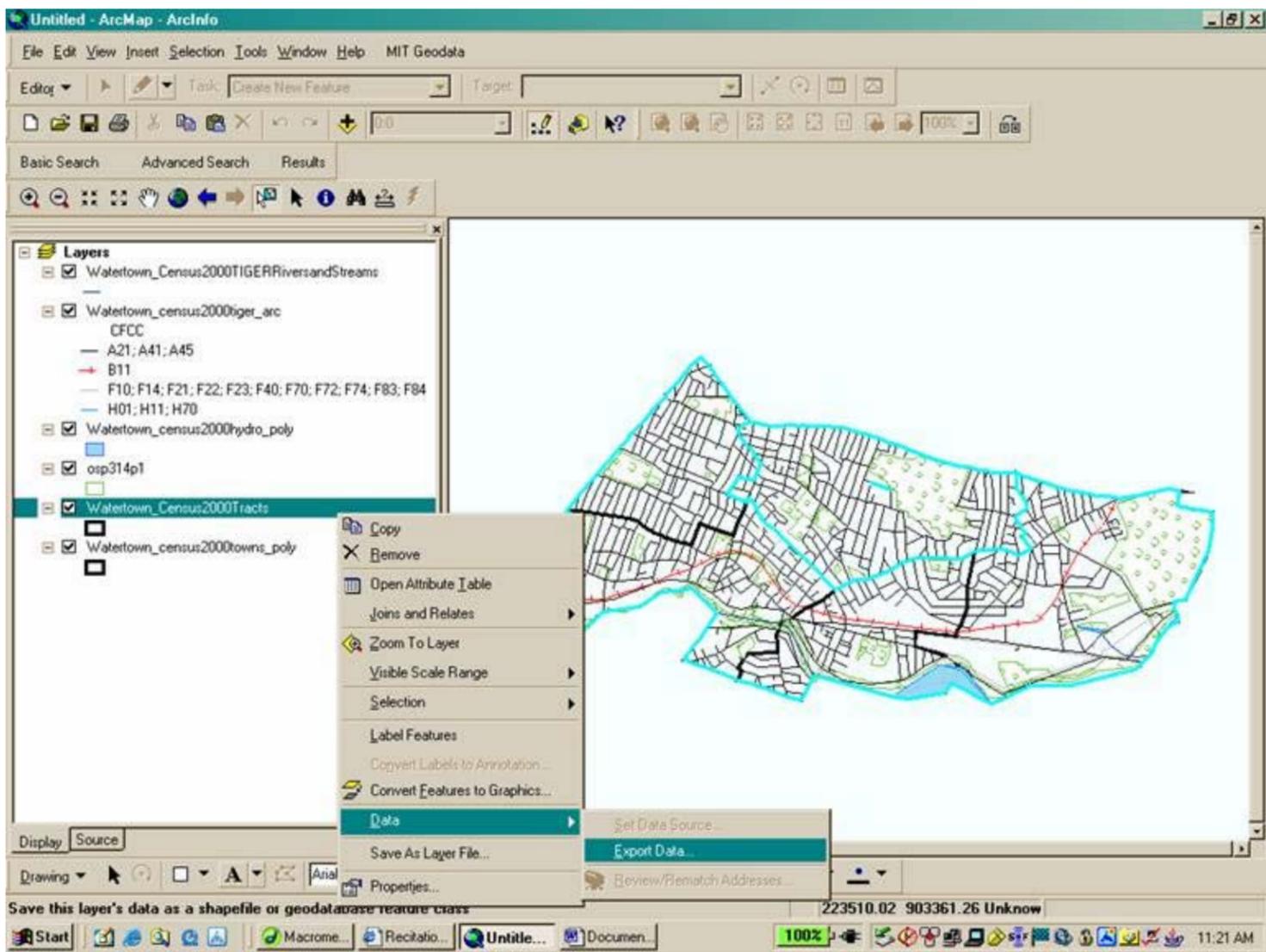
Attributes of Watertown\_Census2000Tracts

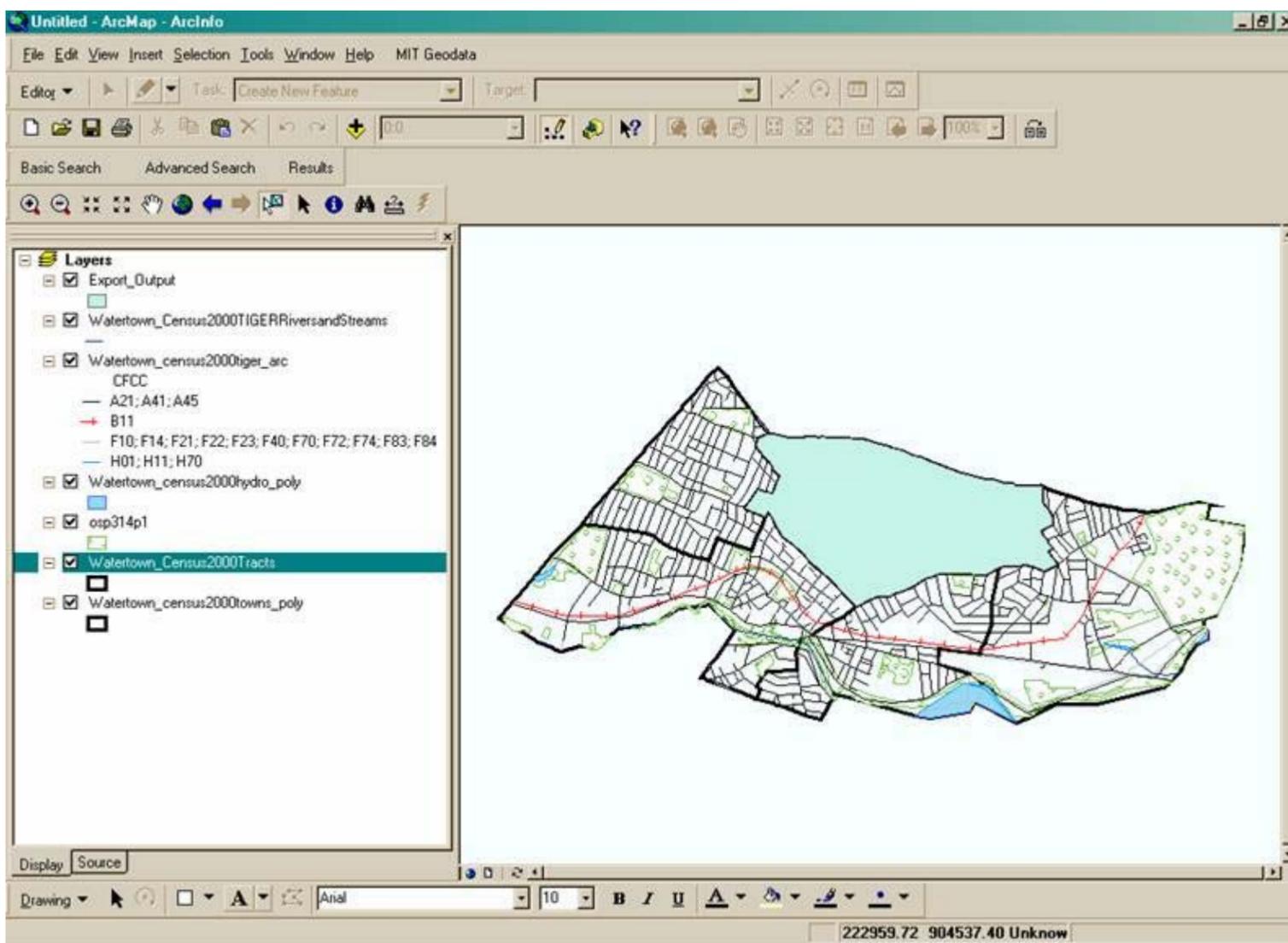
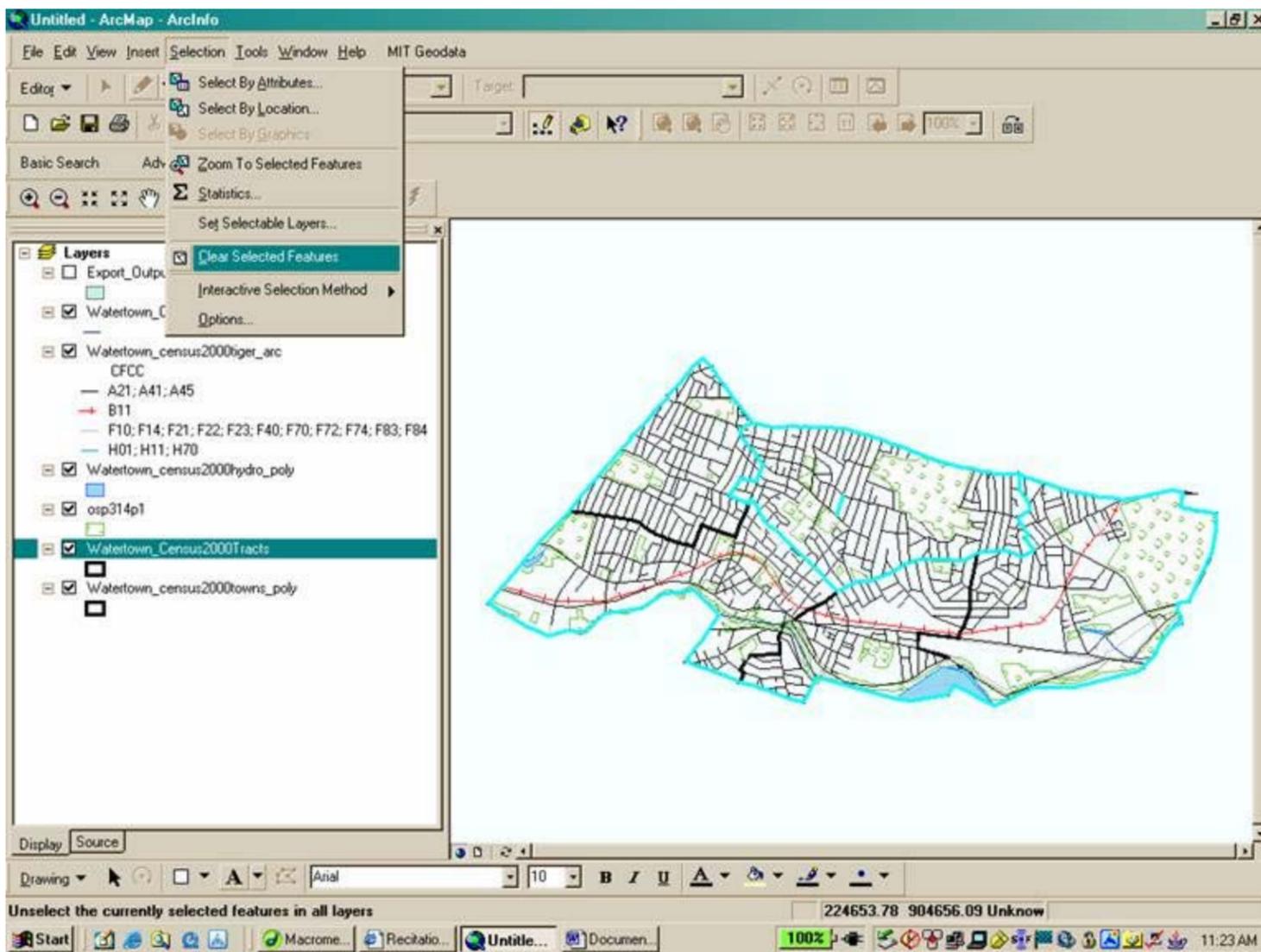
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4	Polygon	761	1656453.698	7538.057	25	017	370400	25017370400	0010768	

100%

11:2

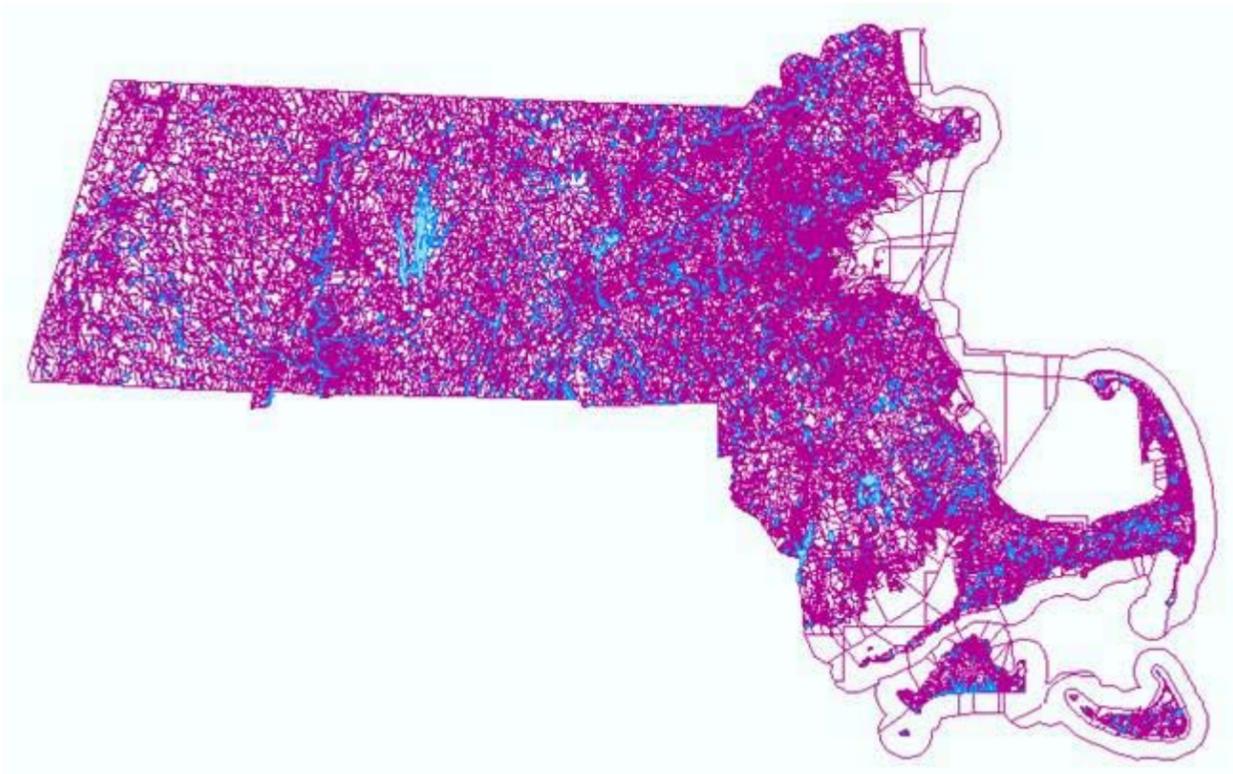






## 6. Clipping New Spatial Data Layers

This section describes how to use spatial data processing to go from shape layers that cover the entire state to customized layers showing only the data pertaining to the project's towns (i.e., creating a layer for each individual town). The two methods for creating individualized shape layers -- selecting vs. clipping -- are explained through step-by-step instructions aided by ArcMap displays. The pros and cons of each method are also examined.



After all the layers which are statewide in scope and the individual town layer which is composed of the town's census tracts are added to the map, clipping of the layers can begin . . .

### **Clip Features**

#### **A. Clip Streets Using Select By Location**

Here ArcMap's Select By Location function is used in conjunction with the town of Chelsea's census tracts as a study area to extract streets in Chelsea.

Switch to the Chelsea and Clipping Roads Data Frame in the Table of Contents and Right-Click on it and Select Activate.

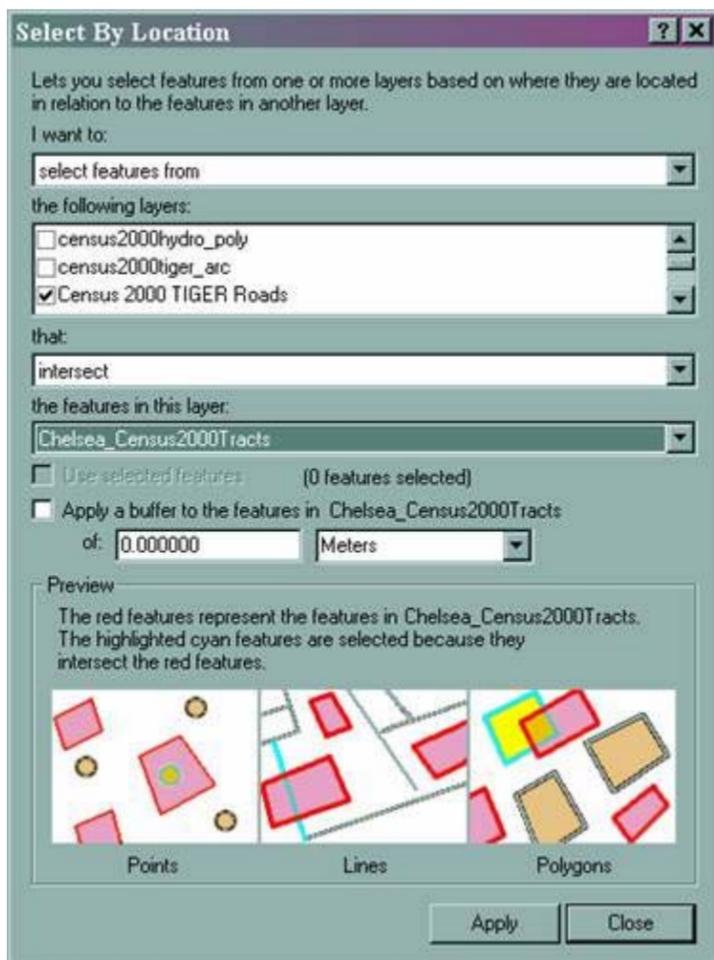
**Step 1: From the pulldown menu, click Selection, Select By Location . . .**

**Step 2: Check Census 2000 TIGER Roads as the layer to select features from**

**Step 3: Click the drop down list arrow of the second drop list field in the Select By Location window and click Intersect**

**Step 4: Click the drop list arrow of the third drop list field in the Select By Location window and click Chelsea\_Census2000Tracts.**

*Now Chelsea\_Census2000Tracts is selected as the "cookie cutter" to select roads. "Intersect" will select all lines that are on the boundary or in the interior of Chelsea\_Census2000Tracts polygons.*

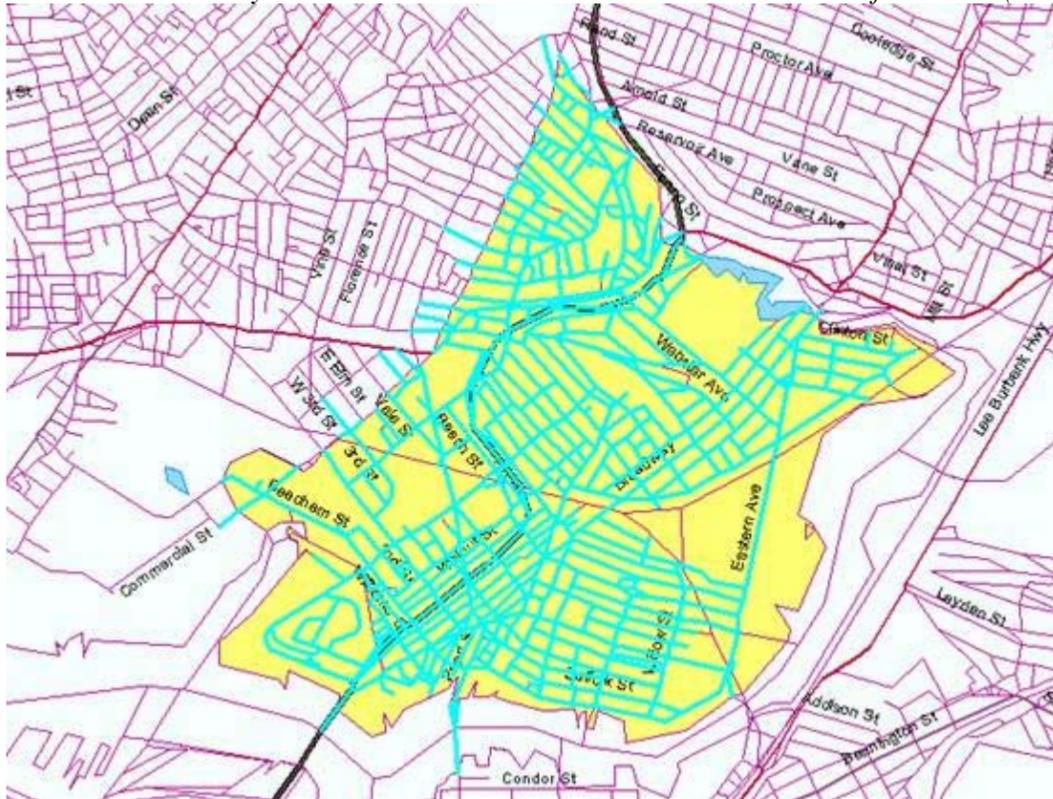


**Step 5: Click Apply and Close.**

#### **B. Show Selected Feature and Convert to Shapefile**

**Step 1: Click View, Zoom Data, Zoom to Selected Features**

The selected streets are those only within or those that intersect the Census Tracts of Chelsea. (Selected Streets Highlighted in



Aqua Color)

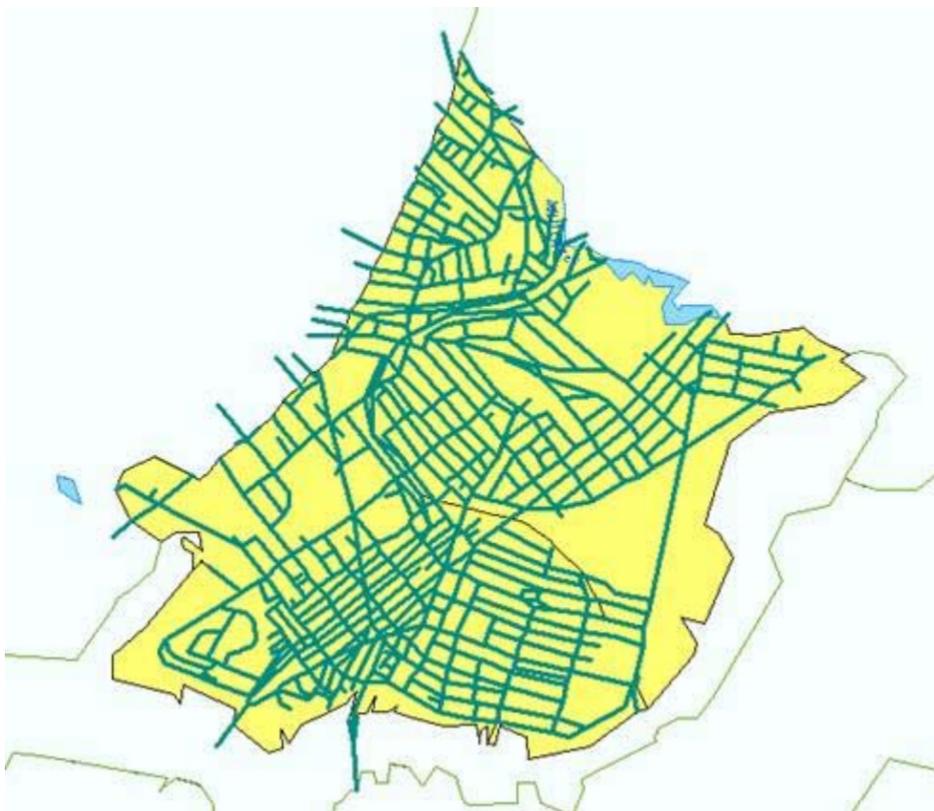
**Step 2:** In the table of contents, right click on the Census 2000 TIGER Roads layer, Click Data and click Export Data . . .

**Step 3:** Save the output shapefile to a directory.

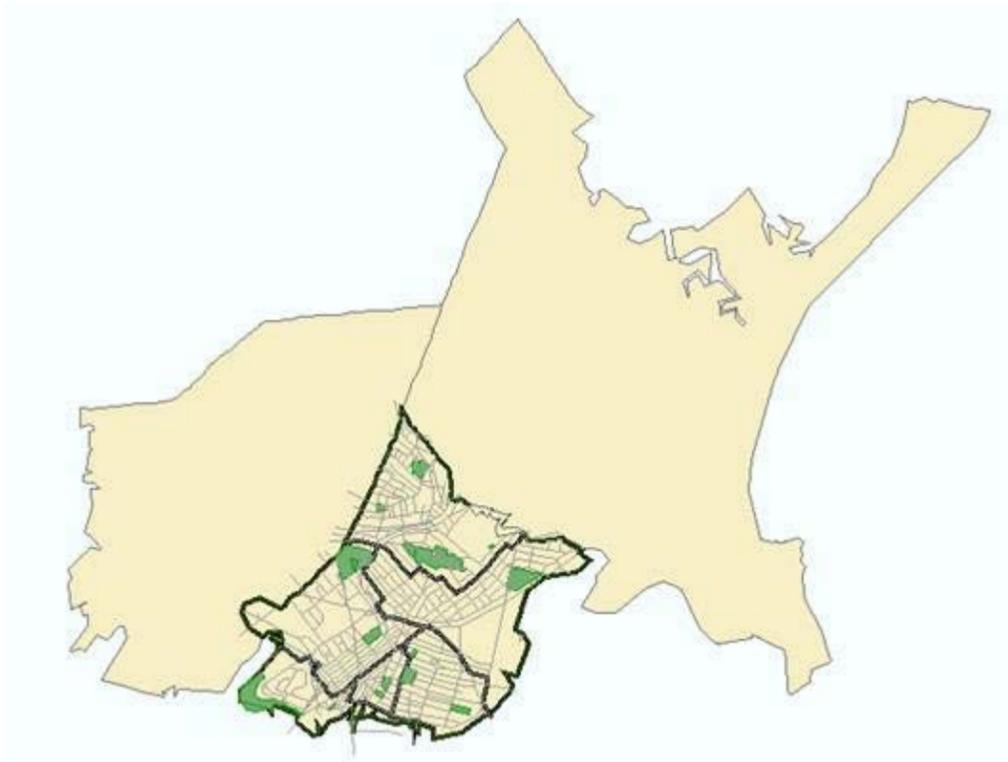
**Step 4:** Click OK and Yes to add the layer to the map

**Step 5:** Turn the original Census 2000 TIGER Roads layer off to see only the new Chelsea Streets.

*New layer/shapefile for Chelsea\_Intersect\_Census2000TigerRoads. Notice that some of the streets extend or "dangle" Beyond the Chelsea Census Tracts outline.*



This process can be repeated for each the remaining themes. However, as the image below shows the problem of "dangling" layers occurs with more than just the streets theme. Chelsea is outlined in black, but the "intersect" technique also includes the polygons for Everett (left) and Revere (right) which we do not need for this project. They can be deleted by editing the new layers or we can use the "clipping" technique in ArcMap's Geoprocessing Extension.



### C. Clip Streets Using GeoProcessing Extension

The GeoProcessing Extension is one of the available extensions to ArcMap's interface and it can be used to create layers that are clipped exactly to the edge of the study area. No "dangling" edges will remain in the new map.

**Step 1: From the pulldown menu, click Tools, GeoProcessing Wizard . . .**

**Step 2: Click the Clip one layer based on another radio button, and click the Next button in the GeoProcessing window**



**Step 3: Click the drop list arrow in the Select input layer to clip field and click Census 2000 TIGER Roads**

**Step 4: Click the drop list arrow in the Select a polygon clip layer field and click Chelsea\_Census2000Tracts**

**Step 5: Click the browse button, navigate to your preferred directory and change the file name to Chelsea\_Clipped\_Census2000TigerRoads.shp and click Save.**

**Step 6: Click Finish in the GeoProcessing window.**



*After you wait for processing to finish, the new clipped Chelsea Clipped Streets layer is added to your view automatically.*

**Step 7: Turn on your new layer and turn off the other Census 2000 Tiger Roads layer.**

*Notice that the new layer's clipped streets and other layers do not cross boundaries of Chelsea's Census Tracts, unlike the earlier "dangling" streets, etc.*



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Created November 2004 by Shannon McKay with assistance from Masa Matsuura and Rhonda Ryznar.