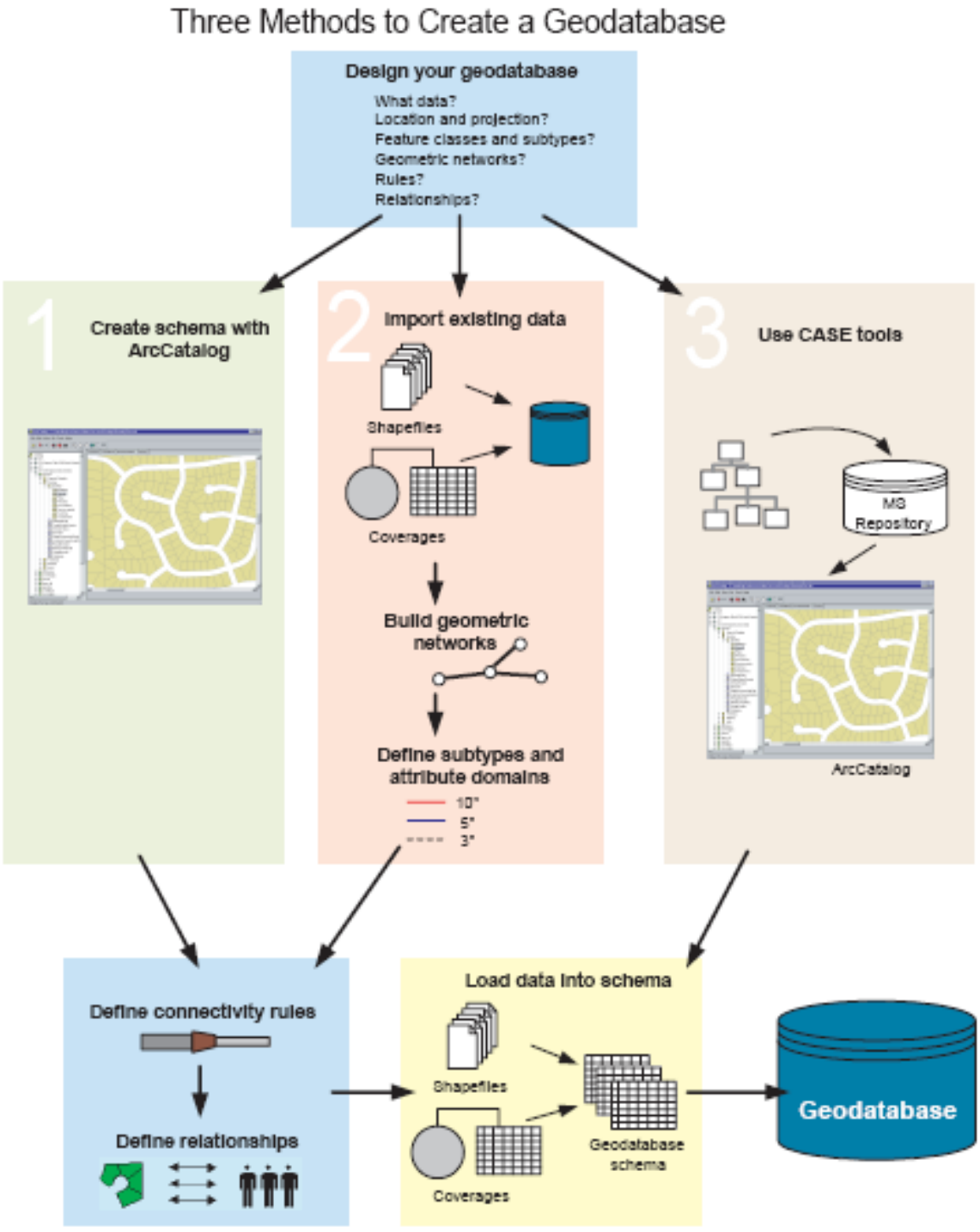
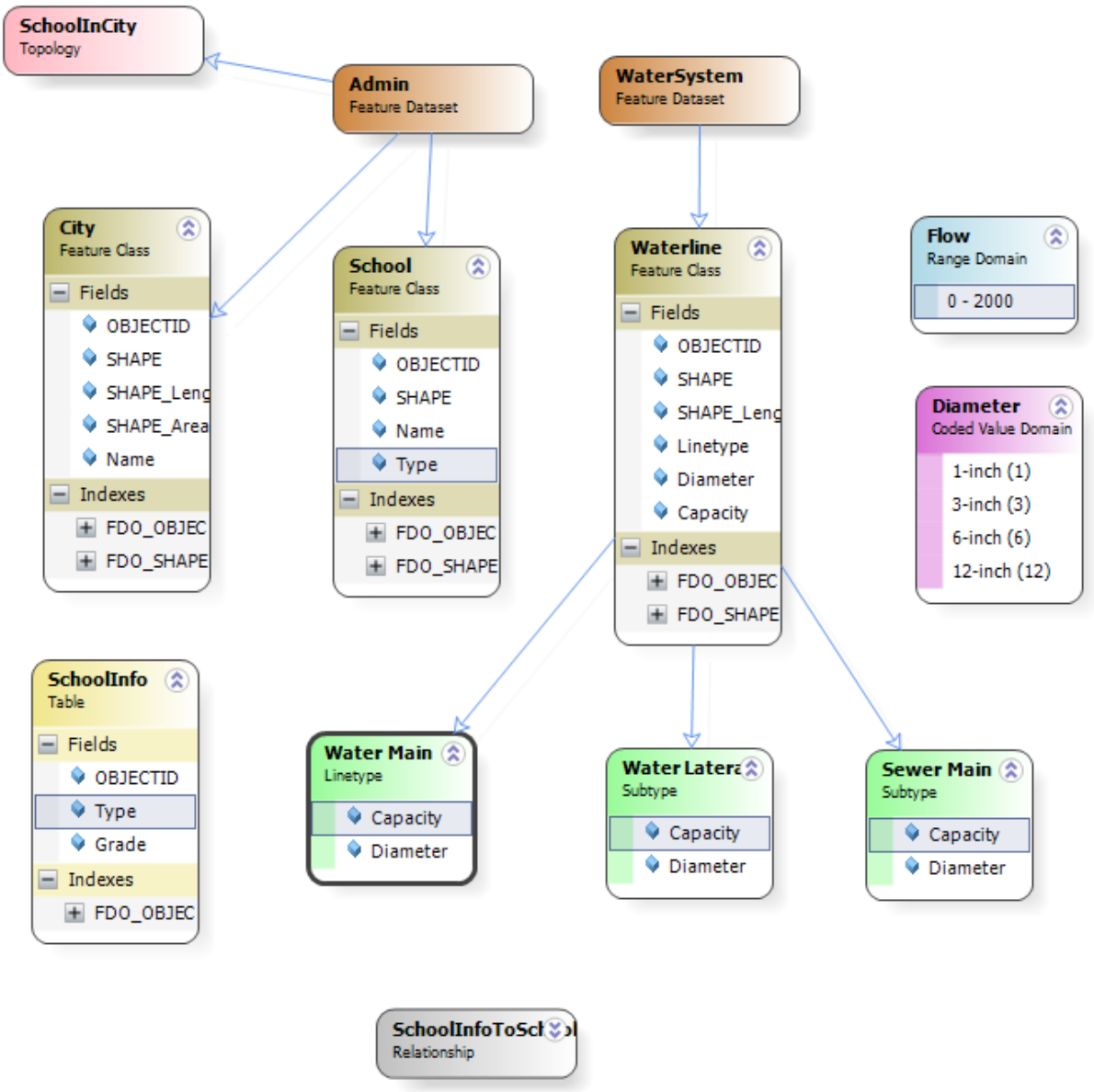
GEOG3140 GIS Database Design

ArcGIS Geodatabase



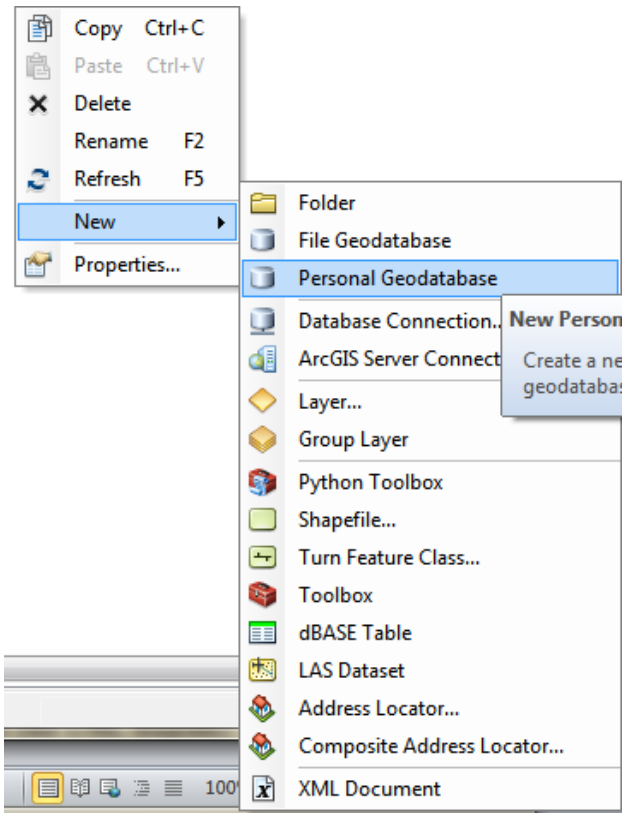
I. Create a geodatabase with ArcCatalog



1. Create an empty geodatabase in ArcCatalog

➔ Open ArcCatalog, find the folder you want to create the database.

➔ Right click the folder to create a new empty geodatabase (use **personal** geodatabase. File geodatabase may cause issues with spatial indexing)


Copy Ctrl+C
Paste Ctrl+V
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Rename F2
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Properties...
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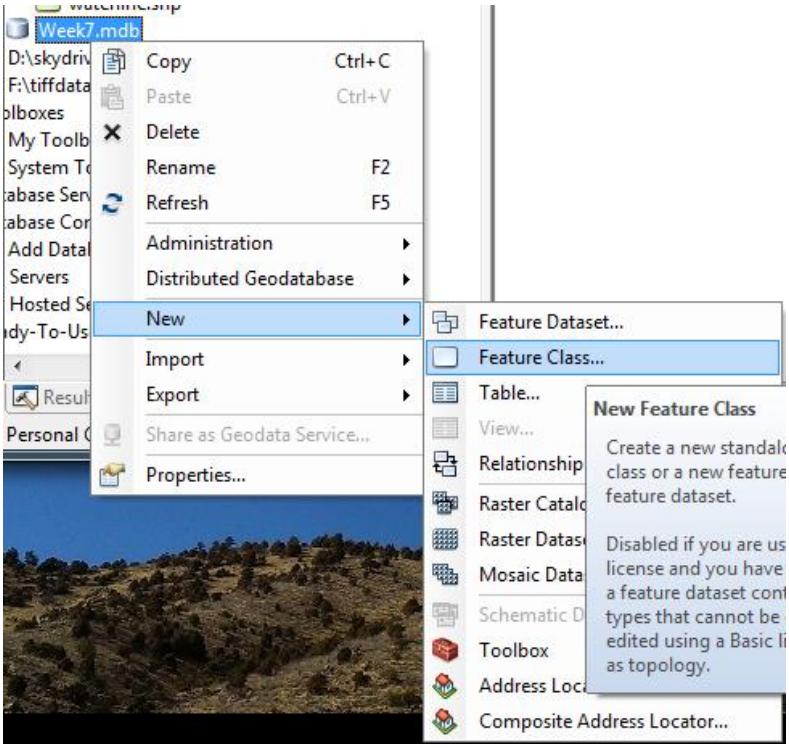
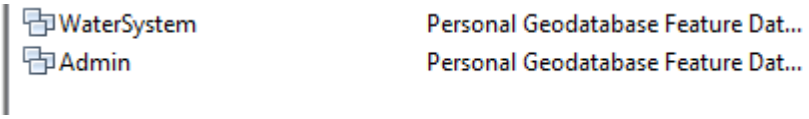
File Geodatabase
Personal Geodatabase
Database Connection...
ArcGIS Server Connect
Layer...
Group Layer
Python Toolbox
Shapefile...
Turn Feature Class...
Toolbox
dBASE Table
LAS Dataset
Address Locator...
Composite Address Locator...
XML Document
New Person
Create a ne
geodatabas

2. Create feature dataset.

➔ Right click the **database** and add **a new dataset**. You may want to select the right **coordinate** system.



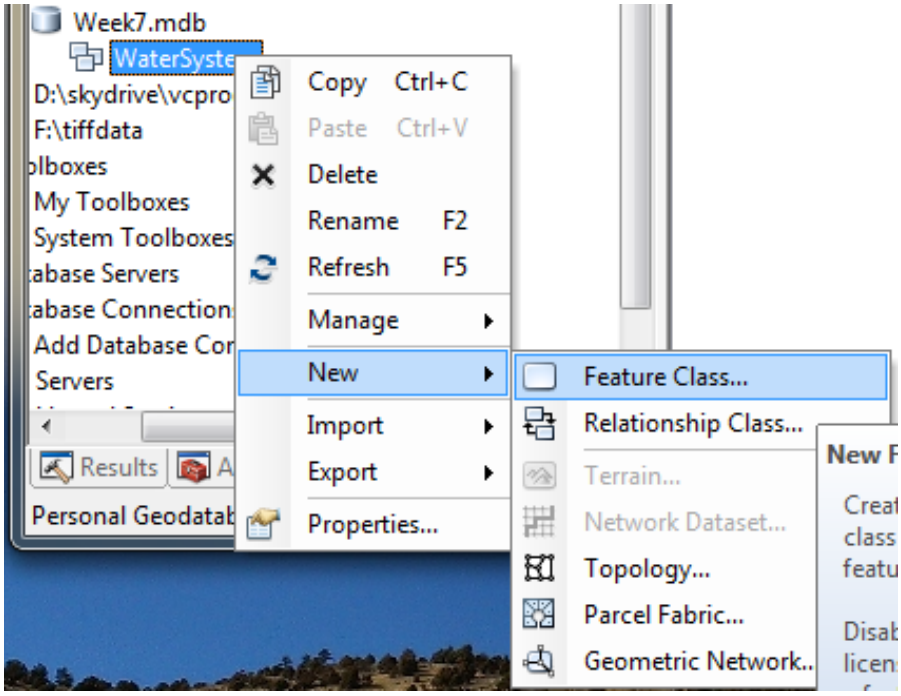
➔ Create two feature datasets: Admin and Water System



Notes: datasets are similar to thematic layers which are used to group feature classes of the same theme together.

3. Create feature class.

➔ Right click the dataset **WaterSystem** to create the feature class **WaterLine**



➔ Right click the Properties→ Fields tab, add the following fields: Diameter (Long integer); Flow (Long integer), LineType (Short integer).

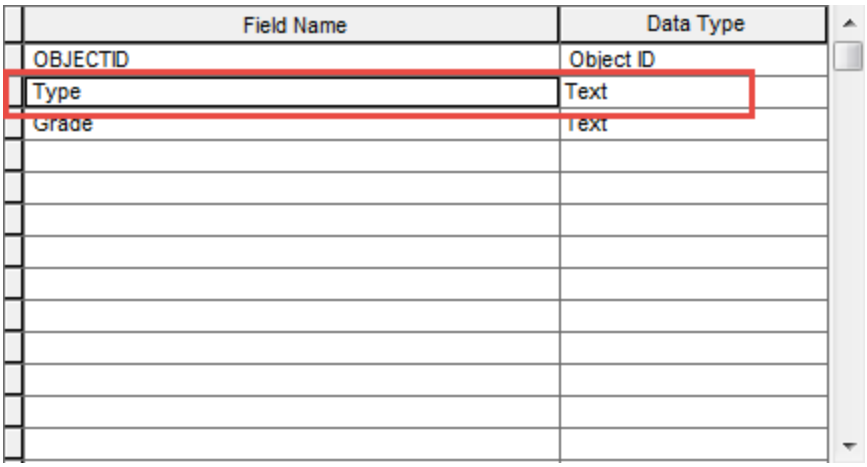
Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Linetype	Short Integer
Diameter	Long Integer
Capacity	Long Integer
SHAPE_Length	Double

➔ Now add the following feature classes to **Admin** dataset: **city** and **school**

city (**polygon**): Name(string)

school (**point**): Name(string), Type(string)

➔ Add a table to **Admin** dataset: schoolinfo



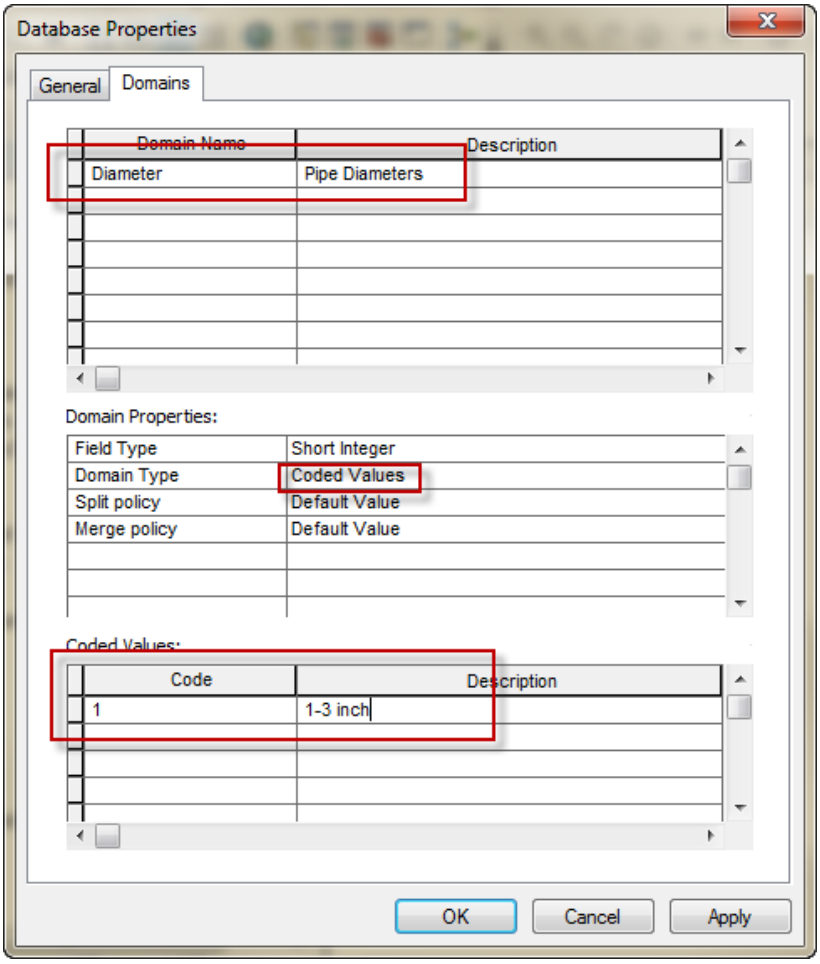
Note: You always need to check if you have include required attributes, set up fields correctly. You may revise the design of a feature class after you set up domains.

4. **Configure a geodatabase in ArcCatalog**

➔ View database properties and select **Domains** Tab.

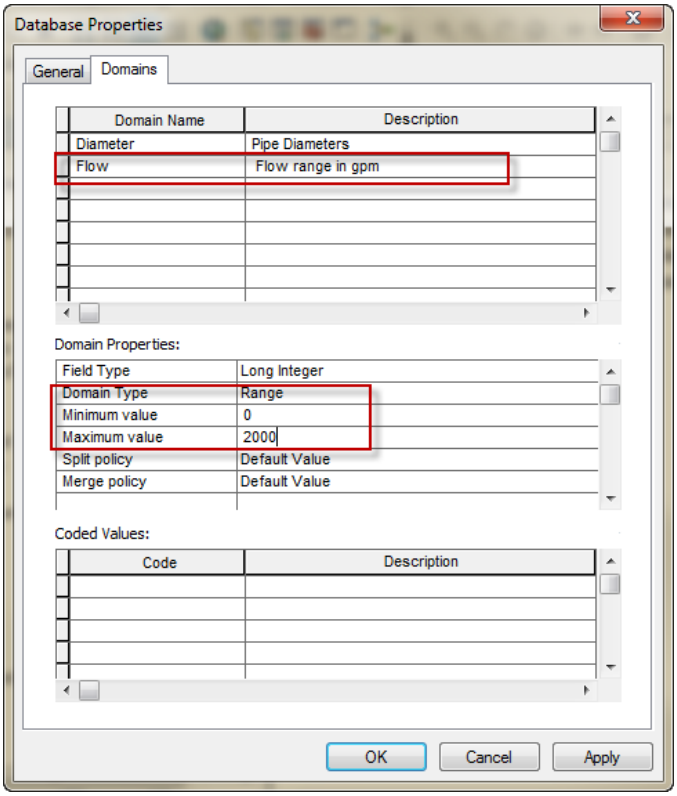
➔ Type **Diameter** in the Domain Name, **Pipe Diameters** as Description. Select **Coded Values** as Domain Type. **Short integer** as the data type. You can use default **merge policy** and set up the split policy as **Duplicate**.

➔ Add a code value and the corresponding description. Change its name to **Diameter,** Description to **Pipe Diameters**



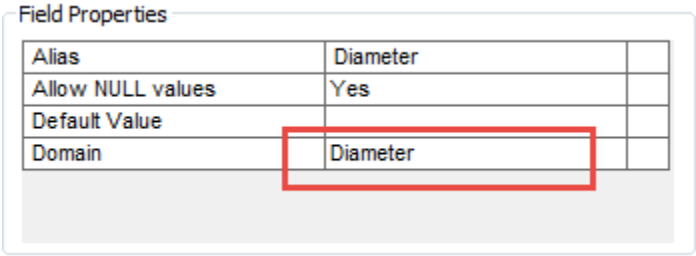
Code	Description
1	1-inch
3	3-inch
6	6-inch
12	12-inch

➔ Add **Flow** as a range domain. Change the **min** value to **0** and the **max** value to **2000**. Add description: **Flow range in gpm**.



➔ You can delete and add domains.

➔ Open the properties of the feature class **WaterLine**. For each field, assign the correct domain to the field.

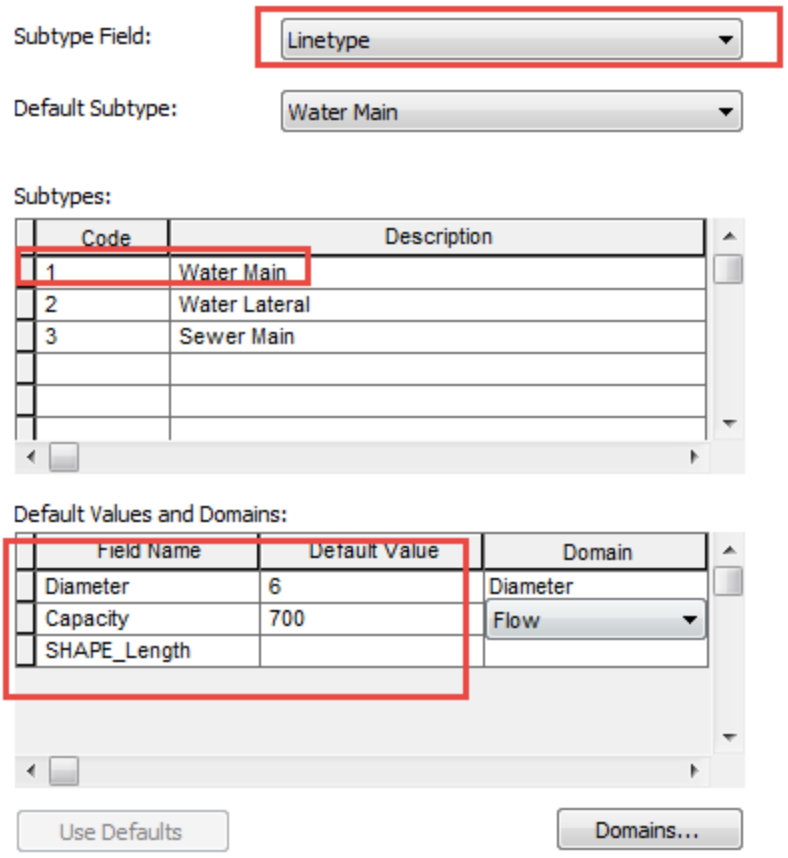


Note: The field type of a domain should be the same as the field type of the attribute that the domain is applied to. Two types of domains are available: coded and range. After creating a domain, you should associate the domain with appropriate attribute.

➔ Create a domain for a field of your selection.

➔ Create **subtypes**. Right click the **waterline** and click on **Subtypes** tab. Choose **LineType** as the subtype field. Define subtypes starting from **Code =1**

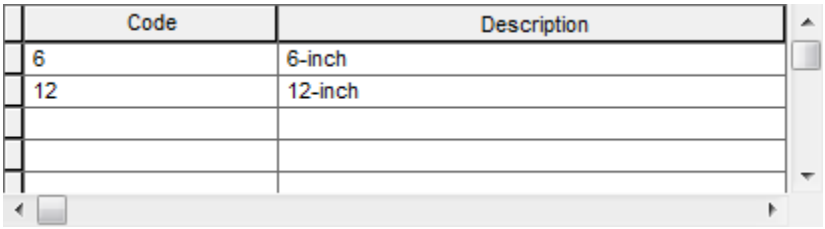
➔ Set up the default values for the subtype to define that particular type. Do not forget to set up Domain.



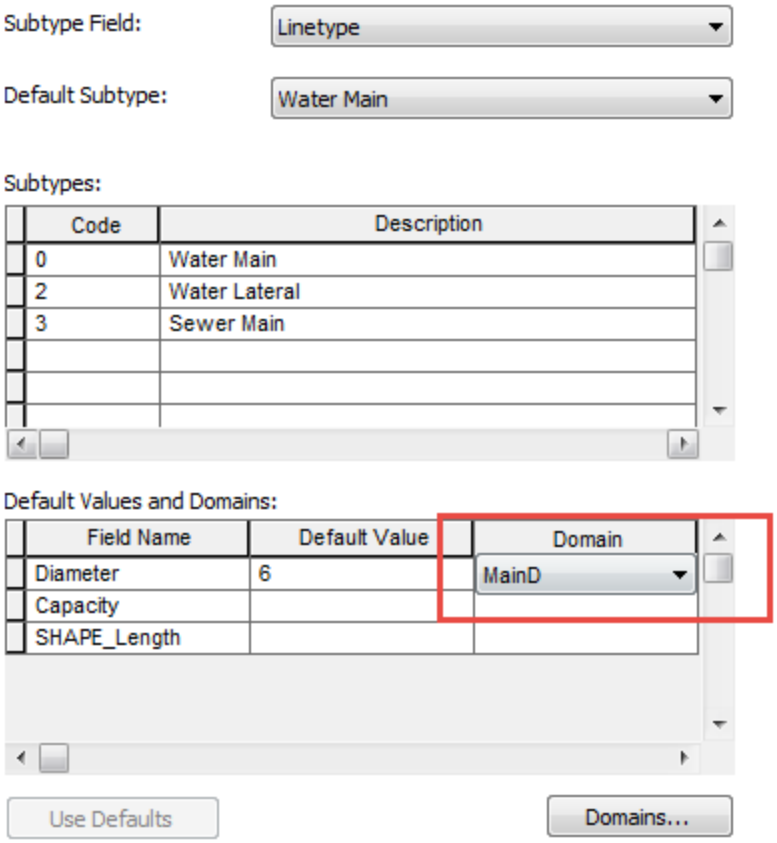
The default subtype is Water Main. **This makes Water Main as the only subtype for the waterline feature class. Only one default subtype is created.**

Subtype	Diameter	Capacity	Code
Water Main	6	700	1
Water Lateral	3	125	2
Sewer Main	12	1500	3
Sewer Lateral	6	230	4

➔ You can assign different domains to the fields of a subtype. Under Properties of the geodatabase, create a coded domain main diameter with 6-inch and 12-inch as codes.



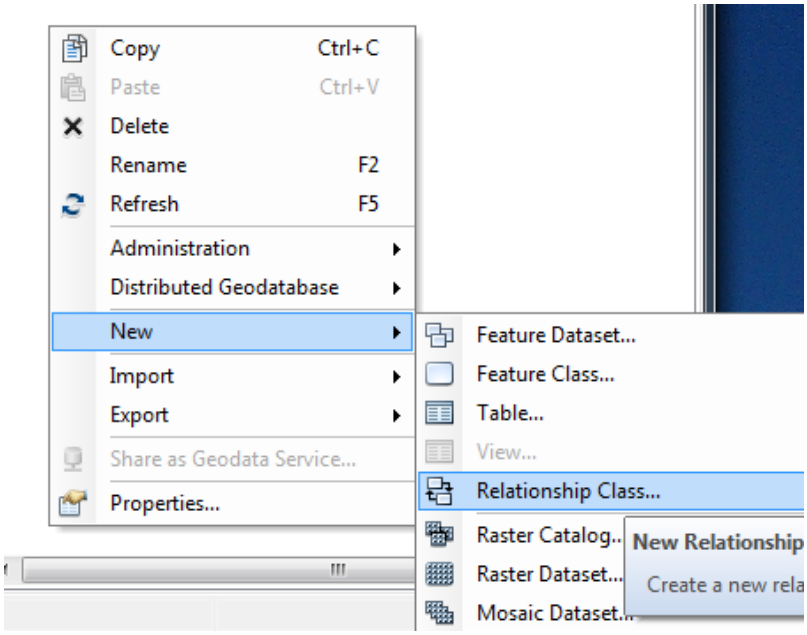
➔ Under the properties of the feature class, click **Subtypes** field, assign the coded domain as the domain for **Diameter** for **Water Main**



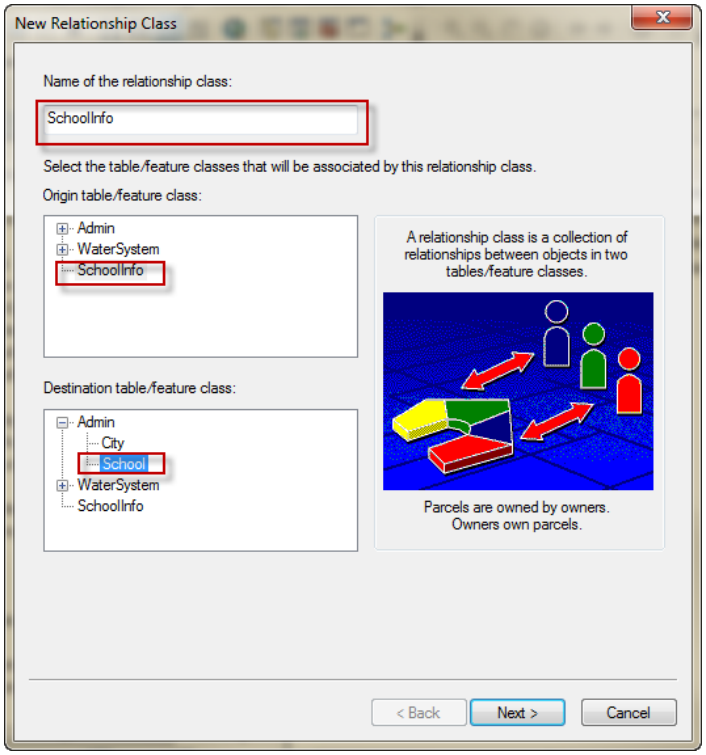
5. **Create relationship class.**

➔ Create a one to many relationship class for School (point) and SchoolInfo(table). School includes the following attributes: school Name, Type; SchollInfo includes the following attributes: Type, Grade.

➔ Right click the **database** to create a new **relationship class**

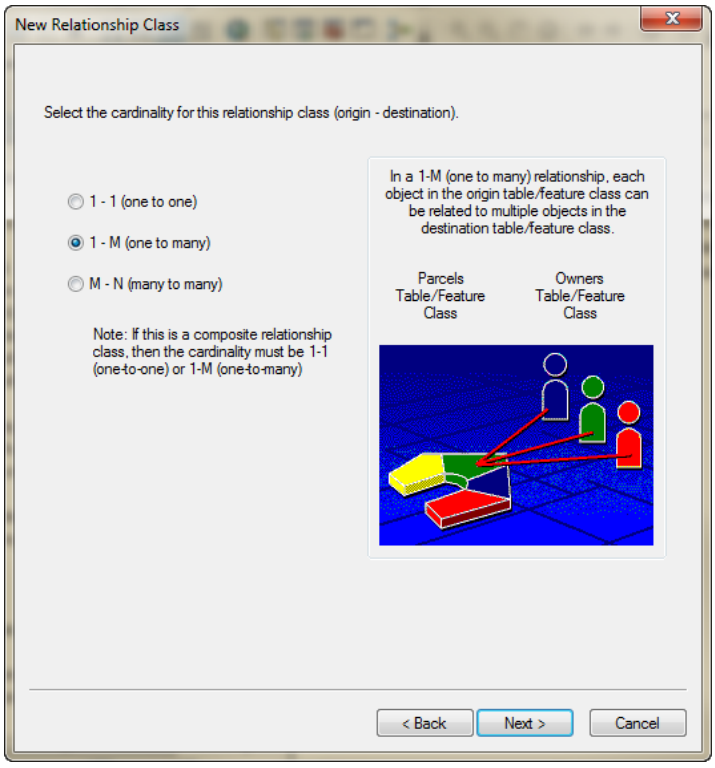


➔ Specify the relationship class name and choose the table and the feature class for the relationship class



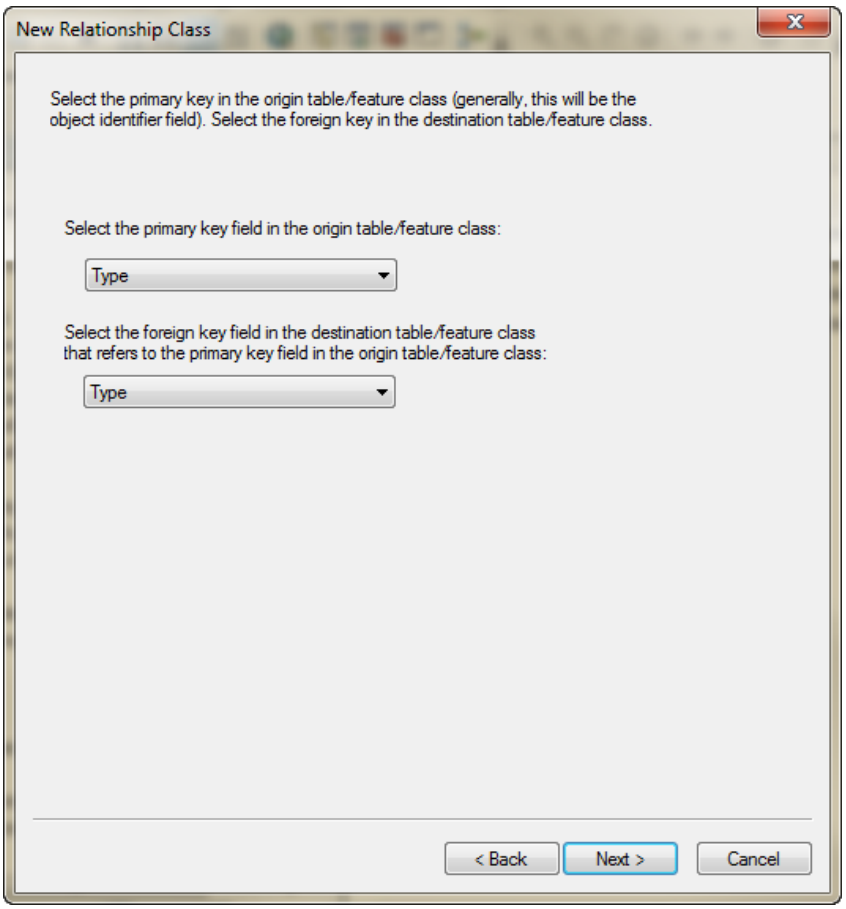
➔ Specify the relationship type as **composite**. Think about the benefit of using composite relationship.

➔ Specify the cardinality of the relationship class as 1 (schoolinfo)-M (school)



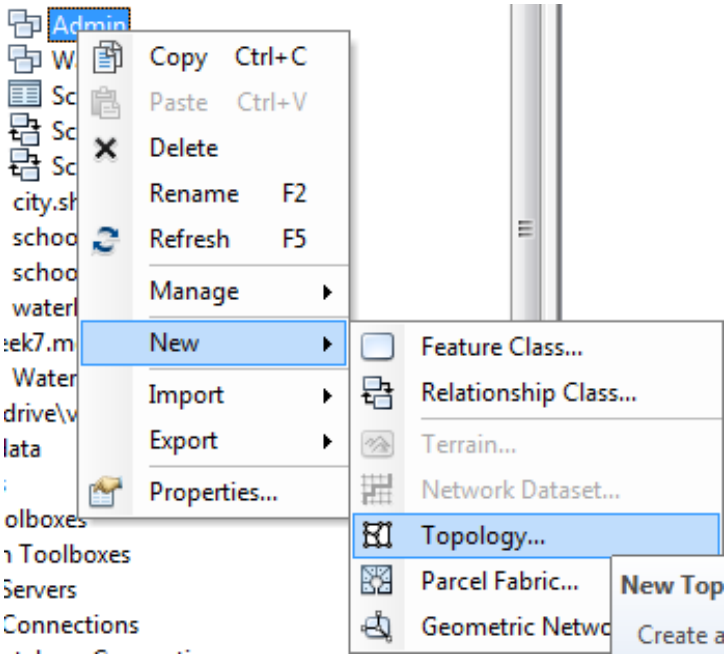
➔ Specify keys for joining tables. **The foreign key should be an attribute from the destination feature class/table** (**Type** field in School) that corresponds to the primary key in the origin featureclass/table (**Type** field in SchoolInfo).

- Origin Primary Key is the primary key (**Type**) of the **Origin Class** (SchoolInfo) and Origin Foreign Key is the name of the PK (**Type**) of Origin in the Destination Class (School).
- If you are specifying a many-to-many relationship, you need to specify the Destination PK and Destination FK. But foreign keys are not physically present in the both sides. ArcCatalog will automatically create FKs.

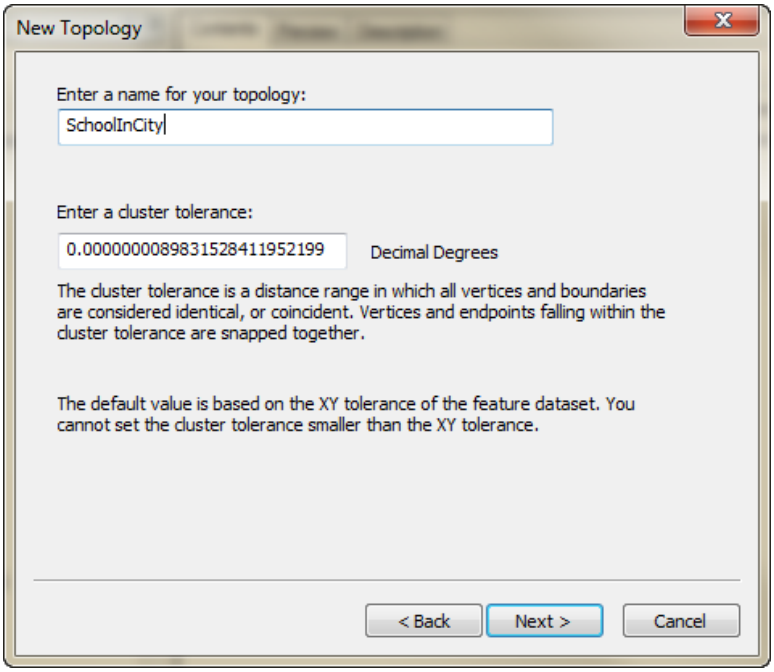


6. Create topological rules

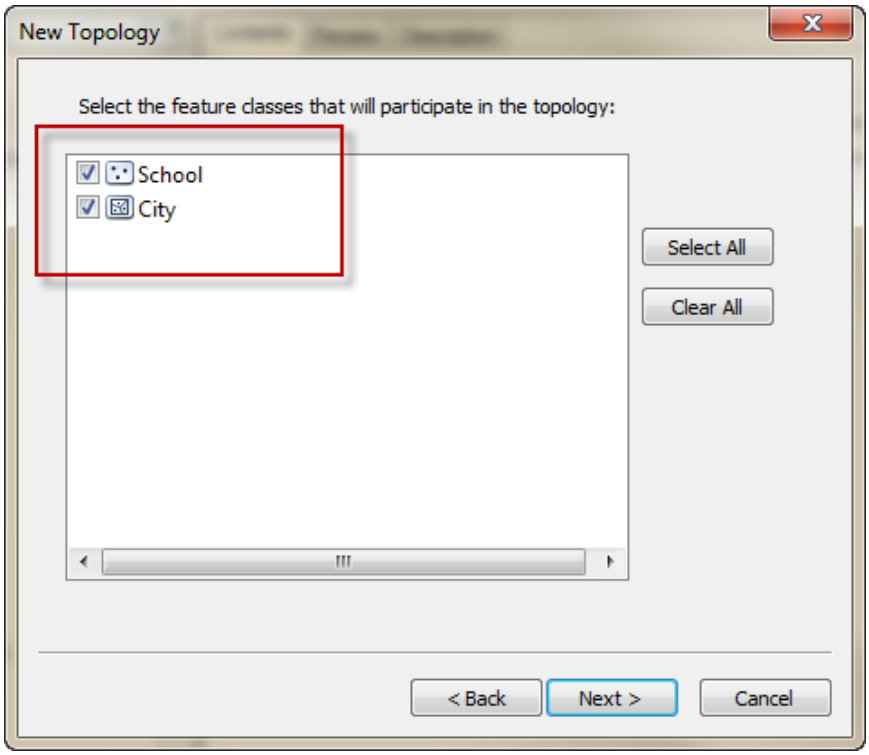
➔ Choose **Admin** Dataset. Topological rules should be created within a dataset.



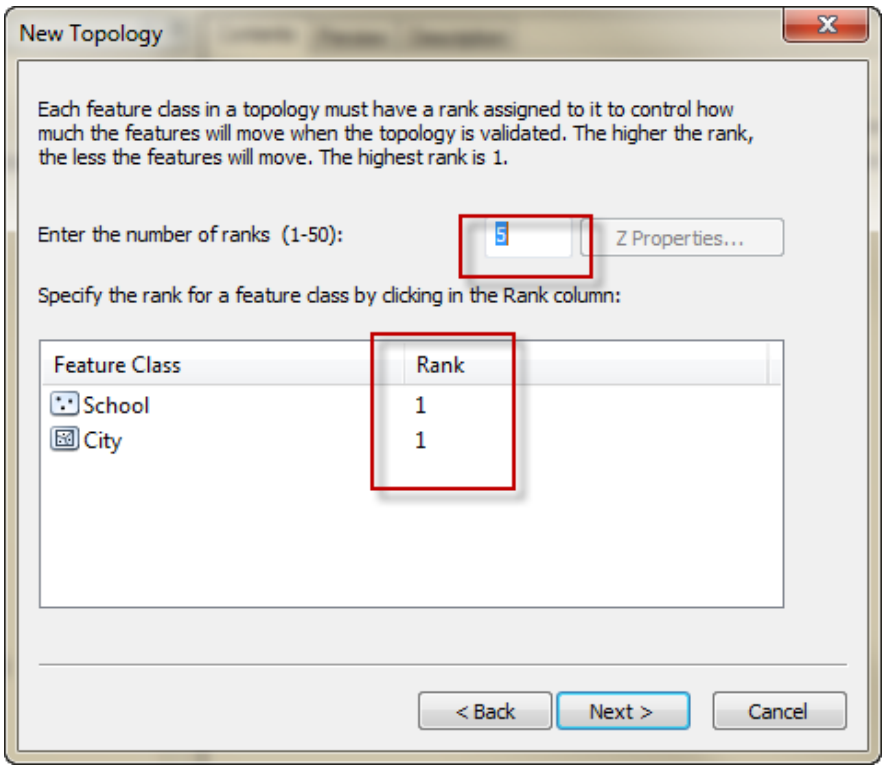
➔ Specify the name of the topological rule.



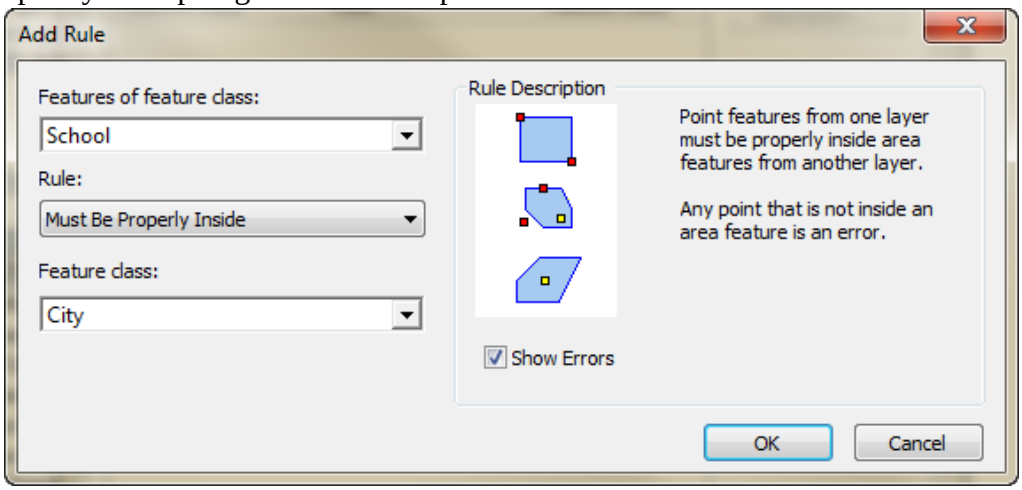
➔ Specify School and City as feature classes for participating the topological rule.



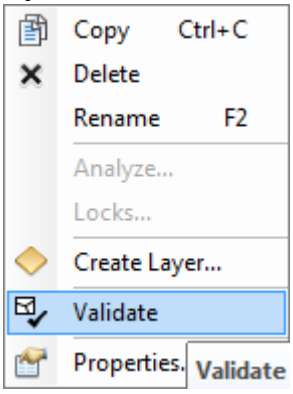
➔ You may want to change the rank too.

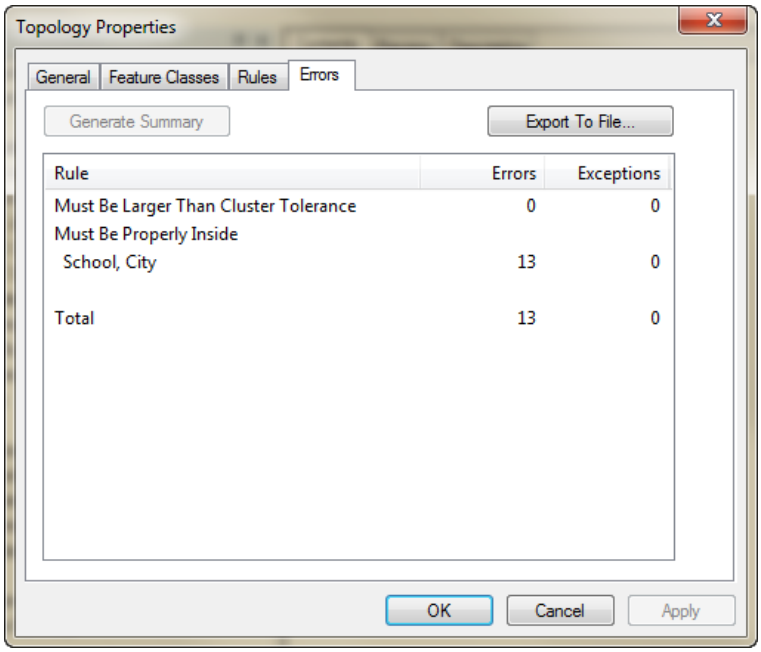


➔ Specify the topological relationship that should be met.

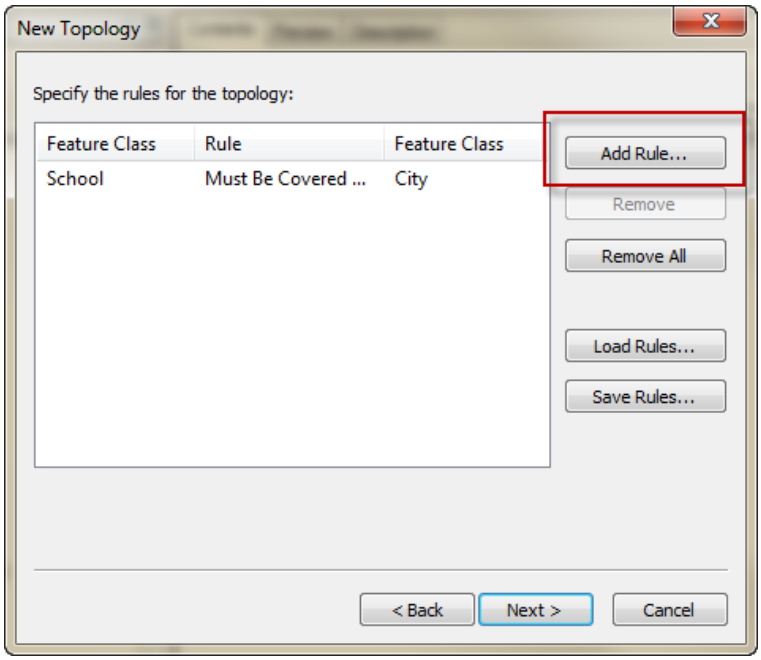


➔ Once you create a topological rule, you are asked to validate the data.





➔ Topology can be only added to a dataset which include feature classes participating in the topology. **Multiple topological rules can be added to the same topology**. **However, you can not add another topology element to the dataset if all feature classes already participate in one topology.**

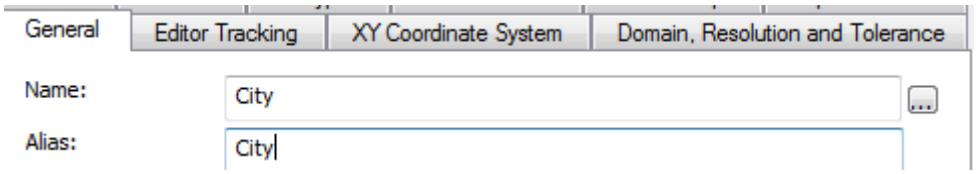


➔ When only one feature class (e.g., waterline) participates in the topology, you can not set up rules such as "…with" because the ***second*** layer is not available.

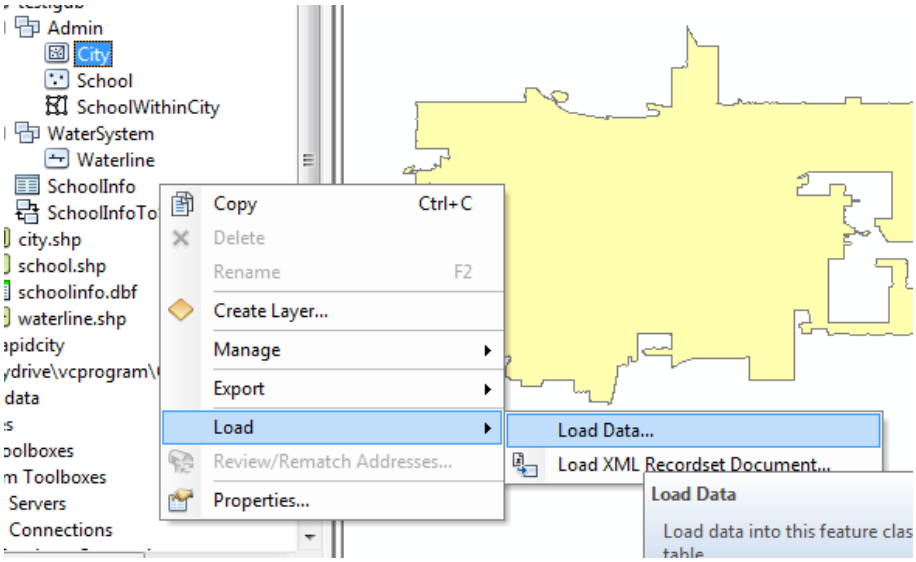
➔ Add a topology for the waterline feature class. You should add a rule for the subtypes (e.g., water main and sewer main can not intersect) and a rule for the waterline (e.g., not self-intersect)

II. Manipulate the geodatabase

➔ In geodatabase, verify **alias** has been correctly set up for each of the feature classes.

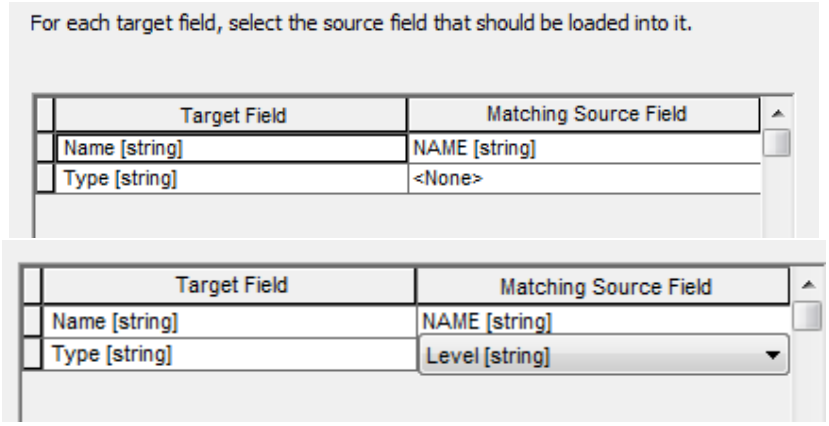


➔ You can load data to every feature class by right click the layer and select **Load**.



➔ When you load the data, you can specify the attributes can be loaded.

Note: Fields in the source may not match the target fields. You should manually select the field that matches your target field.



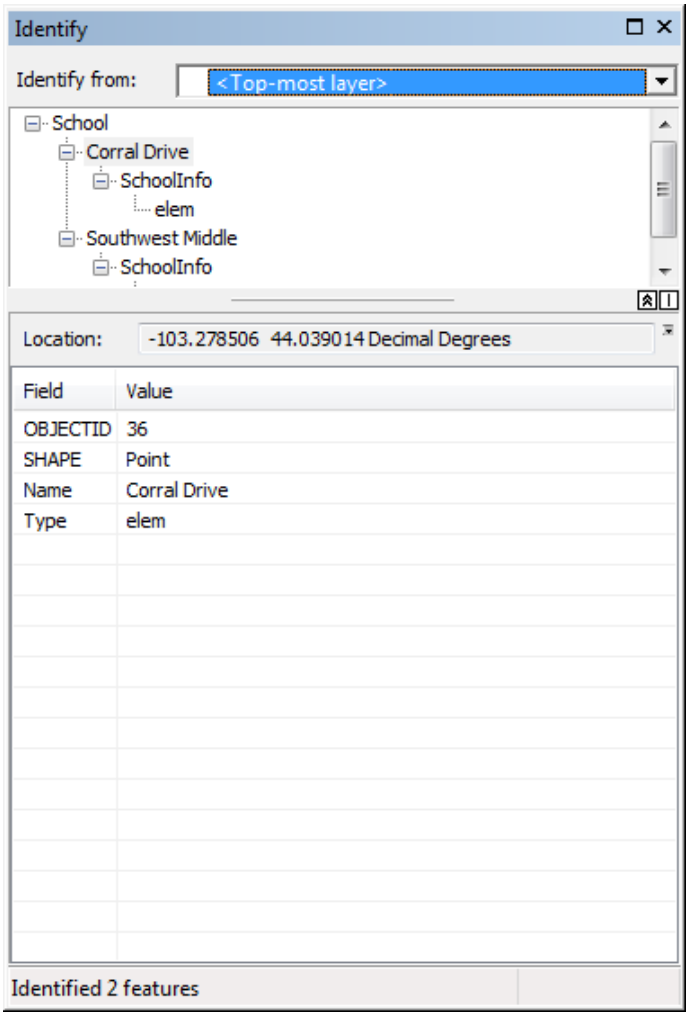
➔ Subtype. If you load data including subtype information, you may choose a) want to load one subtype→ to show only subtype only or b) do not load all→ all subtypes can show up.

➔ After importing datasets to the geodatabase, open ArcMap and add all datasets from the geodatabase.

➔ When you load data to **schoolinfo**, you will receive an error message below because "***The Simple Data Loader can't be used with some types of nonsimple feature classes such as Origin feature classes in composite relationships***." You should delete the relationship class first, load data into schoolinfo and add the relationship class.

➔ Relationship class. Read the webpage to get the information of using relationship class in ArcGIS (http://desktop.arcgis.com/en/arcmap/10.3/manage-data/relationships/benefits-of-relationship-classes.htm).

➔ Verify relationship class with **Identify** tool to view the information linked through relationship class.

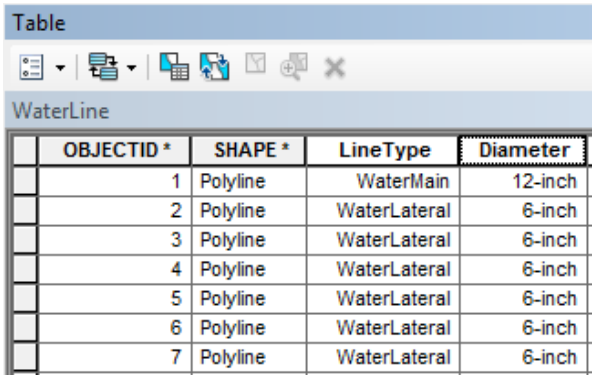


➔ Start Editor. Open the table of SchoolInfo, delete one record. Check the attribute table of School to see if the related records are deleted.

➔ Stop editing. Do not save edits.

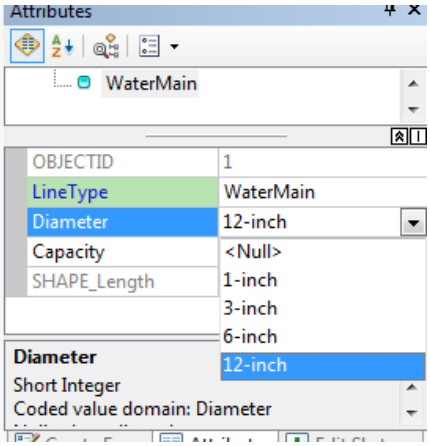
➔ Verify domain constraints. View the attribute table of **WaterLine**. Check the **properties** of the **Diameter** field. While the data type shows **Short**, the content shows the

description of the code. When you perform queries on LineType (Select by Attributes), you should use short integer values (e.g,. 6 not 6-inch).

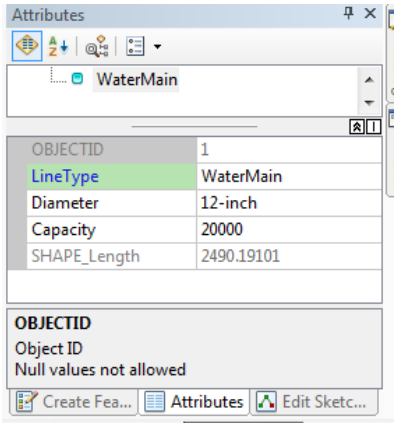


OBJECTID *	SHAPE *	LineType	Diameter
1	Polyline	WaterMain	12-inch
2	Polyline	WaterLateral	6-inch
3	Polyline	WaterLateral	6-inch
4	Polyline	WaterLateral	6-inch
5	Polyline	WaterLateral	6-inch
6	Polyline	WaterLateral	6-inch
7	Polyline	WaterLateral	6-inch

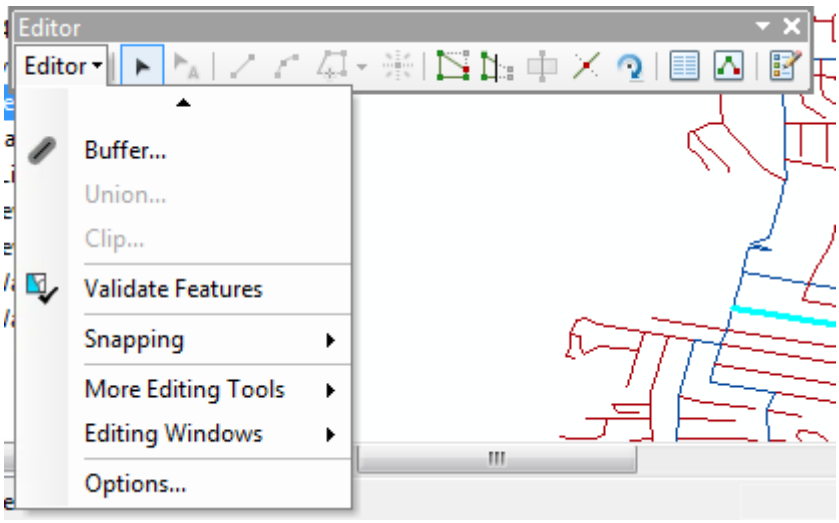
➔ Add a new feature to the **WaterLine** or select an existing feature through **Editor**. Modify the **Diameter** attribute. Note: ArcGIS may not be able to recognize the domains created through ArcGIS Diagrammer. Then you should recreate the domains within ArcCatalog.

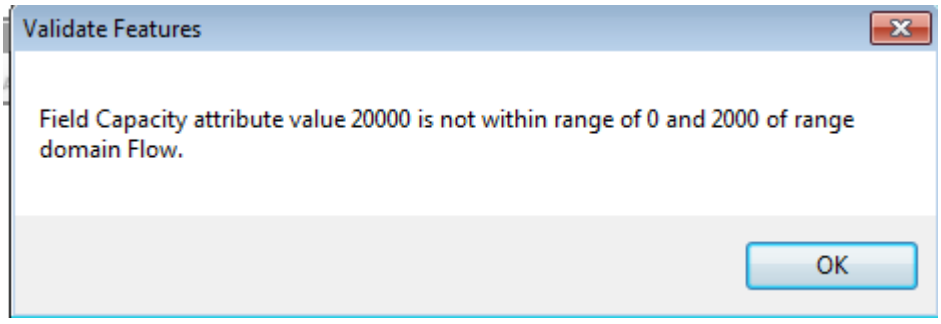


➔ Change the Capacity to **20000** which is beyond the range of Flow.

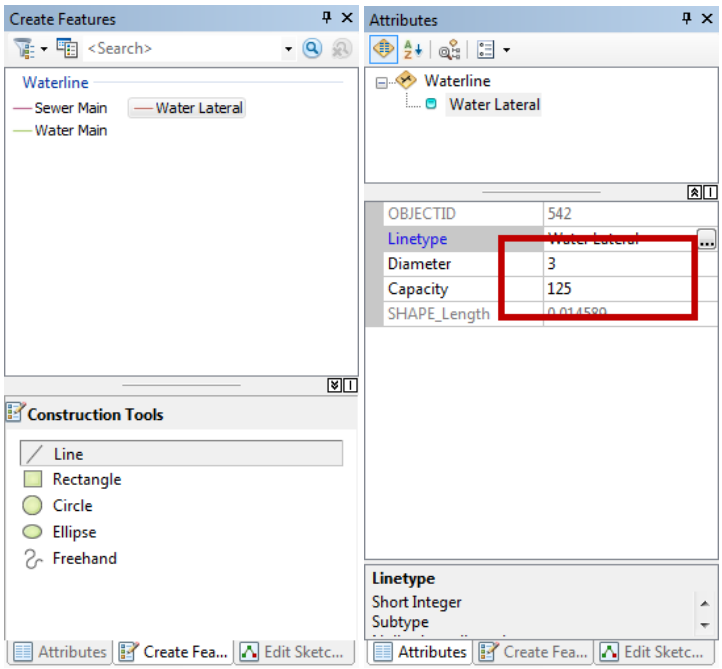


➔ Validate features. Select the feature. **Editor-->Validate Features**. Then you should receive a message saying the ***field value*** is not valid. This tool validates ***attribute values***.

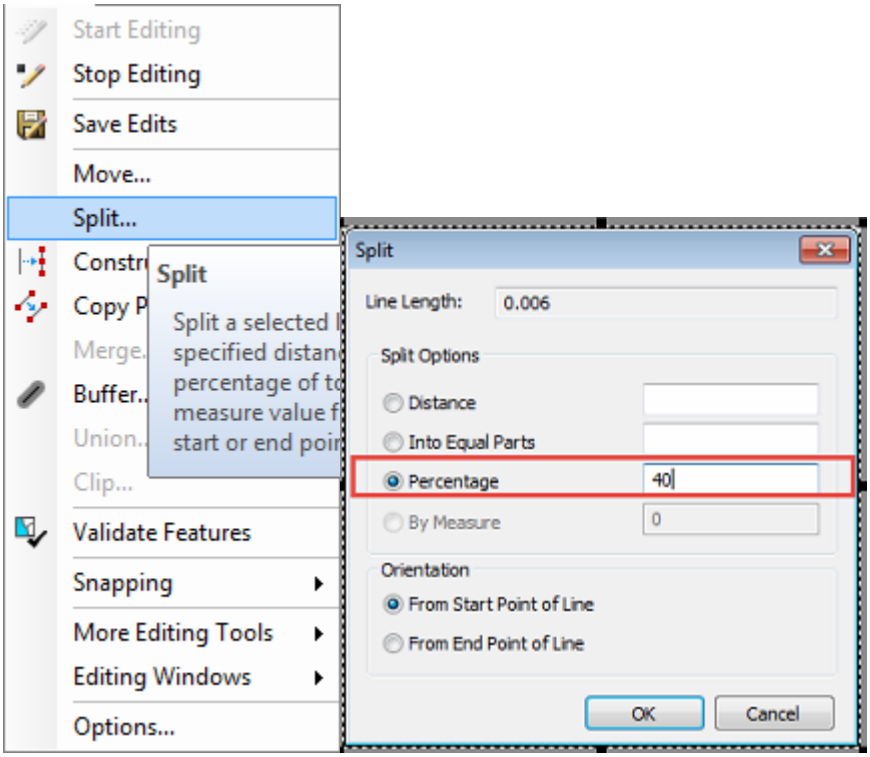




➔ Create a new feature of water line with a subtype. When you specify the line type, the values of the other two fields are updated at the same time.



➔ Split features. Choose a water line and select Split from the Editor toolbar.



➔ Check the attributes of the split features. Depending on the policies you set up earlier, the attributes of the split features may vary.

Before:

VaterLine1

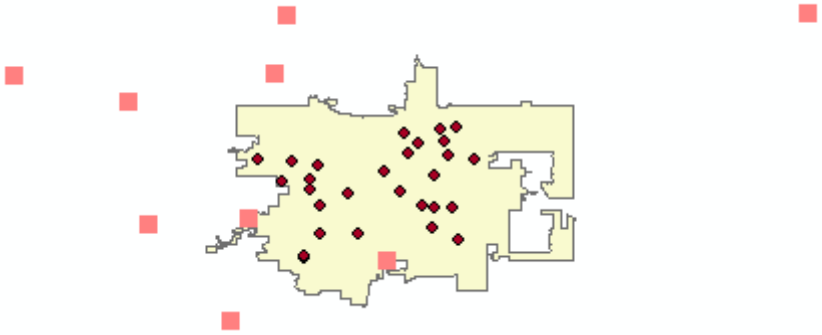
OBJECTID *	SHAPE *	Linetype	Diameter	Capacity	SHAPE_Length
511	Polyline	Water Main	12-inch	200	0.005671

After:

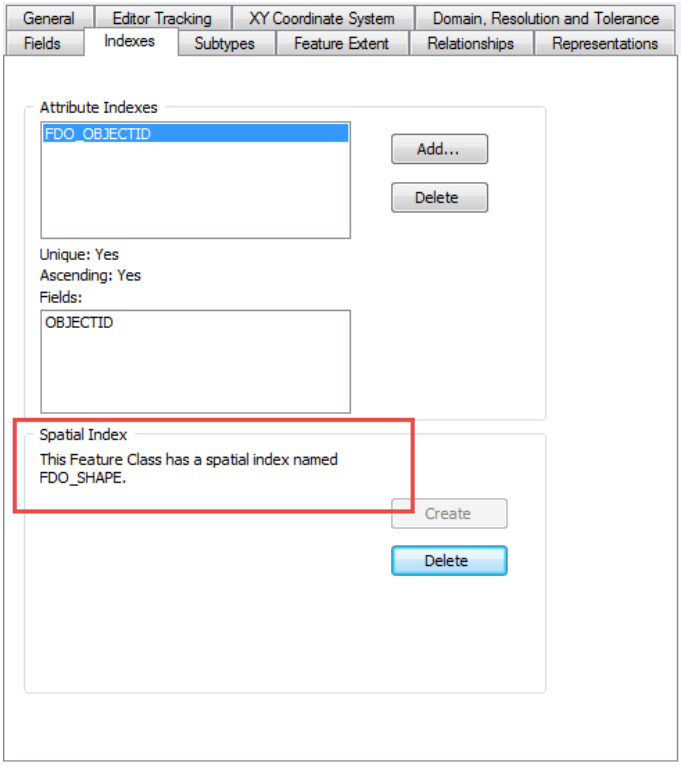
OBJECTID *	SHAPE *	Linetype	Diameter	Capacity	SHAPE_Length
545	Polyline	Water Main	12-inch	80	0.002269
511	Polyline	Water Main	12-inch	120	0.003403

➔ Open a new empty map. Add the topology rule from the database.

➔ Enable **Editor**. Move or delete points of schools with **Editor** tool and validate topology again. You need to turn on the **Topology** toolbar.



- ➔ The error tolerance may change the results of validation.
- ➔ You can validate topology in ArcCatalogy by right clicking the topology→**Validate**. Check the properties →Errors to get a report of the validation.
- ➔ If the topology does not work properly, you may want to rebuild the spatial index (if available) for feature classes or reload data records. When you create an empty feature class with the New Feature Class wizard, a spatial index is created for file, workgroup, desktop, and all enterprise geodatabases except those in DB2 databases.



III. Using existing ArcGIS data model designs

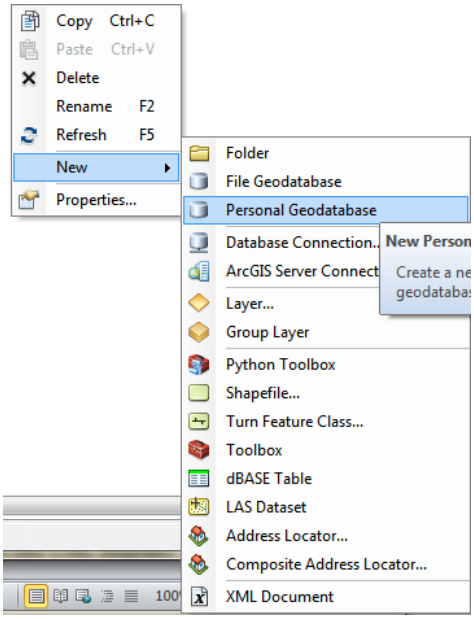
1. Download the appropriate data model from the ESRI Support Center at http://support.esri.com/datamodels (suggested workable models: Census, **Forestry**, Biodiversity, Geology, Water Utilities)

a. Select one application. You may want to choose the one with a sample geodatabase provided.
b. Download the database model and the sample database (.gdb or .mdb). Some models are provided as UML diagrams and others are provided as ArcGIS UML diagrams. If you are not able to open the UML diagrams in .vsd format, try to view the images of the model.

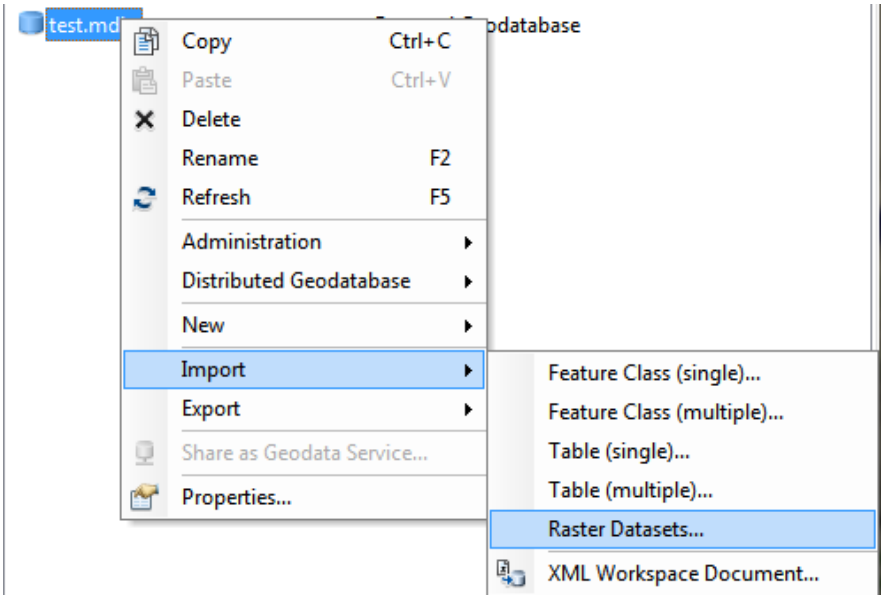
2. View the data model, answer the following questions. If the UML diagram includes multiple data models (organized into several packages), view the simplest one.
   a. What is the model about?
   b. What are the feature types? Are there any raster datasets? For each of the feature class, view the attributes and subtypes or domains if available.
   c. Does the model provide descriptions for non-spatial relationships? How? Does the model describe topological relationships? How?

Now, you can create a geodatabase with the models. But most models may not work without any modifications due to comparability issues.

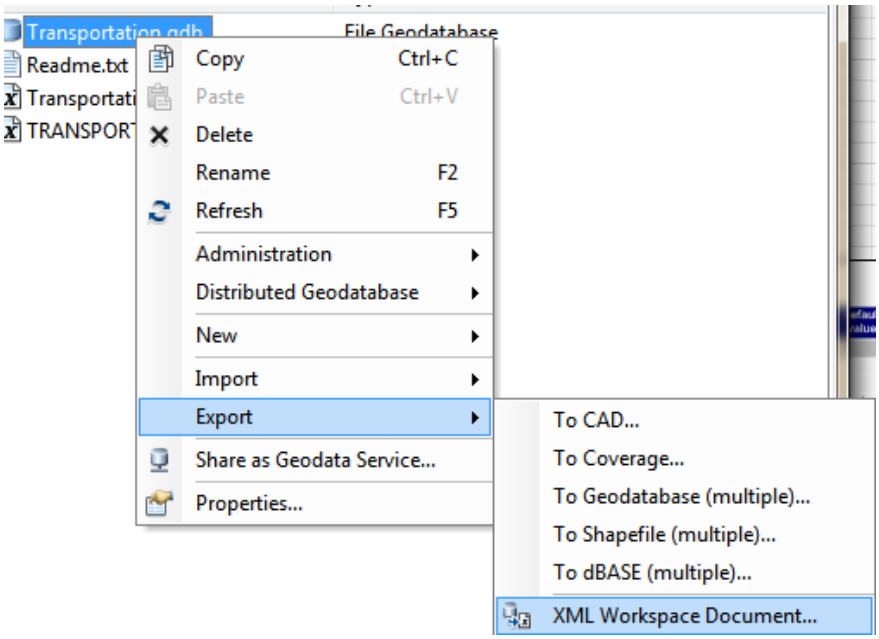
3. Create an empty test geodatabase as a personal geodatabase.
   a. Open ArcCatalog.
   b. Right click the blank space to create a new geodatabase.



   c. Right click the geodatabase and import the schema (the XML file). Import schema only.



d. If the XML does not work properly, you may want to export the sample geodatabase to create a schema first.



4. View the schema in the test database and compare the schema to the data model (the UML diagram)
5. Submit the XML schema