Introduction to GIS Using ArcExplorer and Brooklyn Data Sets

The following set of exercises was developed for a GK-12 workshop with high school teachers from Brooklyn and Brooklyn College Graduate Fellows. The participants gathered water data in Prospect Park and merged their data with existing data using ArcExplorer, the AEJEE version. These exercises were also used during the first two weeks of an introduction to GIS course for undergraduates. After these exercises, the undergraduates were introduced to ArcView.

The following exercises were directly adapted from the online ESRI tutorial for AEJEE.

Learning Objectives
Students will:

- learn to use ArcExplorer, AEJEE
- apply GIS concepts such vector and raster data models and map projections
- create a map using AEJEE
- describe spatial patterns in water data
- use GIS to develop hypotheses and additional questions

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Lesson 1: Working with AEJEE

What is covered
Opening ArcExplorer
Adding vector layers
Moving the order of layers
Panning and zooming
Exploring attribute tables
Selecting features
Naming layers
Labeling features
Metadata

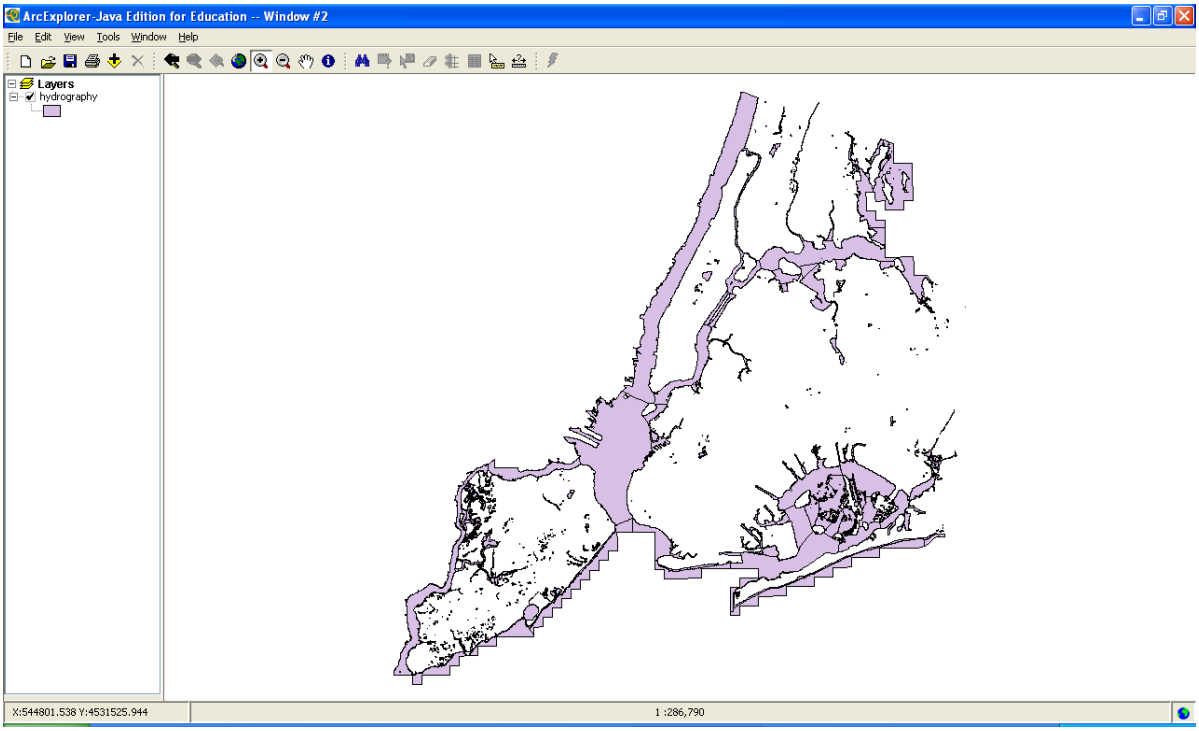
Refer to pages 5 and 6 on the ESRI AEJEE tutorial hand out. These pages show the layout of AEJEE and terminology used. As well, you may want to refer to the hand out, "Notes about using AEJEE" for additional help.

1. Start AEJEE. Go to "Start" at the bottom left, then "All Programs". Select "AEJEE".

2. After AEJEE opens, enlarge the window to fit the full computer screen. Click the "+" sign on the toolbar at the top. Browse to the folder, "hydrography", and add the layer called hydrography.shp. PATHWAY FOR THE FILE WILL BE GIVEN.

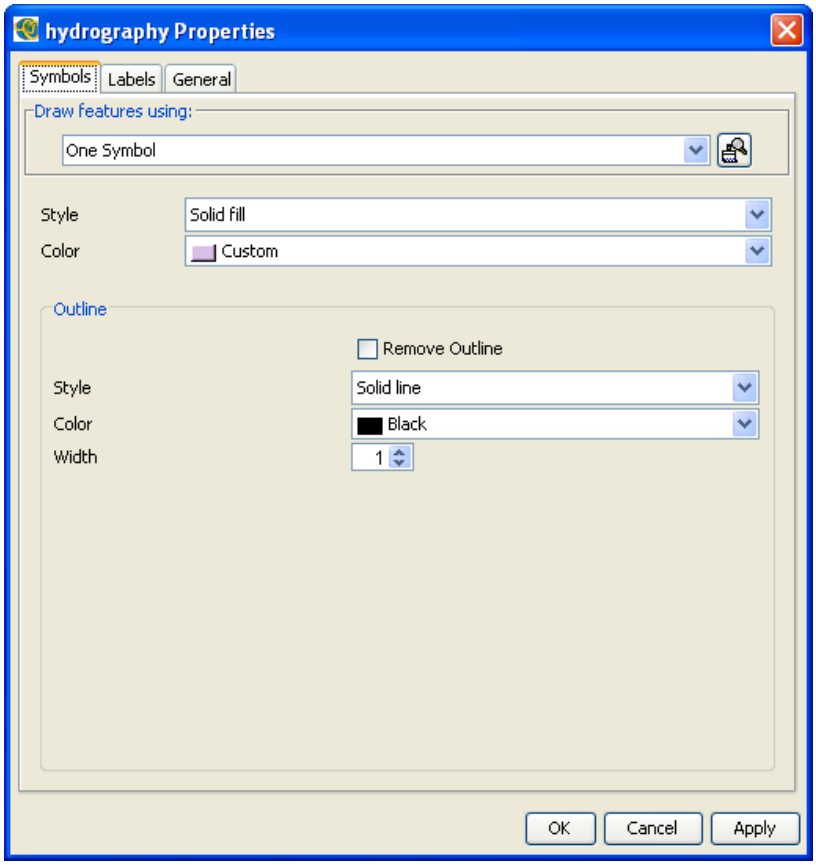
3. Under File in the menu bar, call your project NAME_lesson1 (fill in your name) and save to PATHWAY FOR THE FILE WILL BE GIVEN. You have now started a project using a shapefile. You will add more shapefiles to this project and save frequently. You can exit the project at any time, reopen the project, and start where you left off. If you look at the project file in Windows Explorer, you will see that the file extension is .axl. This is used for AEJEE.

    a. Can you understand what is being shown? Probably not. It should look like the picture below, although the color of the features may be different.



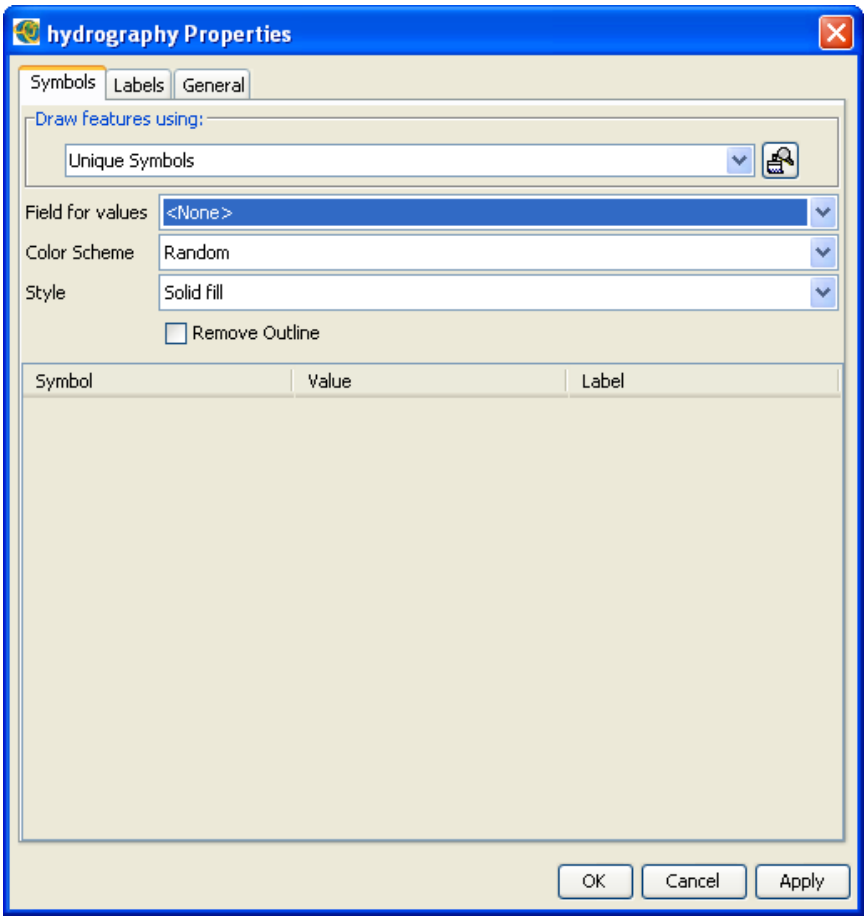
b. Go to the Table of Contents (TOC) to the left and right click on the title of the layer, "hydrography". Scroll down to "Attribute table" and open. Look at the column headings (or fields).
    i. What type of vector feature is shown (point, line, or polygon)?
    ii. What types of features are shown?
    iii. How many features are in the table?
    iv. Do you recognize any names of the features?

c. Close the attribute table. Right click on the "hydrography" title and open "Properties" at the bottom of the list. A new box should come up like below.



d. Open the list within "Draw features using" using the pull down option to the right. Three options should show up. Click on "Unique Symbols".

e. A new box will show like below.

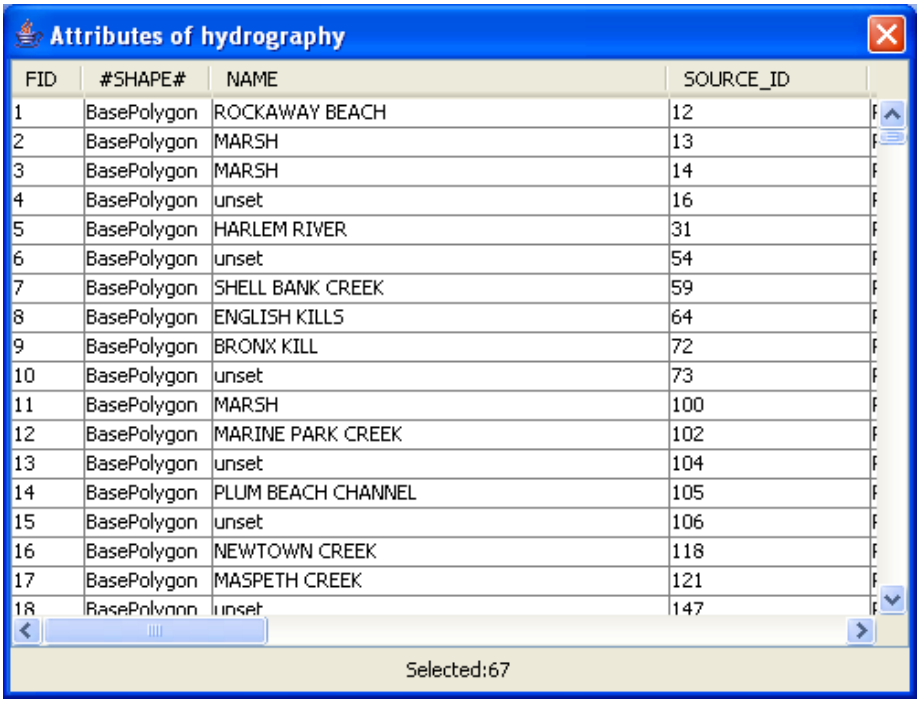


f. For “Field for values”, use the pull down option and click on “FEAT_DESC”. Then click “OK”.
   i. What do you see?
   ii. Does this image make sense?
   iii. Could the colors of the hydrography features be changed to make it more intuitive?
   iv. Play around with changing the colors of the feature classes (Bay/Ocean, Beach/shoreline, etc) to make a better sense. To do this, right click on the “hydrography” title and go to “properties” again. Try different color combinations under “color scheme” and “style”. As well, you can change the colors on each class individually. To do this, left click on one of the colors in the table at the bottom. A new box will come up that allows you to select from a color palate.

g. Save. It is good to get into the habit of saving frequently.

h. In the Table of Contents, left click on the square color symbol by Bay/ocean. What happens to the view to the right? You have selected all the Bay/ocean features in the view.

i. Open the attribute table for hydrography. Anywhere in the headings (FID, #Shape#, etc.) right click and a list should appear. Select "Sort Selected Data to Top". All of the Bay/Ocean features should appear in blue at the top of the table.



Attributes of hydrography

FID	#SHAPE#	NAME	SOURCE_ID
1	BasePolygon	ROCKAWAY BEACH	12
2	BasePolygon	MARSH	13
3	BasePolygon	MARSH	14
4	BasePolygon	unset	16
5	BasePolygon	HARLEM RIVER	31
6	BasePolygon	unset	54
7	BasePolygon	SHELL BANK CREEK	59
8	BasePolygon	ENGLISH KILLS	64
9	BasePolygon	BRONX KILL	72
10	BasePolygon	unset	73
11	BasePolygon	MARSH	100
12	BasePolygon	MARINE PARK CREEK	102
13	BasePolygon	unset	104
14	BasePolygon	PLUM BEACH CHANNEL	105
15	BasePolygon	unset	106
16	BasePolygon	NEWTOWN CREEK	118
17	BasePolygon	MASPETH CREEK	121
18	BasePolygon	unset	147

Selected:67

j. Clear your selected items by using the icon at the tool bar at the top. You may need to look at the description in the ESRI tutorial on page 6 to know which icon to use. Another way to find out which one is to move the mouse curser over the icon and read what it says

k. Another way to select features is to use the "select feature" icon on the menu bar. Click on the icon and look at the drop list of rectangle, circle, line and polygon. Select rectangle and then move the cursor to some place in the hydrography view and hold the mouse cursor to another place in the view. Double click to make selection.

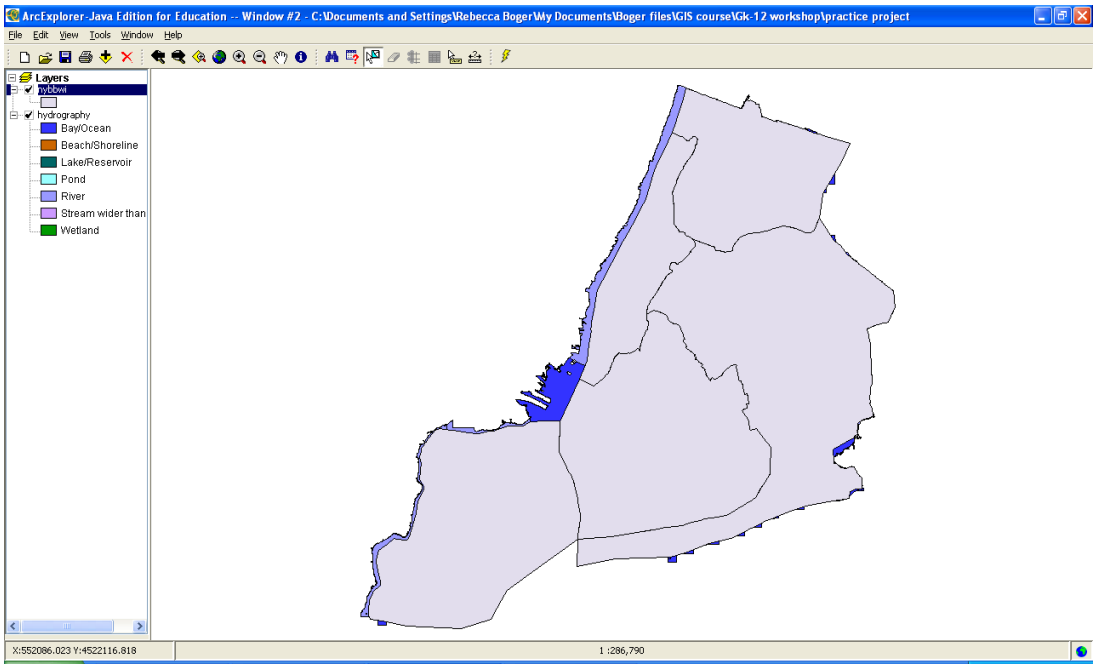
   i. Open the attribute table as before and look at what is selected.
   ii. Try using the other ways to select (circle, line, and polygon). How do they differ in selecting features?

l. Minimize the AEJEE window and let's learn more about the hydrography data. Open up "Windows Explorer" or "My Computer" from the start bar at the bottom of the computer screen. Go to the hydrography folder. PATHWAY WILL BE GIVEN Double click on the "hydrography_metadata" icon. This link provides the metadata for the hydrography.

i. What is the source of the data?
ii. What is the projection (listed as grid coordinate system)? Write this in your notebook.
iii. What is the datum (listed as horizontal datum name)? Write this in your notebook.

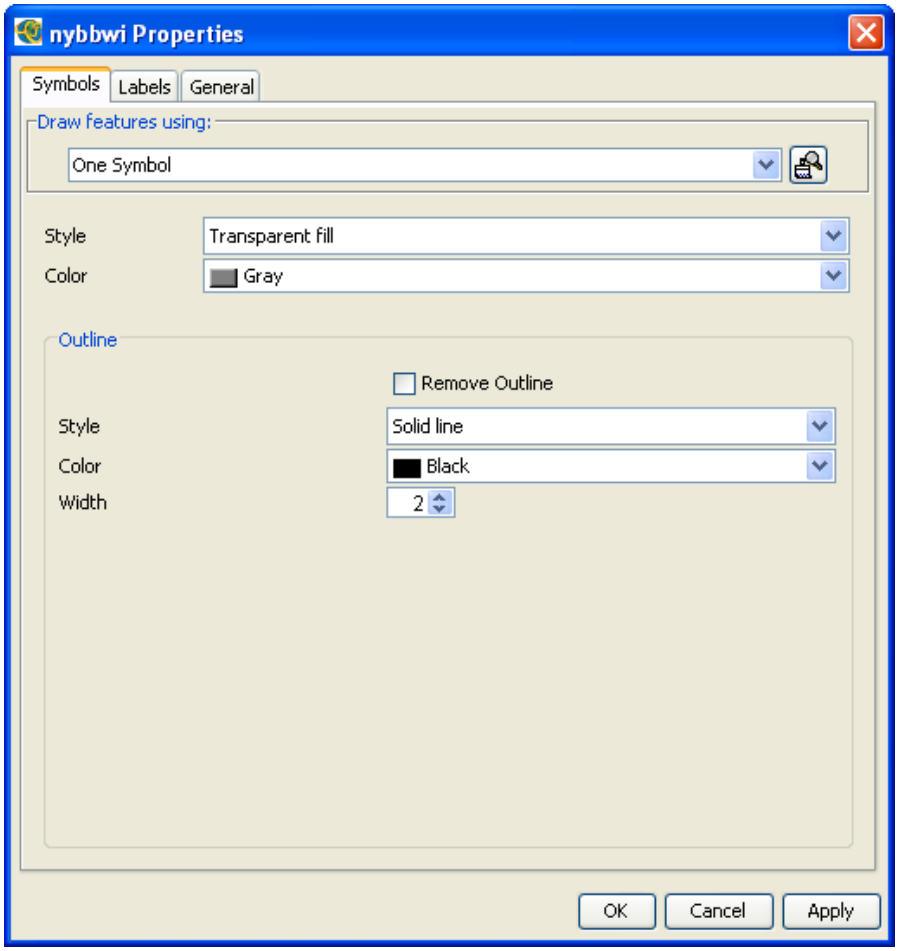
4. Expand the AEJEE window with the hydrography data. Add another layer by clicking on the + sign in the tool bar. Go to the folder called "Borough boundaries". FILE PATHWAY WILL BE GIVEN. Select nybbwi.shp. Open file.

   a. Open the attribute table for nybbwi. Can you identify what the layer is?
   b. When you add nybbwi to the other layer, the polygons for the boroughs are all the same color. As well it is on top of the hydrography layer so that you cannot see the hydrography very well.

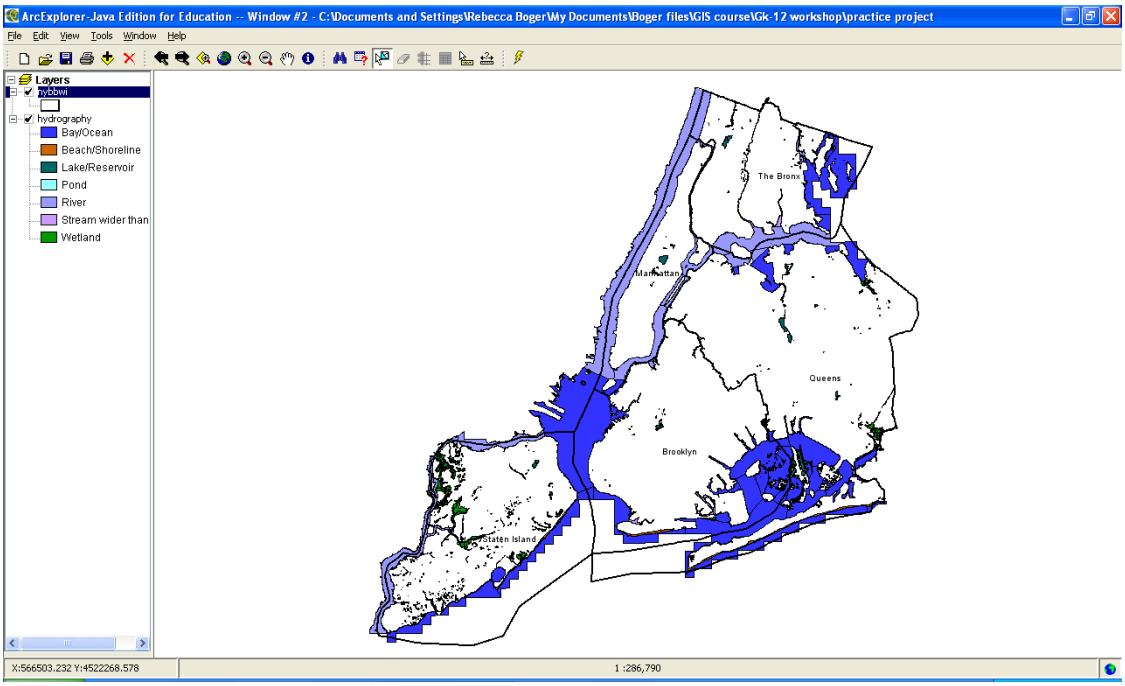


   c. In the Table of Contents to the left, highlight the nybbwi layer and while holding it with the cursor, move it below the hydrography layer. What happens? Move it to the top again. When you have many layers open, you can move them around to see particular features better.

   d. Open the properties for nybbwi. (Remember how to do this?) The box for symbols should show. Under "style", pull down the list and select "transparent fill. Then, under "outline" toward the bottom of the box, increase the line width to 2. Then, select "OK".



e. Next, click on properties again. Click on tab “labels” at the top of the box. Under “label features using”, select BoroName. Click “OK”. You should get something like this:



f. Open up "properties" again. Try different font, size, color, and effects for the text.

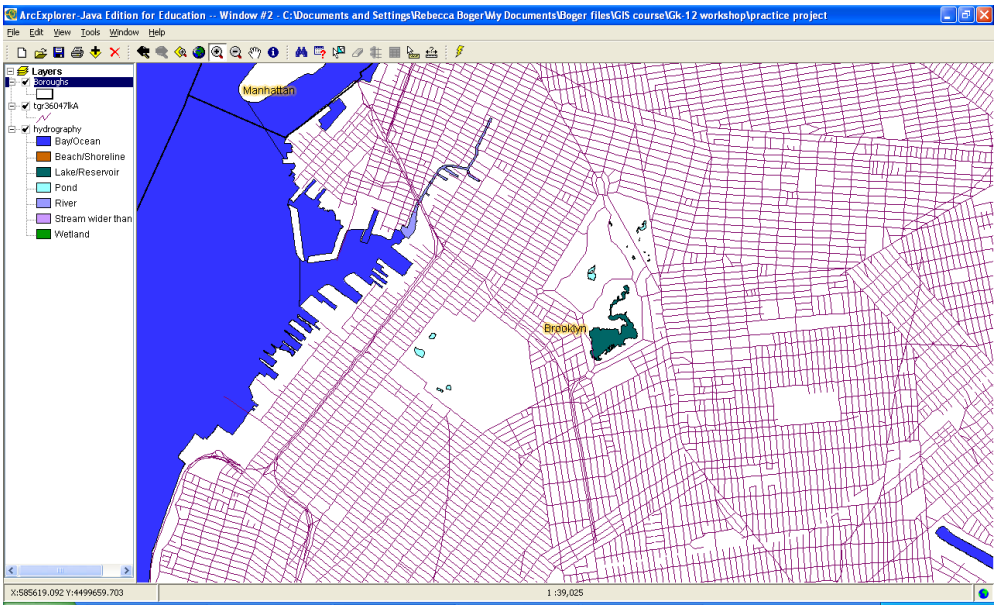
g. Remember to save frequently.

h. Nybbwi doesn't make much sense. Let's change the title. Open "properties" again. This time highlight "general". Under "layer name" type in "Boroughs".

5. Zoom into Brooklyn.
   a. Can you locate approximately where Prospect Park might be?

   b. Add another layer. Browse to the folder \ESRI TIGERdata_Kings\roads. PATHWAY WILL BE GIVEN. Select tgr36047lkA.shp and click "OK". This is the road network for Kings County. The road data set is from the TIGER US Census data. To learn more about the data, go to www.esri.com/tiger. It will explain the coding system used for the data.

   c. Zoom to where you think Prospect Park might be. You might have something similar to the picture below.



6. Save project. Go to file and “exit”. To see what you did again. Start AEJEE and under “file”, select “open” and go to the location of your project and select.

Lesson 2

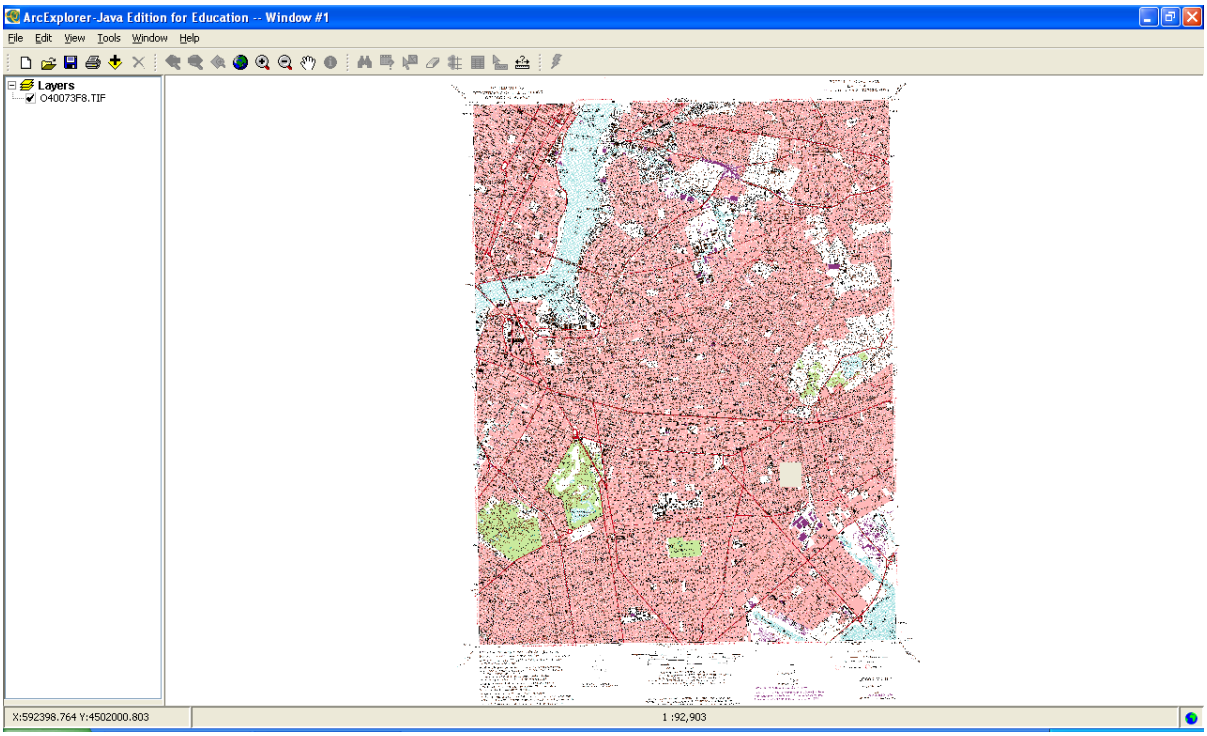
Go to the ESRI tutorial and do Lesson 3 starting on page 25 to learn about map projections and making maps.

Lesson 3

What is covered
Integrating image data
Integrating field data
Queries
Hot links

1. If AEJEE is not open, start it.

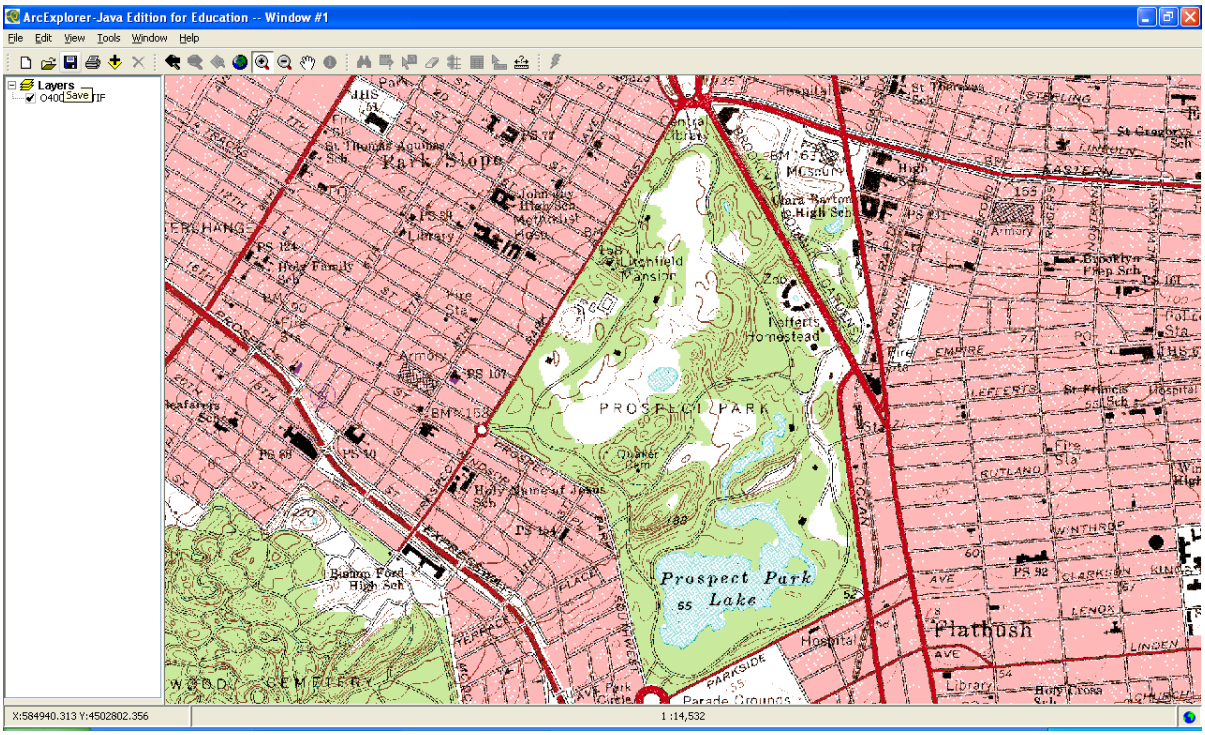
2. Open 040073F8.tif (Brooklyn topo map in the folder \Brooklyn DRG. PATHWAY WILL BE GIVEN. This is a digital raster graph of the Brooklyn topographic map. Refer to the hand out "Notes about using AEJEE" and read about DATA MODELS.



3. Save project. Save it as NAME_lesson3 (fill in your name).

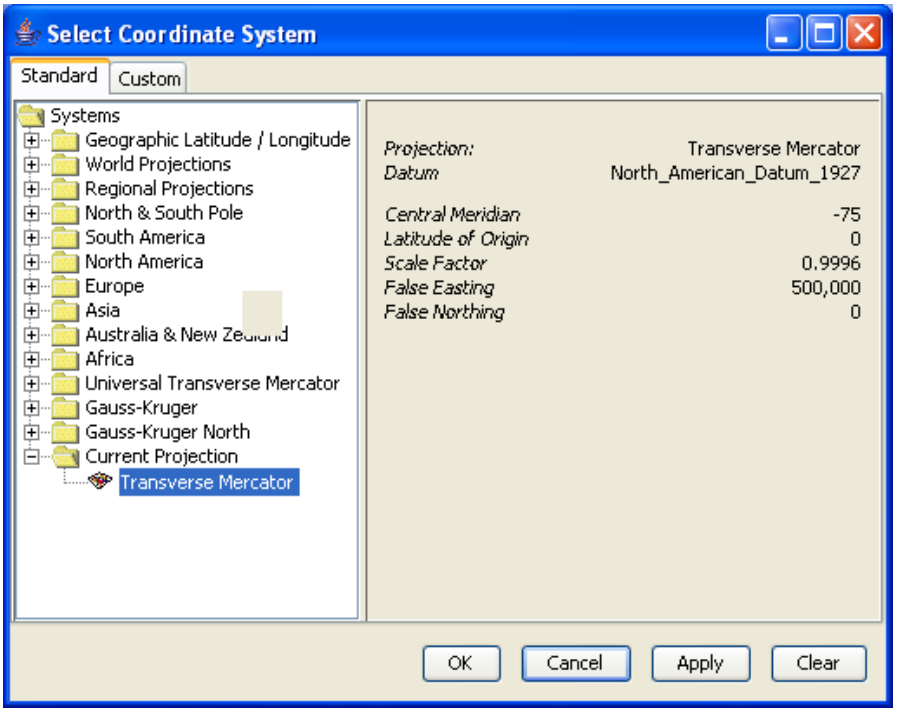
4. You may not be able to decipher any features except some color differences and lines after the image shows up on the screen. There are two green patches in the lower left corner. Zoom to the slighter higher green area. Keep zooming until you are able to

identify Prospect Park. The view should look similar to the paper topo maps displayed in class.



5. Rename 040073F8.tif to Brooklyn topo in the Table of Contents.

6. Click on “Tools” in the menu bar and select “projection”. You will get a box like the one below.
    a. What is the projection?
    b. What is the datum?



7. Click "OK".

8. Add the hydrography layer you used in Lesson 1. Can you see the layer with the topo image? If the hydrography layer is below the Tif layer in the Table of Contents, move the hydrography layer to the top. Can you now see the hydrography layer?

9. Click "Zoom to full extent" in the menu bar?

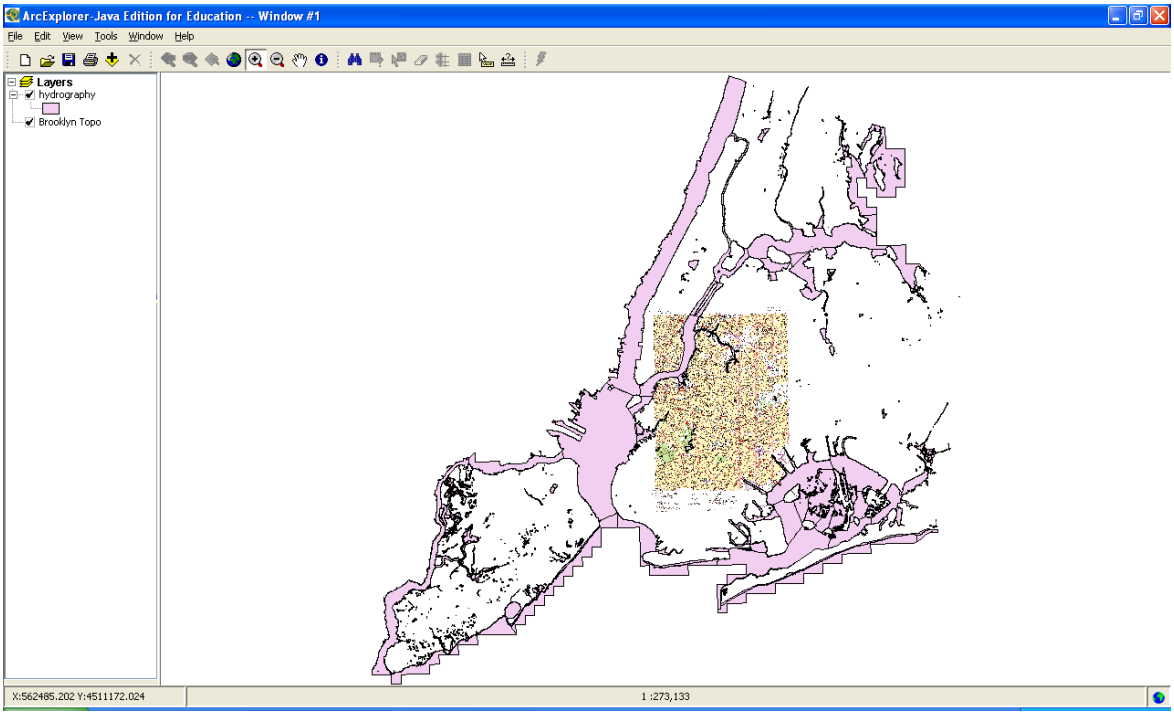
    a. What do you see? Does this make sense?

10. In Lesson 1, you looked up the projection and datum for the hydrography layer. It has the State Plane Coordinate System projection and a NAD 1983 datum. These are different from the map above.

    a. AEJEE cannot project image data like the topo map above. AEJEE can project vector data if the data are stored in a decimal degree coordinate system. You can set the view's projection to match the UTM 18N, NAD27 projection of the topo map.

    b. To change the projection, go to "Tools" in the menu bar and click on "projections" as before. In the list of projections on the left, scroll down to UTM Zone 18N. When you do this, the box to the right lists the datum. Select NAD (North American Datum) 1927. Then, click "OK".

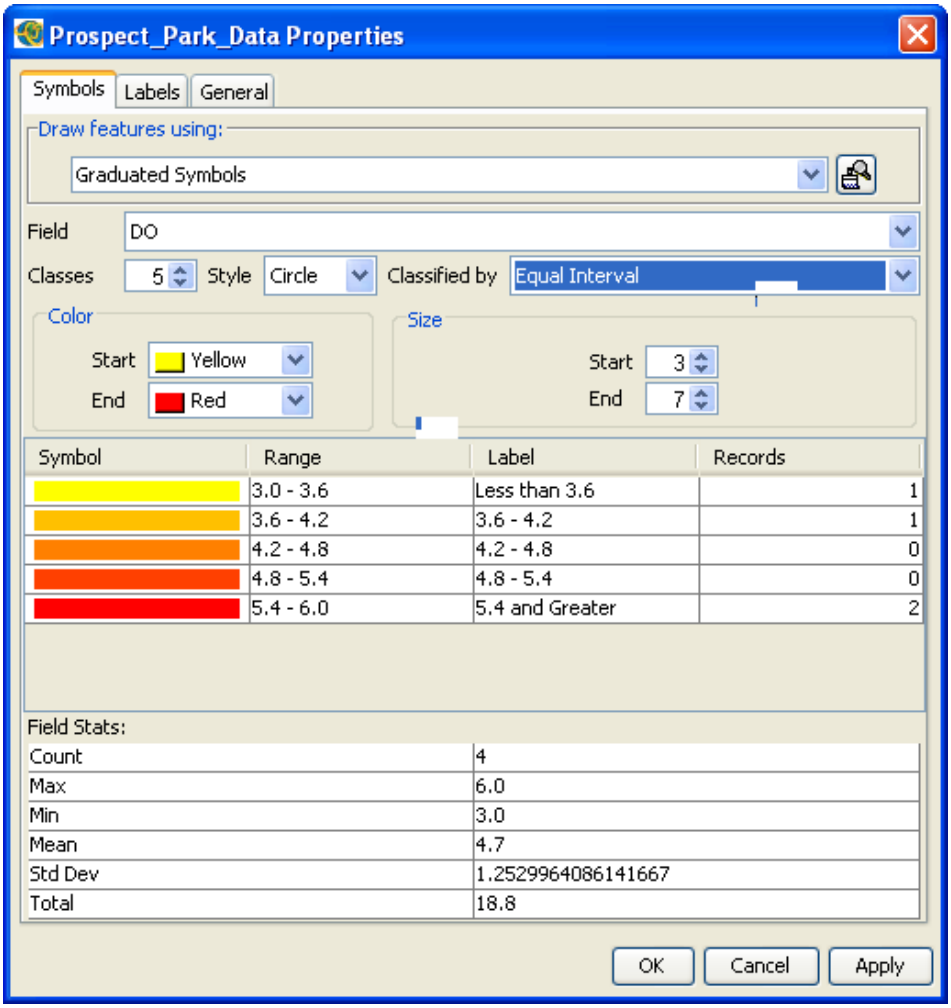
    c. Zoom into Prospect Park. Do the hydrography layer and the topo map line up exactly? If not, what may cause the two to be different?



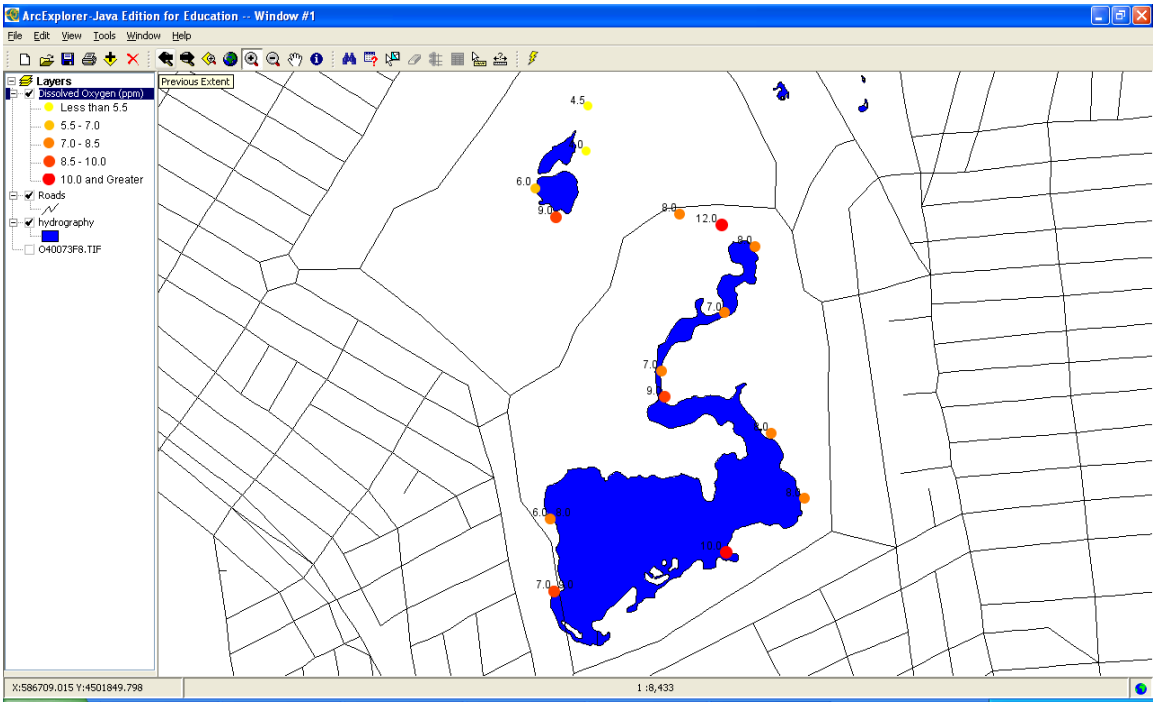
11. Next, let's add water data collected by teachers and graduate student fellows a few weeks ago. Add the shapefile called Park_Data_NAD27. PATHWAY WILL BE GIVEN.

12. Turn off the topo map layer (remove the check next to the name in the Table of Contents) and add the road layer you used in Lesson 1.

13. Select the "properties" for the water quality data layer.
    a. For "Draw features using", select "Graduated symbols".
    b. For "Field", select DO (dissolved oxygen).
    c. Next click on "Labels" tab at the top. A new box will appear. For "label features using", click on "DO".
    d. Select the "General" tab. In the new box, rename the layer name to "Dissolved Oxygen (ppm)".
    e. Click "OK".



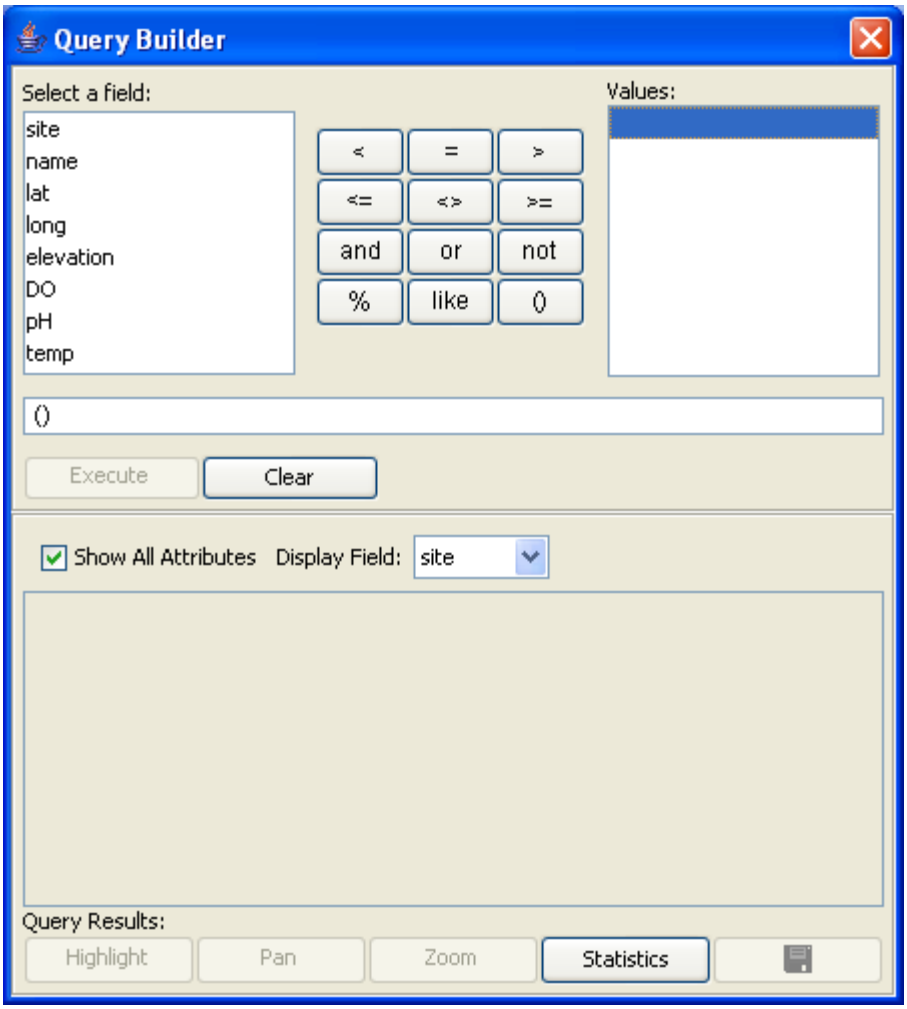
14. Look at the Table of contents and View. What do you see? You may need to zoom in on the sites to see the labels.



15. Add the Park_Data_NAD27 shapefile. You can add the same layer several times to the view. Follow the steps that you used for DO above, but this time use temperature.

16. You can try using different colors and text to display the DO and water temperature data. As well, you can do the same for the other water measurements taken.

17. In Lesson 1 you learned about ways to select features in AEJEE. Another way to select features is using the Query Builder. In the Table of Contents, highlight the top field data layer. Click on the icon for "Query Builder" in the Tool bar. Refer to the ESRI tutorial on page 6 or hold cursor over the icons until you identify which is the correct icon. A window such as below will appear. Please note that the fields listed under "Select a field" will be different in your project.



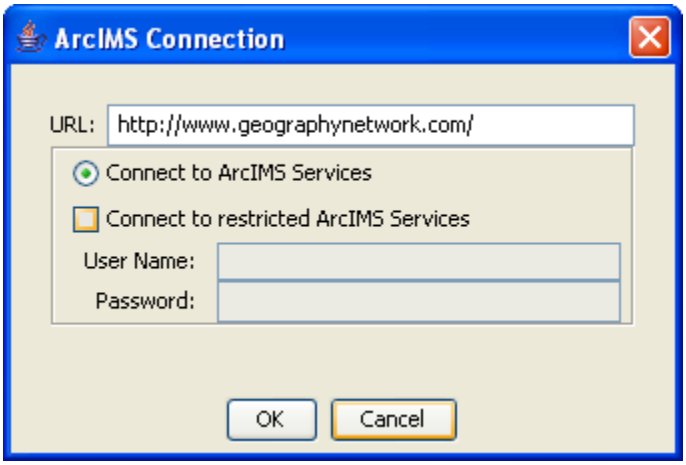
a. Under “Select a field”, click on DO (dissolved oxygen). It will appear in the space below between the ().
b. Next, click on < (less than). It will appear after the DO (DO <).
c. Lastly, type in 5. The equation will now say (DO < 5). Click “Execute”. A table will appear on the bottom listing those sites with DO < 5 mg/L.
d. Look at the view. Can you find the sites that have been selected? These sites should be highlighted.
e. Try other queries. You can make queries more complex, for example (DO < 5 and temp > 25).

18. Save project.

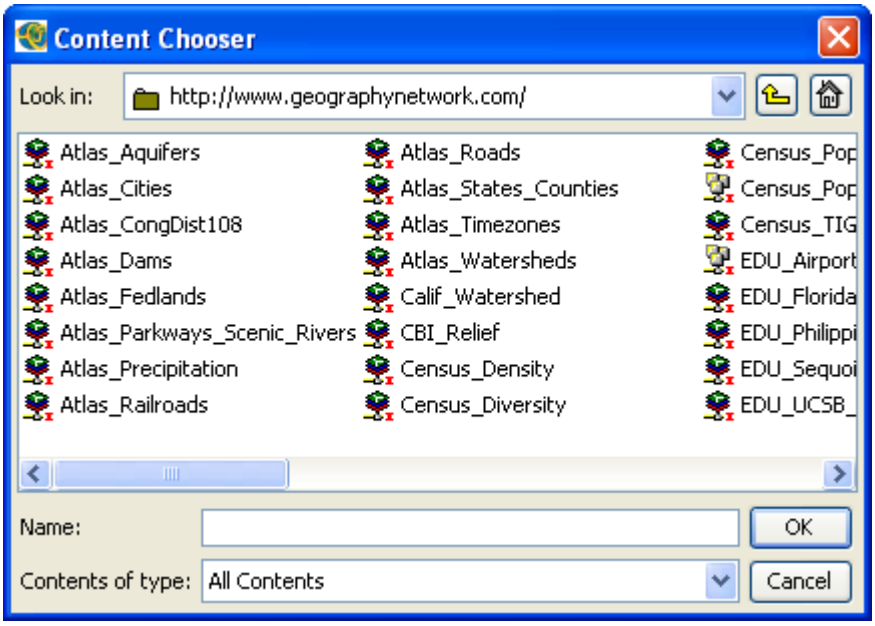
Lesson 4

What is covered
Adding Internet data
Making a map of Prospect Park

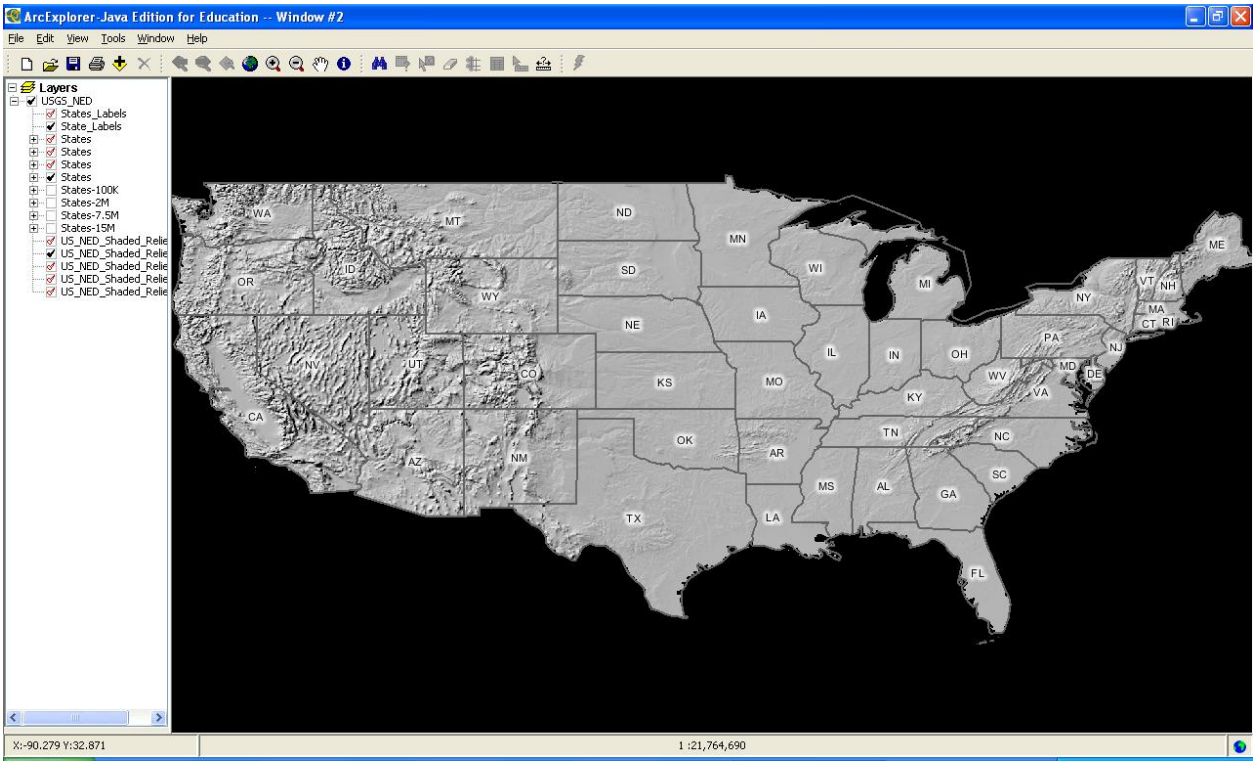
19. If AEJEE is not open, start it.
20. Click on + to add a layer. In the Content Chooser, scroll down and select "Add Internet Server". Click "OK". A new box will appear with an automatic default of the geography network. Click "OK". See the box below.



21. A new box will show as here. The list shows web-based data sets that you can view in AEJEE.



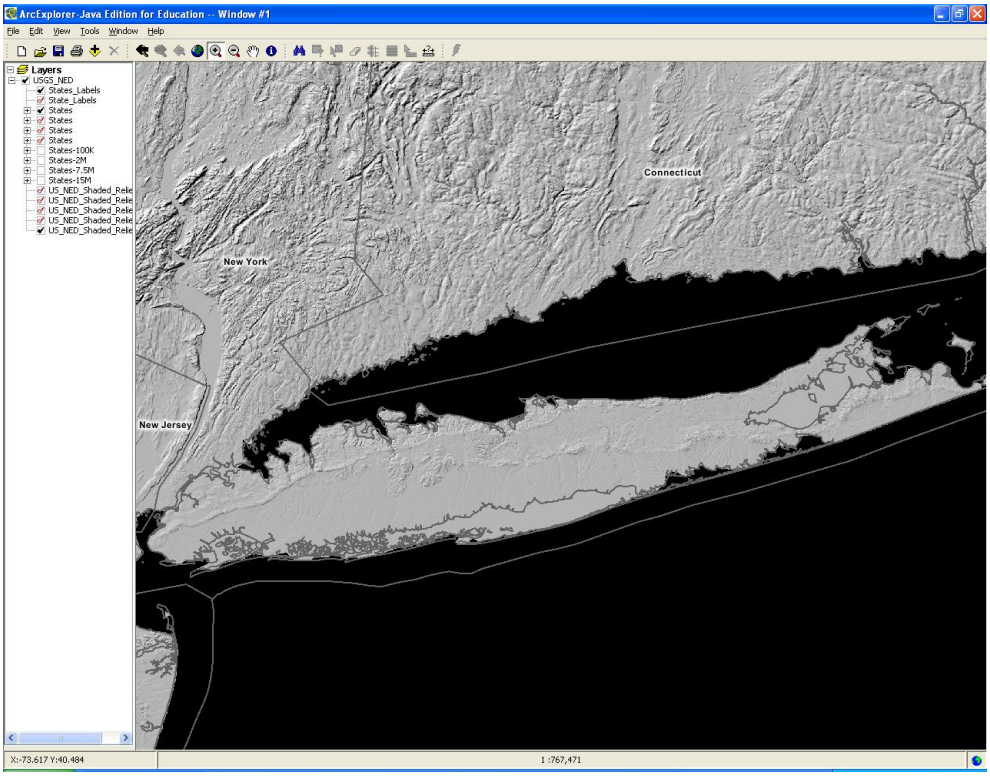
22. Scroll to the right until you see USGS_NED. Click on USGS_NED and in the new box that shows select the only item. Click OK. NED stands for National Elevation Dataset. To learn more about NED, please visit http://ned.usgs.gov/.



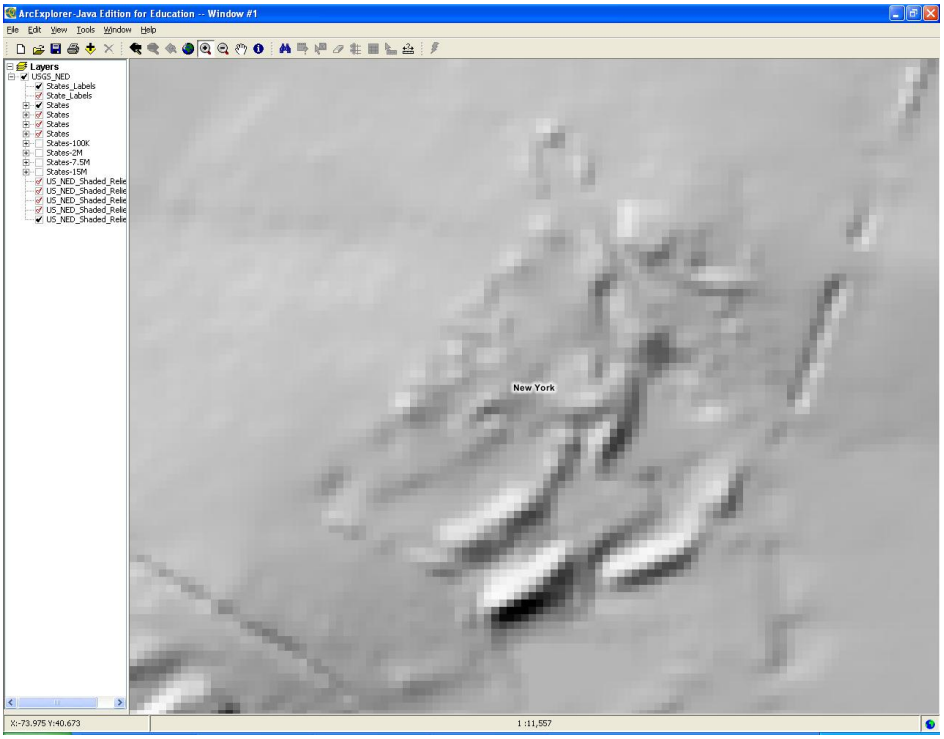
23. This data set is coming through the Internet. You will notice that in the Table of Contents, there is a list of items with many having the same name. Some of the items have a red check and others have a black check. This image is scale dependent meaning that certain items will be shown and others not at different scales. Those items with a black check are shown at the current scale.

24. Zoom into the Long Island area. You may need to wait a few seconds for the image to appear. Are there different red and black checks by the items in the Table of Contents?

    a. Examine the relief of Long Island. Do you see any outstanding features? Here is a great geology lesson for students. To learn more, visit http://people.hofstra.edu/J_B_Bennington/research/long_island/li.html



25. Zoom in again to the Prospect Park area. You may need to do this a few times. After each zoom, wait to see the picture become clear. When you zoom in very close you will start to see little squares. These squares are the individual cells in the raster file. Each cell or pixel contains a unique elevation value.



26. Now let's add other data sets from the CD. Click on + icon and add hydrography, roads and the field data. See what happens.

27. After you feel comfortable with the USGS NED data set, explore with other data sets from the Geography Network. In particular, look at the ESRI_Satellite image.

28. Your last task! You have learned most of the tools available in AEJEE. There are some more like the buffer and catalog tools. You can explore these on your own. Explore spatial patterns in the water data. Create a map with your field data. You can choose any layers you want to show and how you want to show them.

Turn in the following week.

1. A map showing at least one of the water parameters. What and how you display is up to you. Export as a jpg file.
2. Describe spatial patterns (or lack of) in three of the water data (chlorine, dissolved oxygen, temperature, pH, nitrate, phosphate). The water quality units and methods are described in the file, WQ methods, in the folder called Water data.
3. From the data, form two questions/hypotheses for further research.