ArcGIS® 9

Getting Started With ArcGIS®

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Getting to know ArcGIS

Section 1

Introduction

Welcome to *Getting Started With ArcGIS*. This book is intended to help you get started using ESRI® ArcGIS® software and to illustrate the methods and procedures involved in conducting a geographic information system (GIS) project. If you are new to GIS, this book is a great place to start—you can learn how to use a GIS to solve problems while you are learning to use ArcGIS.

This book is divided into two sections. The first section, 'Getting to know ArcGIS', discusses the basics of ArcGIS and GIS data. The second section, 'Conducting a GIS project', begins with Chapter 4, 'Planning a GIS project', and is a sample GIS project that you can work through. The project is designed to let you work at your own pace, without the need of additional help. Readers who wish to complete the entire GIS project section of the book should plan to spend about eight hours of focused time on the project.

In order to get started, you will need ArcGIS installed on a Windows® machine. You will also need to install the ArcTutor tutorial data on your machine or on a networked drive. Proceed to Chapter 1, 'Welcome to ArcGIS', when you are ready to get started.

Welcome to ArcGIS

1

IN THIS CHAPTER

- **What can you do with ArcGIS?**
- **Unique projects to daily business**
- **Tasks you perform with ArcGIS**
- **Tips on learning ArcGIS**

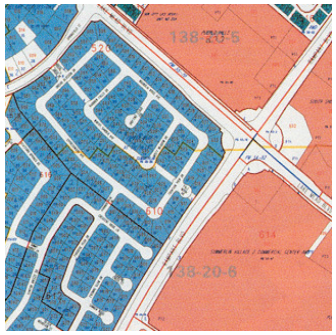
Welcome to ArcGIS, ESRI's premier GIS software. You can do virtually any GIS job at any scale of complexity with ArcGIS, from conducting a single analysis project on your own to implementing a vast, multiuser, enterprisewide GIS for your organization.

Use this book to learn what GIS is all about, and in just a short time you can begin to apply ArcGIS for all of your GIS needs.

Today, GIS is used by thousands of different organizations and hundreds of thousands of individuals to access and manage fantastically varied sets of geographically related information.

In this chapter, you will find samples of real-world uses of ArcGIS, a brief discussion of the different ways GIS is used, some examples of how ArcGIS lets you use central GIS functions, and finally, some directions for learning more about ArcGIS.

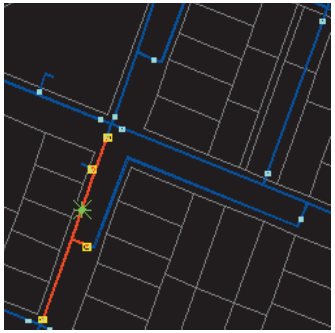
What can you do with ArcGIS?

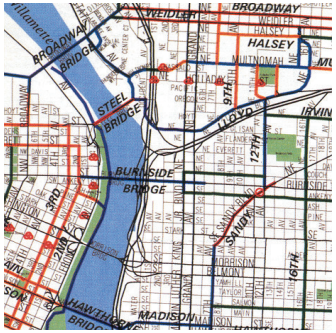


A tax assessor's office produces land use maps for appraisers and planners.

An engineering department monitors the condition of roads and bridges and produces planning maps for natural disasters.

A water department finds the valves to isolate a ruptured water main.

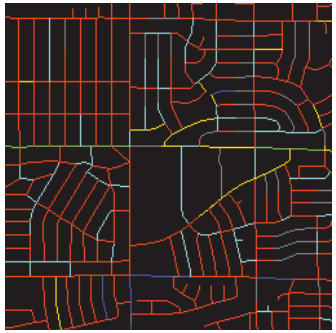


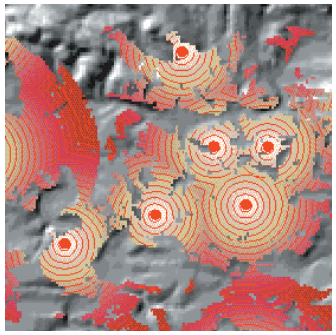


A transit department produces maps of bicycle paths for commuters.

A police department studies crime patterns to intelligently deploy its personnel and to monitor the effectiveness of neighborhood watch programs.

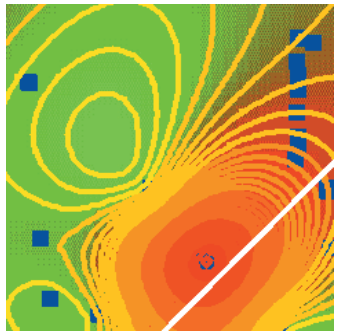
A wastewater department prioritizes areas for repairs after an earthquake.



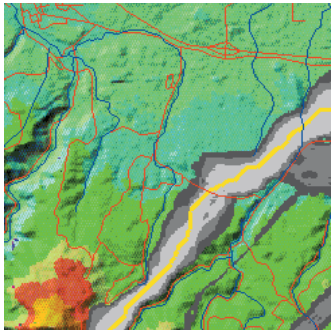


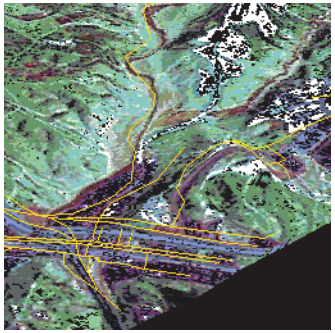
A telecommunications company studies the terrain to find locations for new cell phone towers.

A hydrologist monitors water quality to protect public health.

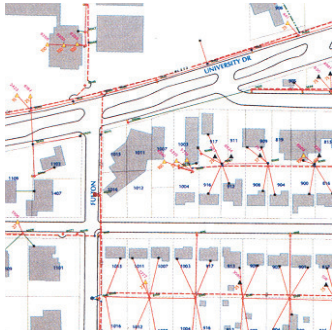


A pipeline company finds the least-cost path for a new pipeline.



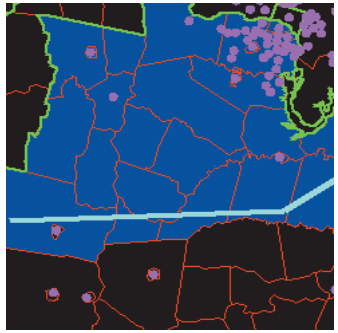


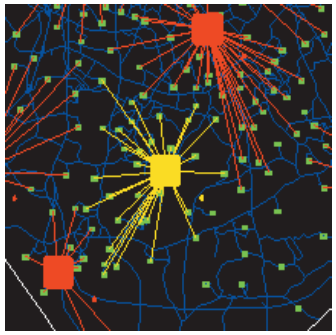
A biologist studies the impact of construction plans on a watershed.



An electric utility models its circuits to minimize power loss and to plan the placement of new devices.

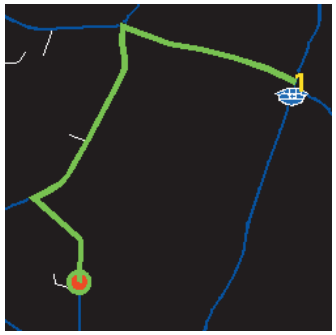
A meteorologist issues warnings for counties in the path of a severe storm.



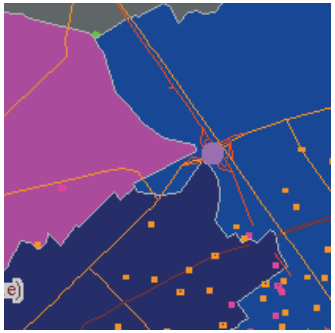


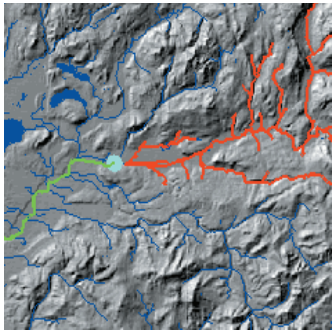
A business evaluates locations for new retail outlets by considering nearby concentrations of customers.

A police dispatcher finds the fastest route to an emergency.

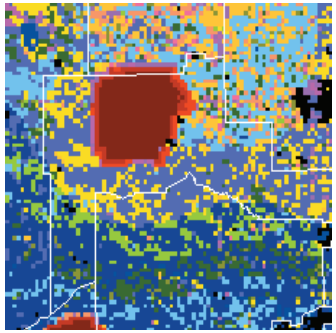


An emergency management agency plans relief facilities by modeling demand and accessibility.





A water resource manager traces upstream to find the possible sources of a contaminant.



A fire fighting team predicts the spread of a forest fire using terrain and weather data.

What will you do with ArcGIS?

From unique projects to daily business

You can use ArcGIS in different ways, depending on the complexity of your needs.

Some people use ArcGIS primarily as a single-user mapping and analysis tool, usually in the context of a well-defined, finite project. This common use of ArcGIS is sometimes called project GIS. Other people use ArcGIS in a multiuser system designed to serve an organization's ongoing needs for geographic information. Multiuser GIS is sometimes divided into departmental and enterprise GIS according to a system's level of complexity and integration with the day-to-day operation of an organization.

This book presents ArcGIS in the context of project GIS because a project is a good, self-contained way to explore a variety of basic GIS functions.

Project GIS

In a GIS analysis project, an analyst faces a variety of tasks that can be grouped into four basic steps.

The first step is to convert a question, such as "Where is the best place for a new building?" or "How many potential customers are near this store?", into a GIS database design and analysis plan. This involves breaking the question into logical parts, identifying what layers of data will be needed to answer each part, and developing a strategy for combining the answers to each part of the question into a final answer.

The next step is to create a database that contains the geographic data required to answer the question. This may involve digitizing existing maps, obtaining and translating electronic data from a variety of sources and formats, making sure the layers are of adequate quality for the task, making sure the layers are in the same coordinate system and will overlay correctly, and adding items to the data to track analysis result values. Personal workspaces of file-based data, file geodatabases, and personal geodatabases are used to organize project GIS geodatabases.

The next step is to analyze the data. This usually involves overlaying different layers, querying attributes and feature locations to answer each logical part of the question, storing the answers to the logical parts of the question, and retrieving and combining those answers to provide a complete answer to the question.

The final step in a project-based analysis is to communicate the results of the analysis, usually to people who do not use GIS and who have different levels of experience in dealing with maps. Maps, reports, and graphs are all used, often together, to communicate the answer to the question.

Multiuser GIS

In a multiuser GIS, people in an organization—from a few in a single office to hundreds in different branches—use GIS in different ways to support their daily tasks.

Departmental GIS refers to systems developed within a single department to support a key function of the department. For example, a planning department might routinely use GIS to notify property owners of proposed zoning changes near their property.

A departmental GIS is usually managed within the department and often has specialists devoted to different

tasks. For example, a department might have its own system administrator, digitizer, and GIS analyst. Departmental GIS is often customized to automate and streamline procedures. For example, a planning department could use a GIS application that finds the names and addresses of parcel owners within a designated area and automatically generates notification letters.

An enterprise GIS spans departments in an organization. These large systems support multiple functions of an organization, from daily business to strategic planning. An enterprise GIS is usually managed as a part of the organization's information technology infrastructure. For example, a city's enterprise GIS integrates the business functions of building and maintaining the city. The engineering department builds the infrastructure for a subdivision using the same geodatabase that the planning department and assessor use to do their jobs.

An organization's entire network becomes the platform for an enterprise GIS. To provide access to many users, an enterprise GIS stores data in commercial relational database management systems (RDBMSs), such as Oracle®, Informix® Dynamic Server, and Microsoft® SQL Server™, that have been spatially enabled by ESRI's ArcGIS Server® software.

Using ArcGIS Server allows geodatabases to be viewed and edited by many people simultaneously. To make the most of a networked system's capabilities, multiple seats of key applications, such as ArcCatalog™ and ArcMap™, are deployed on desktop machines across an organization. Servers supply them with data and perform processor-intensive tasks.

The functions of a multiuser GIS are similar to those of a project GIS but on a larger scale and operating in a continuous, cyclical fashion. Planning is crucial for multiuser systems, but the rewards—including increased operational efficiency, better allocation of scarce resources, consistency of information, and better-informed decisions—are tremendous.

Tasks you perform with ArcGIS

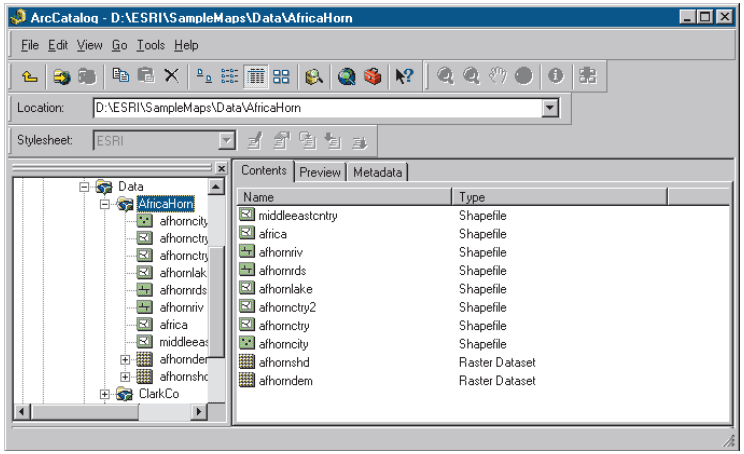
Whether you use GIS in a project or multiuser environment, you can use the ArcGIS Desktop applications to do your work.

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 a dockable window in the ArcGIS applications used for data conversion and geoprocessing.

Using these applications together, you can perform any GIS task, simple to advanced, including mapping, data management, geographic analysis, data editing, and geoprocessing.

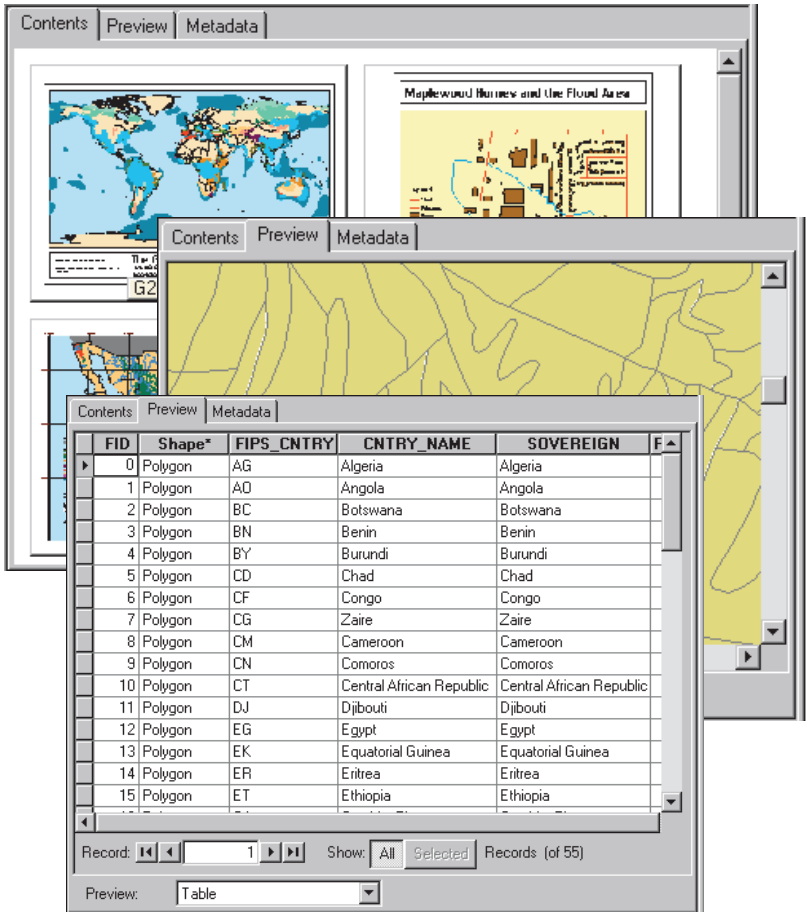
ArcCatalog

ArcCatalog lets you find, preview, document, and organize geographic data and create sophisticated geodatabases to store that data.



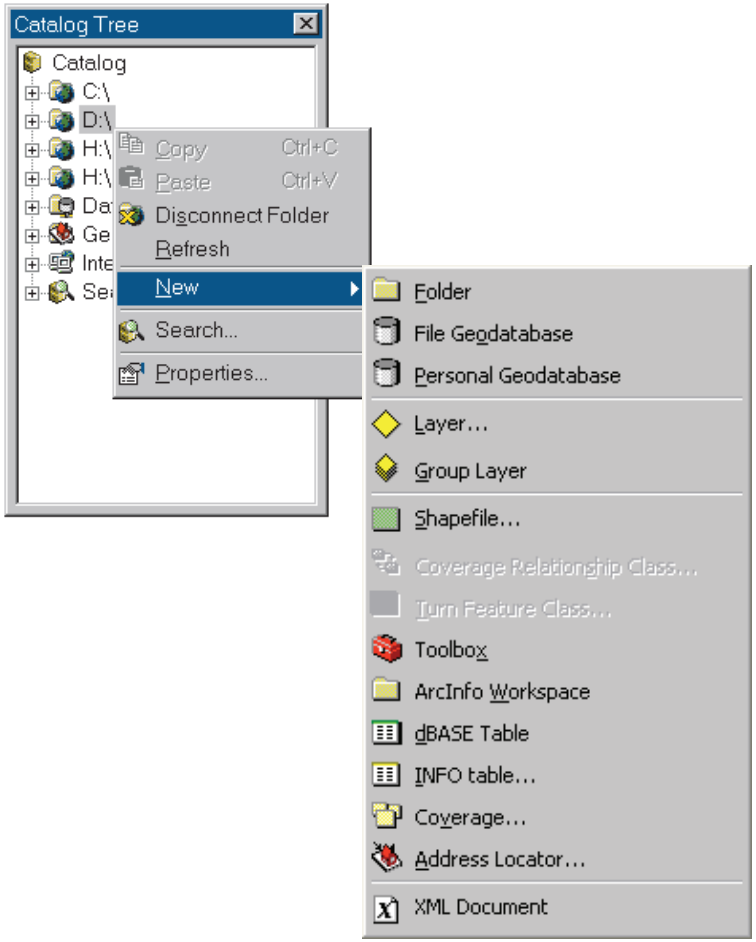
ArcCatalog provides a framework for organizing large and diverse stores of GIS data.

Different views of your data help you quickly find what you need, whether it is in a file, personal geodatabase, or remote RDBMS served by ArcGIS Server.

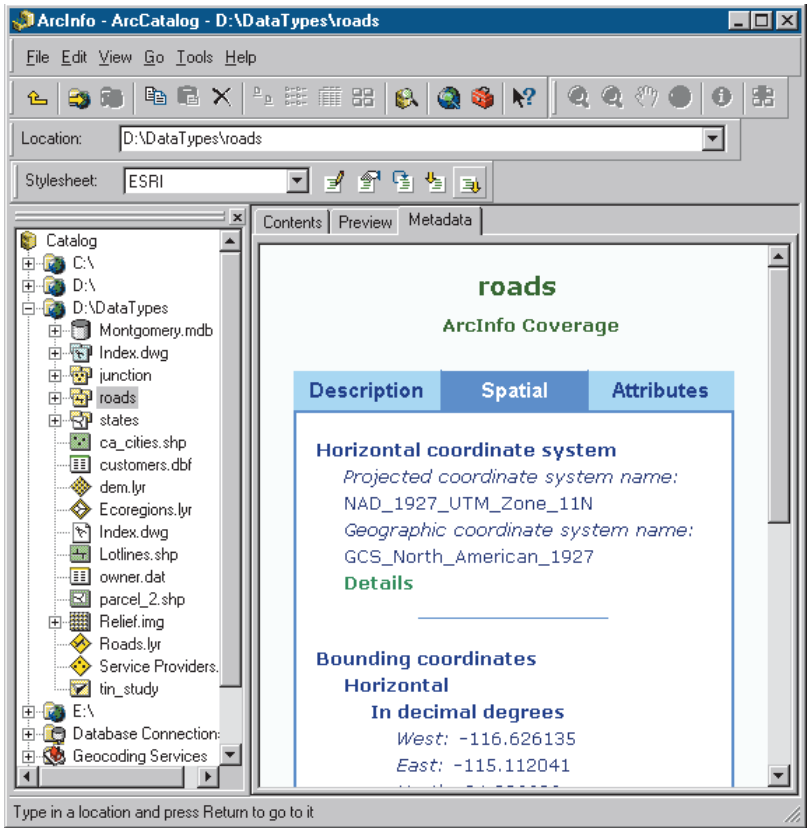


You can use ArcCatalog to organize folders and file-based data when you build project databases on your computer.

You can create geodatabases and use tools in ArcCatalog to create or import feature classes and tables.

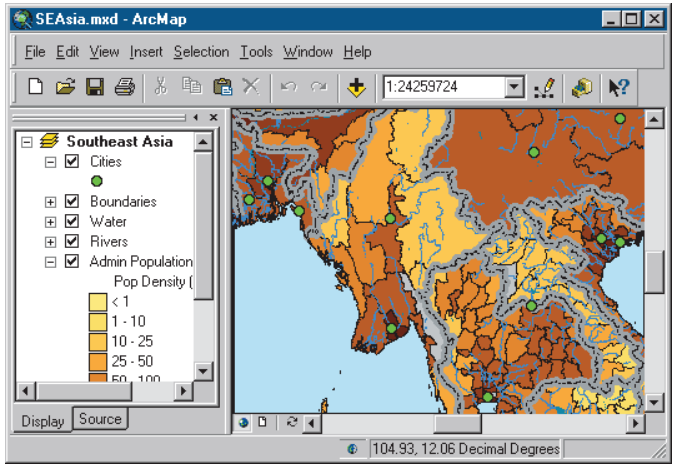


You can also view and update metadata, allowing you to document your datasets and projects.

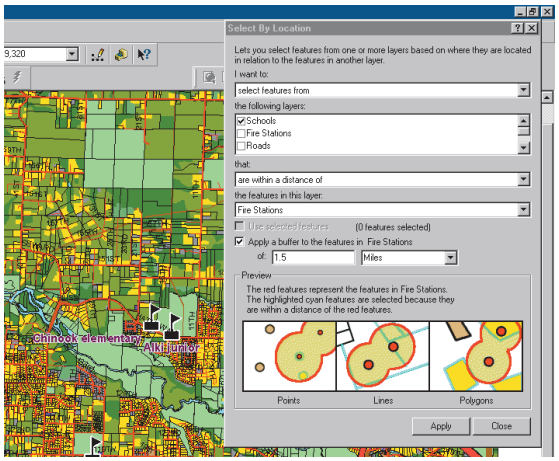


ArcMap

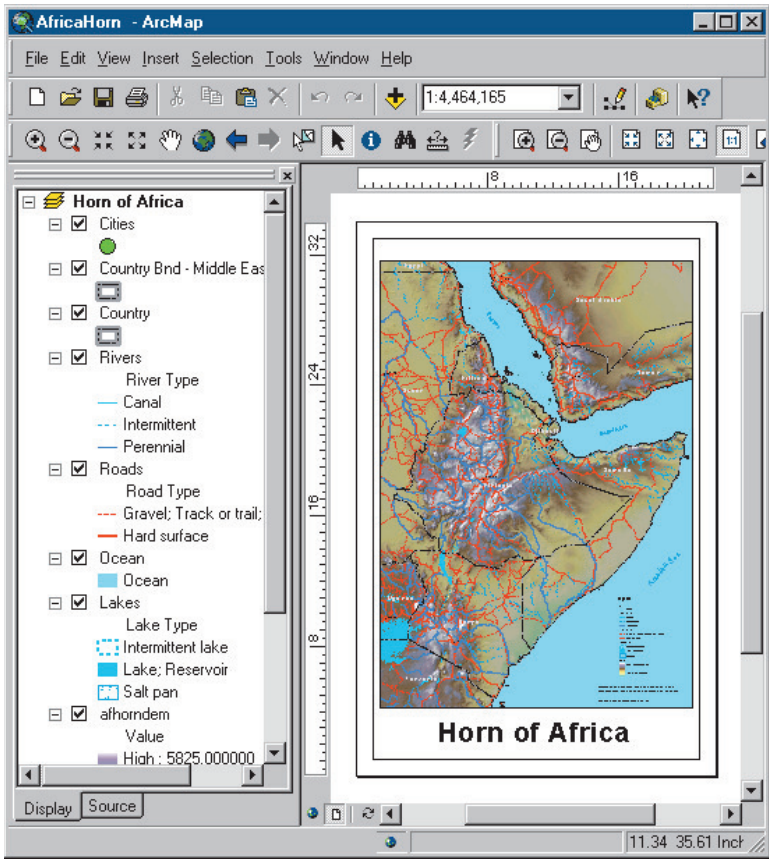
ArcMap lets you create and interact with maps. In ArcMap, you can view, edit, and analyze your geographic data.



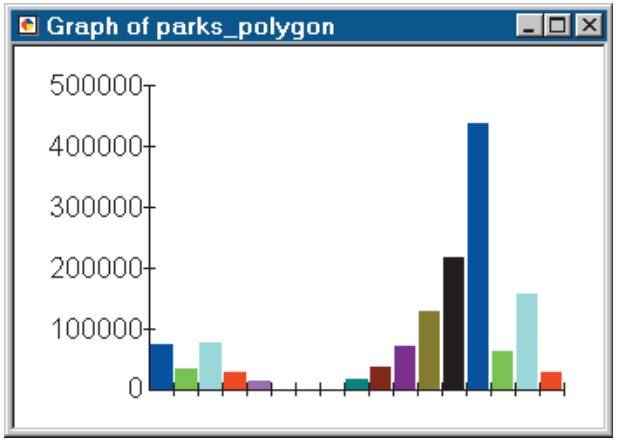
You can query your spatial data to find and understand relationships among geographic features.



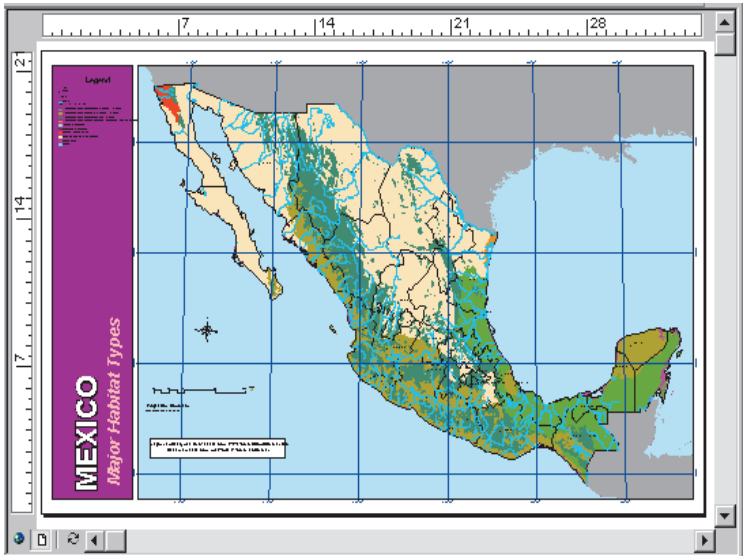
You can symbolize your data in a wide variety of ways.



You can create charts and reports to communicate your understanding with others.



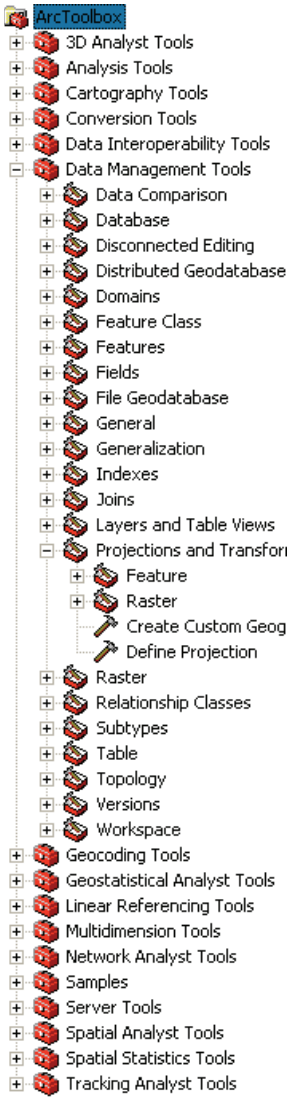
You can lay out your maps in a what-you-see-is-what-you-get layout view.



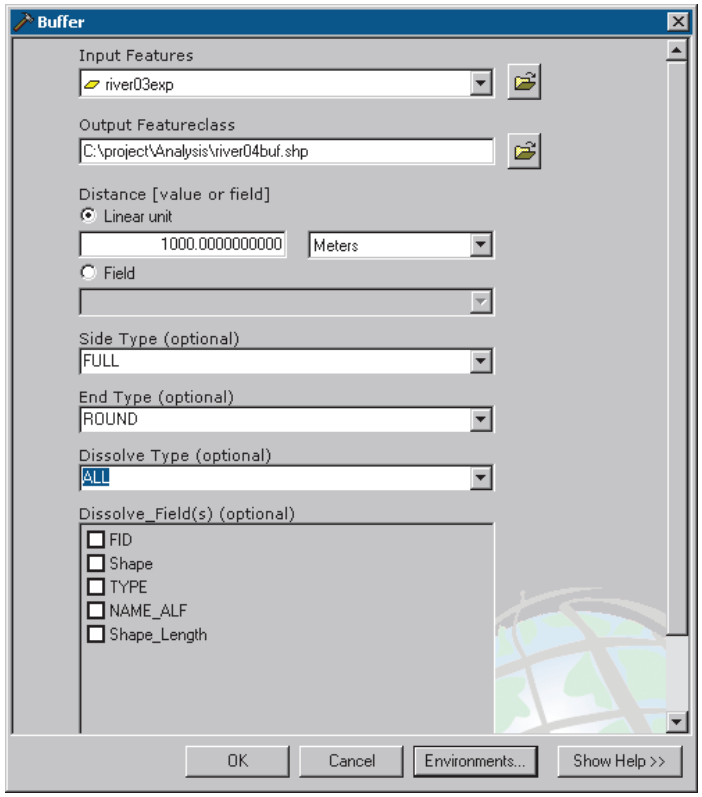
With ArcMap, you can create maps that integrate data in a wide variety of formats including shapefiles, coverages, tables, computer-aided drafting (CAD) drawings, images, grids, and triangulated irregular networks (TINs).

ArcToolbox

ArcToolbox contains many GIS tools used for geoprocessing. It is a dockable window integrated into all the ArcGIS Desktop applications.



Geoprocessing tasks are accomplished through form-based tools.



Accessing the ArcGIS Desktop applications

The ArcGIS Desktop applications can be accessed using three software products, each providing a higher level of functionality.

- ArcView® provides comprehensive mapping and analysis tools, along with simple editing and geoprocessing tools.
- ArcEditor™ includes the full functionality of ArcView, with the addition of advanced editing capabilities.
- ArcInfo® extends the functionality of both to include advanced geoprocessing.

ArcToolbox for ArcView contains nearly 200 tools and ArcEditor contains nearly 250 commonly used tools for data conversion, analysis, and management.

ArcToolbox for ArcInfo comes with a comprehensive set of tools—almost 300 of them, including ArcInfo Workstation coverage geoprocessing tools.

You can use this tutorial with ArcView, ArcEditor, or ArcInfo since it uses functionality common to all three software products.

For more information on ArcView, ArcEditor, and ArcInfo, see *What is ArcGIS?*

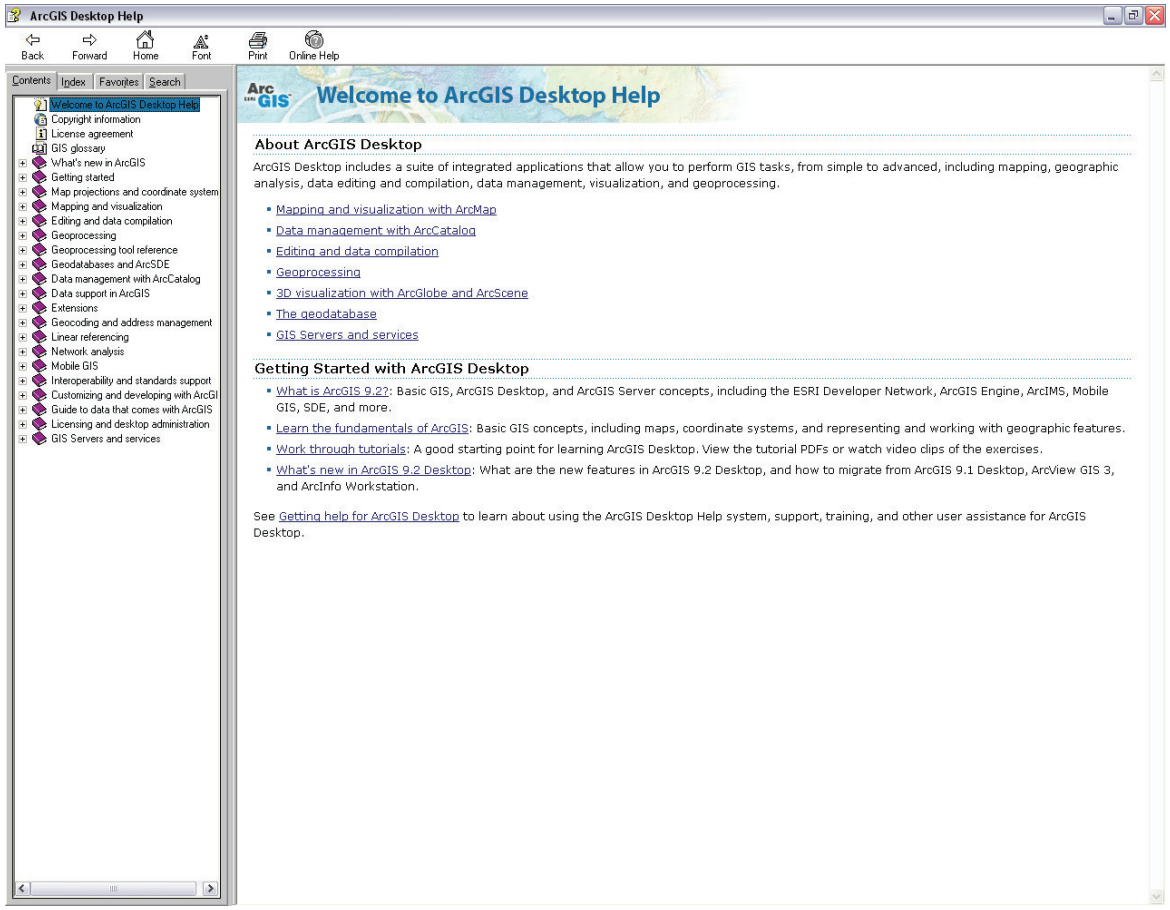
Tips on learning ArcGIS

This tutorial is intended to help you learn the basics of ArcGIS. You can use the other tutorials that come with ArcGIS to supplement the information in this tutorial and to learn more about other tasks you can perform using ArcGIS.

When you want quick information about how to do a specific task, you can look it up in the ArcGIS Help. The Help system is organized around specific tasks. They provide answers in clear, concise steps. Many of the help topics also contain background information if you want to find out more about the concepts behind a task.

Just click the Help button on any toolbar or dialog box. For more information, see the Help section 'Getting more help'.

The 'What's next?' section at the end of this book lists additional resources for learning ArcGIS and for getting help in completing your own GIS projects.



Exploring ArcCatalog and ArcMap 2

IN THIS CHAPTER

- Introducing ArcCatalog
- Viewing data in ArcCatalog
- Connecting to data
- Introducing ArcMap
- Working with maps
- Exploring a map
- Adding a layer to a map
- Adding features from a database
- Changing how features are drawn
- Adding labels to a map
- Working with the map layout
- Saving a map
- Printing a map
- What's next?

Maps are the most commonly used tools for understanding spatial information. Whether you do analysis or editing, produce wall maps or illustrate reports, design GIS databases or manage them—when you work with GIS you work with maps. ArcMap allows you to work with all of your geographic data in maps, regardless of the format or location of the underlying data. With ArcMap, you can assemble a map quickly from predefined layers, or you can add data from coverages, shapefiles, geodatabases, grids, TINs, images, and tables of coordinates or addresses.

ArcCatalog is designed to work with ArcMap. In ArcCatalog, you can browse, organize, and document your data and easily drag and drop it onto an existing map in ArcMap. Using the tools in ArcToolbox, you can perform sophisticated geoprocessing operations—from a dockable window available in all the ArcGIS Desktop applications. It has never been easier to use the power of GIS.

In this chapter, you will create a map for a planning meeting of the Greenvalley City council. You will use ArcCatalog to find the data and produce the map in ArcMap.

Introducing ArcCatalog

ArcCatalog is the tool for browsing, organizing, distributing, and documenting an organization's GIS data holdings.

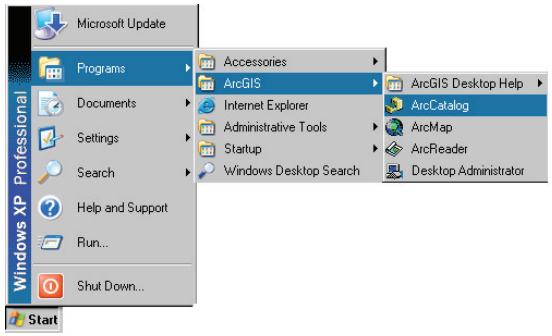
In this exercise you work for the (fictitious) city of Greenvalley. The city council is debating a proposal to build additional water mains downtown. As part of the process, the council is reviewing water use in the downtown area.

You have been asked to make a map that shows the water mains in downtown Greenvalley and the relative water use at each parcel downtown.

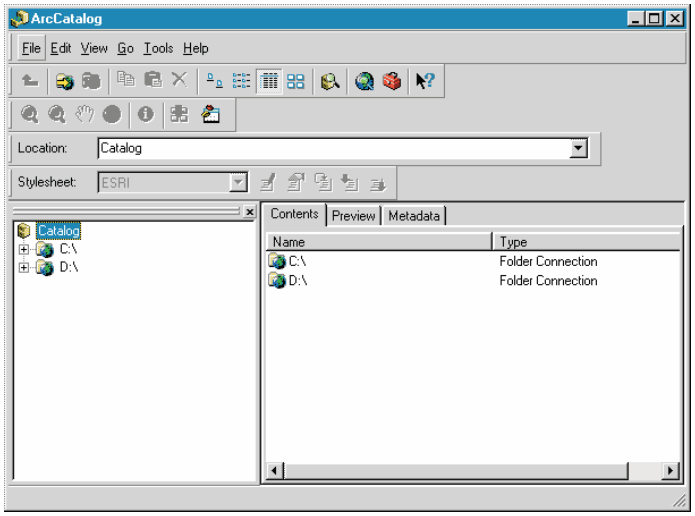
To make the map easy to read, you will add the data to a general-purpose map of the town.

Starting ArcCatalog

1. Click the Start button on the taskbar.
2. Point to Programs to display the Programs menu.
3. Point to ArcGIS.
4. Click ArcCatalog.



ArcCatalog starts, and you see two panels in the ArcCatalog window.

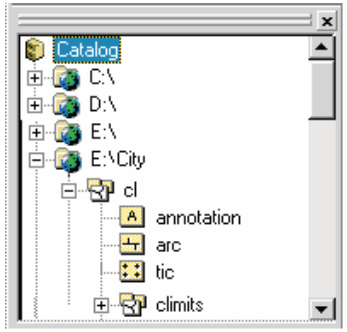


The Catalog tree on the left side of the ArcCatalog window is for browsing and organizing your GIS data. The contents of the current branch are displayed on the right side of the Catalog window.

Viewing data in ArcCatalog

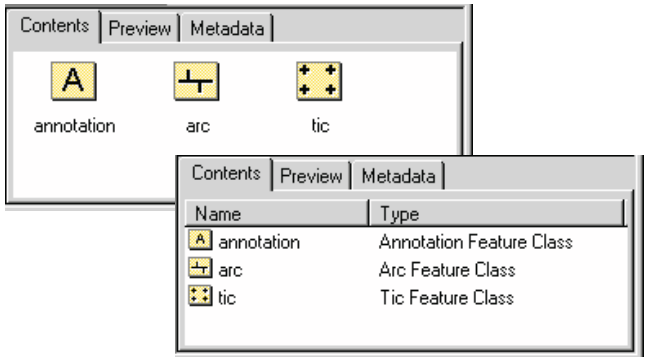
When you need more information about a branch of the Catalog tree, you can use the Contents, Preview, and Metadata tabs to view your data in many different ways.

In this example, the ArcInfo coverage “cl” contains street centerlines. It is located on a computer’s E:\ drive in a folder called City.

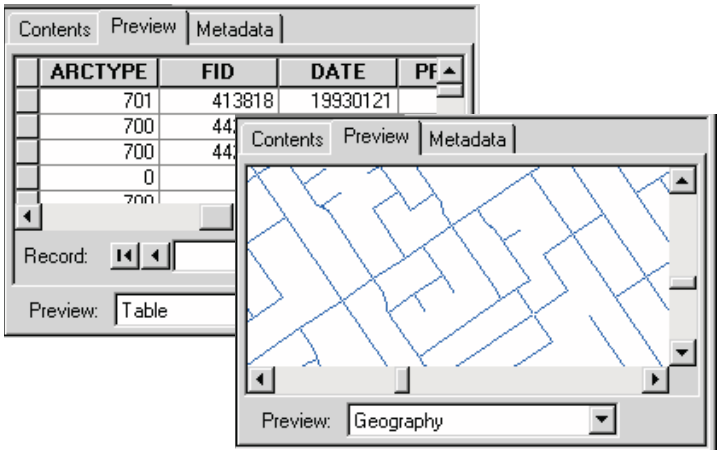


If you select a data source in the tree, you can view it in several ways, depending on the tab that you choose. Each tab has a toolbar associated with it that allows you to modify how you see your data.

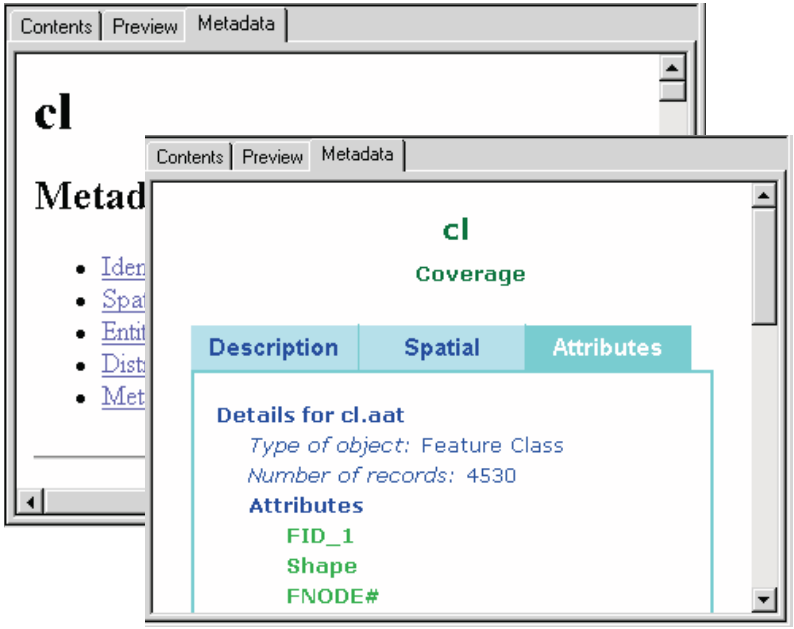
These are the Contents views:



These are the Preview views:



These are the Metadata views:



Connecting to your data

When you start ArcCatalog for the first time, the Catalog tree has a branch for each local hard drive. Branches for coordinate systems, database connections, geocoding services, Internet servers, and search results can be added by clicking the Tools menu and clicking Options, then checking the check boxes next to the branches you want to add to the Catalog. You can view the contents of a branch by double-clicking it or by clicking the plus sign beside it.

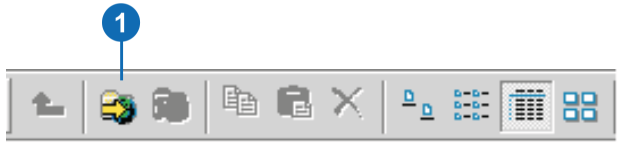
You can also create new branches in the Catalog tree to make it easier to navigate to your data. These branches are called connections.

Before continuing, you will need to know where the tutorial data has been installed on your system.

Making a connection to the tutorial data

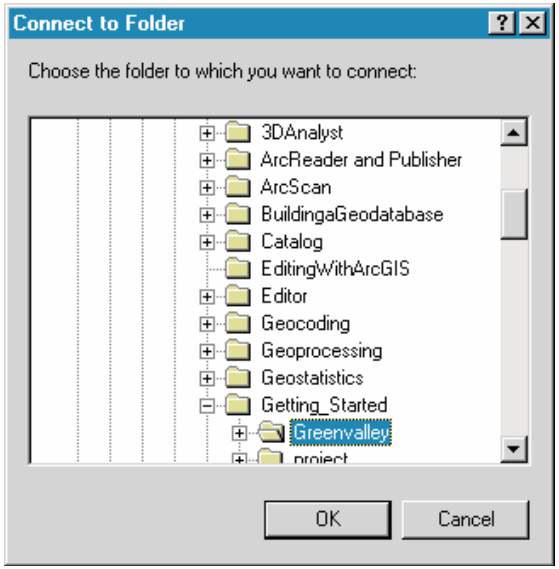
Now you will add a connection to the folder that contains the tutorial data. This new branch in the Catalog tree will remain until you delete it.

1. Click the Connect to Folder button.

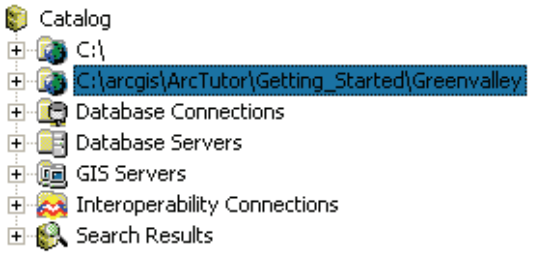


When you click the button, a window opens that lets you navigate to a folder on your computer or to a folder on another computer on your network.

2. Navigate to the ArcGIS\ArcTutor\Getting_Started\Greenvalley folder on the drive where the tutorial data is installed. Click OK.



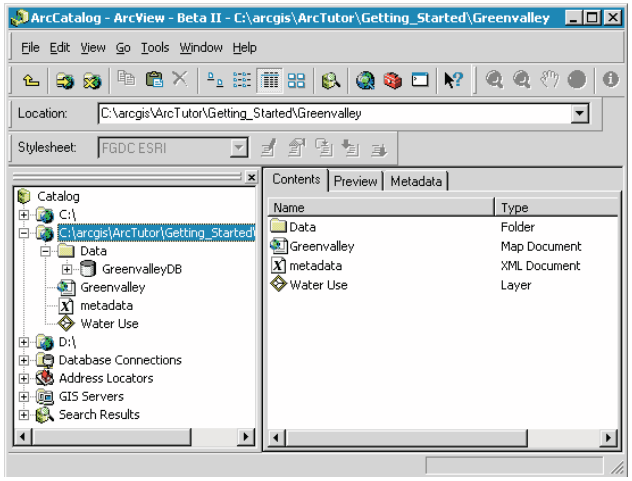
The new connection shows up as a branch in the Catalog tree.



Exploring the Greenvalley folder connection

You can now look at the tutorial data that you have added.

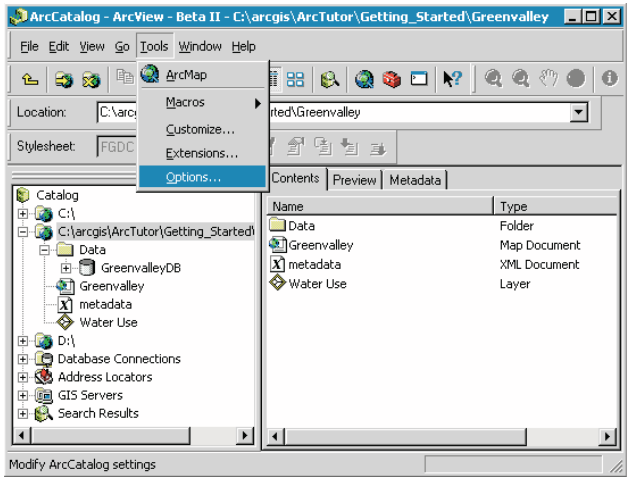
1. Click the ArcGIS\ArcTutor\Getting_Started\Greenvalley folder to view its contents on the right side of the ArcCatalog window.
2. Click the plus sign to expand the connection in the Catalog tree. This branch of the tree contains a folder, map documents, and a layer.



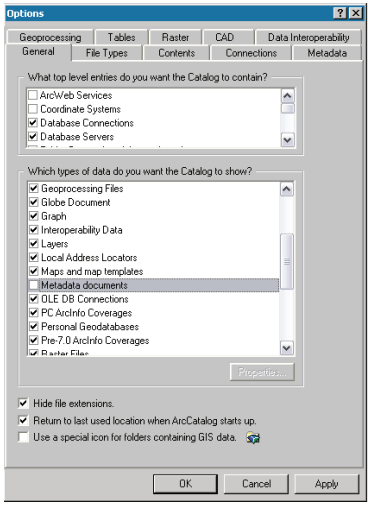
The Greenvalley folder has a special icon to show that it contains GIS data. By default, ArcCatalog recognizes many different file types as GIS data including shapefiles, coverages, raster images, TINs, geodatabases, projection files, and so on. It also shows all available file types, including the metadata files with the .xml extension, by default. If the list of recognized file types does not include a file type that you use in GIS analysis, you can customize ArcCatalog to recognize additional file types—for example, text files—as GIS data.

You will turn off the option to show files with the .xml extension to provide a less cluttered view of the ArcCatalog tree.

1. Click the Tools menu and click Options.



2. Click the General tab and uncheck Metadata documents in the second panel, then click OK.



The Greenvalley map document is a general-purpose map of the city.

The Water Use layer shows a set of parcels in Greenvalley with a color scheme that indicates relative water use at each parcel.

Maps and layers

Maps and layers are important ways of organizing and displaying data in ArcGIS.

ArcGIS maps, like everyday paper maps, can contain many kinds of data. The data on a map is organized into layers, which are drawn on the map in a particular order. Each map contains a page layout where graphic elements, such as legends, North arrows, scalebars, text, and other graphics, are arranged. The layout shows the map page as it will be printed.

Layers define how a set of geographic features will be drawn when they are added to a map. They also act as shortcuts to the place where the data is actually stored—not necessarily the same place as where the layer file is stored. In this case, both the map and the layer refer to data that is stored in the Data folder.

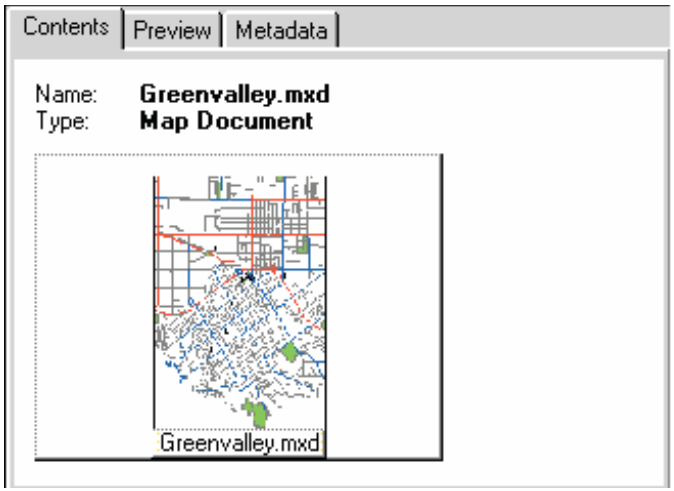
If you store your geographic data in a central database, you can create maps and layers that refer to the database. This makes it easy to share maps and layers within an organization and eliminates the need to make duplicate copies of your data.

Viewing the thumbnail sketch of the Greenvalley map

The right panel of ArcCatalog displays datasets in many different ways. You can click an object in the left panel to view it in the right panel. One of the views that can be useful when you want to select a particular map is the thumbnail view.

1. Click the Thumbnails button on the Standard toolbar.

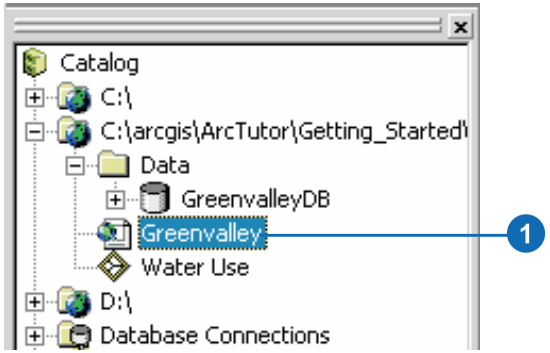
You can see the thumbnail sketch of the map.



Opening the Greenvalley map

You will use the Greenvalley map to provide context for the information that the city council wants.

1. Double-click Greenvalley in the Catalog tree.



Double-clicking a map in the Catalog tree opens the map in ArcMap.

Sometimes you may want to start ArcMap without opening an existing map. You can start ArcMap by clicking the Launch ArcMap button in ArcCatalog.

Launch ArcMap button

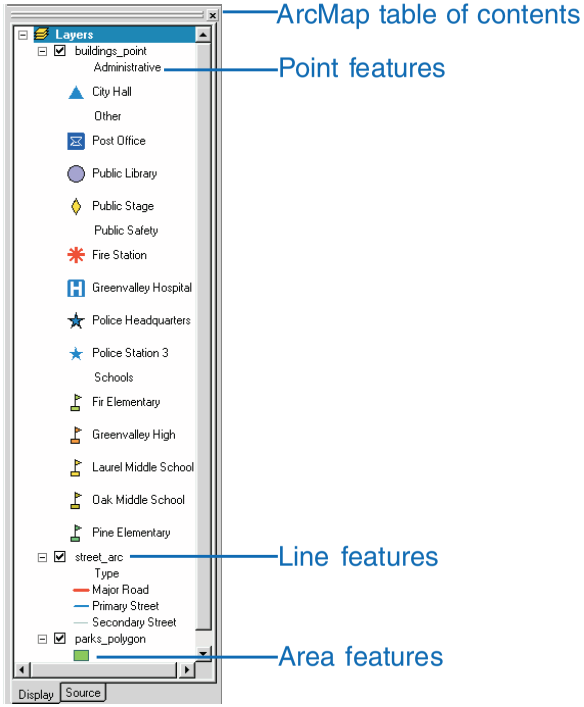
You can also start ArcMap as you would any other program on your system, whether the Catalog tree is open or not.

Introducing ArcMap

ArcMap is the tool for creating, viewing, querying, editing, composing, and publishing maps.

Most maps present several types of information about an area at once. This map of Greenvalley contains three layers that show public buildings, streets, and parks.

You can see the layers in this map listed in the table of contents. Each layer has a check box that lets you turn it on or off.



Within a layer, symbols are used to draw the *features*. In this case, buildings are represented by points, streets by lines, and parks by areas. Each layer contains two kinds of information. The spatial information describes the location and shape of the geographic features. The attribute information tells you about other characteristics of the features.

In the park layer, all the features are drawn with a single green fill symbol. This single symbol lets you identify areas that are parks, but it does not tell you anything about the differences between the parks.

In the street layer, the features are drawn with different line symbols according to the type of street that the lines represent. This symbol scheme lets you differentiate streets from other types of features and tells you something about the differences between the features as well.

In the buildings layer, the features are drawn with different point symbols. The shapes and colors of the symbols allow you to differentiate the institutions that they represent. All of the schools are grouped together and drawn with a particular symbol, so you can easily differentiate schools from the hospital or from City Hall. Each school symbol is drawn with a different color, which lets you differentiate Pine Elementary from Greenvalley High.

Working with maps

ArcMap offers many ways to interact with maps.

Exploring

Maps let you see and interpret the spatial relationships among features. You could use the map you have just opened to find City Hall, to identify parks near schools, or to determine the names of the streets around the library.

Analyzing

You can create new information and find hidden patterns by adding layers to a map. For example, if you added a layer of demographic information to the Greenvalley map, you might use the resulting map to define school districts or find potential customers. If you added layers of geology and surface slope, you might use the map to identify areas at risk for landslides.

Presenting results

ArcMap makes it easy to lay out your maps for printing, embedding in other documents, or electronic publishing. You can quickly make great maps of your data. When you save a map, all of your layout work, symbols, text, and graphics are preserved.

ArcMap includes a vast array of tools for creating and using maps. In the rest of this chapter, you will use some of these tools.

Customizing

Maps are tools for getting a job done. You can create maps that have exactly the tools you need to help you complete your job quickly. You can easily customize the ArcMap interface by adding or removing tools to or from existing toolbars or by creating custom toolbars. You can save these changes to the interface with a particular map or for every map that you open.

You can also use the Visual Basic® for Applications (VBA) programming language included in ArcMap to create new tools and interfaces. For example, you can create a VBA tool to make a table of the addresses of houses in a selected area. Once the tool is created, you can associate it with a custom toolbar and save it with a map for anyone to use.

Scripting

You can create geoprocessing scripts to manage and analyze your GIS data using the Python scripting language.

Programming

You can build completely new interfaces for interacting with your maps and create new, specialized classes of features. ArcGIS is built using Microsoft's Component Object Model (COM); all of the COM components are available to developers using a COM-compliant programming language.

Exploring a map

You can explore a map in several ways. The Tools toolbar contains frequently used tools that let you navigate around the map, find features, and get information about them.

Zooming in and getting information

If you want to see an area of the map in greater detail, you can zoom in to the map.

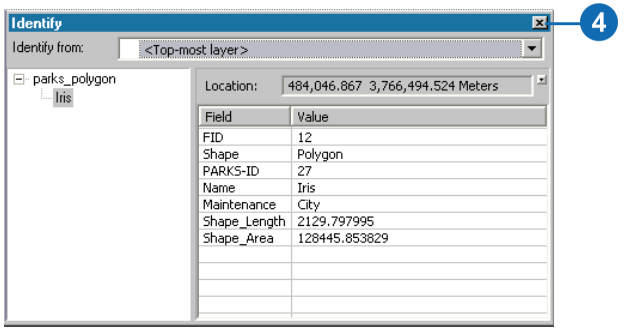
1. Click the Zoom In button.
2. Drag a box around one of the parks to zoom in to it.

   When you drag a box on the map after clicking the Zoom In button, the map zooms to the new area. You can click the Back button to jump back to the previous map extent.
3. Click the Identify Features button and click the park.

When you click a feature with the Identify Features tool, the Identify Results window appears. You can inspect the attributes of the feature from this window.

If the tool finds several features where you clicked, it lists each feature on the left side of the window. You can click the features in this list to view their attributes on the right side of the window.

4. Close the Identify Results window.



Zooming to the map's full extent

If you have zoomed in to the map and want to see all of it, you can quickly zoom out to the map's full extent.

1. Click the Full Extent button.

Now you can see the full extent of the map. The map scale will vary depending on your screen setup and the size of the ArcMap window, which you can see on the Standard toolbar.

2. Type "90,000" in the map scale text box and press Enter. The map scale will change to 1:90,000.

At this scale, the building symbols are not visible. The Maximum Visible Scale *property* of this layer has been set to 1:70,000. You will change some of the properties of a layer later in this chapter.

Finding a feature

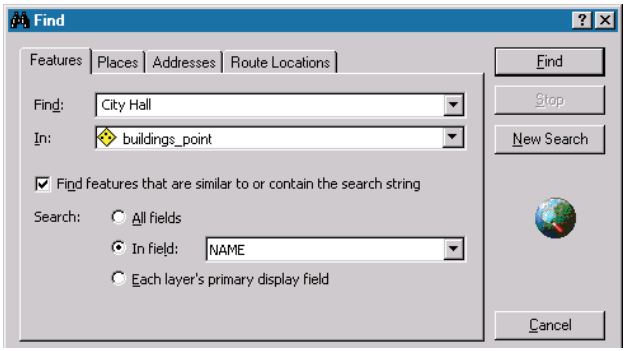
The Find button lets you search a map for features that match your search criteria. The area you want to map is around the Greenvalley City Hall, so you will find City Hall and zoom to it.

1. Click the Find button .

When you click the Find button, the Find dialog box appears. You can search for features from a particular layer or from all layers on the map.

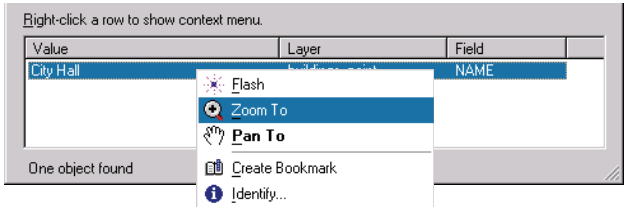
2. Type "City Hall" in the Find text box. Click the In dropdown arrow and click buildings_point. Click In field, then click the dropdown arrow, and click NAME. Click Find.

City Hall appears in the list of features that the tool has found.



3. Right-click City Hall and click Zoom To.

The map zooms to the City Hall. As the scale is now greater than the 1:70,000 threshold, the building features



appear on the map, and you can see the blue triangle symbol for City Hall.

4. Click Cancel to close the Find dialog box.

The map now shows some of the area that you need to map for the city council.

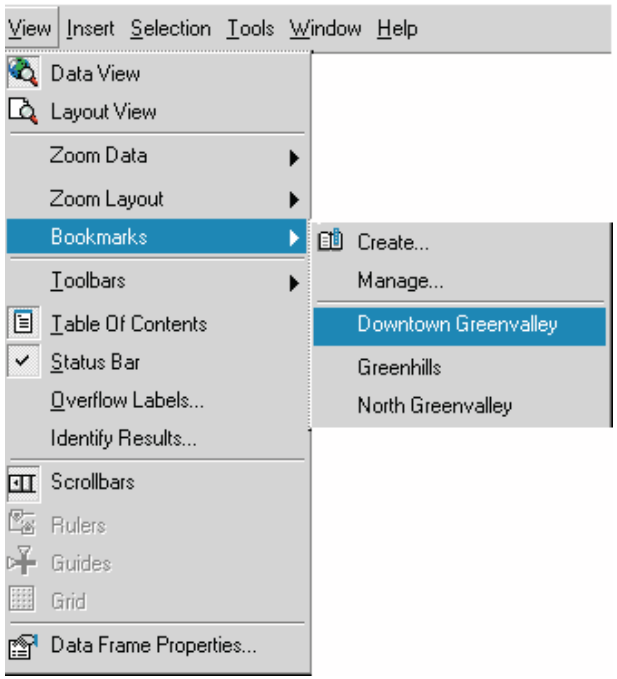
When you chose Zoom To, another option on the list was Create Bookmark. A spatial bookmark preserves a particular map extent so that you can zoom back to it whenever you want.

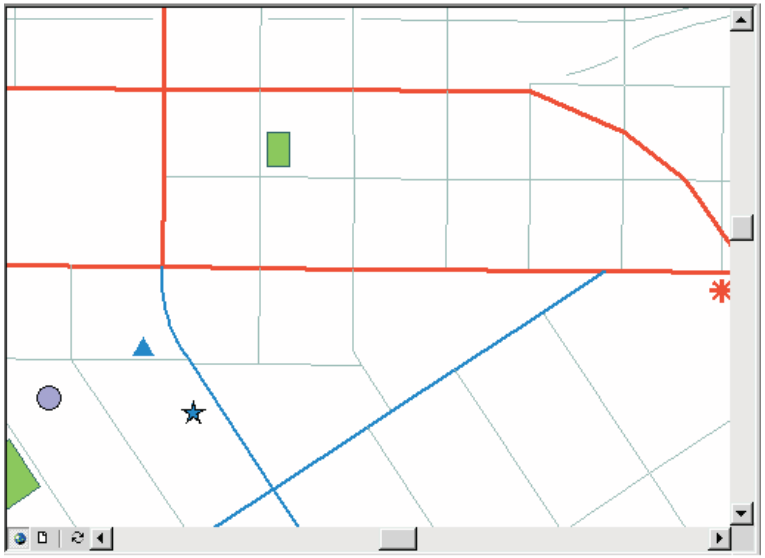
Spatial bookmarks are saved with a map, so anyone who opens a map can quickly zoom to a particular bookmarked area.

Zooming to a bookmarked area

Because you use this map to provide a context for other information, you have created some spatial bookmarks for the areas you frequently map. Downtown Greenvalley is one of these areas.

1. Click View and point to Bookmarks.
2. Click Downtown Greenvalley.





Now the map is zoomed to the downtown area. This map extent and scale have been used for previous maps of downtown Greenvalley. The map you are making will be easy for the council members to compare with the other maps of the downtown area.

ArcMap provides an excellent interface for interactively exploring existing maps. You can use the tools you have just used and others to answer questions about particular features, to find features, and to view your maps at a variety of scales.

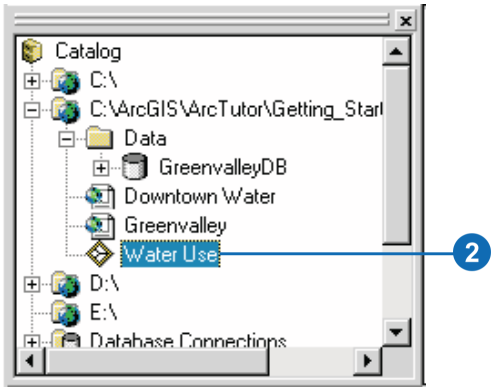
You can change the information that is displayed on maps by adding and removing layers and changing the way that layers are displayed.

In the next part of this chapter, you will add data to your map and change the properties of a layer.

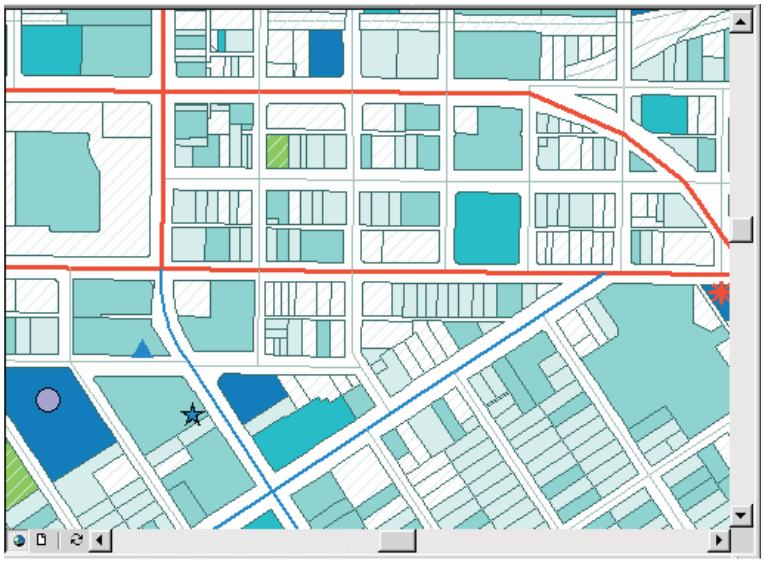
Adding a layer to a map

Now that you have opened a map of Greenvalley and set the extent to downtown, it is time to make the map you need. The city council wants the map to include downtown water use and the location and size of existing water mains. You will start by adding the Water Use layer to your map.

1. Position the ArcMap and ArcCatalog windows so that you can see both of them.
2. Click the Water Use layer in ArcCatalog and drag it onto the map. You can click and drag any layer from the ArcCatalog tree onto an open map in ArcMap.



The layer shows parcels drawn with a graduated color ramp. Just as the roads and buildings were drawn with predetermined symbols when you opened the Greenvalley map, this layer is drawn with a particular set of symbols.



A layer serves as a shortcut to data. It also tells ArcMap how the data should be drawn. You can store layers in a place that is accessible to everyone in your organization who needs a particular set of data; the data will be displayed the same way for each of them.

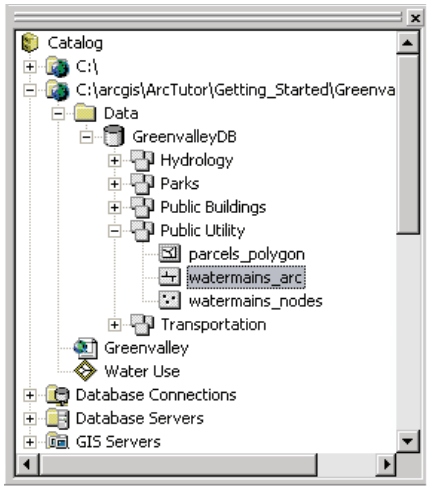
As useful as layers are, sometimes they are not available. Fortunately, you can add raw geographic data to a map just as easily as you can add a layer.

Adding features from a database

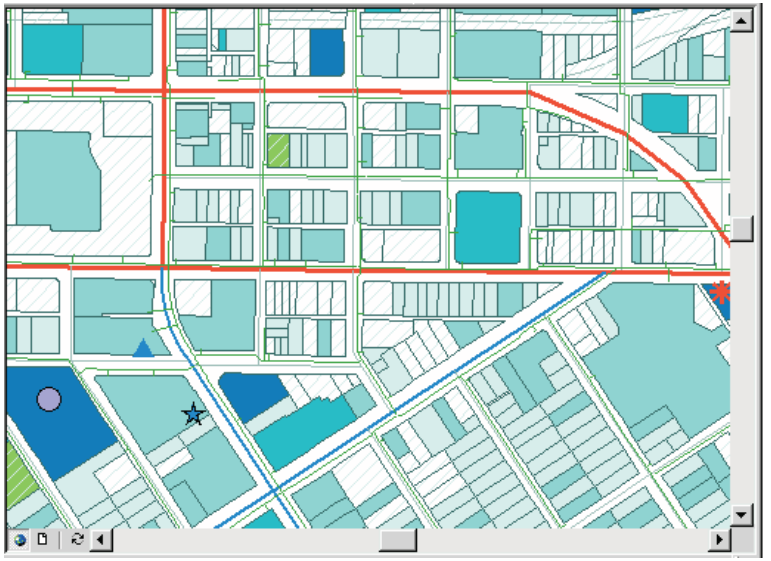
When you add features directly from a coverage, shapefile, or geodatabase, they are all drawn with a single symbol.

Now you will add the water main features to your map.

1. Position the ArcMap and ArcCatalog windows so that you can see both of them.
2. Click the plus sign next to the Data folder in the Catalog tree to view the contents of the folder.
3. Click the plus sign next to GreenvalleyDB. GreenvalleyDB is a geodatabase that contains the remainder of the data you will be using. The data in this geodatabase is organized in five feature datasets: Hydrology, Parks, Public Buildings, Public Utility, and Transportation.
4. Click the plus sign next to Public Utility.
5. Click watermains_arc and drag it onto your map.



Watermains_arc is a feature class—a collection of features represented with the same geometry (shape). In this case, the features are polyline shapes that represent the pipes in the water distribution system.

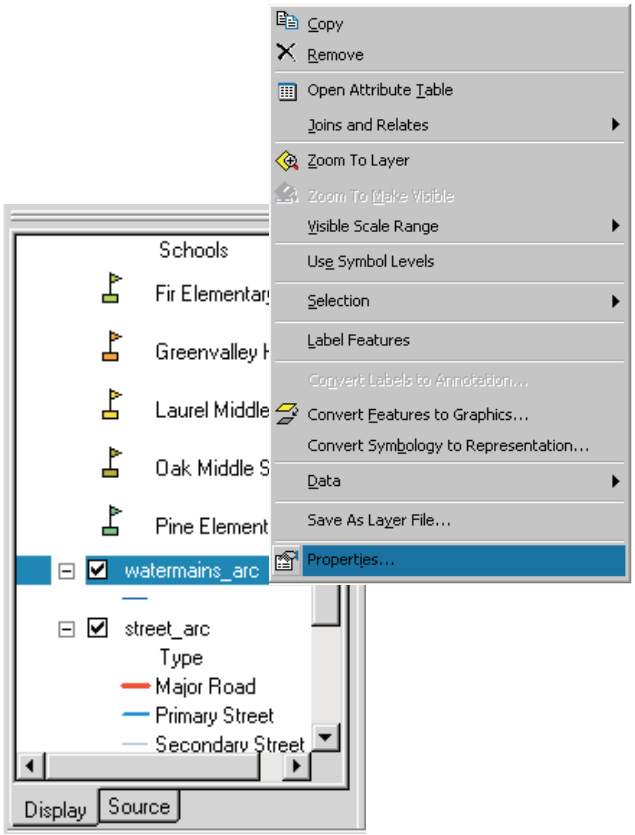


Geodatabases containing feature datasets and feature classes are how ArcGIS applications manage geographic information. In Chapter 3, you will learn more about these and other GIS data types.

Changing how features are drawn

The council wants to know the approximate sizes of the water mains downtown, so you must assign some new symbols to the features.

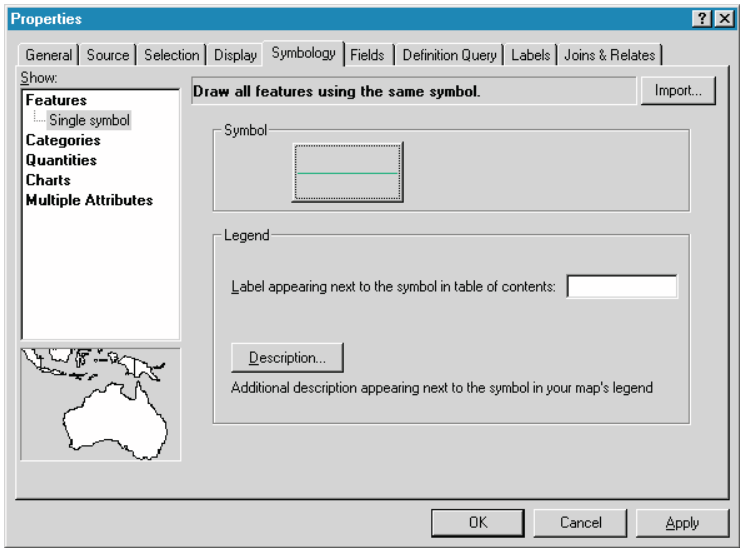
1. Right-click watermains_arc in the ArcMap table of contents and click Properties.



The layer Properties dialog box appears. You can use this dialog box to inspect and change a wide variety of layer properties.

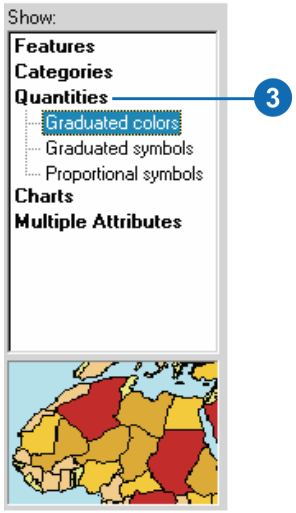
The water mains feature class includes several attributes of the water mains. As the council wants to know the sizes of the water mains, you will group the mains into five classes based on their diameter attribute.

2. Click the Symbology tab on the Properties dialog box.

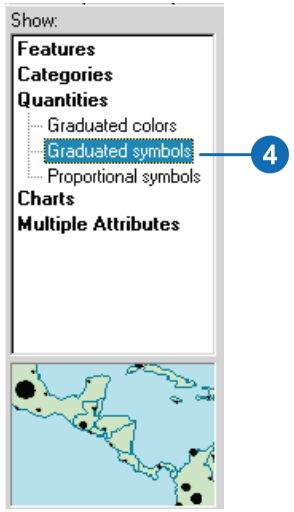


You can change the symbol scheme for the layer, as well as its appearance in the table of contents, from this tab.

3. Click Quantities. The panel changes to give you controls for drawing with graduated colors.



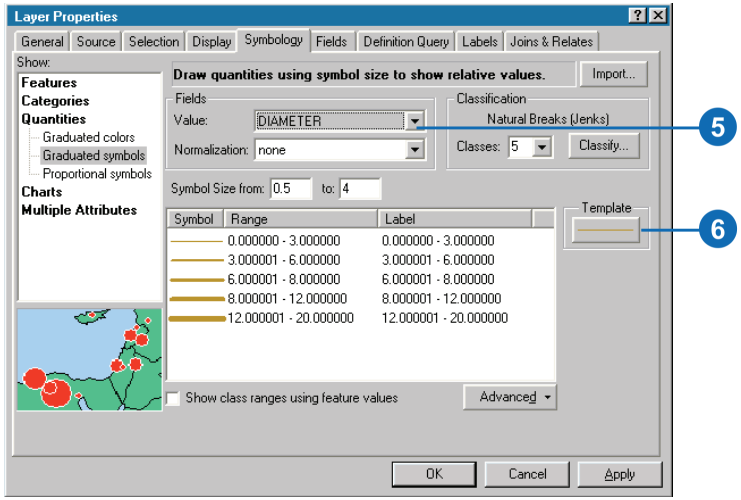
4. Click Graduated symbols. The panel changes to give you controls for drawing with graduated symbols.



5. Click the Value dropdown arrow and click DIAMETER. ArcMap assigns the data to five classes using the Natural Breaks classification (Jenks' method).

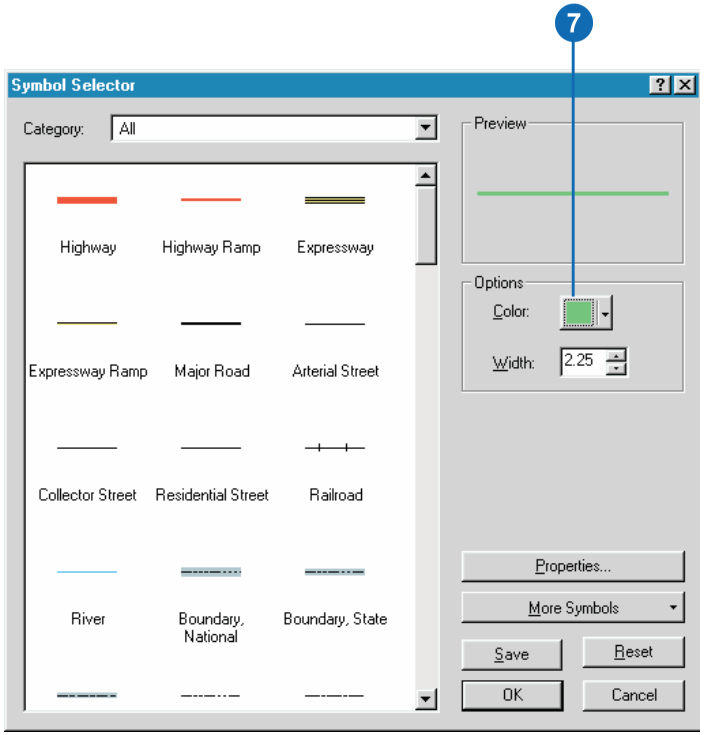
Now the width of the line symbols indicates the diameter of the water mains. You want the water mains to be blue, so you will change the base symbol.

6. Click the Template button.

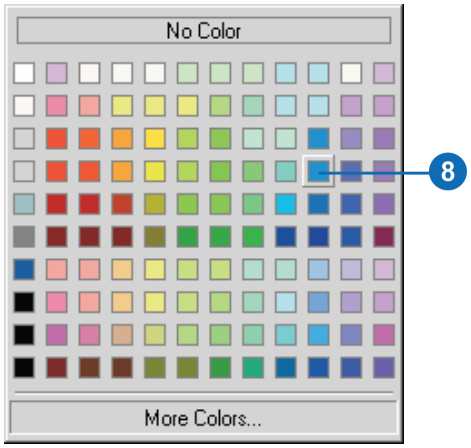


When you click Template, the Symbol Selector dialog box appears. Here you can choose predefined symbols, such as the Highway line symbol, or you can design your own symbols.

7. Click Color. The color selector dialog box appears. You can select one of the predefined colors from this palette or click More Colors to mix your own colors using one of several popular color models.



8. Choose a dark shade of blue and click OK.



Now all of the water mains will be drawn with dark blue lines, with the line width representing the diameter of the water main.

9. Click OK on the Properties dialog box to see your map with the new line symbols.

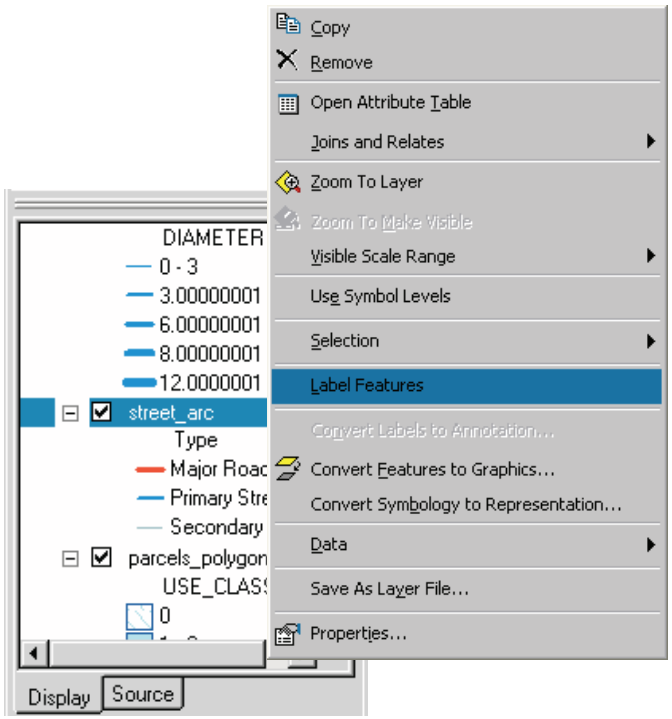
As you have seen, ArcMap has a rich set of line symbol selection and editing tools. These and other tools also work with point and polygon symbols.

Once you have set the symbolization for a layer to your satisfaction, you can preserve it for later use by saving the map (later in this chapter) or by saving the layer as its own layer file, such as the Water Use layer you added.

Adding labels to a map

The map now shows some of the street centerlines and water mains with similar symbols. To avoid confusing a map reader, you will add street names on the map and change the street centerline symbol.

1. Right-click street_arc in the table of contents.

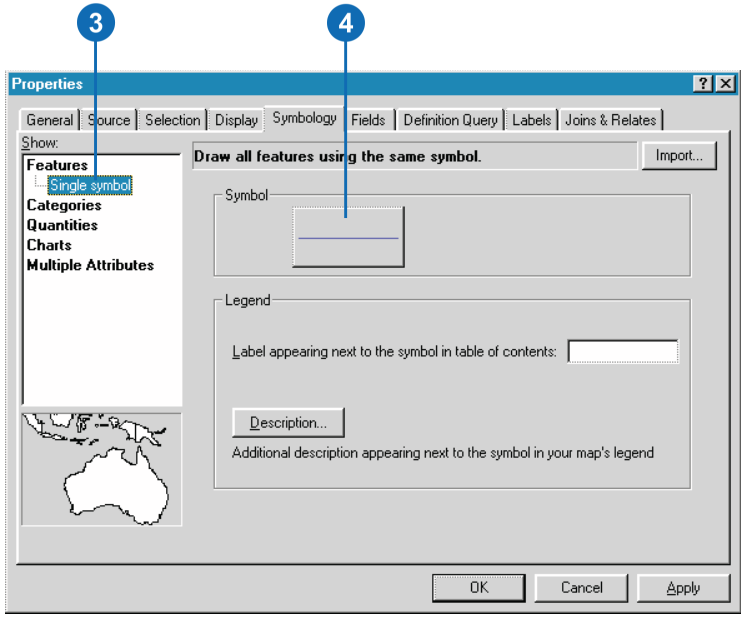


2. Click Label Features.

   ArcMap adds the names of the streets to the map.

Changing the street centerline symbol

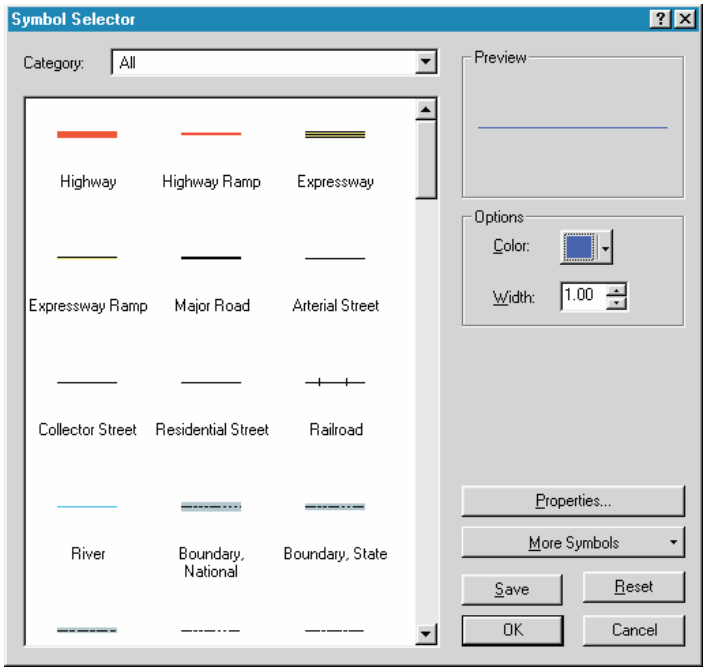
1. Right-click street_arc in the table of contents again and click Properties.
2. Click the Symbology tab.
3. Click Features, then click Single symbol.



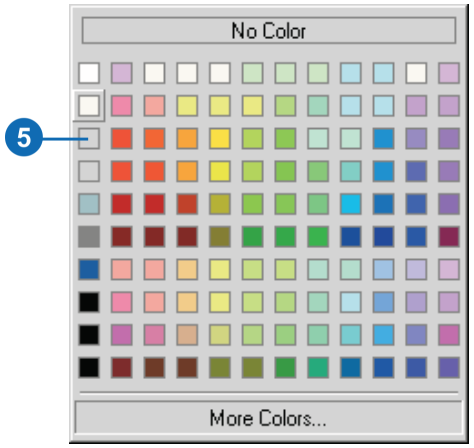
The street centerlines will now be drawn with a single symbol. You will change the default line color to a light gray, so the centerlines will be visible but unobtrusive.

4. Click the Symbol button.

The Symbol Selector dialog box appears.

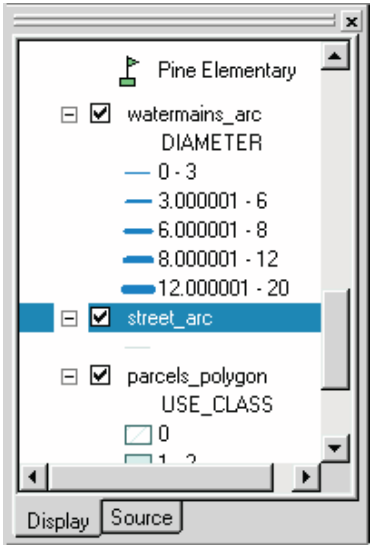


5. Click Color. Click a light gray and click OK.



6. Click OK on the layer Properties dialog box.

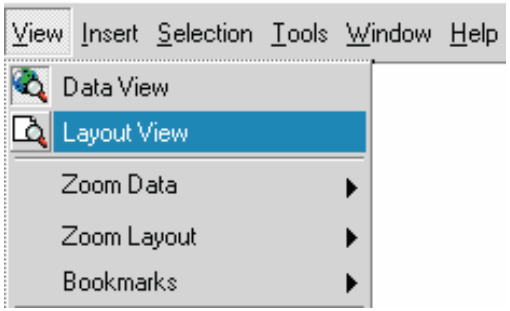
   Now the centerlines will be drawn in a light gray, so they will not be confused with the water mains.



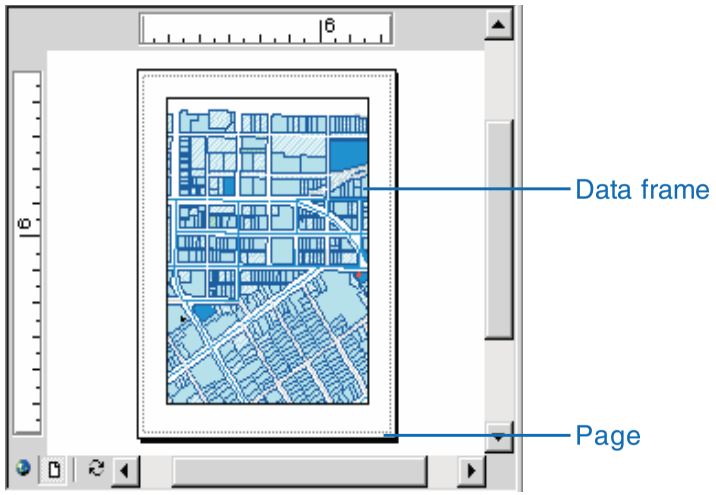
Working with the map layout

All of the data you need is now on the map and has symbols. The map that you are making for the council meeting will be printed in color on an 8.5" x 11" sheet of paper and distributed to each council member.

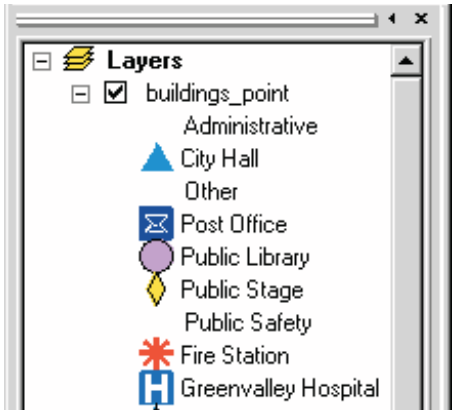
1. Click View and click Layout View.



Now you can see the map on a virtual page. The layers of data appear in a *data frame* on the page. Data frames are a way of organizing the layers you want to see together on a map.



There is always at least one data frame on a map. This one is called Layers; you can see its name at the top of the ArcMap table of contents.



You can add additional data frames to a map to compare two areas side by side or to show overviews or detailed insets.

You can see all of the data frames on your map in Layout view. If you switch back to Data view, you will see the layers that are in the active data frame. The active data frame is shown in boldface type in the table of contents.

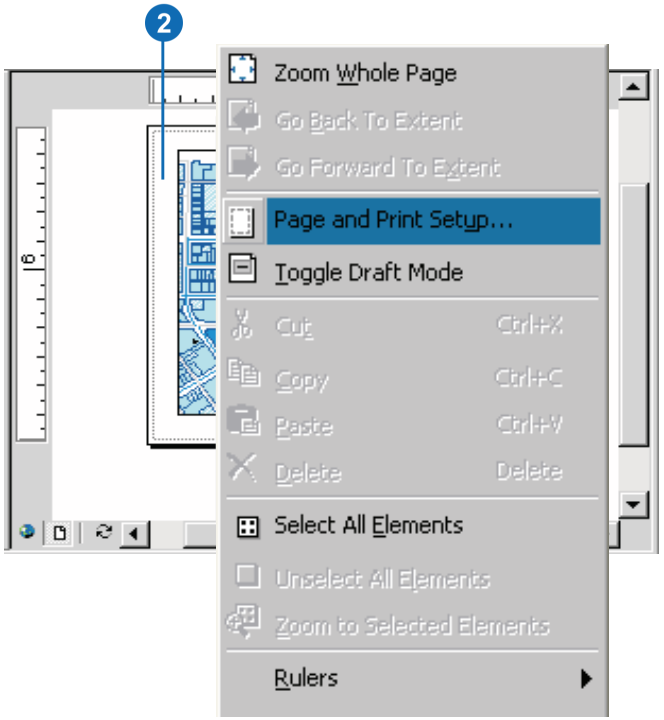
In Layout view you can change the shape and position of the data frame on the page; add other map elements, such as scalebars and legends, to the map; and change the page size and orientation.

The Layout toolbar is added to the ArcMap interface when you choose Layout view.

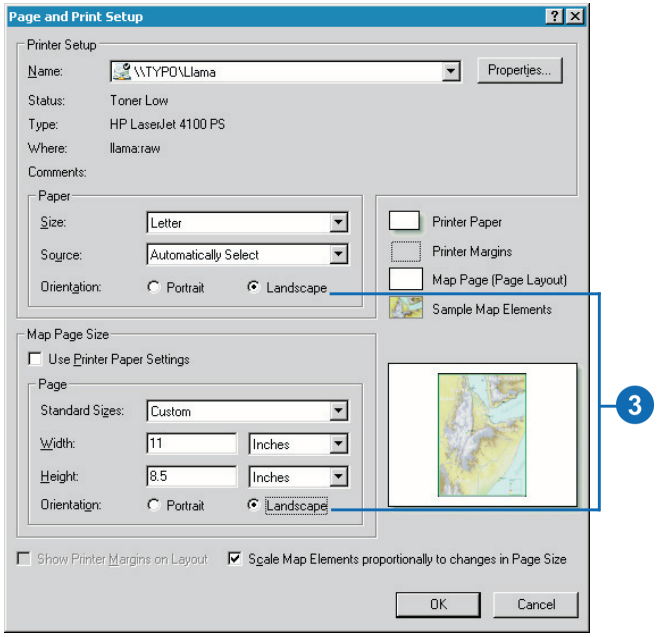
You can use the tools on the Layout toolbar to change the size and position of the virtual page on your screen or to zoom in or out of the virtual page.

You can also use the Tools toolbar in Layout view to change the extent of the layers that are shown in the data frame.

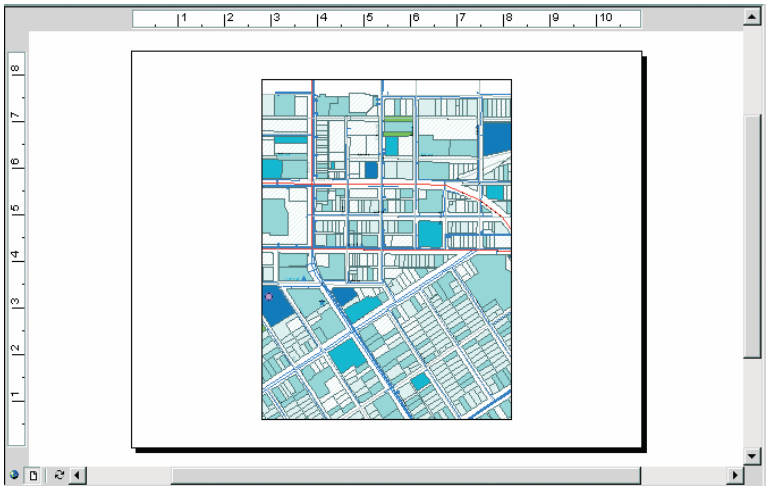
2. Right-click the page and click Page and Print Setup.



3. Click Landscape under Paper and Page to change the page orientation, then click OK.



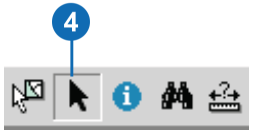
Now the page is in landscape orientation.



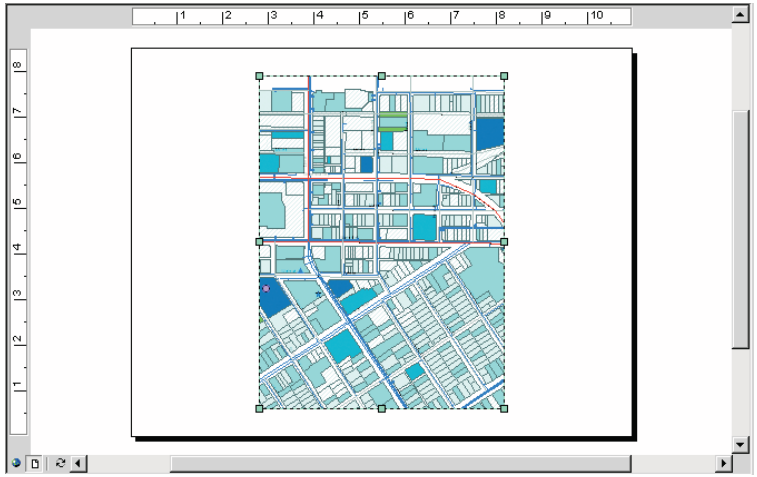
You will add a scalebar, North arrow, legend, and title to the page to help the council members use the map.

First, you will make some space on the page for these other map elements by reducing the size of the data frame.

4. Click the Select Elements button.

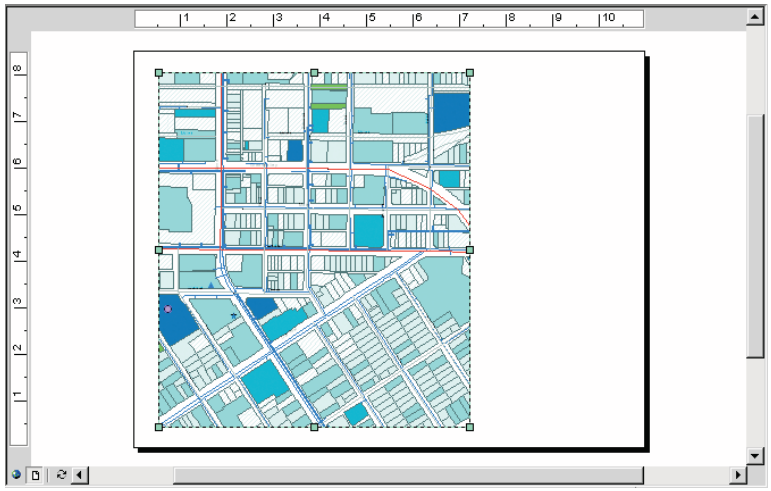


5. Click the data frame to select it. The data frame is now outlined with a dashed line and has selection handles at its corners and edges.



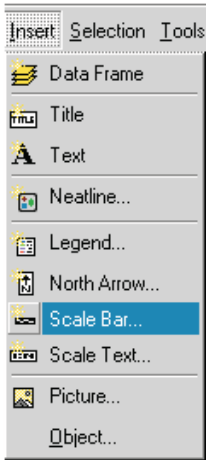
6. Click the center of the data frame and drag it to the upper-left corner of the layout.

7. Point to the selection handle at the lower-right corner of the data frame. The mouse pointer becomes a two-pointed resize arrow. Click the corner and drag it up and to the left.



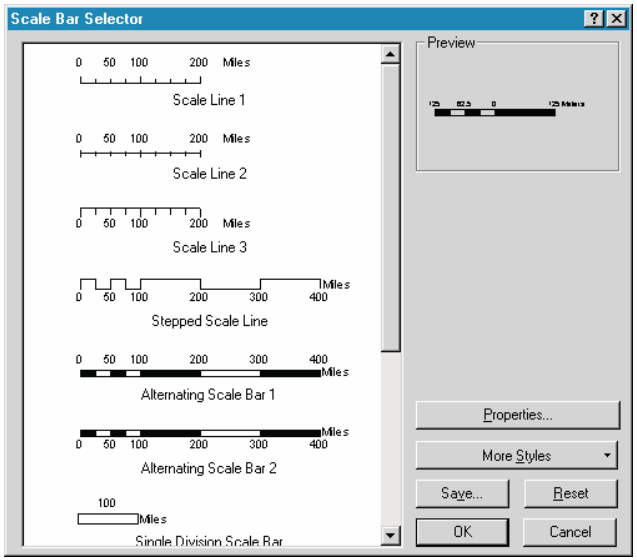
Adding a scalebar

1. On the Insert menu, click Scale Bar.

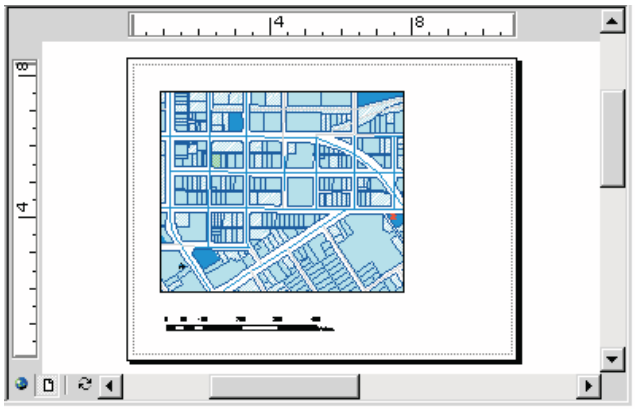


The Scale Bar Selector dialog box appears.

2. Click one of the scalebars and click OK.

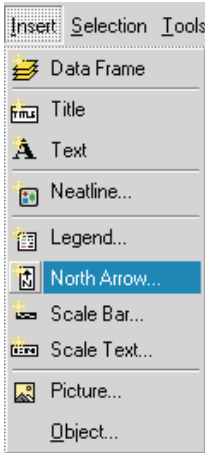


3. Click the scalebar and drag it to the empty space below the left side of the data frame.



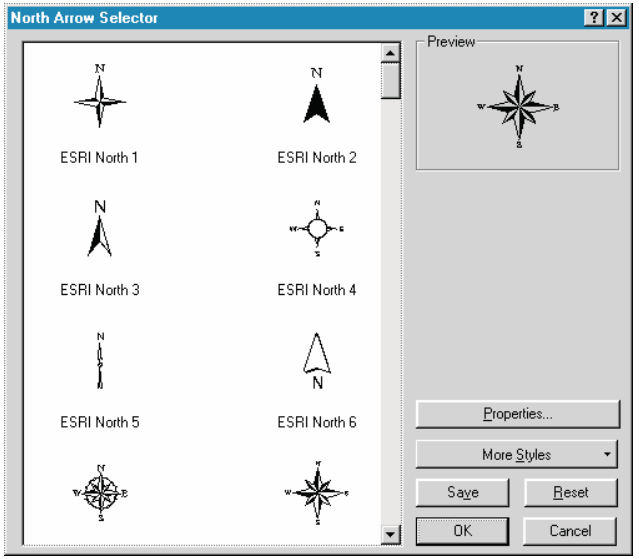
Adding a North arrow

1. Click the Insert menu and click North Arrow.

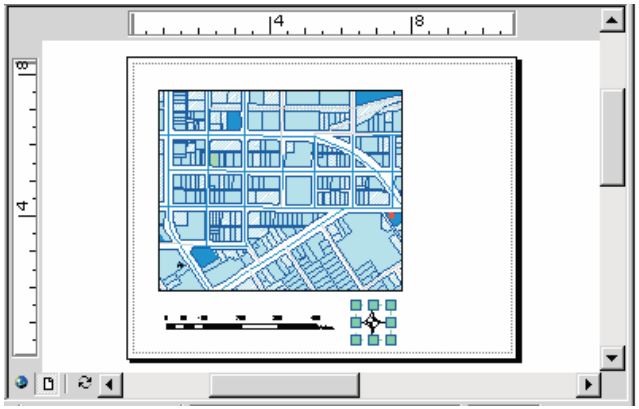


The North Arrow Selector dialog box appears.

2. Click one of the North arrows and click OK.

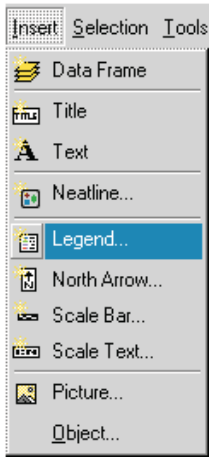


3. Click the North arrow and drag it to the empty space below the data frame and to the right of the scalebar.

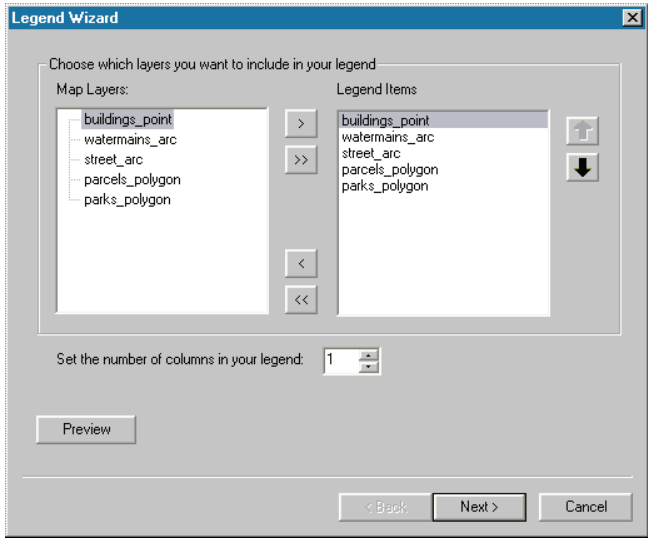


Adding a legend

1. Click the Insert menu and click Legend.



The Legend Wizard appears.



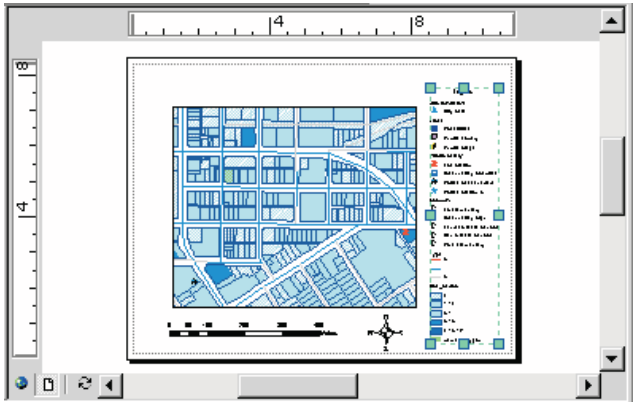
Changing Legend Wizard parameters alters the appearance of the legend on your map. The Legend Wizard takes you through five dialog boxes that allow you to change the layers included in your legend, the appearance of the legend title, the appearance of the legend frame, the size and shape of the symbol patches used to represent line and polygon features, and the spacing between legend items.

In this case, the default legend parameters are appropriate for your map. However, legend parameters can be modified at any time by right-clicking the legend in the Layout view and choosing Properties from the menu that appears.

2. Click Next several times to step through the wizard, accepting the default legend parameters. Click Finish when done.

The legend appears on your map.

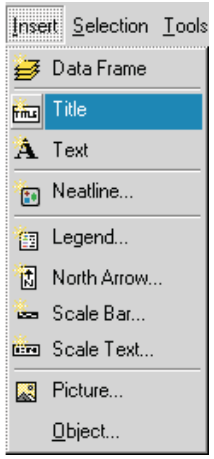
3. Click the legend and drag it to the empty space to the right of the data frame.



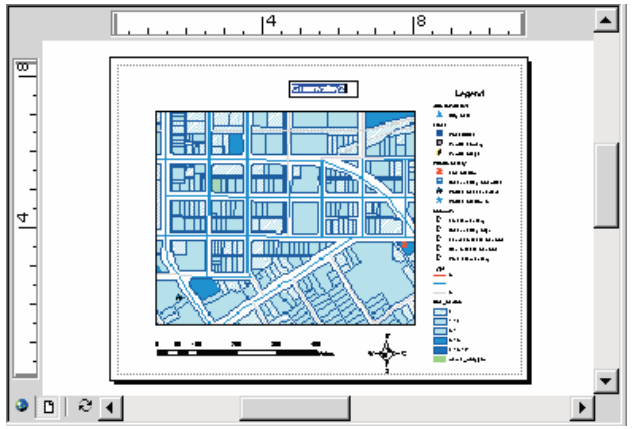
You can click on the blue selection handles to resize the legend so it fits along the right side of the page.

Adding a title

1. Click the Insert menu and click Title.

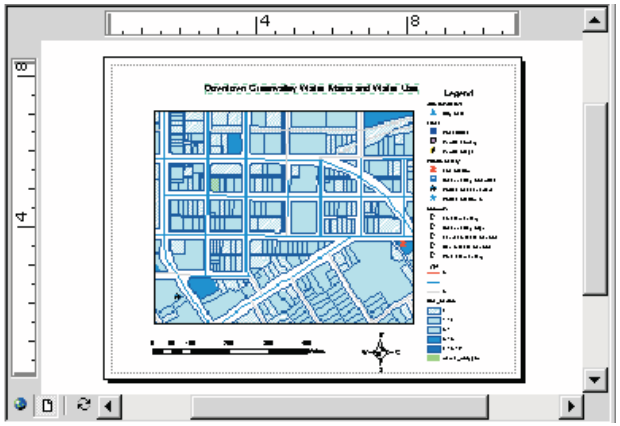


A partial title, "Greenvalley", appears in the Layout view.



Greenvalley is the name of the map document, but you will need a more explanatory title on the map.

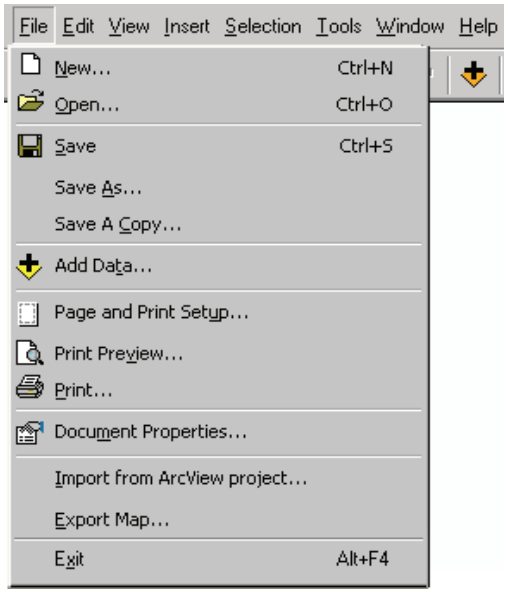
2. Click the title and type "Downtown Greenvalley Water Mains and Water Use". Press Enter, then click and drag the title to the top and center it on the page.



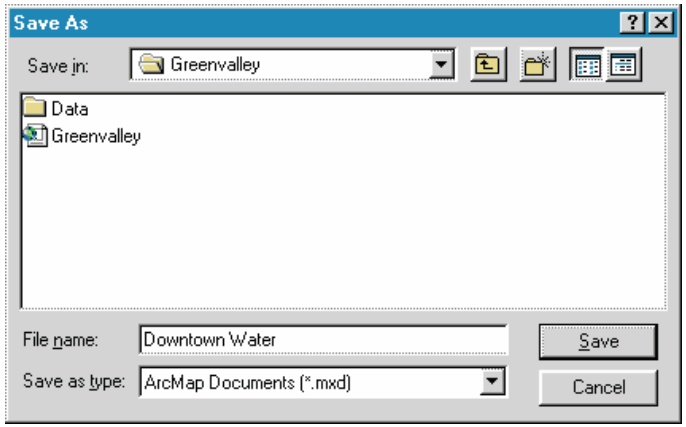
Saving a map

You have made a lot of changes to this map. Because you want to keep the new map that you have created and also keep the old template map, you will use Save As to save this map under a new name.

1. Click File and click Save As.



2. Navigate to the Greenvalley folder.
3. Type “Downtown Water”. Click Save.



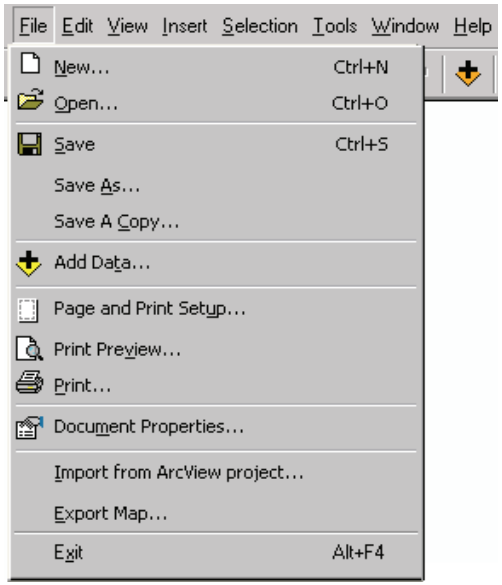
Now you are ready to print a copy of this map for the city council.

Printing a map

You can easily print the maps you have composed in ArcMap. The Layout view lets you arrange map elements, such as data frames, scalebars, and North arrows, on the page exactly as you want them to print.

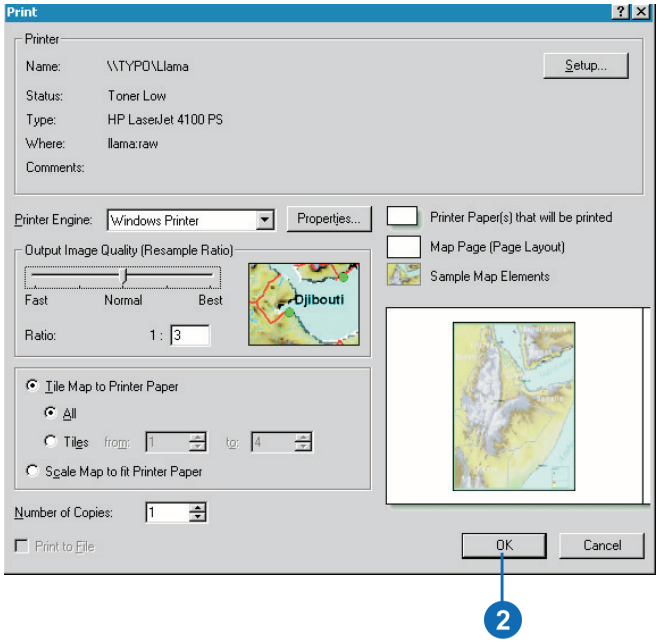
You can print your maps using any printer on your network, and you can choose to print using Windows® or ArcPress™ printer engines.

1. Click File and click Print.



   The Print dialog box appears. You can change the default printer by clicking Setup.

2. Click OK.



   You are ready to take the map to the council meeting.

Close ArcMap and ArcCatalog.

3. Click File and click Exit, or simply click the Close button (X) in the upper-right corner of the ArcMap window. Do the same for ArcCatalog.

What's next?

While making your first map, you learned how to start and use two GIS applications: ArcCatalog and ArcMap.

In the next chapter you will learn more about GIS data and how to work with various data types. Working in the field of GIS analysis inevitably means working with geographic data in a variety of different formats. Understanding the advantages and limitations of each format is an important first step in any project and is essential to the project you will begin in Chapter 4, 'Planning a GIS project'.