X

Working with Geodatabases

Exercise 1A: Exploring the Geodatabase
Estimated time: 5 minutes

Exercise 1B: Create and Load GDB Elements
Estimated time: 15 minutes

Exercise 1C: (optional) Working with attribute behavior
Estimated time: 30 minutes

Exercise 1D: (optional) Working with Topology
Estimated time: 15 minutes

Exercise 1A: Exploring the Geodatabase

Estimated time: 5 minutes

In this exercise, you will assume the role of a GIS Manager at an environmental organization. You need to edit and expand your existing data for water quality in the Yellowstone River Basin.

Upper management identified the following requirements for this task:

- All spatial data must be stored in a central location to improve access to, and sharing of, spatial data.
- The storage format must have built-in solutions to manage and store large amounts of spatial data.
- The storage format must enable data to meet the organization's high standards for accuracy and integrity.

The environmental organization decides that the best storage format is the *file geodatabase* because it meets, and exceeds, these requirements.

In this exercise, you will:

- Navigate a geodatabase.
- Understand and recognize elements in a geodatabase.

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Step 1: Explore geodatabase elements in ArcCatalog (Demo)

In this step, observe and participate as the instructor explains elements contained within a geodatabase.

Conclusion

In this exercise, the instructor explained the elements contained within a geodatabase. The geodatabase is the native data structure for ArcGIS and is the primary data format used for editing and data management in ArcMap. It is a comprehensive data model for representing and managing geographic information implemented as a series of tables holding feature classes, raster datasets, and attributes. In addition, advanced GIS data objects add GIS behavior; rules for managing spatial integrity; and tools for working with the numerous spatial relationships of feature classes, raster datasets, and attributes.

In the following exercise, you will create and load data into a file geodatabase.

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Exercise 1B: Create and Load GDB Elements

Estimated time: 15 minutes

In this exercise, you will assume the role of a GIS Manager at an environmental organization. Before you can start adding behavior to your data, you will move it into a geodatabase. You decide to create new elements in a file geodatabase and load data using two different methods.

In this exercise, you will:

- Create new geodatabase elements.
- Load data into an existing feature class using the Simple Data Loader.
- Load data into a file geodatabase using geoprocessing tools.
- Discover the properties of a geodatabase feature class.

Step 1: Create a new feature class

In this step, you will create a new polygon feature class and import the field definitions from an existing polygon coverage.

☐ Open ArcMap from the Start button > All Program > ArcGIS > ArcMap.

☐ Click New Maps > My Templates on the left pane of the ArcMap - Getting Started dialog box.

☐ Select Blank Map on the right pane and click OK.

A new enhancement for ArcMap 10 is the introduction of the Catalog window. The Catalog window provides tools for organizing and managing your map documents, layers, geodatabases, geoprocessing models and tools, and file-based data. These elements are organized and managed in file folders on your computer. The Catalog window is used to add data to your map and to save and organize results.

Step 1 will be performed from the Catalog window.

☐ If the Catalog window is not visible in ArcMap, open it by clicking Windows > Catalog on the main menu.

☐ Click the push-pin to pin the Catalog window open.

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First, you will establish a connection to the workspace folder that you want to use. Folder connections are used to access the file folders whose content you plan to work with in ArcMap.

☐ Click the Connect To Folder button  in the Catalog window to create a connection to the data folder.

☐ Navigate to C:\EdUC\GDB and click OK to create the folder connection.

☐ Expand Folder Connections in the Catalog tree.

☐ Expand the Data folder.

The data folder contains two coverages: minerals and wshed. A coverage is an older format for storing spatial data. You can use the Item Description window to preview data in the folder.

☐ Right-click the minerals coverage and choose Item Description.

☐ Click the Preview tab in the Item Description window.

Notice that the minerals coverage contains polygons.

☐ Select Table from the Preview drop-down list.

☐ Examine the coverage table schema.

There are software-defined fields for named AREA and PERIMETER.

☐ Close the Item Description window.

☐ Expand the minerals coverage.

Often, there are more then one geometry type stored in an Arc/Info coverage. Each coverage stores a set of points, lines, polygons, or annotation.

☐ Expand the Ex1b folder.

☐ Expand the WaterAssessment geodatabase.

Notice that some feature classes are already loaded. Feature classes are a collection of geographic features with the same geometry type (such as points, lines, or polygons), the same attributes, and the same spatial reference. You can create empty feature classes for data loading or on-screen digitizing.

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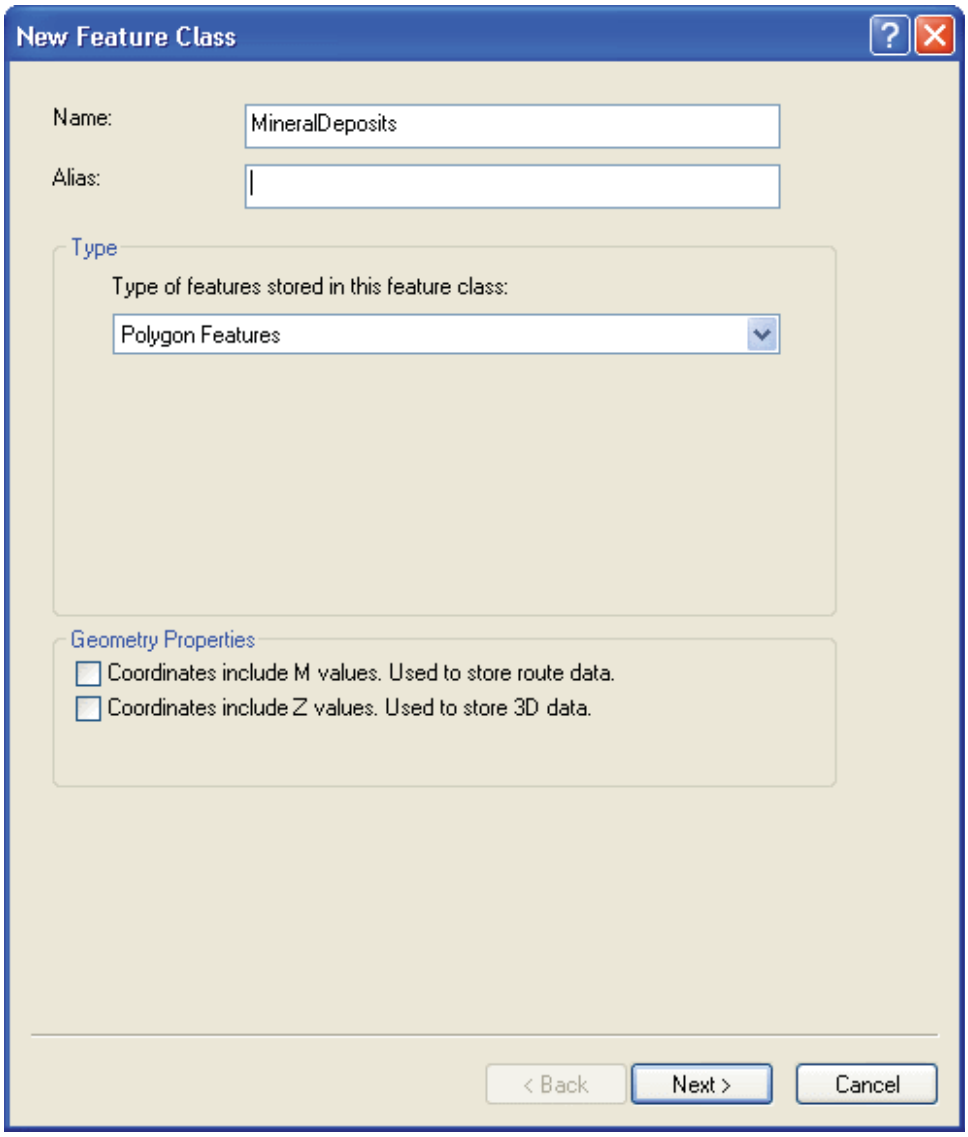
☐ Right-click the WaterAssessment geodatabase, then select New > Feature Class.

☐ In the New Feature Class dialog box, in the Name field, type **MineralDeposits**.

☐ For type of features, make sure that Polygon Features is selected.



☐ Click Next.

When you create a new feature class, you must choose a coordinate system. The coordinate system may be defined as Geographic (e.g., latitude/longitude) or Projected (e.g., Stateplane, UTM). A spatial reference describes where features are located in the

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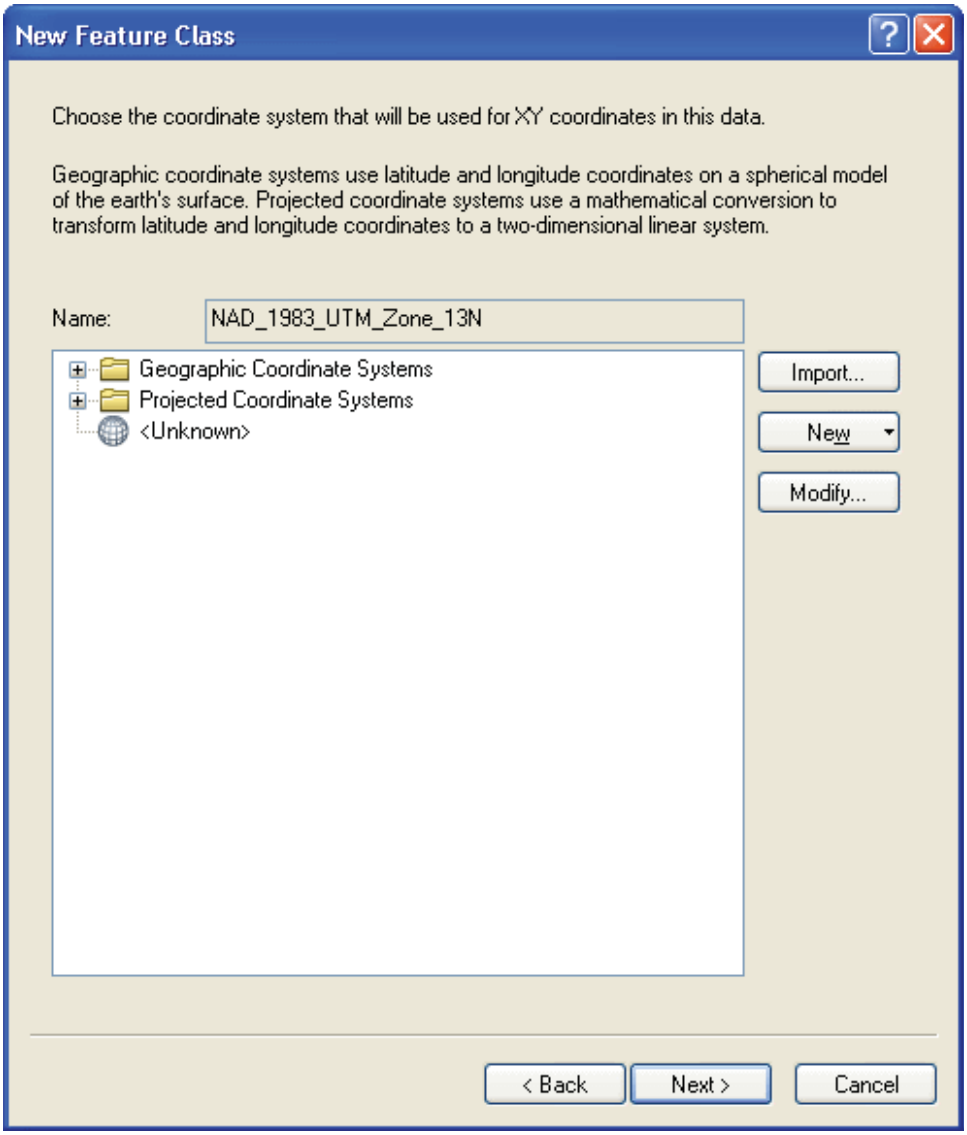
real world. You can select a predefined coordinate system or import the coordinate system parameters used by another feature class.

☐ Click the Import button to open the Spatial Reference Properties dialog box.

☐ Navigate to C:\EdUC\GDB\Ex1b\WaterAssessment via the folder connection and select the watersheds feature class, then click Add.

Notice that the Name became "NAD_1983_UTM_Zone_13N"



☐ Click Next.

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☐ Accept the default settings for XY Tolerance.

☐ Click Next.

☐ Accept the default Configuration Keyword.

Configuration keywords specify how data and database objects, such as tables, indexes, feature classes, network classes, and raster columns are stored in the geodatabase.

☐ Click Next.

When you create a new feature class, you can specify the fields to be included and the properties for those fields, such as the field type and the maximum size of the data that it can store. You have the option to import fields from another feature class.

☐ Select Import and navigate to C:\EdUC\GDB\Data via your Folder Connections.

☐ Double-click minerals > and select polygon.

☐ Click Add.

The field definitions (schema) from the coverage defines all the fields for the new geodatabase feature class. Notice that AREA and PERIMETER are the third and fourth fields, respectively. You will delete those two fields because they are automatically created as a part of the schema in a geodatabase feature class.

☐ Select the small grey box to the left of AREA in the Field Name column to highlight it and press delete on the keyboard.

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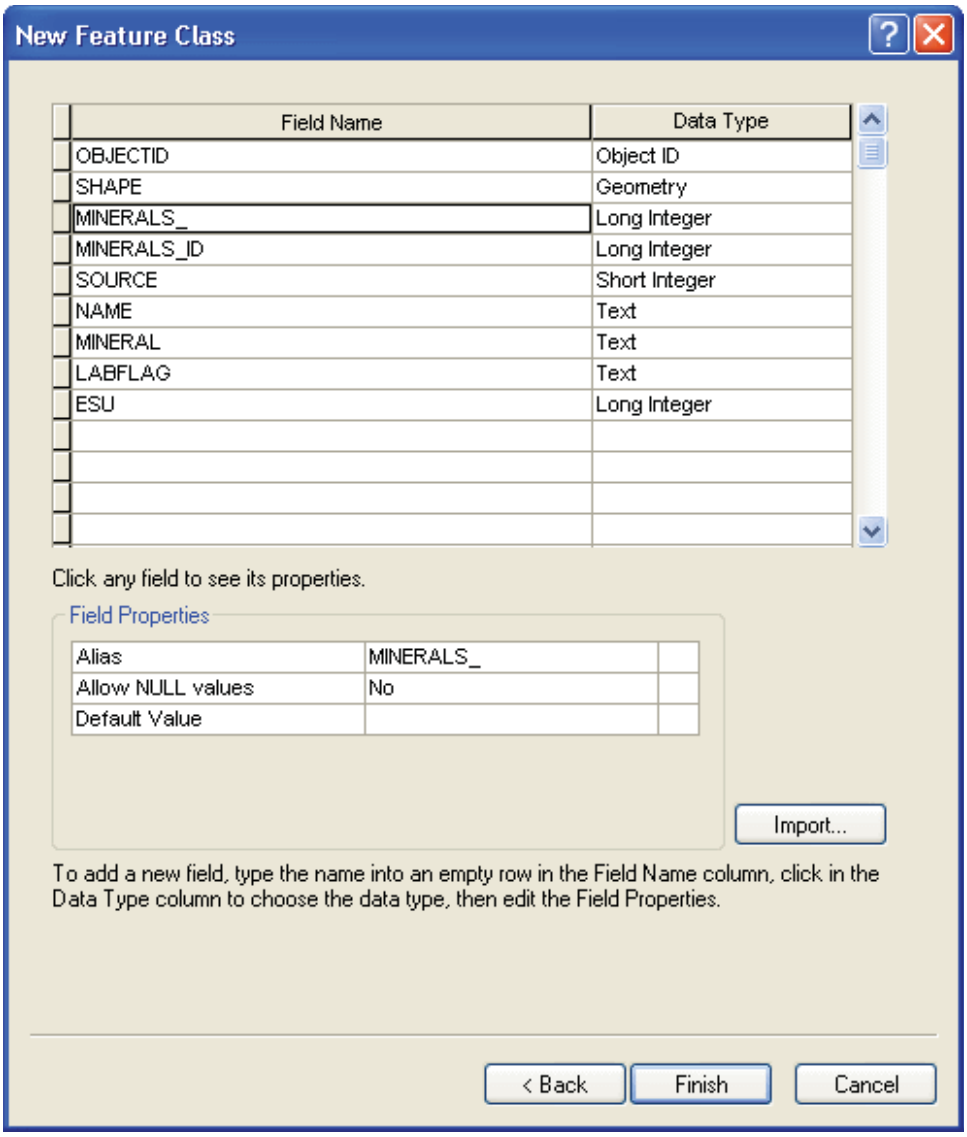
☐ Repeat the step for the PERIMETER field.



☐ Click Finish to execute the New Feature Class wizard.

☐ Do not close ArcMap.

The new MineralDeposits feature class should now appear in the WaterAssessment geodatabase and has been added to Layers data frame in ArcMap. If you do not see the MineralDeposits feature class in the Catalog window, right-click the WaterAssessment geodatabase and select Refresh from the context menu.

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In the next step, you will add data to the MineralDeposits feature class using the Simple Data Loader and geoprocessing tools.

Step 2: Load data with the Simple Data Loader

In this step, you will use the Simple Data Loader to load data from the minerals Arc/Info coverage into the newly created MineralDeposits feature class in the WaterAssessment file geodatabase.

This entire step will be performed from the Catalog window.

The Simple Data Loader wizard enables you to specify a number of source tables and feature classes to load into an existing feature class, provided their schema match. The schemas match because you imported the minerals schema to into the MineralDeposits geodatabase feature class.

☐ In the Catalog tree, navigate to C:\EdUC\GDB\Ex1b via your Folder Connections.

☐ Expand the *WaterAssessment* geodatabase.

☐ Right-click on the *MineralDeposits* feature class and click Load > Load Data.

The Simple Data Loader wizard opens.

☐ Click Next to skip the welcome screen.

☐ For the Input Data box, click the folder to browse into the minerals coverage in the C:\EdUC\GDB\Data folder, select polygon and click Open.

☐ Navigate to C:\EdUC\GDB\Data via your Folder Connections.

☐ Double-click minerals > and select polygon.

☐ Click Open.

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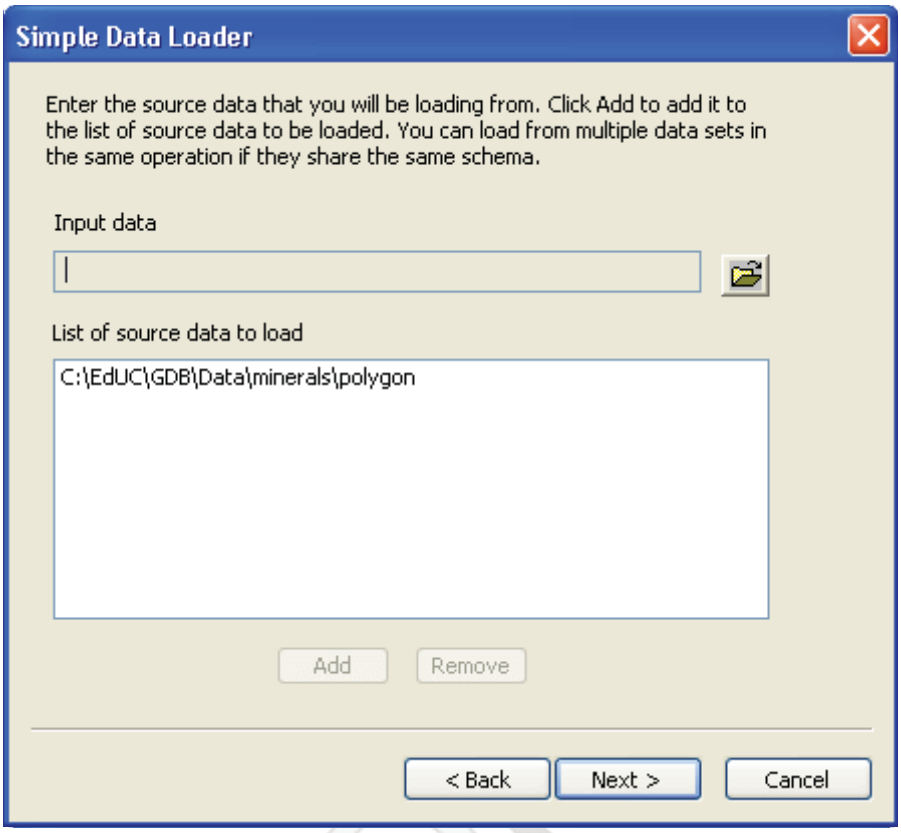
☐ Click Add to add it to the list of source data to load.



☐ Click Next.

☐ Click Next again. You do not want to load all features into a subtype.

Notice that two Matching Source Fields are missing. The Simple Data Loader allows you to specify which fields in the input data are loaded into which fields of the target feature class.

☐ For the MINERALS_ [int] target field, click the Matching Source Field box and select **MINERALS# [int]** field from the drop-down to match the source field to the target field.

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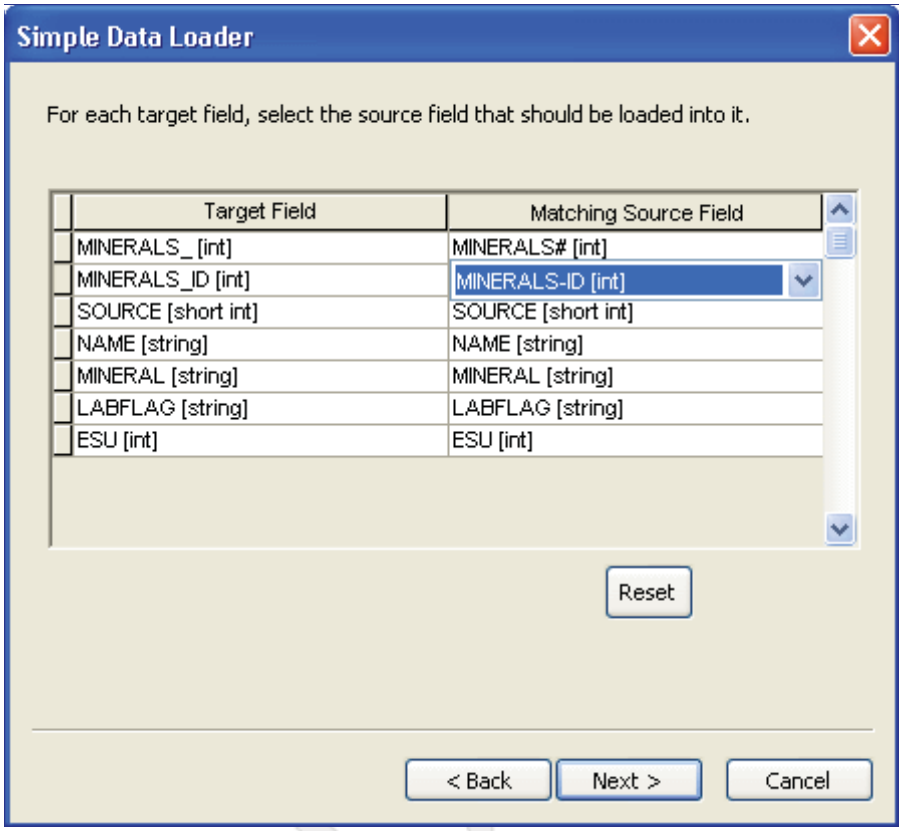
☐ Repeat this step for the MINERALS-ID [int] target field selecting **MINERALS-ID [int]** from the Matching Source Field drop-down.



☐ Click Next.

☐ Verify that the option to Load all of he source data is selected.

☐ Click Next.

☐ Review the summary and click Finish.

☐ In ArcMap, right-click the MineralDeposits layer and select Zoom to Layers to view the newly added polygons.

☐ Right-click the MineralDeposits layer and select Open attribute table to view the layer attributes.

☐ Close the MineralDeposits attribute table.

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You have successfully loaded the contents of a coverage feature class into a geodatabase feature class using the Simple Data Loader. In the next step, you will load data using geoprocessing tools.

Step 3: Load data using geoprocessing tools

In this next step, you will first create a feature dataset in the WaterAssessment geodatabase. Then you will move the watersheds feature class into this feature dataset and import data from the sample_site shapefile using geoprocessing tools.

This entire step will be performed from the Catalog window.

A feature dataset is a collection of feature classes that share the same spatial reference. Feature datasets are used to spatially integrate related feature classes into a common dataset for building a geodatabase topology, a network dataset, a terrain dataset, or a geometric network.

☐ In the Catalog tree, navigate to C:\EdUC\GDB\Ex1b via your Folder Connections.

☐ Right-click the WaterAssessment geodatabase and select New > Feature Dataset.

☐ For the feature dataset name, type **Sites**.

☐ Click Next.

When creating a new feature dataset, you must define its spatial reference. This includes its coordinate system, coordinate units, and tolerances. All feature classes in the same feature dataset must share a common coordinate system, and the XY coordinates of your feature classes should fall within a common spatial extent.

You can choose from a predefined coordinate system or click Import from a feature class or feature dataset that uses the same spatial reference.

☐ Click the Import button to open the Spatial Reference Properties dialog box.

☐ Navigate to C:\EdUC\GDB\Ex1b via your Folder Connections.

☐ Expand the WaterAssessment geodatabase.

☐ Select the watersheds feature class, then click Add.

☐ Click Next.

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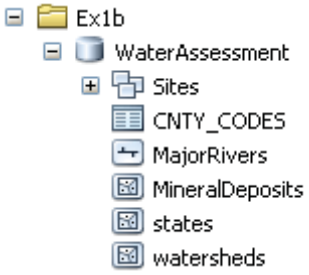
☐ Accept the defaults for Vertical Coordinate Systems, then click Next.

☐ Accept the default for XY Tolerance, Z Tolerance, M Tolerance, and Resolution/ domain extent.

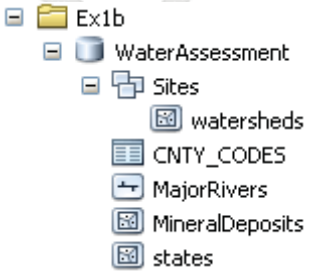
☐ Click Finish.

You have just created a new feature dataset. Now you will move the watersheds feature class into it.



☐ In the Catalog tree, drag and drop the watersheds feature class into the Sites feature dataset.

☐ Expand the Sites feature dataset to confirm that the watersheds feature class was moved into the feature dataset.



You will now import the sample_site shapefile into the Sites feature dataset.

☐ Navigate to C:\EdUC\GDB\Data via the folder connection.

☐ Use the Item Description window to preview the geometry and table for the sample_site shapefile.

☐ Close the sample_site Item Description window.

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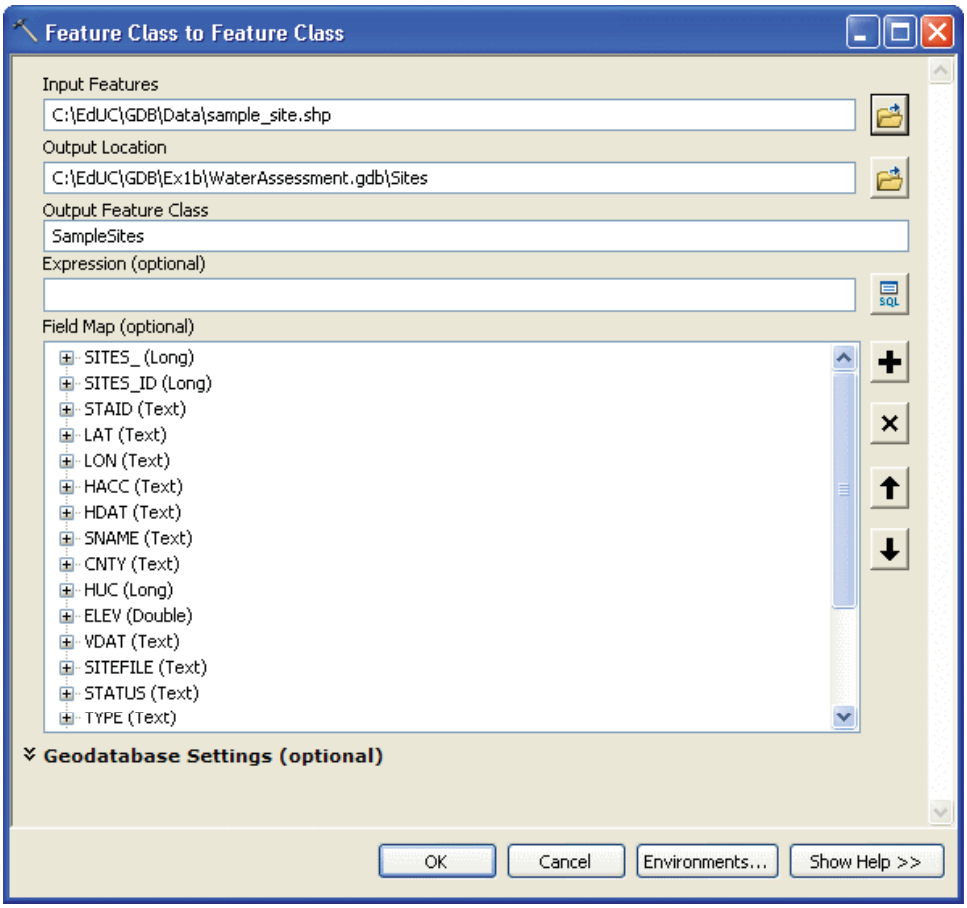
☐ Right-click the Sites feature dataset located in the C:\EdUC\GDB\Ex1b\WaterAssessment geodatabase and choose Import > Feature Class (single).

☐ For Input Features, browse to sample_site.shp.

☐ For Output Location, browse to the Sites feature dataset.

☐ For Output Feature Class, type SampleSites.



There is no need to modify the Field Map. All of the fields from the shapefile will be imported into the new geodatabase feature class.

☐ Click OK.

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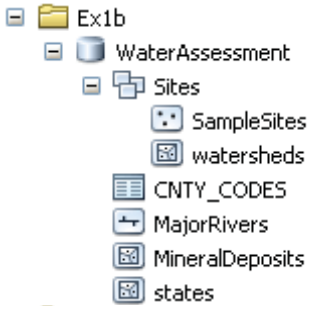
☐ When the import is complete, expand the Sites feature dataset to confirm that the sample_sites shapefile was imported into the Sites feature dataset as the SampleSites feature class.



Now there is a feature dataset in the WaterAssessment file geodatabase containing both the watersheds and SampleSites feature classes that you moved and imported, respectively.

☐ Close ArcMap and do not save your changes if prompted.

The following optional exercise explains how to apply attribute behavior to your data.

Conclusion

In this exercise, you created a new feature class, loaded data using the Simple Data Loader, created a new feature dataset, and imported a shapefile using a geoprocessing tool.

ArcGIS Desktop contains additional tools to import data from a wide variety of formats into the geodatabase. These tools include:

Copy/paste between geodatabases
Drag/drop between geodatabases
Import/export commands
XML Workspace document
Object Loader
Append geoprocessing tool

The next two optional exercises describe attribute validation through the use of subtypes and domains and spatial validation through the use of a geodatabase topology. There may not be enough time to complete both optional exercises. You may choose the optional exercise that best suits your interest.

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Exercise 1C: (optional) Working with attribute behavior

Estimated time: 30 minutes

In this optional exercise, you will continue the role of a GIS Manager at an environmental organization. Since your editors receive new field data daily, you want to set up the geodatabase to make editing attributes more efficient and accurate. You decide to implement subtypes, domains, and default attributes values for your feature classes.

In this exercise, you will:

- Understand subtypes and domains.
- Create and implement subtypes and domains for the attributes in a feature class.
- Appreciate how subtypes and domains maintain efficient editing and accurate data.

Step 1: Set up a coded-value domain

Your GIS editors regularly add water sampling locations and edit mineral deposits data. You want to ensure that the spelling and attribute values are being entered correctly. You will use attribute domains. Attribute domains are rules that describe the legal values of a field type and provide a method for enforcing data integrity. They are used to constrain the values allowed in any particular attribute for a table or feature class. In this step you will create two coded-value domains for the SampleSites feature class.

This entire step will be performed from the Catalog window in ArcMap.

☐ Start ArcMap.

☐ In the ArcMap - Getting Started dialog box, click Blank Map from the New Maps > My Templates directory.

☐ For the Default geodatabase for this map, click the Open button  and select the C:\EdUC\GDB\Ex1c\WaterAssessment geodatabase.

☐ Click Add.

☐ Click OK to open a blank map.

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☐ If necessary, start the Catalog window in ArcMap by clicking the Catalog window button on the Standard toolbar and click the push-pin to lock the window to ArcMap.

☐ In the Catalog window, click the Go to Default Geodatabase button (or, in the Catalog tree, navigate to C:\EdUC\GDB\Ex1c via your Folder Connections).

☐ Expand the WaterAssessment geodatabase and the Sites feature dataset.

☐ Right-click the SampleSites feature class and select the Item Description command from the context menu.

☐ Preview the attribute table for the SampleSites feature class.

In the attribute table, scroll to the right to observe the CNTY field. It records county codes for the states of Montana and Wyoming. Your editors should not have to memorize all of these county codes. If an editor remembers a code incorrectly, your data will be in error. A coded-value domain will allow your editors to choose from a list of valid county codes.

☐ Right-click the CNTY_CODES non-spatial table and select the Item Description command to preview the CNTY_CODES attribute table.

The table records county codes and descriptions. The Table to Domain geoprocessing tool can be used to create a coded-value domain from the values in this table. In ArcGIS 10, it's easy to find geoprocessing tools.

☐ Close the Item Description window.

☐ Open the Search window by clicking Windows > Search menu (or press CTRL-F on the keyboard).

☐ Click the push-pin to hold the Search window open.

☐ In the search box, type **coded value domain** and click the Search icon .

The search will return several items. One is the Table to Domain (Data Management) geoprocessing tool.

☐ Click the tool hyperlink name to open the geoprocessing tool.

☐ Click the Show Help button to read about the functionality of the tool.

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☐ For Input Table, browse to C:\EdUC\GDB\Ex1c via the folder connection.

☐ Double-click the WaterAssessment geodatabase, click the CNTY_CODES table and click Add.

☐ For Code Field, select CODE.

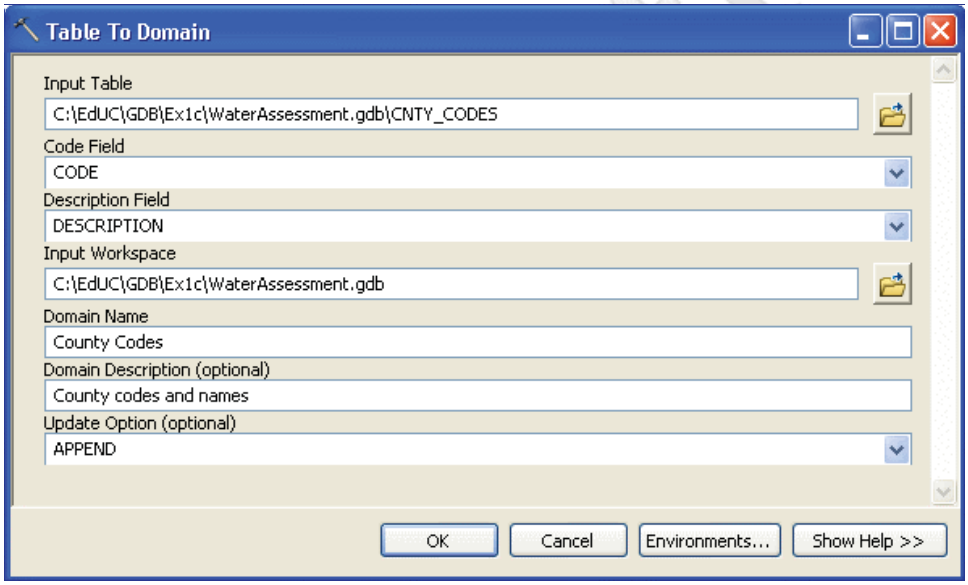
☐ For Description field, select DESCRIPTION.

☐ For Input Workspace, browse to C:\EdUC\GDB\Ex1c via the folder connection.

☐ Click WaterAssessment.gdb, then click Add.

☐ For Domain Name, type **County Codes**.

☐ For Domain Description (optional), type **County codes and names**.



☐ Click OK to convert the non-spatial table to a geodatabase domain.

☐ Click the push-pin on the Search window to retract it.

☐ Right-click the WaterAssessment geodatabase and click Properties.

☐ Click the Domains tab.

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☐ Review the values in the Coded Values fields as well as the settings in the Domain Properties.

> ***Note:*** For now, we do not need to worry about the Split and Merge Policies because this domain will be applied to a points feature class. For more information on Split and Merge review the Desktop Help.

☐ Click Cancel.

The CNTY_CODES table is now a coded value domain in the geodatabase. This domain can be shared across feature classes, tables, and subtypes in a geodatabase. In the next step you will manually create a range domain.

Step 2: Set up a range domain

Your editors have been adding numeric values well beyond the acceptable range for the SOURCE attribute field in the MineralDeposits feature class. In this step, you are going to create a range domain to ensure that these values are within the acceptable range.

This entire step will be performed from the Catalog window in ArcMap.

☐ In the Catalog tree, navigate to C:\EdUC\GDB\Ex1c via the folder connection.

☐ Expand the WaterAssessment geodatabase.

☐ Right-click the MineralDeposits feature class and select Item Description to preview the attribute table.

The SOURCE field records codes that fall within a range from 1 to 18. Your editors should not use numbers outside of this range. A range domain specifies a valid range of values for a numeric attribute. When creating a range domain, you enter a minimum and maximum valid numeric value.

☐ Close the Item Description window.

☐ Right-click the WaterAssessment geodatabase.

☐ Click Properties.

☐ If necessary, click the Domains tab.

☐ In the Domain Name field, type **Source Codes** in the empty space below County Codes.

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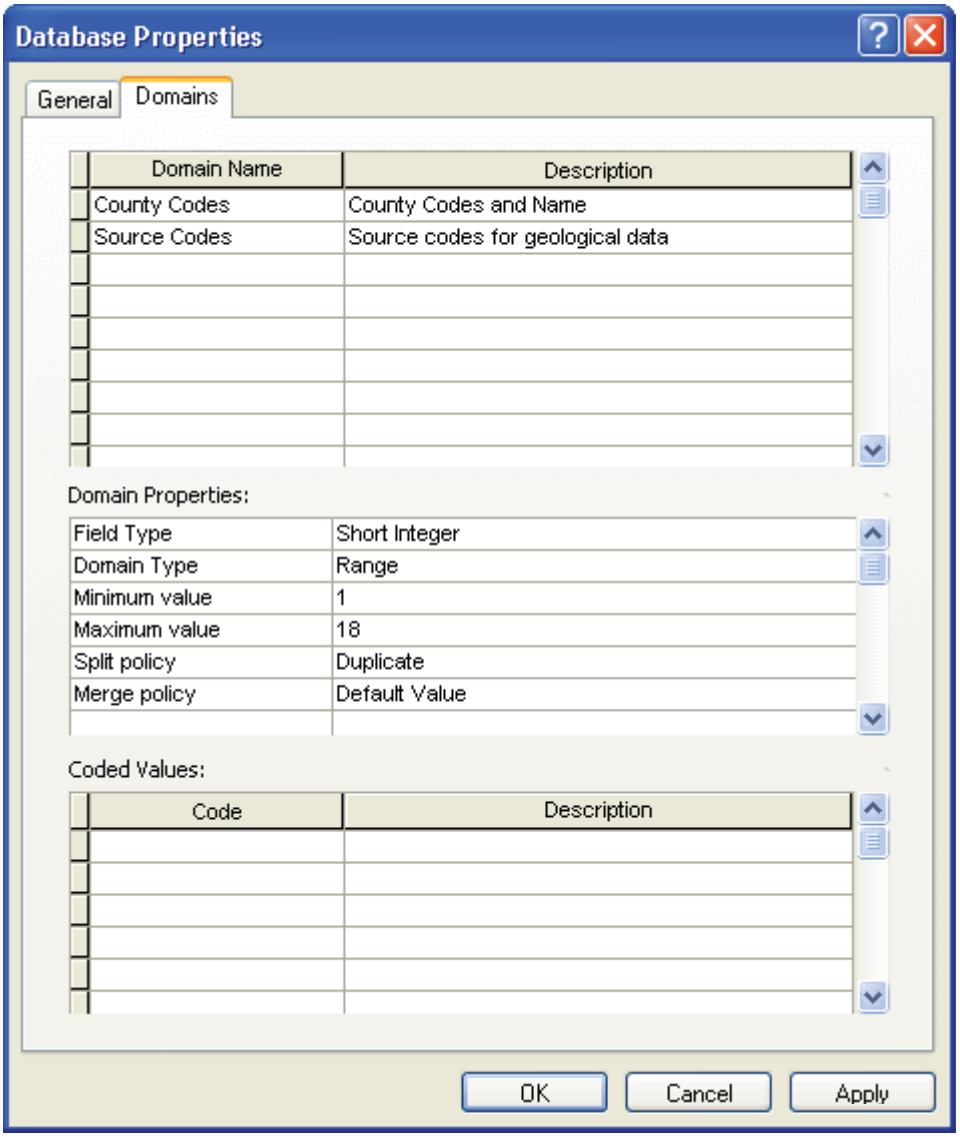
☐ In the Description field, type **Source codes for geological data**.

☐ In the Domain Properties pane, set the Field Type as Short Integer and Domain Type as Range.

☐ Change the Minimum Value to **1** and the Maximum Value to **18**.

☐ For Split Policy, choose Duplicate from the drop-down menu.

☐ For Merge Policy, choose Default Value.



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☐ Click OK to accept the changes to the Database Properties.

The Source Codes range domain table is now a property of the geodatabase. This domain can be shared across feature classes, tables, and subtypes in a geodatabase. In Step 4, you will apply these domains to attribute fields so they can be used to maintain attribute integrity during editing.

In the next step, you will create subtypes.

Step 3: Create subtypes

Subtypes provide a way to categorize features within a feature class. The feature classes that your editors update on a regular basis are MineralDeposits and SampleSites. In this step, you will create subtypes for these two feature classes to assist in their editing processes.

First, you will examine the MineralDeposits attribute table.

This entire step will be performed from the Catalog window in ArcMap.

☐ In the Catalog tree, navigate to C:\EdUC\GDB\Ex1c via your Folder Connections.

☐ Expand the WaterAssessment geodatabase.

☐ Right-click the MineralDeposits feature class and use the Item Description command to preview the attribute table.

Examine the ESU field. The numeric values in this field represents non-metallic minerals, metallic minerals, and uranium. You will create a subtype based on the values in this field.

☐ Close the Item Description window.

☐ Right-click MineralDeposits and choose Properties.

☐ Select the Subtypes tab.

☐ Set the Subtype Field to ESU.

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☐ Code your subtypes according to the following codes and descriptions below.

Code	Description
0	Non-metallic minerals
1	Metallic minerals
2	Uranium

When you create a new feature in the feature class without specifying a default subtype, it will automatically be assigned the first subtype code/description in the subtype list. In this case, whenever a new feature is added to the MineralDeposits feature class, its ESU attribute should be automatically be set to Metallic minerals.

☐ Set the Default Subtype to Metallic minerals.

Subtypes are implemented by creating codes and user descriptions. Subtypes are a property of a feature class and may be associated with short or long integer field data types. These integer values represent a feature in the subtype element.

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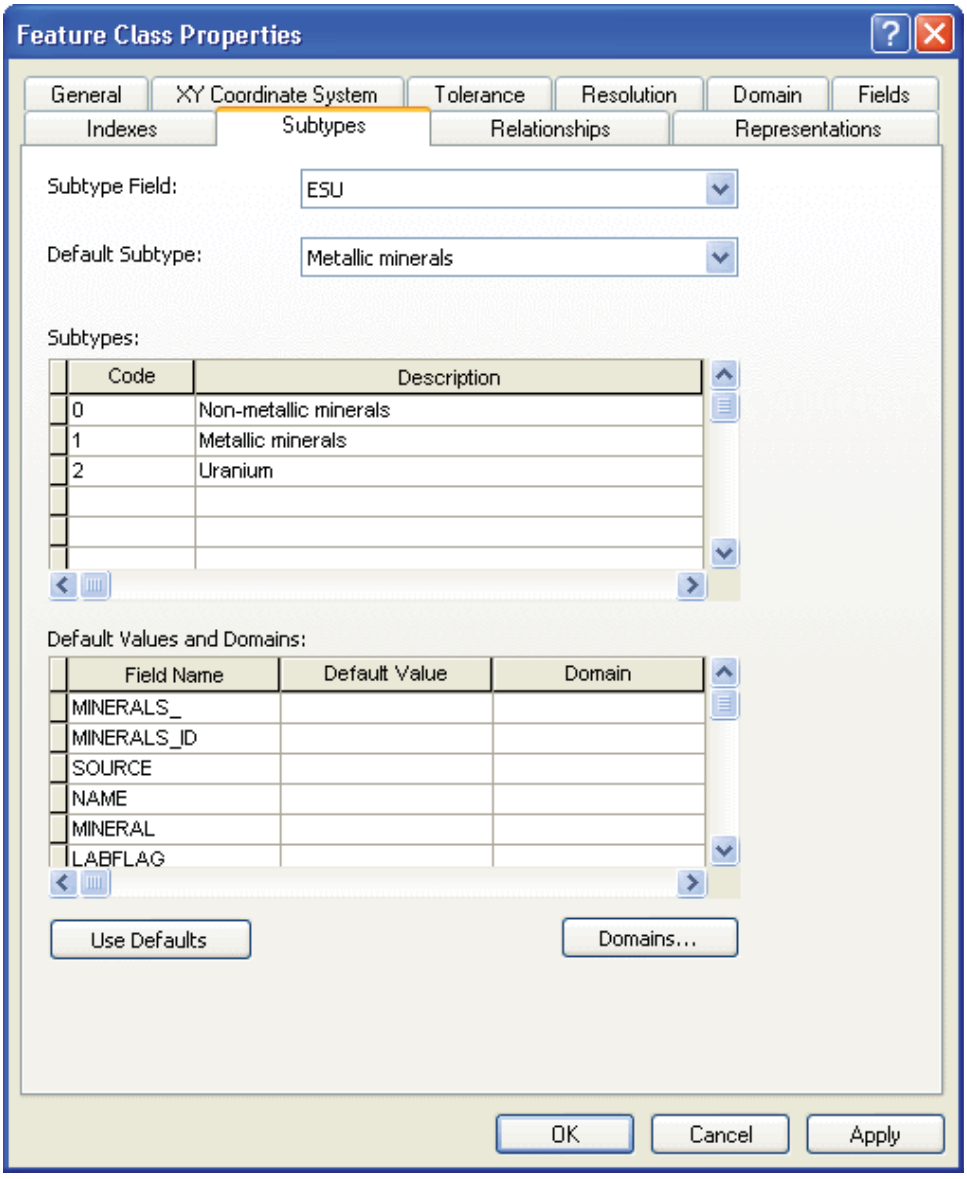

Each subtype can have its own set of default values. In this case, the Non-metallic minerals subtype could have the default value for the MINERAL field set to 0, while the Metallic minerals subtype could have the default value for the MINERAL field set to 1. Whenever a feature is added, its subtype will automatically populate the MINERAL field with its default value.

☐ Click the small gray box to the left of Code 0 in the Subtypes pane to highlight it.

☐ In the Default Values and Domains pane, locate the MINERAL Field Name.

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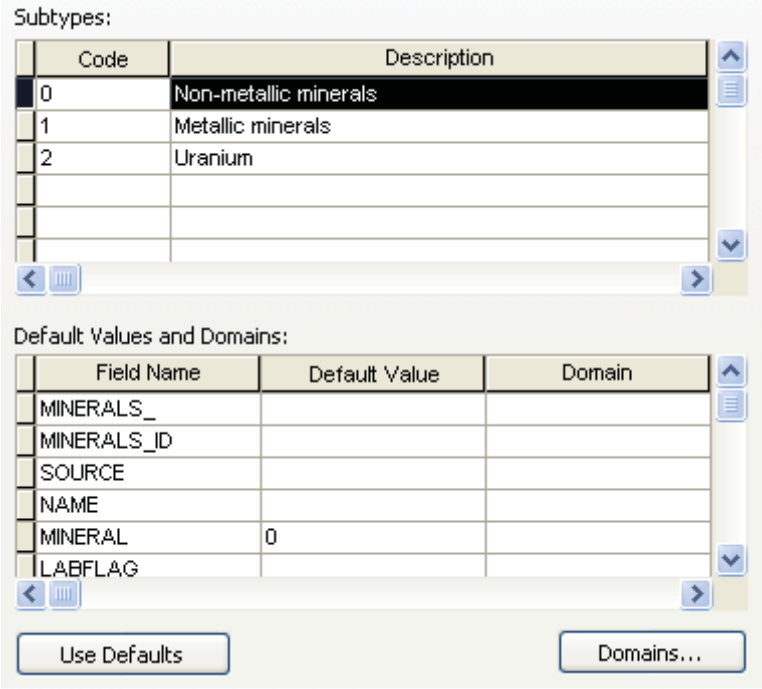
☐ Click the blank box to the right of the MINERAL field name and type **0** for the Default Value.

☐ Repeat this step for Codes 1 and 2 using a default value of **1** and **2**, respectively.



Each subtype can also have its own domain for a given field. In this case, the SOURCE field should only use values from the Source Codes domain.

☐ Click the small gray box to the left of Code 0 in the Subtypes pane to highlight it.

☐ In the Default Values and Domains pane, locate the SOURCE Field Name.

☐ To the right of the SOURCE field name, click the blank box for the Domain header and select Source Codes from the drop-down menu.

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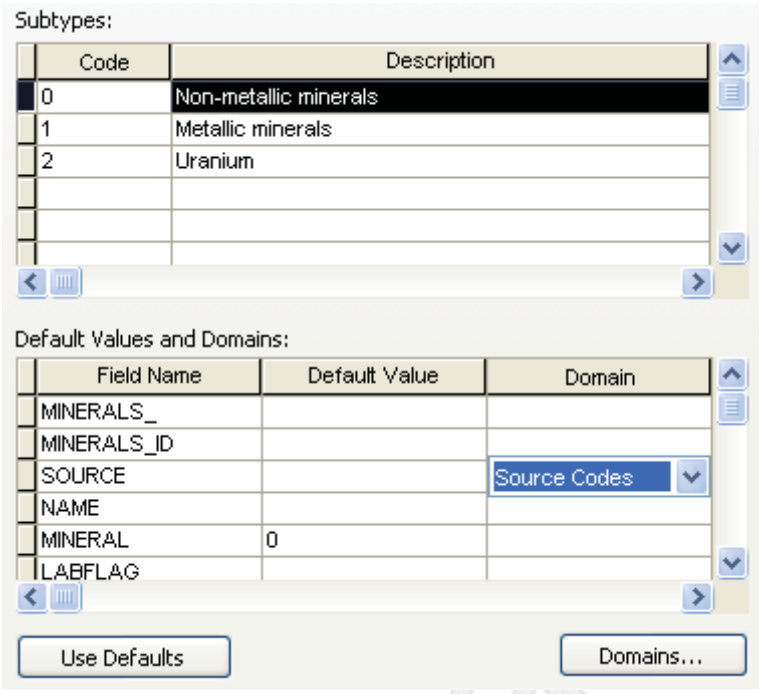
☐ Repeat these steps for Code 1 and Code 2.



☐ Click OK.

You will also create subtypes for the SampleSites feature class based on the integer field SENCODE. SENCODE is the sensitivity code for the river at the point that the sample was taken.

Using the skills you have learned thus far, create a subtype on the field SENCODE for the SampleSites feature class located in the Sites feature dataset.

☐ Set the Subtype Field to SENCODE.

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☐ Code your subtypes according to the following codes and descriptions.

Code	Description
0	No sensitivity
1	Mild sensitivity
2	Moderate sensitivity
3	Moderate High sensitivity
4	High sensitivity
5	Extreme sensitivity

☐ Set the Default Subtype to Moderate sensitivity.

☐ In the Default Values and Domains pane, locate the CNTY Field Name.

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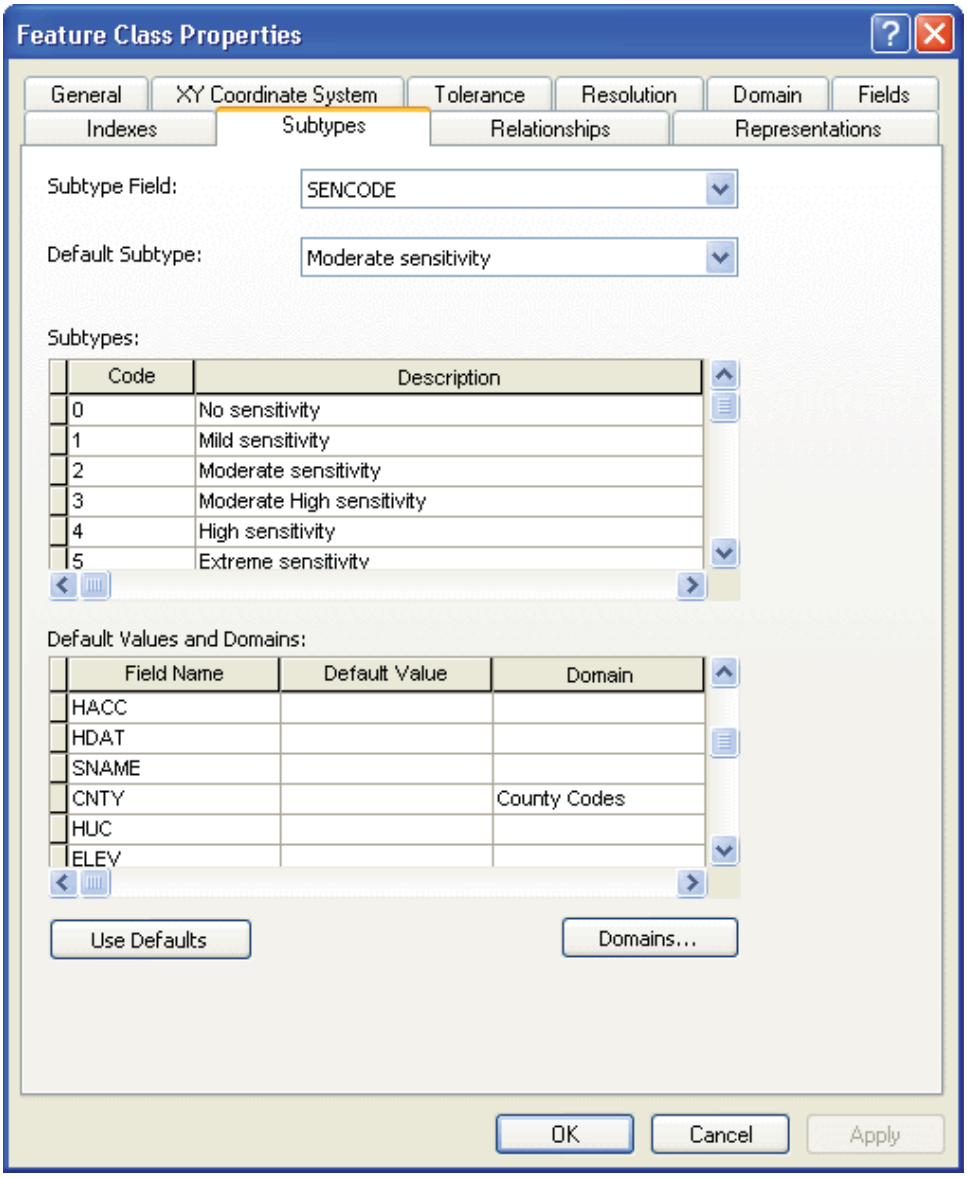
☐ To the right of the CNTY field name, click the blank box for the Domain header and select the County Code domain from the drop-down menu for each subtype.



☐ Click OK.

You now have subtypes, where each subtype has its own default value and domain assigned to it. Subtypes are a subset of features in a feature class or objects in a table. They are used to categorize your data in ArcMap and can be used to directly edit into a subtype for a feature class.

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In the next step, you will edit with subtypes and domains.

Step 4: Edit with subtypes and domains

Attribute domains are rules that describe the legal values of a field type, providing a method for enforcing data integrity. Multiple feature classes and tables can share the same attribute domains stored in the geodatabase. For example, the domain you created for valid County Codes can be assigned to the CNTY field of SampleSites feature class as well as any other feature class in the geodatabase that contains county codes.

In this step, you will edit your data to see how subtypes, domains, and default values make editing efficient and accurate.

☐ In the Catalog tree, navigate to C:\EdUC\GDB\Ex1c via the folder connection.

☐ Expand the Sites Feature Dataset in the WaterAssessment geodatabase.

☐ Right-click SampleSites and select Properties.

☐ Click the Fields tab.

☐ Highlight the CNTY field by clicking the small gray box to the left of the CNTY field name.

☐ In the Field Properties pane, select County Code as the Domain from the drop-down list.

The County Codes Domain is the only valid domain for the Text field data type. The Source Code Domain does not show up because it was defined as a short integer field data type and the CNTY field is defined as a text field data type. Domains can only be applied to fields of the same field type.

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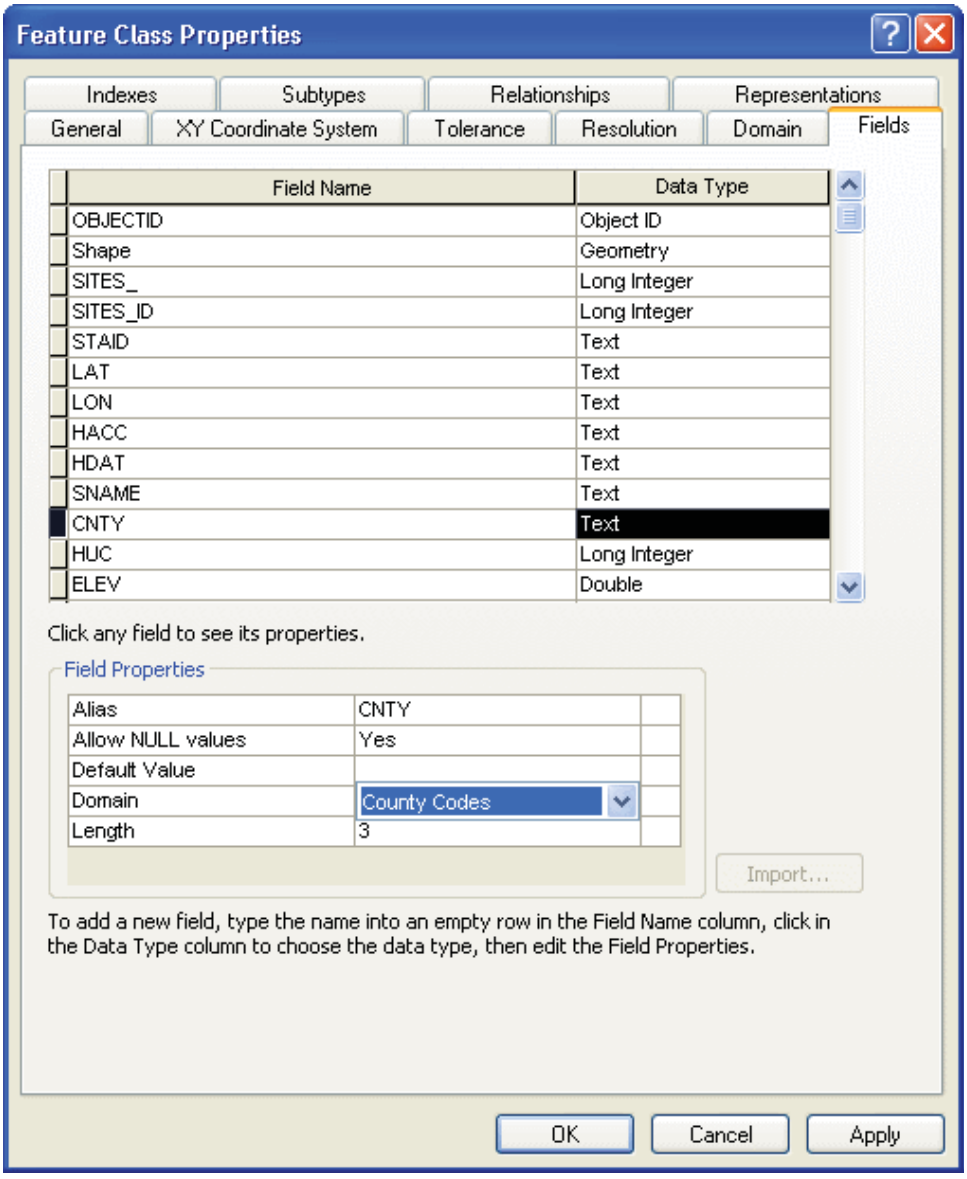

☐ Click OK.

☐ In the Catalog tree, right-click MineralDeposits and select Properties.

☐ If necessary, click the Fields tab.

☐ Highlight the field SOURCE by clicking the small gray box to the left of the SOURCE field name.

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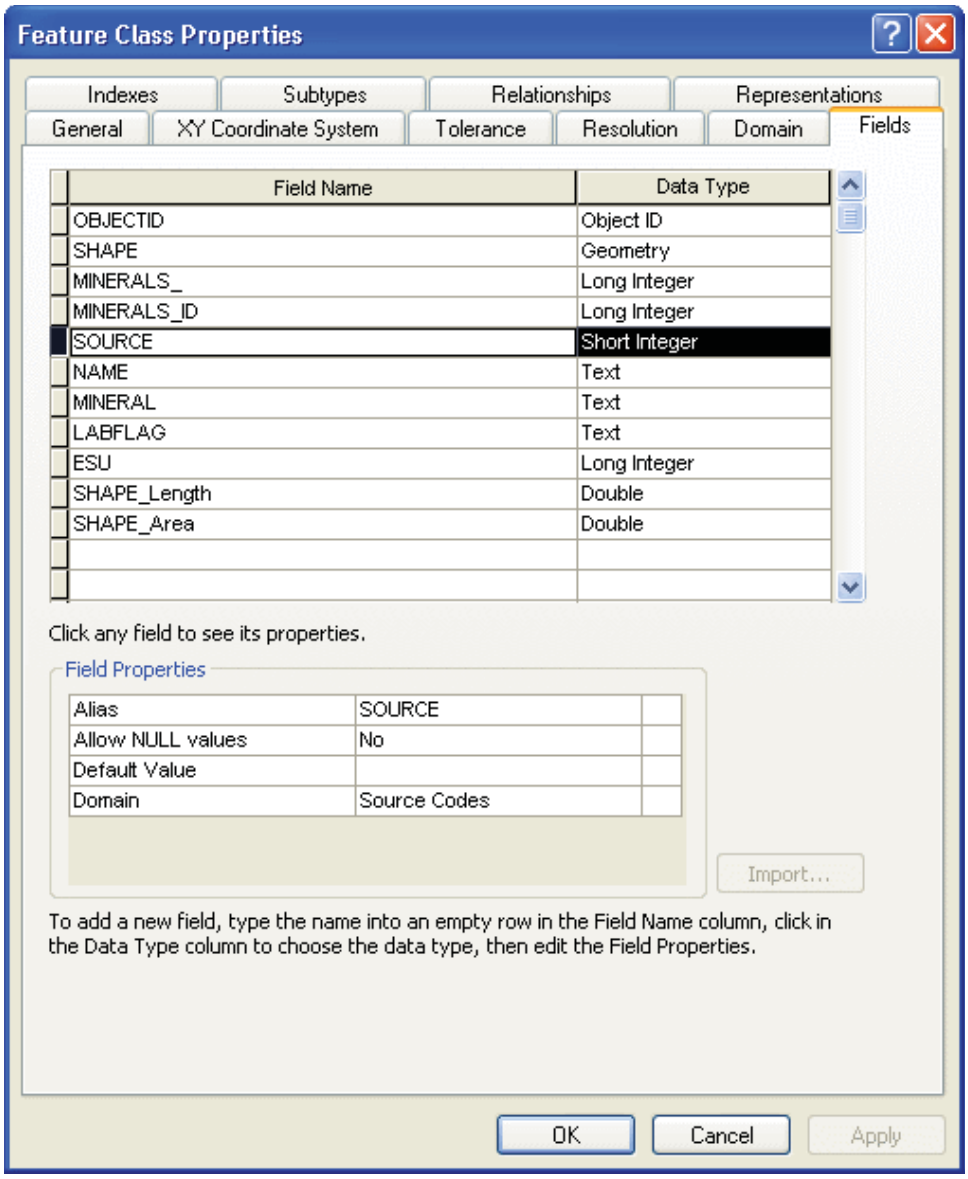
☐ In the Field Properties pane, select Source Codes as the domain.



☐ Click OK.

The domains you assigned will apply to all the features in each feature class. Now that you have set up your subtypes and domains, you are ready to edit your SampleSites and MineralDeposits layers.

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One of the field technicians has sent you data with new water sample points. You will add the new points and use the subtypes and domains to ensure the attributes are complete and accurate.

☐ In ArcMap, click File > Open on the main menu. Navigate to C:\EdUC\GDB\Ex1c folder and select AttributeEdits.mxd.

☐ Click Open.

☐ If prompted to save your current map document, click No.

☐ From the Catalog window in ArcMap, drag and drop the MineralDeposits feature class from the WaterAssessment geodatabase and the SampleSites feature class located in the C:\EdUC\GDB\Ex1c\Sites feature dataset to your map display to add them to the data frame.

Notice that both feature classes are already categorized in the Data Frame by the Subtype description value. While the user "sees" the Description of the subtype, ArcGIS "sees" the Code integer data field type. This is default behavior for subtypes.

☐ Right-click the SampleSites layer in the table of contents.

☐ Select Properties from the context menu and click the Symbology tab from the Layer Properties dialog box.

☐ Uncheck the box beside the symbol for <all other values> to turn off its visibility.

☐ Click the **Value** Header and select Reverse Sorting.

☐ Highlight the value for No sensitivity (i.e., the 0 value) and click the Remove button. This removes the zero values from the display, not from the attribute table.

☐ Highlight all other values (1 to 5) and right-click to bring up the context menu and click Properties for All Symbols.

☐ Increase the font size from the default 4 to 8.

☐ Click OK.

☐ Without unselecting the values, choose a new color ramp that will better distinguish the symbols from each other. Feel free to experiment with different color ramps.

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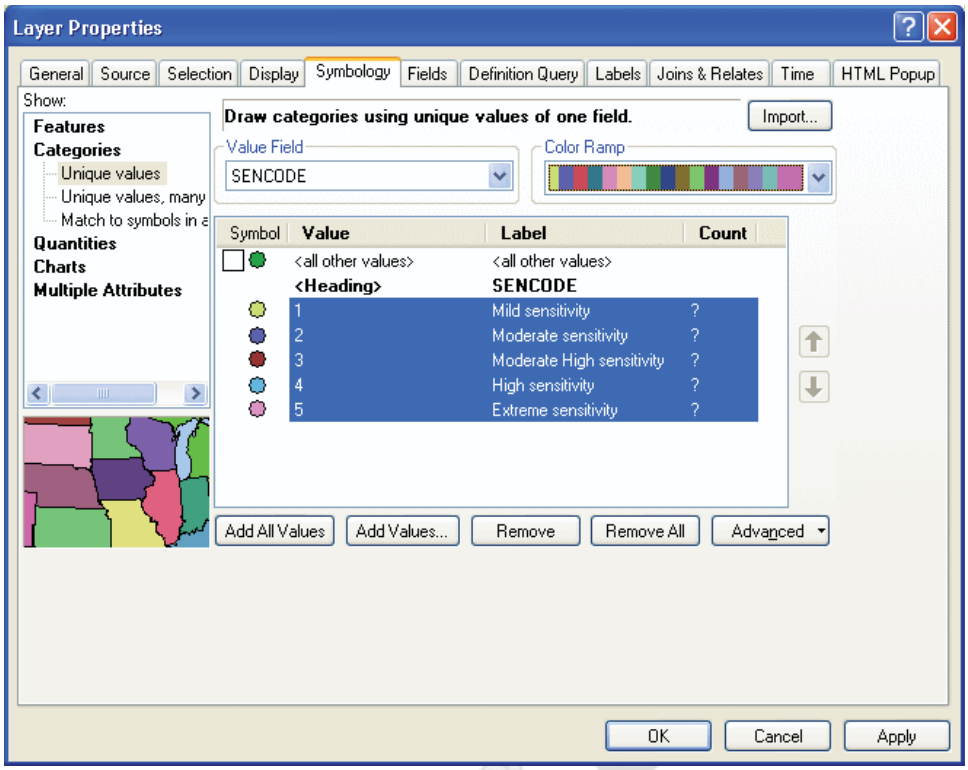
☐ Click OK.



☐ Using the skills you just learned, perform the same steps for the MineralDeposits feature class. Remove the symbol with the value 0 (No Metallic Minerals), and choose better colors for the remaining two values.

Now you will add a new point to the SampleSites feature class and use the County Codes domain to populate a field.

☐ If necessary, click the Editor toolbar button  on the Standard toolbar to open the Editor toolbar.

☐ Click Editor > Start Editing to activate the Create Features window. If necessary, click the push-pin on the Catalog window to retract it.

☐ In the Create Features window, click the Extreme sensitivity feature template to activate the Point construction tool.

☐ Click anywhere along the Yellowstone River to place a new point and leave the new feature selected.

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☐ Click the Attributes button on the Editor toolbar to open the Attributes window.

☐ Click the <Null> value in the CNTY field to reveal a drop-down menu.

☐ Select any county name you prefer.

In reality, you would select the correct county coded-value domain attribute value for the new Sampling Site, but for the purpose of this exercise it's appropriate to select any value.

These are the values in the County Codes domain created in Step 1. The geodatabase stores the codes and ArcMap displays the code descriptions. You are restricted to choose from only these values. As such, invalid attribute values cannot be added to new features in the SampleSites feature class.

☐ Click the close button on the Attribute window to close it.

☐ Click the Clear Selected Features button on the Tools toolbar.

☐ Click Editor > Save Edits.

Now you will add a new polygon to the MineralDeposits feature class and use the Source Codes domain to validate a value.

☐ In the Create Features window, click the Metallic minerals template to activate the Polygon construction tool.

☐ Create a new polygon anywhere within the area defined by the Watersheds feature class.

☐ In the Layers data frame, right-click the MineralDeposits layer and click Open Attribute Table from the context menu.

☐ In the MineralDeposits attribute table, click the Show selected records button.

Notice that the ESU and Mineral fields are already populated. In the previous step, you set the default subtype to the Metallic minerals subtype. Whenever a Metallic minerals feature is added, its subtype description will automatically populate the ESU field and a default attribute value of 1 in the Mineral field.

☐ Change the value of SOURCE to **22** and press the ENTER key.

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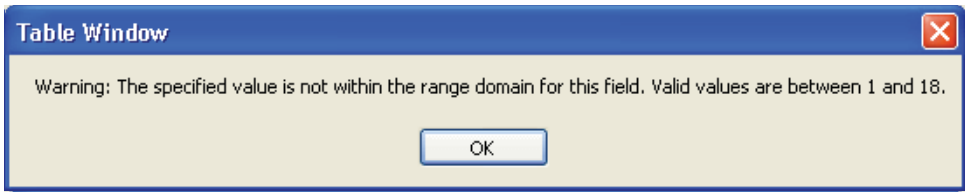
☐ The following warning will appear:



Remember the valid range of values in the Source Codes range domain is from 1 to 18.

☐ Click OK.

☐ Change the value of SOURCE to **6** and hit the ENTER key.

This time you should not see a warning message regarding invalid values. The new value **6** is valid within the Minimum and Maximum numeric values set for the range domain. ArcMap has an option to automatically validate records while editing. To enable this, one could go to Customize > ArcMap Options > Tables tab and check "Automatically validate records while editing."

☐ Close the Attribute Table for the MineralDeposits layer.

☐ From the Editor toolbar, click Editor > Validate Features.

A message box will appear informing you that all features are valid.

☐ Stop editing and do not save your edits.

☐ Close ArcMap and do not save the map document.

In this step, you edited layers using coded value domains and range domains to ensure only valid values were entered in the data. Coded value domains appear as a drop-down menu listing only the valid attribute values you may choose from. Range domains provide warning messages and a method to validate your features to ensure the integrity of your attribute data.

In the next optional exercise, you will create a geodatabase topology.

Conclusion

In this exercise, you created and implemented subtypes, domains, and default attribute values to maintain efficient and accurate editing.

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One of the advantages of storing your data in a geodatabase is that you can define rules about how the data may be edited. Attribute domains are rules that describe the legal values of a data field type. Multiple feature classes and tables can share attribute domains stored within the database. Subtypes are a subset of features in a feature class or objects in a table that share the same attributes. You can create a separate set of domains and default values for each subtype to further distinguish features within a feature class.

In the following optional exercise, you will create a geodatabase topology, validate your data for accuracy, and edit a topological error.

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Exercise 1D: (optional) Working with Topology

Estimated time: 15 minutes

In this optional exercise, you will continue the role of a GIS Manager at an environmental organization. Since your editors receive new field data daily, you want to create a geodatabase topology to ensure that the spatial relationships between features are accurately modeled. You will create a geodatabase topology, validate the data, and fix any topological errors that may exist.

In this exercise, you will:

- Understand how to build a geodatabase topology.
- Use a geodatabase topology to help discover and correct topological errors.

Step 1: Create a simple topology

If you have features that are coincident and share the same XY coordinates, a geodatabase topology will help you better manage your geographic data. Geodatabase topologies help you ensure data integrity. Using a geodatabase topology provides a mechanism to validate your data and maintain better feature representations in your geodatabase. In this step, you will create a geodatabase topology.

This entire step will be performed from the Catalog window in ArcMap.

☐ Start ArcMap.

☐ In the **ArcMap - Getting Started** dialog box, click Blank Map from the New Maps > My Templates directory.

☐ For the Default geodatabase for this map, click the Open button  and select the C:\EdUC\GDB\Ex1d\WaterAssessment geodatabase.

☐ Click Add.

☐ Click OK to load the Blank Map.

☐ In the Catalog tree, navigate to C:\EdUC\GDB\Ex1d via the folder connection.

☐ Expand the WaterAssessment geodatabase and the Sites feature dataset.

Note: The feature dataset contains the SampleSites and watersheds feature classes.

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☐ Right-click the Sites feature dataset and select New > Topology.

☐ Click Next on the first screen of the New Topology wizard.

The name and cluster tolerance of the new topology can be changed if desired. The name cannot contain reserved words or special characters, and the Cluster Tolerance should not be a large numeric value (e.g., 1, 2, 3). Accepting default values is the recommended practice.

Creating topological relationships involves analyzing the XY coordinates of feature vertices among features in the same feature class as well as other feature classes that may participate in the geodatabase topology. A cluster tolerance is used to integrate vertices. All vertices that are within the cluster tolerance are assumed to represent the same location and may move slightly in the validation process.

Generally, you can use an XY tolerance that is 10 times the XY resolution and expect very good results. A typical XY tolerance is orders of magnitude smaller than the true accuracy of your data capture. If your XY tolerance is too large, feature coordinates may collapse on one another. Conversely, if your XY tolerance is too small, feature coordinates may not properly integrate the line work of coincident boundaries. This can compromise the accuracy of feature boundary representations.

☐ Click Next to accept the default name and cluster tolerance.

All feature classes that participate in the topology must be organized into the same feature dataset and have the same coordinate system. In the wizard, you are shown all the feature classes that reside in the feature dataset. In some cases, you may create a geodatabase topology with only one feature class. In other cases, you may want more than one feature class to participate in the geodatabase topology.

☐ Click Select All to include all the feature classes in the feature dataset.

☐ Click Next.

Ranks control how vertices move when they fall within the cluster tolerance of one another. With ranked data, less accurate features move to the location of more accurate features. In this case, the most accurate feature class will receive a rank of 1 and less accurate feature classes descend in order from the highest rank (the second most accurate feature class receives a rank of 2 and so on). With Equal Ranked data, multiple feature classes have the same accuracy rank. If you cannot perceive that there is a difference in accuracy, set the ranks of all feature classes to 1.

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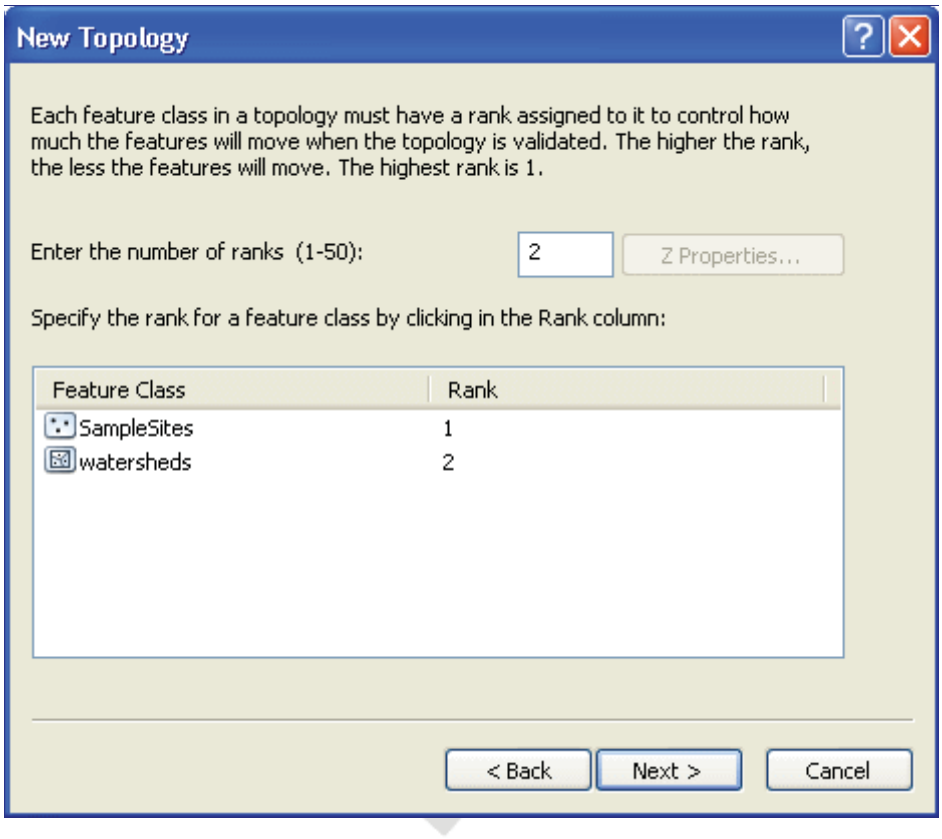
☐ For Number of Ranks, type **2**.

☐ For SampleSites, choose **1**.

☐ For Watersheds, choose **2**.



☐ Click Next.

Topology rules define spatial relationships between features. For example, in a ownership parcels feature class, the rule Must not overlap will ensure that ownership parcels do not overlap. The rules you define for a geodatabase topology control the relationships between features within a feature class, between features in different feature classes, or between subtypes of features. In ArcGIS 10, there are 32 rules from which to choose.

You will add only one rule to establish a relationship between the two feature classes.

☐ Click Add Rule.

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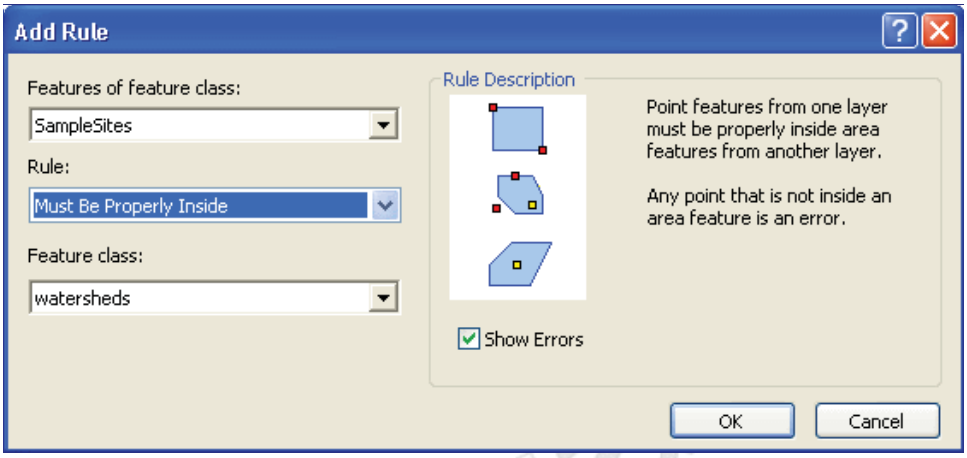
The Add Rule dialog box has user controls for selecting a rule and the feature class(es) that participate in the rule. It also gives a description of the selected rule.

☐ For Features of feature class, select SampleSites.

☐ For Rule, select Must be Properly Inside.

☐ For Feature Class, select watersheds.



☐ Click OK to add the rule and close the Add Rule dialog box.

☐ Click Next.

☐ Review the summary and click Finish.

You have created a new geodatabase topology and its properties in a feature dataset. Next, you will be asked if you would like to validate your new geodatabase topology. The validation process checks the ranks, the rules, and the cluster tolerance to identify those features that are invalid. In ArcMap, there are topology tools as well as standard editing tools to correct the spatial errors identified in the validation process.

☐ Click No.

The geodatabase topology is stored in a feature dataset as an element with rules to define how the features in one or more feature classes share geometry. In the next step, you will validate the geodatabase topology.

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Step 2: Explore the topology in ArcMap

Once you have created a geodatabase topology, you can validate the topology any time against the feature class(es) of the topology. ArcMap contains a number of advanced tools and functions for managing and editing a geodatabase topology. In this step, you will validate the geodatabase topology, then locate and fix a topological error.

☐ In ArcMap, click File > Open on the main menu. Navigate to the C:\EdUC\GDB\Ex1d folder, select GeometryEdit.mxd and click OK.

☐ If prompted to save your current map document, click No.

☐ From the Catalog window, drag and drop the Sites_Topology from the Sites feature dataset located in the C:\EdUC\GDB\Ex1d\WaterAssessment file geodatabase.

☐ Click No when prompted to add the feature classes that participate in the geodatabase topology to the map.

A topology layer is added to your table of contents to display errors, exceptions, and dirty areas. You can access the display properties for a topology layer just like any other layer—by double-clicking or right-clicking the layer name and clicking Properties.

☐ Right-click the topology layer and select Properties.

☐ Click the Errors tab and click Generate Summary.

The summary yields no errors. Since validation runs a set of integrity checks to identify any violations of the rules that have been defined for the topology, errors have not yet been identified.

☐ Click OK to close the Sites_Topology layer properties dialog box.

☐ In the Catalog window, right-click the Sites_Topology element in the C:\EdUC\GDB\Ex1d\Sites feature dataset and select Validate.

When you validate your topology, you may generate a summary report to identify spatial errors by rule violation as well as those features that are marked exceptions. In this way, a geodatabase topology helps you know about the integrity of your datasets.

☐ Click OK to close the Validate message box.

☐ In the Layers data frame in ArcMap, right-click the Sites_Topology layer and select Properties.

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☐ If necessary, click the Errors tab.

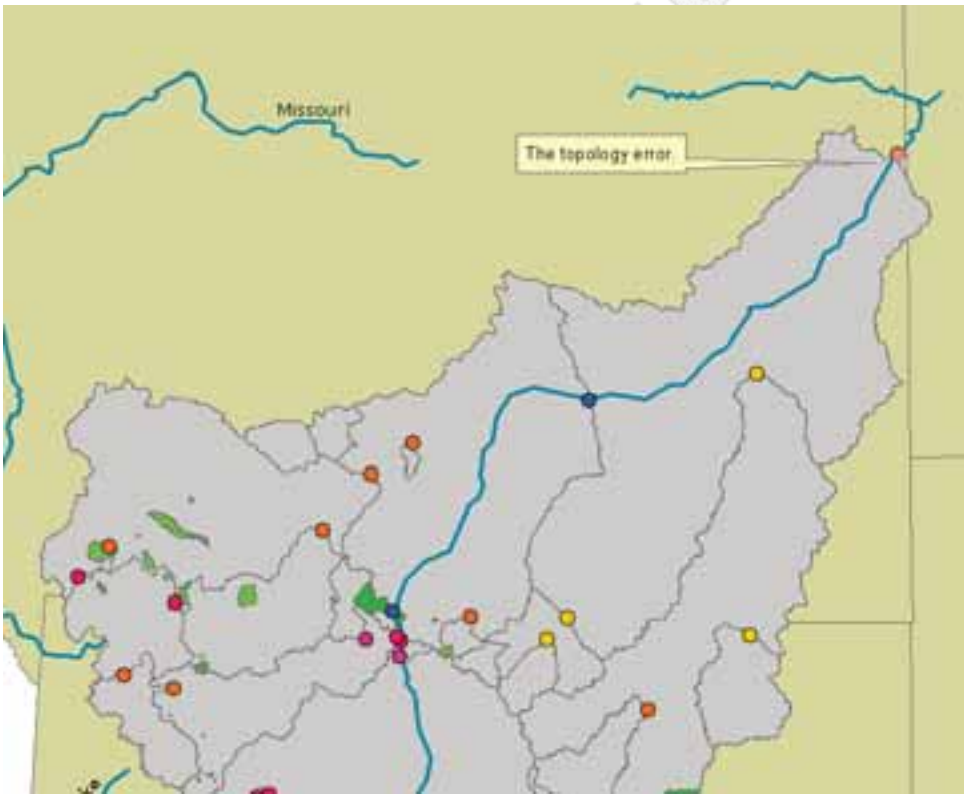
☐ Click the Generate Summary button.

There is one error. The Must be Properly Inside rule has been violated.

☐ Click OK to close the Layer Properties window.

By default, the topology layer symbolizes topology errors in pink, exceptions in green, and dirty areas as a hatch blue pattern. If you choose, you can access the display properties for a topology layer and click the Symbology tab to change the drawing properties for your topology.

☐ Using the Zoom in tool from the Tools toolbar, zoom to the error in the right-uppermost area of the watershed.



☐ Select 1:250 000 from the scale drop-down on the Standard toolbar.

The error summary reported that the Must be Properly Inside rule has been violated. Specifically, the SampleSites point is not properly inside the Watershed.

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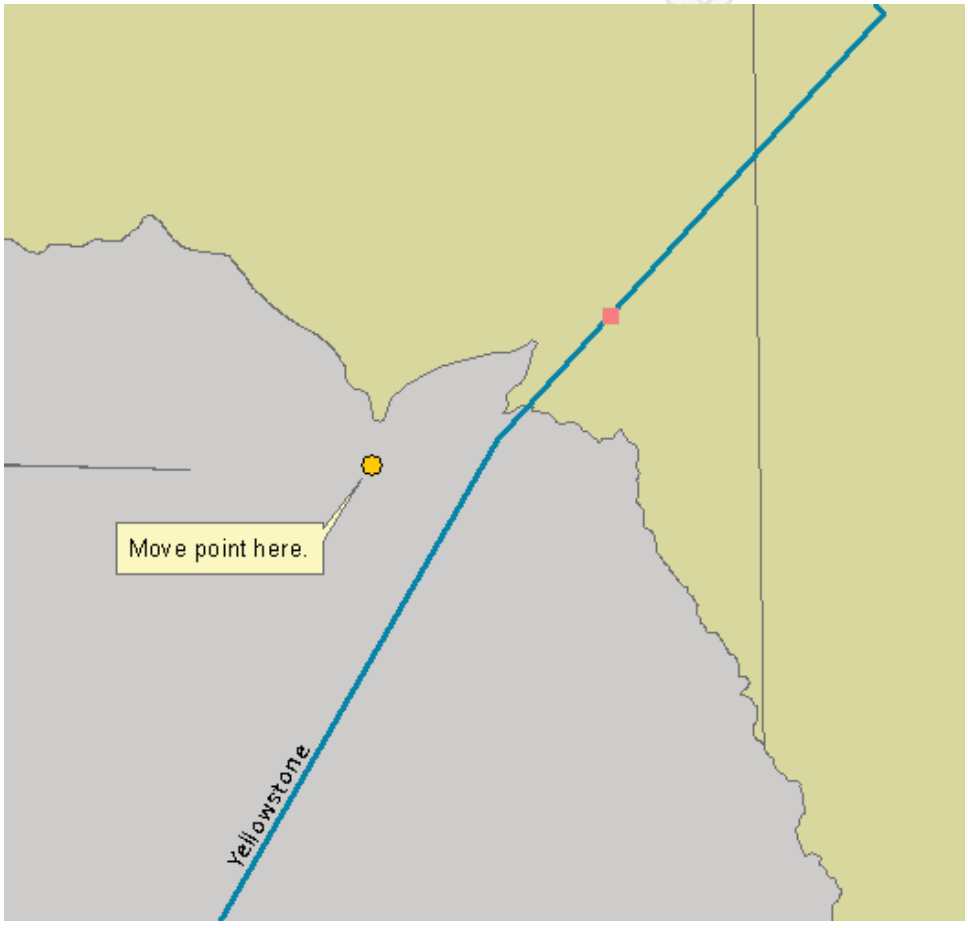
You realize that the site is in the wrong location and it should be moved inside the boundary of the watershed polygon feature. You will use the Topology toolbar to correct the misplaced site location in an edit session.

☐ Click Customize > Toolbars > Topology from the main menu to open the Topology toolbar.

☐ If the Editor toolbar is not open, click the Editor Toolbar button on the Standard toolbar to open it.

☐ Click Editor > Start Editing.

☐ Select the erroneous point with the Topology Edit Tool on the Topology toolbar. Move the point within the watersheds polygon boundary along the Yellowstone River.



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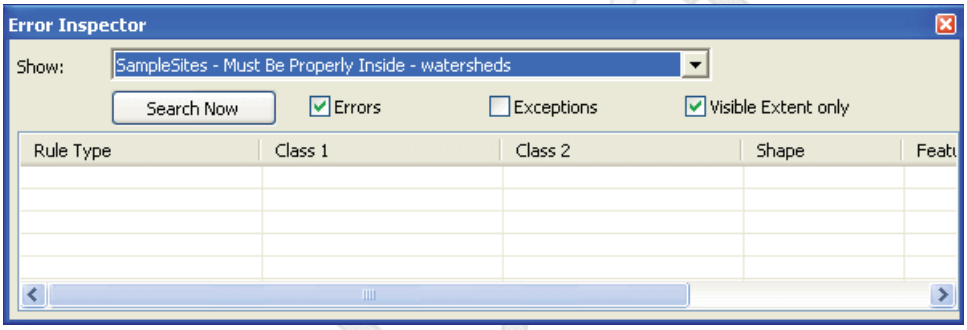
☐ Click the Validate Topology In Current Extent button on the Topology toolbar to validate only the extent of your map display.

☐ Click the Error Inspector button on the Topology toolbar to enable it.

The Error Inspector lets you view topology errors in a table that tells you the rules violated, the feature class(es) involved in the errors, the geometry of the errors, the feature IDs of the features involved in the errors, and whether or not the errors have been marked as exceptions. You can sort the errors by any of the fields in the table so that you can work with all the errors of a given type. You can also limit the errors shown in the table to errors by a given type, errors that occur in the currently visible map extent, or errors that have been marked as exceptions.

☐ Select SampleSites - Must Be Properly Inside - watersheds from the Show drop-down and click Search Now.



☐ Since the error has been fixed, the Error Inspector does not return a result.

☐ On the Editor toolbar, click Editor > Stop Editing.

☐ Save your edits.

☐ Close ArcMap without saving the map document.

The ArcMap editing environment provides several ways to maintain the integrity of your data. You have validated a geodatabase topology, found a spatial error, and fixed the topological error. Geodatabase topologies assist you in better managing the accuracy of your geographic data.

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Conclusion

In this exercise, you created a geodatabase topology, validated your data, and fixed a topological error to ensure that the spatial relationships between features are valid.

Topology is the arrangement that constrains how point, line, and polygon features share geometry. Geodatabase topologies help you ensure data integrity. It provides a mechanism to perform integrity checks on your spatial data and helps you to validate and maintain better feature representations in your geodatabase. A topology is stored in a geodatabase feature dataset and is defined by it's rules, ranks, cluster tolerances, and participating feature class(es).

This is the final exercise in the geodatabase lesson.

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