Data Creation and Management

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Course Overview

- Up until this point we've been consumers of Geospatial data:
- We've learned that
  - There are several places we obtain data from:
    - Enterprise Geodatabases (DOTB6GISDB01, DOTB6GISDBST01 server)
      - GTI_PUB_UTM
      - RIL_LRS_PUB
    - Shared Folders (DOTPWDXX, DOTB6PWHQCS01, ETC)
    - Hosted Services (Https://gis.transportation.wv.gov/arcgis)
    - Open Data Portal, WVDOT Data share (https://data-wvdot.opendata.arcgis.com/, https://transportation.wv.gov/SDMT/GIS/Pages/DataCatalog.aspx)

Course Overview

- Data comes in the following forms:
  - Shapefile
  - Feature Class
  - Hosted Services
  - Raster
- The data are data referred to as geospatial data and are used in a variety of products such as maps, applications, services, etc.
- Question: How do we create data for geospatial features and the form that they reside in?

Course Content

- This course explores:
  - Data Management and how it is applied to GIS.
  - The creation of Shared Folder Directories including: (Section 2)
    - Creating a Shared Folder Directory.
    - Learning about Hierarchical Folder Structure.
    - Determining the difference between Folder and Files.
    - Discussing best practices.
    - How to share folders.
  - Creating a File Geodatabase and best practices for them including: (Sec. 3 & 4)
    - What are File Geodatabases and how to create them.
    - The organization and structure of File Geodatabases.
  - The creation of Feature Classes and Shapefiles. (Sections 5 & 6)
  - Creating and editing features in a feature class. (Sections 7 & 8)

Disclaimer

- This course is entirely hands on learning, and it is advised that you have at least two monitors – one for reading and one for doing the exercises.
- This course is more challenging than previous courses, and it is best if you:
  - Follow along with the instructor step-by-step.
  - Complete the exercises.
- I will try to accommodate to fit any needs. Whenever you need help, please feel free to tell the instructor to slow down.
- In this course we will use information and data interchangeably.

Section 1: Review of Data and Information

Information and Data

- Information can be thought of as the basement or foundation of a building.
  - The user (you) can be considered the foreman of the construction project.
  - The software is like the workers building the house (the database).
  - You and the software need to be the best of friends and work together to produce a product that the customer wants.
- The challenge with data (like the foundation of a building) is that they must really be good, or the map/product will not be good.
  - Without good data and a strong foundation, the map product will not be reliable and stable.

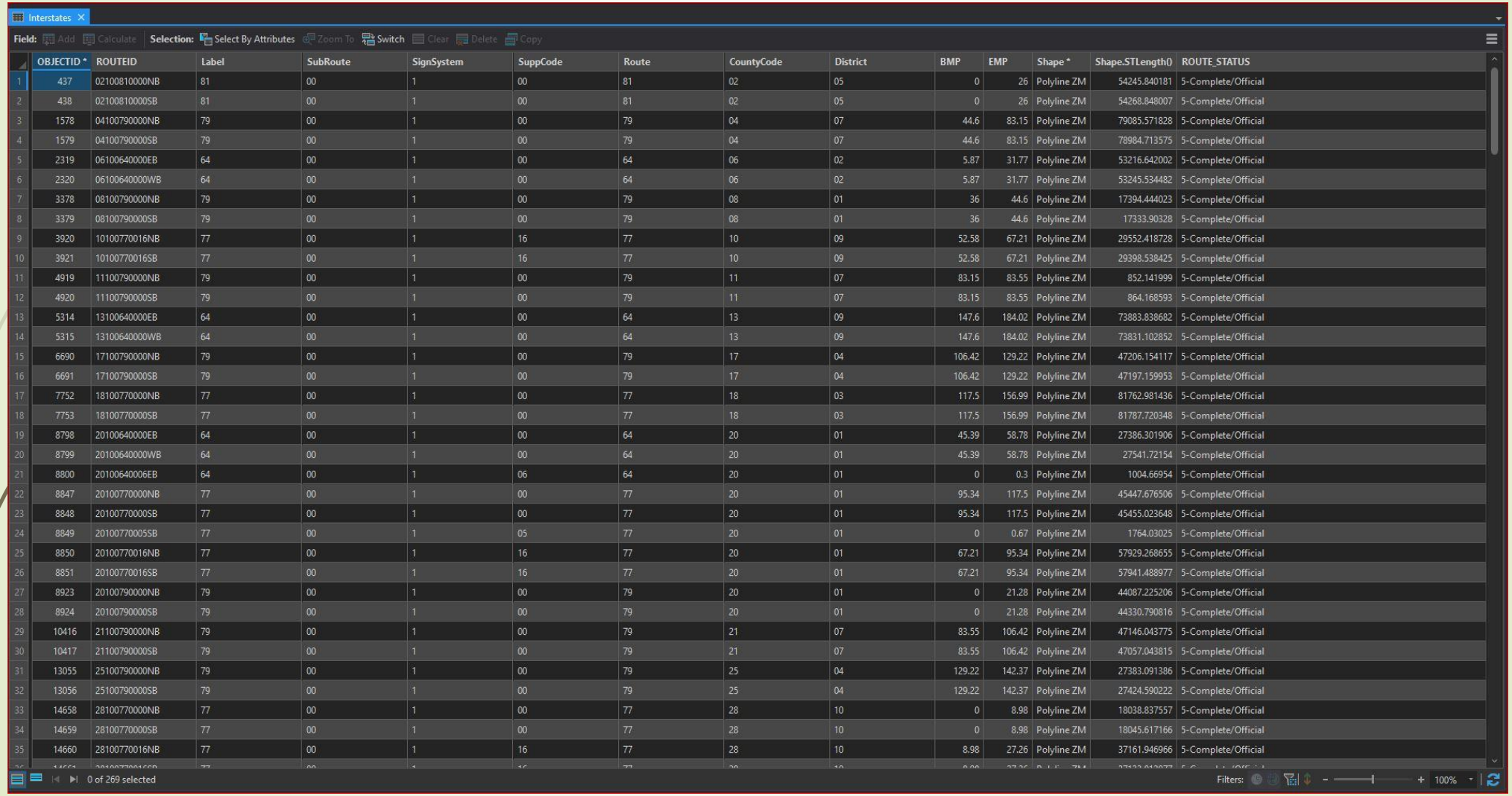
Information and Data

- Answer the what component of GIS
- Information:
  - Is data that has been refined, structured, and converted into useful facts and figures that can be further analyzed into knowledge.
  - Includes:
    - ✓ Characteristics that describe or identify a feature name, type, and unique identifier.
    - ✓ Measurements in meaningful units such as length, area, height, etc.
  - Has a collective, logical meaning (for example, the route feature conveys attributes such as surface type, speed limit, grade, etc. of a given route).
  - Is used for:
    - ✓ Providing a reference.
    - ✓ Highlighting a feature or theme.
    - ✓ Aiding in decision making.

Information and Data

- Data are:
  - A collection, of raw unorganized facts, figures, symbols, descriptions, etc. that alone, do not contain any meaning.
  - Not dependent on information.
  - Insufficient for decision making. Data needs to be analyzed first and converted into information.
  - Measured in Bits and Bytes.
- Data are organized and stored in:
  - Tables
  - Excel Spreadsheets
  - Database Tables
  - Databases

Example of a Data Table



Interstates

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

	OBJECTID *	ROUTEID	Label	SubRoute	SignSystem	SuppCode	Route	CountyCode	District	BMP	EMP	Shape *	Shape.STLength()	ROUTE_STATUS
1	437	02100810000NB	81	00	1	00	81	02	05	0	26	Polyline ZM	54245.840181	5-Complete/Official
2	438	02100810000SB	81	00	1	00	81	02	05	0	26	Polyline ZM	54268.848007	5-Complete/Official
3	1578	04100790000NB	79	00	1	00	79	04	07	44.6	83.15	Polyline ZM	79085.571828	5-Complete/Official
4	1579	04100790000SB	79	00	1	00	79	04	07	44.6	83.15	Polyline ZM	78984.713575	5-Complete/Official
5	2319	06100640000EB	64	00	1	00	64	06	02	5.87	31.77	Polyline ZM	53216.642002	5-Complete/Official
6	2320	06100640000WB	64	00	1	00	64	06	02	5.87	31.77	Polyline ZM	53245.534482	5-Complete/Official
7	3378	08100790000NB	79	00	1	00	79	08	01	36	44.6	Polyline ZM	17394.444023	5-Complete/Official
8	3379	08100790000SB	79	00	1	00	79	08	01	36	44.6	Polyline ZM	17333.90328	5-Complete/Official
9	3920	10100770016NB	77	00	1	16	77	10	09	52.58	67.21	Polyline ZM	29552.418728	5-Complete/Official
10	3921	10100770016SB	77	00	1	16	77	10	09	52.58	67.21	Polyline ZM	29398.538425	5-Complete/Official
11	4919	11100790000NB	79	00	1	00	79	11	07	83.15	83.55	Polyline ZM	852.141999	5-Complete/Official
12	4920	11100790000SB	79	00	1	00	79	11	07	83.15	83.55	Polyline ZM	864.168593	5-Complete/Official
13	5314	13100640000EB	64	00	1	00	64	13	09	147.6	184.02	Polyline ZM	73883.838682	5-Complete/Official
14	5315	13100640000WB	64	00	1	00	64	13	09	147.6	184.02	Polyline ZM	73831.102852	5-Complete/Official
15	6690	17100790000NB	79	00	1	00	79	17	04	106.42	129.22	Polyline ZM	47206.154117	5-Complete/Official
16	6691	17100790000SB	79	00	1	00	79	17	04	106.42	129.22	Polyline ZM	47197.159953	5-Complete/Official
17	7752	18100770000NB	77	00	1	00	77	18	03	117.5	156.99	Polyline ZM	81762.981436	5-Complete/Official
18	7753	18100770000SB	77	00	1	00	77	18	03	117.5	156.99	Polyline ZM	81787.720348	5-Complete/Official
19	8798	20100640000EB	64	00	1	00	64	20	01	45.39	58.78	Polyline ZM	27386.301906	5-Complete/Official
20	8799	20100640000WB	64	00	1	00	64	20	01	45.39	58.78	Polyline ZM	27541.72154	5-Complete/Official
21	8800	20100640006EB	64	00	1	06	64	20	01	0	0.3	Polyline ZM	1004.66954	5-Complete/Official
22	8847	20100770000NB	77	00	1	00	77	20	01	95.34	117.5	Polyline ZM	45447.676506	5-Complete/Official
23	8848	20100770000SB	77	00	1	00	77	20	01	95.34	117.5	Polyline ZM	45455.023648	5-Complete/Official
24	8849	20100770005SB	77	00	1	05	77	20	01	0	0.67	Polyline ZM	1764.03025	5-Complete/Official
25	8850	20100770016NB	77	00	1	16	77	20	01	67.21	95.34	Polyline ZM	57929.268655	5-Complete/Official
26	8851	20100770016SB	77	00	1	16	77	20	01	67.21	95.34	Polyline ZM	57941.488977	5-Complete/Official
27	8923	20100790000NB	79	00	1	00	79	20	01	0	21.28	Polyline ZM	44087.225206	5-Complete/Official
28	8924	20100790000SB	79	00	1	00	79	20	01	0	21.28	Polyline ZM	44330.790816	5-Complete/Official
29	10416	21100790000NB	79	00	1	00	79	21	07	83.55	106.42	Polyline ZM	47146.043775	5-Complete/Official
30	10417	21100790000SB	79	00	1	00	79	21	07	83.55	106.42	Polyline ZM	47057.043815	5-Complete/Official
31	13055	25100790000NB	79	00	1	00	79	25	04	129.22	142.37	Polyline ZM	27383.091386	5-Complete/Official
32	13056	25100790000SB	79	00	1	00	79	25	04	129.22	142.37	Polyline ZM	27424.590222	5-Complete/Official
33	14658	28100770000NB	77	00	1	00	77	28	10	0	8.98	Polyline ZM	18038.837557	5-Complete/Official
34	14659	28100770000SB	77	00	1	00	77	28	10	0	8.98	Polyline ZM	18045.617166	5-Complete/Official
35	14660	28100770016NB	77	00	1	16	77	28	10	8.98	27.26	Polyline ZM	37161.946966	5-Complete/Official

0 of 269 selected Filters: 100%

Geospatial Data

- Refers to any data that describe features, objects, or events that:
  - Can be physically located on earth.
  - Have some sort of spatial reference assigned to them.
- They are stored in the following data formats:
  - Vector
  - Raster
  - Surfaces and Triangulated Irregular Networks (TIN)

Geospatial data

- They are shared in the following data types:
  - Shapefiles
  - Feature Classes
  - KML/KMZ
  - ArcGIS services
- The different geospatial datatypes can be housed in:
  - Geodatabases
  - Database
  - File Folders

Vector Data

- Majority of the data you will work with in ArcGIS Pro
- A coordinate-based data model that represents geographic features
- Consists of a geometry (geographical feature)and attribute data
  - Geometry is made up one or more interconnected vertices (XYZ coordinates associated with the feature).
  - Attributes are associated with each vector feature.
  - The arrangement of XYZ coordinates defines one of three geometries:

    - ✓ Point: a feature consisting single discrete vertex like a sign, rest area, etc.

    - ✓ Line: a feature defined by a sequence of multiple interconnected vertices that are in a path or segment like a road centerline, railroads, rivers and streams, etc.
    - ✓ Polygon: a feature defined by a sequence of multiple interconnected vertices whose origin and end are in the same position such as parcels, counties, etc.

Vector Data

- Can be easily created and edited
- Displays discrete real-world features instead of continuous features
- Are scalable meaning that feature will grow or shrink in size without becoming distorted
- Can be used for Spatial Analysis in a GIS application
- https://docs.qgis.org/2.8/en/docs/gentle_gis_introduction/vector_data.html
- Short video on Vector and Raster Data
- Another Short Data of Raster and Vector Data

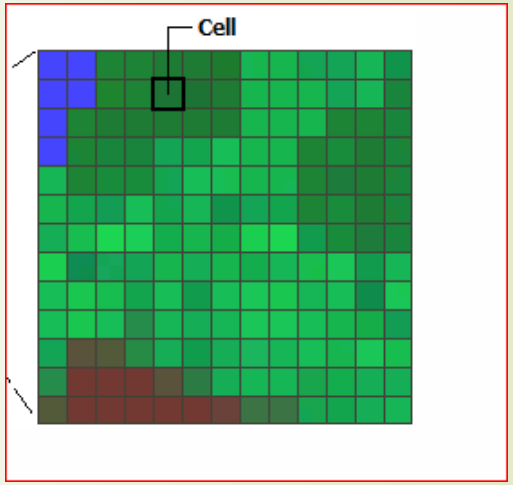
Raster Data

- Are continuous data representing an image from a satellite, remote sensing device, or scanned map or orthophoto representing real world phenomena.
- Can be:
  - Thematic data such as soils, land surface, vegetation cover.
  - Continuous data such as temperature, elevation, LiDAR
  - Scanned pictures such as an old map, orthophoto, blueprint
- Rasters are continuous in value from point to point rather than discreet like vector data.

  https://desktop.arcgis.com/en/arcmap/10.3/manage-data/raster-and-images/what-is-raster-data.htm

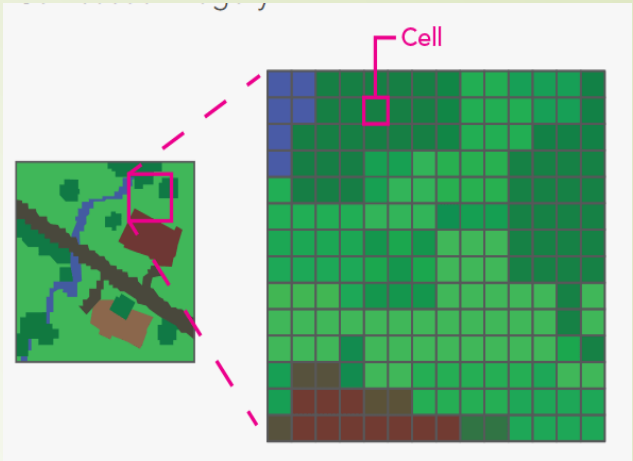
Raster Data

- Are composed of cells are organized into a matrix of rows and columns called a grid.
- Are mostly used in the following roles:
  - Basemaps – primarily what we use them for
  - Surface or Elevation map
  - Thematic maps such as land use, soil type, vegetation
  - 3D Raster images



- Are not scalable when zooming in and out meaning the picture will pixilate when zooming in and become clearer zooming out.
- Short video on rasters

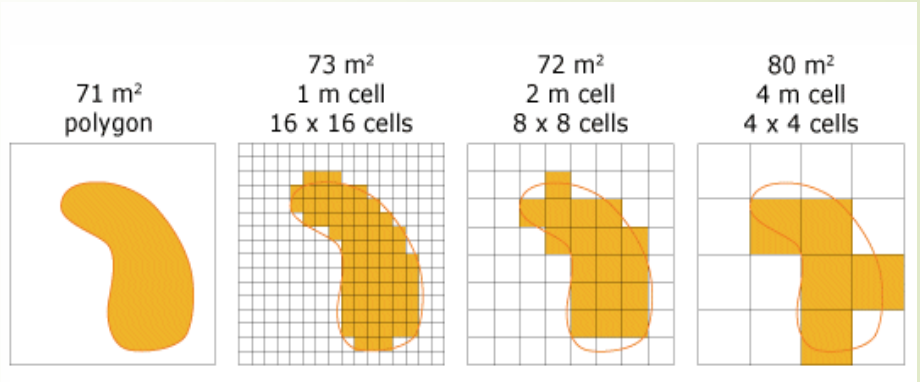
Raster Data: Cells



- Are the smallest unit of information in a raster dataset
- Are sometimes referred to as a pixel
  - Pixel is an abbreviation for the picture element and is used when describing imagery.
- Cells represent the phenomenon portrayed by the raster data set.
  - Each value represents a numeric piece of information of real-world phenomena such as height, land use, color, vegetation.
  - Each has Real number value (values with a decimal place) and Integer number (values without a decimal place).
  - Each value can be both positive and negative.
- Cells use scale or the ratio/relationship between a distance or area on a map and the corresponding distance in reality.

Raster Data: Resolution

- Resolution
  - Refers to the size of the cells in a raster dataset and the ratio of screen and the ratio of Screen Pixels to image pixels
    - ✓ IE 1 screen pixel = 100 image pixels
  - Is calculated by cell size which is the surface area of the cell (Width * Height).
    - ✓ Cell size determines the spatial resolution.



  - Determines how coarse or fine the image is going to look
    - ✓ The smaller the cell size, the smoother (clearer) the image becomes.
    - ✓ The larger the cell size, the coarser (pixilated) the image becomes.
    - ✓ The smaller the raster cell size, the longer it is going to take to process the data in the GIS software.

https://desktop.arcgis.com/en/arcmap/10.3/manage-data/raster-and-images/cell-size-of-raster-data.htm

Raster Data: Resolution

- There are 4 kinds of resolution:
  - Radiometric: describes the ability of a sensor to distinguish slight differences in the spectrum between adjacent points.
  - Spatial describes the smallest object that can be resolved by the sensor.
    - ✓ It is the dimension of the area on the ground represented by a single cell
    - ✓ It determines the level of detail represented by an image.
  - Spectral: describes the ability of a sensor to distinguish between wavelength intervals in the electromagnetic spectrum.
    - ✓ The higher the spectral resolution is, the narrower the wavelength range for a particular band.
  - Temporal: refers to the frequency at which the image was captured over the same place on the earth's surface.

Triangle Irregular Network(TIN)

- Stands for a Triangle Irregular Network
- Used to represent height values and surface morphology across an extent
- This is done through triangulating interconnected sets of vertices (vector-based XYZ points) to form a network of interconnected triangles.
- These interconnected non-overlapping triangles create a more accurate surface capturing accurate linear features.
- Measured in English and metric units not decimal degrees
- https://pro.arcgis.com/en/pro-app/latest/help/data/tin/tin-in-arcgis-pro.htm

Data Sources

- Data is stored in the following formats:
  - Raster Format
    - ✓Img
    - ✓jpeg2
    - ✓GIF
    - ✓LAS
  - Vector Format (Focus of this course)
    - ✓Shapefile
    - ✓Feature Class in a Personal, File, Enterprise Geodatabase
    - ✓KML

Geospatial Data Storage: Shapefile

- A shapefile is probably the simplest and most portable in terms of the types of geospatial data storage
- Consists of multiple files including a:
  - Database file (DBF): houses the information and data for the shapefile.
  - Shape Index File (SHX): contains the column headers and indexes that are used to organize the data in the database file (DBF) for fast retrieval.
  - Shapefile (SHP): contains the feature's geometry and some of the data.
- Additionally, sometimes there can be a Projection (PRJ) file that contains the projection or geographical coordinate system of the feature.

https://desktop.arcgis.com/en/arcmap/10.3/manage-data/shapefiles/what-is-a-shapefile.htm

Geospatial data Storage: Shapefile

- Advantages
  - It is easy to create, and you can export data to it very easily.
  - It is very portable and lightweight. It can be used by other GIS software such as QGIS, Mapworks, and CAD software such as AutoCAD and MicroStation.
  - It can be housed on it own and does not need to have a special place such as a geodatabase.
- Disadvantages
  - It does not have the ability to store complex geographical information such as annotations, topologies, relationships, attribute domains, etc.
  - It is limited in the number of characters you can have (10 for names and 255 in headers, etc.).
  - It cannot use the complex tools and features found in ArcGIS.
  - It cannot be versioned and edited by multiple people concurrently.
  - It stores data in a non-binary format and has trouble storing non-English language data.
  - It has 2GB size for shapefile component.

https://pro.arcgis.com/en/pro-app/latest/tool-reference/appendices/geoprocessing-considerations-for-shapefile-output.htm

Geospatial Data Storage: Feature Class

- Collection of homogenous geographic feature data that share the same geometry type (Point, Line, Polygon, etc.) and the same attribute fields
- Resides in a Geodatabase.
- Can be organized with other like feature classes into groups called feature datasets
- Consists of the basic point, polyline, or polygon shape as well as:
  - Annotation – saved map text or string of text that are associated with a point, polyline or point feature.
  - Dimension – special type of annotation showing spatial text (height, distance, etc.).
  - Routing or network – a network of point and linear features that are interrelated.
  - Multi-point – feature containing clustered multiple point feature classes that represent a feature.
  - Multiple Patch – 3D surface that represents a 3D geometry such as building front, tree, etc.

Geospatial Data Storage: Feature Class

- Contains both the geometric shape of the feature as well as descriptive attributes
- Can contain both single and multiple parts of a polygon or polyline.
  - IE you can have a single feature for Hawaii as a state when it contains multiple polygon values.
- Along with the X,Y,Z coordinates, feature classes can have a M value.
  - The M Value is the linear measurement to interpolate distances along linear features.
  - The "M" stands for Measurement.
  - It is the building block of Linear Referencing. It is something we use in our statewide road network.
  - This value also is used in georeferencing or the process of geolocating an event along the measurement system. It is also called dynamic segmentation.

Geodatabases

- A geodatabase is a collection of spatial and non-spatial data held in a common folder on a disk or database management system (SQL, Oracle, DB2, etc.)
- It maintains data through a series of interrelated tables (relational) that contain the information, geometries, etc.
- It uses a unique identification (primary key) to interlink the data.
- It can be used for editing, managing, sharing and creating data.
- It houses both vector, raster, and tabular (table) data as well as TIN networks.
- A geodatabase can include any of the following types:
  - Personal Geodatabase (PGDB or MDB)
  - File Geodatabase (FGDB)
  - Enterprise Geodatabase (SDE or EGDB)

https://desktop.arcgis.com/en/arcmap/10.3/manage-data/geodatabases/what-is-a-geodatabase.htm

https://desktop.arcgis.com/en/arcmap/latest/manage-data/geodatabases/types-of-geodatabases.htm

Geodatabase: Personal Geodatabase

- It is the simplest of al the geodatabase types.
- It is based on a Microsoft Access database that can store up to 2GB of both Spatial and Non-Spatial data.
- It can include:
  - Attachments
  - Annotation
  - Feature Classes and Datasets
  - Geometric Networks
  - Mosaics
  - Network Datasets
  - Parcel Fabric
  - Relationship Classes
  - Raster Catalog and Datasets
  - Schematic
  - Table (nonspatial)
  - Terrain
  - Toolboxes
  - Topology

Geodatabase: Personal Geodatabase

- It can also:
  - Have domains.
  - Use subtypes.
  - Participate in check-in and checkout replication.
  - Participate in one-way replications.
- Only one user can use it a time.
- It is not supported or used in ArcGIS Pro.

https://desktop.arcgis.com/en/arcmap/latest/manage-data/administer-file-gdbs/personal-geodatabases.htm

Geodatabase: File Geodatabase

- Middle range of all the ArcGIS Databases
- Native version of Geodatabase in ArcGIS
  - Only accessible from ArcGIS software
  - Does not need to be stored on a database server
- It can also:
  - Contain subtypes and domains.
  - Participate in checkout/check-in replication and one-way replication.
- It can be accessed simultaneously, but if being edited, each user must work on different datasets.
- https://desktop.arcgis.com/en/arcmap/latest/manage-data/administer-gdb-intro/geodatabase-administration.htm

Geodatabase: File Geodatabase

- Can store up 1 TB but can be upgraded to 256TB of both Spatial and Non-Spatial data
  - Annotation
  - Attachments
  - Feature Classes and Datasets
  - Geometric Networks
  - Mosaics
  - Network Datasets
  - Parcel Fabrics
  - Raster Catalog and dataset
  - Relation classes
  - Schematic dataset
  - Table
  - Terrains
  - Toolboxes

Geodatabase: Enterprise Geodatabase

- Most complex of the different types of geodatabases
- Collection of various types of tables held in table format in a relation database (the recommended native data format for ArcGIS).
- Housed on a Relational Database Management System (RDBMS) or database system that houses data in multiple tables that all have a similar unique value called a primary key.
  - SQL Server or SQL Express
  - PostgreSQL
  - Oracle
  - DB2 or Infomix
  - SAP
- Has no limit in data size

Geodatabase: Enterprise Geodatabase

- Designed for medium to large scale use for enterprise-wide implementations
- Advantages
  - Provides better data security through assigning different levels of access to the datasets including:
    - ✓ Geodatabase Administrator: individual who creates and owns all the database objects (tables, views, functions, etc.) that make up an enterprise geodatabase and who maintains it.
    - ✓ Data Creator: small number of people who create feature classes, tables, raster datasets, and mosaic datasets that other people in the organization publish, map and analyze.
    - ✓ Publisher: people who create and configure the web maps and services.
    - ✓ Editors: people who maintain the data through editable features, services, and portal feature layers.
    - ✓ Analysts: people who run geoprocessing tools on feature services and image services in ArcGIS Desktop/Pro or through Python.
    - ✓ Viewer: people who interact with map, feature, or image services in maps created in ArcGIS Pro and map viewer.

Geodatabase: Enterprise Geodatabase

- Advantages continued…
  - Provides backup and recovery capabilities.
  - Provides multiuser/multi-editor environment where users can:
    - ✓ Access and edit datasets at the same time.
    - ✓ Have multiple editors editing the same dataset at the same time.
    - ✓ Edit through Versioning (the use of multiple induvial snapshots of a database at a given point in time).
  - Allows archiving which makes it possible to track changes.
  - Facilitates easy data transmittal to other enterprise and file geodatabases through a process of replication (2-way replication).
- In WVDOT, we have implemented two SQL servers that house both enterprise geospatial and non-geospatial data. They are:
  - DOTB6GISDB01 – Production Enterprise Geodatabase
  - DOTB6GISDBST01 – Staging Enterprise Geodatabase

DOTB6GISDB01

- Production Enterprise Geodatabase Server
- Houses:
  - All data currently used in mapping projects and applications.
  - Geospatial data products being shared with the public.
  - Most current data that is updated semiannually as part of the roadway publication.
- Consists of 82 enterprise geodatabases, 64 of which are operational (online).
- The two enterprise geodatabases most commonly used by WVDOT are:
  - GTI_PUB_UTM
  - RIL_LRS_PUB

DOTB6GISDBSTSA01

- Staging Enterprise Geodatabase Server
- Houses all data used for:
  - developing new applications and web maps.
  - developing new datasets and data.
  - testing how applications will work.
- Consists of 59 enterprise geodatabases.
- The two enterprise geodatabases most commonly used by WVDOT are:
  - GTI_PUB_UTM
  - RIL_LRS_PUB

GTI_PUB_UTM

- Location: Production and Staging Geodatabase Servers
- Purpose:
  - Main enterprise geodatabase used to house all feature datasets and features classes related to creating maps and mapping products in West Virginia.
  - Contains:
    - ✓ Statewide transportation and route data features maintained by WVDOT.
    - ✓ Statewide Boundaries, Cultural, Economic, Environmental, and Hydrological datasets.
- GTI_PUB_WM is a mirror of GTI_PUB_UTM enterprise geodatabase, but GTI_PUB_WM is used for web mapping and application creation.
- Updated semiannually or as needed when new data becomes available.

RIL_LRS_PUB

- Location: Production and Staging Geodatabase Servers
- Purpose:
  - Main enterprise geodatabase use to house all feature classes and corresponding attribute tables related to WVDOT roadway network including:
    - ✓State and County Networks
    - ✓Surface Type
    - ✓Lane Width
    - ✓Speed Limit
    - ✓Bridges
  - It is a copy of the RIL_LRS which is the enterprise geodatabase used to edit and maintain the roadway network.

Important Datasets

- There are several key datasets used within WVDOT.
- GTI_PUB_UTM datasets:
  - Boundaries
    - ✓ Counties: West Virginia Counties
    - ✓ Incorporated _Places_20XX: Location of all incorporated municipalities, towns, and cities within WV
    - ✓ WVDOH_Districts: Polygon feature of all WVDOH Districts
  - Economic
    - ✓ Parcels_20XX: Statewide parcel layer used for right of way
    - ✓ WVDOT_Parcels: Location of all WVDOT owned parcels
  - Hydrology
    - ✓ Major_Rivers_Other_NHD: polygon feature of all major rivers in WV
    - ✓ Rives_Streams_NHD: Polyline feature of all rivers and streams in WV
    - ✓ Lakes_Oter_Waterbodies_NHD: All lakes, ponds and other waterbodies in WV

Important Datasets

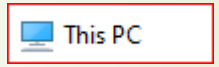
- Routes
  - ✓ Dominant_Routes: Feature class derived from the county mile point network showing the primary routes on centerline in WV.
    - Dominant routes is used for displaying routes and eventing tables to the route network.
- Transportation
  - ✓ Bridges: Shows all bridges within West Virginia
  - ✓ Lane_Info_RH: Shows AADT Traffic Counts, Roadway Surface Type, and Lane Width
  - ✓ WV_Railroads: WV Railroad Layer
  - ✓ WV_DOT_Facilities: Location of WVDOT Facilities
  - ✓ WV_Airports: WV Airports
  - ✓ WV_Fuel_Sites: Location of all WVDOH Fuel Sites

Important Datasets

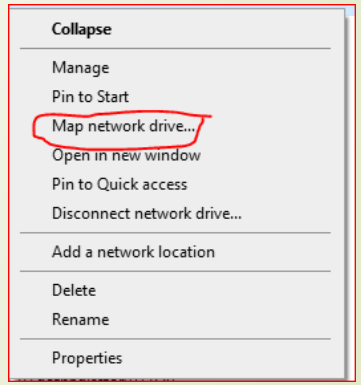
- RIL_LRS_PUB
  - County_Milepoint: Dataset showing both primary routes (Dominant) and the secondary route(Subordinate) on a centerline.
  - Used similar to Dominant Routes for mapping routes and eventing route information to the route network.
  - LRSE_Bridges: slimmed down version of the bridge feature class in GTI_Pub_UTM.
  - Street_Name_Sams: Contains the street names of every route in WV.

Section 2: Introduction to File Shares

Connecting to a Shared Directory

- If you have not mapped a network drive, go to \\dotb6gisrh01\WVDOT_Training\Course3
- To map to a network drive, open a file browser. 
- On the left-hand side is the quick access toolbar. This lists all the files, folders and mapped drives located on the PC.
- Search for a button called 'This PC' and right click on it. 

- Here, select 'Map network drive'.
- This will bring up an interactive window where you can connect to a drive.



Connecting to a Shared Directory

- In the interactive window, select the following:
  - Drive Letter:
    - ✓ Refers to a letter (A through Z) that corresponds to a mapped network location or hard disk drive on the computer.
    - ✓ By default, there are drives automatically mapped including:
      - C which is the internal hard disk drive on the computer
      - S which is the DOT shared drive automatically mapped with the base image on the PC
    - ✓ If it is not mapped already, choose Q drive

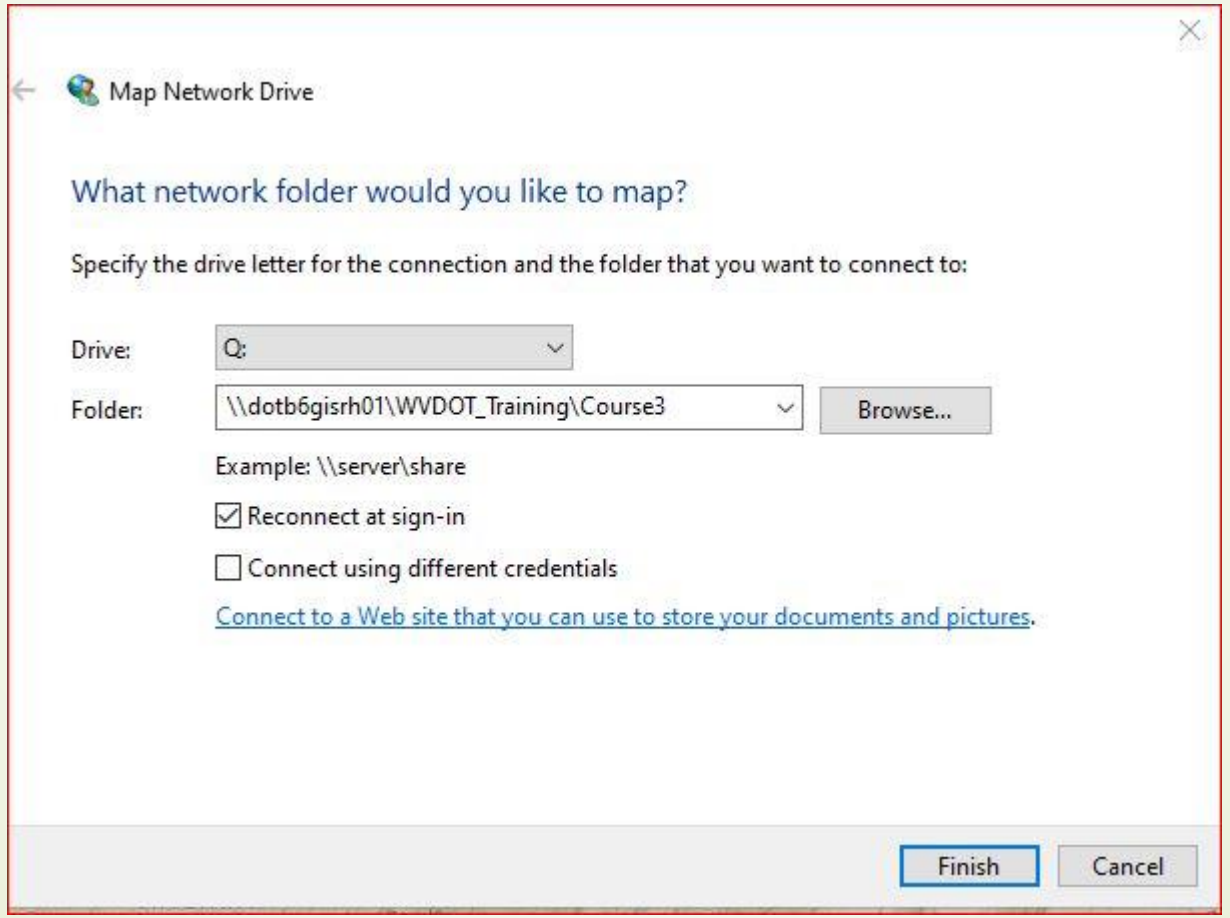
Connecting to a Shared Directory

- Folder
  - ✓ Refers to the location where the network file or file share is located.
  - ✓ Usually, it specifies this in the following format:

    \\server\share
  - ✓ 'Server' identifies the server or the physical location on the network where the shared folder is being hosted.
  - ✓ Share refers to the file or file name that is being shared.
    - You will learn later on that any file or folder that is being shared must have permissions assigned to them prior to sharing them.
  - ✓ For us copy the following \\dotb6gisrh01\WVDOT_Training\Course3
- Leave as default
  - ✓ 'Reconnect at sign in' means the drive will reconnect every time the user logs onto the computer.
  - ✓ 'Connect using different credentials' means that the drive will use special credentials to access it.

Connecting to a Shared Directory

It should look like this. Click Finish.



Shared Directory

- Is a folder used to house files, folders and information made accessible to multiple users on a network including:
  - Geospatial data and features
  - Other corresponding project data
  - Mapping projects
  - Maps or applications
  - Any combination of the above
- Is the most common way of exchanging information on any network
- Usually houses data with a common theme or use such as:
  - A workspace or data storage area for a district, division, program, unit, etc.
  - A collaborative internal or external project
  - Access to informational products such as downloadable data, webmaps, applications
  - Or in our case, a place to learn a new skill or procedure

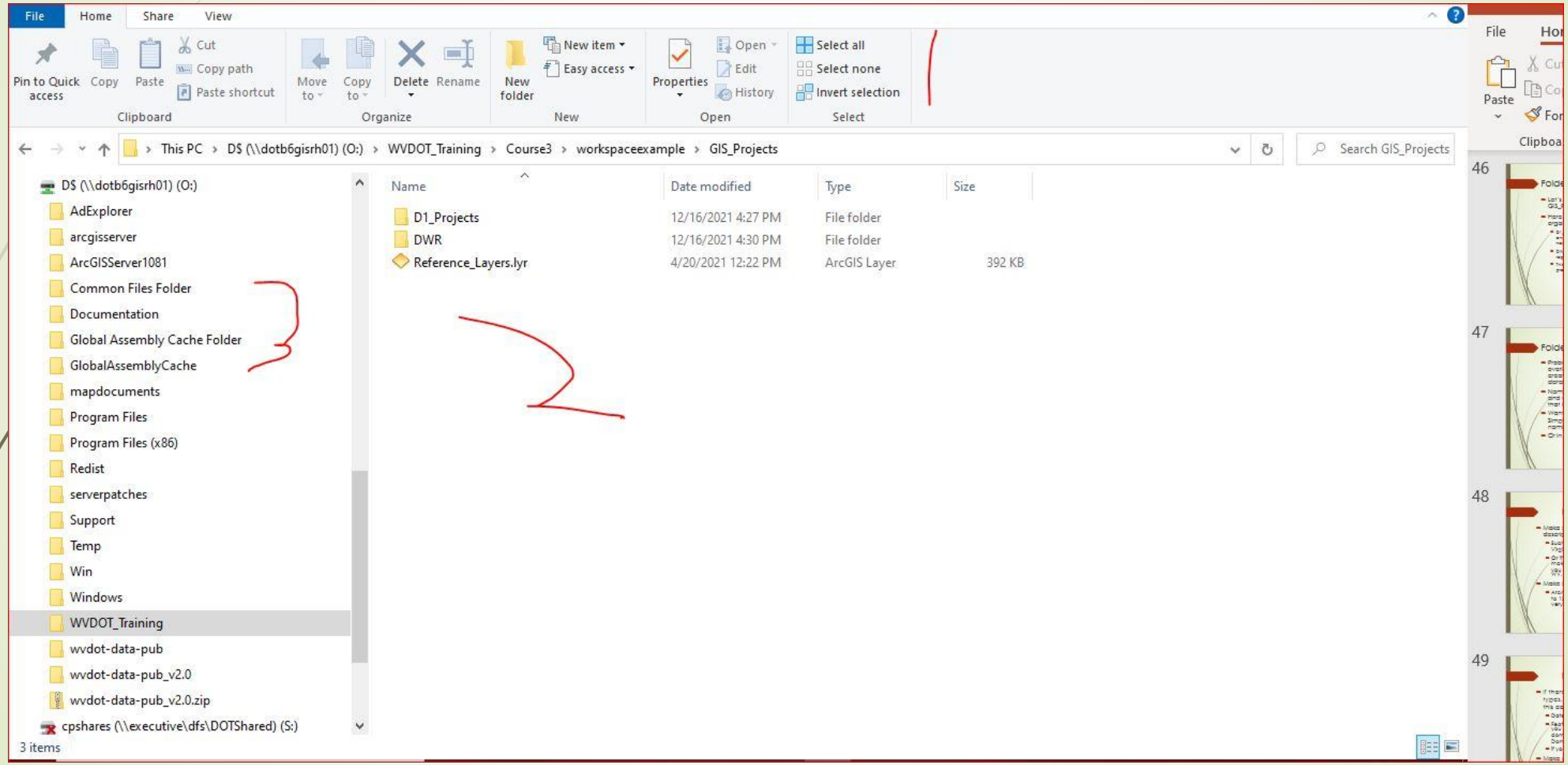
Anatomy of a Shared Directory

- A Shared Directory consists of a:
  - Top tool bar which allows the user to:
    - ✓ Add, copy, paste, select, delete and rename subfolders and features
    - ✓ View properties of the main directory or any selected subdirectories
    - ✓ Share with, remove access to, email, zip, burn to disc, print or fax a directory or subdirectory
    - ✓ Configure the file share view, icon size, folder and icon groupings, columns, and display settings such as file name extensions and hidden folders and directories
  - Workspace which allows the user to
    - ✓ Access, view, create, manage, and organize content for the shared directory
    - ✓ Create new subdirectories or folders
    - ✓ Access the properties of the folder or object including assigning and sharing folders.

Anatomy of a Shared Directory

- The Quick Access Toolbar, which was covered briefly in the beginning of this lesson, is used to:
  - ✓ Access frequently used directories stored on the PC such as the C drive and other built-in hard drives.
  - ✓ Create, view, and access existing shared network files.
  - ✓ Access the directory tree.
- There are 4 steps that go into creating a shared directory:
  - Planning
  - Content development
  - Assigning access and permissions
  - Sharing the folder

Shared Directory Anatomy



Planning

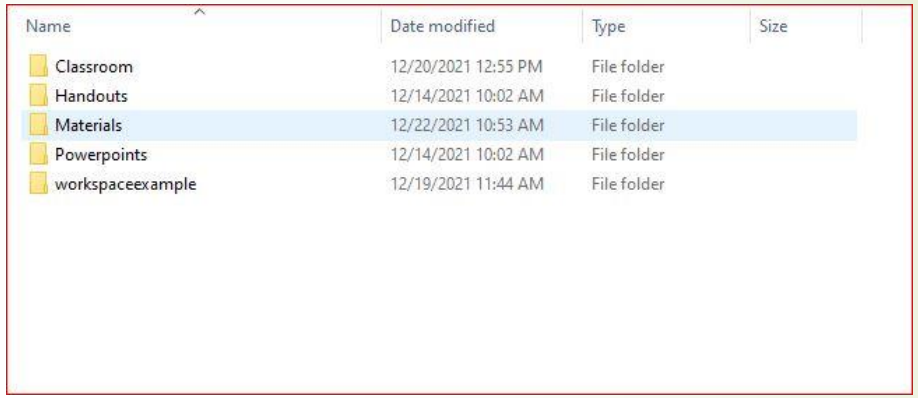
- The first and most important step in developing any shared folder.
  - It defines
    - ✓ Directory structure and layout.
    - ✓ Whether subdirectories will be needed in the share and if so, how many.
    - ✓ Naming conventions and schemes for the content in the shared directory.
  - It determines
    - ✓ What information and the format that information will be stored in (geospatial and non-geospatial datasets, finished goods, mapping document or project, etc.).
    - ✓ Who will have access to the shared directory and subdirectories, and which subdirectories the user will need access to.
    - ✓ What level of access (read, write, full, etc.) the user will need.

Planning Shared Directory Definitions

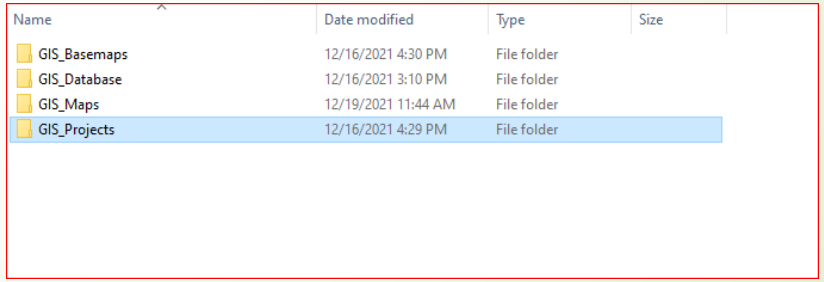
- There are some terms used with shared directories that are important to know.
  - Directory: The main container or folder housing all subfolders and content being shared.
  - Subdirectory: Any folder that resides within the main directory used to organize and store like datasets or features.
  - Folder and Directory Structure: The way folders, subfolders, data, etc. are organized within a directory for ease of access.
  - File: The common storage unit where programs, data, and finished products are written to, accessed from, or viewed.
    - Usually some type of specialized software is needed to access them.
  - Extension: A 3 or 4 character suffix that identifies the type of feature it is and its intended purpose(use).

Planning: Shared Directory Structure

- Open up the course 3 share if it isn't already opened.
- It consists 5 subdirectories:
  - Classroom
  - Handouts
  - Materials
  - PowerPoints
  - Workspaceexample



- To investigate what the folder structure looks like, double click on the workspace example folder.
- This is a replica of a District's GIS Share. It contains different subdirectories including:
  - GIS_Basemaps
  - GIS_Data_Bases
  - GIS_Maps
  - GIS Projects



- Like the previous Course 3 shared directory, these are examples of how a folder structure should look. But what goes into making an effective folder structure ?

Planning: KISS Method

- When creating anything in GIS, especially something used to house data and content, the most important thing to keep in mind is that you are trying to convey a message to a broad group people with different technical capabilities.
- So, keep it simple and straight forward.
- The shared folder or content should:
  - Be organized in a logical fashion.
    - ✓ Content and data that have similar specific roles or function should be housed together (e.g. geospatial data should be housed with geospatial data, PowerPoint presentations should be housed with PowerPoint presentation, etc.).
    - ✓ Content and data that have a similar theme should be housed with each other (e.g. all content and data for paving projects should be housed in a folder named Paving Projects; all transportation data should be housed in a folder called Transportation, etc.).
    - ✓ The number subdirectories created should match up to how the shared folder is organized. For example, if you organized data by projects, the number of folders should match up with the number of projects.

Planning: KISS Method

- Be readily and easily accessible to the audience.
  - ✓ Limit the number of clicks required to access content by limiting the levels of subdirectories underneath the shared directory.
    - The more subdirectories below the shared directory, the less likely someone will want to access the data or content.
    - However, there are exceptions. For example, in the GIS_Basemaps there are two subdirectories that house the corresponding basemap document, ArcMap and ArcGIS Pro Projects.
    - Click on GIS_Maps Here you can easily access several static maps.
- Have a clear and concise name that aptly describes the use or role of the content being housed in the subdirectory.
  - ✓ A folder containing content about airports in West Virginia would be named WV_Airport.
  - ✓ A folder containing handouts for this course will be named handouts for this course
- Follow ESRI Naming Convention for the names of the shared directory, its subdirectories, and its content.

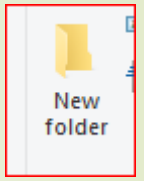
ESRI Naming Convention

- All names must begin with a letter not a number.
- They cannot have any special characteristics such as an asterisk, percent sign, etc.
- They cannot contain spaces. If you want to use two words, use a _ or – .
- They cannot have reserved words such as Abort, Begin, Bernoulli, etc.
- Names should be limited to 32 characters although12 or more characters can cause problems.

https://pro.arcgis.com/en/pro-app/2.8/tool-reference/tool-errors-and-warnings/001001-010000/tool-errors-and-warnings-00426-00450-000447.htm

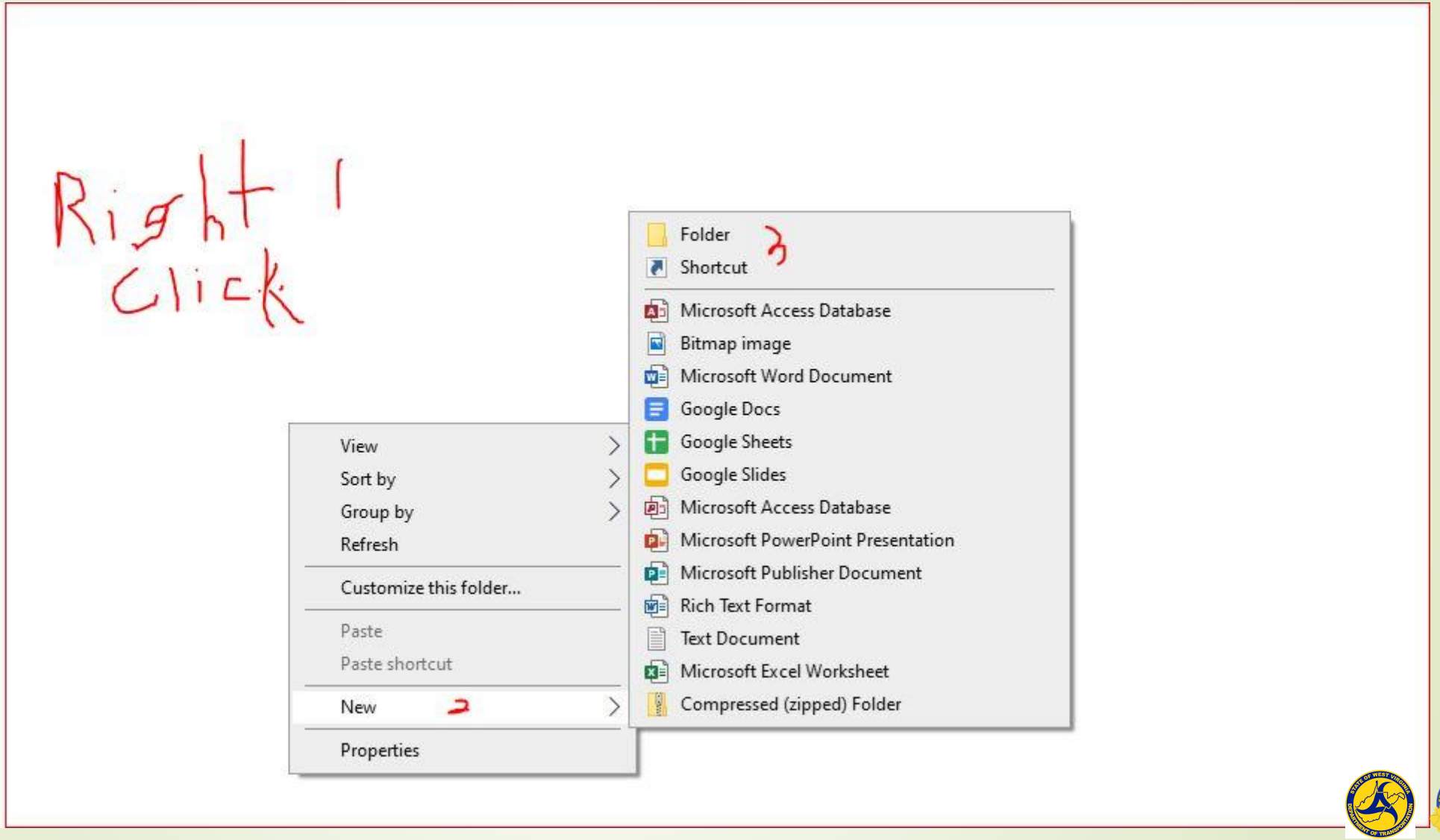
Creating a Folder

- There are two ways to create a folder.
  - On the top toolbar on the home tab, there is a button called New Folder. Click on it.
  - Right click anywhere in the white part of the workspace.
    - Select new
    - Then select folder



- I use the second method more often as it allows the user not only to create a folder, but to create other content such as:
  - Documents
  - ZIPS
  - Spreadsheets
  - Shortcuts

Creating a Folder: Method 2



Folder Structure: Exercise

- Scroll back out of the workspace example and go to classroom.
- This is where the corresponding exercises to the lessons are located. Create a folder and name it Course3_yourinitials.
  - Example: Course3_AD
  - If there is more than one person with the same initials, use a middle initial or another identifier such as unit, district, etc.
- This folder will be needed for later parts of the course involving data creation.
- Open this folder up and create two subdirectories. Name them:
  - GIS_Data
  - GIS_Workspace
- Return back to the classroom folder.

Content Development

- The meat and potatoes of any shared directory development.
- Involves creating and adding the materials being shared to the sharefolder.
- The materials that can be added and shared at this step include:
  - Data – geospatial and non geospatial
  - Related data products – layers, downloadable features, etc.
  - Information – PowerPoint presentations, how-to documentation, etc.
  - Maps and corresponding map documents or map projects
  - Stand-alone applications
- This course will cover sharing data.

Assigning Access and Permissions: Security

- This step addresses the following questions:
  - Who should have access to this shared directory?
  - Which directories and subdirectories will they need access to?
  - What level of access (permissions) will they need in these directories and subdirectories?
- There are two models used to assign roles and permissions for a shared directory.
  - Hierarchical Permission Model
  - Explicit Permission Model

Hierarchal Permission Model

- Similar theory to the folder structure or hierarchy where you have a root folder that houses subfolders that may house additional sub folders.
- The Hierarchal Permission Model consists of:
  - Assigning user access and permissions for the root shared folder that passes down automatically to any subfolder residing in it.
  - Also referred to as inheritance, trickle-down rights, or parent and child model.
- Advantages
  - Simple to set up as all access and permissions are centralized.
  - Do not have to worry about knowing what level of access is assigned to each folder and which people have this access.
  - Everyone who has access to this share folder has the same level of permission.

Hierarchal Permission Model

- Disadvantages
  - Difficult to customize or remove access to subdirectories that everyone does not need access to.
  - Hierarchal permissions eclipse explicit permissions for a folder unless the inheriting permission is turned off.
    - This means that the level of access (permissions) set at the top folder (root) will be the ones recognized for all folders even if additional access (permission) is given to an individual.

https://www.ntfs.com/ntfs-permissions-explicit.htm#:~:text=Explicit%20permissions%20are%20permissions%20that,child%20of%20a%20parent%20object

https://www.panorama.com/nectoproduct/v11/help_en/source/Permission_Hierarchy_and_Inheritance.htm#:~:text=When%20a%20user%20has%20multiple,the%20strongest%20of%20the%20permissions

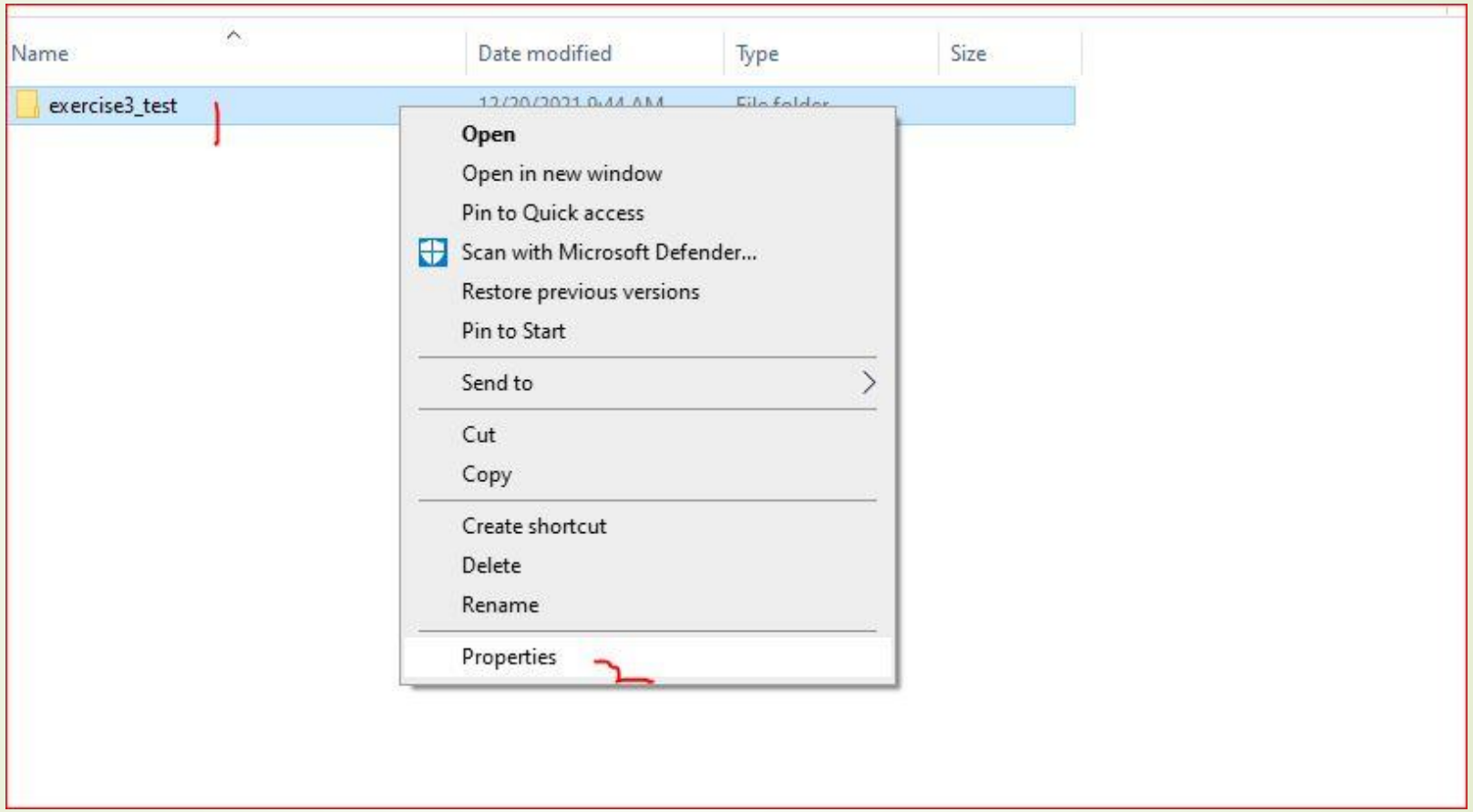
Explicit Permission Model

- Explicit Permission includes:
  - The default permissions assigned when the folder or file is created.
  - A special level of access assigned to an already created folder or file that goes beyond the base level of permissions assigned to it and is given to a specific group of individuals.
- Think of it as the a-la-carte assigning.
- Advantages
  - Can limit specific roles to certain users for a subdirectory. For example, if there is a geodatabase everyone should be able view but not edit, you can create an explicit permission to allow a small group of users to write and modify the folder.
- Disadvantage
  - Harder to manage. You cannot set up blanket permissions. You have to know which user has access to each folder and what permission they have.
  - Hierarchal permissions eclipses explicit permissions on a folder unless " Inheriting Permission" is turned off.
    - This means that the level of access (permissions) set at the top folder (root) will be the ones recognized even if additional access (permission) is given to an individual.

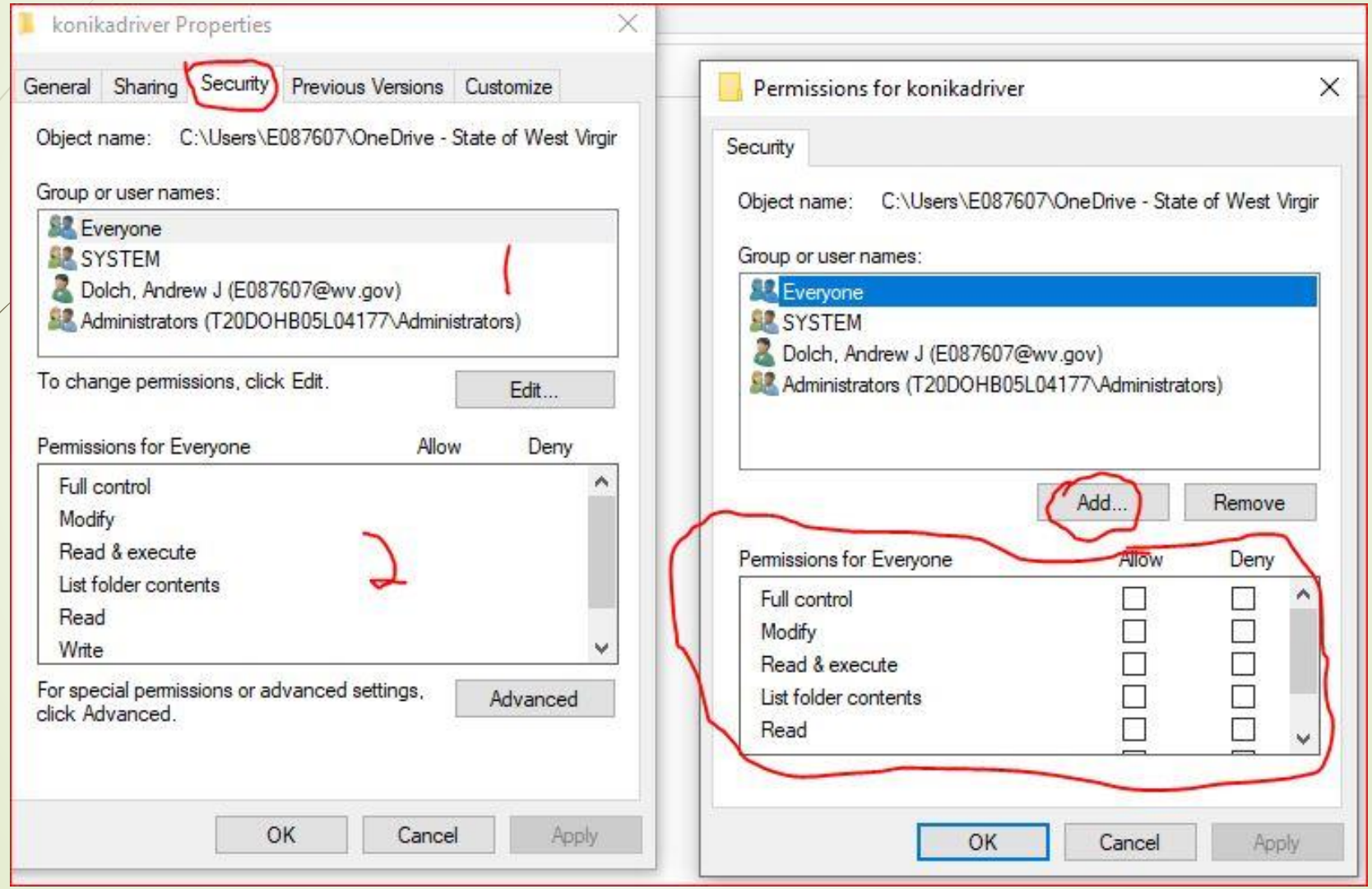
Exploring Adding Users and Permissions

- Let's explore assigning permissions.
- Right click on Course3_yourinitials and select properties.
- This will bring up the Properties screen which allows the user to
  - View and customize attributes of the folder including:
    - ✓ Making it
      - Hidden
      - Read-only
      - Compressed to save disk space
      - Encrypted
    - ✓ Customizing the look of the folder
    - ✓ Customizing what the folder will be used for (photos, files, etc.)
  - View details
  - Set security
  - Share datasets

Exploring Adding Users and Permissions

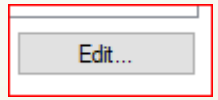


Parts of a workspace – Properties

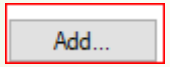


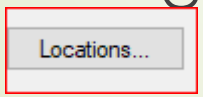
Security Tab

- Click on the Security Tab.
- Here you can:
  - Grant and remove user access to the shared folder.
  - Grant and deny permissions to a user
  - Select Advance Security Settings
    - Enable and disable inheritance
    - Assign Permissions and Access to users
    - Audit the object and users in the object
    - Assign effective permissions to a user, group, or device
- Click on the Edit Tab.



Adding Users

- This brings up the Control tab where the user can:
  - Add and Remove User and Groups.
  - Assign or deny permissions.
- Click on add. 

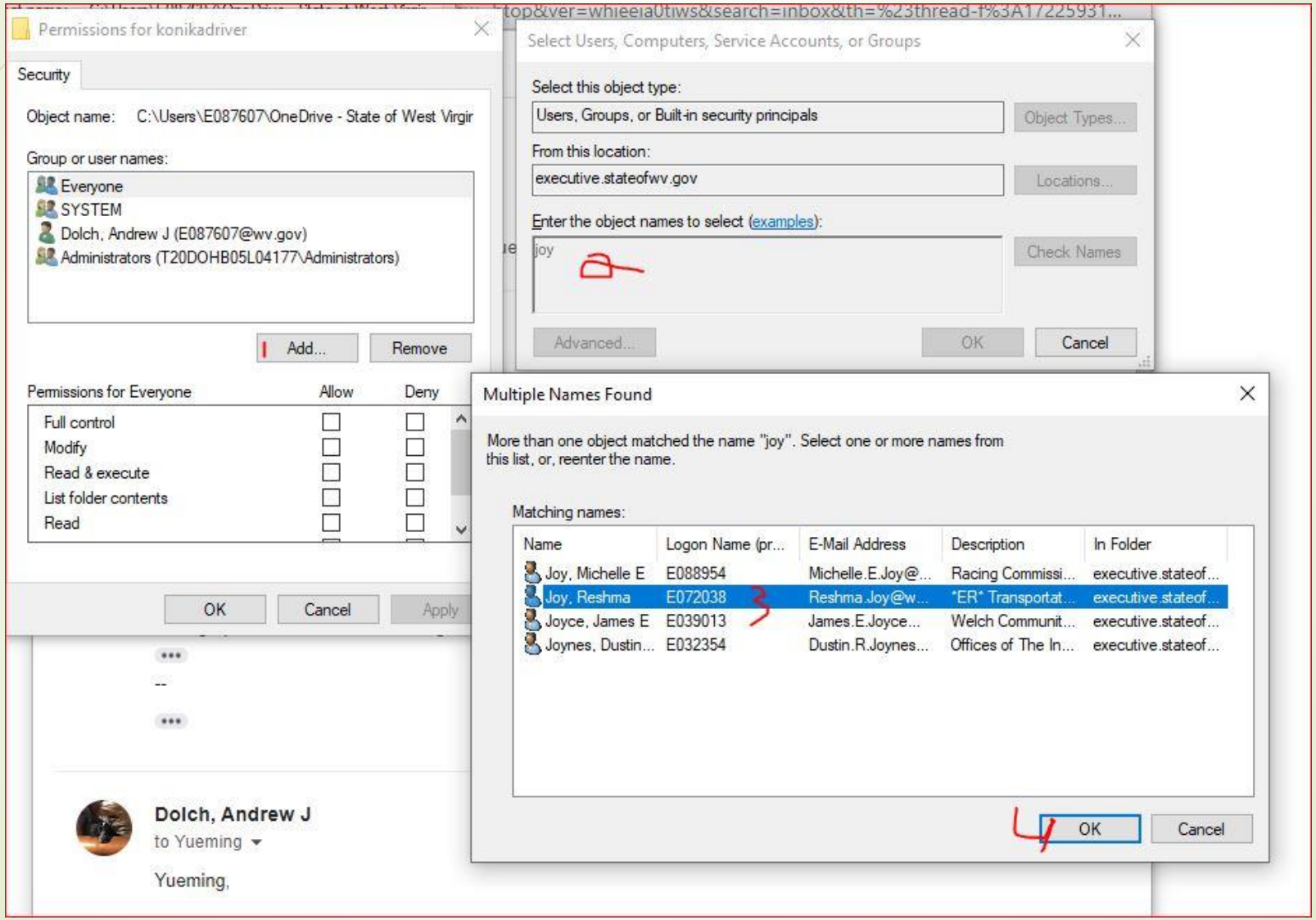
- Another screen will pop up where the user can add specific users, groups, or built-in security roles from:
  - A Local Computer
  - A Domain
  - Other network locations
- To switch between the different network locations, select Locations and then navigate to the local workstation, domain, or other network. 

Adding Users and Permissions

- Let's go down to the bottom and type in Joy and click screen that allows people to add users.
- Click on Reshma and hit ok.
- Let's go ahead and add me. Type in Dolch.
- It should look like the following slide. Now that we have added these users, go ahead and click OK.
- Two new people should show up. Go ahead and add permission to these two people.
- Select Reshma Joy and go down to permissions.
- A group of permissions will show up. By default the user has read and write related permission. These include:
  - Read and Execute
  - List Folder Content
  - Read

Let's explore these permissions further.

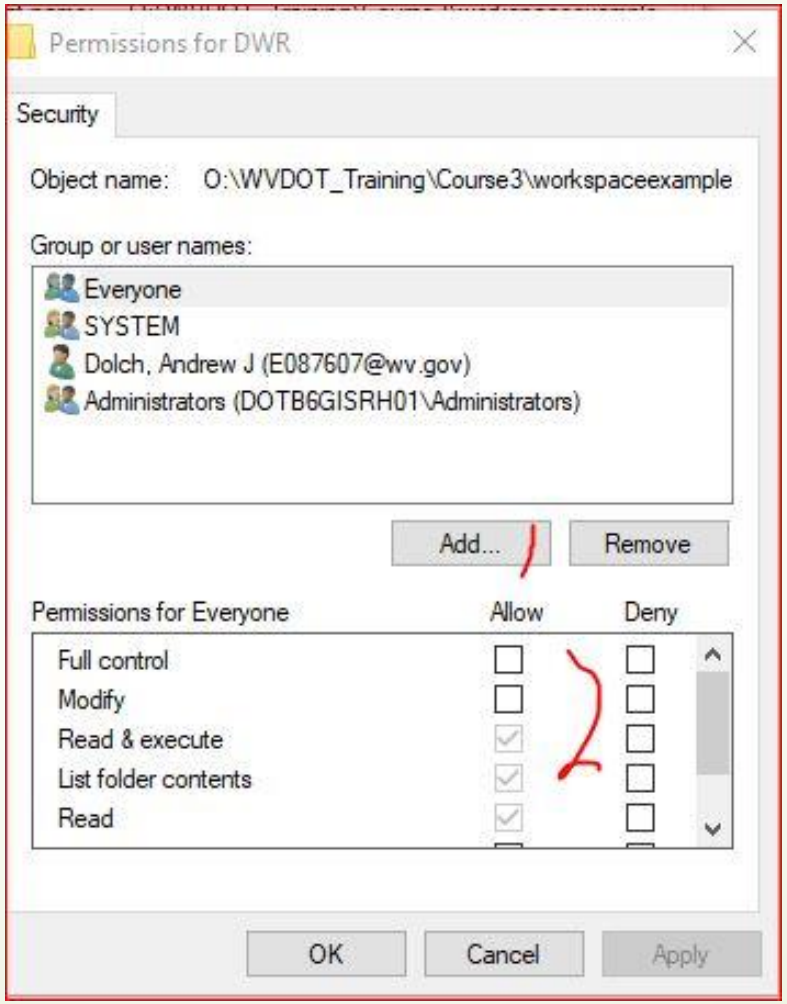
Adding Users



Adding Permissions

- There are 5 permissions.
  - Full Control – Full access to read, write to, change and delete a folder or file (God Credentials).
  - Modify: Permits adding files and subdirectories (writing to) to the folder.
  - Read and Execute – Permits viewing, listing and accessing the folder, its subfolders and the contents in these directories and subdirectories.
  - List Folder Content – Permits viewing and listing of files, subfolders, as well as executing of files.
  - Read – Viewing, listing and accessing the folder, subfolder, and its contents.
  - Write - Permits adding files, subfolders (writing to the folder)
  - Special permissions – Permissions assigned by the administrator.

Parts of a Workspace – Adding Permissions

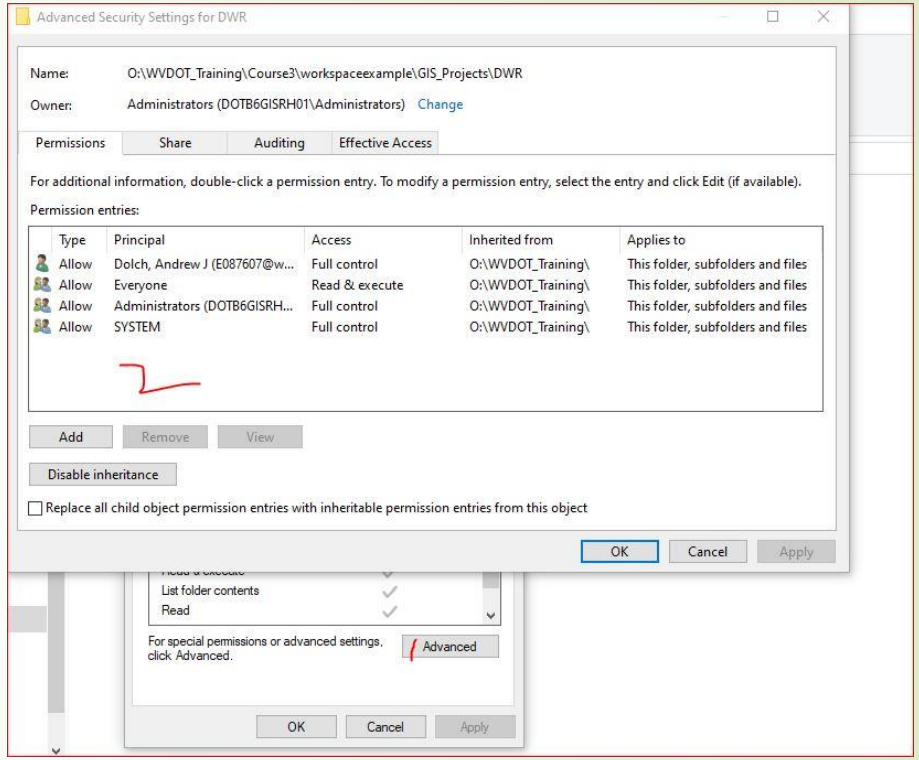


Adding Permissions

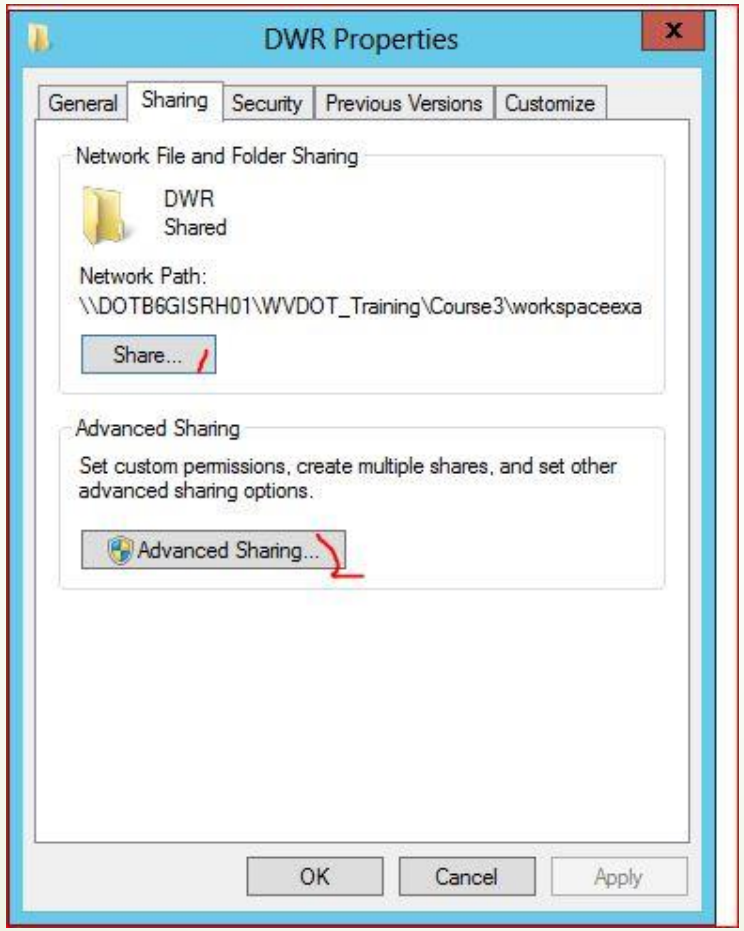
- Along with these permissions, the user creating the share folder can:
  - Allow and deny users certain permissions.
- Give Reshma the basic 3 permissions (Read, Read & Execute, List Folder Contents) + Write
- Now focus on Andrew Dolch. Give him the 3 basic permissions + Full Control, Modify and Write.
- When done, click apply. We now have two users.

Parts of a Workspace – Security

- When you assign permissions in Microsoft, it uses the hierarchal structure where the permissions set at the root level trickle down to each of the subdirectories.
- To set specific permissions you need to go into the permission of each folder and select advance table and then disable inheritance.
- With inheritance disabled, specific permissions can be set.



Sharing Tab


DWR Properties
General
Sharing
Security
Previous Versions
Customize
Network File and Folder Sharing
DWR
Shared
Network Path:
\\DOTB6GISRH01\WVDOT_Training\Course3\workspaceexa
Share...
Advanced Sharing
Set custom permissions, create multiple shares, and set other advanced sharing options.
Advanced Sharing...
OK
Cancel
Apply

Sharing the Folder

- The Final Step in creating a shared directory is sharing the directory itself.
- This involves two actions:
  - Defining which users, groups, etc. will have access to the directories IE how the directory will be shared.
    - ✓ Specific Users or Groups: Limits access to certain people and groups within an organization.
    - ✓ Organization level (Usually ArcGIS Enterprise): Limits access to people on the network domain.
    - ✓ Everyone: Access is given to any user regardless of whether they are on the domain or not.
  - Configuring the sharing properties of the folder including:
    - ✓ Limiting the number of users accessing the data at a given time.
    - ✓ Configuring which features and programs will be cached when the folder is offline.
    - ✓ Assigning basic permissions to specific users or groups.
      - Full Control – user has both read and change permissions to the shared directory and its contents.
      - Change – user may modify the shared directory and its content.
      - Read – user can only read, view, and access the shared directory and its contents.

Sharing the Folder

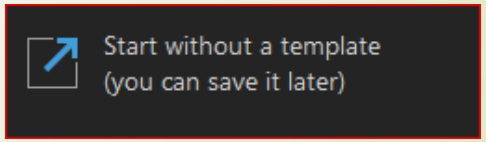
- When sharing a folder, there are a couple of things to keep in mind.
  - The person sharing the document must be logged onto the machine directly or remotely.
  - Once the directory is shared, it is near to impossible to remove the share.
  - All sharing properties and tools are accessed from the folder's properties field.
  - All shares, as you learned in the beginning of the course, are accessed in following way:
    - Internally: \\servername\share

      Example Photos: \\dotb6gis
    - Externally: https:\\websitename\share
  - If sharing to the internet, make sure that there is a record added in the internet directory.
- https://support.microsoft.com/en-us/windows/file-sharing-over-a-network-in-windows-10-b58704b2-f53a-4b82-7bc1-80f9994725bf

Section 3: Database Design, Creation, and Management

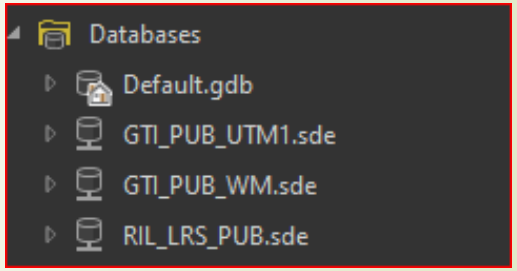
Geospatial Data Review

- Question: Now that we have the shared folder infrastructure in place, what do we store in it?
  - Answer: Geospatial Data used in the map products and applications.
  - But how do we create these data?
- As we learned earlier, Geospatial Data:
  - Are data that have a geographical (coordinates) and spatial (area, length, etc.) component associated with them.
  - Come in the following formats:
    - ✓ Raster
    - ✓ Vector
  - Vector Data, which we will be working with, are organized and stored in two ways:
    - ✓ Standalone Shapefile
    - ✓ Feature Class residing within a geodatabase
- If not opened, open ArcGIS Pro and select a new project.



Exploring GTI_PUB_UTM

- Next, add GTI_PUB_UTM.
  - Right click on Database Folder
  - Select add new Database Connection
  - Type in the following:
    - ✓ Database Platform: SQL Server
    - ✓ Instance: DOTB6GISDB01
    - ✓ Authentication Type: Operating System Authentication
    - ✓ Database: GTI_PUB_UTM
    - ✓ Click OK.
    - ✓ Right click and select rename and rename it GTI_PUB_UTM.
  - Open up GTI_PUB_UTM and Boundaries.

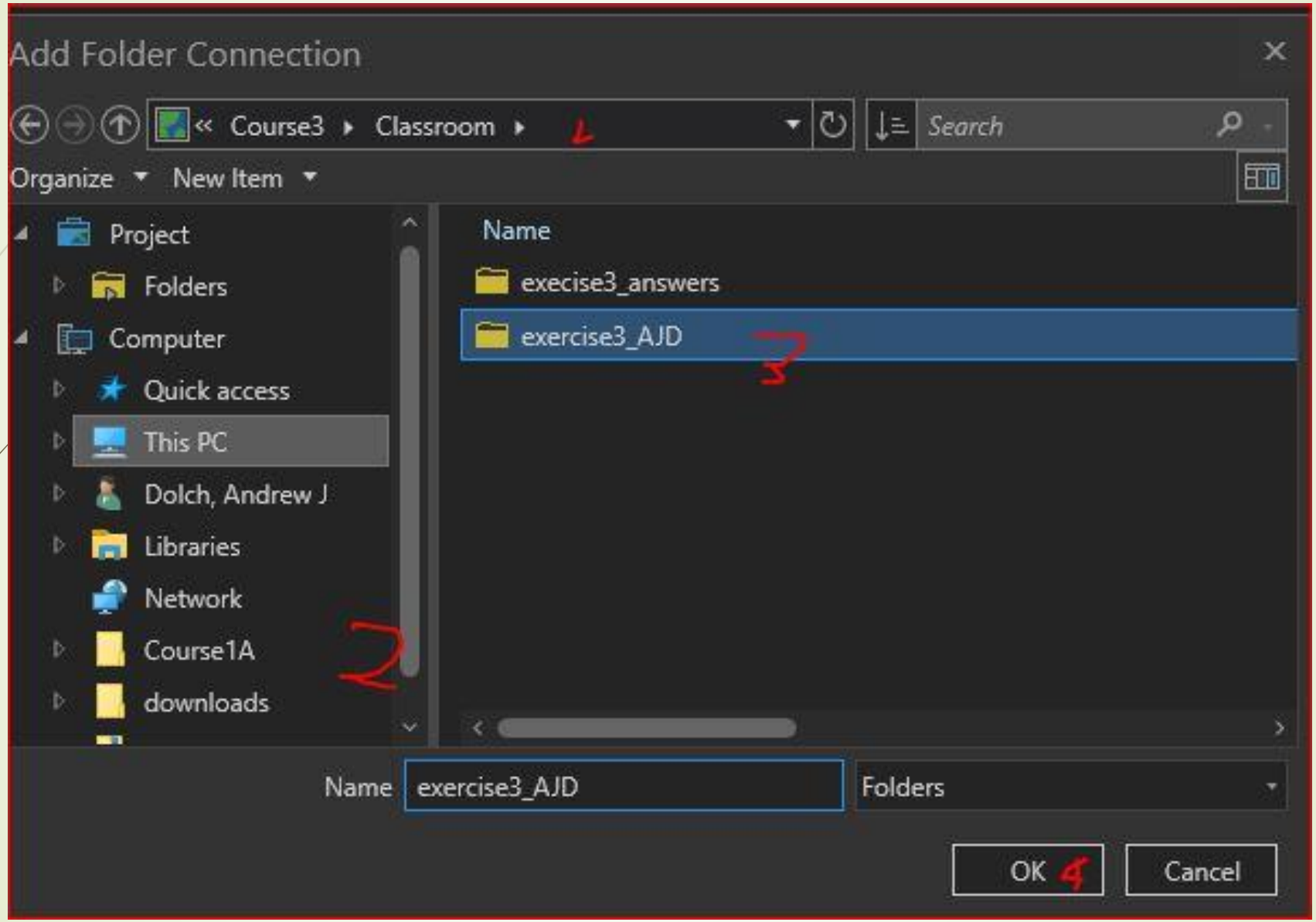


Exploring GTI_PUB_UTM

- This is an example of a typical geodatabase housing features used in mapping projects.
- It consists of:
  - A variety of different vector, raster, and tabular (geospatial and non-geospatial) feature classes.
  - Feature classes containing a shared theme, use, project type, etc. grouped into feature datasets.
- So, how do you create a geodatabase and the feature datasets and classes residing in it?

Creating the Geodatabase

- Before creating any geodatabase, you need to:
  - Define how the geodatabase will be used and shared (small group, project specific, entire enterprise).
  - Define the amount and scope of data needed to be housed in the database.
  - Identify the location of the data.
- For us, it is very simple. We want to have a geodatabase that will be edited by one and shared among the course.
  - Specifically, we want the file geodatabase in the shared folder we created in the previous part of this course.
  - Right click on folders and select add a folder connection. This time navigate to the Course3 folder → Classroom → Exercise3_Your initials.
  - Click Add.

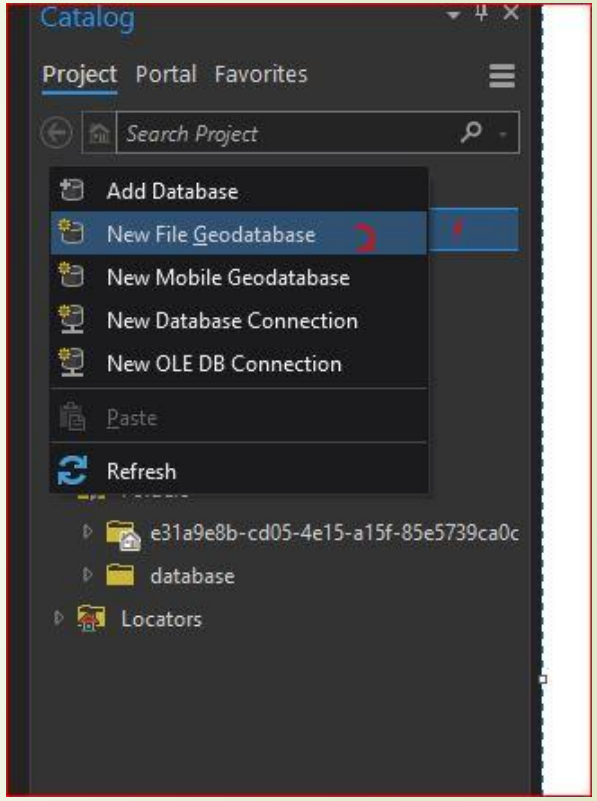

Add Folder Connection
Course3 ▸ Classroom ▸
1
Search
Organize
New Item
Project
Folders
Computer
Quick access
This PC
Dolch, Andrew J
Libraries
Network
Course1A
downloads
2
Name
execise3_answers
exercise3_AJD
3
Name
exercise3_AJD
Folders
OK
4
Cancel

Creating the Geodatabase

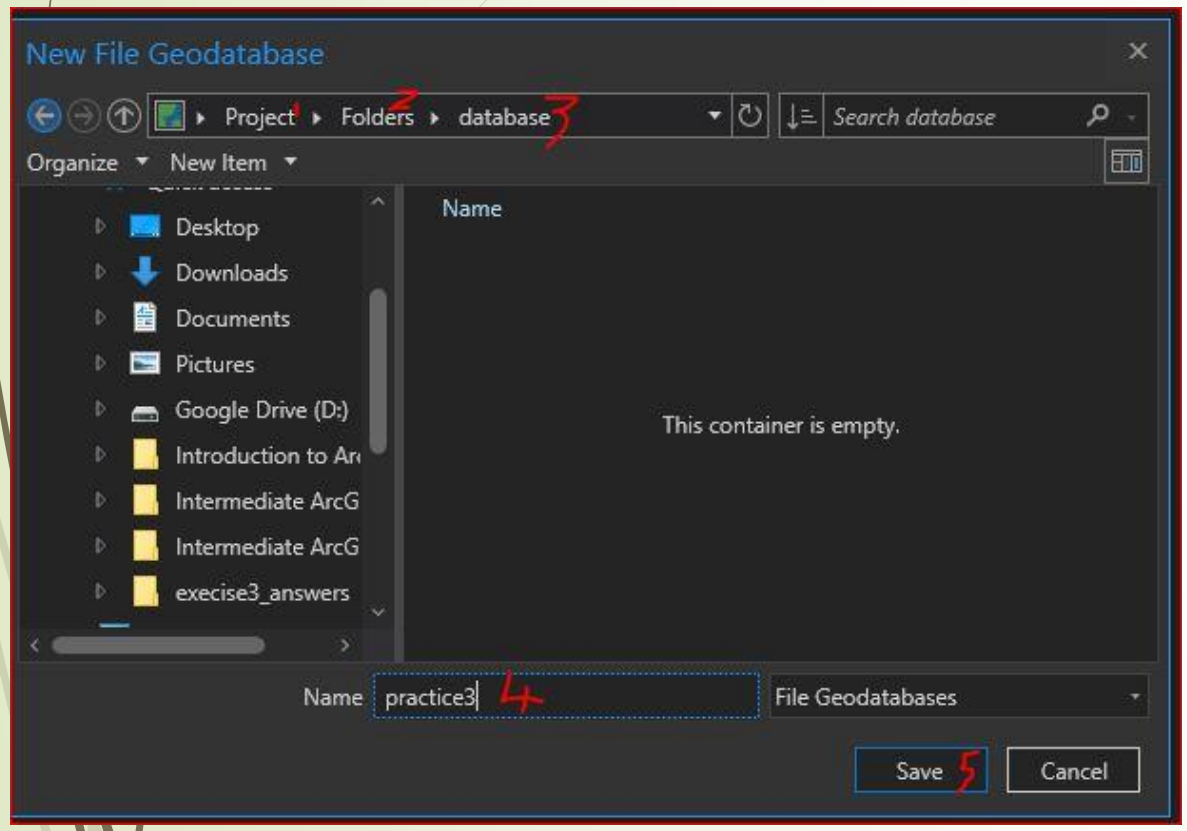
- We have added the folder and connected to one of the enterprise geodatabases.
- Next, we will create a new file geodatabase. File geodatabases:
  - Make up the majority of the geodatabases you will create geospatial data in.
  - Consist of a collection of like files in a folder used for storing, querying, and managing spatial and non-spatial data including:
    - ✓Feature Classes and datasets
    - ✓Mosaic datasets
    - ✓Raster datasets
    - ✓Tables
  - Are used for small projects and sharing data among a small group.
- ESRI Definition of File geodatabase

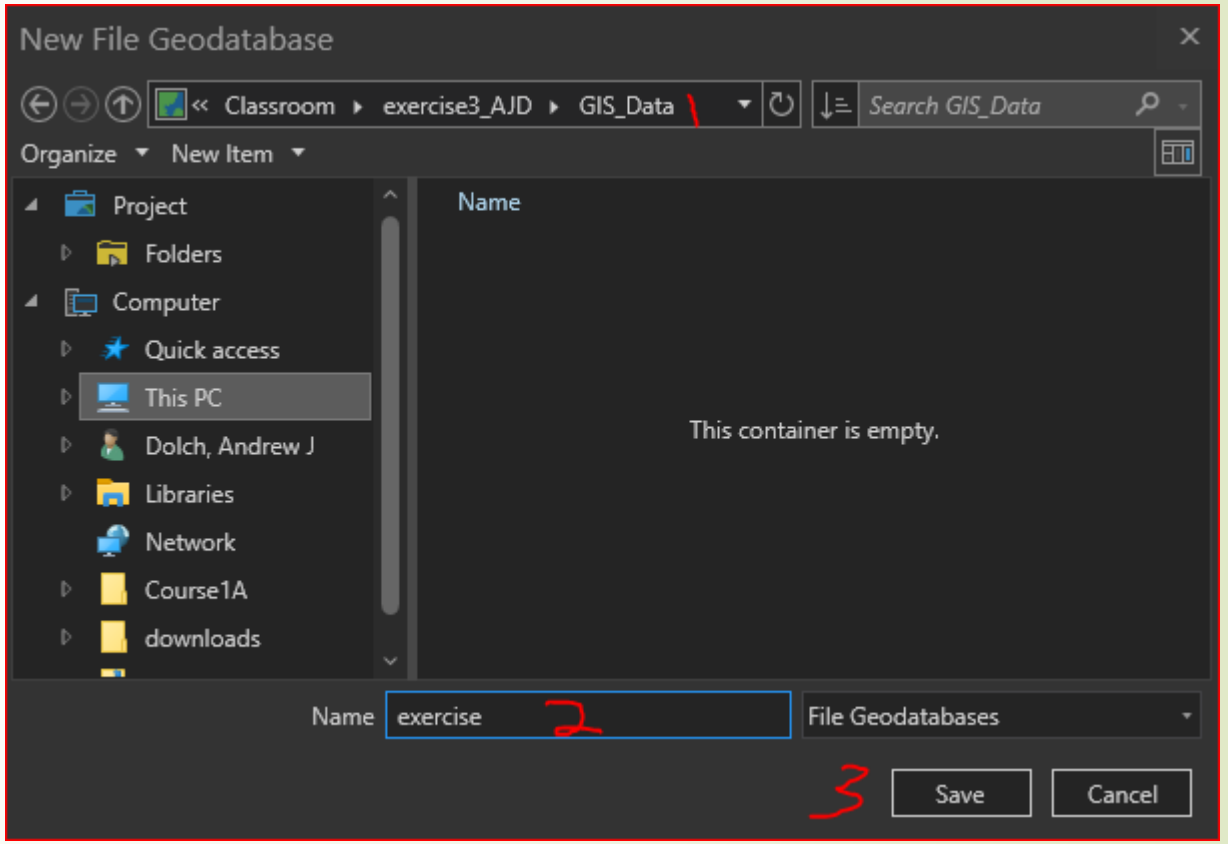
Creating the File Geodatabase

- Right click on the database folder and select New File Geodatabase.
- Navigate to the folder we created in the last section: (\\dotb6gisrh01\WVDOT_Training\Course3\Classroom \exercise3_your initials\)
- Here we are going to create the following geodatabase Practice3.
- Click Save. It should look like this.
- Create a second one in that location and call it exercise.
- The finished product should look like these.

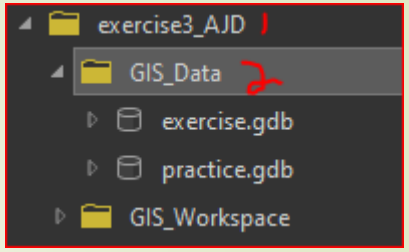


Introduction to File Geodatabase

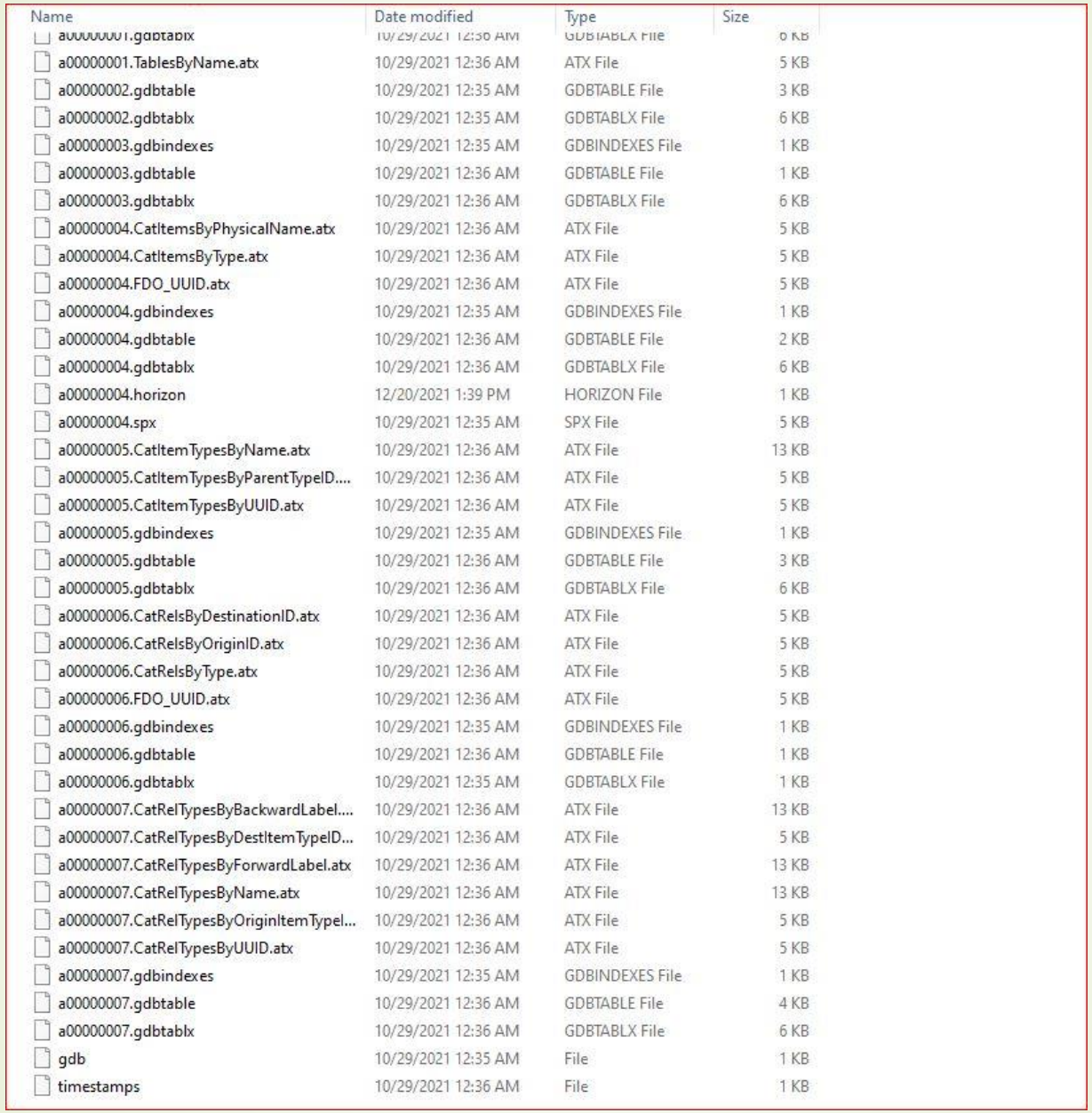




Introduction to File Geodatabase



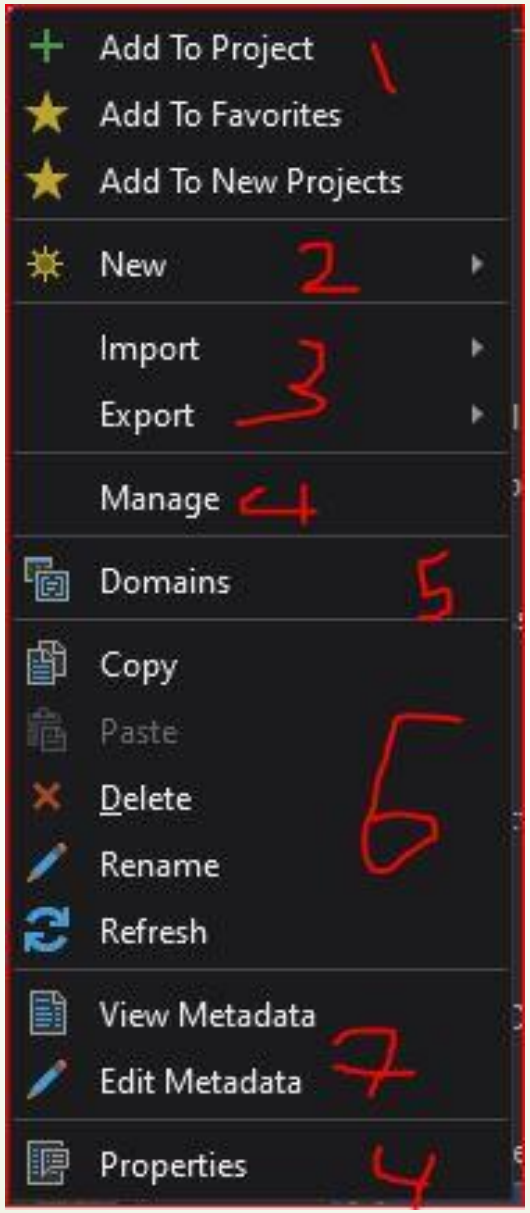
- Next, access the folder drop down on the catalog pane and navigate to the GIS_Data Folder.
- There should be two new file geodatabases called exercise and practice. These will be our workspace for the rest of this course
- Open practice.gdb. As you can tell, there's noting in it. Now bring up the folder browser and navigate to the folder location of the exercise and practice.gdb.
- This looks different than what is currently inside the practice.gdb on ArcGIS Pro.
- These are the tables, indexes, geometries, and geodatabase structures used to house, organize, and define different features within the geodatabase.
- Close out of it and return to ArcGIS Pro.



Name	Date modified	Type	Size
a00000001.gdbtablx	10/29/2021 12:36 AM	GDBTABLX File	6 KB
a00000001.TablesByName.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000002.gdbtable	10/29/2021 12:35 AM	GDBTABLE File	3 KB
a00000002.gdbtablx	10/29/2021 12:35 AM	GDBTABLX File	6 KB
a00000003.gdbindexes	10/29/2021 12:35 AM	GDBINDEXES File	1 KB
a00000003.gdbtable	10/29/2021 12:36 AM	GDBTABLE File	1 KB
a00000003.gdbtablx	10/29/2021 12:36 AM	GDBTABLX File	6 KB
a00000004.CatItemsByPhysicalName.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000004.CatItemsByType.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000004.FDO_UUID.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000004.gdbindexes	10/29/2021 12:35 AM	GDBINDEXES File	1 KB
a00000004.gdbtable	10/29/2021 12:36 AM	GDBTABLE File	2 KB
a00000004.gdbtablx	10/29/2021 12:36 AM	GDBTABLX File	6 KB
a00000004.horizon	12/20/2021 1:39 PM	HORIZON File	1 KB
a00000004.spx	10/29/2021 12:35 AM	SPX File	5 KB
a00000005.CatItemTypesByName.atx	10/29/2021 12:36 AM	ATX File	13 KB
a00000005.CatItemTypesByParentTypeID....	10/29/2021 12:36 AM	ATX File	5 KB
a00000005.CatItemTypesByUUID.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000005.gdbindexes	10/29/2021 12:35 AM	GDBINDEXES File	1 KB
a00000005.gdbtable	10/29/2021 12:36 AM	GDBTABLE File	3 KB
a00000005.gdbtablx	10/29/2021 12:36 AM	GDBTABLX File	6 KB
a00000006.CatRelsByDestinationID.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000006.CatRelsByOriginID.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000006.CatRelsByType.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000006.FDO_UUID.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000006.gdbindexes	10/29/2021 12:35 AM	GDBINDEXES File	1 KB
a00000006.gdbtable	10/29/2021 12:36 AM	GDBTABLE File	1 KB
a00000006.gdbtablx	10/29/2021 12:35 AM	GDBTABLX File	1 KB
a00000007.CatRelTypesByBackwardLabel....	10/29/2021 12:36 AM	ATX File	13 KB
a00000007.CatRelTypesByDestItemTypeID...	10/29/2021 12:36 AM	ATX File	5 KB
a00000007.CatRelTypesByForwardLabel.atx	10/29/2021 12:36 AM	ATX File	13 KB
a00000007.CatRelTypesByName.atx	10/29/2021 12:36 AM	ATX File	13 KB
a00000007.CatRelTypesByOriginItemTypeI...	10/29/2021 12:36 AM	ATX File	5 KB
a00000007.CatRelTypesByUUID.atx	10/29/2021 12:36 AM	ATX File	5 KB
a00000007.gdbindexes	10/29/2021 12:35 AM	GDBINDEXES File	1 KB
a00000007.gdbtable	10/29/2021 12:36 AM	GDBTABLE File	4 KB
a00000007.gdbtablx	10/29/2021 12:36 AM	GDBTABLX File	6 KB
gdb	10/29/2021 12:35 AM	File	1 KB
timestamps	10/29/2021 12:36 AM	File	1 KB

Rules for Creating Features in Geodatabases

- Before we proceed with creating features and populating our file geodatabase, there are some basic rules for creating a file geodatabase and features residing within them.
  - The limit on characters in the name, by default, is 255; however, in practice it is 12, usually about 8-10.
  - The name of the file geodatabase, feature, or feature class should not contain any spaces in it. You will need to use an underscore _ or dash – instead.
  - The feature name or class should not begin with a number.
  - The name should be easy to understand, meaningful, and describes what is in the geodatabase.
- Start by right clicking on practice GDB.


Add To Project
Add To Favorites
Add To New Projects
New
Import
Export
Manage
Domains
Copy
Paste
Delete
Rename
Refresh
View Metadata
Edit Metadata
Properties
1
2
3
4
5
6
7
4

Introduction to File Geodatabase

- This will bring up the main geodatabase administration menu where the user can:
  - Add the geodatabase to the project, favorites or any new project.
  - Create new features and feature classes, tables, views, relationship classes, rasters, mosaic datasets and toolboxes.
  - Import and export feature classes, tables, and XML configurations.
  - Manage and view the functionality of the geodatabase including compressing, upgrading the version, and setting up a replica.
  - Create coded domains.
  - Copy, paste, edit (rename), delete, and refresh the geodatabase.
  - View and edit metadata.
- Click on domains.

Domains/Coded Domains

- Are a set of pre-defined values and rules used to:
  - Describe a field
  - Enforce data integrity
  - Better organize features
  - Constrain the values allowed for a particular attribute in a feature or table
- Can be shared across feature classes, tables, and subtypes in a geodatabase
- Consists of two types:
  - Coded: a single value (text, numeric, etc.) assigned to a specific attribute. (For example, 1 = Interstates, county 20 = "Kanawha", etc.)
  - Range: range of numeric values assigned to a specific attribute. (For example, 20 – 60 PSI in a gas line = medium pressure.)
- ESRI Description of what is a domain

Domains

- Commonly used domains include:
  - Counties
  - Sign Systems (road type)
  - Yes or No
  - Roadway Surface Type
- Let's create a domain for counties.
  - Name: Counties
  - Description: Names of counties in WV
  - Field Type: Text
  - Domain Type: Coded value domain
  - Rest Default
  - Values: Use coded list from next slide

County List

01 Barbour	20 Kanawha	39 Preston
02 Berkeley	21 Lewis	40 Putnum
03 Boone	22 Lincoln	41 Raleigh
04 Braxton	23 Logan	42 Randolph
05 Brooke	24 McDowell	43 Ritchie
06 Cabell	25 Marion	44 Roane
07 Calhoun	26 Marshall	45 Summers
08 Clay	27 Mason	46 Taylor
09 Doddridge	28 Mercer	47 Tucker
10 Fayette	29 Mineral	48 Tyler
11 Gilmer	30 Mingo	49 Upshur
12 Grant	31 Monongalia	50 Wayne
13 Greenbrier	32 Monroe	51 Webster
14 Hampshire	33 Morgan	52 Wetzel
15 Hancock	34 Nicholas	53 Wirt
16 Hardy	35 Ohio	54 Wood
17 Harrison	36 Pendleton	55 Wyoming
18 Jackson	37 Pleasants	**99 Reserved for Other Statewide Continuous features**
19 Jefferson	38 Pocahontas	

Sign System

1	Interstate
2	US
3	WV
4	CO
5	N/A
6	State Park and Forest Road
7	FANS
8	HARP
9	Other
0	MNS (Municipal Non-State)
R	Railroad (WV State Rail Authority)
T	Trail
U	USFR (United State Forest Road)

Supplemental Code

00	Not Applicable
01	Alternate
02	Wye
03	Spur
04	North
05	South
06	East
07	West
08	Business
09	North Bound (Business)
10	South Bound (Business)
11	East Bound (Business)
12	West Bound (Business)
13	Truck Route
14	Bypass
15	Loop
16	Toll
17	Ramp
18	Other
19	City Street Non-State
20	Road Under Construction
21	Footbridge
22	Historical Bridge
23	Connector
24	New/Proposed
25	Crossover (btw dual geometry)
26	Emergency Crossover
27	Left Turn Lane
28	Right Turn Lane
51	Rail Trail
99	Abandoned

* The direction will be NB, SB, EB, and WB on routes that always have dual geometry (sign system 1 and 2). The direction is 00 on routes that are bidirectional (single geometry, sign system 3 and above). Where WV or County routes switch from single to dual geometry, the main direction of travel (normally north bound or east bound) will have direction as 00 while the opposite direction will have directional characters (normally SB or WB).

** If the ramp is also part of an existing route, the routeid will remain the same as the connected route. Otherwise, the ramp routeid is the routeid for the highest sign system (interstate, us etc.) or lowest route number if in same sign system with the addition of the exit number and ramp letter. The exit number is the mile point of the exit. Mile point is also used at the end of emergency crossover routeid.

*** In creating the route layer in ArcGIS we drew lines over every segment of road. This created the possibility of additional lines not in the RIL. Currently these pieces are mainly undocumented wye segments. The decision was made to use the sequence number (exit segment) of the field to account for duplicate routeid designation. For the first instance of any route, the sequence number is blank. For the first duplicate, the sequence number would be 0001 and increment as needed (example: 0240032000200 is the first wye on route 32. If second wye present, routeid would be 02400320002000001).

**** Railroads and rail trails in the LRS are only for WV State Rail Authority lines. The county code and sign system will always be 99, and R or T respectively. Each line has a unique route number. Small spurs will be given the main line route number and a unique sub route number. The supp. code is 00 for railroads and 51 for rail trails. The direction is 00 for railroads and rail trails.

Domains

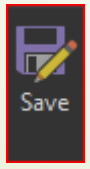
- Next, create a coded domain for Sign Systems and Districts.
  - Sign System
    - ✓ Name: SignSystem
    - ✓ Description: Roadway types in WV
    - ✓ Field Type: Text
    - ✓ Domain Type: Coded value domain
    - ✓ Values: Use coded list from previous list

Code	Description
1	Interstates
2	US Routes
3	WV Routes
4	County Routes
6	State Parks and Forest Routes
7	Federal Aid Non State Routes
8	HARP Routes
0	Municipal Non State

  - Districts
    - ✓ Name: Districts
    - ✓ Description: DOH Districts
    - ✓ Field Type: Short
    - ✓ Domain Type: Coded Value Domain
    - ✓ Values: See adjacent list

Code	Description
1	District 1
2	District 2
3	District 3
4	District 4
5	District 5
6	District 6
7	District 7
8	District 8
9	District 9
10	District 10

- Click Save.



Exercise: Creating File Geodatabase

- Now, in the database file under your Lesson3_first initial last name folder that you created, create an additional database.
- Name it: Exercise3(initials)
- Create 4 domains
  - Counties
  - Districts
  - Sign System
  - Priority
    - ✓ File Type Short
    - ✓ Coded
    - ✓ 1 = High and Critical Priority
    - ✓ 2 = Medium Priority
    - ✓ 3 = Low Priority
- Click Save.

End of Day 1

Any Questions? Thanks

Data Creation and Management: Day 2

Section 4: Introduction to Creating Feature Datasets

Recap

- In the previous sections we:
  - Reviewed data.
  - Created a shared folder and subfolders to house and organize our project.
  - Created a geodatabase file where the information we want to display resides.
  - Explored and created domains, a process that will help us organize and simplify data.
- Now we will address creating feature datasets and adding the data and information we want to share.
- First, save our project as exercise3_yourintials and save it to the GIS_Workspace folder underneath the Exercise3_yourinitials.

Recap: Feature Classes and Shapefiles

- There are multiple formats or sources that geospatial data for features can reside in. These include:
  - Shapefile
  - Feature Class
  - Feature Dataset
  - Rasters
  - Tables
  - Views
- We will review the first three sources.

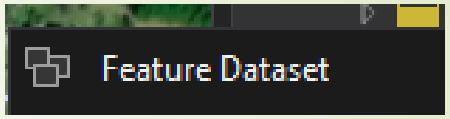
Shapefile

- As you recall, Shapefiles:
  - Are the simplest of the vector geospatial data storage vehicles.
    - ✓ Do not require any special storage areas such as a geodatabase to house data
  - Can be viewed in all GIS and most CAD software packages.
  - Are portable.
  - Consist of four stand-alone storage vehicles.
    - ✓ Shapefile (SHP): which stores the geospatial feature's geometry
    - ✓ Shape Index File (SHX): which stores the geospatial feature's columns and indexes
    - ✓ Database file (DBF): which stores the feature's data and records
    - ✓ Optional Projection (PRJ): which stores the feature's coordinate system
  - Are used mostly to share geospatial data with others .

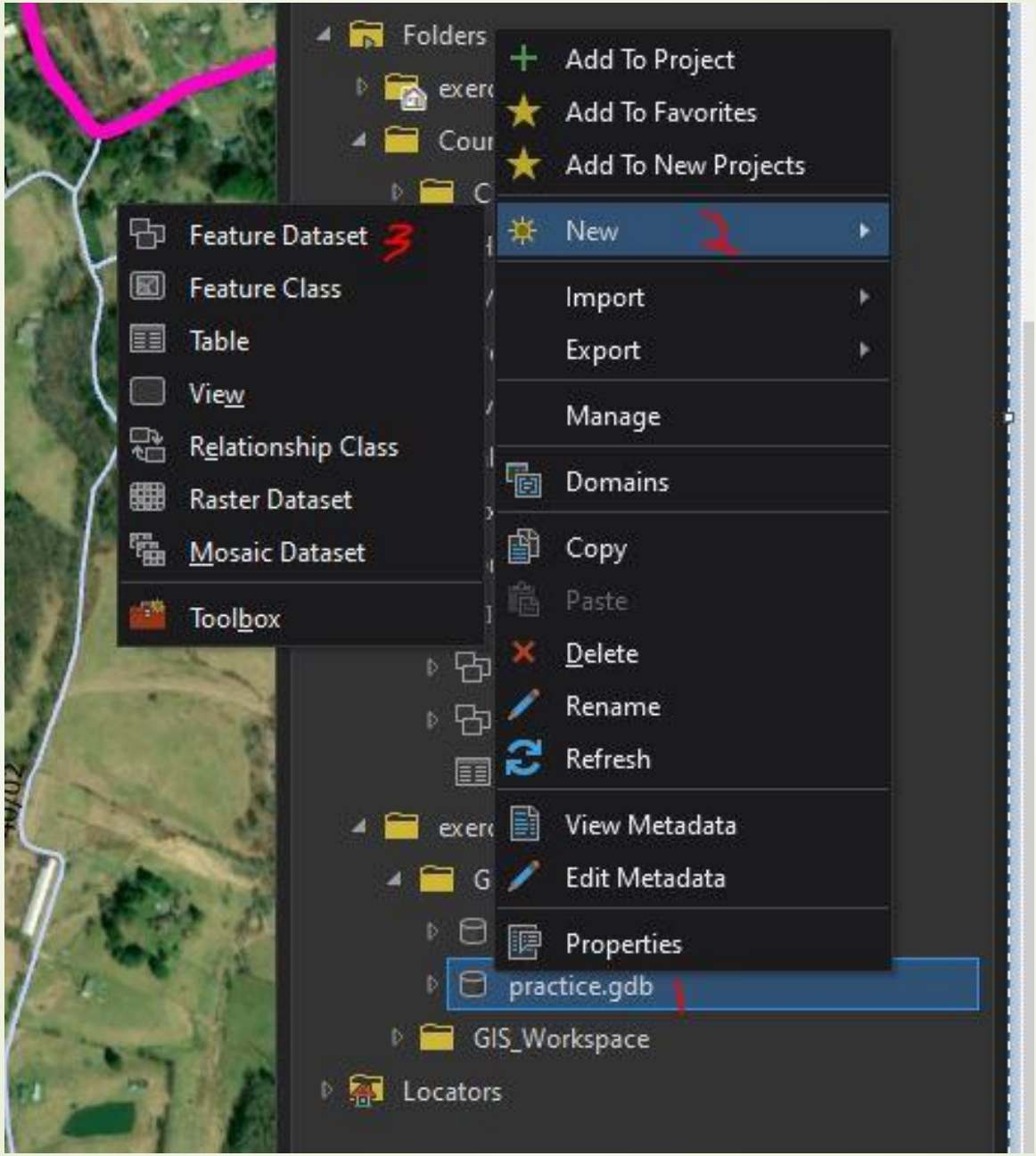
Feature Class and Feature Dataset

- Are interrelated
  - Feature Class is a collection of a single homogenous feature that contains a common set of attributes and geometry (polygons, points, lines, etc.)
  - Feature Datasets are a collection of feature classes and tables that share a common theme or use (IE boundaries, hydrology, transportation, etc.)
- Both
  - Require special storage devices (geodatabase)
  - Are proprietary ESRI Products and cannot be viewed in other GIS and CAD software
  - House specialized calculations such as linear route measurements (m values) and height (z values) that can be configured
  - Can be edited, accessed, etc. by multiple people in parallel

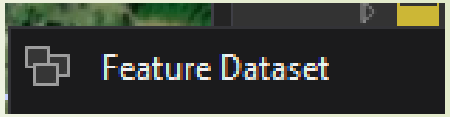
Feature Dataset



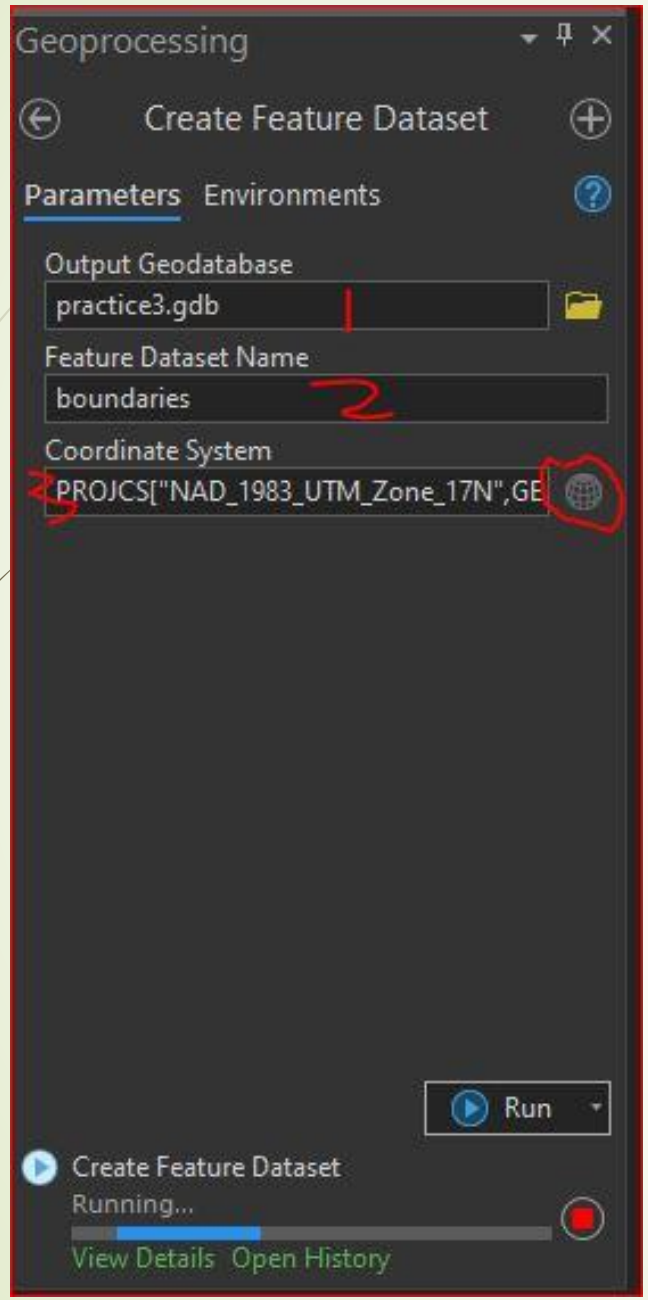
- Go ahead and create a feature dataset so we can:
  - Maintain an organized geodatabase that others can easily and quickly access.
  - Standardize feature class characteristics such as:
    - ✓Coordinate system
    - ✓Tolerances and resolutions
    - ✓Linear measurements (M) and height (Z)
- Right click on the practice geodatabase → select New → Feature Dataset
- ArcGIS Pro definition of a Feature Dataset

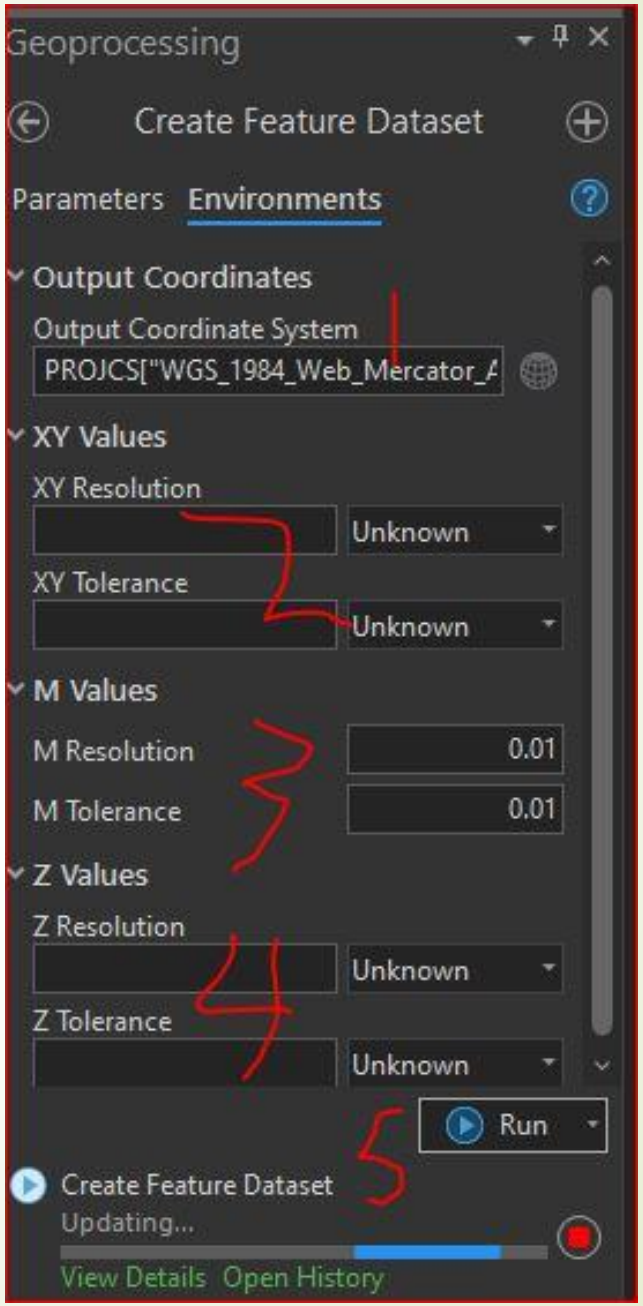

Folders
Add To Project
Add To Favorites
Add To New Projects
New
Import
Export
Manage
Domains
Copy
Paste
Delete
Rename
Refresh
View Metadata
Edit Metadata
Properties
Feature Dataset
Feature Class
Table
View
Relationship Class
Raster Dataset
Mosaic Dataset
Toolbox
practice.gdb
GIS_Workspace
Locators

Feature Dataset Creation

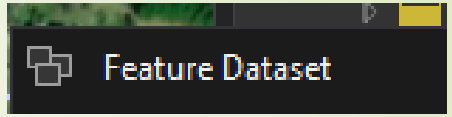


- This brings up a Create Feature Dataset Screen where we can configure:
  - Parameters such as:
    - ✓ Output Geodatabase
    - ✓ Feature Dataset Name
  - Environments or coordinate system and additional advanced features such as:
    - ✓ Resolution – the accuracy of the coordinate system (number of decimal places)
    - ✓ Tolerance – the minimum distance between points before they are equal including:
      - XY(Lat, Long)
      - Z (height)
      - M (linear measurement)


Geoprocessing
Create Feature Dataset
Parameters
Environments
Output Geodatabase
practice3.gdb
1
Feature Dataset Name
boundaries
2
Coordinate System
3
PROJCS["NAD_1983_UTM_Zone_17N",GE
Run
Create Feature Dataset
Running...
View Details
Open History

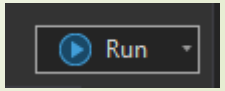

Geoprocessing
Create Feature Dataset
Parameters
Environments
Output Coordinates
Output Coordinate System
1
PROJCS["WGS_1984_Web_Mercator_A
XY Values
XY Resolution
Unknown
XY Tolerance
2
Unknown
M Values
M Resolution
0.01
M Tolerance
3
0.01
Z Values
Z Resolution
Unknown
Z Tolerance
4
Unknown
Run
5
Create Feature Dataset
Updating...
View Details
Open History

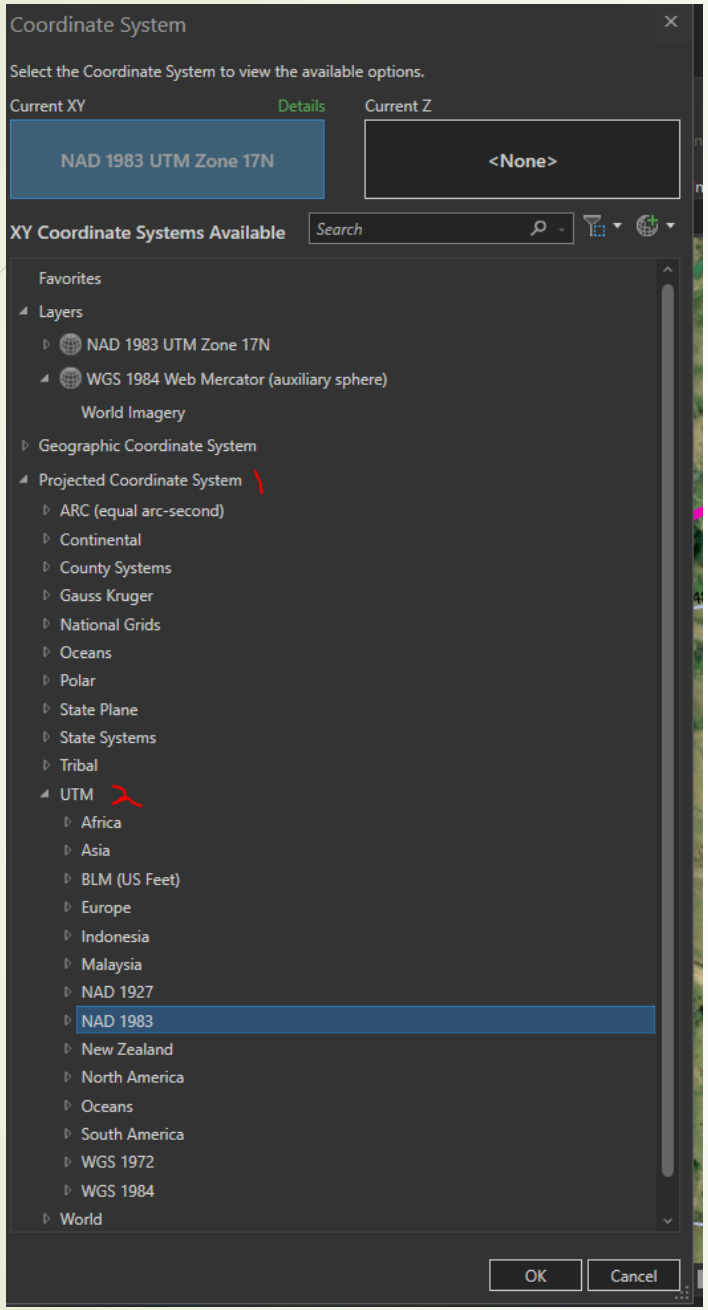
Feature Dataset Creation

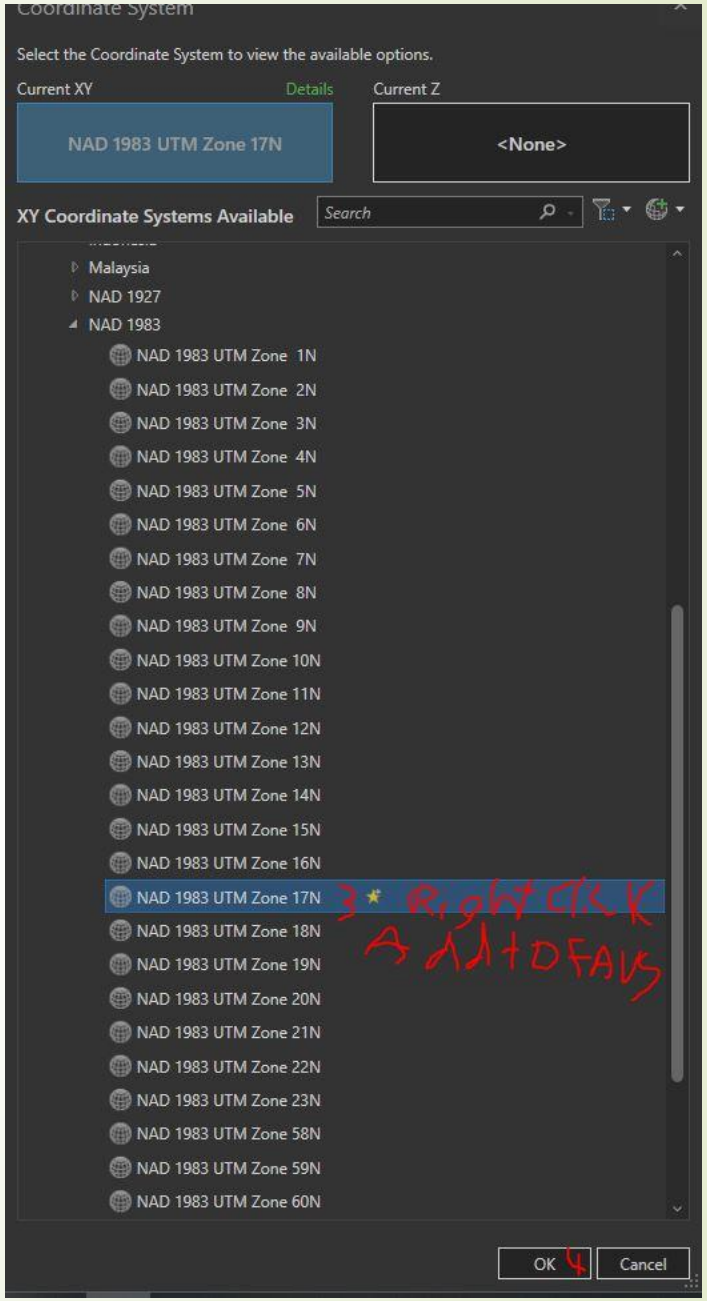


- Configure the following parameters in our feature dataset.
  - Output Geodatabase: Leave as Practice.GDB
  - Feature Dataset Name: Boundaries
  - Coordinate System: NAD 1983 UTM Zone 17N
- To change the coordinate system, click on the globe next to default coordinate system.

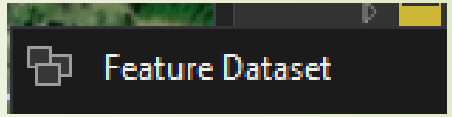
  - The default coordinate system is whatever the map is in or WGS_1984_Web_Mercator_Auxilliary_Sphere – the default of ArcGIS Pro.
  - At the bottom you will see Projected Coordinate System. Click on it and then NAD1983 → NAD 1983 UTM Zone 17N.
  - Right click and select add to favorites. Then hit ok.
- Leave all the environments as defaults and click Run




Coordinate System
Select the Coordinate System to view the available options.
Current XY
Details
Current Z
NAD 1983 UTM Zone 17N
<None>
XY Coordinate Systems Available
Search
Favorites
Layers
NAD 1983 UTM Zone 17N
WGS 1984 Web Mercator (auxiliary sphere)
World Imagery
Geographic Coordinate System
Projected Coordinate System
ARC (equal arc-second)
Continental
County Systems
Gauss Kruger
National Grids
Oceans
Polar
State Plane
State Systems
Tribal
UTM
Africa
Asia
BLM (US Feet)
Europe
Indonesia
Malaysia
NAD 1927
NAD 1983
New Zealand
North America
Oceans
South America
WGS 1972
WGS 1984
World
OK
Cancel


Coordinate System
Select the Coordinate System to view the available options.
Current XY
Details
Current Z
NAD 1983 UTM Zone 17N
<None>
XY Coordinate Systems Available
Search
Malaysia
NAD 1927
NAD 1983
NAD 1983 UTM Zone 1N
NAD 1983 UTM Zone 2N
NAD 1983 UTM Zone 3N
NAD 1983 UTM Zone 4N
NAD 1983 UTM Zone 5N
NAD 1983 UTM Zone 6N
NAD 1983 UTM Zone 7N
NAD 1983 UTM Zone 8N
NAD 1983 UTM Zone 9N
NAD 1983 UTM Zone 10N
NAD 1983 UTM Zone 11N
NAD 1983 UTM Zone 12N
NAD 1983 UTM Zone 13N
NAD 1983 UTM Zone 14N
NAD 1983 UTM Zone 15N
NAD 1983 UTM Zone 16N
NAD 1983 UTM Zone 17N
NAD 1983 UTM Zone 18N
NAD 1983 UTM Zone 19N
NAD 1983 UTM Zone 20N
NAD 1983 UTM Zone 21N
NAD 1983 UTM Zone 22N
NAD 1983 UTM Zone 23N
NAD 1983 UTM Zone 58N
NAD 1983 UTM Zone 59N
NAD 1983 UTM Zone 60N
OK
Cancel

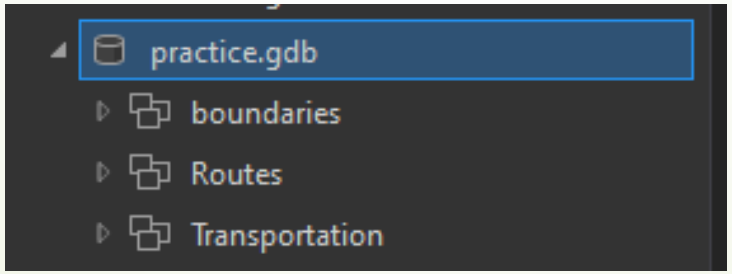
Feature Dataset Creation



- Repeat the previous steps and create the following Transportation and Routes feature datasets.
- Transportation
  - Output Geodatabase: Leave as Practice.GDB
  - Feature Dataset Name: Boundaries
  - Coordinate System: NAD 1983 UTM Zone 17N
  - Environments: Leave Default
- Routes
  - Output Geodatabase: Leave as Practice.GDB
  - Feature Dataset Name: Boundaries
  - Coordinate System: NAD 1983 UTM Zone 17N
  - Environments: M Resolution and Tolerance 0.0001 MI

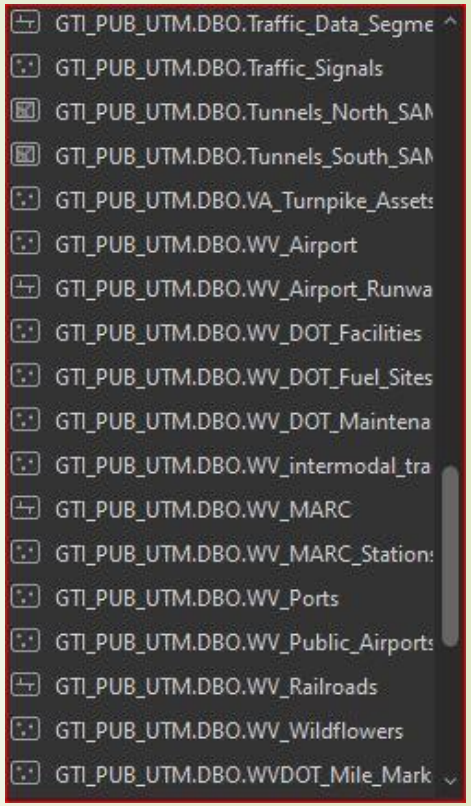
Feature Dataset Creation

- Return to the Catalog pane and open Practice.GDB
  - You should see the 3 feature datasets we created. Click on routes.
  - As you can see, there are still no feature classes housed in each feature dataset.
- How to add feature classes to each of the feature datasets will be covered in the next section.



Exercise: Creating a Feature Dataset

- Open up the Exercise3_yourinitials.gdb
- We will add the same three features (Boundaries, Transportation, Routes) we just covered but with additional information.
- For Boundaries
  - Environments
    - ✓ Set the output coordinate system to also be NAD 1983 UTM Zone 17N
    - ✓ Z Resolution and Tolerance 0.01 Resolution Measurement FT
  - Routes
    - ✓ Set the output coordinate system to also be NAD 1983 UTM Zone 17N
    - ✓ M Resolution and Tolerance 0.001 Resolution Measurement Miles
  - Transportation: Leave the same
- Once complete, refresh Exercise3_yourinitials.gdb and refresh the database. If completed correctly, all three should appear.



Section 5: Importing Feature Classes

Project Recap

- So far, we have:
  - Created the shared folder(s) for the project we're working in
  - Created the two file geodatabases needed for our project
  - Implemented feature datasets to keep our geospatial data organized
- We still have to add the feature classes and data needed for the project.

Feature Class Review

- More complex than a Shapefile.
- Consist of a homogeneous collection of common vector features that have similar spatial representations
- Composed of the basic point, polyline, or polygon feature types as well as these feature types:
  - Annotation – saved map text or string of text associated with a point, polyline or polygon feature
  - Dimension – special type of annotation showing spatial text (height, distance, etc.)
  - Routing or network – a network of point and linear features that are interrelated and contain a system of measurement
  - Multi-point – feature composed of clustered multiple point features combined into a single entity
  - Multi-path – a surface representation of a 3D geometry in space such as a building, tree, etc.

https://desktop.arcgis.com/en/arcmap/10.3/manage-data/feature-classes/a-quick-tour-of-feature-classes.htm

Feature Class Review

- Reside in a Geodatabase
- Can have advanced analysis and features capabilities assigned to them including:
  - Subtypes – a subset of features in feature class or objects that share the same attributes (e.g. streets include local, arterial, collector, etc.)
  - Domains – as previously defined, a set or range of specific attribute values that are assigned a specific value
  - Versioning – workflow process where multiple users can edit the same feature class in different environments at the same time
  - Topology: a set of rules for how point, line, and polygon features share geometry that are used to enforce integrity and QA/QC and edit data
  - Network: grouping interconnected points, lines, etc. for complex analysis, routing, and mapping

Feature Class Review

- Can have a schema assigned to them
  - A schema defines the structure of the geodatabase along with the rules, relationships, and properties of each dataset including:
    - ✓Feature Rules
    - ✓Geometry Rules
    - ✓Topology Rules
  - https://pro.arcgis.com/en/pro-app/2.8/arcpy/classes/schema.htm

Creating a Feature Class

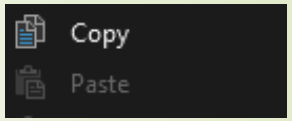
- There are several ways to create a feature class within ArcGIS Pro:
  - Import it from another source (geodatabase, shapefile, table, etc.)
  - Create the feature from scratch
  - Code tabular data using Lat/Long Coordinates
  - Event tabular data onto a linear feature

Importing Data from Other Sources

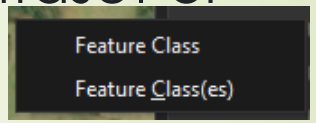
- Easiest of the methods for creating feature classes
- Used for adding data and information that:
  - Will not be modified in the project.
  - Are used directly or indirectly in creating additional new datasets.
  - Cannot be edited
    - ✓ User has Read Only or View permissions for the original dataset
    - ✓ Dataset is mission critical or frequently being accessed, and taking it offline to do any sort of editing is not feasible
- Used where only a small subset of the data is needed for the project

Importing Data from Other Sources

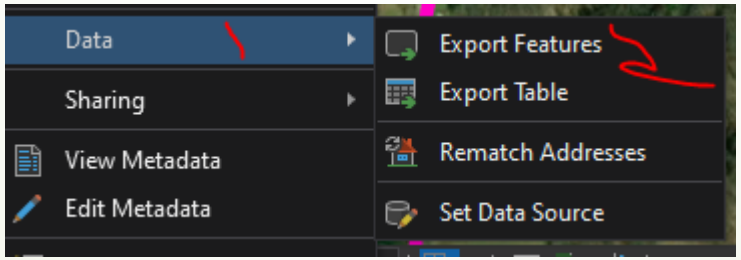
- There are several ways to import data into a feature class.
  - Using the Copy and Paste tools on the feature dataset or geodatabase just created



  - Using the Import → Feature Class (es) tool on the feature dataset or geodatabase just created



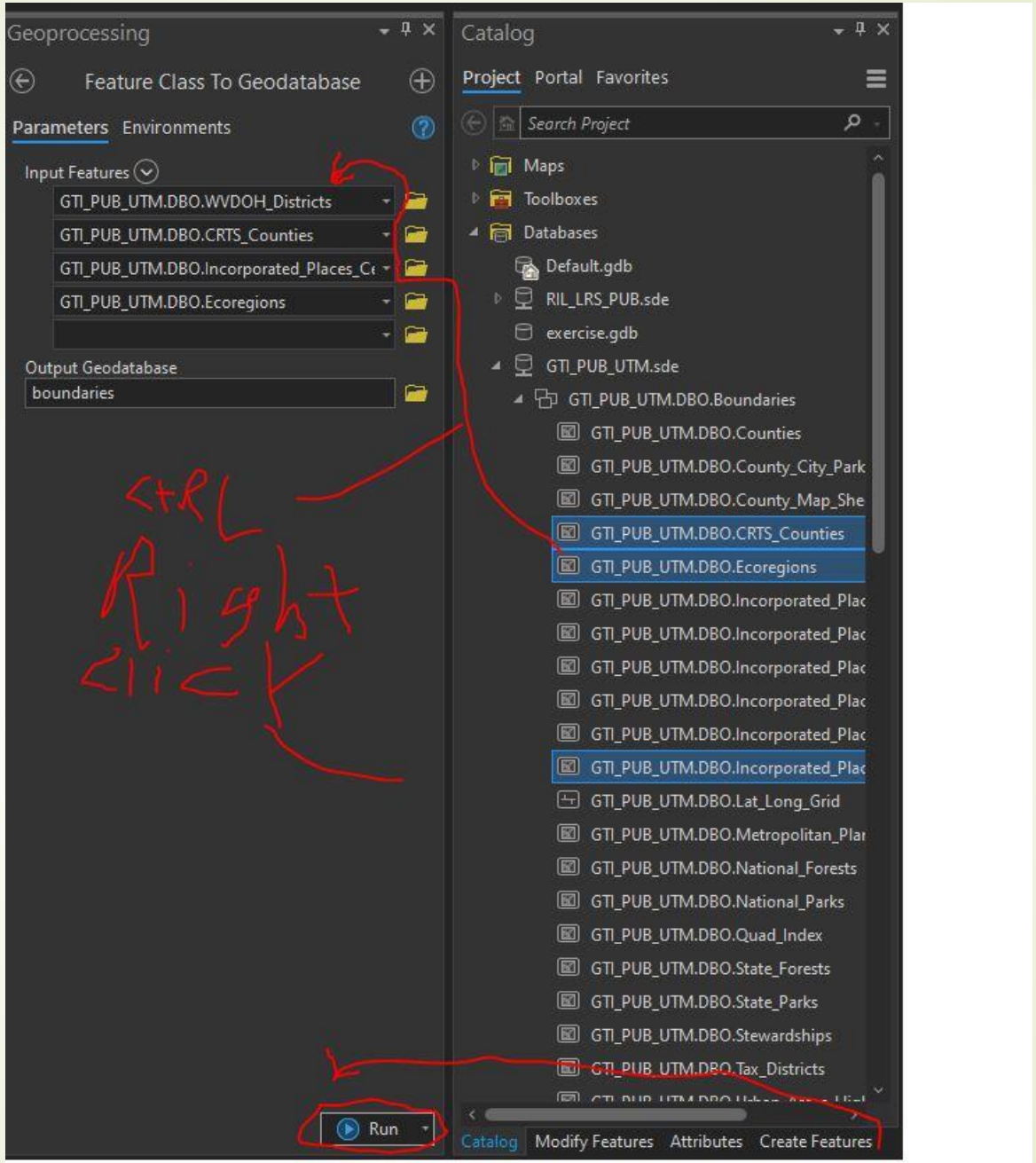
  - Using the Export Features tab on the feature you are exporting from



  - Dragging and dropping from one feature class to the other feature class

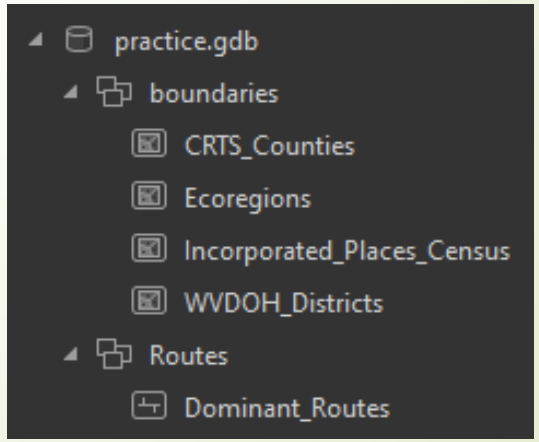
Importing into a Feature Class

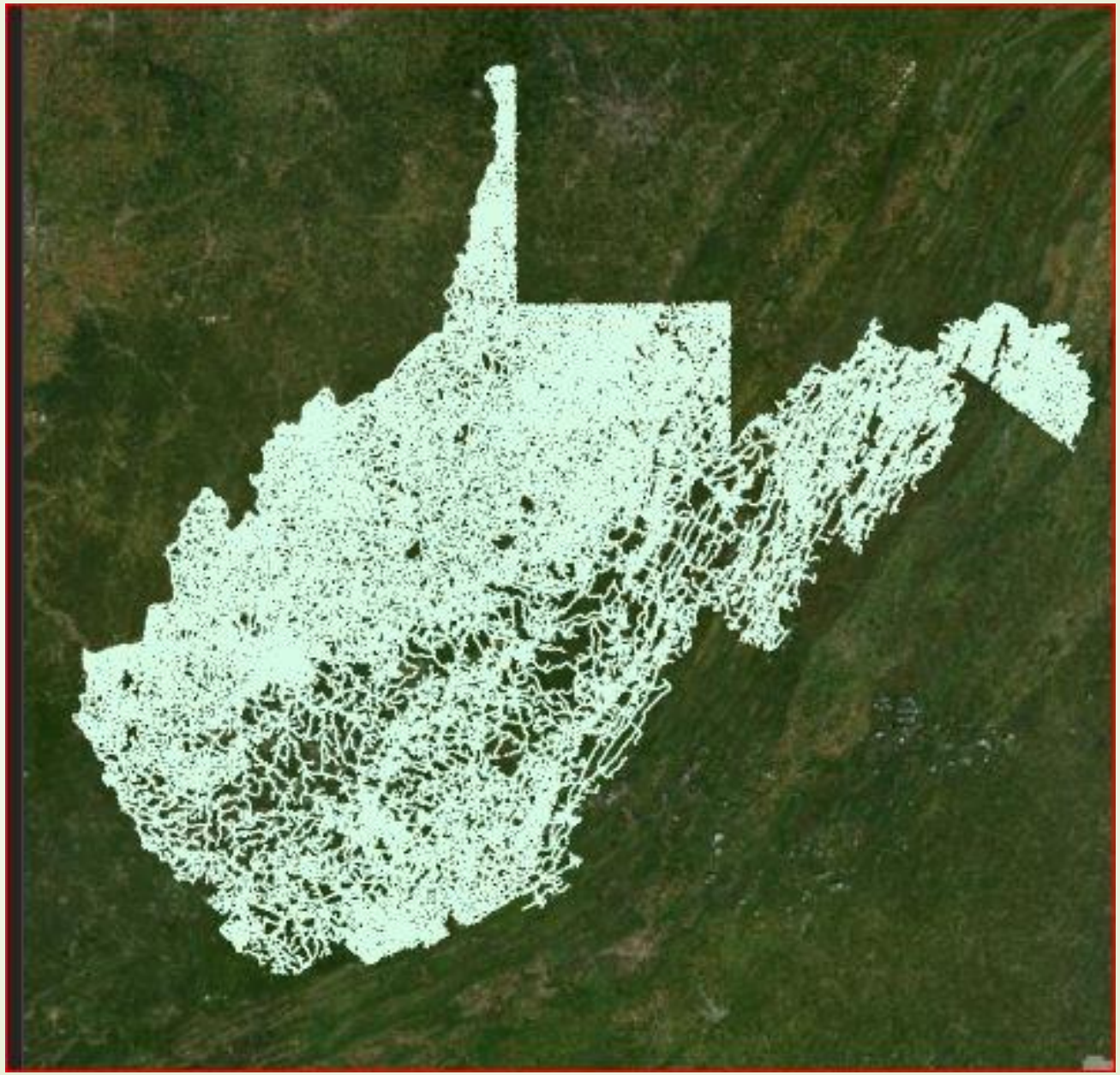
- If not open, open the GTI_PUB_UTM → Boundaries and Routes.
- Next, open your practice.gdb and right click on boundaries select import → Feature Classes.
- Drag the geoprocessing pane which opened up next to the catalog pane.
- Bring up the catalog pane →GTI_PUB_UTM→Boundaries.
- Drag in the following four items:
  - Counties
  - Ecoregions
  - Incorporated_Places_2021
  - WVDOH_Districts
  - To do so, hold the CTRL Key and right click on each of them
- Click Run


Geoprocessing
Feature Class To Geodatabase
Parameters
Environments
Input Features
GTI_PUB_UTM.DBO.WVDOH_Districts
GTI_PUB_UTM.DBO.CRTS_Counties
GTI_PUB_UTM.DBO.Incorporated_Places_Ce
GTI_PUB_UTM.DBO.Ecoregions
Output Geodatabase
boundaries
ctRL
Right
click
Run
Catalog
Project
Portal
Favorites
Search Project
Maps
Toolboxes
Databases
Default.gdb
RIL_LRS_PUB.sde
exercise.gdb
GTI_PUB_UTM.sde
GTI_PUB_UTM.DBO.Boundaries
GTI_PUB_UTM.DBO.Counties
GTI_PUB_UTM.DBO.County_City_Park
GTI_PUB_UTM.DBO.County_Map_She
GTI_PUB_UTM.DBO.CRTS_Counties
GTI_PUB_UTM.DBO.Ecoregions
GTI_PUB_UTM.DBO.Incorporated_Plac
GTI_PUB_UTM.DBO.Incorporated_Plac
GTI_PUB_UTM.DBO.Incorporated_Plac
GTI_PUB_UTM.DBO.Incorporated_Plac
GTI_PUB_UTM.DBO.Incorporated_Plac
GTI_PUB_UTM.DBO.Incorporated_Plac
GTI_PUB_UTM.DBO.Lat_Long_Grid
GTI_PUB_UTM.DBO.Metropolitan_Plar
GTI_PUB_UTM.DBO.National_Forests
GTI_PUB_UTM.DBO.National_Parks
GTI_PUB_UTM.DBO.Quad_Index
GTI_PUB_UTM.DBO.State_Forests
GTI_PUB_UTM.DBO.State_Parks
GTI_PUB_UTM.DBO.Stewardships
GTI_PUB_UTM.DBO.Tax_Districts
Catalog
Modify Features
Attributes
Create Features

Importing into a Feature Class

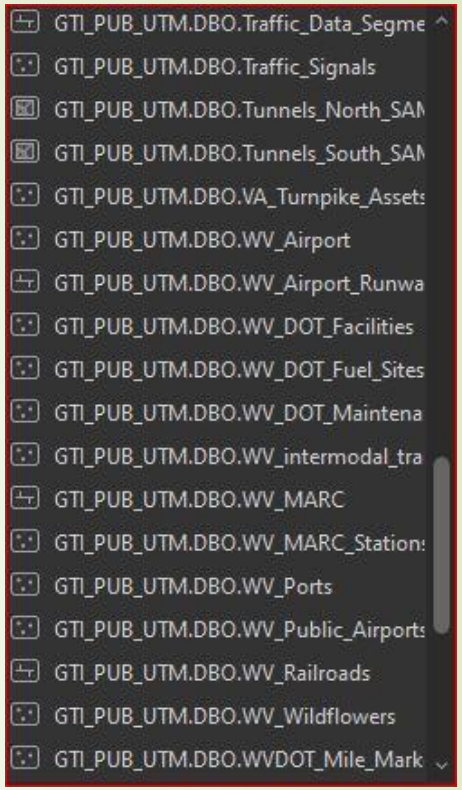
- This will take a little bit of time to run.
- Once complete, open the practice.gdb and boundaries
  - The 4 features should look like this.
- Repeat the previous steps; however, this time with routes and adding dominant routes to the Routes feature dataset in the practice GDB
- Right click on dominant routes and select add to map.
- The final product should look like this.
- Click Save.





Exercise: Importing Geospatial Data

- Open exercise_yourintials.gdb
- Add the following features:
  - ? Boundaries
    - ✓ Counties
    - ✓ Incorporated Places_2021
    - ✓ WVDOH_Districts
    - ✓ Metropolitan Planning Areas
  - ? Routes
    - ✓ Dominant_Routes
  - ? Transportation
    - ✓ WV_Railroads
    - ✓ Signs



Section 6: Creating Feature Classes

Creating a New Feature Class

- In the previous slides, we learned how to import already existing data into our project file geodatabase.
- However, there are times when the data needed for the project
  - Do not exist
  - Exist in a format that is not visible in GIS software such as a table
- This section explores:
  - How to create feature classes from scratch.
  - How to convert tabular data into a geospatial feature class through.
    - ✓XY Coordinates
    - ✓Eventing tabular data to an already existing network feature class.
- How to create a Feature Class in ArcGIS Pro

Creating a Feature Class from Scratch

- Is a common scenario where one is trying to map something, and data does not exist either in-house or from any outside source.
- Involves a multi-step process where the user:
  - Defines the feature type and measurements (height, mileage, etc.) that will be displayed in the map.
  - Identifies which attributes (columns) provide the most salient information to the user and creates the corresponding fields.
  - Creates each individual feature being housed within the feature class.
- Creates a more-customizable feature that shows information tailored to fit the customer's need.
- Can be very time-consuming particularly if you have many records to add into the feature.

Creating a Feature Class from Scratch

- Create a feature class called railroad signals and save it to the transportation feature dataset.
- Right click on Transportation feature dataset → New → Feature Class
- This brings up an interactive, stepwise menu that:
  - Defines the name and alias of the feature
  - Defines the geometry type (polygon, point, line, etc.)
  - Defines the geometric properties (route data and height)
  - Adds fields to the feature class
  - Defines the:
    - ✓ Feature Class's Coordinate System
    - ✓ Tolerances and Resolutions
    - ✓ Storage Configuration

Creating a Feature Class: Adding a Name

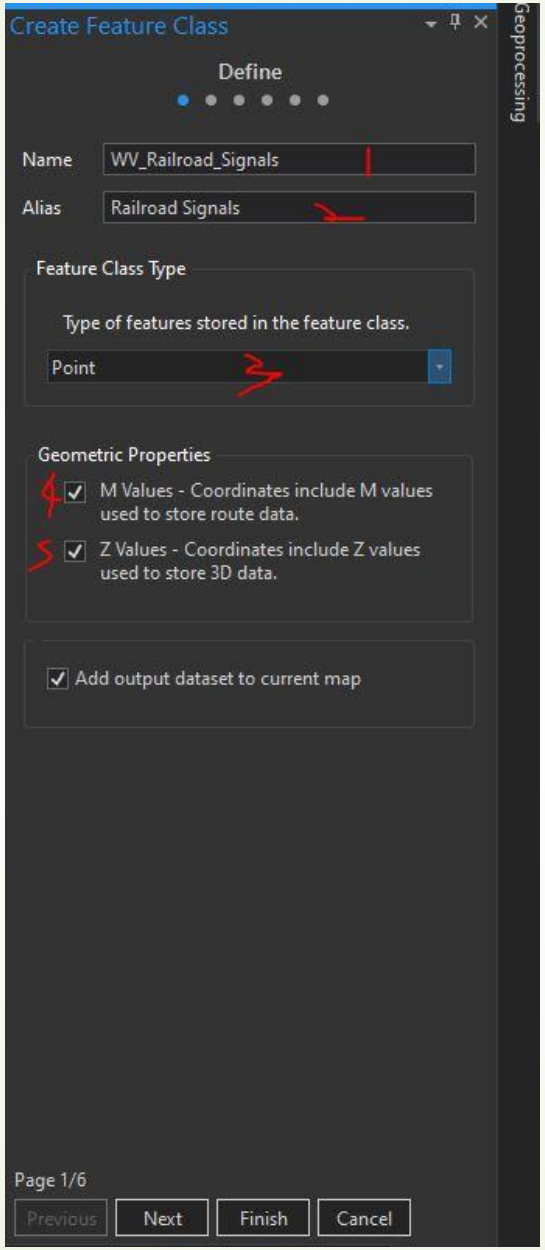
- Let's explore the define screen. The first thing we see is the Name and Alias.
  - Name is the name of the feature class residing in the geodatabase. Like folder names, it must adhere to the following rules:
    - ✓ Number of Characters are limited to 255 (but practically, 10-12)
    - ✓ Cannot begin with a number
    - ✓ Cannot use special characters such as @#$%^
    - ✓ Must use of _ or – instead of a space
    - ✓ Must be descriptive and meaningful to the feature
  - Alias is the display name of the feature within a project or map. Unlike the Name Field, this can use spaces, numbers, and special characters.
- Type in the following
  - Name: WV_Railroad_Signals
  - Alias: Railroad Signals

Creating a Feature Class: Defining the Geometry and Geometric Properties

- The next step is to define the Feature Class's appearance (geometry or type) and its corresponding geometric properties such as height (Z value) or distance(M Value).
- This is one of the most important steps in feature creation as it defines:
  - Functionality within a map or project including:
    - ✓ Can the dataset be used within a network model?
    - ✓ Can the dataset be used in a 3D setting?
    - ✓ Are we showing a single instance or are we showing something with dimensionality such as area or route?
  - Which analyses can be performed on the feature as well as which tools can be run on and with it.

Creating a Feature Class: Defining the Geometry and Geometric Properties

- There are eight different features class geometry types:
  - Standard Point, Line, or Polygon feature classes.
  - Multipath: a collection of polygon, points and lines that represent a 3D object.
  - Multipoint: a collection of multiple points on top of each other combined to make a single entity.
  - 3D Object : a 3-dimensional object or feature with 3D surface faces in space.
  - Annotation: a text features associated with a feature associated with a point, line or polygon feature.
  - Dimensions: which are special type annotation used for measurements such as length, width, etc.
- Now, select points, and then select X and M Values as well. Click next.


Create Feature Class
Define
Name
WV_Railroad_Signals
Alias
Railroad Signals
Feature Class Type
Type of features stored in the feature class.
Point
Geometric Properties
M Values - Coordinates include M values used to store route data.
Z Values - Coordinates include Z values used to store 3D data.
Add output dataset to current map
Page 1/6
Previous
Next
Finish
Cancel
Geoprocessing

Creating a Feature: Adding Fields

- Is an important step in creating a feature class.
- Defines the attributes and information being shared in the feature.
- Allows the data creator to:
  - Identify and differentiate each feature.
  - Incorporate salient information about the feature.
  - Model attributes shared by a collection of features.
- What is a Field

Adding Fields – Data Type

- Two fields are created by default for a feature class.
  - ObjectID, FID, OID: is an automatically generated field by ArcGIS used to uniquely identify any features added to the feature class.
  - Shape: is an automatically generated field by ArcGIS which stores the geometry of the feature.
- Along with the ObjectID and Shape, there are several field types the user can add for the feature.
  - Text: field that utilizes words or string of words to describe an attribute up to 255 characters.
  - Date: field used to show a date and or time (usually a feature's creation and/or modification date.
  - Raster: field that stores raster data along side vector data in the geodatabase such as:
    - ✓ Photos of an object
    - ✓ Map Image or 3D Drawing

Adding Fields – Data Type

Click here to add a new field

- Unique Identification Field: an ESRI generated field used to uniquely identify a feature in a geodatabase – primarily for sharing and tracking of features such as:
  - ✓ GUID: Global Unique Identifier
  - ✓ Global ID
- Binary Large Object (BLOB): field consisting of a long sequence of binary numbers containing information about annotation, dimensions, images, Multimedia and Code
- Numbers: field defining numeric data type including:
  - ✓ Short Integer: fields storing whole numeric values up to 5 digits (0 ± 99999)
  - ✓ Long Integer: fields storing whole numeric values up to 10 digits (0 ± 9999999999)
  - ✓ Float: fields storing single precision whole and decimal values – mostly for measuring distances and heights.
  - ✓ Double: fields storing double precision whole and decimal values mostly for measuring distances and heights and adding coordinates.

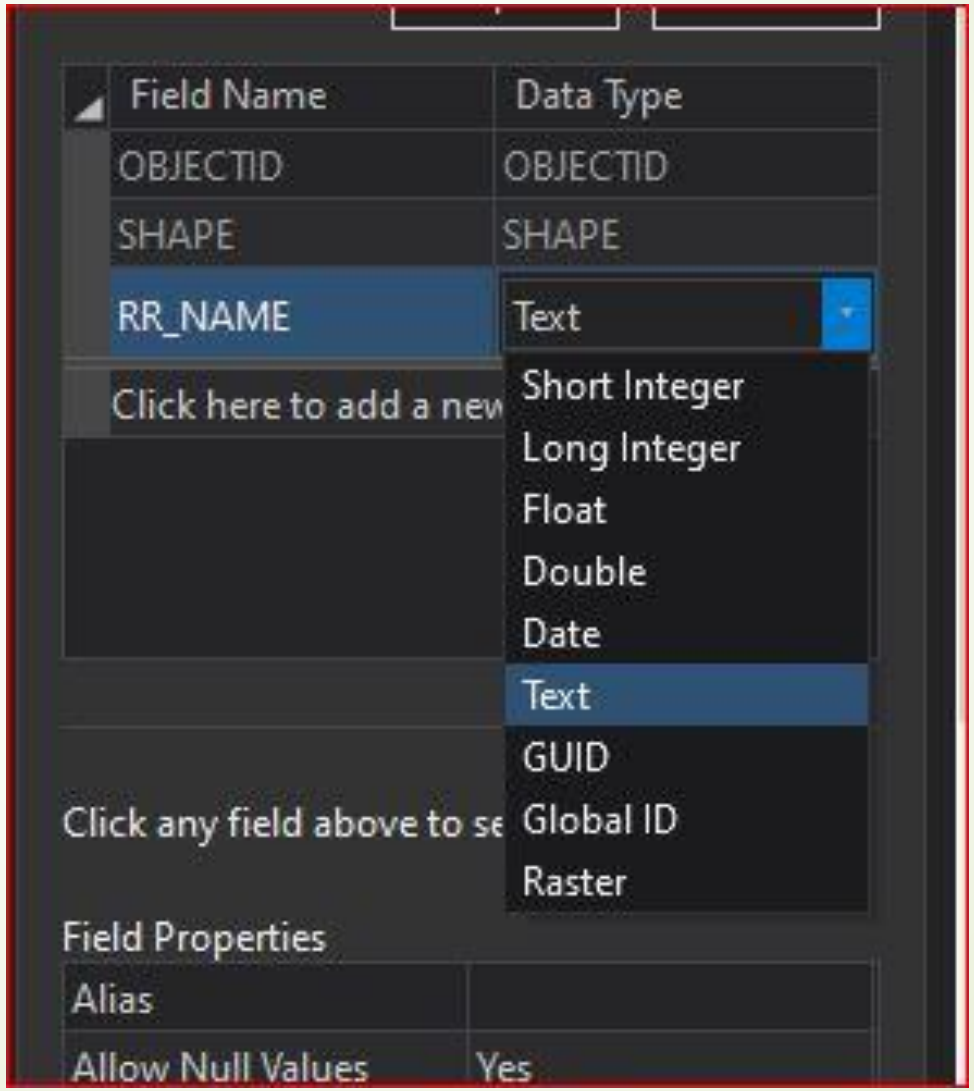
Common field types in ArcGIS Pro

Adding Fields – Rules

Click here to add a new field

- As with other naming, the following rules apply:
  - No spaces, but if spaces are needed, use a _ or -
  - 12 or fewer characters
  - No special characters
  - Cannot begin with a number
- Additionally, when creating a field, it is important to keep in mind that:
  - The field's name should correspond with the information it is conveying (IE if the field measures distance, the field should have DIST or something related to distance).
  - At least one field should identify the feature for the audience (Name, Route Number, etc.).
  - At least one field should describe what the feature is being used for (feature type, sign system, etc.).

Adding Fields



Adding Fields – Practice

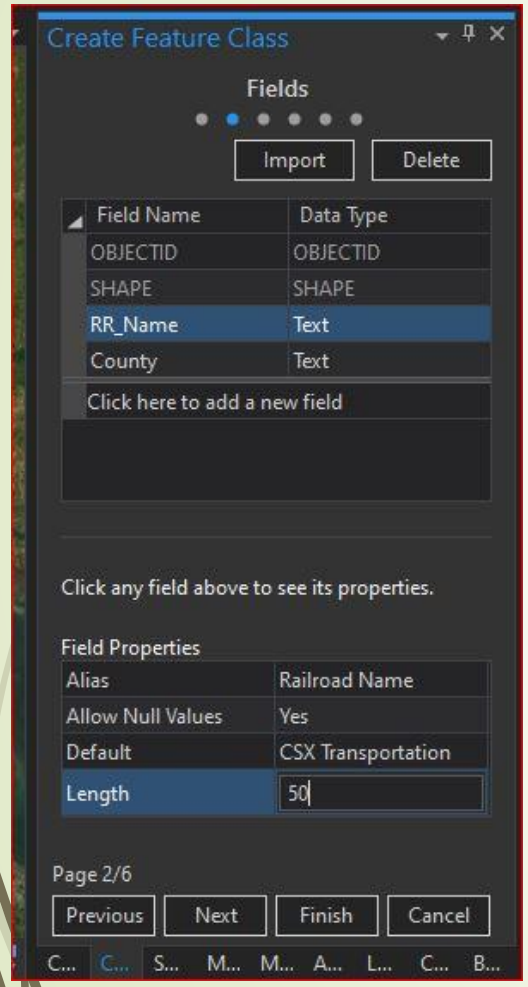
- Click on "Click here to add a new field".
- By default, a field called Field pops up. Name it "RR_Name" and scroll to the bottom to the Field Properties window.
- In the Field Properties window, the user can configure how and what items will be displayed in the field including:
  - Adding Aliases
  - Allowing NULL values (IE does the feature need to have a quality or quantity assigned to that field or can it be left blank)
  - Setting Default Values
  - Adding Domains
  - Field Length

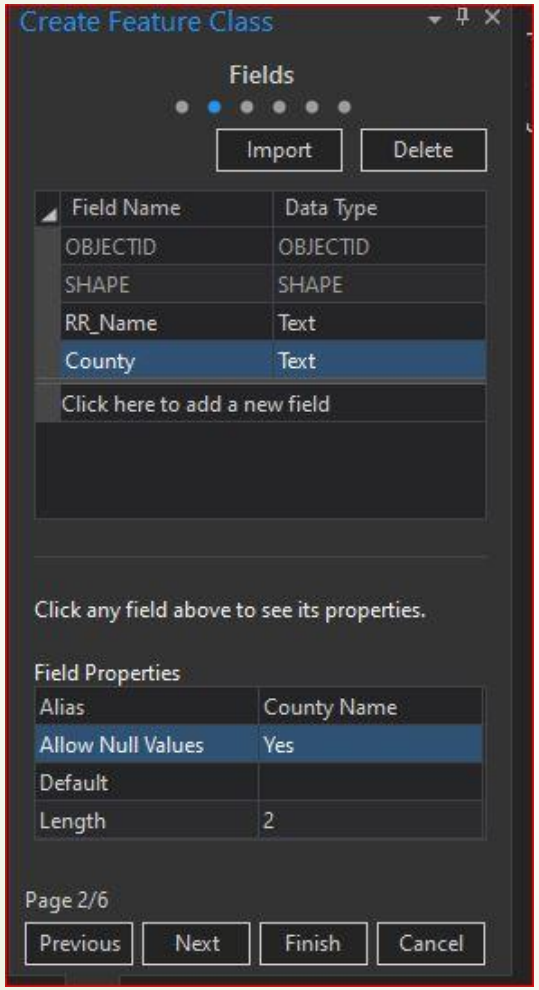
Adding Fields – Practice

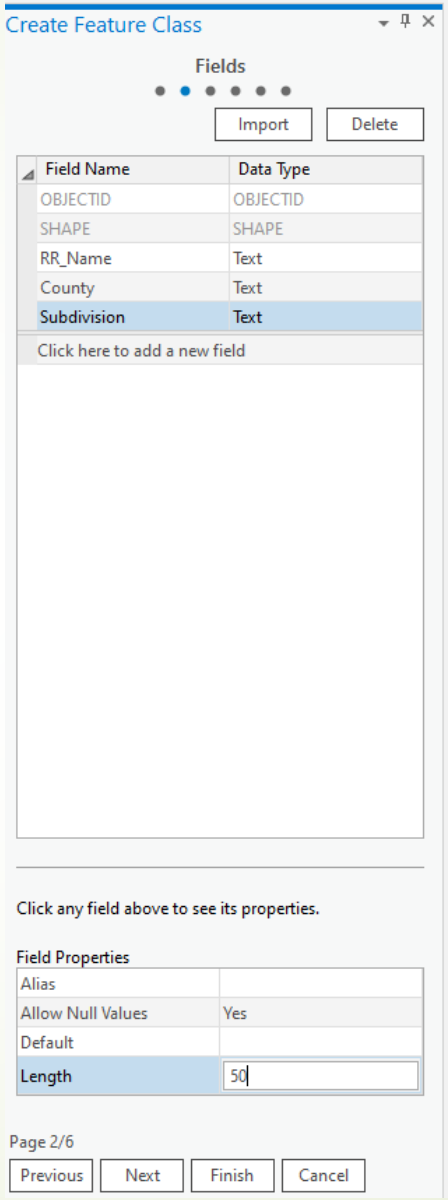
- Add the following:
  - Alias: Railroad Name
  - Allow Null Values: Yes
  - Default: CSX Transportation
  - Length: 50
- Create additional fields for Counties, XY Coordinates, Subdivision and MP
  - Field Name: County
  - Data Type: Text
  - Alias: County Name
  - Allow Null Values: Yes
  - Default: Leave Blank
  - Length: 2

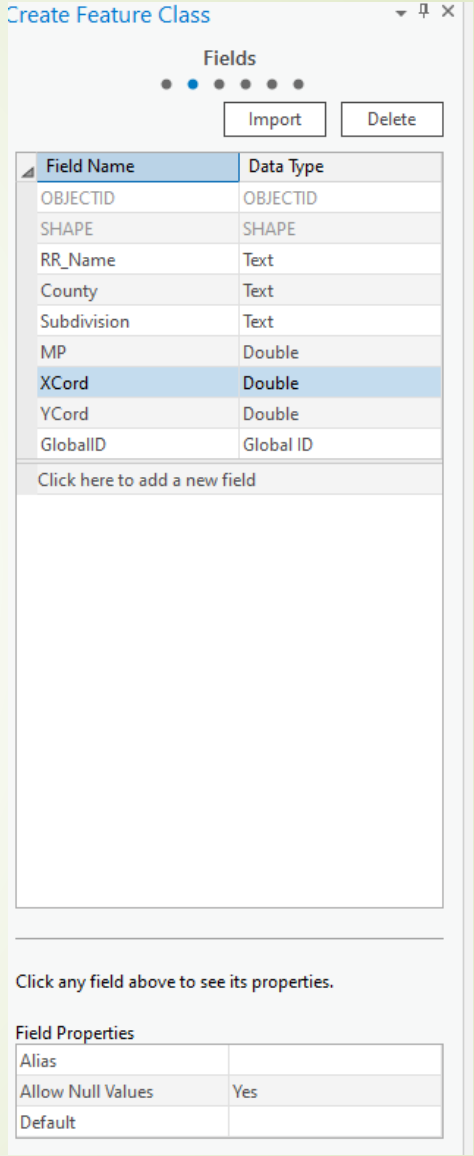
Adding Fields – Practice

- Subdivision
  - ✓ Name: Subdivision
  - ✓ Field Text
  - ✓ Alias: Leave Blank
  - ✓ Allow Null Values: Yes
  - ✓ Default: Leave Blank
  - ✓ Length: 50
- MP, Xcord, Ycord (3 different fields)
  - ✓ Name: MP, Xcord, Ycord
  - ✓ Field: double
  - ✓ Alias: Leave Blank
  - ✓ Allow Null Values: Yes
  - ✓ Default: None
- Add a GlobalID Fields. The design should look as follows. Click next.


Create Feature Class
Fields
Import
Delete
Field Name
Data Type
OBJECTID
OBJECTID
SHAPE
SHAPE
RR_Name
Text
County
Text
Click here to add a new field
Click any field above to see its properties.
Field Properties
Alias
Railroad Name
Allow Null Values
Yes
Default
CSX Transportation
Length
50
Page 2/6
Previous
Next
Finish
Cancel

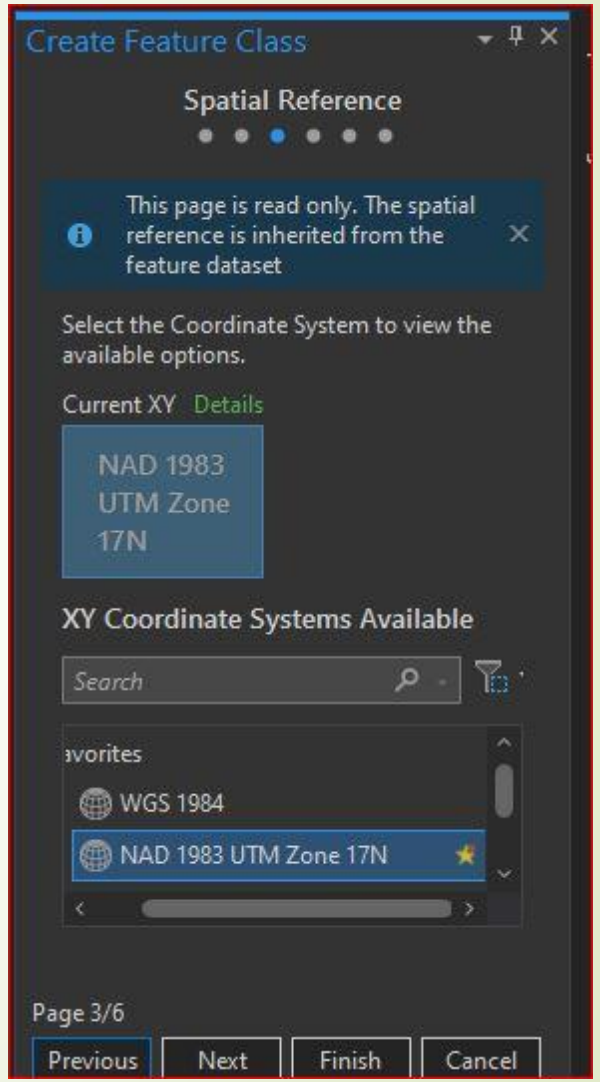

Create Feature Class
Fields
Import
Delete
Field Name
Data Type
OBJECTID
OBJECTID
SHAPE
SHAPE
RR_Name
Text
County
Text
Click here to add a new field
Click any field above to see its properties.
Field Properties
Alias
County Name
Allow Null Values
Yes
Default
Length
2
Page 2/6
Previous
Next
Finish
Cancel


Create Feature Class
Fields
Import
Delete
Field Name
Data Type
OBJECTID
OBJECTID
SHAPE
SHAPE
RR_Name
Text
County
Text
Subdivision
Text
Click here to add a new field
Click any field above to see its properties.
Field Properties
Alias
Allow Null Values
Yes
Default
Length
50
Page 2/6
Previous
Next
Finish
Cancel


Create Feature Class
Fields
Import
Delete
Field Name
Data Type
OBJECTID
OBJECTID
SHAPE
SHAPE
RR_Name
Text
County
Text
Subdivision
Text
MP
Double
XCord
Double
YCord
Double
GlobalID
Global ID
Click here to add a new field
Click any field above to see its properties.
Field Properties
Alias
Allow Null Values
Yes
Default

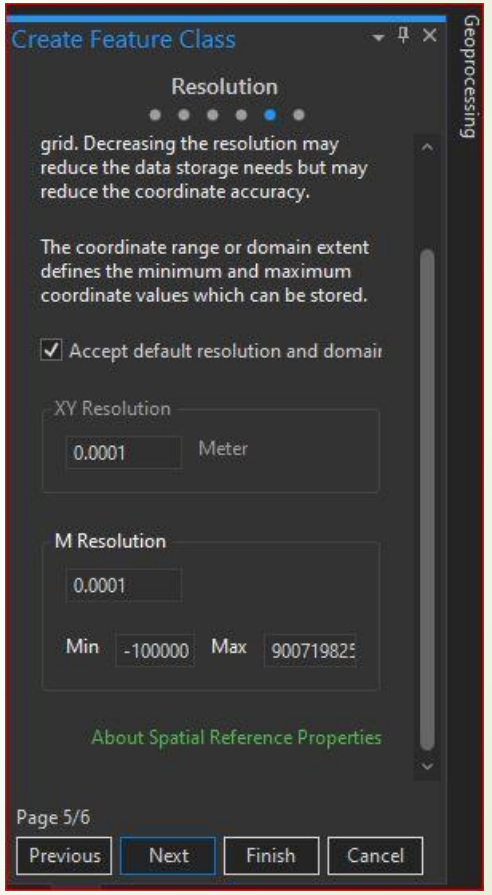
Creating a Feature Class: Adding a Spatial Reference

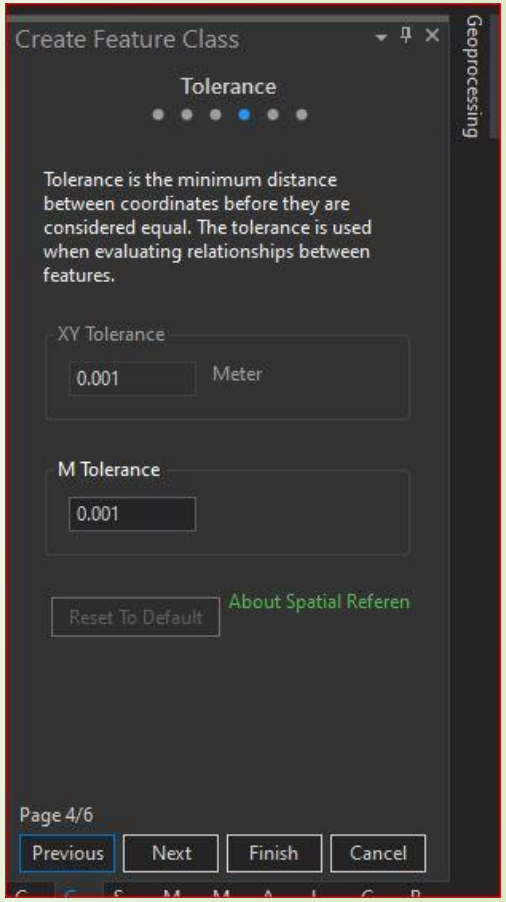
- Does this look familiar?
- As with Feature Datasets previously, this section is where you assign a projection and height to the feature class or shapefile.
- However, unlike feature datasets, this time you have a projection already assigned to it.
- So, click Next.



Creating a Feature Class: Defining Tolerance and Resolution

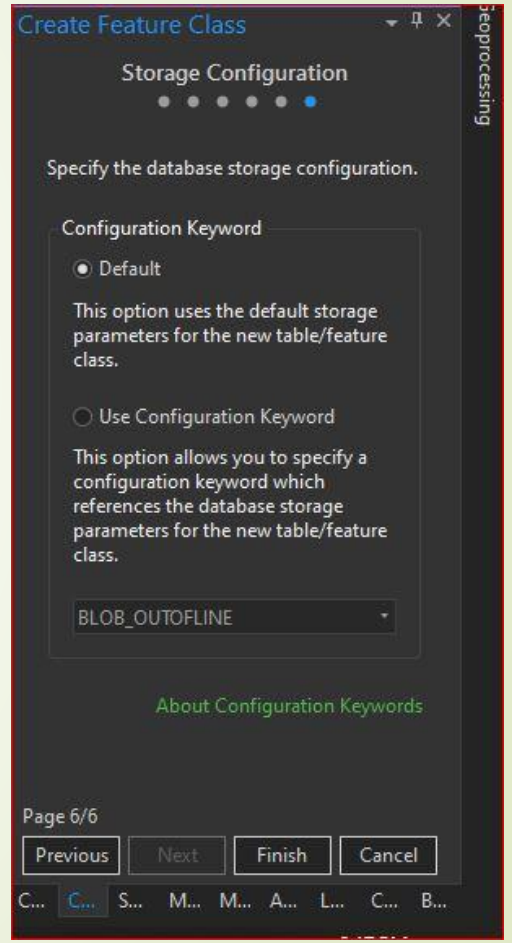
- Tolerance and Resolution are interrelated as they deal with precision and accuracy.
  - Tolerance refers to the minimum distance between the coordinates before they are considered equal.
  - Resolution refers to the cell size of the underlying coordinate grid (used to snap vector features to).
- Since we rarely define these grids, leave them as default and click Next for both.





Creating a Feature Class: Defining Storage Configuration

- The final feature that is configured is Storage (how the feature class and its data will be stored within the geodatabase). Options include:
  - Default
  - Configuration Keyword
    - ✓Blob
    - ✓Storage Type
    - ✓Geometry
    - ✓Text
    - ✓Characters
    - ✓Defaults
- Select Default. Click Finish and Save the project.



Converting Tabular Data into a Feature Class

- A New Feature Class shows up, but there are no feature in it. Click on Railroad Signals and select Attribute Table.
- There are no records in it. Why?
  - Answer: We still need to create the individual features and populate the data.
- Question: How do we create the data and make information available for the Feature Class?
  - Answer: By converting information into a tabular format and importing it into a feature class either through:
    - ✓ A table with XY Coordinates.
    - ✓ Eventing a table onto a linear network.

Converting Tabular Data into Vector Data for a Feature Class

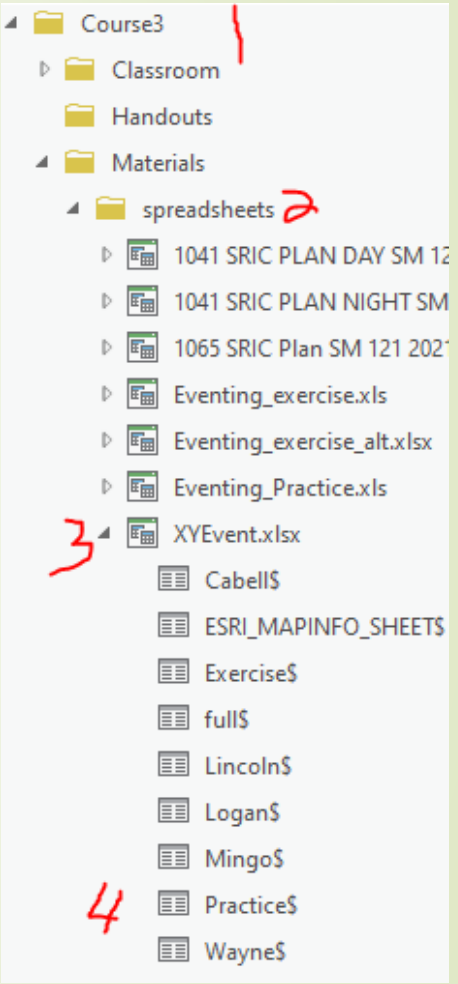
- When importing any geospatial data from a table, there are standard procedures to follow. These include:
  - Create and organize the data in a spreadsheet or table.
  - Copy the table into ArcGIS Pro Project or Geodatabase.
  - QA/QC the resulting table in the project or geodatabase.
    - ✓ If features didn't import correctly, review and make any necessary changes to the table and reimport it.
  - Run a tool to create a temporary layer.
  - QA/QC the temporary layer and look for any features that did not import correctly.
    - ✓ If necessary, make any changes to the table and rerun the tool again.
  - Convert the temporary layer into a permanent feature class.

Converting Tabular Data into Vector Data

- To convert tabular data into Vector data, the columns in the table must follow the same naming rules as creating a field or feature class.
  - Number of characters are limited
  - Cannot begin with a number
  - Cannot use special characters such as @#$%^
  - Must use of _ or – instead of a space
- In addition, there are table specific rules for importing tabular data.
  - When importing data using coordinates, make sure there are two dedicated columns stating Lat/Long or XY.
  - When importing data using Lat/Long coordinates, make sure that they are in a decimal format with positive and negative numbers.
  - When eventing a table or feature to import data, make sure you have a field in both the table and the feature class that uniquely identifies the feature data.

Converting Tabular into Vector Data

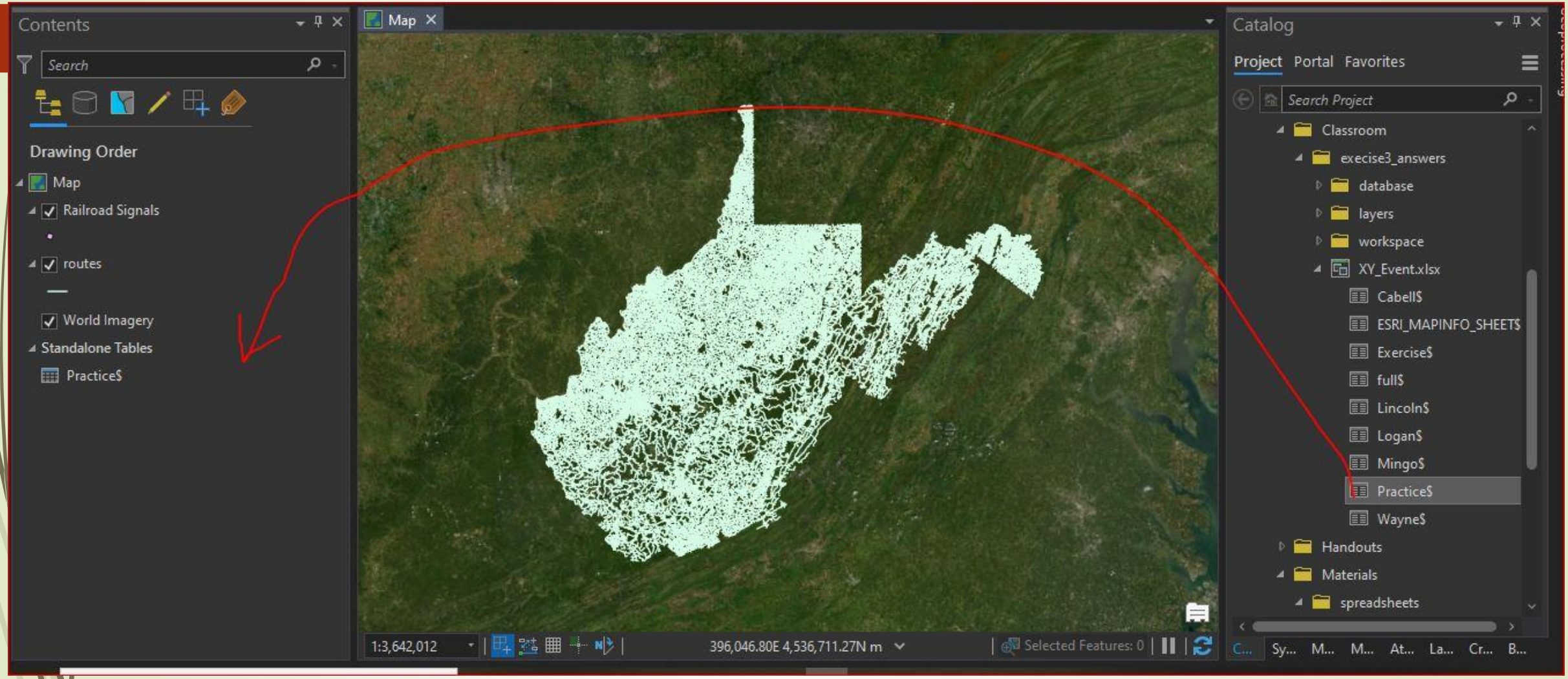
- In this practice we will convert a table, Practice$, to vector data.
- If there is not one, create a folder connection to Exercise 3.
- Navigate to Materials → Spreadsheets → XYEvents.xls → Practice$
- Drag Practice$ over to Contents and right click to open the table. Is there anything that shows the XY coordinates?



Practice$

Field: Selection: Rows:

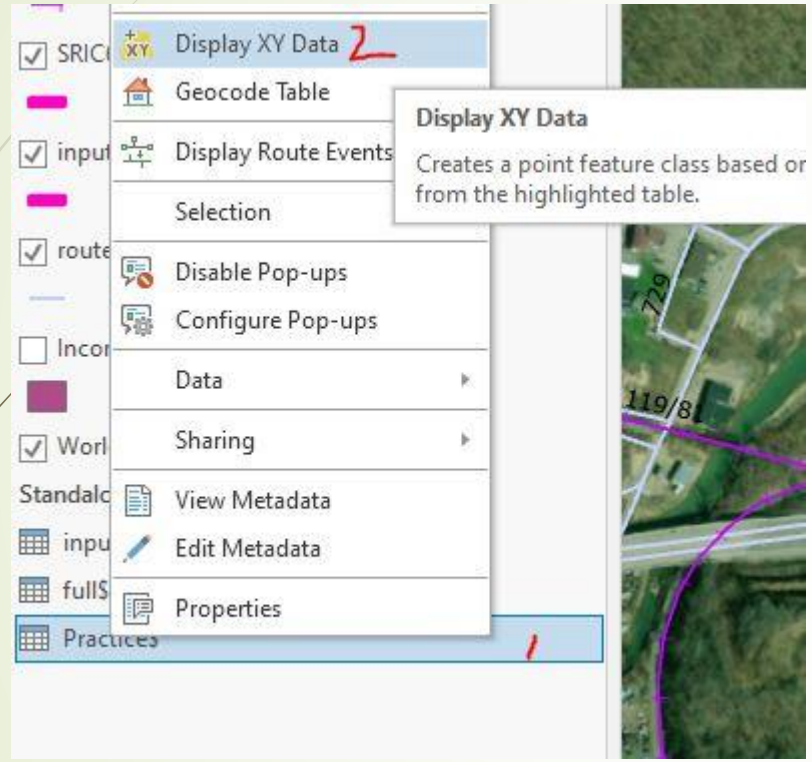
	YCORD	XCORD	INTNUM	COUNTY	CITY	R
1	37.84674205	-81.99896514	23001	Logan	Logan	23
2	37.83797127	-81.96452625	23002	Logan	Stollings	23
3	37.8492394	-81.99836768	23003	Logan	Logan	23
4	37.84845854	-81.99518851	23004	Logan	Logan	23
5	37.84766762	-81.99433297	23005	Logan	Logan	23
6	37.84749119	-81.99453766	23006	Logan	Logan	23

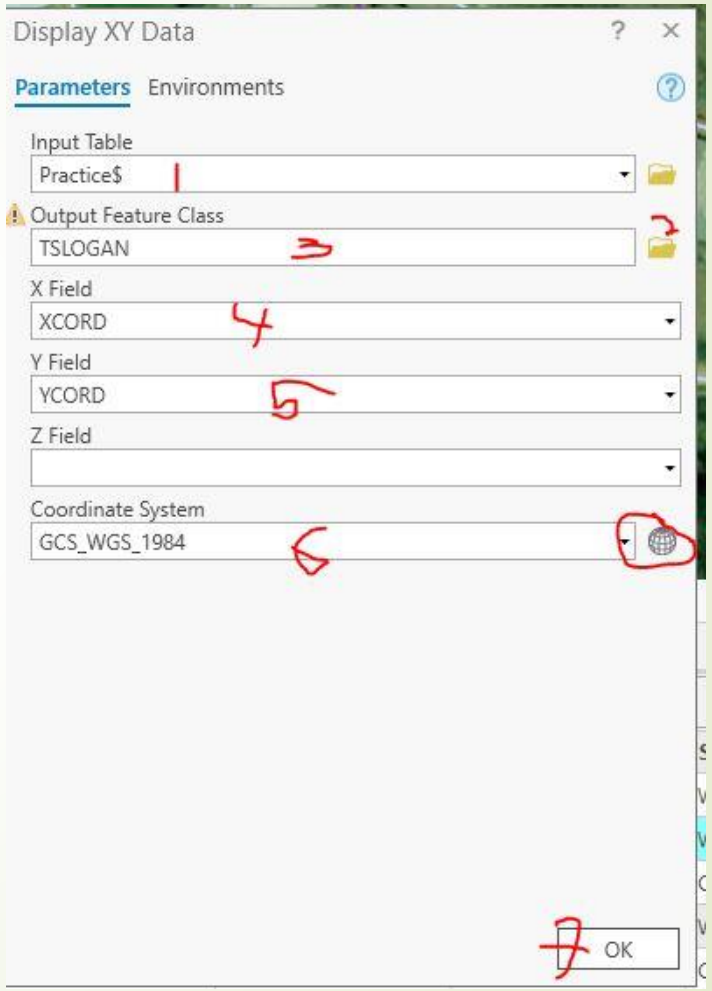

Contents
Search
Drawing Order
Map
Railroad Signals
routes
World Imagery
Standalone Tables
Practice$
Map
1:3,642,012
396,046.80E 4,536,711.27N m
Selected Features: 0
Catalog
Project
Portal
Favorites
Search Project
Classroom
execise3_answers
database
layers
workspace
XY_Event.xlsx
Cabell$
ESRI_MAPINFO_SHEET$
Exercise$
full$
Lincoln$
Logan$
Mingo$
Practice$
Wayne$
Handouts
Materials
spreadsheets

Converting Tabular Data into Vector Data: Using the Display XY Data Wizard

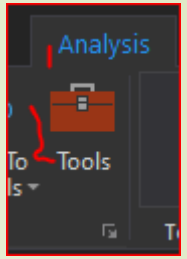
- Right click on Practice$ table and select Display XY Table
- This will bring up the Display XYData wizard. Type in the following:
  - Input Table: Practice$
  - Output Feature Class: Practice.gdb\Transportation\TSLogan
  - X Field: Long
  - Y Field: LAT
  - Z Field: Leave Blank
  - Coordinate System: GCS_WGS_1984
- Click Ok. You have converted the table, Practice$, to Vector Data in the Transportation Feature Class.

Converting Tabular Data: Display XY Wizard

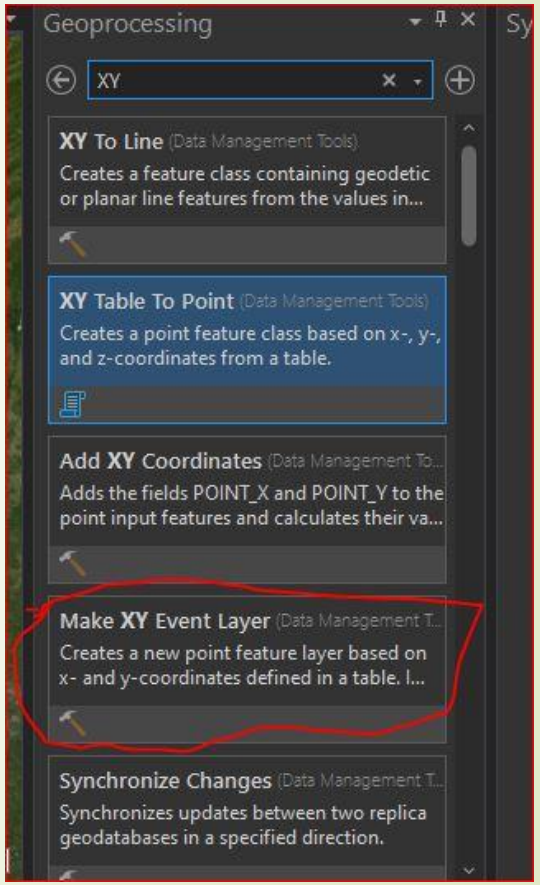




Converting Tabular Data into vector Data: Alternative Method Using XY Coordinates

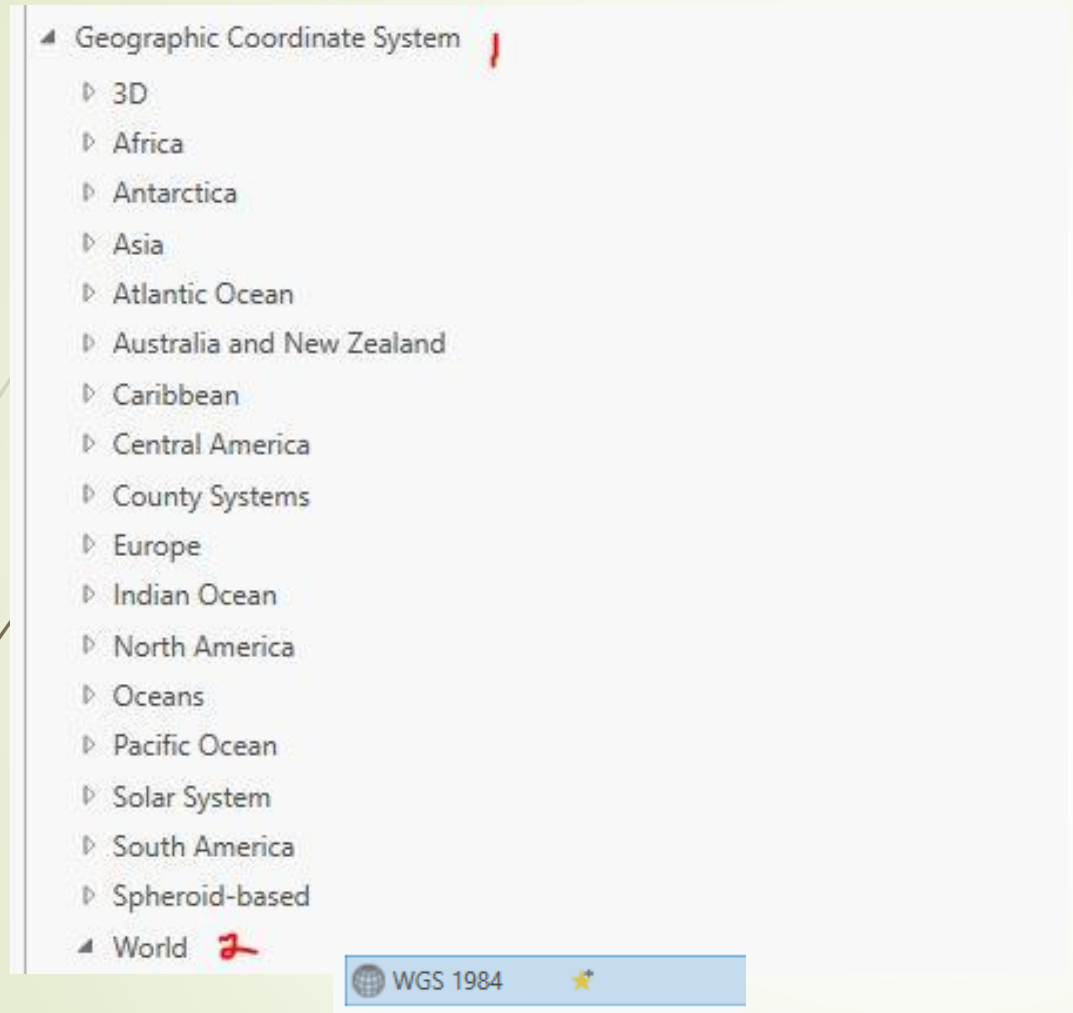


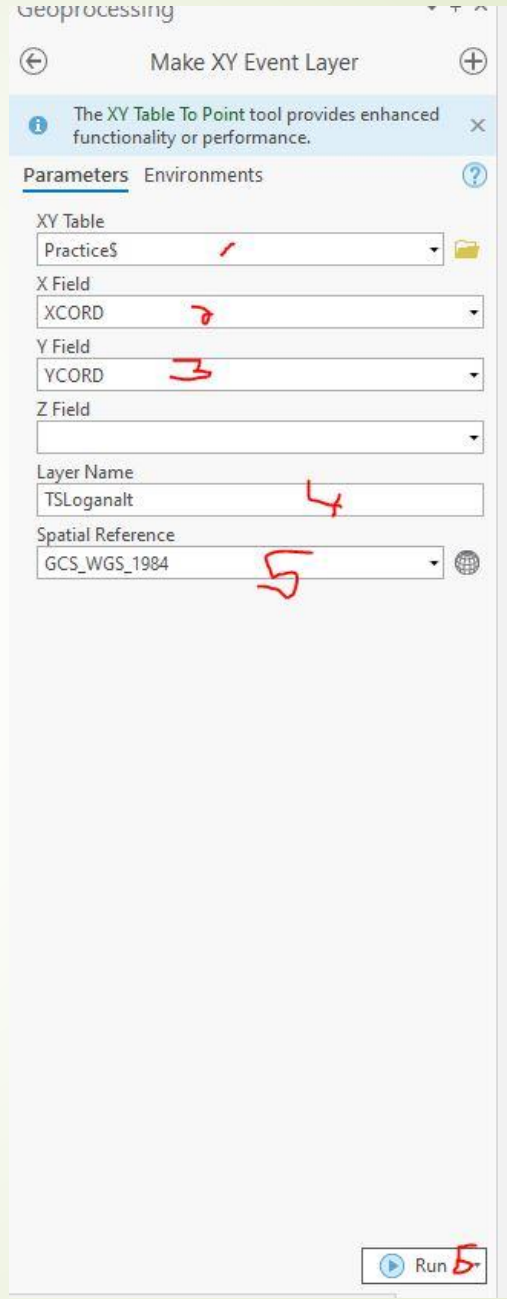
- Alternatively, there is a second way to convert to Vector data.
- Go to top tool tabs and select Analysis →Tools.
- This brings up the geoprocessing window where you can look up tools. At the top, type in XY.
- Tools with XY in the name will pop up. Choose Make XY Event Layer.
- A tool will pop up that consists of the following entries:
  - XY Table: Table from which we are importing the feature data
  - X field (X cord or Long)
  - Y Field (Y cord or LAT)
  - Z Field (Optional Height)
  - Layer Name: Temporary layer's name
  - Spatial Reference: Projection you want to use



Converting Tabular Data into Vector Data: Alternate Method

- Let's add in the following:
  - XY Table: Practice$
  - X Field: XCORD
  - Y Field: YCORD
  - Z Field: Leave Blank
  - Layer Name: TSLoganALT
  - Spatial Reference: see below
- When importing any feature with XY Coordinates, make sure to use a Geographic Coordinate System as they are raw XY Coordinates.
  - Click on the  pe
  - Navigate to Geographic Coordinate System → World WGS1984
  - Select OK. The finished product should look like this:
- Click Run


Geographic Coordinate System
1
3D
Africa
Antarctica
Asia
Atlantic Ocean
Australia and New Zealand
Caribbean
Central America
County Systems
Europe
Indian Ocean
North America
Oceans
Pacific Ocean
Solar System
South America
Spheroid-based
World
2
WGS 1984


Geoprocessing
Make XY Event Layer
The XY Table To Point tool provides enhanced functionality or performance.
Parameters
Environments
XY Table
Practice$
1
X Field
XCORD
2
Y Field
YCORD
3
Z Field
Layer Name
TSLoganalt
4
Spatial Reference
GCS_WGS_1984
5
Run
6

Converting Tabular Data into Vector Data: Alternate Method

- This creates a temporary layer.
- Right click on the feature and select attribute table and comfirm everything copied over.
  - If it not copy over, go back to the second step and type in Excel and search for Excel Table.
  - Convert the Excel Spreadsheet into a table and rerun the XY Event Layer tool.
- Once complete, right click on the feature, select data → export feature
- Enter in the following
  - Input Feature: TSLoganALT
  - Output Location: Practice\GDB\transportation
  - Output Name: TSLoganAlt
- Click OK. Once running is completed, click save.

Converting Tabular Data: Eventing Tabular Data to an Existing Feature Class

- The second way of importing tabular data into a feature class is by eventing a table onto an existing network feature.
- This involves using a table and feature class that share a similar unique identification field (such as a RouteID) to interlink the two.
- Our situation involves eventing a table onto a linear network feature class using a common unique identifier.
  - Optional beginning and ending mile points can be used along with a common identifier to locate linear features along a route.
- This session events the table, Input$, to the Transportation feature class.
- How to Event a table onto a route

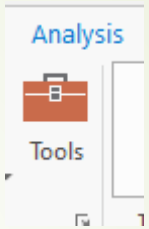
Eventing Route Tabular Data to Route Feature Class

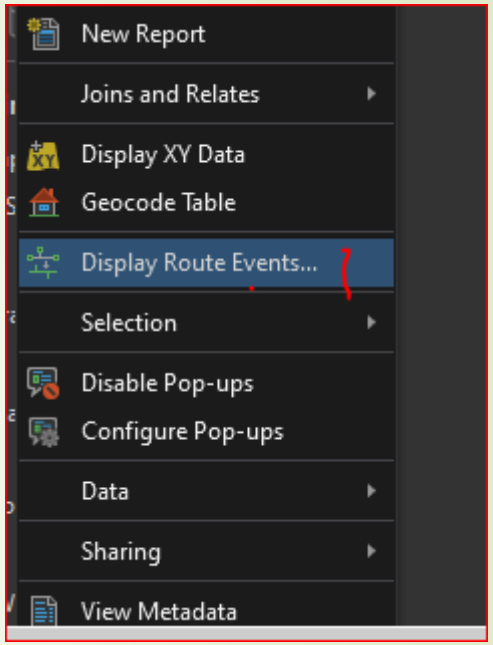
- Returning to ArcGIS Pro, open Course 3 → Materials →Eventing_Practice.xls and drag Input$ over to the contents pane and open the attributes.
- From the practice.gdb/transportation, drag in Dominant Routes and open the attribute table.
- Do you see any fields that are common in both Dominant Routes and the input table we just added?
- Answer there are three:
  - RouteID – the 12-digit + unique identification code assigned to all routes in WV
  - Beginning Mile Point or facsimile thereof
  - Ending Mile Point or facsimile thereof
- These three fields are the fields we use to event a feature to a route feature class.

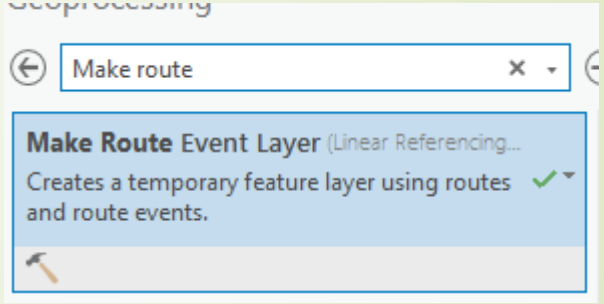
	Routeid	beginMP	From	EndMP	To	M
1	41200190000NB	0	Mercer County Line	8.7	WV 3	
2	41200190000NB	0	Mercer County Line	8.7	WV 3	
3	4140040000000	7.07	CR 19/21	10.33	US 19	
4	4140031000000	0	US 19	0.66	US 19	

Eventing Route Tablular Data to Route Feature Class

- Right click on the input$ and select Display route events.
  - Additionally, this can be accessed through the Analysis tab and Tool Box then searching for the Make Route Event Layer.
- The Display Route Event Tool will appear. This consists of:
  - Input Route Feature: Feature you are eventing the data tables to.
  - Route Identifier Field: Unique identification field common to both the feature and table used to link the two together.

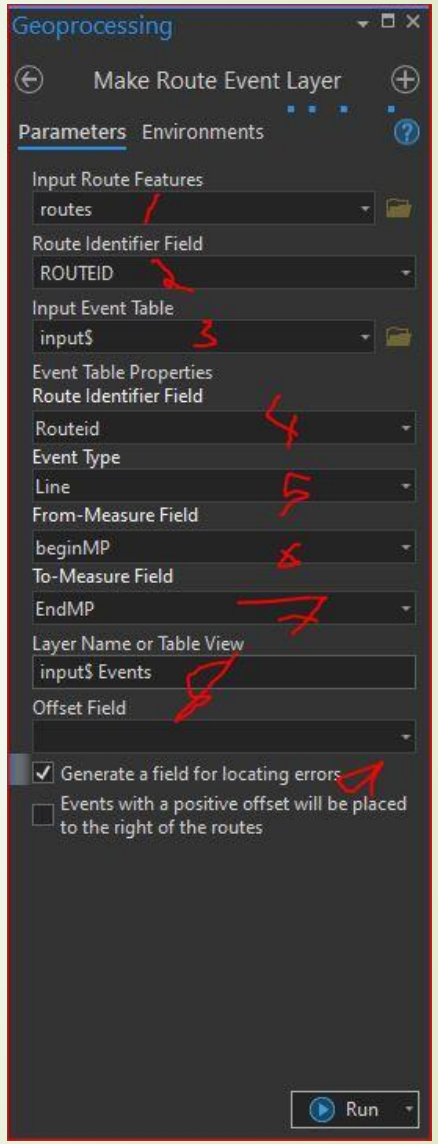






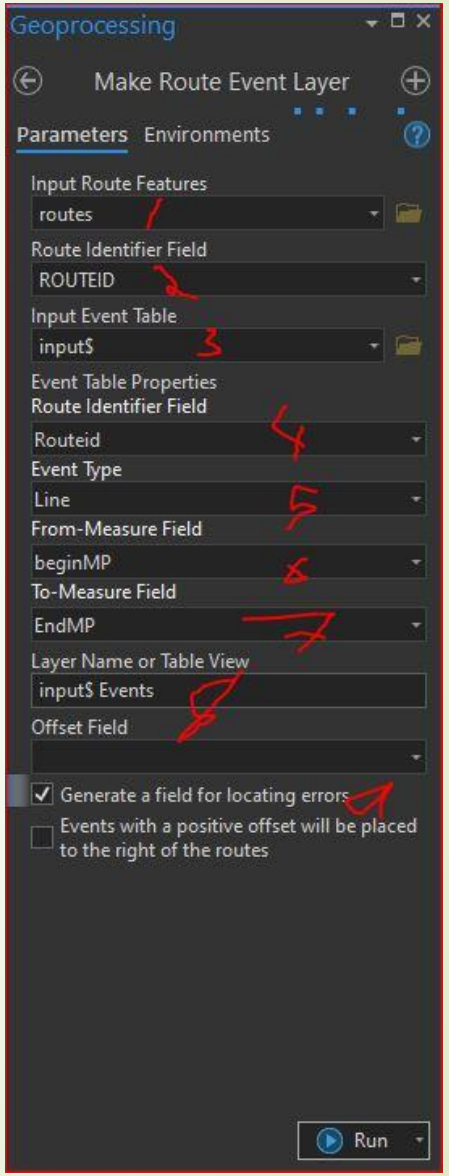
Eventing Route Tabular Data to Route Feature Class

- Display Route Event Tool continued…
  - Input Event Table: Table from which we are eventing the data.
  - Event Type: The temporary layer feature created from joining the Route Feature and the Event Table. There are two types:
    - Line
    - Point
  - From Measure Field: Originating(beginning) mile point of the Input Route Feature
  - To Measure Field: Optional Terminating(ending) mile point of the Input Route Feature
  - Layer Name or Table View: Name of the Output Layer



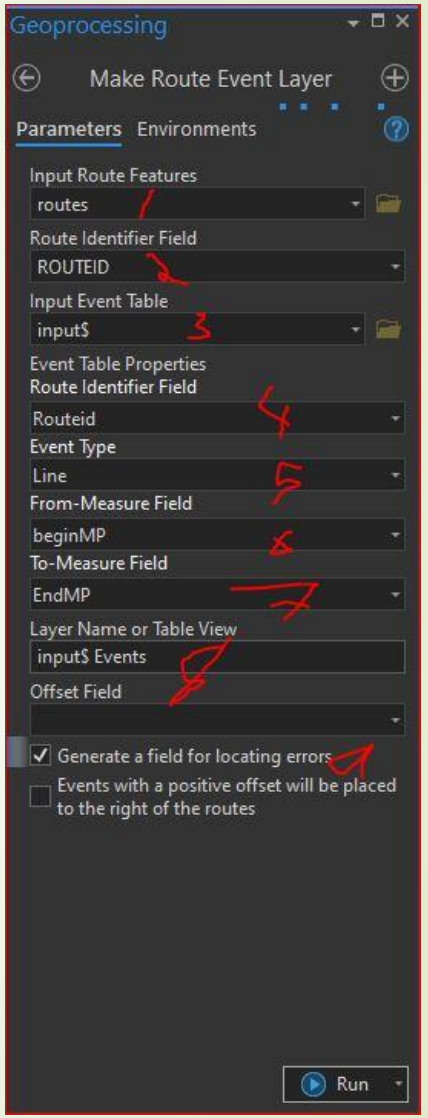
Eventing Route Tabular Data to Route Class Feature

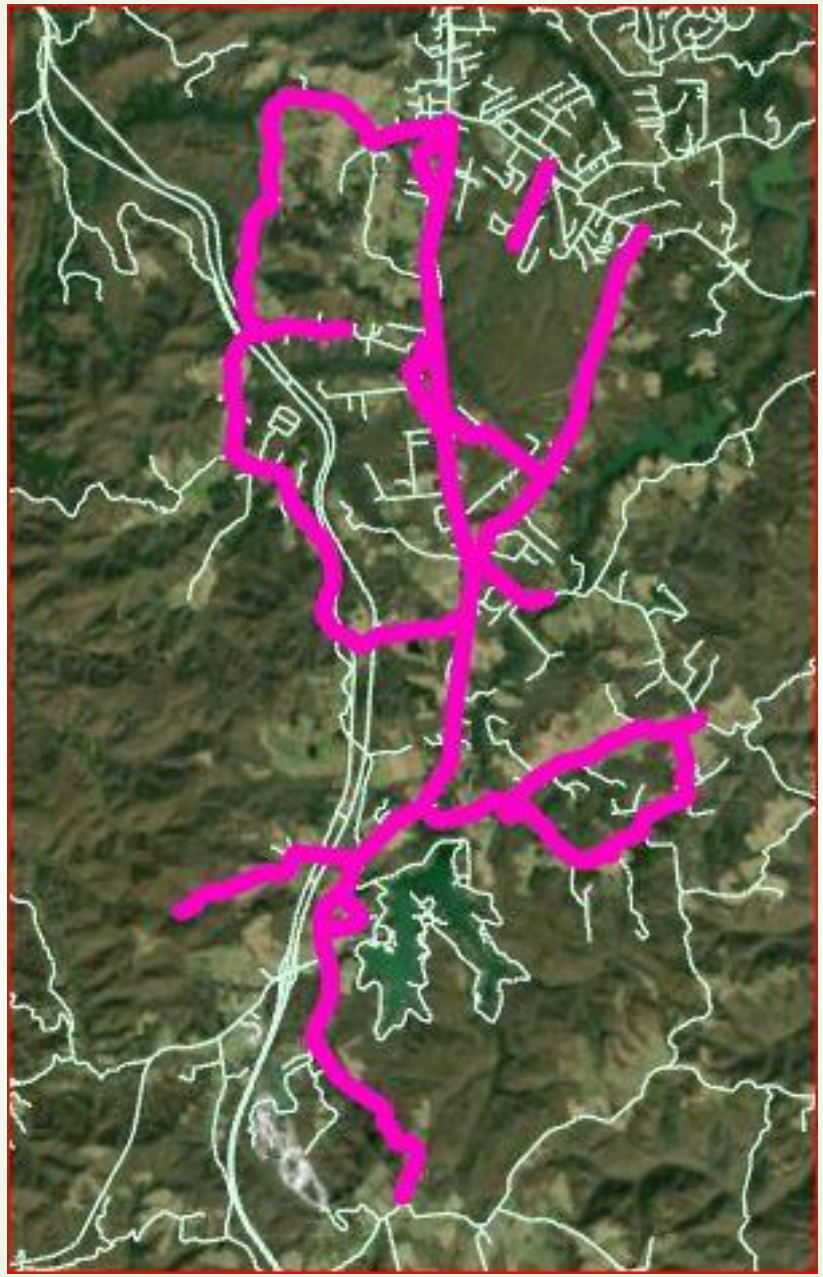
- Display Route Event Tool continued…
  - Offset Field: Field used to offset events from their underlying route.
  - Generate a Field for Locating Errors: Toggle that creates a field showing the accuracy of how an object in the table evented onto the route feature. These include:
    - No Error
    - Partial Match for the TO or From Measure
    - No Match
- Events with a positive offset will be placed on the right of the route.



Eventing Route Tabular Data to Route Feature Class

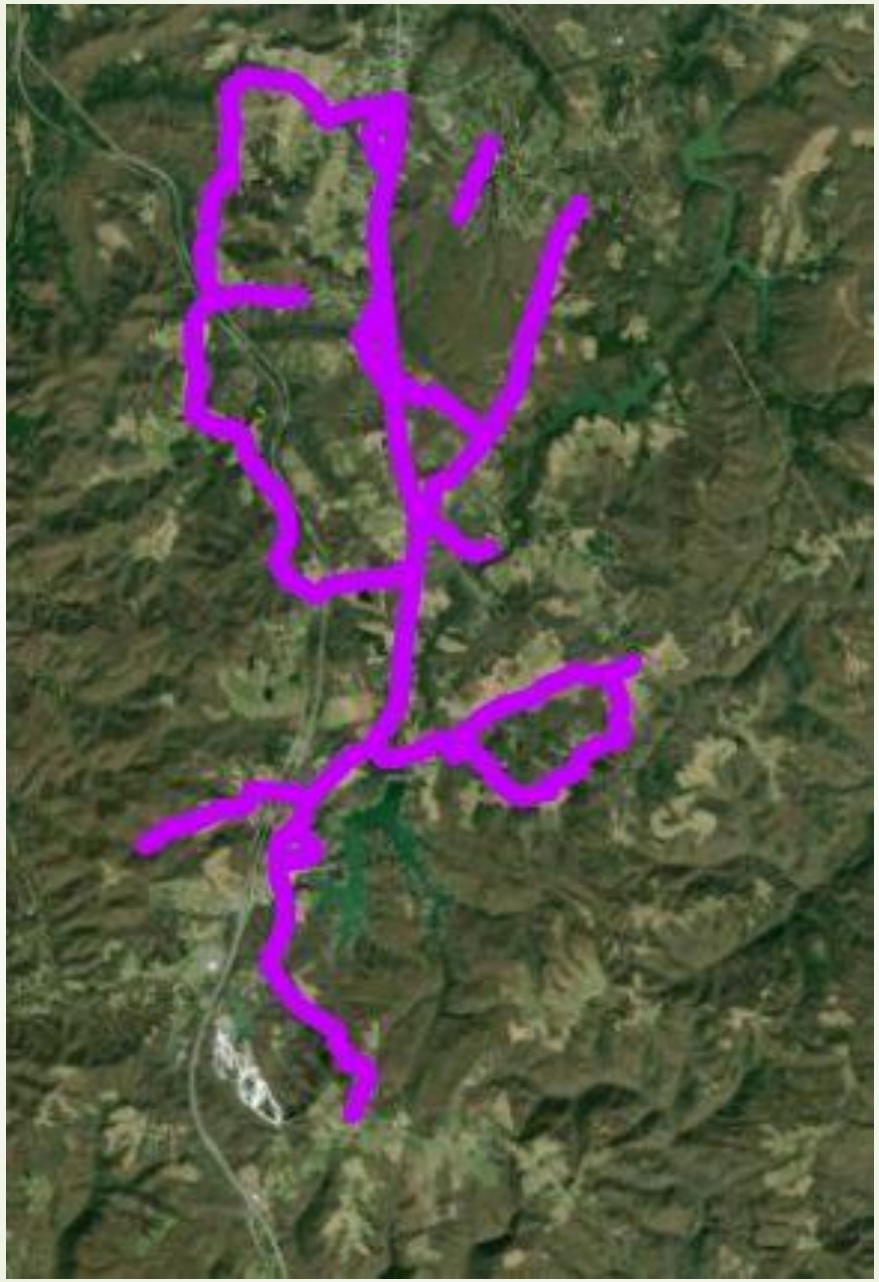
- For our example, enter the following information:
  - Route Features: Routes
  - Route Identifier field: RouteID
  - Input Event table: Input$
  - Event Type: Line
  - From Measure Field: BeginMP
  - To Measure Field: EndMP
  - Layer Name: SRIC
  - Generate a field for LOC errors: checked
- Click Run





Eventing Route Tabular Data to Route Feature Class

- If everything goes according to plan, the SRIC event layer is created.
- Open the Table on the bottom to see if everything imported correctly., (Hint: Check the error field.)
- Select one of the features and zoom to it. Once zoomed, unselect it.
- Change the line size to 5 and the color to pink.
- Right click on SRIC and export it to a feature with the:
  - Input name: SRIC
  - Output: Practice.gdb\Routes
  - Name: SRIC6_Raleigh
- Click Run and once complete, change the line size 5 to Amethyst. 



Exercise: Creating Data

- Open up Exercise3_yourinitials project.
- Create a new feature
  - Define
    - ✓ Name: Road_Surface
    - ✓ Alias: Road Surface
    - ✓ M Values: Checked
    - ✓ Z Values: Checked
  - Field – RouteID
    - ✓ Type: Text
    - ✓ Alias: Leave Blank
    - ✓ Allow Null Values: No
    - ✓ Default: None
    - ✓ Length: 20

Exercise: Creating Data

- Field – Route Label
  - ✓Type: Text
  - ✓Alias: Leave Blank
  - ✓Allow Null Values: No
  - ✓Default: Leave Blank
  - ✓Length: 6
- Field – Begin MP
  - ✓Type: Double
  - ✓Alias: None
  - ✓Allow Null Values: No
  - ✓Default: None

Exercise: Creating Data

- Field – EndMP
  - ✓Type: Double
  - ✓Alias: None
  - ✓Allow Null Values: No
  - ✓Default: None
- Field Area_FT
  - ✓Type: Double
  - ✓Alias: Road Area
  - ✓Allow Null Values: No
  - ✓Default: None
- Spatial Reference, Tolerance, Resolution, Storage Configuration: Leave Default

Exercise: Creating Data

- From the XY Event spreadsheet, import Exercise$ table and create a feature naming it District2_traffic_Lights.
- From the Eventing_alt.xls/all table, select Randolph or Tucker.
- Create a feature class called Randolph_roads or Tucker_roads and event the Randolph or Tucker table to them. Save the result to Routes.
- Repeat for the other one as well as Pendleton and Pocahontas.
- Make sure that the feature for each county is color coded.
  - Pendleton: Amethyst 
  - Pocahontas: Ginger Pink 
  - Randolph: Leaf Green 
  - Tucker: Lapis Lazuli 
- Click Save.

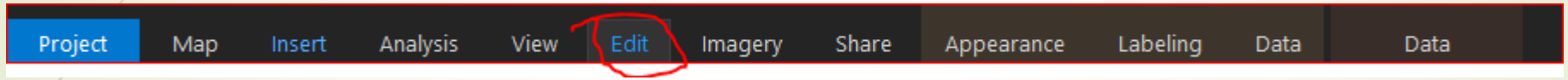
Section 7: Creating and Adding Features to a Feature Class

Recap

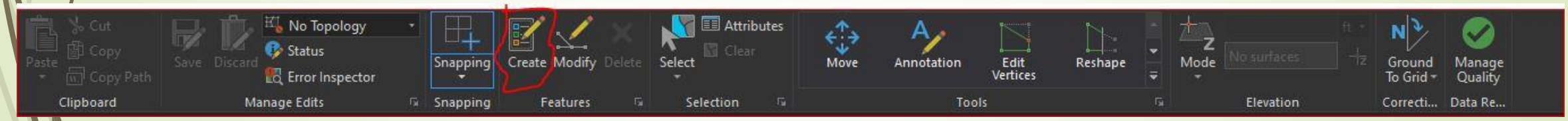
- Previously we have learned how to:
  - Create:
    - ✓ A shared directory and the components that make it up.
    - ✓ A File Geodatabase
    - ✓ Feature Datasets
    - ✓ Feature classes from scratch
  - Import data by converting tabular data into feature classes through:
    - ✓ XY Coordinates.
    - ✓ Eventing tabular data into a network feature class.
- There are two final components to creating data:
  - Adding features to the feature class.
  - Editing existing features within a feature class.

Creating and Adding Features: Edit Tool Tab

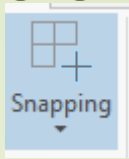
- Go to the top tool bar and select the Edit tab.



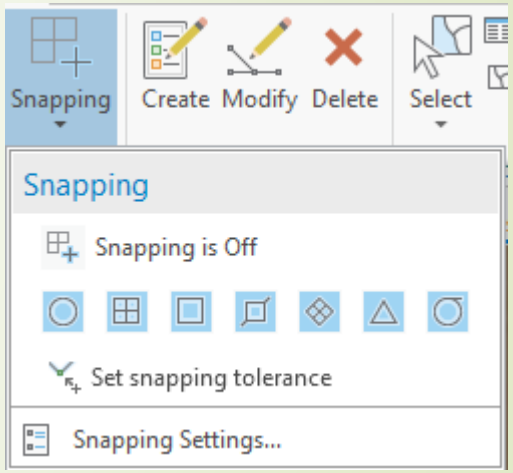
- You may recall, the edit ribbon is primarily used for:
  - Creating new features.
  - Modifying or deleting existing features.
  - Adding and modifying data attributes.
  - Saving existing changes.
- We use a handful of specific tools on the edit tool tab regularly.



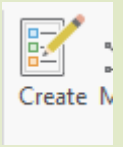
Creating and Adding Features: Snapping Tool



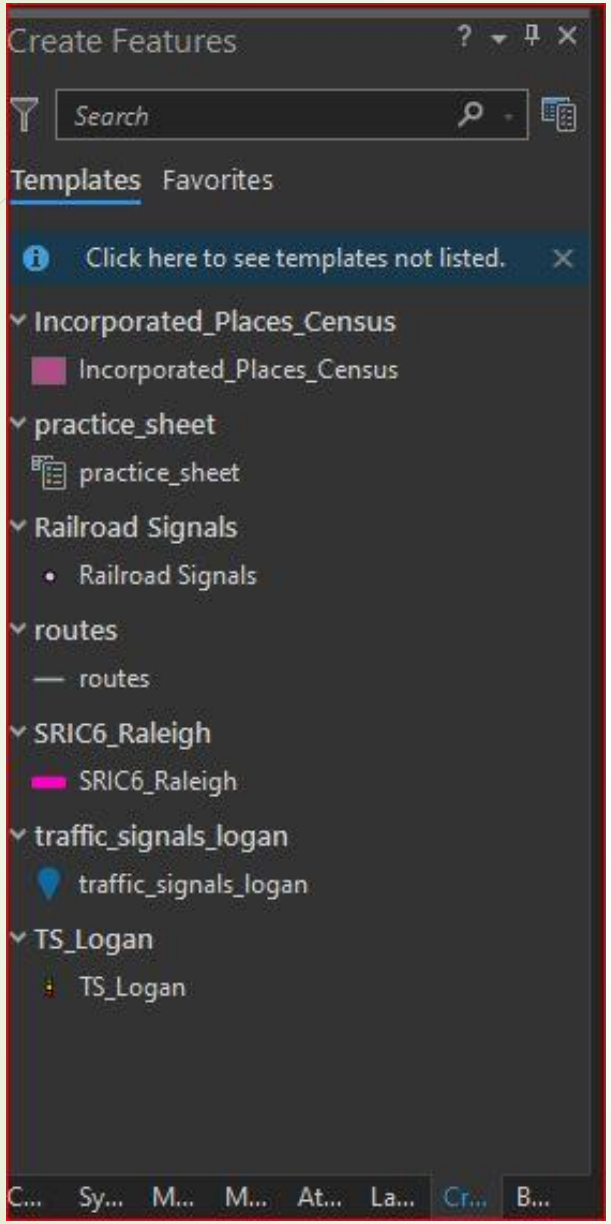
- One of the first tools to turn on prior to creating or editing any feature is the snapping tool.
- This allows you to snap (connect) new and existing features onto the faces (sides) of already existing features using:
  - End of the feature
  - Vertices
  - Edges
- What is snapping?
- Click on Snapping and make sure it is turned on and the features are checked.

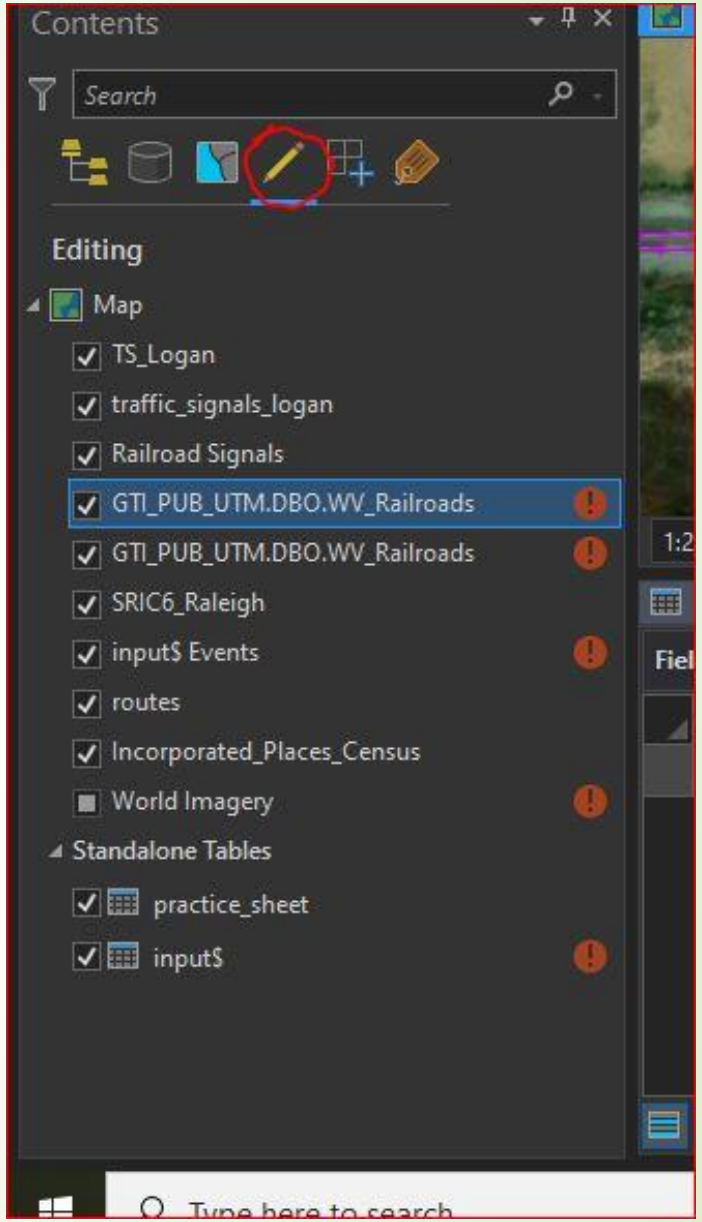


Creating and Adding Features: Create Feature Tool



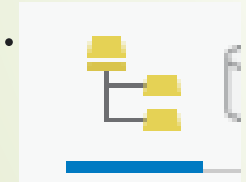
- Situated next to the Snapping tool is the Create feature tool. Click on it.
- This will bring up the create feature pane on the right side where the user can create and add a new feature to existing features.
- Before creating any new feature, scroll over to the contents pane and select editing. 
- Here, uncheck the following:
  - Features we are not planning on adding features to.
  - Any feature that we do not have permission to edit.
  - If these features are not unchecked, the create feature pane will add to them.

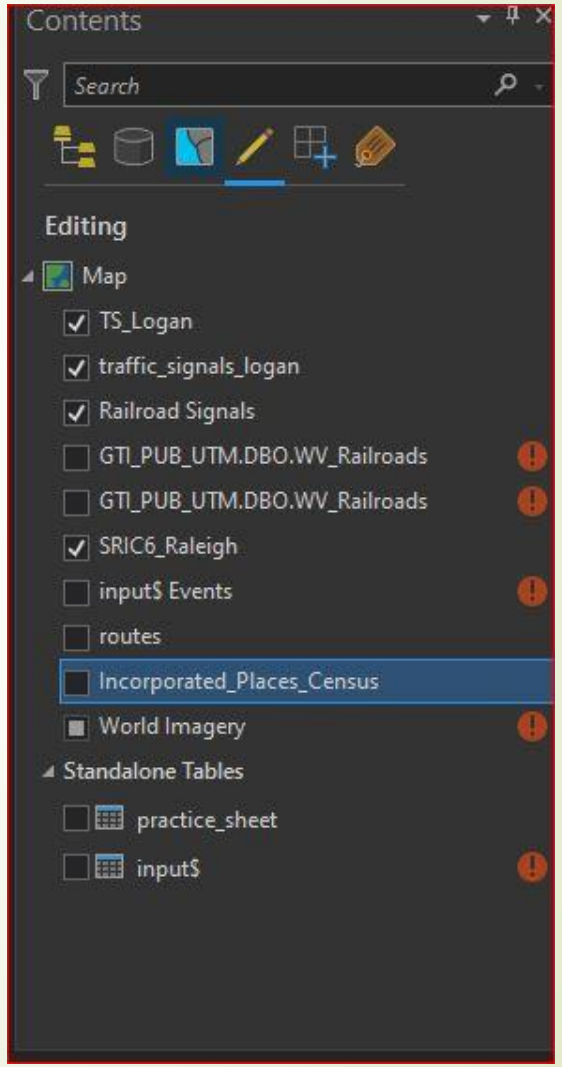

Create Features
Search
Templates
Favorites
Click here to see templates not listed.
Incorporated_Places_Census
Incorporated_Places_Census
practice_sheet
practice_sheet
Railroad Signals
Railroad Signals
routes
routes
SRIC6_Raleigh
SRIC6_Raleigh
traffic_signals_logan
traffic_signals_logan
TS_Logan
TS_Logan
C...
Sy...
M...
M...
At...
La...
Cr...
B...


Contents
Search
Editing
Map
TS_Logan
traffic_signals_logan
Railroad Signals
GTI_PUB_UTM.DBO.WV_Railroads
GTI_PUB_UTM.DBO.WV_Railroads
SRIC6_Raleigh
input$ Events
routes
Incorporated_Places_Census
World Imagery
Standalone Tables
practice_sheet
input$
Type here to search

Creating and Adding a Feature

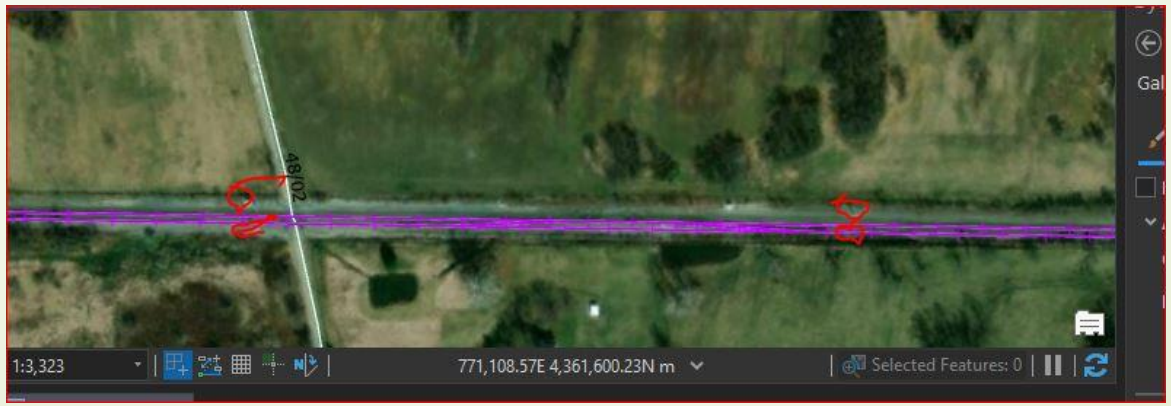
- Features to uncheck include:
  - WV_Railroads
  - Input$Event
  - Routes
  - Incorporated places as well as the two stand alone tables
- Once complete, click on List by Drawing Order box.





Creating and Adding a Feature

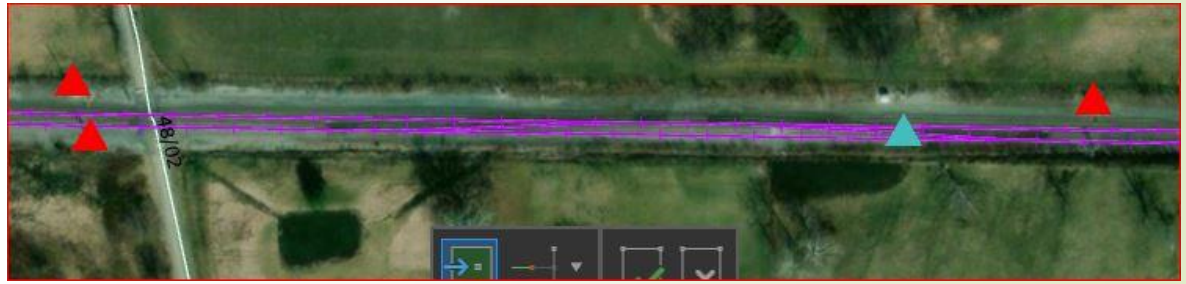
- Now that we are ready to create features, select incorporated places and do a query for the town of Ransom.
- Turn on labeling for incorporated places and routes.
- Next navigate to where Jefferson CR 48/2 crosses the railroad tracks.
- This is a crossover between two main lines where four different signals are located.
- Question: How do we add them to the signal feature class?



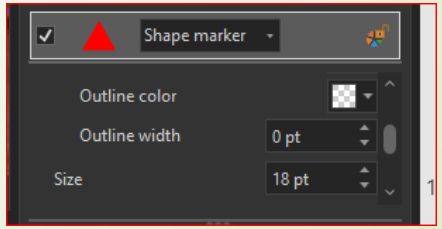
Creating and Adding a Feature

- In the Create Features pane, click on railroad signals.

- Zoom in close on the map to where the red triangles are.
- Change the display into:
  - Name: Railroad Signals
  - Shape: Triangle
  - Color: Red
  - Size: 18 and click Apply



- Navigate down the line a little until you hit another set of crossing tracks.
- Add two additional points to the rail line at this location as illustrated on the next slide.
- Final product should look like this.

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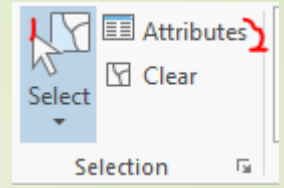
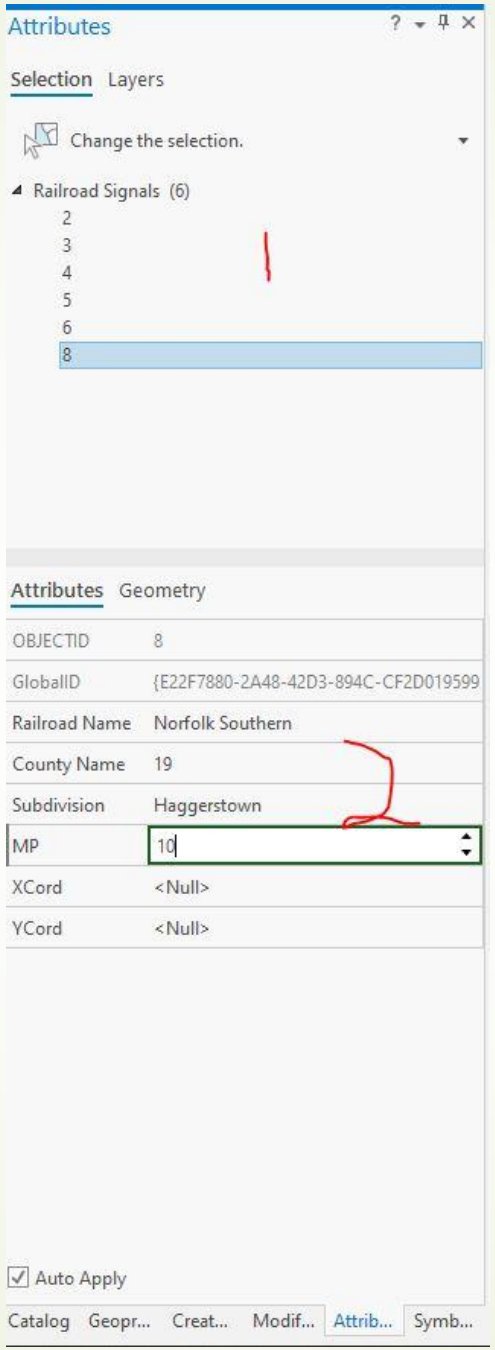
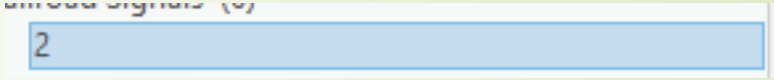
Adding Features to a Feature Class: Adding Attributes



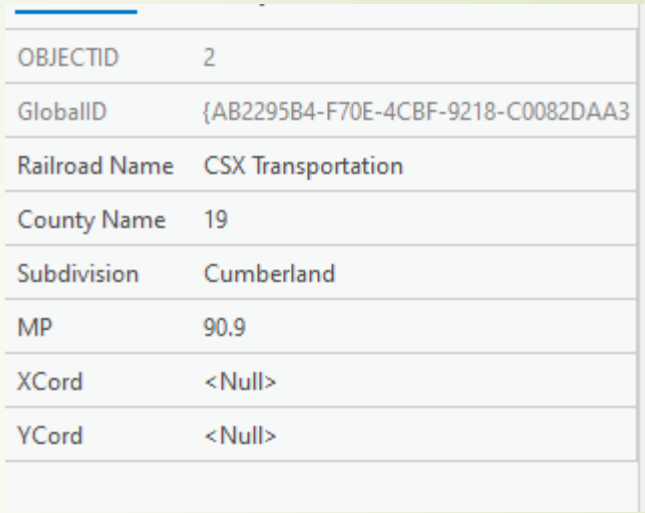
- An attribute is a specific piece of data about a geographic feature.
- We have six new features. It is time to add attributes to them.
- There are two ways to add attributes:
  - Open the attribute table and navigate to the feature that was created and add the attributes individually.
  - Click on the select → select the features that need to have attributes added to them →Click Attributes on.
- Using the second approach, select the 6 features we created and then attributes.
- This will bring up the attributes pane consisting of:
  - A top Pane showing all features that are getting attributed.
  - A bottom pane where the attribute is defined.


Attributes
Selection Layers
Change the selection.
Railroad Signals (6)
2
3
4
5
6
8
Attributes Geometry
OBJECTID 8
GlobalID {E22F7880-2A48-42D3-894C-CF2D019599
Railroad Name Norfolk Southern
County Name 19
Subdivision Haggerstown
MP 10
XCord <Null>
YCord <Null>
Auto Apply
Catalog Geopr... Creat... Modif... Attrib... Symb...

Adding Attributes

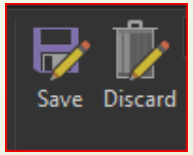


- Select the first feature and type in the following:
  - Railroad Name: CSX Transportation
  - County Name: 19
  - Subdivision: Cumberland
  - MP: 90.9

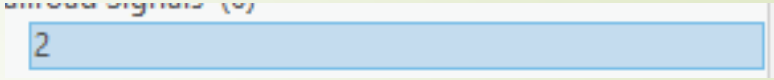


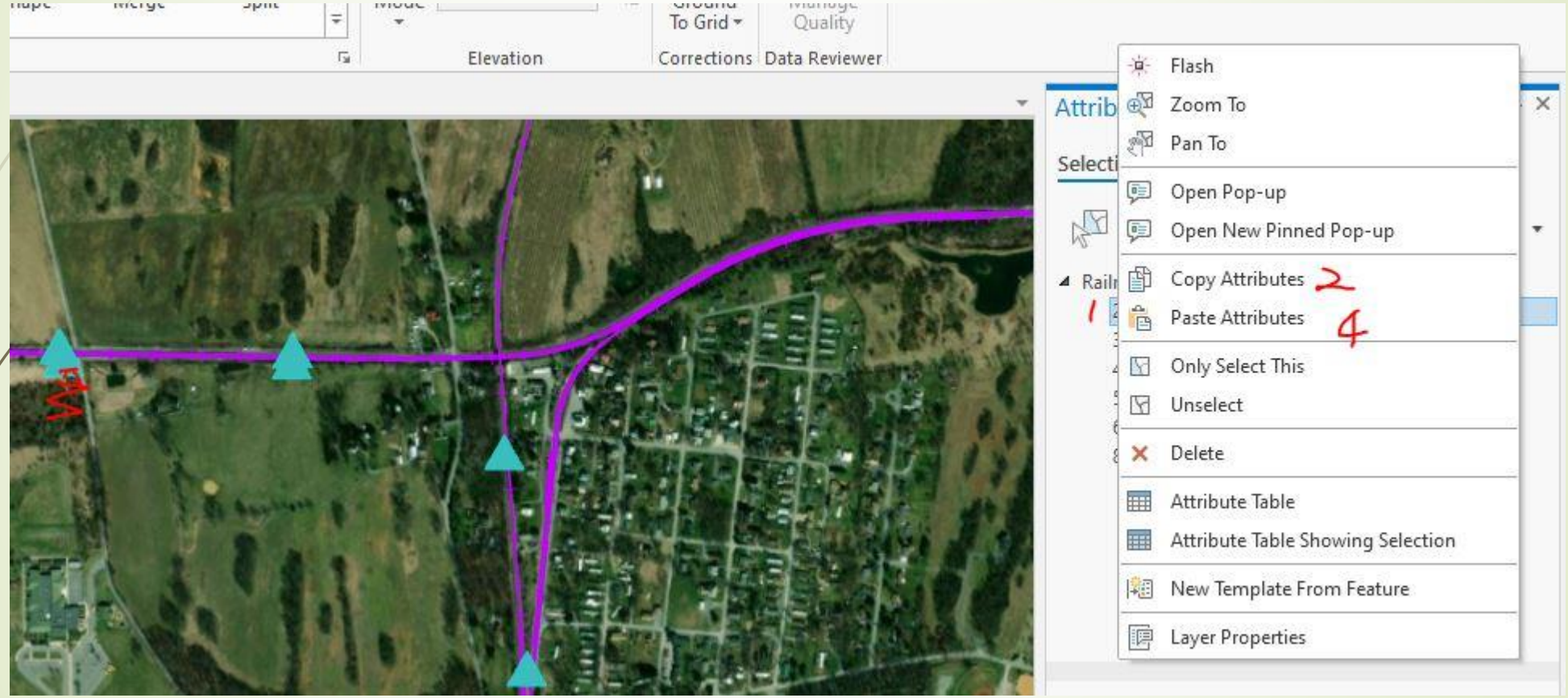
OBJECTID	2
GlobalID	{AB2295B4-F70E-4CBF-9218-C0082DAA3
Railroad Name	CSX Transportation
County Name	19
Subdivision	Cumberland
MP	90.9
XCord	<Null>
YCord	<Null>

- We have added the attribute for the first feature.
- Now repeat this step for the one next to it. This time right click on the one we just attributed, select → copy attributes → scroll down to the one next to it and hit paste.
- Click on Save to save the edits.
  - This is important to do every time you complete edits as it minimizes the risk of loosing edits if something were to happen.

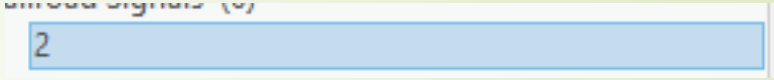


Adding Attributes

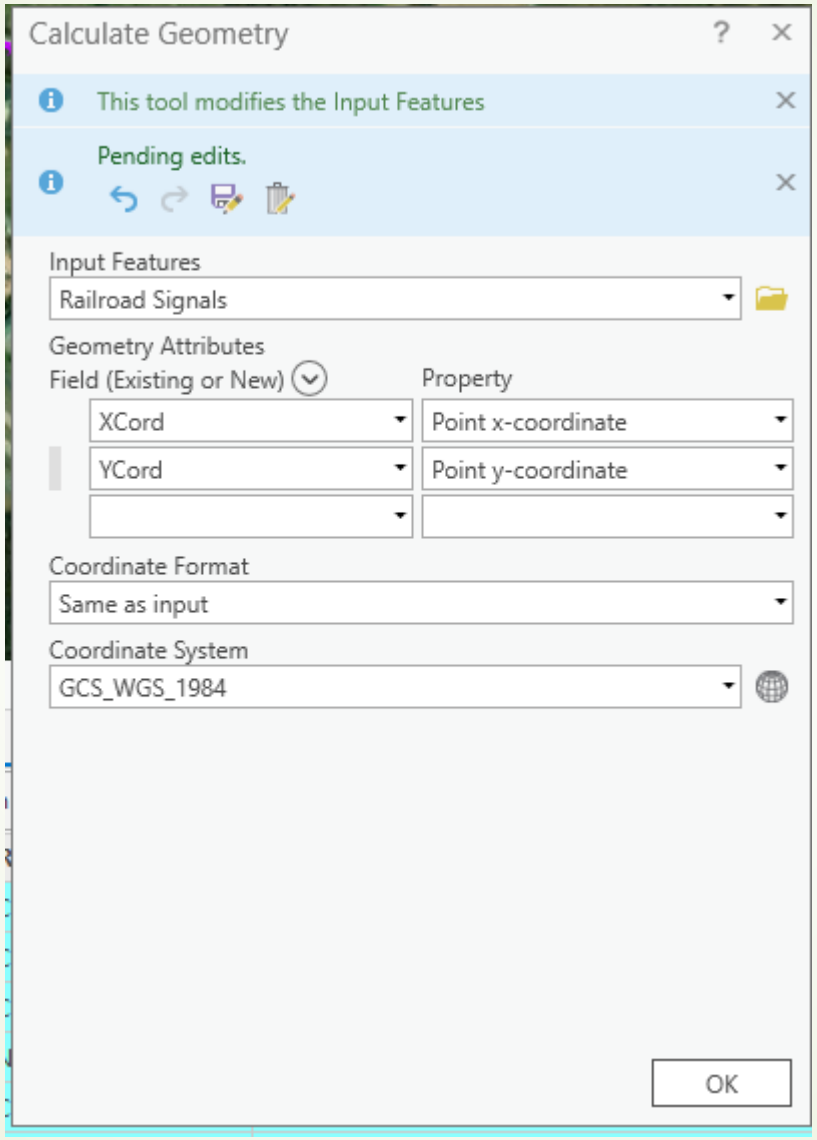




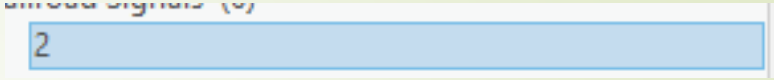
Adding Attributes



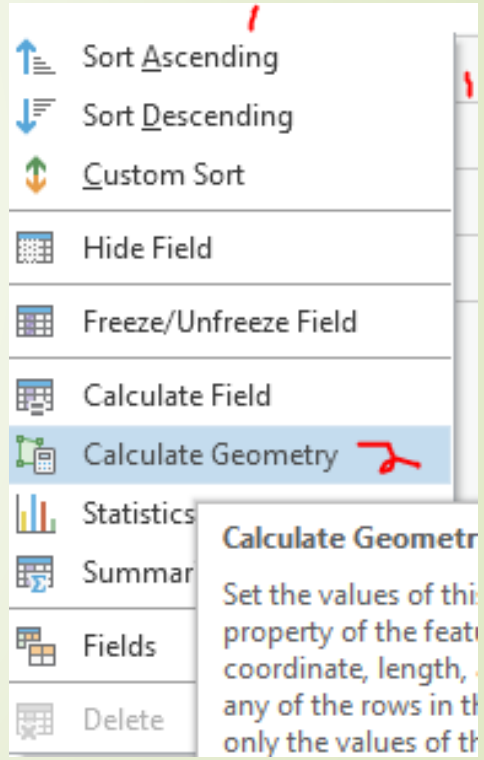
- Repeat these for the two additional features.
- Type in the following for the first one:
  - Railroad Name: CSX Transportation
  - County Name: 19
  - Subdivision: Cumberland
  - MP: 90.6
- Type in the following for the second one:
  - Railroad Name: Norfolk Southern
  - County Name: 19
  - Subdivision: Hagerstown
  - MP: 90.6
- Click on Save to save the edits and save document.


Calculate Geometry
This tool modifies the Input Features
Pending edits.
Input Features
Railroad Signals
Geometry Attributes
Field (Existing or New)
Property
XCord
Point x-coordinate
YCord
Point y-coordinate
Coordinate Format
Same as input
Coordinate System
GCS_WGS_1984
OK

Adding Attributes



- Open up the corresponding attribute table. The only thing missing is the X and Y coordinates. How do we add those to the feature?
- Right click on the X Coord Field and select Calculate Geometry.
- Type in the following:
  - Fields (existing or new)
    - XCORD: Point X Coordinate
    - YCORD Point Y Coordinate
    - Coordinate Format: Same as input
    - Coordinate System: GCS_WGS_1984
  - Click OK. The following attributes should look like this.



Adding Attributes

Railroad Signals

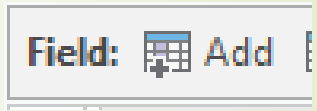
Field: Add Calculate | Selection: Select By Attributes Zoom To Switch Clear Delete Copy

	OBJECTID *	SHAPE *	GlobalID *	Railroad Name	County Name	Subdivision	MP	XCORD	YCORD
1	2	Point ZM	{AB2295B4-F70E-4CBF-9218-C0082DAA31F0}	CSX Transportation	19	Cumberland	90.9	-77.853075	39.360239
2	3	Point ZM	{D49080EC-81E4-4382-A987-2E6BC243B35F}	CSX Transportation	19	Cumberland	90.6	-77.848896	39.360243
3	4	Point ZM	{0E12E893-78E7-410E-BC7F-8B803F9DE7C6}	CSX Transportation	19	Cumberland	90.6	-77.848914	39.360086
4	5	Point ZM	{A1B9F72A-AA0F-41D3-B9E6-29A8898945ED}	Norfolk Southern	19	Hagerstown District	22.7	-77.845107	39.358702
5	6	Point ZM	{B3D3777E-ACA8-4D3D-B954-B52204C36688}	CSX Transportation	19	Cumberland	90.9	-77.853138	39.360419
6	8	Point ZM	{E22F7880-2A48-42D3-894C-CF2D01959982}	Norfolk Southern	19	Hagerstown District	22.7	-77.844832	39.355634

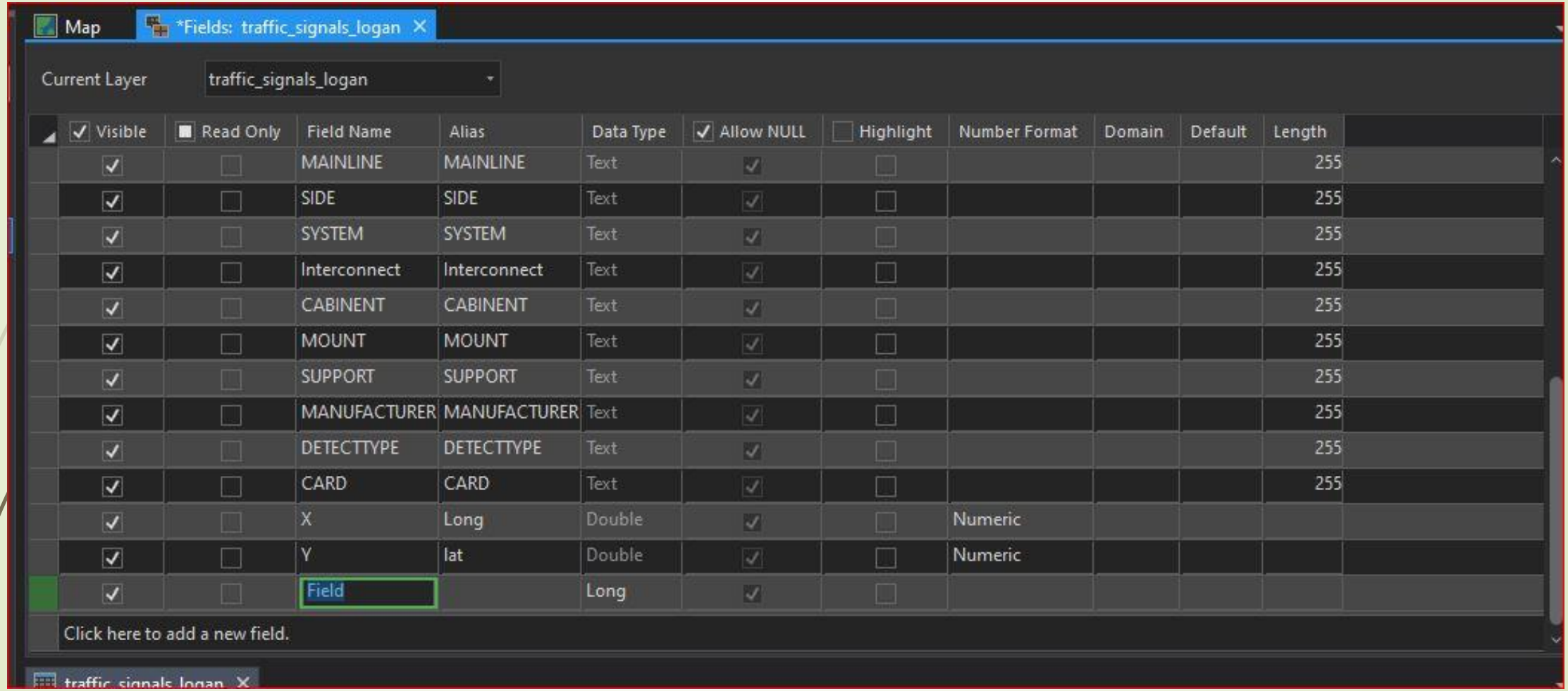
Click to add new row.

Adding Features to a Feature Class: Adding a Field

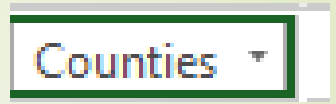
- There are times when we need to add a new field to the attribute or modify or delete a field in the table.
- At the top of the Attribute Table, find the Field Tab.

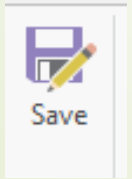


- Click on Add Field. This will bring up a menu where the user can:
  - Add or Remove a field
  - Make a field Read Only
  - Change the Alias
  - Add a Highlight to a field
  - View Numeric Formats
  - Add a Domain
  - Set defaults and field length


Map
*Fields: traffic_signals_logan
Current Layer
traffic_signals_logan
Visible
Read Only
Field Name
Alias
Data Type
Allow NULL
Highlight
Number Format
Domain
Default
Length
MAINLINE MAINLINE Text 255
SIDE SIDE Text 255
SYSTEM SYSTEM Text 255
Interconnect Interconnect Text 255
CABINENT CABINENT Text 255
MOUNT MOUNT Text 255
SUPPORT SUPPORT Text 255
MANUFACTURER MANUFACTURER Text 255
DETECTTYPE DETECTTYPE Text 255
CARD CARD Text 255
X Long Double Numeric
Y lat Double Numeric
Field Long
Click here to add a new field.
traffic_signals_logan

Adding a Field

- For the County Field, click on Domain and select Counties 

- Click on "Click here to add a new field." Type in the following:
  - Read Only: Not Checked
  - Field Name: Type
  - Alias: Signal Type
  - Data Type: Text
  - Highlight: Checked
  - Domain: None
  - Length: 100
- Drag the Type field to fall between MP and Xcord.
- Click Save. 

The result should look like this.

Current Layer: Railroad Signals

Visible	Read Only	Field Name	Alias	Data Type	Allow NULL	Highlight	Number Format	Domain	Default	Length
☑	☑	OBJECTID	OBJECTID	Object ID	☐	☐	Numeric			
☑	☐	Shape	SHAPE	Geometry	☑	☐				
☑	☑	GlobalID	GlobalID	Global ID	☐	☐				
☑	☐	RR_Name	Railroad Name	Text	☑	☑			CSX Transportation	50
☑	☐	County	County Name	Text	☑	☐		Counties		2
☑	☐	Subdivision	Subdivision	Text	☑	☐				50
☑	☐	MP	MP	Double	☑	☐	Numeric			
☑	☐	Type	Signal Type	Text	☑	☑				100
☑	☐	XCORD	XCORD	Double	☑	☐	Numeric			
☑	☐	YCORD	YCORD	Double	☑	☐	Numeric			

Click here to add a new field

Adding an Attribute to a New Field

- A new Type field was added to the signal feature class.
- Add in the following:
  - CSX Transportation: Crossover
  - Norfolk Southern: Siding
- Click on Edit → Save. The finished product should look like this.

Railroad Signals

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

	OBJECTID *	SHAPE *	GlobalID *	Railroad Name	County Name	Subdivision	MP	Signal Type	XCORD	YCORD
1	2	Point ZM	{AB2295B4-F70E-4CBF-9218-C0082DAA31F0}	CSX Transportation	Jefferson	Cumberland	90.9	Crossover	-77.853075	39.360239
2	3	Point ZM	{D49080EC-81E4-4382-A987-2E6BC243B35F}	CSX Transportation	Jefferson	Cumberland	90.6	Crossover	-77.848896	39.360243
3	4	Point ZM	{0E12E893-78E7-410E-BC7F-8B803F9DE7C6}	CSX Transportation	Jefferson	Cumberland	90.6	Crossover	-77.848914	39.360086
4	5	Point ZM	{A1B9F72A-AA0F-41D3-B9E6-29A8898945ED}	Norfolk Southern	Jefferson	Hagerstown District	22.7	Siding	-77.845107	39.358702
5	6	Point ZM	{B3D3777E-ACA8-4D3D-B954-B52204C36688}	CSX Transportation	Jefferson	Cumberland	90.9	Crossing	-77.853138	39.360419
6	8	Point ZM	{E22F7880-2A48-42D3-894C-CF2D01959982}	Norfolk Southern	Jefferson	Hagerstown District	22.7	Siding	-77.844832	39.355634

Click to add new row.

Exercise

- Open Roadway Surface Feature and scroll over to the State Capital area.
- Add in the following:
  - Road in front of the capital:
    - RouteID: 20200600000EB and WB respectively
    - Route Label: US 60
    - Beginning MP: 17.65
    - End MP: 20.62
    - Area_Ft: 60
  - Road on the west side between Kanawha Blvd and Washington St (see above).
    - RouteID: 20200600000EB and WB respectively
    - Route Label: US 60
    - Beginning MP: 17.65
    - End MP: 20.62
    - Area_Ft: 60

Exercise

- Road from Washington St. E to the interstate
  - RouteID: 20301140000000
  - Route Label: WV 114
  - Beginning MP: 0.23
  - End MP: 20.62
  - Area_Ft: 90
- Interstate (see above)
  - RouteID: 20100770000NB and SB respectively
  - Route Label: I 77
  - Beginning MP: 95.34
  - End MP: 117.5
  - Area_Ft: 126

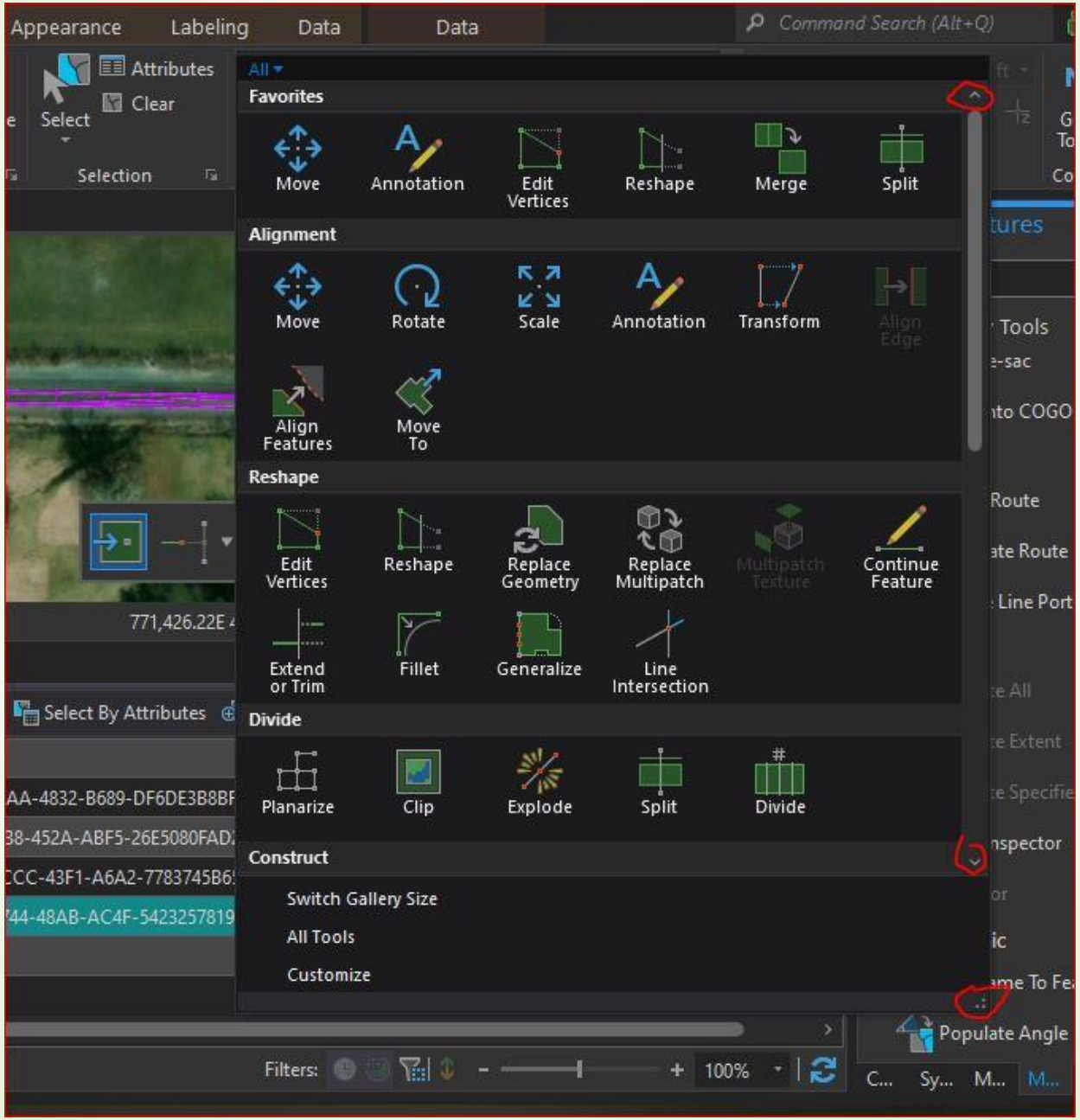
Exercise

- Click on Save Edits
- Add an additional Field
  - Read Only: Not Checked
  - Field Name: Streetname
  - Alias: Street Name
  - Data Type: Text
  - Highlight: Checked
  - Domain: None
  - Length: 100
- Name the three roads as follows
  - 1st one: Kanawha Blvd
  - 2nd and third one: Greenbrier Street
  - Last one I 77
- Save edits

Section 8: Editing Features in a Feature Class

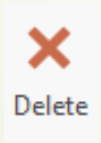
Editing Features

- We have learned how to:
  - Create a feature from scratch.
  - Add attributes to a new or existing feature.
  - Add, modify, and delete fields from the Attribute table for a feature.
- However, there are times when the data need to be modified or deleted.
- This is where the Edit Menu is used. The edit menu can be used to:
  - Align, move, and rotate features.
  - Edit, replace, or intersect vertices.
  - Edit, reshape, extend, or trim features.
  - Flip, merge, move, and spilt features.
  - Divide, clip, and split features.
  - Annotate features.


Appearance
Labeling
Data
Data
Command Search (Alt+Q)
Attributes
Clear
Select
Selection
All
Favorites
Move
Annotation
Edit Vertices
Reshape
Merge
Split
Alignment
Move
Rotate
Scale
Annotation
Transform
Align Edge
Align Features
Move To
Reshape
Edit Vertices
Reshape
Replace Geometry
Replace Multipatch
Multipatch Texture
Continue Feature
Extend or Trim
Fillet
Generalize
Line Intersection
Divide
Planarize
Clip
Explode
Split
Divide
Construct
Switch Gallery Size
All Tools
Customize
771,426.22E
Select By Attributes
Populate Angle
Filters:
100%

Editing Features

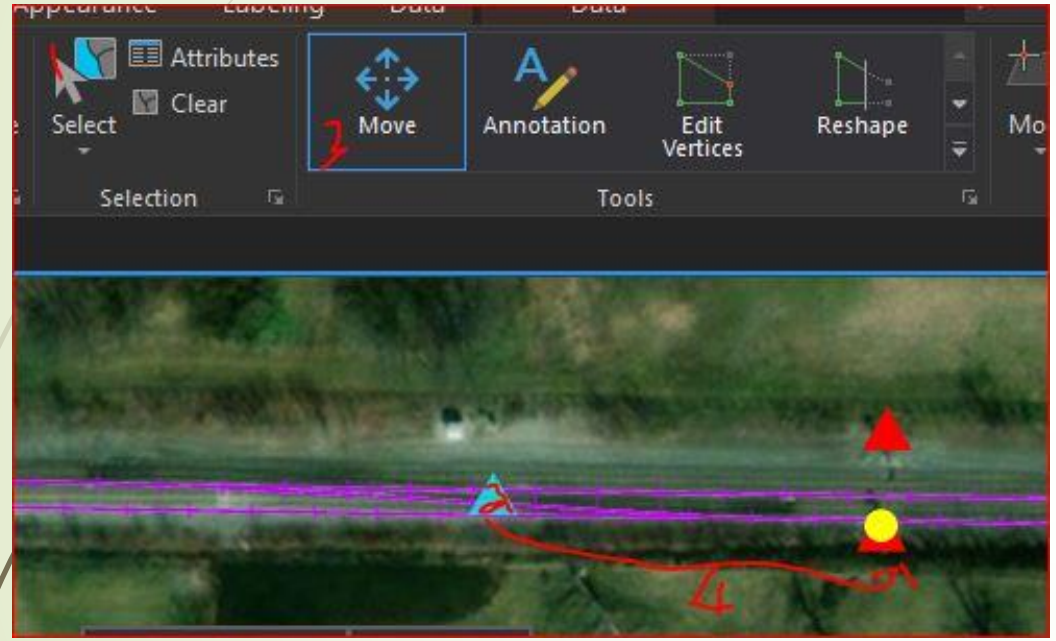
- The tools most commonly used to edit features include:
  - Move
  - Edit Vertices
  - Reshape
  - Split
  - Merge
- All of these can be found on the Favorites menu.
- Additionally, the delete button is used to delete any feature.

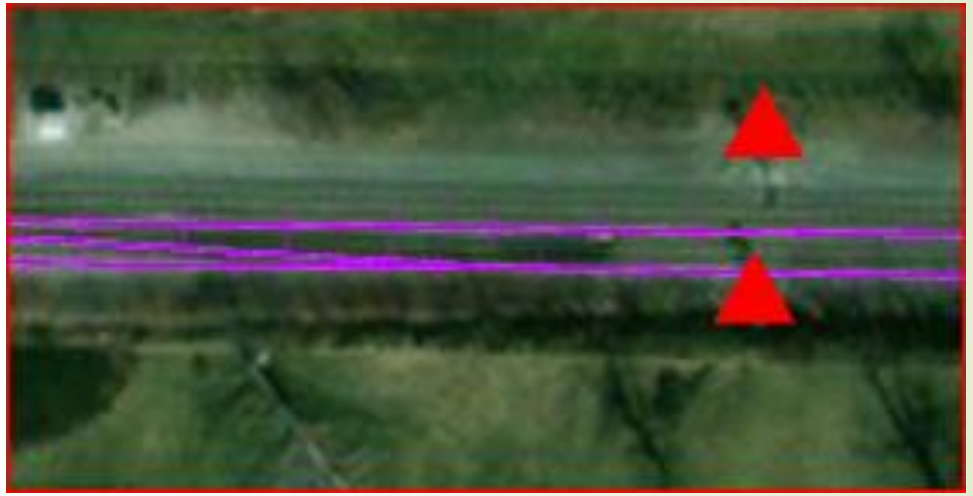


Editing Features – Move Tool

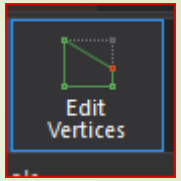
- This tool is used to drag and drop point and annotation features to new destinations.
  - Often in our case to clean up points that are incorrect.
- Steps to move a feature:
  - Click on the Move button and select the feature.
  - Click on Drag.
  - Drag the feature to its next location.
  - Click outside of the feature to set it.
  - Click Save. The feature has been moved.

Editing Features – Move Tool

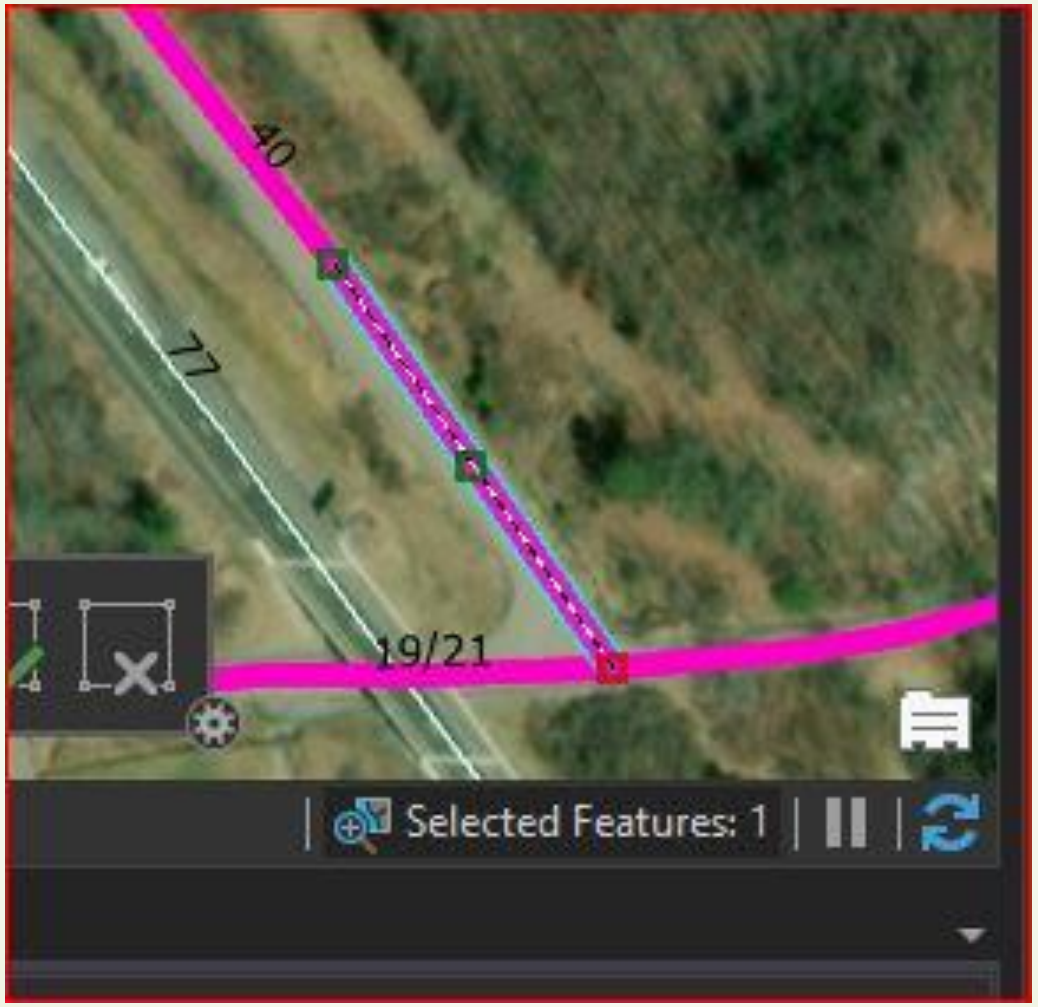




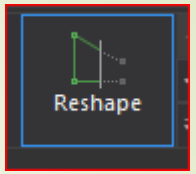
Editing Features – Edit Vertices Tool



- Scroll over SRIC6_Raleighto CR 40 and create an additional line to connect it to CR 19/21. (Although this is not accurate, we are going to try it for demonstration purposes.)
- Select the new line and click on Edit Vertices
- The first thing you will notice is that the line consists of interconnected green and red squares called vertices. The vertices:
  - Give a polygon or polyline its shape.
  - Consist of:
    - ✓ Green: Representing the beginning and in-between points that give shape to the feature.
    - ✓ Red: Representing the end point or terminus of the feature.

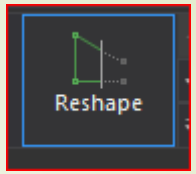

40
77
19/21
Selected Features: 1

Editing Features – Reshape Tool



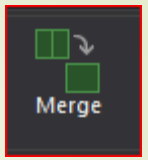
- Go ahead an add a vertex halfway between the start and finish of the line and bend it to 45 degrees. Click save edits.
- Once complete, click on the Reshape tool.
  - Along with the edit vertices tool, it allows you to reshape lines and polygon features.
  - However, unlike edit vertices, the Reshape Tool requires an existing line or polygon boundary that traces the feature.
- There are several sub-tools associated with the Reshape Tool including:
  - Point to point: Fastens the feature to points. 
  - Curve: Creates a curve or circular feature with the line or polygon. 
  - Linear: Creates a straight line from point A to B. 
  - Traces: Traces the feature's boundary or line along an existing feature's boundary or line. 
  - Cancel: Cancels any new sketches or drawings. 
  - Finish: Finishes any feature edits. 

Editing Features – Reshape Tool



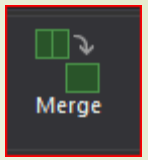
- After clicking on the Reshape Tool, use the trace tool and retrace along the existing dominant route layer.
- The finished product should look like this.
- Save it and select both the new feature and the feature above it. 
- At this point, there are two features representing one long feature.
- Since they represent the same feature and there is no natural break, how do you combine them?
- Answer: Merging

Editing Features – Merge Tool



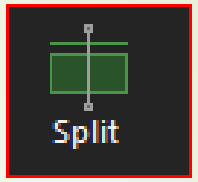
- Involves physically combining at least 2 or more features in the same feature class into one single feature.
- Used when:
  - Adding a new area or lengthening a feature.
  - Combining features that share similar attributes that may be separated by another feature such as a series of islands, rest areas, etc.
  - Combing a feature that may be spread with adjacent features having similar attributes (e.g. Parcels into a Zone).
- Rules for merging features:
  - Must merge features from the same feature class
  - Must merge the same type of feature (IE Line to line, polygon to polygon, etc.). Cannot mix and match.
  - Make sure that features on top of and below the feature being merged are not selected.

Editing Features – Merge Tool



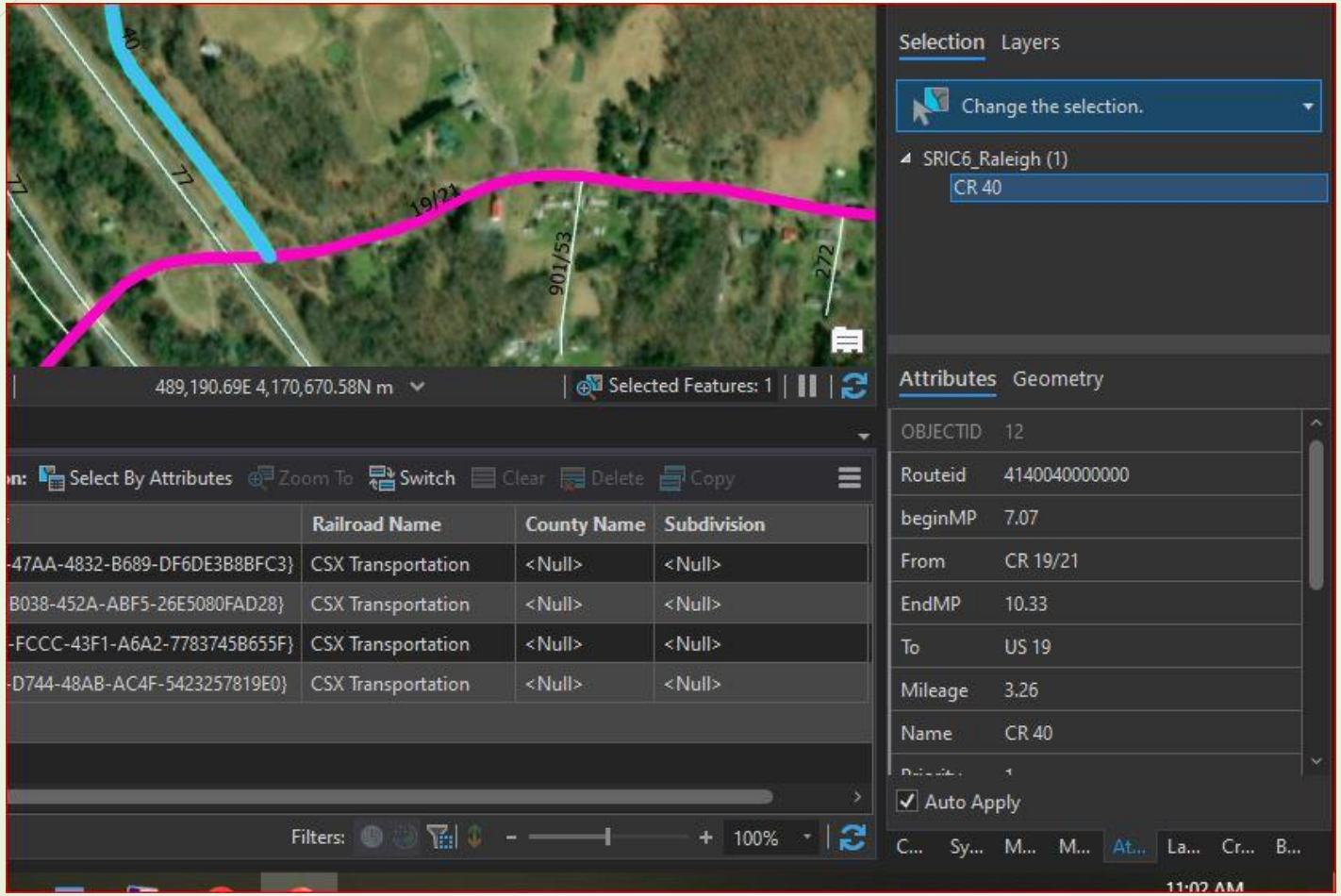
- Click on the merge button in the editing tools menu.
- The following menu will pop up containing the features being merged and the corresponding characteristics.
- To merge the features, makes sure the following:
  - Attributes are not blank.
  - The objectID is close to zero.
  - The specific attributes and characteristics match up.
- Select CR 40 since the first feature has no attributes associated with it. Click merge. This will create one feature.
  - Click on it and check to see if the features have been merged.

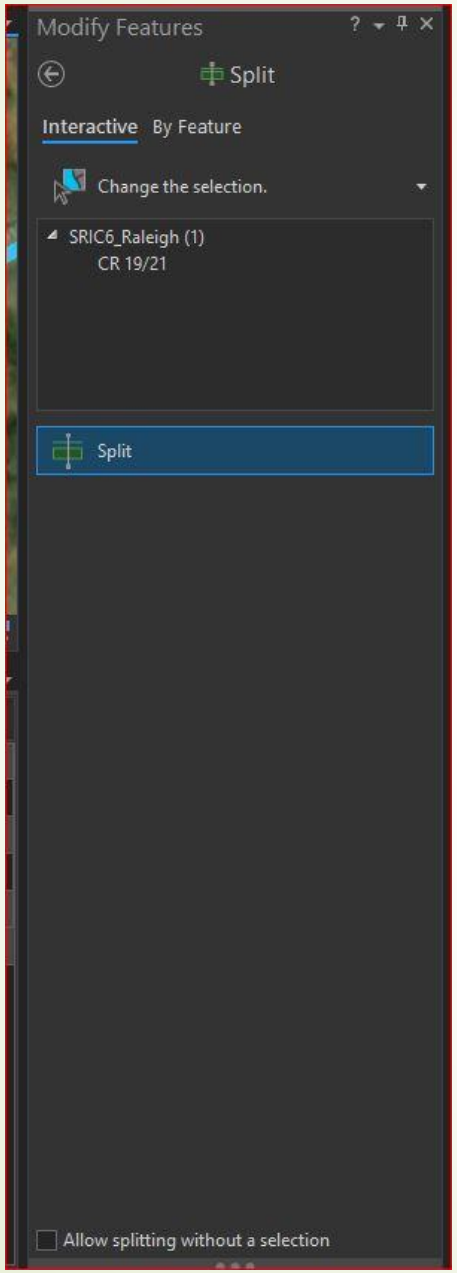
Editing Features – Split

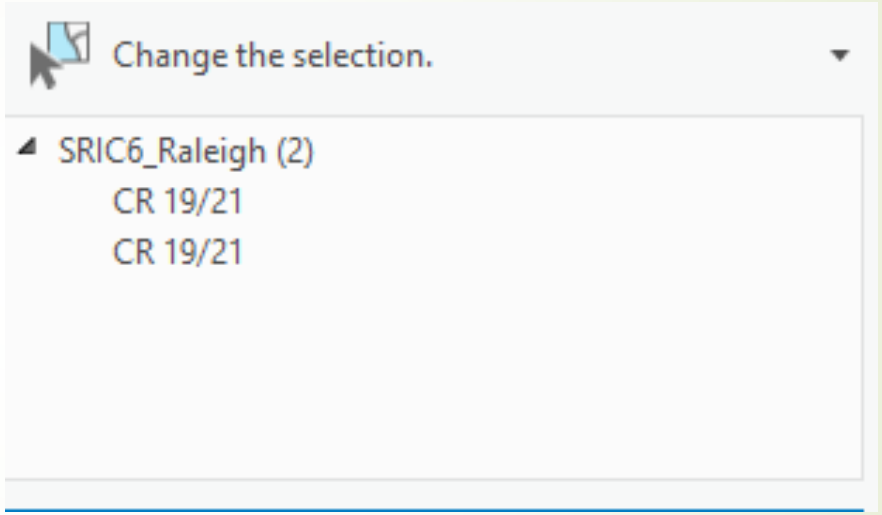


- Select CR 19/21and the Split Tool button on the Edit tab.
- This will bring up the Split tool. It is primarily used for:
  - Segmenting a polygon or line feature at the junction of another line or polygon feature.
  - Trimming any excess line or polygon.
  - Creating new linear or polygon features from old ones.
- However, there are some constraints.
  - If the feature has a coded domain, you will need to reenter it in the feature class.
  - It might not cut exactly where you want it, but on the closest vertices.
- Click the split button where CR 40 and 19/21 intersect to create two separate lines.

Finished Product




Modify Features
Split
Interactive
By Feature
Change the selection.
SRIC6_Raleigh (1)
CR 19/21
Split
Allow splitting without a selection


Change the selection.
SRIC6_Raleigh (2)
CR 19/21
CR 19/21

Exercise

- Using Edit Vertices tool. Extend the end of CR 19/21 to CR 19/19.
- Since this is going to be a direct line, use the Reshape tool and Trace tool and trace the route along the line.
- Extend CR 19 using Edit Vertices until it touches US 19.
- Use the trace tool to send that back to the intersection of CR 19/21.
- Use the split tool to split CR 19/19 at CR 19/21.
- Finally, create a new feature between US 19 and CR 19/17 and WV 40 and merge this new feature with US 19.
- Save all edits.

Section 9: Metadata

Metadata

- The final step in creating a new feature is adding Metadata. What is Metadata?
  - Metadata is the information that describes an item in ArcGIS including:
    - Features
    - Services
    - Maps
    - Applications
  - Metadata answers the Who, What, Where, When, Why, and How about the feature.
    - Who created the data
    - How the data are being used
    - What fields and attributes are included
    - Where the area of interest is geospatially located
    - When the data were created as well as how often they are updated
    - Why the feature is important

Example of Metadata

- Every feature has Metadata associated with it.
- Right click SRIC6_Raleigh feature and select edit metadata.
- This will bring up the metadata editing menu where the user can add:
  - Title for describing the feature.
  - Thumbnail description of the feature class.
  - Tags (single word or phrase) used to locate the data quickly in ArcGIS Enterprise or online.
    - The more tags you use, the easier it will be for you to locate the dataset.
  - A summary or an at-a-glance description of the feature.
  - Abstract: More in-depth description of the feature of including a description, feature attributes, projections, and freshness of data.
  - Credits of who created the feature.

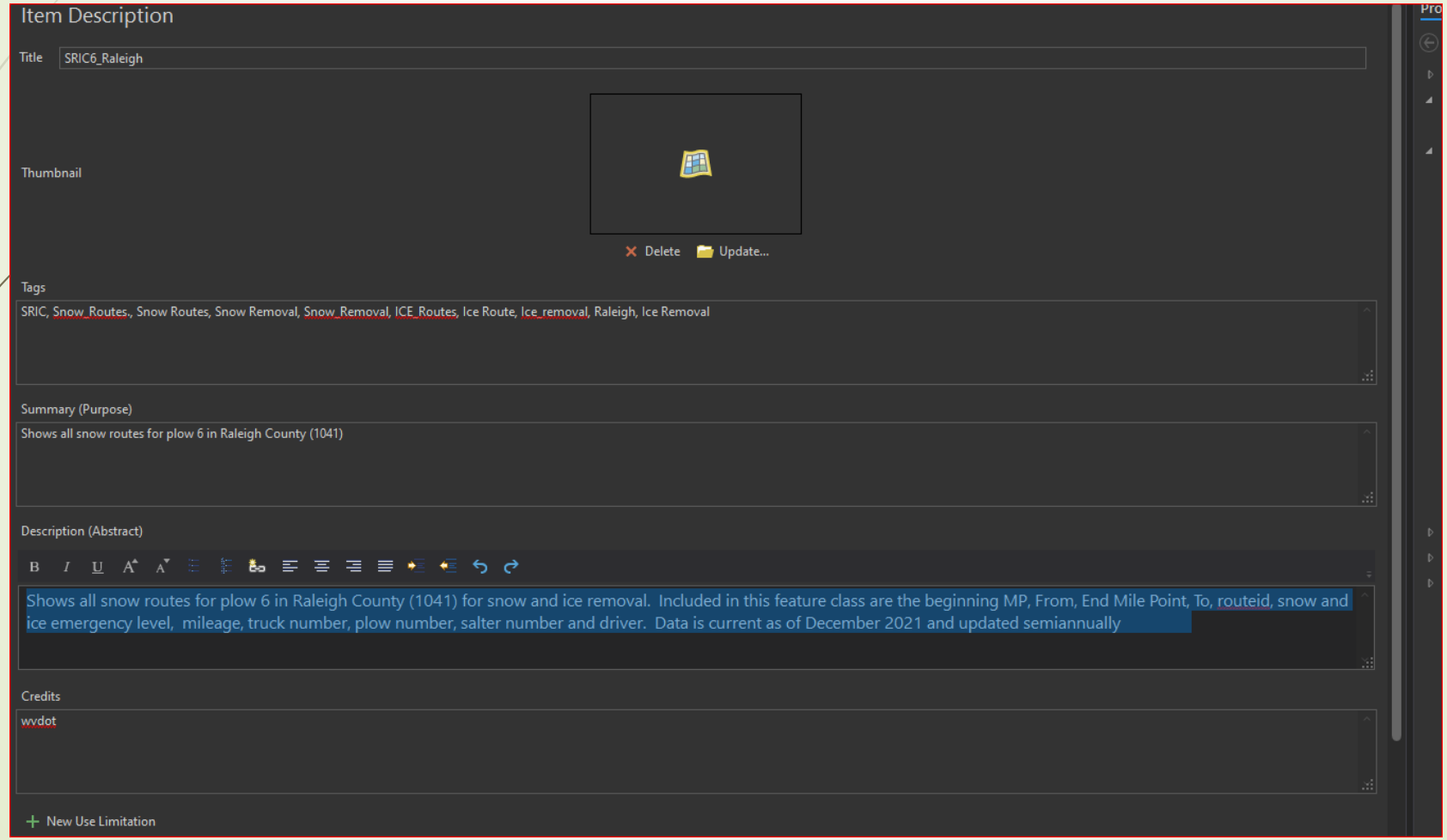
Metadata

- New Use Limitations of who has access to the data.
- Scale Range of how far in and out the data is visible.

- For the SRIC_Raleigh feature, the information should be as follows
  - Title: SRIC6_Raleigh
  - Tags: SRIC, Snow_Routes, Snow Routes, Snow removal, Snow_removal, ICE_Routes, Ice Route, Ice_removal, Raleigh, Ice Removal
  - Summary: Shows all snow routes for plow 6 in Raleigh County (1041).
  - Description: Shows all snow routes for plow 6 in Raleigh County (1041) for snow and ice removal. Included in this feature class are the beginning MP, From, End Mile Point, To, routeid, snow and ice emergency level, mileage, truck number, plow number, salter number, and driver. Data is current as of December 2021 and updated semiannually.
  - Credits: WVDOT, Your name.
- Click Save.

Metadata

It should look like this afterwards. Try it on the SRIC Route feature you created.



Exercise: Final Exercise

- Bring up a browser and go to: https://learn.arcgis.com/en/projects/build-a-geodatabase-to-support-salzburg-tourism/
- There is an additional exercise in the materials folder of this class.
- With the materials provided to you, follow the exercise and use the tools to see if the feature can be recreated.
- Additionally, with the material that you have created throughout the course, try to use and practice it and see what can be done with the datasets.
- Again at any time, you can visit the material and retake the course.
- Thanks again for making this a great class.

End of Part 2

Any Questions? Thanks