ArcGis· 9

Geodatabase QuickStart Tutorial – **8st part**

Building geodatabases

4

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It is easy to create a *geodatabase* and add *behavior* to it, and it requires no programming when you use the data management tools in ArcCatalog—the application for browsing, storing, organizing, and distributing data. When querying and editing the geodatabase in ArcMap—the application for editing, analyzing, and creating maps from your data—you can easily take advantage of the data and behavior in your geodatabase without any customization.

This tutorial lets you explore the capabilities of the geodatabase using an ArcEditor or ArcInfo licensed seat of ArcCatalog and ArcMap. You can complete this tutorial at your own pace without the need for additional assistance. This tutorial includes nine exercises. Each exercise takes between 10 and 20 minutes to complete.

In the first eight exercises of this tutorial, you will use ArcCatalog to create a geodatabase that models a water utility network. You will add behavior to the geodatabase by creating *subtypes*, *validation rules*, *relationships*, and a *geometric network*. You will use ArcMap to take advantage of the behavior by editing some of the existing *features* in the geodatabase and adding some additional features.

The study area for the first eight exercises is a portion of a hypothetical city. A geodatabase that contains most of the data, a *coverage* representing water laterals, and an INFO™ table representing parcel owner data are provided with the software. You will import the coverage and INFO table into the geodatabase, then modify its properties to give it behavior.

In the last exercise, you will take coverages and import selected feature classes into a new geodatabase. The study area for the last exercise is a portion of a drainage basin in Utah.

The datasets for the first eight exercises were created by ESRI using a database schema similar to that of the city of Montgomery, Alabama. The data is wholly fictitious and has nothing to do with the actual city of Montgomery. This information may be updated, corrected, or otherwise modified without notification.

The data for the last exercise on loading coverage data into a geodatabase topology is from the National Hydrography Dataset, published by the USGS in cooperation with the EPA , Utah AGRC, and REDCON. The watershed coverage, basin_utm, was fabricated for this exercise. This information may be updated, corrected, or otherwise modified without notification.

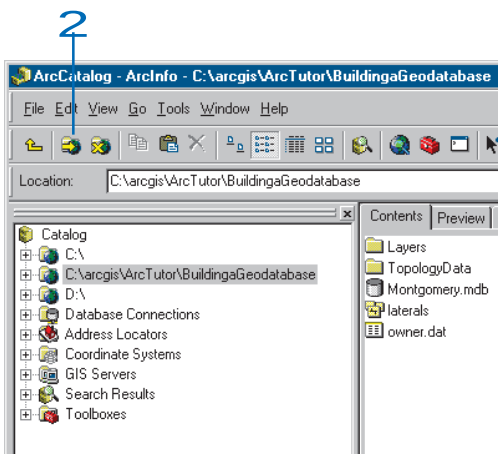
Exercise 1: Organizing your data in ArcCatalog

Before you begin the tutorial, you must find and organize the data that you will need. This can be done using ArcCatalog.

Connecting to data

In ArcCatalog, data is accessed through folder connections. When you look in a folder connection, you can quickly see the folders and data sources it contains. You will now begin organizing your data by creating a folder connection to it.

1. Start ArcCatalog by either double-clicking a shortcut installed on your desktop or using the Programs list in your Start menu.
2. Click the Connect To Folder button and navigate to the BuildingaGeodatabase folder on the local drive where you installed the tutorial data. The default installation path is C:\arcgis\ArcTutor\BuildingaGeodatabase. Click OK to establish a folder connection.

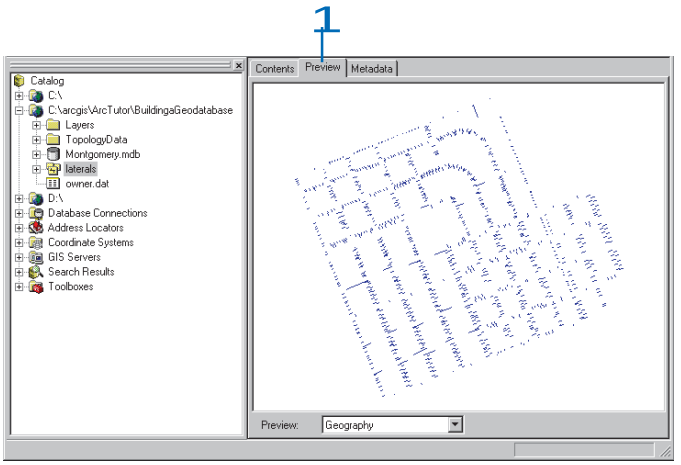


Your new folder connection—C:\arcgis\ArcTutor\BuildingaGeodatabase—is now listed in the Catalog tree. You will now be able to access all the data needed for the tutorial through that connection.

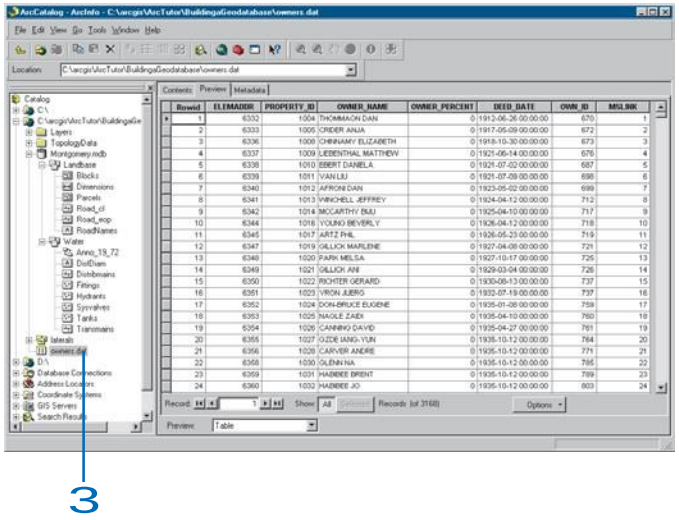
Exploring your data

Before you begin modifying the geodatabase, explore the datasets provided for the tutorial.

1. Click the plus sign next to the C:\arcgis\ArcTutor\BuildingaGeodatabase folder connection to see the datasets contained in the folder. Click the Preview tab and click the laterals coverage to see its geometry.



2. Click the plus sign next to the Montgomery geodatabase and double-click each *feature dataset* to see the *feature classes* and *relationship classes* it contains. Click each feature class to preview its geometry.
3. Click the owner.dat INFO *table*. Notice how the Preview type automatically changes to Table and displays the table's records. This table contains the owner information for the Parcels feature class in the Montgomery geodatabase. In the next part of this exercise, you will import this table into the geodatabase and create relationships between the parcels and their owners.



You will perform most of the tasks for modifying the Montgomery geodatabase schema with ArcCatalog. Later, you will use ArcMap to create *annotation* and edit the geodatabase.

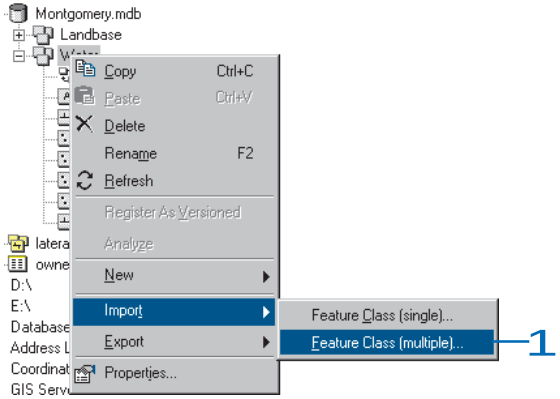
Now that you have found and organized your data in ArcCatalog, you are ready to start the first task in the tutorial—importing data into the geodatabase.

Exercise 2: Importing data into your geodatabase

Before you can start adding behavior to your data, you must get it into a geodatabase. You will import two datasets into the Montgomery geodatabase—laterals and owner.dat. The laterals coverage contains water laterals for the Montgomery water dataset, and the owner.dat INFO table contains owner information for the parcel features already in the geodatabase.

Importing the coverage

1. In ArcCatalog, right-click the Water feature dataset in the Montgomery geodatabase, point to Import, and click Feature Class (multiple).

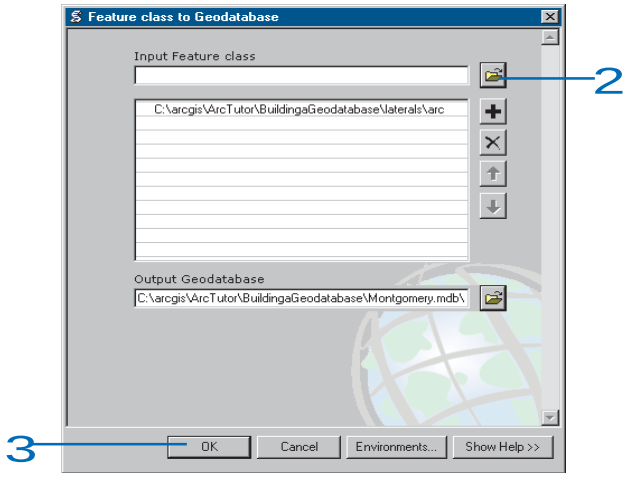


   You will use the Import Feature Class tool to import the arcs in the laterals coverage into the Water feature dataset. Python must be installed on your computer for this tool to function. If you do not have Python installed, use the Import Feature Class (single) tool, which does not require Python.

   This tool is used to specify your input coverage, input feature class, and output feature class. Because you opened this tool by right-clicking a feature dataset, the output geodatabase, Montgomery, and feature dataset, Water, are already filled in for you.

   There are several ways to set the input and output datasets. You can also drag a dataset or datasets from the ArcCatalog tree or Contents tab and drop them on the text box. Alternatively, you can click the Browse button to open the ArcCatalog minibrowser and navigate to your dataset or type the full pathname to the dataset in the text box.

2. Click the Browse button, navigate to the arcs feature class in the laterals coverage, and click Add.

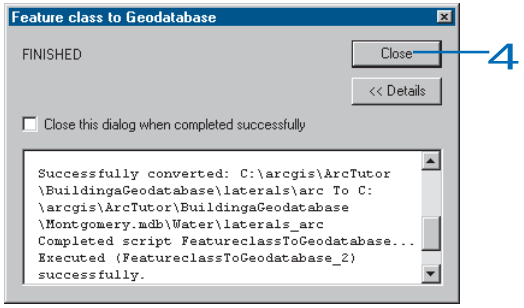


3. Click OK.

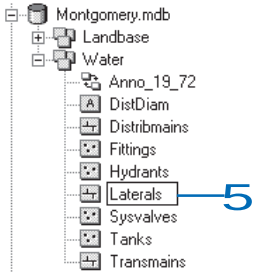
A message appears showing the progress of your data import operation. When the tool is finished, the message indicates that all the features have been imported.

The laterals_arc feature class is now in the Water feature dataset.

4. Click Close.

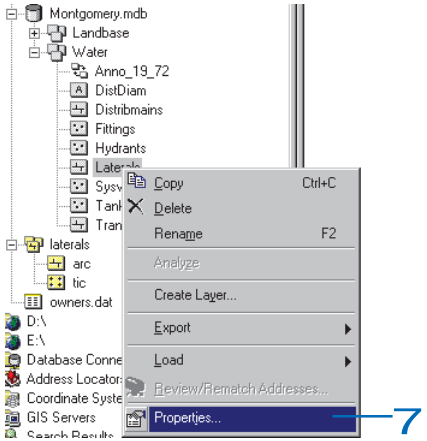


5. In the ArcCatalog tree, navigate to and click the laterals_arc feature class. Press the F2 key, and type "Laterals" to rename the feature class.



6. Click the Preview tab to see the features.

7. Right-click Laterals and click Properties.

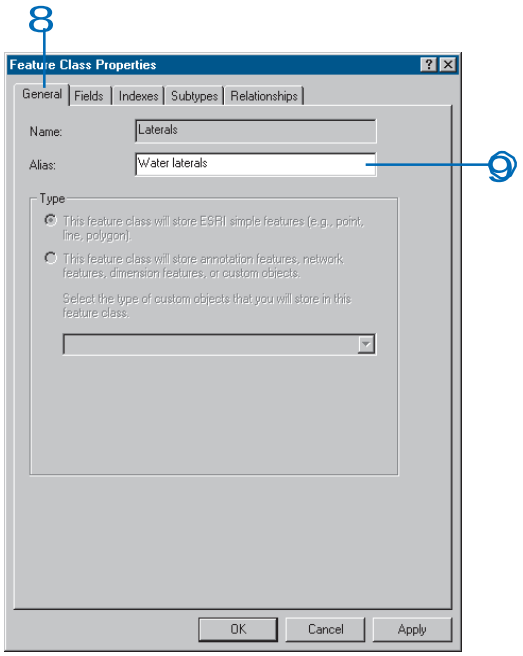


The names of feature classes and tables in a geodatabase are the same as the names of the physical tables in the relational database management system (RDBMS) in which they are stored. When you store data in an RDBMS, the names for tables and fields are often unclear, and you need a detailed data dictionary to keep track of what data each table stores and what each field in those tables represents.

The geodatabase lets you create *aliases* for *fields*, tables, and feature classes. An alias is an alternative name to refer to those items. Unlike true names, aliases can contain special characters, such as spaces, because they don't have to adhere to the database's limitations. When you use data with aliases in ArcMap, the alias name is automatically used for feature classes, tables, and fields. However, in ArcCatalog these items are always represented by their true names.

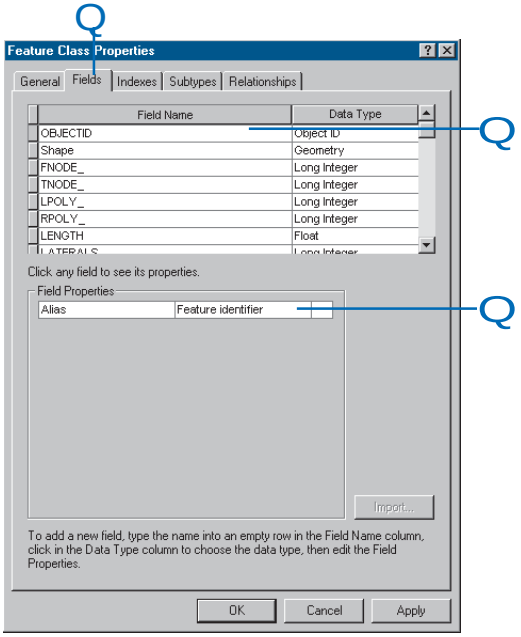
You will now create aliases for your new feature class and its fields.

8. Click the General tab.



9. Type “Water laterals” for the alias for this feature class.

10. Click the Fields tab. Click the OBJECTID field and type “Feature identifier” for its alias.



11. Repeat step 10 for the following fields:

Field	Alias
Shape	Geometry field
DEPTH_BURI	Depth buried
RECORDED_L	Recorded length
FACILITY_I	Facility identifier
DATE_INSTA	Installation date
TYPECODE	Subtype code

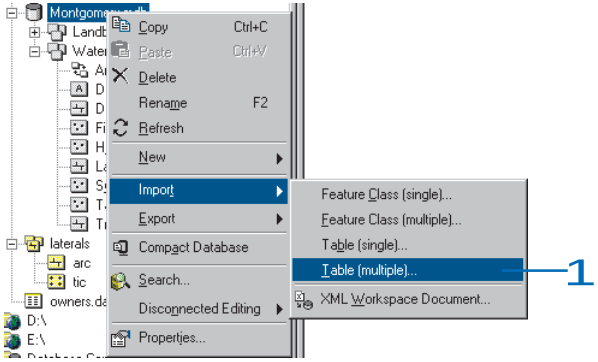
12. Click OK.

Now that you have imported the Laterals feature class into the geodatabase and added some aliases, you are ready to import the owner.dat INFO table.

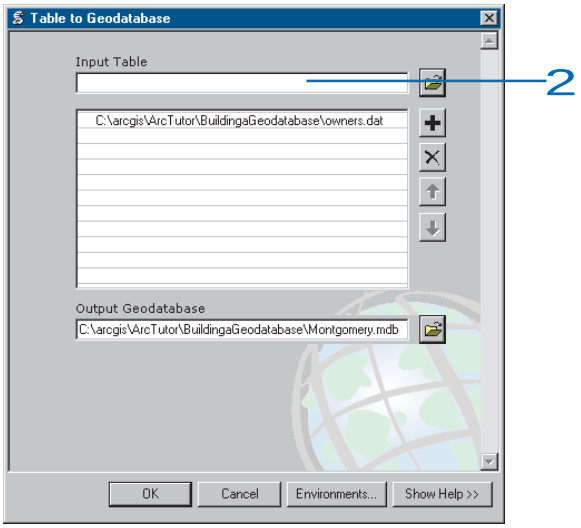
Importing the INFO table

The owner.dat INFO table contains owner information for the parcels in the Parcels feature class in the Montgomery geodatabase. To be able to create relationships between the parcels and their owners, the owner information must be imported into the Montgomery geodatabase. You will use the Table (multiple) import tool to import the owner.dat INFO table into the Montgomery geodatabase. You will then create aliases for the table.

1. Right-click the Montgomery geodatabase, point to Import, then click Table (multiple).

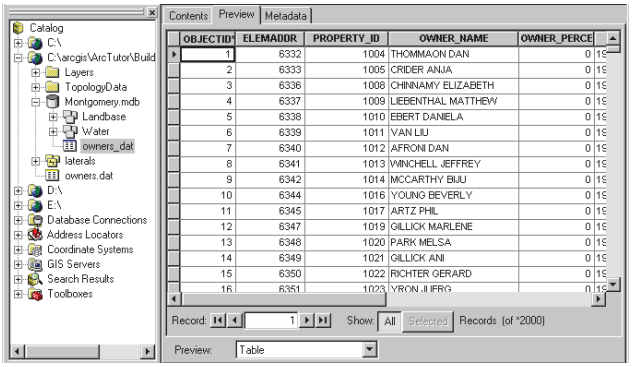


2. Drag and drop the owners.dat INFO table from the Catalog tree to the Input Table box.



3. Click OK. A message informs you of the progress of the operation. When it finishes, click Close.

4. In the ArcCatalog tree, click the Owners table in the Montgomery geodatabase. Click the Preview tab to see its rows.



5. Press the F2 key, and type “Owners” to rename the table.
6. Right-click the Owners table and click Properties to see the table’s properties.
7. Type “Parcel owners” for the alias for this table.
8. Click the Fields tab and type the following field aliases:

Field	Alias
OBJECTID	Object identifier
OWNER_NAME	Owner name
OWNER_PERCENT	Percentage ownership
DEED_DATE	Date of deed

9. Click OK.

   The data in the laterals coverage and owners.dat INFO table is now in the Montgomery geodatabase. Now you can take advantage of the geodatabase by applying behavior to your data. You will begin this task by creating subtypes and *attribute domains*.

Exercise 3: Creating subtypes and attribute domains

One of the advantages of storing your data in a geodatabase is that you can define rules about how the data can be edited. You will define these rules by creating a new attribute domain for lateral diameters; creating subtypes for the Laterals feature class; and associating the new domain, existing domains, and default values with fields for each subtype.

Attribute domains are rules that describe the legal values of a field type. Multiple feature classes and tables can share attribute domains stored in the database. However, not all the objects in a feature class or table need to share the same attribute domains.

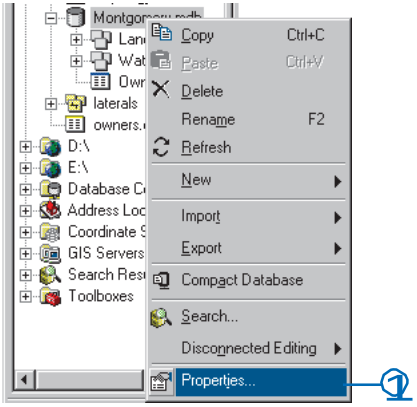
For example, in a water network, suppose that only hydrant water laterals can have a pressure between 40 and 100 psi, while service water laterals can have a pressure between 50 and 75 psi. You would use an attribute domain to enforce this restriction. To implement this kind of validation rule, you do not have to create separate feature classes for hydrant and service water laterals, but you would want to distinguish these types of water laterals from each other to establish a separate set of domains and default values. You can do this using subtypes.

To learn more about subtypes and attribute domains, see the chapter on subtypes and attribute domains in *Building a Geodatabase*.

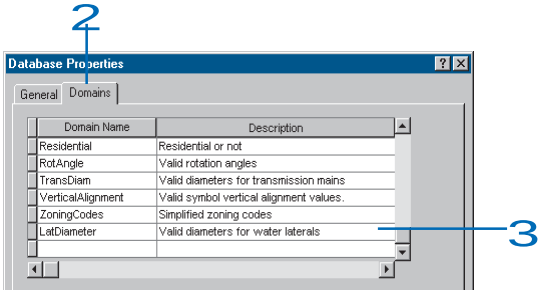
Creating an attribute domain

You will use ArcCatalog to create a new coded value attribute domain. This new domain will describe a set of valid pipe diameters for your new Laterals feature class.

1. Right-click the Montgomery geodatabase and click Properties.



2. Click the Domains tab.



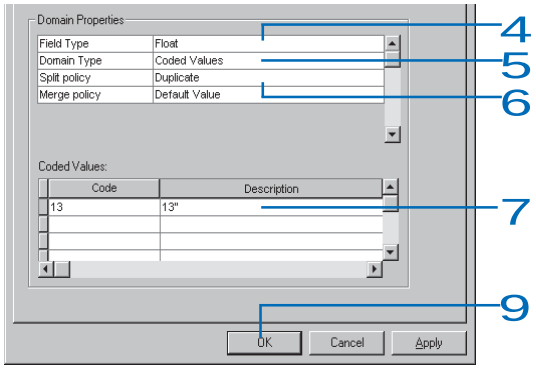
3. Click the first empty field under Domain Name and type “LatDiameter” for the name of the new domain. In the Description field, type “Valid diameters for water laterals” for the domain’s description.

You will now specify the properties of the domain. These properties include the type of field this domain can be associated with, the type of domain it is—range or coded value, the split and merge policies, and the valid values for the domain.

A range domain describes a valid range of numeric values, and a coded value domain describes a set of valid values. In this case, you will create a new coded value domain.

All domains also have split and merge policies. When a feature is split or merged, ArcGIS looks to these policies to determine the values of the resulting feature or features for a particular attribute.

4. Click the Field Type to view a dropdown list and click Float for the field type for this domain.



5. Click the Domain Type to view a dropdown list and click Coded Values for the domain type.
6. Click the *Split policy* to view a dropdown list and click Duplicate for the split policy for the domain. The *Merge policy* will default to Default Value.

You'll type the valid values, or codes, for the coded value domain, and for each code you will provide a user-friendly description. As you will see later in the tutorial, ArcMap uses the user-friendly description, not the code, for values of fields that have coded value domains associated with them.

7. Click the first empty field under Code and type "13" for the code; then click the Description field beside it and type "13"" for the code's description.
8. Add the following coded values to the list:

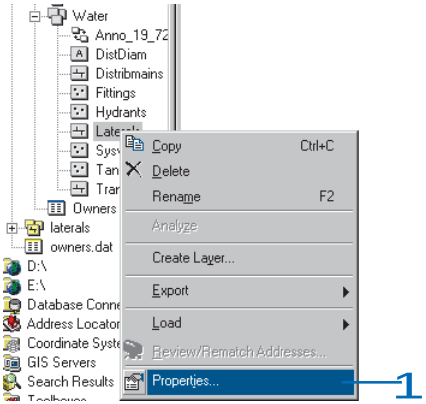
Code	Description
10	10"
8	8"
6	6"
4	4"
3	3"
2.25	2 1/4"
2	2"
1.5	1 1/2"
1.25	1 1/4"
1	1"
0.75	3/4"
-9	Unknown

9. Click OK to add the domain to the geodatabase.

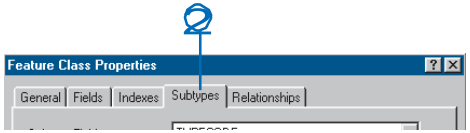
Creating subtypes and associating default values and domains

Now you will create subtypes for the Laterals feature class and associate default values and domains with the fields for each subtype. By creating subtypes, not all the water lateral features need to have the same domains, default values, and as you will see later in the tutorial, connectivity rules.

1. Right-click the Laterals feature class and click Properties.

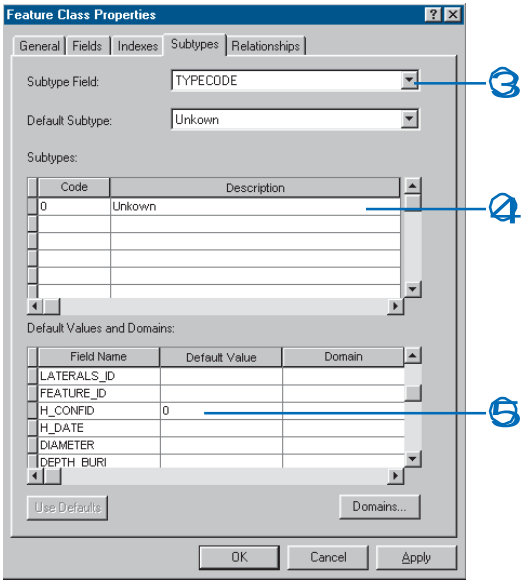


2. Click the Subtypes tab.



You will now specify the subtype field for the Laterals feature class. The subtype field contains the values that identify to which subtype a particular feature belongs.

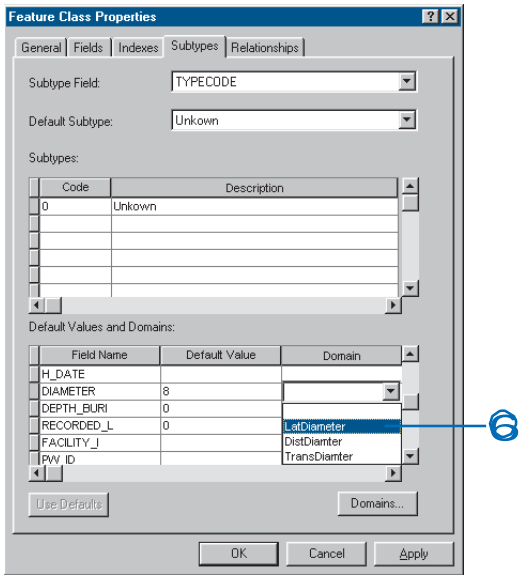
3. Click the Subtype Field dropdown arrow and click TYPECODE.



You will now add subtype codes and their descriptions. When you add a new subtype, you will assign default values and domains to some of its fields.

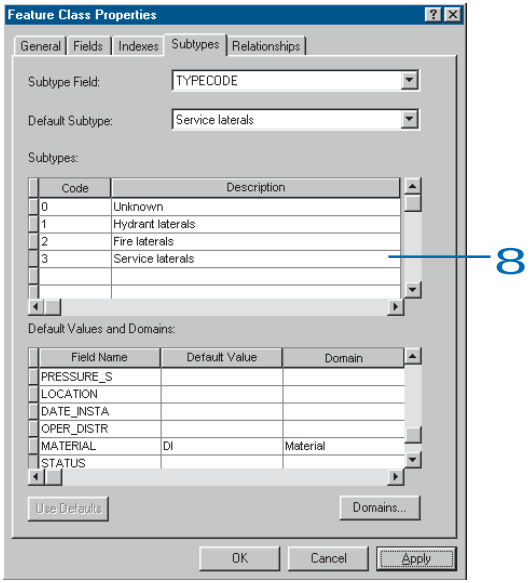
4. Click the Description field next to subtype code 0 and type “Unknown” for its description.
5. Click the Default Value field next to H_CONFID and type “0” for its default value. Do the same for DEPTH_BURI and RECORDED_L. For the WNM_TYPE, PWTYPE fields, type “WUNKNOWN” as the default values.

6. Click the Default Value field next to DIAMETER and type “8” for the default value. Click the Domain dropdown list and click LatDiameter to set it as this field’s attribute domain for the Unknown subtype.



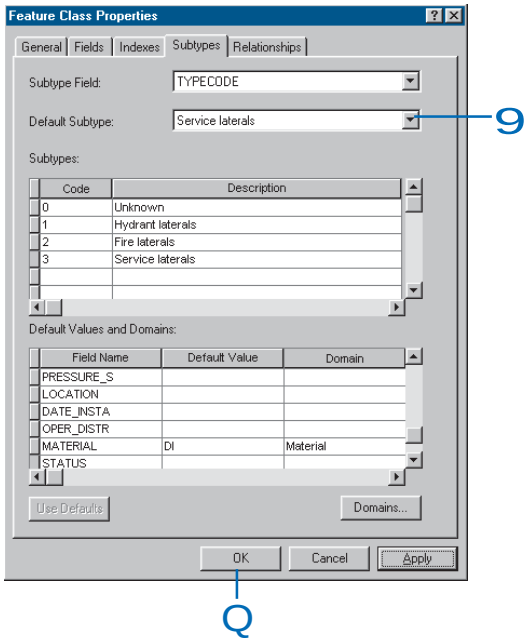
7. Repeat step 6 for the MATERIAL field, typing “DI” for the default value. Click Material in the Domain dropdown list.
8. Add the following subtypes and set the default values and domains the same as for the Unknown subtype, except for the WNM_TYPE and PWTYPE field default values.

Code	Description
1	Hydrant laterals
WNM_TYPE, PWTYPE	default value = WHYDLIN
2	Fire laterals
WNM_TYPE, PWTYPE	default value = WFIRELIN
3	Service laterals
WNM_TYPE, PWTYPE	default value = WSERVICE



When adding new features to a feature class with subtypes in the ArcMap editing environment, if you don't specify a particular subtype, the new feature will be assigned the default subtype. Once you have added all the subtypes for this feature class, you can set the default subtype from those you entered.

9. Click the Default Subtype dropdown arrow and click Service laterals to set it as the default subtype.



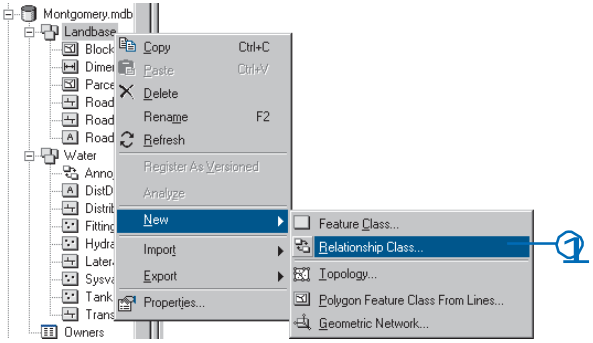
10. Click OK.

You have now added behavior to the geodatabase by adding domains and creating subtypes. Now you will add some additional behavior to the geodatabase by creating relationships.

Exercise 4: Creating relationships between objects

In Exercise 2, you imported an INFO table containing owner objects into the Montgomery geodatabase. The geodatabase already has a feature class called Parcels that contains parcel objects. You will now create a *relationship class* between the parcels and the owners so that when you use the data in ArcMap you can easily find out which owners own which parcels.

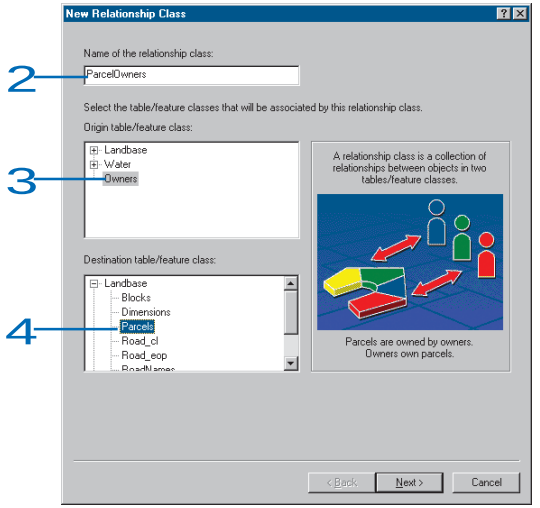
1. Right-click the Landbase feature dataset, point to New, then click Relationship Class.



   The New Relationship Class wizard opens. The first panel of the wizard is used to specify the name, origin, and destination feature class or table for the new relationship class.

2. Type “ParcelOwners” as the name of this relationship class.

3. Click Owners for the origin table.



4. Double-click Landbase and click Parcels for the destination feature class. Click Next.

   The next panel is used to specify the type of relationship class you are creating. You are creating a simple relationship class since owners and parcels can exist in the database independently of each other. You can, therefore, accept the default type—simple relationship class.

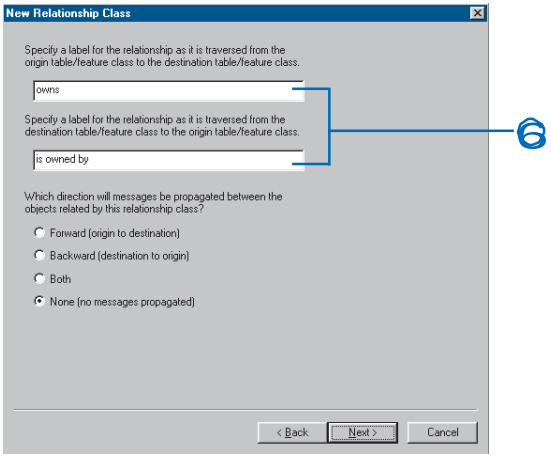
5. Click Next.

   You must now specify the path labels and the message notification direction. The forward path label describes the relationship as it is navigated from the origin class to the destination class—in this case, from Owners to Parcels. The backward path label describes the

relationship when navigated in the other direction—from Parcels to Owners.

The message notification direction describes how messages are passed between related objects. Message notification is not required for this relationship class, so accept the default of None.

6. Type “owns” for the forward path label and type “is owned by” for the backward path label. Click Next.



You will now specify the cardinality of the relationship. The cardinality describes the possible number of objects in the destination feature class or table that can be related to an object in the origin feature class or table.

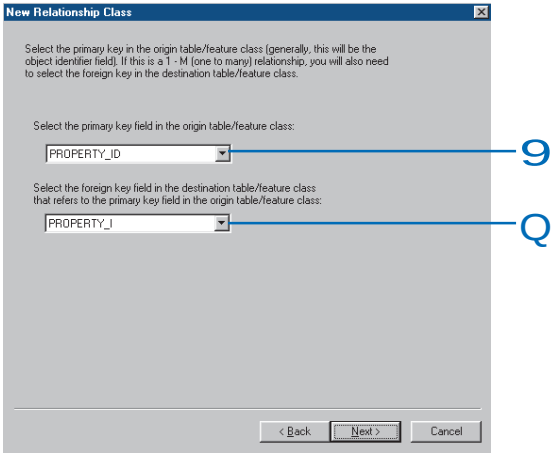
7. Click 1–M (one-to-many) to specify that one owner may own many parcels. Click Next.

You must now specify whether your new relationship class will have attributes. In this example, the ParcelOwners relationship class does not require attributes, which is the default.

8. Click Next.

The next step is to specify the primary key in the origin table (Owners) and the embedded foreign key field in the destination feature class (Parcels). Owners and Parcels that have the same value in these fields will be related to each other.

9. Click the first dropdown arrow and click PROPERTY_ID for the origin table primary key.



10. Click the second dropdown arrow and click PROPERTY_I for the embedded foreign key in the destination feature class.

11. Click Next. A summary page appears. Once you have reviewed the summary, click Finish.

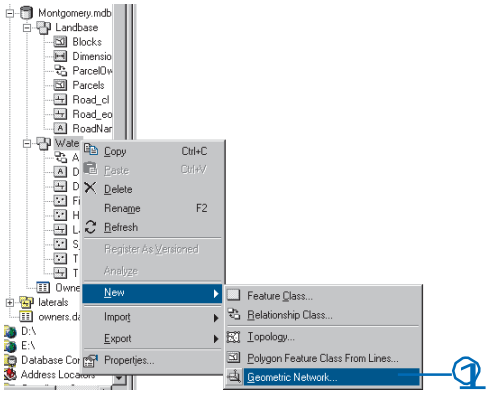
You have now added a second kind of behavior to the geodatabase—relationships. Next you will continue to add behavior to the geodatabase by creating a geometric network and defining connectivity rules.

Exercise 5: Building a geometric network

Feature classes stored in the same feature dataset can participate in a geometric network. Geometric networks model network systems such as water networks. You will build a geometric network from the feature classes in the Water feature dataset in the Montgomery geodatabase. You will then create connectivity rules to define which features can connect to each other in the network.

Creating the water network

1. Right-click the Water dataset, point to New, then click Geometric Network.



The Build Geometric Network Wizard opens. You can use this wizard to either build a geometric network from existing feature classes or to create an empty geometric network. In this case, you will be building a network from the existing feature classes in the Water feature dataset.

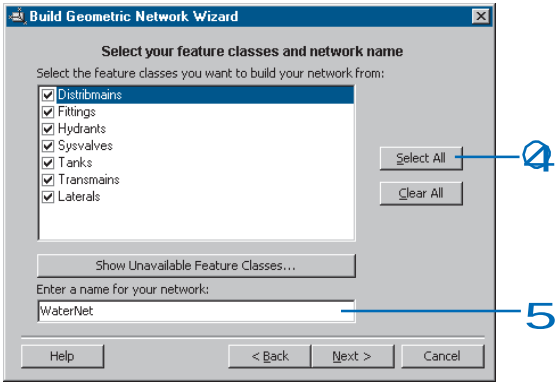
2. Click Next.

   The second panel is used to specify whether to build a network from existing feature classes or to create an empty one. You want the default—Build a geometric network from existing features.

3. Click Next.

   You must now select which feature classes in the feature dataset will participate in the geometric network and what the name of the network will be.

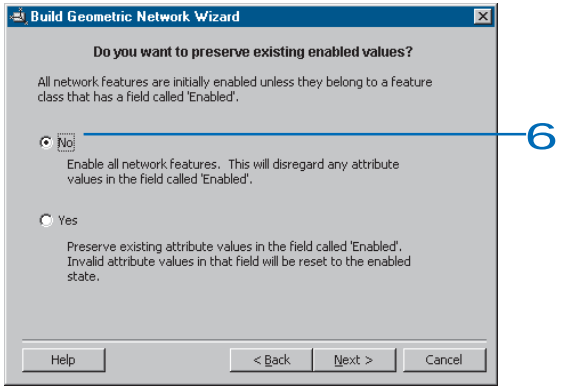
4. Click Select All.



5. Type “WaterNet” for the name of the geometric network. Click Next.

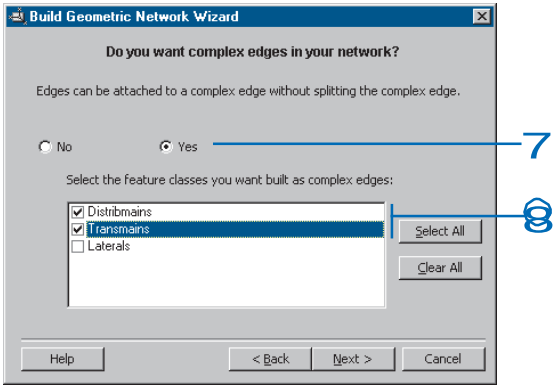
The option to exclude features with certain attributes makes it easier to manage the state of parts of the network if you need to drop the network and rebuild it after you've been working with it for a while.

6. Click No, so that all features will participate in the geometric network. Click Next.



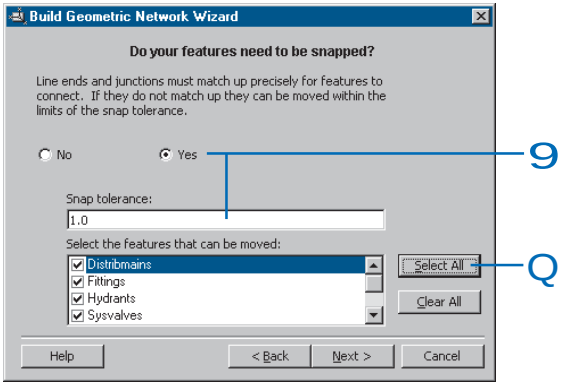
You will now specify which line feature classes will become complex edge feature classes in the geometric network. Complex edge features are not split into two features by the connection of another feature along their length; thus, they are useful for modeling water mains which may have multiple laterals connected to them. By default, all line feature classes become simple edge feature classes.

7. Click Yes to specify that some of the line feature classes will become complex edges.
8. Check Distribmains and Transmains to make the water distribution and transmission mains complex edges. Click Next.



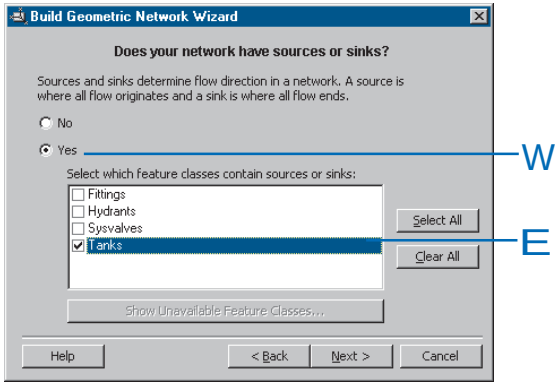
Features in a geometric network must be precisely connected to one another. The input feature classes can be adjusted to ensure connectivity by snapping. You will specify whether these features need to be adjusted to snap to one another in the network-building process.

9. Click Yes to specify that some of the features need to be adjusted. Type "1.0" for the snapping tolerance.
10. Click Select All to indicate that the features stored in each feature class can be adjusted. Click Next.



You must specify which, if any, of the junction feature classes can act as sources and sinks in the network. Sources and sinks are used to determine the flow direction in the network.

11. Click Yes to indicate that some of the junction feature classes will act as sources or sinks.



12. Check the Tanks feature class to indicate that tanks can be sources or sinks in the network. Click Next.

    Now you can assign network weights. A network weight describes the cost of traversing an element in the logical network, such as the drop in pressure as water flows through a pipe. This geometric network does not require weights, which is the default.

13. Click Next. A summary page appears. Once you have reviewed the summary, click Finish.

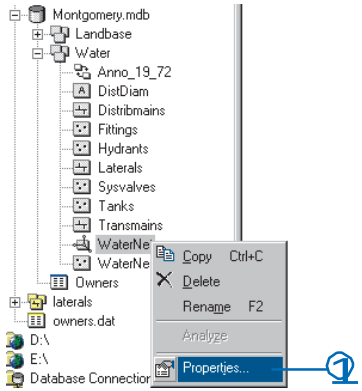
    A progress indicator appears, displaying the progress for each stage of the network-building process.

Your new geometric network, WaterNet, has been created in the Montgomery geodatabase. Next, you'll establish *connectivity rules* for your water network.

Creating connectivity rules

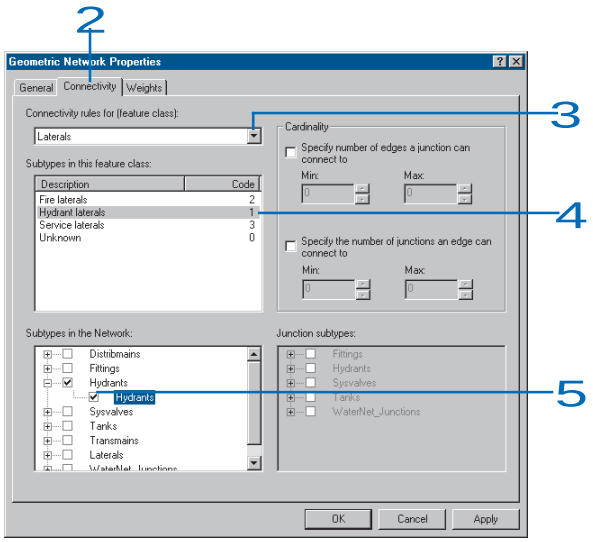
Network connectivity rules constrain the type of network features that may be connected to one another and the number of features of any particular type that can be connected to features of another type. By establishing these rules, you can maintain the integrity of the network connectivity in the database.

1. Right-click WaterNet and click Properties.



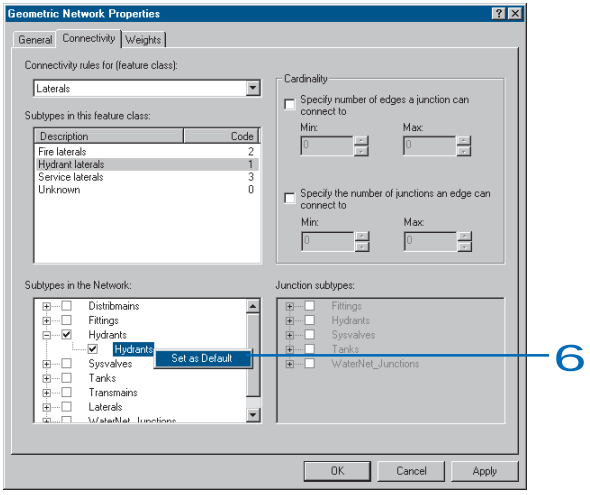
The Geometric Network Properties dialog box opens. The dialog box provides information about feature classes participating in the network and a list of the network weights. You can also add, delete, and modify connectivity rules using this dialog box.

2. Click the Connectivity tab.



This tab lets you add and modify connectivity rules for the geometric network. You will first create a new *edge–junction rule*, which states that hydrants can connect to hydrant laterals; it also indicates that when a hydrant lateral is created, a hydrant junction feature should be placed at its free end.

3. Click the dropdown arrow and click Laterals.
4. In the list of subtypes in the feature class, click Hydrant laterals.



You will now click the types of junctions that hydrant laterals can connect to in the network. For simplicity, hydrant laterals can only connect to hydrants.

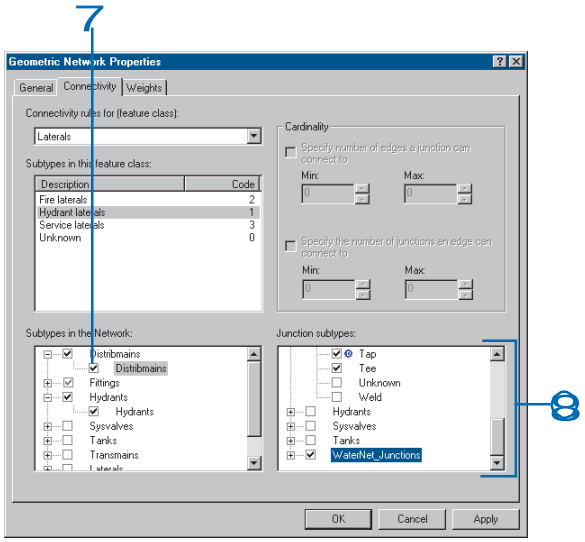
5. Check Hydrants in the list of subtypes in the network.

   You should also specify that when you create a hydrant lateral, if an end of the lateral is not connected to another edge or junction, then a hydrant is placed at that end.

6. Click the plus sign to expand Hydrants, right-click Hydrants under it, then click Set as Default. A blue D will appear next to the hydrant subtype, indicating that it is the default junction for this edge subtype.

You will now create a new *edge–edge rule* that states that hydrant laterals can connect to distribution mains through taps, tees, and saddles. The default junction for connections between hydrant laterals and distribution mains will be taps.

7. In the network subtypes list, click the plus sign to expand Distribmains and check Distribmains under it.



Because you have checked an edge in the network subtypes list, the list of junction subtypes in the network becomes active. In this list, you can specify which junction types hydrant laterals and distribution mains can connect through.

8. In the Junction subtypes list, click the plus sign to expand Fittings and check Tap, Tee, and Saddle in that order. Notice that Tap has a blue D next to it; this means that Tap is the *default junction*. Check WaterNet_Junctions, which is the generic, or default, network junction type.
9. Click OK.

You have now added behavior to your geodatabase by defining connectivity rules. You would normally define many more connectivity rules for a network. However, for this tutorial, you only need to define the connectivity rules specified here. In the next part of the tutorial, you will create feature-linked *annotation* for your new hydrant lateral feature class.