

Getting Started With ArcGIS

2005 SPACE Workshop – OSU

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Purpose: This lab has been designed to help guide you through a review of the ArcGIS software. Like all software, there is a certain language that is associated with certain application. You can expect to become familiar with the ArcGIS language, components and applications through this lab.

Objective: To be come more familiar with ArcGIS through example.

Section 1.

A short history on the evolution of ArcGIS

Environmental Systems Research Institute (ESRI) in was founded in 1969 in Redlands, CA. From its earliest stages, ESRI was focused on the organization and analysis of geographic data. With the advent of the personal computer in the 1980s, ESRI's focus was on the software application development of ARC/INFO. According to the ESRI website, they first developed ARC/INFO in 1982 for minicomputers and by 1986 a PC version for the personal computer was distributed.

ARC/INFO is a command-line based software package that handles both vector and raster geographic data and is an industry standard tool that has been developed since the 1980s.

In contrast, a much less exhaustive ESRI software package called ArcView was released in the early 1990s. Although not as comprehensive as ARC/INFO, ArcView has one major advantage over its big brother, a graphical user interface (GUI).

With its GUI, ArcView has become one of the most popular GIS packages worldwide. However, by 2000, ArcView 8 was released, which was better known under its new name ArcGIS. ESRI combined many of the features of ARC/INFO into a redesigned GUI to produce an all-in-one GIS system. In addition to the ArcGIS package, many extensions are available as Add-On's to "extend" the software capabilities, such as through such extensions as GeoStatistical Analyst, 3D Analyst, Network Analyst, and Spatial Analyst, just to name a few. We will be using ArcGIS 9.0 in our labs during this workshop.

Section 2.

Essentials for lab work using ArcGIS

I. Log on to machines

To log on to the machine please use this username and password

- Username: space
- Password: space2005

II. File naming

Although ArcGIS runs in a Windows based environment, it is HIGHLY recommended that you name all of your files as if working in a restrictive command-line environment. That simply means, that you should:

- A. Never, ever, never have any SPACES in your file/folder names.
- B. Always limit your file/folder names to 12 characters or less if possible.

III. How to save your work

In the lab environment, it is essential that you stress saving your work. Often, however, when work is not saved many hours of grief and work may result. Therefore please follow the simple procedure for saving your work.

A. Work on your local machine

Often working across a network or to a zip drive can be very time consuming. Therefore, work on your local machine.

1. First create a folder on the **c:\workspace** location.
2. Name it with your surname and first initial, (e.g. jvanhorn).
3. Make sure there are NO spaces in your folder name.

B. Save your work

1. Save all of your work in your newly created folder on the **c:\workspace\yourname** drive location.
2. Feel free to create new folders under your folder, just make sure there are NO spaces in your folder/file names.

C. Copy your work to your removable drive

1. When you are finished or at a stopping point for the day, insert your Zip-disk or your memory key into the computer and copy your **c:\workspace\yourname** folder onto your removable drive. This will ensure that everything in your folder is copied over to the removable drive.
2. Remove your removable media and take it with you.

D. Working at a new workstation

1. Now that you have all of your work saved on your removable media, for which ever workstation you choose to work on, all you need to do is copy your folder (yourname) to the c:\workspace. This will ensure all of your files are present on the local drive AS WELL AS your path names of your folders and files are the same as when you saved them.
 2. When you are done working for the day at that workstation, repeat step C.
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Section 3

Navigation in ArcGIS 9.0

ArcGIS is comprised of three parts that work in synergy with one other, ArcCatalog, ArcMap, and ArcToolbox. “**ArcCatalog** is the application for managing your spatial data holdings and database designs and for recording and viewing metadata. **ArcMap** is used for all mapping and editing tasks, as well as for map-based analysis. **ArcToolbox** is used for data conversion and geoprocessing” (ESRI 2004).

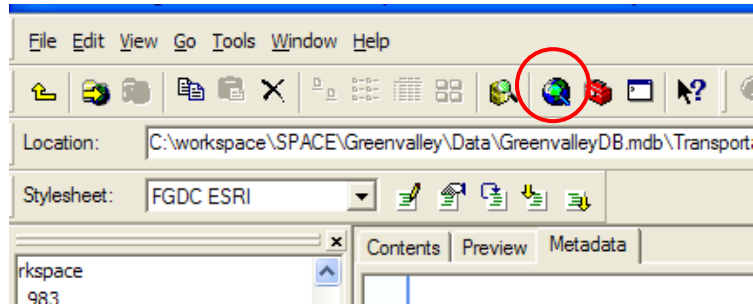
ArcCatalog

1. Open ArcCatalog | Start>All Programs>ArcGIS>ArcCatalog
2. If you have not done so, please create your folder on the **c:\workspace** location.
3. Connect to the w:\space\2005\Lab\ and copy the folder **Greenvalley** into_lab to your c:\workspace.
4. Open to Greenvalley\Data\GreenvalleyDB.mbb in ArcCatalog on your c:\workspace.
5. Notice there are 5 different layers associated with this Geodatabase; Hydrology, Parks, Public Buildings, Public Utility, and Transportation.
6. Double-click Transportation and notice that the “Contents” tab shows that there is an street_arc layer.
7. Select the “Preview” tab and see the geography of the network.
8. Now at the bottom of the “Preview” window, change the Preview: to table. Now you are looking at the attribute table of the street_arc layer. Notice that the street network is made up polylines and that some of the arc’s have street names.
9. Finally select the “Metadata” tab. Notice that this gives you information about the layer in the form of description, spatial, attributes. Select the “spatial” tab and notice that the coordinate system information as well as the spatial bounds are provided. Scroll down and click on street_arc. Notice that information regarding the arc layer is given.

Refresher: Using ArcCatalog, you can organize and deal with your Geodatabase through a series of trees and tabs, allowing you to preview the geography, tables, and metadata associated with your spatial layers.

ArcMap

From the ArcCatalog standard toolbar, launch ArcMap. See below.



In ArcMap, open an existing map ...\Greenvalley\Greenvalley.mxd.

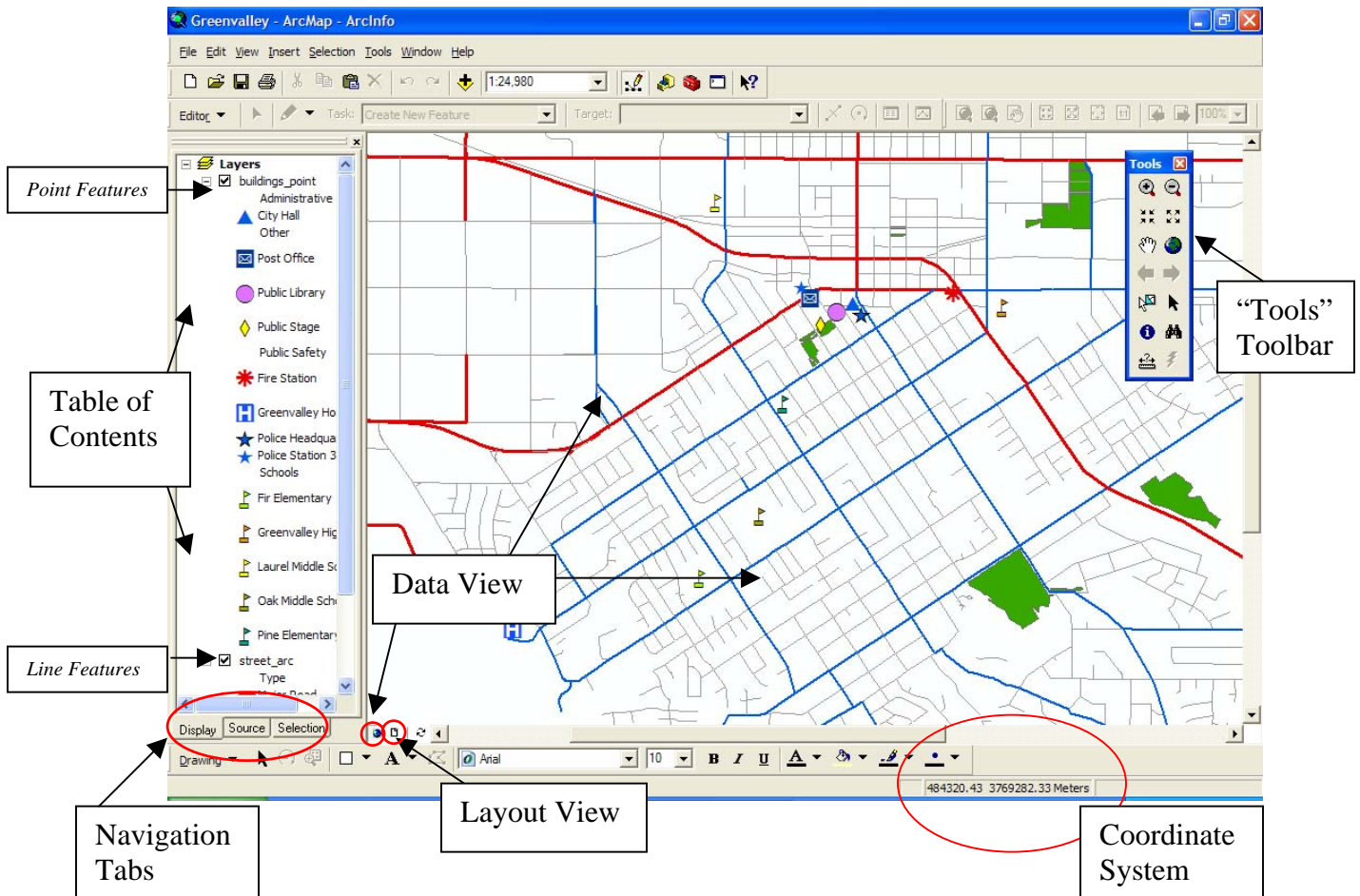
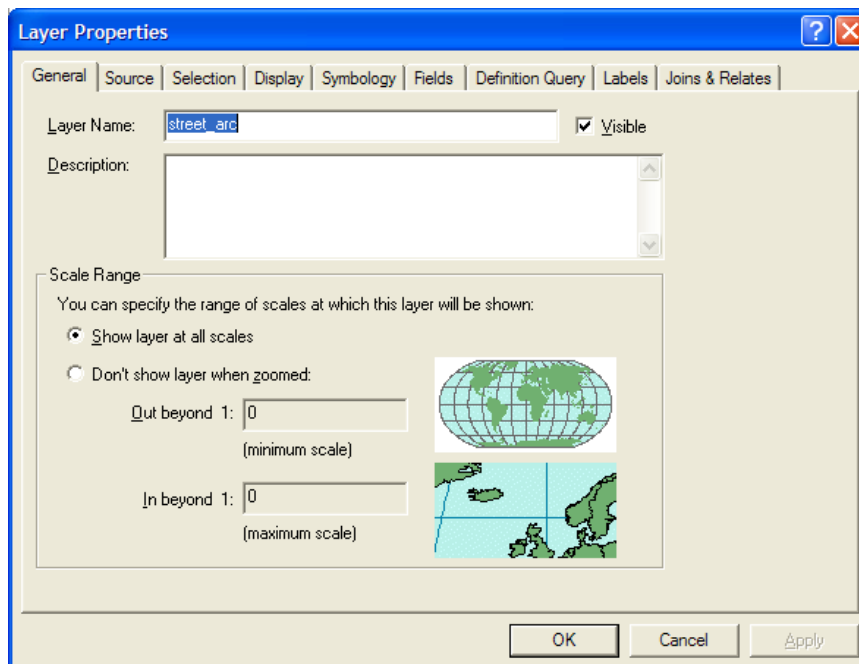


Figure 1. Layout of ArcGIS

As you can see we have the Table of Contents (TOC) on the left side of your screen. In this case, you have point, line, and area features in your TOC. You can switch between the Data View, which contains your geographic data to your Layout View, which is used for final production output (A Map). Also notice that in the lower right of the screen you have your coordinate system and in the upper right you can see the

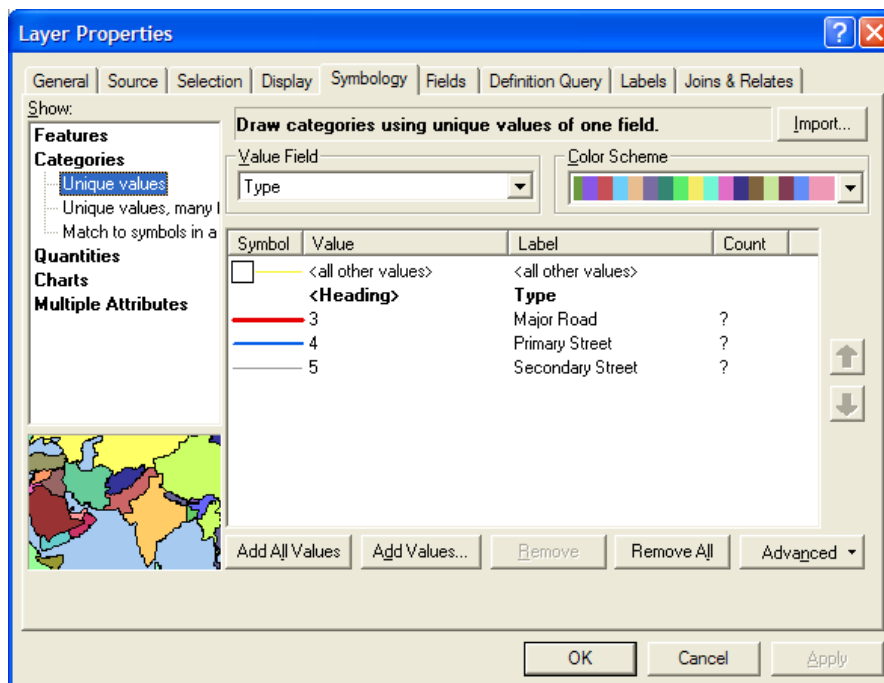
“Tools” toolbar which has your zoom and pan options as well as your id and selection tools. Finally, in the far lower left of the Figure 1 you see Navigation Tabs. These are new to ArcGIS 9.0. The ‘Display’ tab works like the normal TOC, where you can promote or demote layers, rename your layers and change colors. The ‘Source’ tab lets you see the paths or sources of your files, as well as, your imported tables. (eg. c:\workspace\yourfolder\street_arc.cov) . Lastly, the ‘Selection’ tab allows you to deal more efficiently with selection you made. Feel free to play around with these new features if you have not seen them before.

1. With the ‘Display’ tab selected, move the layer street_arc to the top of the TOC. Using this drag and drop method, you can easily promote or demote layers in the TOC.
2. Now Right-click on the street_arc name and choose properties. You should see this window on your screen:



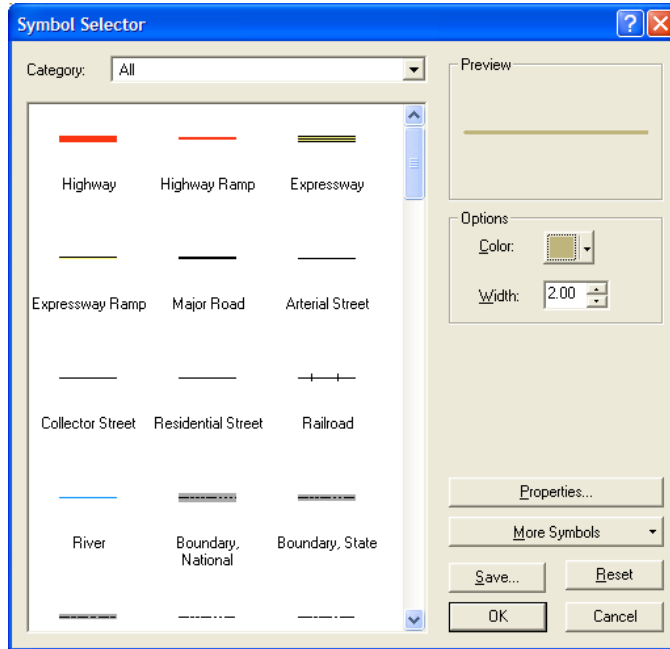
- 'Layer Properties' is a **dialog box** which provides the different characteristic properties associated with your layer.
3. In the ‘General’ tab of the Layer Properties dialog box, change your Layer Name: to streets and click **Apply**. Now notice your TOC name has changed from street_arc to streets.

4. Select the 'Source' tab in the Layer Properties dialog box. Notice that you have extent information about the bounds of your Geodatabase, as well as, path location information and coordinate information. Notice that the projection for the Greenvally Geodatabase is PCS_Transverse_Mercator or in plain language the Transverse Mercator Projected Coordinate System.
5. Now select the 'Fields' tab. Notice that you see the same fields as was in the ArcCatalog for street_arc. You can see database field information about each of the fields (columns) such as type or precision.
6. Now select the 'Symbology' tab. Here is what you should see:



Notice that you have a 'Show' feature box on the left which contains the headings, "Features, Categories, Quantities, Charts, & Multiple Attributes". Also see that there is a symbology setup to deal with different Value_Fields that are associated with your layer, which means that you can symbolize any of the different Value Fields. Click the drop-down and see what different Value Fields there are for this layer. Also see you can change the Color Scheme for the symbolization. In the feature box you can see that the Value Field "Type" has been selected which designates the different types of streets in the layer by number. 3 corresponds to Major Roads, 4 corresponds to Primary Streets, and 5

corresponds to Secondary Streets. Play with the Color Schemes and change the colors, then hit apply to see your new symbology. Now double-click on the color bar to the left of the number '3'. With this dialog box:



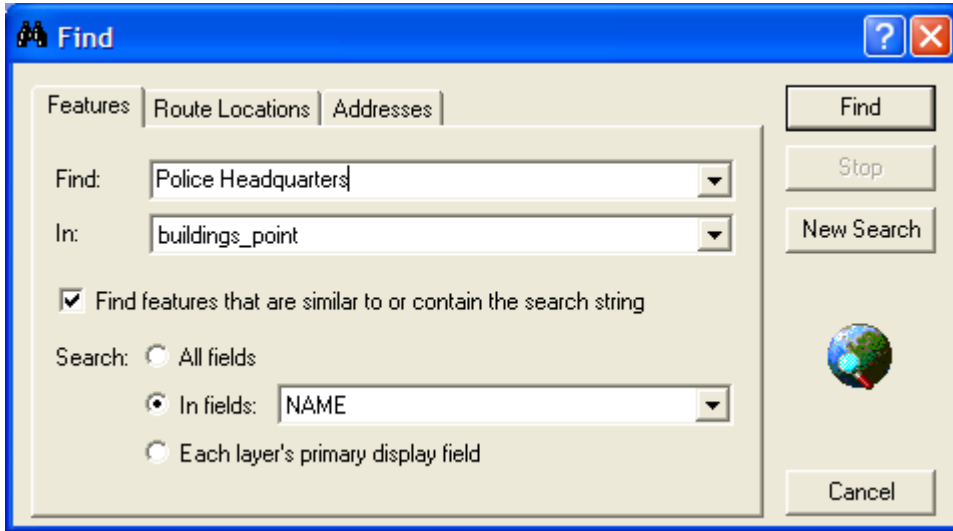
you can change the color of the individual types as well as incorporate pre-designed templates such as colors and thickness to types that correspond to your type. Select Major Road from this dialog box and click OK, then click Apply. Now your road should be represented with a 1.5 width thickness and should be the color black. Close the Layer Properties dialog box. Save your work.



Now lets explore the map a little. If your 'Tools' toolbar is not showing, Under the



main menu, select View>Toolbars>Tools and this toolbar should be displayed. With the 'Tools' toolbar, click on the 'Globe' icon and notice that the entire map is displayed for Greenvalley. The 'Globe' icon gives you the full extent. Now put your mouse over each of the different icons and you should see a short description of the function of each of the icons on the 'Tools' toolbar. What do the binoculars do? Well let's find out together. Click the binoculars tool which will help us find features on our map. In the 'Find:' type *Police Headquarters* of the Find dialog box. Now with the drop-down menu of 'In:' choose *buildings_point*. Now check the

radio circle 'In fields:' and choose *Name*. Your dialog box for Find should look like this:



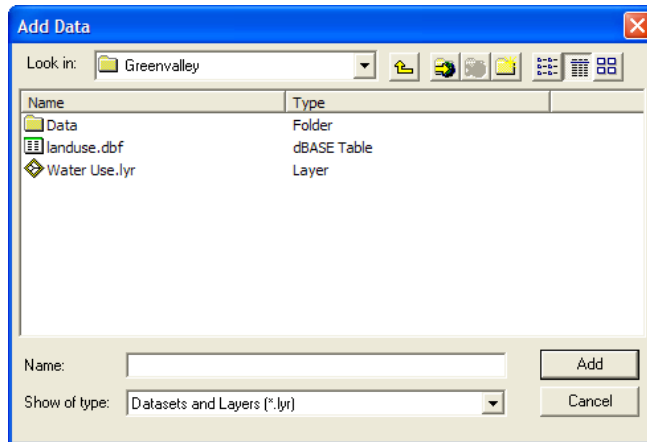
now click the 'Find' button in the upper right of the dialog box. The database is now searching for the information we requested. It found 1 data named 'Police Headquarters'. Right-click on the name in the results box and select 'Zoom to Feature' Now you have located the Police Headquarters for Greenvalley. Close the Find dialog box. Choose the ID icon from the 'Tools' toolbar and click on the star that represents the Police Headquarters. Now you can see all the attribute information in an 'Identify Results' dialog box for that feature. Close the dialog box and now play with the 'Fixed Zoom Out' button  and the 'Back to Previous Extent' . Finally use the 'Pan' option to 'grab-and-drag' your way around the map.

Now lets do some intermediate procedures.

1. Please close any dialog boxes that are open and click the 'Globe' in the Tools toolbar to make the extent full. Save your work.
2. Now add a new layer to the map using the 'Add Data' button.

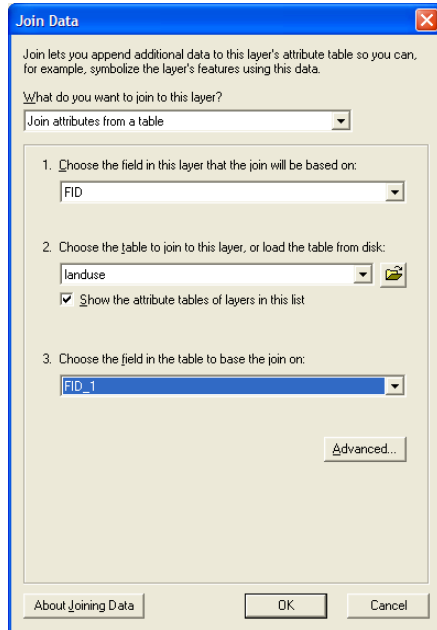


3. Navigate to your Greenvalley folder and select WaterUse.lyr. Click Add.



4. Notice now, there is a new layer added to the map. In the TOC, Right-Click on the parcels_polygon layer and choose 'Zoom to Layer'.
5. Now you should see the water use polygons for a subsection of Greenvalley. Notice that the numerical range for the polygon layer establishes which polygons have high water usages (7-8-9) and those that have low or none(0, 1-2). Open the attribute table for this layer by Right-clicking and choose 'Open Attribute Table'. Explore the fields of the table.
6. Now, let's join this layer with a .dbfIV file so that we can see what type of zoning each polygon has. First, we need to add the land use table we are going to use. Click on 'Add Data' button, the same as you did above (the 'plus sign' button) and navigate to the Greenvalley folder. Select the landuse.dbf database file and click Add.
7. In the TOC, Right-click on the newly added landuse.dbf file and choose open. This allows you to see the attribute table for the database. Notice there are several different types of land uses associated with unique Federal ID numbers (FID). Close the table when done.
8. Now click on the 'Display' tab at the bottom of the TOC. Right-click on the parcels_polygon layer and choose 'Joins & Relates'>'Join'.
9. We will now join the parcel water use layer with the land use data. In the Join Data dialog box select 'Join attributes from a table' from the drop-down menu. In the '1. Choose the field in this layer that the join will be based on:' choose FID.

10. In the '2. Choose the table to join to this layer...' select landuse from the drop-down menu.
11. Finally, for '3. Choose the field in the table to base the join on:' choose FID_1 from the drop-down menu. Your dialog box should look like this:



12. Click OK and choose YES to automatically create an index, if prompted.
13. Now Right-click on the parcels_polygon layer and choose to 'Open Attribute Table'. Notice the column headings have changed (indicating that a join is in place) and that the landuse information is now present in the table. Close the attribute table when done.
14. Now lets see what types of land use zones are using the most water in Greenvally. Start by Right-clicking on the parcels_polygon layer and selecting 'Properties'.
15. Select the Symbology tab and then change the color of the color ramp to something like 'brown'. Click 'Apply' and close the dialog box. Save your work.
16. Now on the main menu choose Selection>Select By Attributes. We are going to create a query to answer our question, "What types of land uses are associated with the highest usage of water?".
17. For 'Layer:' choose parcels_polygon. For 'Method:' choose to 'Create a new selection'.

18. In the 'Fields' attribute box, double-click on parcels_polygon.USE_CLASS. This will take the attribute down into the query box.
19. Now choose the 'greater than & equal to' button and then type the number 7. This will create a query, `SELECT *From parcels_polygon_landuse WHERE: parcels_polygon.USE_CLASS >= 7`, which will give us all the parcels that have a water usage of 7 or greater. Click Apply, then Close.
20. Notice now that some of the polygons are selected. These are the areas in Greenvalley that use the most water. Now Right-Click on parcels_polygon and choose 'Open Attribute Table'.
21. Look at the bottom of the 'Attributes of parcels_polygon' dialog box, you can see that there are 18 out of *2000 records selected.
22. Click the button that reads, 'Selected' and notice now you see the 18 records that were selected from the query. At the bottom of the 'Attributes of parcels_polygon' dialog box, click on 'Options' and choose to 'Export'. Save your file in the Greenvalley folder as hwu_landuse.dbf (High water use and landuse). Add the new table to the map. Close your table.
23. Click on the 'Source' tab at the bottom of the TOC and you will then see that the table hwu_landuse is now in the Table of Contents. Right-Click and Open the table and notice now that the field columns are named their original names and that the join data is now in one complete file for the selected tuples (rows) of data you previously exported.
24. Look at the far right column of LANDUSE. Notice that there are many different types of landuse. Good data is always accompanied by good metadata, so that is where we will look to see if we can find a definition for each of the LANDUSE types. Sort the data (Ascending) by Right-clicking the column label LANDUSE and choosing to Sort Ascending. Notice that HDR seems to be most common. But what does HDR stand for? That is what we will answer next.
25. If you do not have **ArcCatalog** open, please open it and navigate in the TOC to the location of the Greenvalley folder you are presently using. Click on landuse.dbf and then on the Metadata tab next to the Preview tab.

The metadata associated with the file should appear. However, we are going to change the format of the metadata to something a little more standard. In the Stylesheet: drop-down box just above the TOC, please change it to FGDC FAQ. According to ESRI (2004), “ArcGIS provides several predefined stylesheets—the default is the ESRI stylesheet, which you used earlier. You can also create your own stylesheets. The FGDC FAQ stylesheet was developed by the Federal Geographic Data Committee to present the metadata in the form of a set of frequently asked questions. This format lets you see the values for each attribute in a layer (as long as they’ve been defined in the metadata)”.

26. From the FAQ choose under ‘The Frequently-asked questions’ > ‘What does this data set describe?’ > ‘7. How does the data set describe geographic features?’.
27. Now you can see what the values are for each of the LANDUSE types in the file landuse.dbf.
28. Go between ArcCatalog and ArcMap and make notes of which types of landuse are represented in the file hwu_landuse. Feel free to use the blanks below:

Landuse Value	Landuse Type	Count
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

29. Circle above which two landuse types are most common by count. Does that make sense? Now look at the rest of the land use types. Are there any that stand out as not making sense?
30. You should have answered that VAC and VLDR do not make any sense because these are listed as being unoccupied by landuse. There is an apparent discrepancy.

This points out the problem that often exists with datasets. Either the data is wrong, or represents a different time frame, or there is further information that you need to have to understand the discrepancy. So please be cautious when working with real datasets that you have a method for validation and reliability of your data and you understand the scale and time frame the data was collected.

31. Please save your work in ArcMap and close your attribute table.

Congratulations! You have made it through the basic and intermediate section of Getting Started With ArcGIS. Many of the procedures covered in this section are common everyday practices that you should have mastered in no time.

ArcToolbox

Having explored ArcCatalog and ArcMap and some of the basic and intermediate procedures in each, now it is time to see a little of what ArcToolbox can do.

Remember that ArcToolbox is part of the ESRI suite that deals with conversion of data and geoprocessing operations. So let's begin.

Here is what the city of Greenvalley wants: The city is interested in building a new park on a vacant lot of the city. However, they have some restrictions regarding where it can be built. Their restrictions are as follows: the park has to be located on a vacant lot that is at least 2000 square meters and is not within 200 meters of an major roads to account for children's safety.

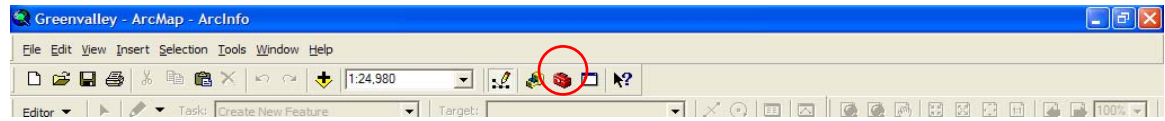
So lets try and help them out. However, this time the instructions will be somewhat vague for operations that you have already accomplished in the previous sections.

The part using ArcToolbox, however, will be specific.

1. First lets build a query. Remember how to build a query? Build a query so that you are making a selection from parcels_polygon of land uses that are vacant and that have a shape area of greater than or equal to 2000. (HINT: With

landuse.LANDUSE selected, click on the 'Get Unique Values'). How many parcels were selected? You should have gotten 13 parcels as being selected.

2. Now open the ArcToolbox. It is the little red box on the main menu (see below)



3. As you can see ArcToolbox is fully incorporated into ArcGIS 9.0 unlike previous versions (if you are familiar with previous versions). There are several different effective and powerful tools in the toolbox and today we are going to use a couple of geoprocessing options in the Analysis Tools section of ArcToolbox.
4. Within ArcToolbox choose Analysis Tools > Extract > Select and double-click on Select.
5. You should now be in a Select dialog box. For 'Input Features' choose the parcels_polygon from the drop-down. For the 'Output Features' make the path, C:\workspace\yourname\greenvalley\parcels_polygon_Select (notice that this is a shorter path than the default you are given). Click OK.
6. Now a toolbox dialog script will open and run. Close it when it is done.
7. In your TOC you should now see a new layer has appeared called parcels_polygon_Select. The Select option in Analysis Tools will take any selection of a layer you make and then creates a new shapefile layer.
8. Turn off the layer parcels_polygon by 'unchecking' the layer in the TOC.
9. Now you should clearly see the vacant lots in Greenvalley that are greater than 2000 square meters. Good job!
10. Also let's turn off the buildings_point layer and the parks layer in the TOC as well since we don't need it presently.
11. Now zoom to the parcels_polygon_Select layer. Remember how to 'Zoom to a Layer'?
12. Now we are going to buffer the vacant lots. In the ArcToolbox choose Analysis Tool > Proximity > Buffer.
13. Input Features should be parcels_polygon_Select and go ahead and keep the default path
c:\workspace\yourname\greenvalley\parcels_polygon_Select_Buffe.shp

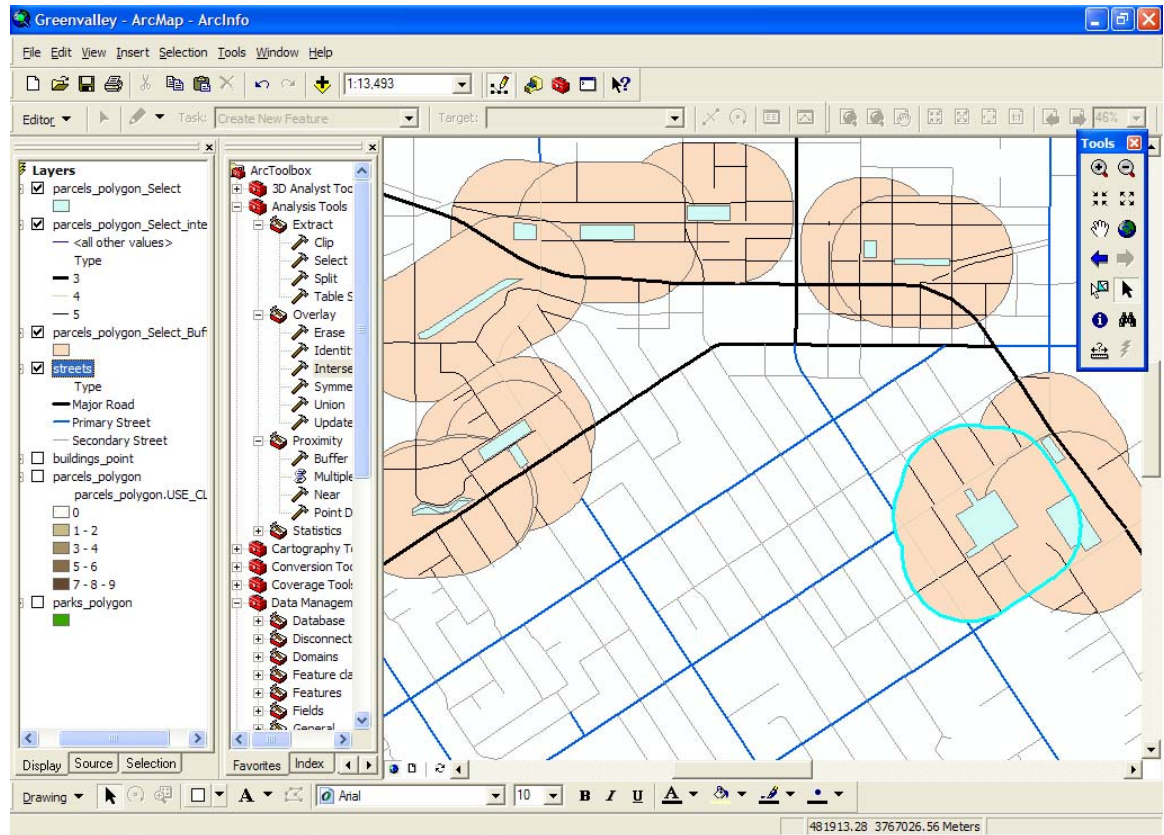
14. Notice the Linear unit changed automatically to Meters. In the input box below the Linear unit label, enter in '200'. This will buffer around all of the parcels out 200 meters in Euclidean distance. Click OK.
15. Now you have a new layer in the TOC, parcels_polygon_Select_Buffe. This shows the buffers of 200 meters around all of the vacant parcels that are greater than or equal to 2000 square meters.
16. Now lets see if there are any roads crossing through those buffer zones. In ArcToolbox, choose the Analysis Tools > Overlay > Intersect.
17. In the dialog box, for Input Features, choose parcels_polygon_Select_Buffe AND *streets* from the drop down menu. For your output path and file name choose c:\workspace\yourname\greenvalley\parcels_polygon_Select_intersect.shp
18. Click OK. Now you have the new shape file in the TOC.
19. Right-click on the new layer and choose 'Properties'. Now select the Symbology tab and choose Categories in the left hand 'Show' box. Choose 'Unique values' and select from the 'Value Field' drop-down menu, 'Type'. At the bottom of the dialog box, click on the 'Add All Values' box. Now change the line next to the number '3' to the major road template.
20. Now turn off all layers except the ...Select_intersect and ...Select_Buffe layers.
21. Make a query on the parcels_polygon_Select_intersect layer where the Type is equal to 3.
22. Now open the attribute layer of the ...Select_intersect layer. At the bottom you should see 61 of 477 Selected. Go ahead and click the 'Selected' button instead of 'All'. Now you see the 61 tuples selected.
23. Right-click on the parcels_po column and choose to 'Sort Ascending'. Keep the table open.
24. Now Right-click on the ...Select_Buffe layer and open its attribute table.
25. Sort the parcels_po column as well. The parcels_po number is a unique number associated with the buffer zone you previous created.
26. Now compare the two tables to see if the parcel_po appears in both. If it does not then we can conclude that the major road that we intersected into the buffer zone does not exist, thus we are able to build a park on that vacant lot because it meets

the requirements of the city. Use the chart below to help you organize.

	parcel_po for Buffer	parcel_po for Intersect	appear in both?
1227	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1274	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1279	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1318	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1358	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1442	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2173	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2258	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2300	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2577	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2633	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2665	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2682	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

27. Were there any that DID NOT appear in both? Well you should have noticed that 2577 buffer zone did not intersect with a major road. Therefore we can suggest to the city that the parcel which is associated with number 2577 is the best suggestion for converting a vacant parcel into a park given their constraints. Close the two attribute tables, leaving the one with selections, still selected.
28. Finally, we need to produce an output map. First arrange your layers in the TOC, so that the parcels_polygon_Select layer is first, the parcels_polygon_Select_intersect layer is second, and the parcels_polygon_Select_Buffe layer is third and the streets layer is fourth and make sure these are the only layers 'checked'.
29. Now, Right-click on the Select_Buffe layer and open the attribute table. On the far left select the 'square tab' associated with the tuple (row) 2577. Now the whole record for 2577 should be seen on your display surrounding the buffer you

created for that zone. Close the table. Now click on the 'Selection' tab on the bottom of the TOC, and right-click on the *name* parcels_polygon_Select_intersect and choose 'Clear Selected Features'. Go back to the 'Display' tab at the bottom of the TOC. Your display should look something like below.



30. Referring to Figure 1. on page 4, notice the 'Layout View' button. Go ahead and click it and from here you can use the 'Insert' command on the main menu to add several map elements such as a north arrow, scale bar, and legend. Also use the 'Draw' toolbar to help you add text where appropriate and use the zooms and pan options when adjust your box sizes. Here might be a suggest look for your output:

31. Print your output on the black & white laser and evaluate it for any errors. Adjust as necessarily until you are satisfied. Now print your final version in color.
32. CONGRATULATIONS! You are done!

This concludes your refresher course in ArcGIS. I hope that it has been helpful for you to go through some of the different operations and procedures in ArcCatalog, ArcMap, and ArcToolbox. If you have any questions or suggestions, please let me know.

Citations:

ESRI 2004, *ArcGIS 9: Getting Started with ArcGIS*. Redlands, CA: 272 pages.