

In this lab, we'll use a number of conventions to help you understand ArcGIS. When you see a numbered list, like below:

1. Then it means that each number is an action for you to do in order.
2. Each number in the list will correspond to a numbered icon in the screen shot shown (when possible)
3. Look for the number in the screenshot to see visually the order of steps for you to take

Occasionally, instead of putting each numbered step into a list, we may put it into a sentence in parentheses (4). Those numbers still correspond to the numbers in the image.

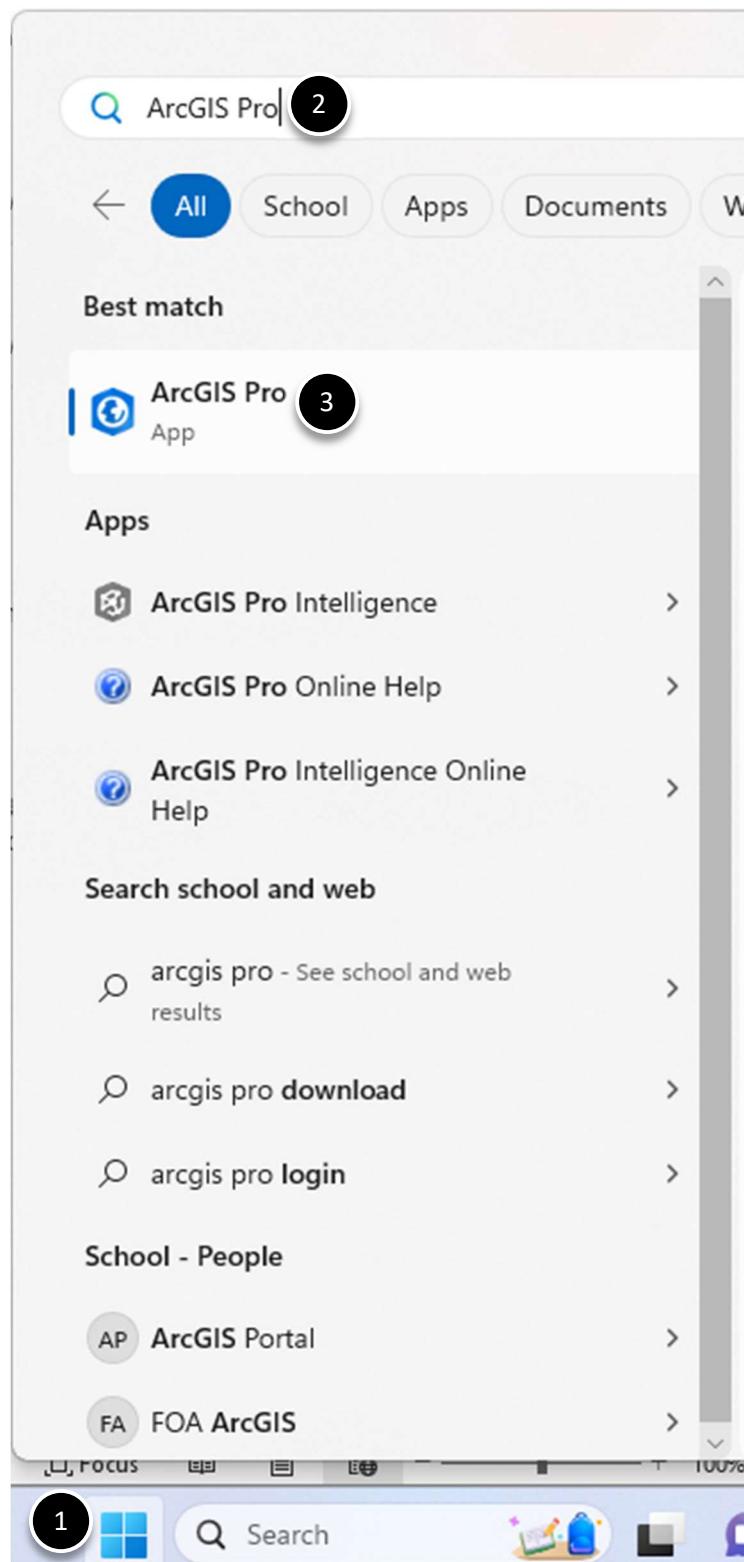
We'll also occasionally italicize rather than "quote" new terminology or a specific thing we want you to do (such as the name of an item we want you to click, like the Symbology menu). We do this because it's often easier to read than quoting and removes the confusion quotes can create with new users.

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1. Open up ArcGIS Pro

First, let's open up ArcGIS Pro. You can do this any way you know how, but if you're less familiar with Windows, the easiest way is to search for it.

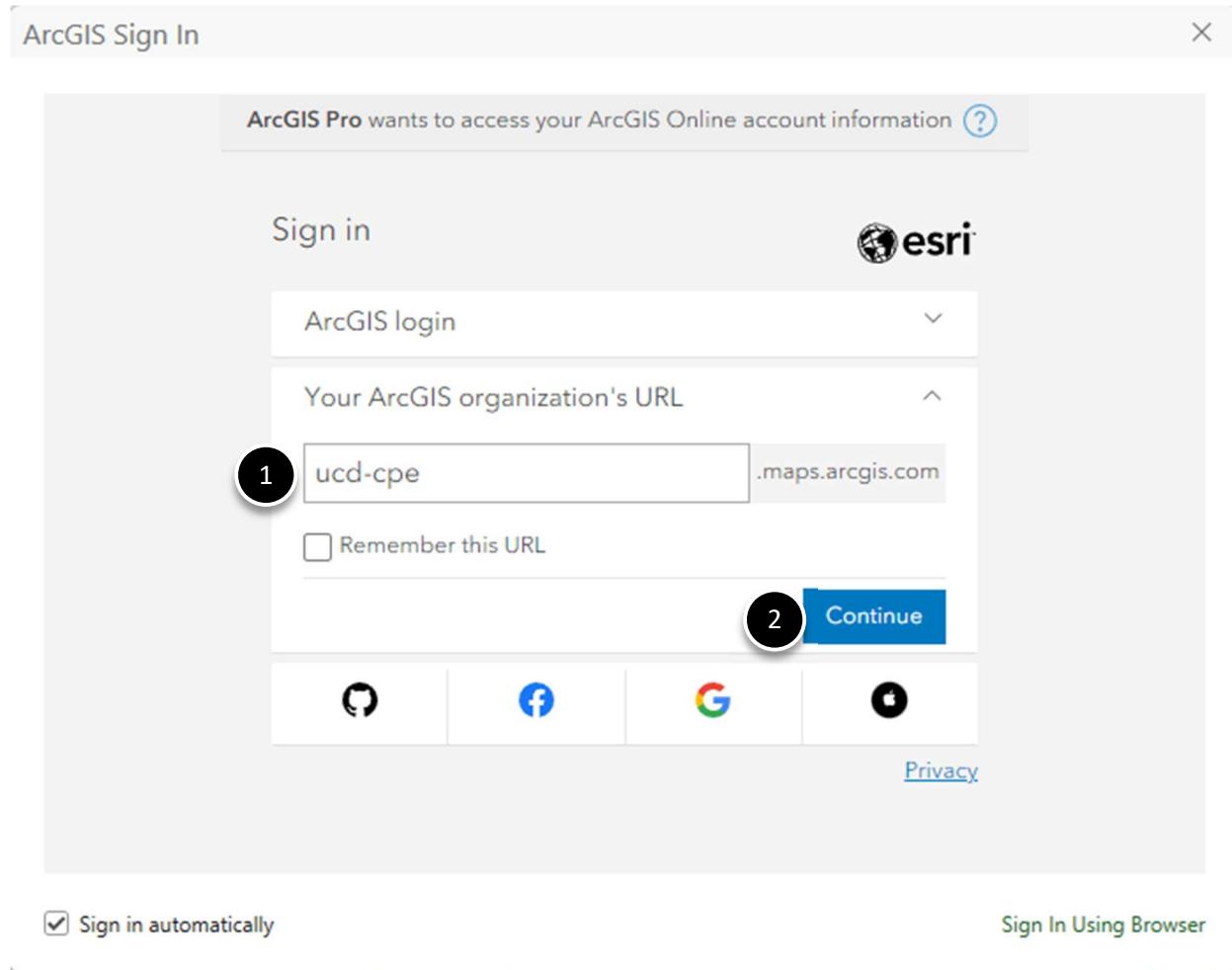
1. Click on the Start (Windows) button.
2. Start typing your search terms - in this case, ArcGIS Pro
3. Click on the ArcGIS Pro tile when it appears, and ArcGIS Pro will launch, showing a loading screen first
Your loading screen may be different - this is ok.



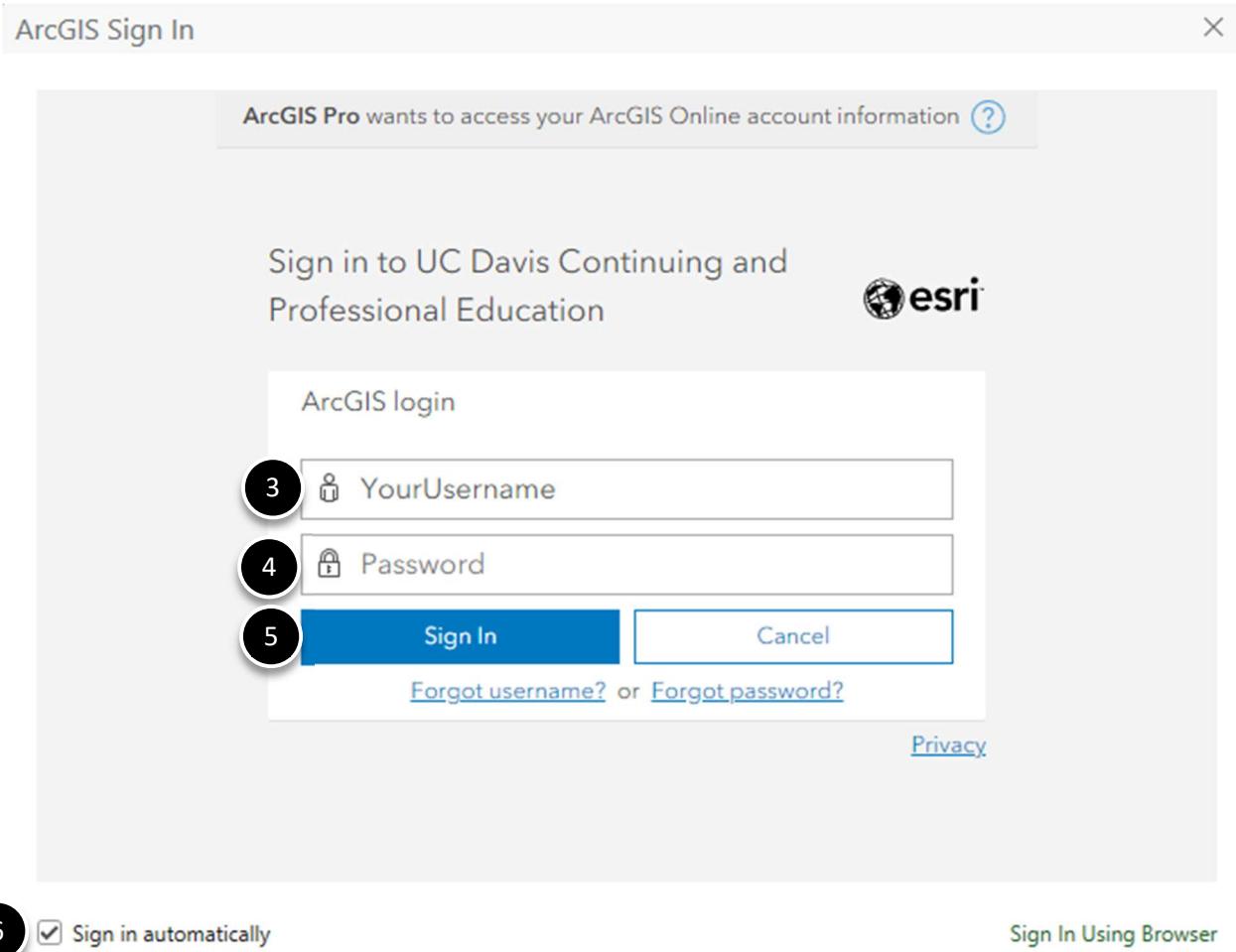
1.1 Create a new map document

When ArcGIS Pro loads for the first time it will ask you to login to ArcGIS Online to verify that you have an appropriate license.

1. To log enter the *ucd-cpe* into the text field so the complete URL listed is *ucd-cpe.maps.arcgis.com*
2. Click the *Continue* button



3. Type in your username into the username text field
4. Type in your password into the password text field
5. Click on the blue *Sign In* button
6. Verify that that *Sign in automatically* checkbox is checked (this will simplify the process of using ArcGIS Pro in the future).

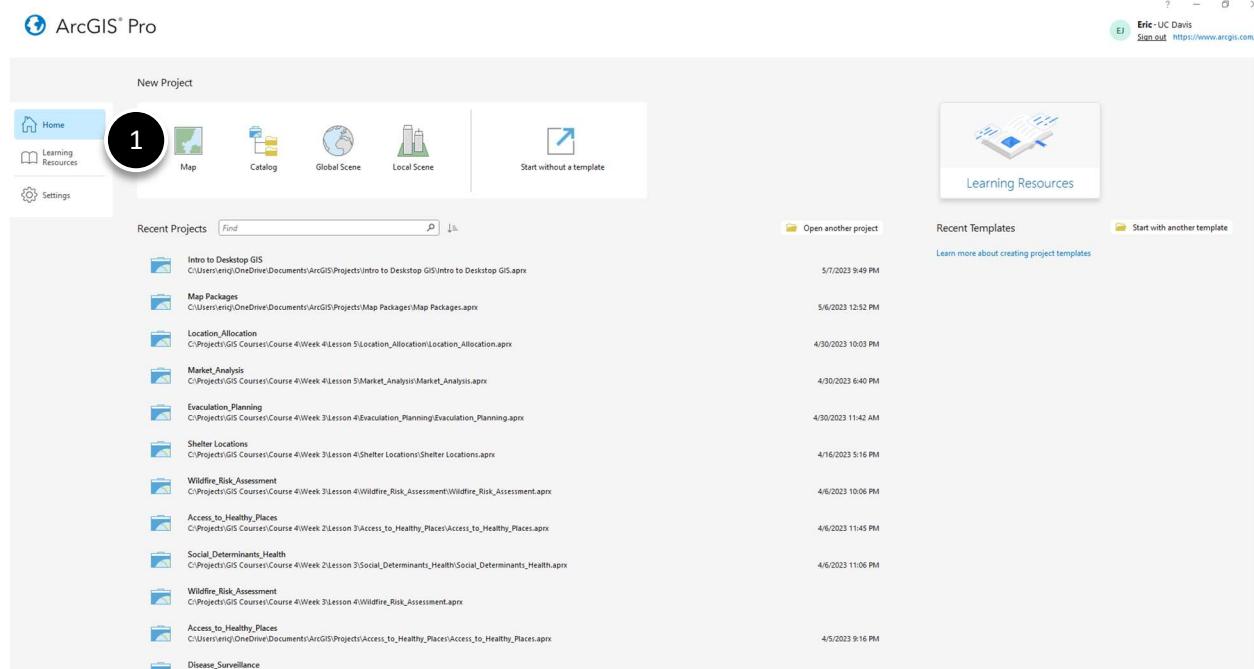


You have successfully logged into the UC Davis Continuing and Professional Education ArcGIS Online Organization. By logging in the ArcGIS Pro software and now pull the licensing information it needs to open ArcGIS Pro on your local computer.

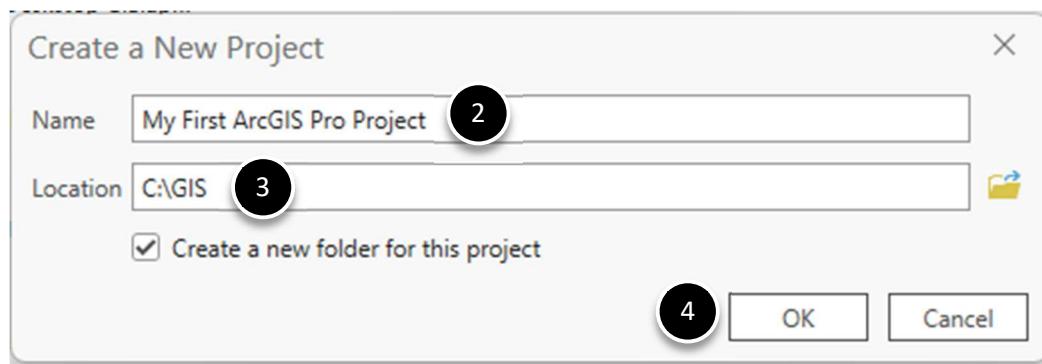
1.2 Create a New Project

When ArcGIS Pro opens it will give you the option to create a new project.

1. Feel free to explore this screen for a moment to get a quick look at the different type of ArcGIS Pro projects that are possible, but then click the *Map* icon to create a new map project.

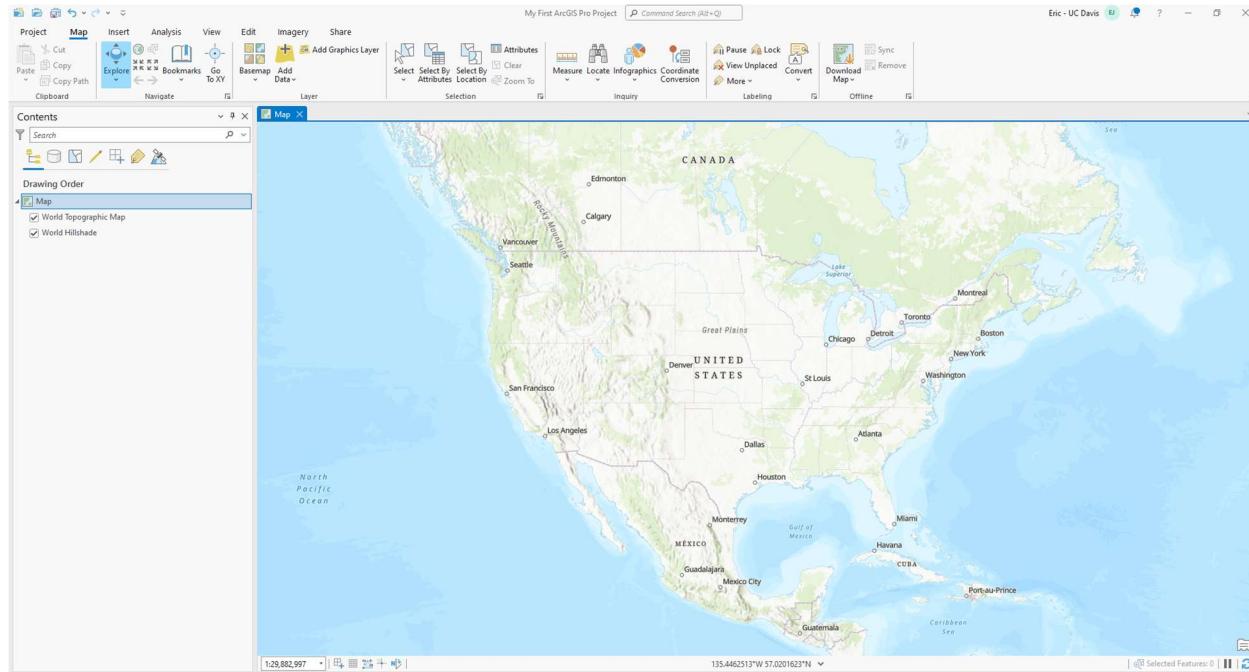


2. Once the Create a New Project dialog box opens, type in a name for your new project.
3. Specify the location to create the new project folder in an existing directory (I created a "GIS" folder in my C drive to store all of my project), you can use the folder button to the right of the text box to navigate to and select a specific folder.
4. Click *OK* to create the new project.



Look around a bit

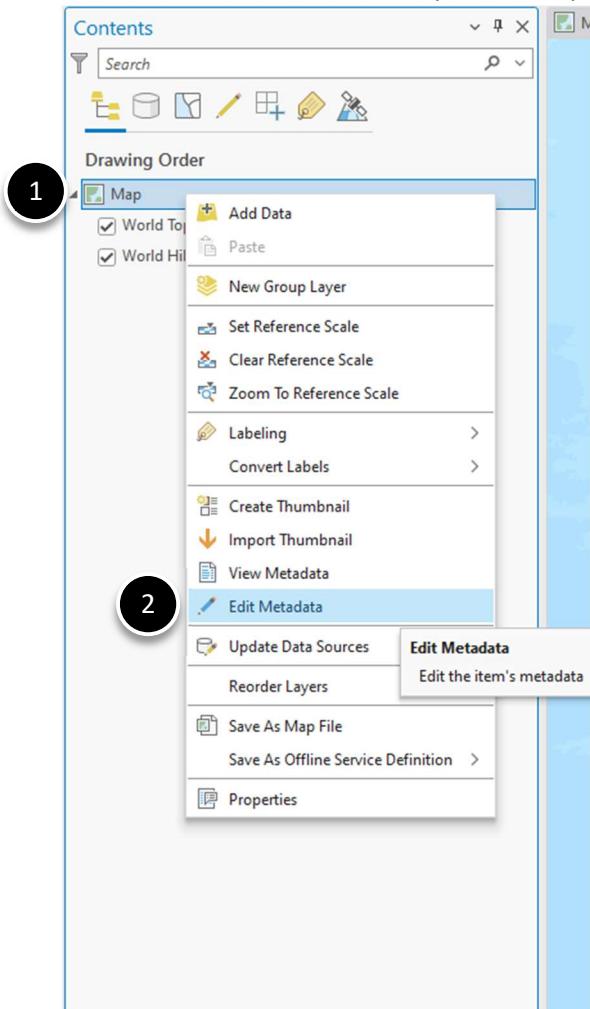
What do you notice about the ArcGIS Pro interface? What kinds of *conventions* is it using? It has menus – what can you do with them? It also has *toolbars* with icons and *windows/panes* that can attach to different sides of the screen. Take some time to look through the menus and hover your mouse on the toolbar items to see what they do.



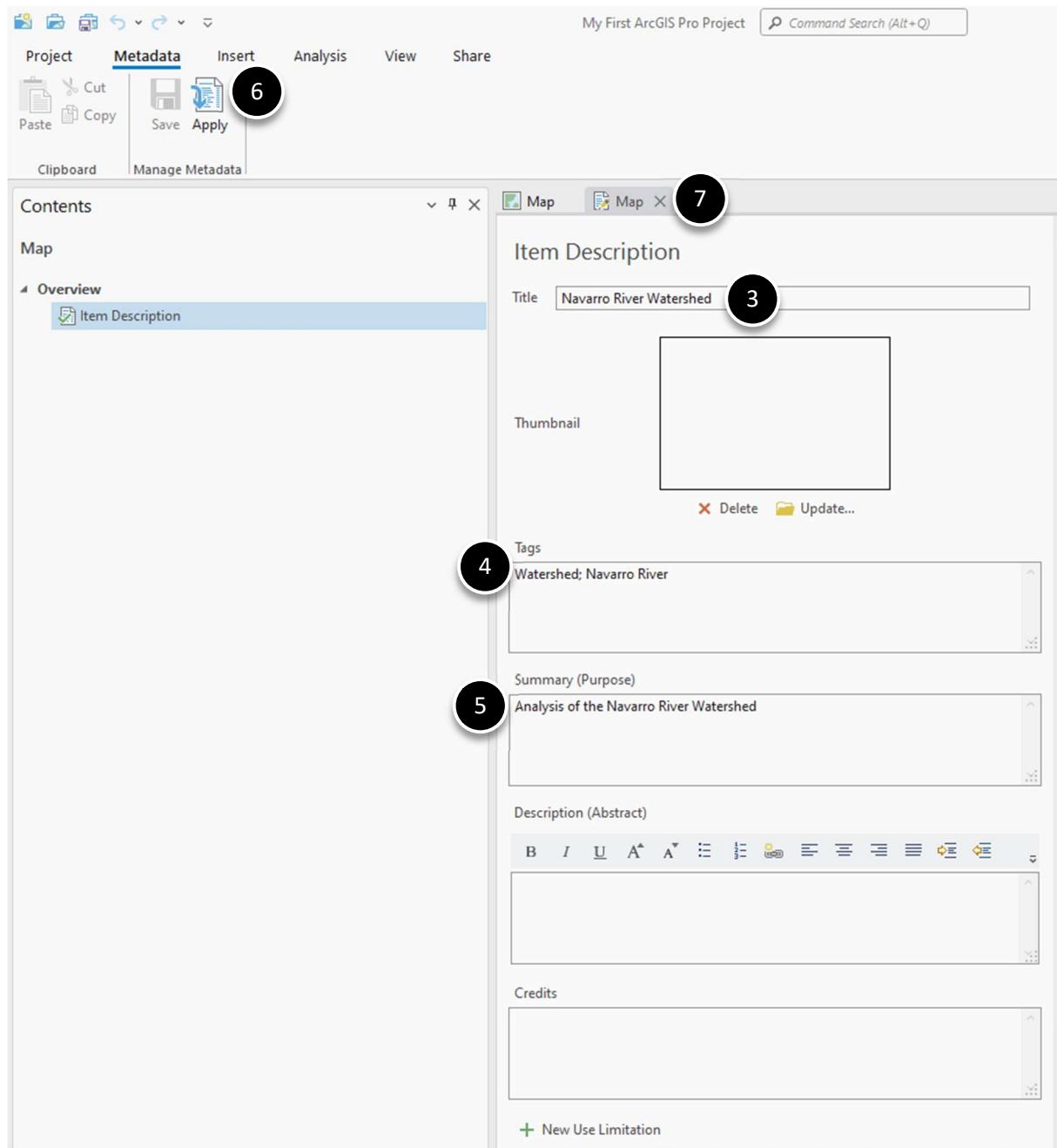
2. Edit the Maps Metadata

Let's change our maps *metadata* so we can better track some details on our first project.

1. Right click on the *Map* item in our Contents pane
2. Click *Edit Metadata* button to open the maps item description pane

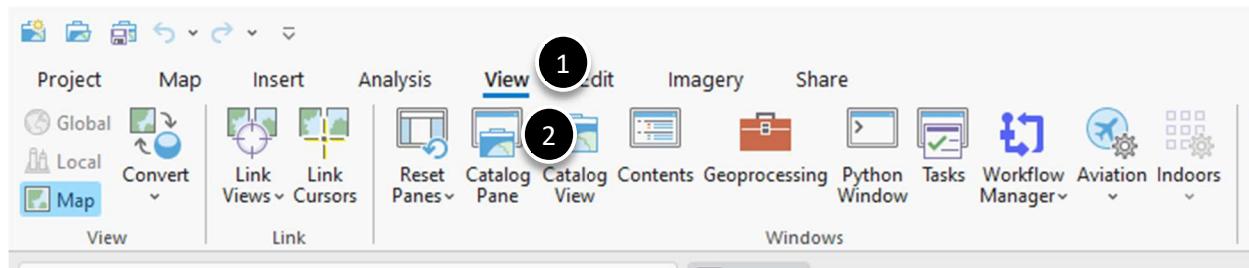


3. In the *Title* box, type Navarro River Watershed – It is good practice give to complete the metadata associated with your maps to prevent issues in the future, like now knowing the purpose or the contents of a map.
4. Feel free to enter any useful tags into the tags section separated by a semicolon. Tags can help your search for specific content.
5. Provide a *Summary* for the map, in ArcGIS summaries are short descriptions stating the purpose of the map and/or datasets.
6. Click the *Apply* button to save your edits.
7. Close the Item Description pane by clicking on the x next to the Map title.



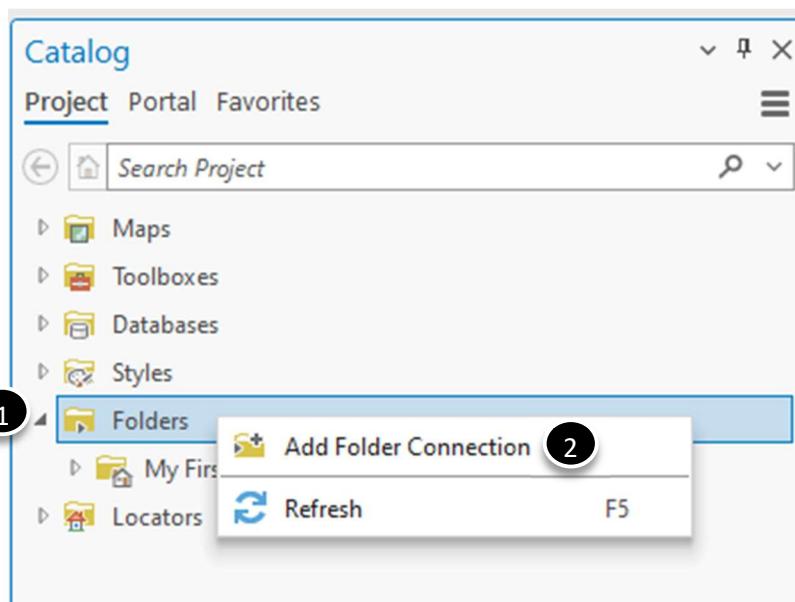
3. Adding Data Into Your Map

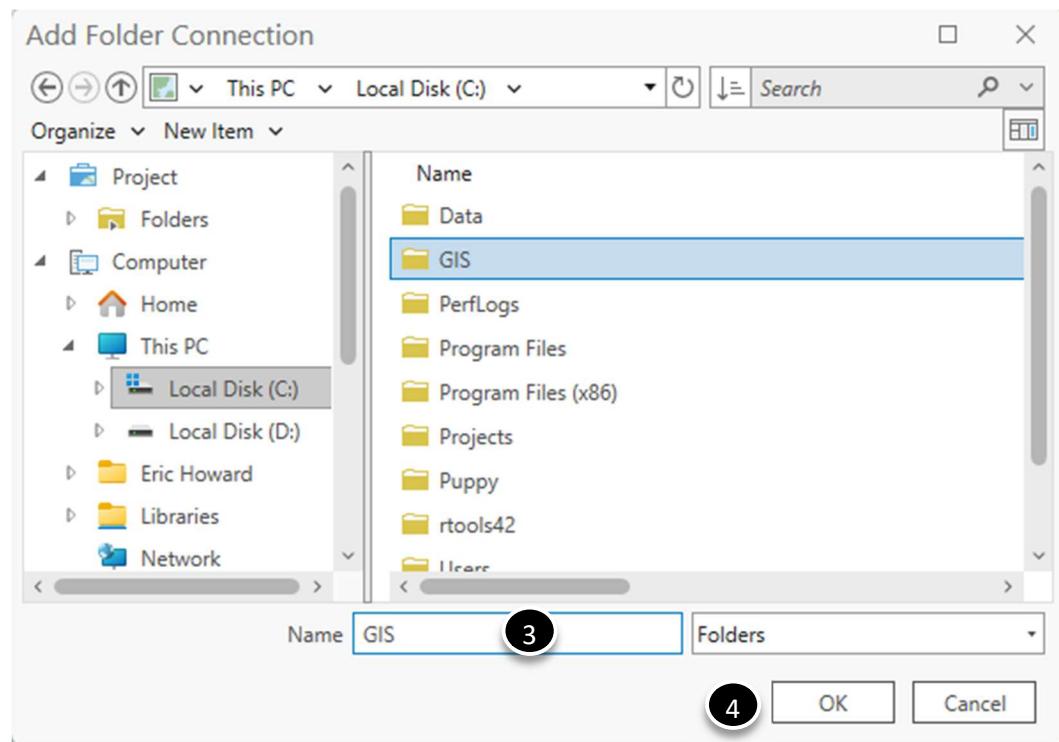
Now it is time to make ArcGIS Pro do some work! Let's add some geospatial data to our map. To do this we will establish a connection to a folder on our computer using the catalog panel. To view the catalog pane click on the *View* (1) and then click on the *Catalog Pane* (2) button. This will open up the catalog pane in ArcGIS Pro.



3.1 Connecting to Folders

Folder connections allow you to create a shortcut to a specific folder on your computer. For this exercise we want to create a connection to the folder where you placed the files for this exercise. To create a new folder connection right click on the *Folders* item listed in the catalog (1) and click the *Add Folder Connection* (2). This will open the *Add Folder Connection* dialog box. Select the C:\GIS folder (or any location where you placed the data for this exercise) (3) and click the OK button (4). This will add the folder under the *Folders* item in the *Catalog Pane*.

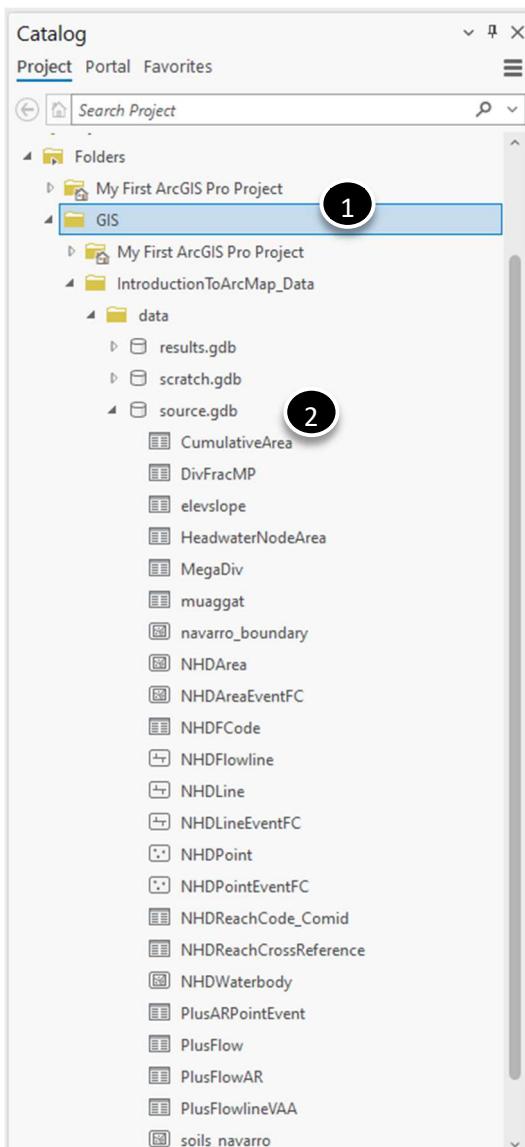




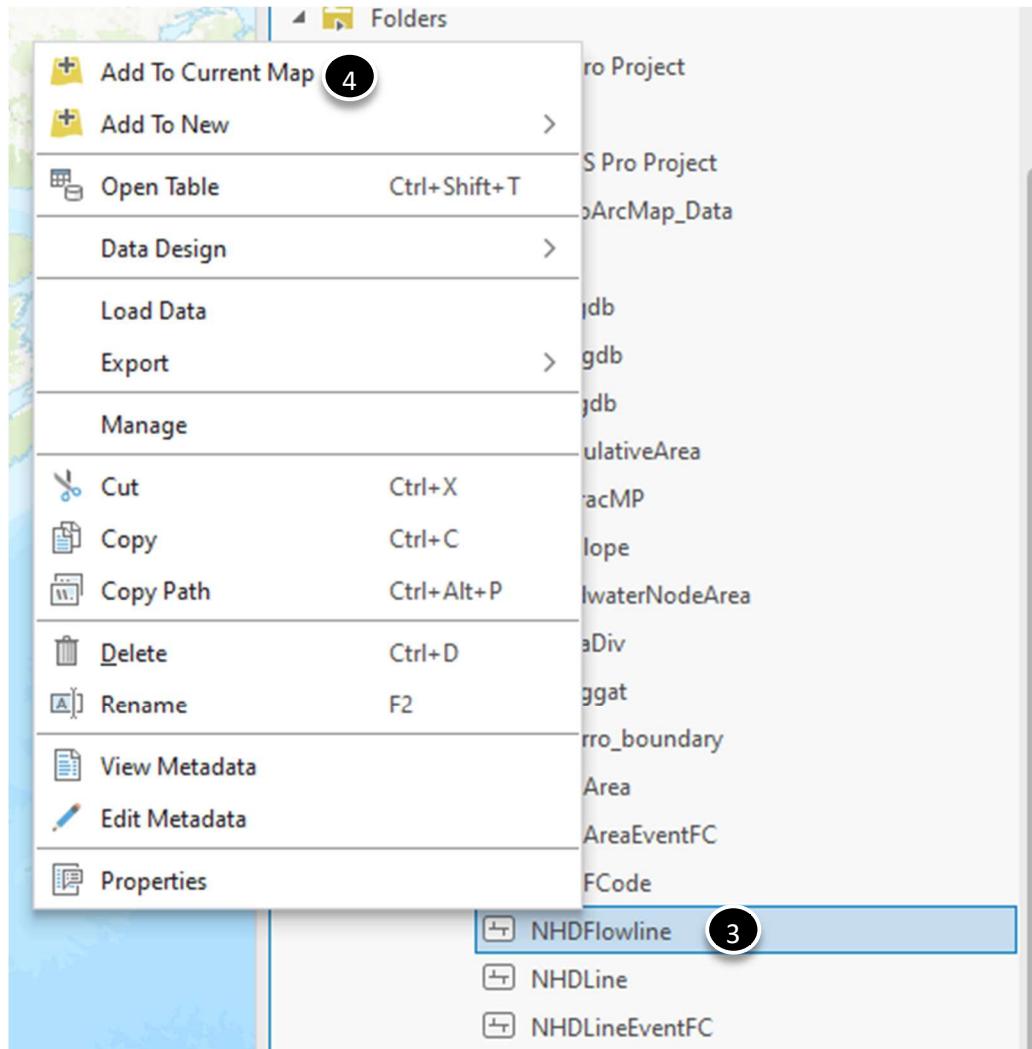
3.2 Find Your Data

Once you create a folder connection, ArcGIS Pro will add it under the *Folders* item in the catalog pane. To find the data we want to add to the map:

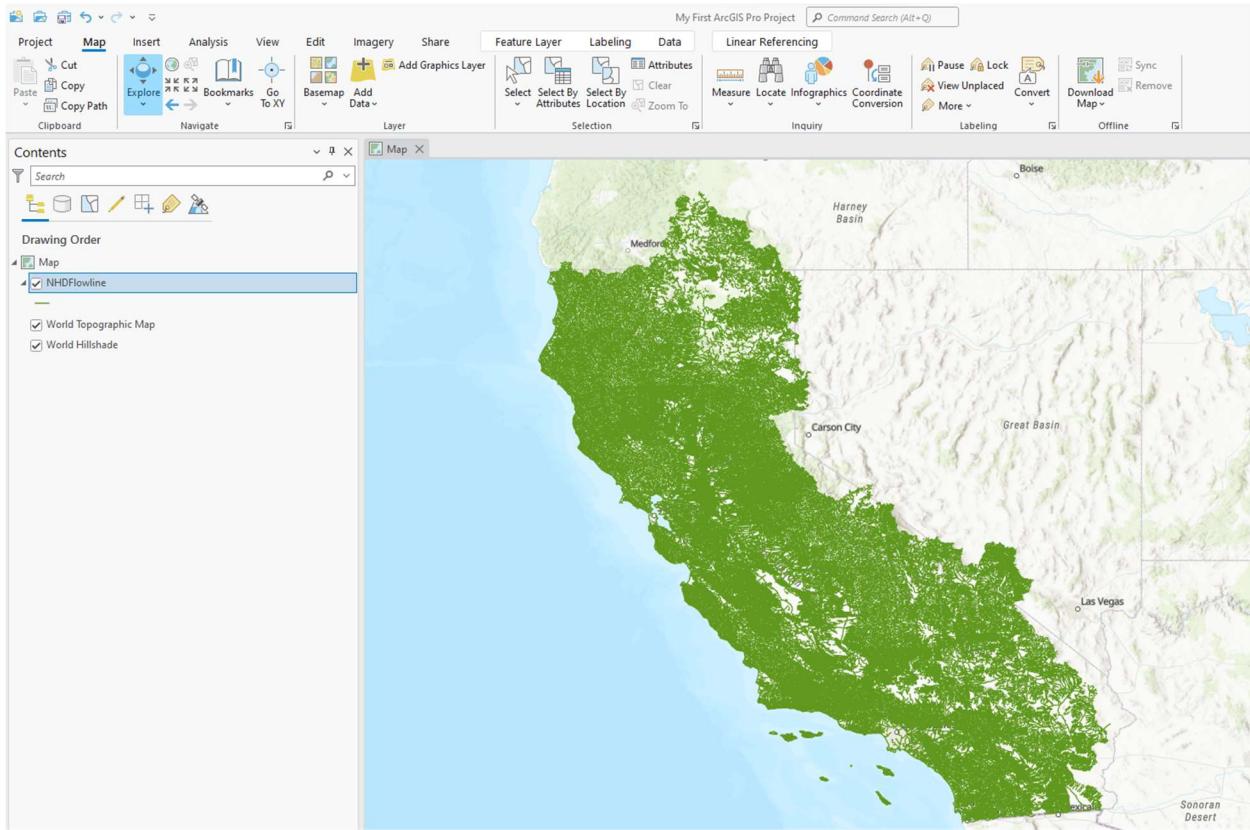
1. Expand the Folders, IntroductionToArcMap_Data, and data folders in the catalog pane
2. Expand the *source* file geodatabase. A *geodatabase* is a type of database that lives directly in your files. It is a way to group all kinds of geospatial data together. We will learn more about them later, but for now, note that the icon for a geodatabase is different from folder icons in order to tell you at a glance that it is a geodatabase, and the field extension is *.gdb*. What else on the screen has this same icon?



3. Right click on NHDFlowline item in the catalog pane
4. Click on the *Add to Current Map* button



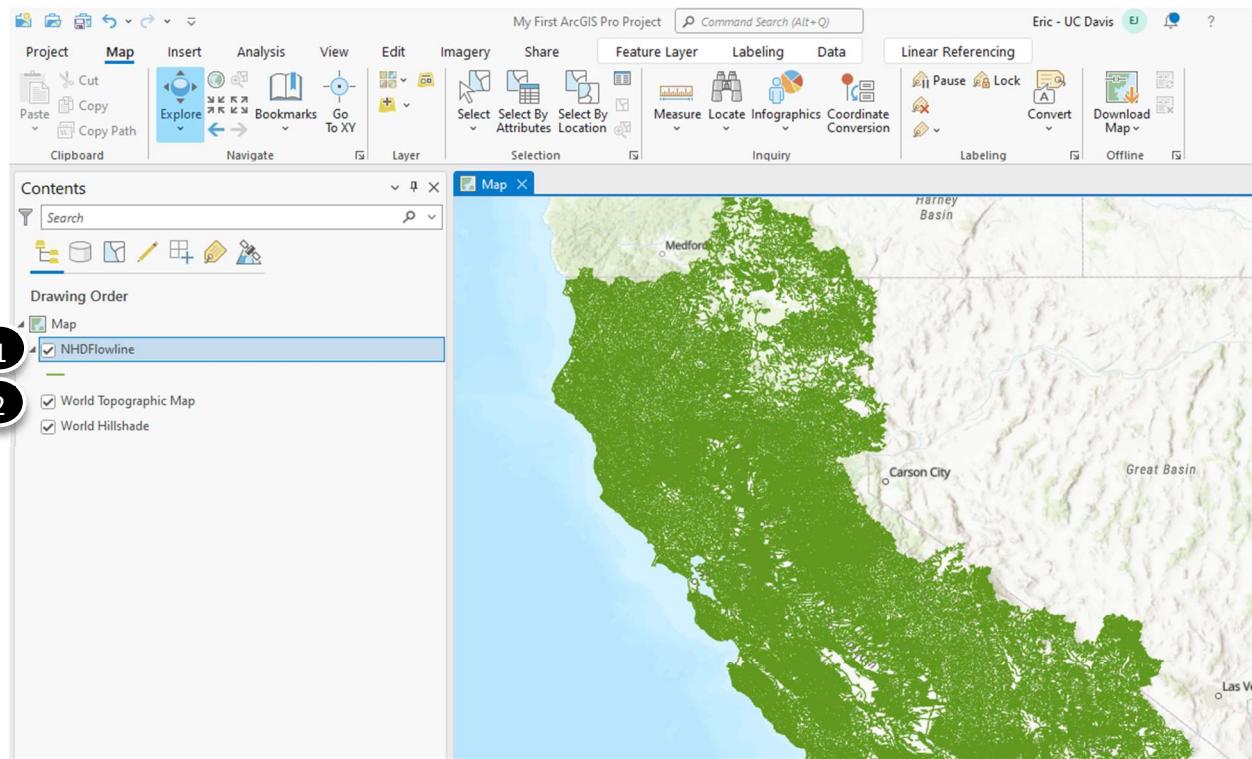
The NHD Flowline data layer will be added to the map.



4. What is it?

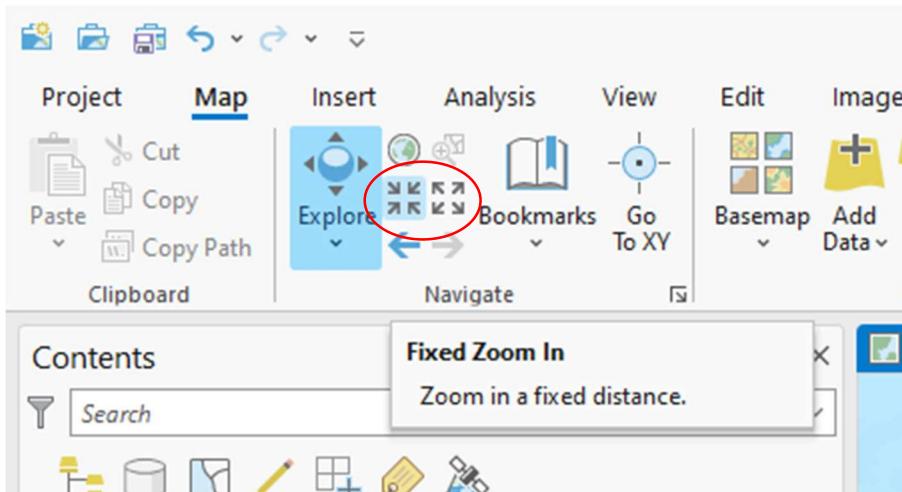
When you add the NHD Flowline data to the map, your screen will draw a large blob – what is it? Can you figure it out from the layer name or the shape? Can you figure out how to zoom around and look closer? On my computer, ArcGIS Pro chose to show the data in green – it may show up different on your screen. We will change it to a more appropriate color later.

1. From what I see, it is a pretty solid green mass, with some breaks in it. And it is named NHDFlowline. In the *Table of Contents* on the left, notice that you have a list for this *layer* (consider for a moment why it is called that). We can leave the item in our map, but *turn it off* so we can't see it, but can see other layers underneath instead. We do this by click the check box next to its name to clear the checkbox. The layer will be removed from the map window.
2. Click the checkbox again to turn the layer back on.



4.1 Zooming In

Let figure out what this data is by zooming in and taking a closer look. You can zoom in and out using your mouse's wheel, but you can also zoom in and out using the fixed zoom buttons in the map ribbon menu. Additionally, you can hold down the shift key on your keyboard and draw a rectangle to zoom into.



4.2 Click and Drag

Hold down the shift key (you will see the hand cursor change to a magnifying glass) and click on the map using the left mouse button. While holding down the left button draw a rectangle like the screenshot below. Release the left mouse button. Your map window will zoom into the area within the rectangle you drew.



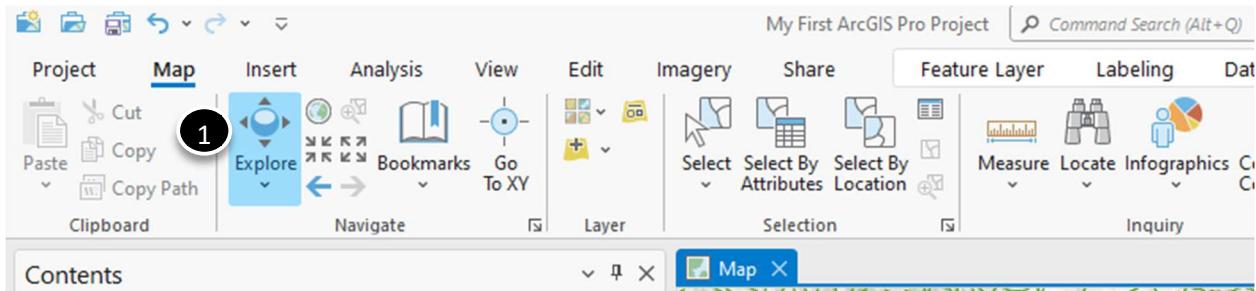
4.3 A Better Scale to See Features

Now that we are zoomed in, we will see a lot of lines on the map – what do they mean? Why do they show up as solid green when we are zoomed out? We can start to get a sense of what the data might be – it could be a transportation network or water moving – something that we would choose to represent with lines. Given the waviness of the lines, we would probably speculate that they are rivers, but let's confirm by inspecting the data.

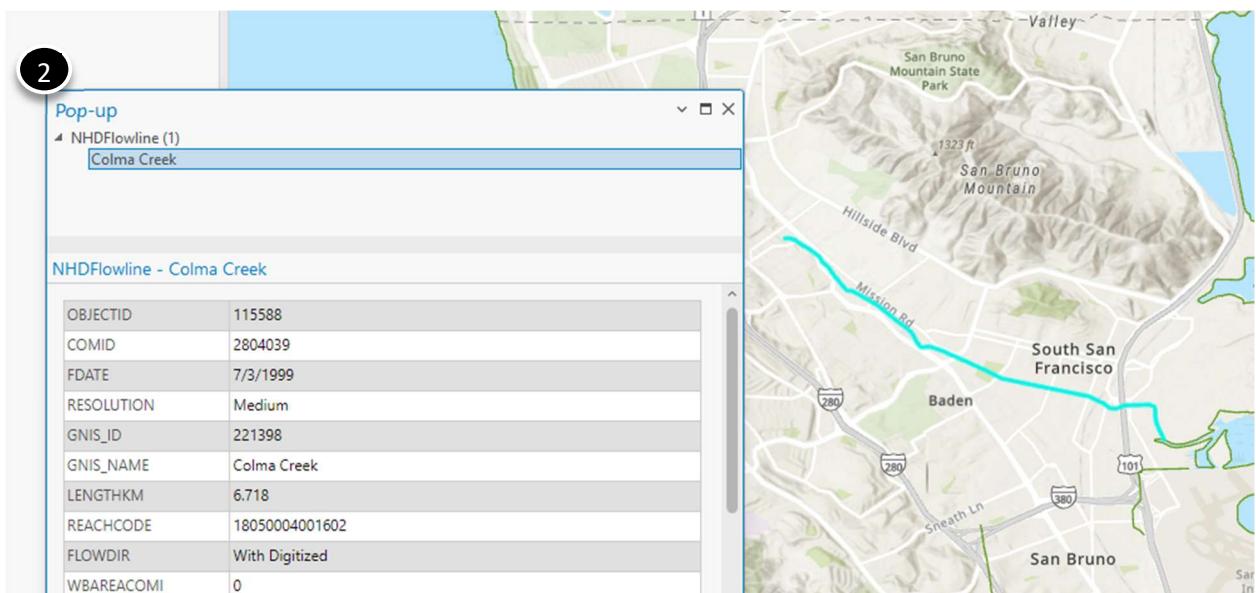


4.4 Identifying Features

Verify that the *Explore* tool is currently activated by clicking on *Explore* tool button under the Maps ribbon menu (1).

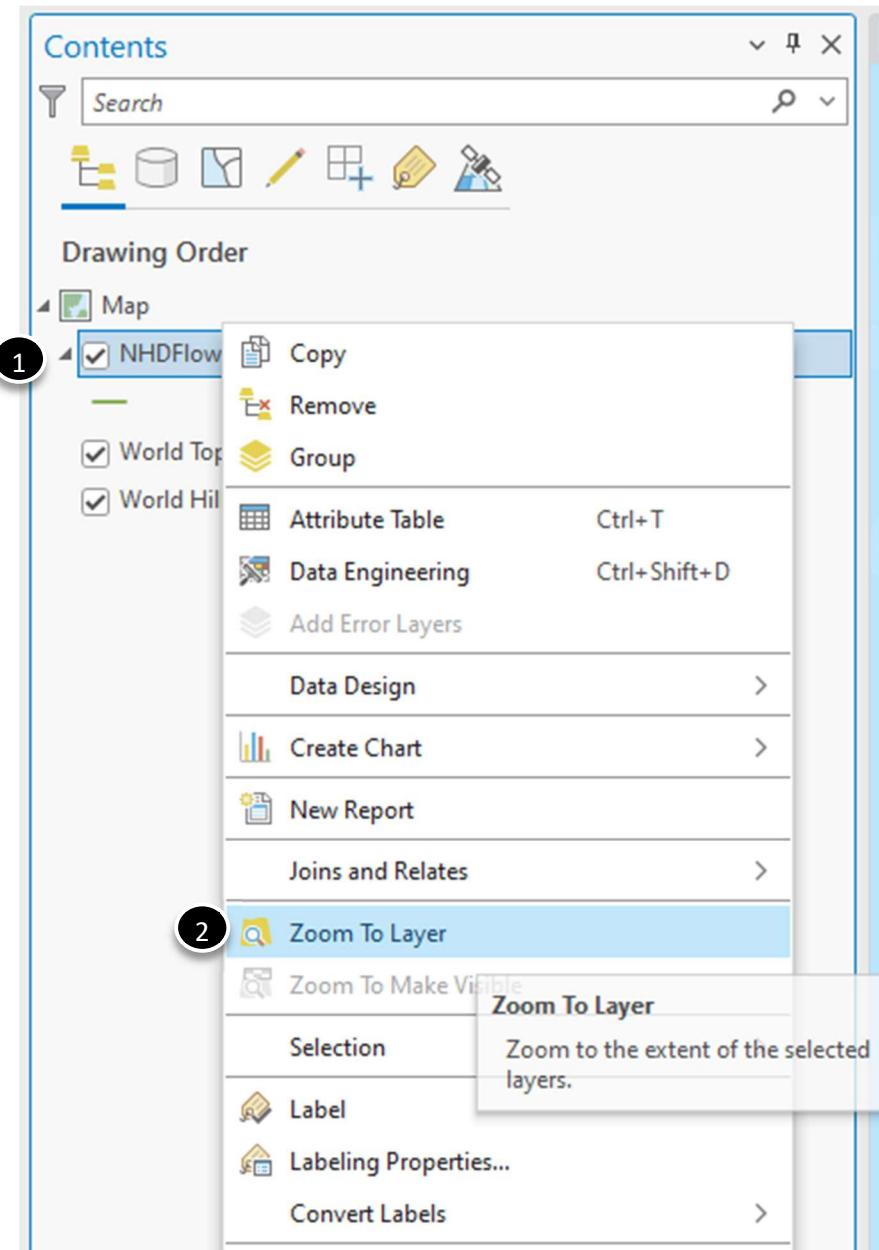


Click on one of our line features using the *Explore* tool. Click on an item will open a popup (2) that will show you all of the details associated with the feature you clicked on. In this case I clicked on Colma Creek. The attribute information in the popup confirms our hypothesis that the data represents water (creeks and rivers). This data is from the National Hydrography Dataset (NHD). The NHD includes information and feature for rivers, water bodies, and watersheds in the United States. In this case we are displaying the rivers (flowlines) on our map.



4.5 Returning to an Overview

Let's zoom back out. Right click on the *NHDFlowline* in the Table of Contents (1) and select *Zoom to Layer* (2). This zooms our map view out to the layer's full *extent* (shows the entire layer on screen).

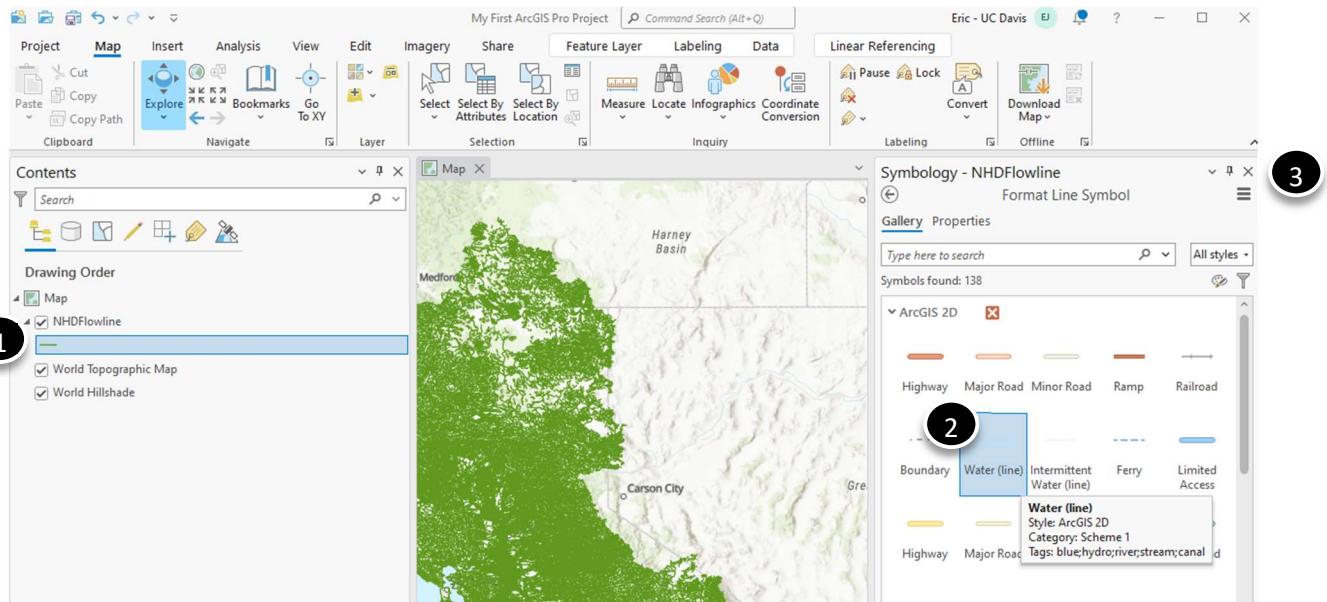


5. Setting Symbology

Now that we know we are looking at rivers, let's make them a more appropriate color. To do this, we deal with the part of cartography called *symbology*. There are multiple ways to accomplish this in ArcGIS Pro with different options, but for now we will use the fastest method.

Symbology is concerned with how we choose to display GIS data – there is no one way to represent any GIS dataset. You as the analyst and cartographer choose how to show it to the viewer and have the responsibility of choosing something that makes sense and conveys the information appropriately. ArcGIS Pro provides great flexibility to you to change how your data appears. Let's quickly do that now.

1. Click on the green (or whichever color was automatically selected) underneath *NHDFlowline* in the Table of Contents. The line is there to remind us of the symbology for the layer and provides us quick access to change the symbology
2. The symbology pane will open, click on the *Water (line)* button to quickly change the symbology.
3. Close the symbology pane by clicking the x in the top right corner of the pane.

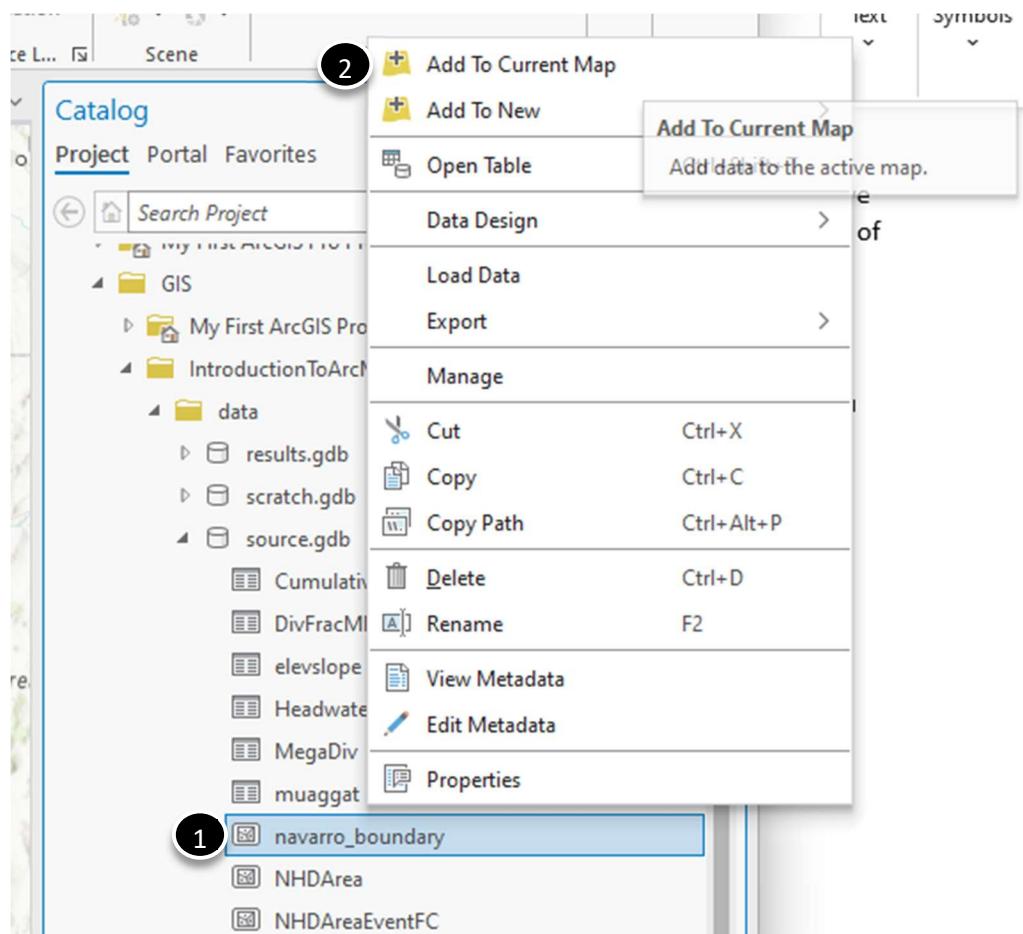


6. Add the Navarro River Watershed

The NHD Flowline data covers all of hydrologic region 18 (most of California, and parts of Oregon, Nevada, and Arizona). You may have also noticed that it is slow to render – that is, to be drawn on your computer screen. So, now we will add a region of interest that we can use for the rest of this exercise that will limit the drawing time and data processing.

For this project, we are interested in the Navarro River watershed on the coast of northern California. Watersheds are often good areas of interest because in using them for boundaries, we usually preserve ecological units within them rather than artificially splitting them up. In running an analysis at the scale of a watershed, you can see important interactions at work. If you find your watersheds are splitting up something important, try using a larger watershed (or using something else in combination with a watershed) to define your *region of interest (ROI)*.

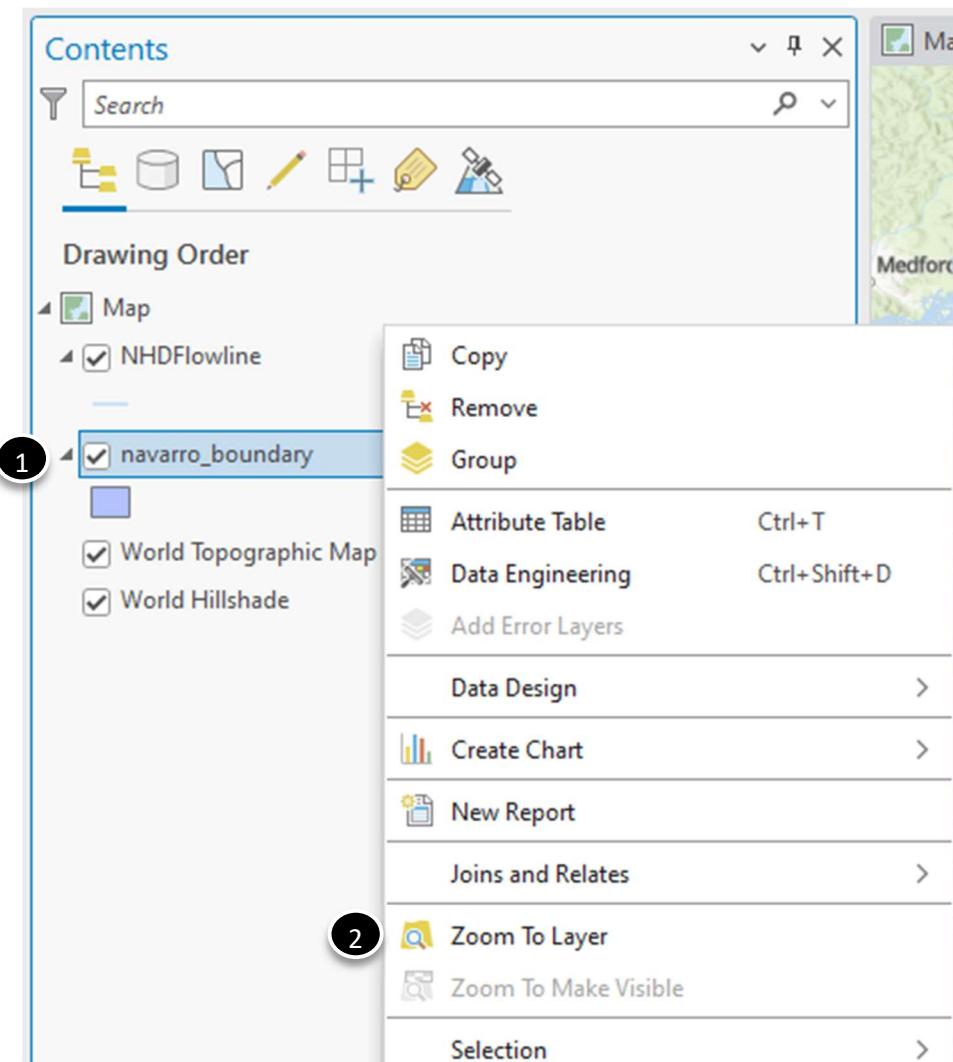
Expand open the *source* geodatabase using the catalog pane (remember how? Look back to when you added the NHDFlowline layer if you forgot). In the same geodatabase as the flowline data is another layer named *Navarro_boundary*. Right click on that item (1) and click *Add to Current Map* (2).



6.1 Zoom to the Layer

You won't really be able to see the layer at first, so let's zoom directly to it.

1. Right click on the *navarro_boundary* layer in your table of contents.
2. Select *Zoom To Layer*.



7. Select the Streams Within the Watershed

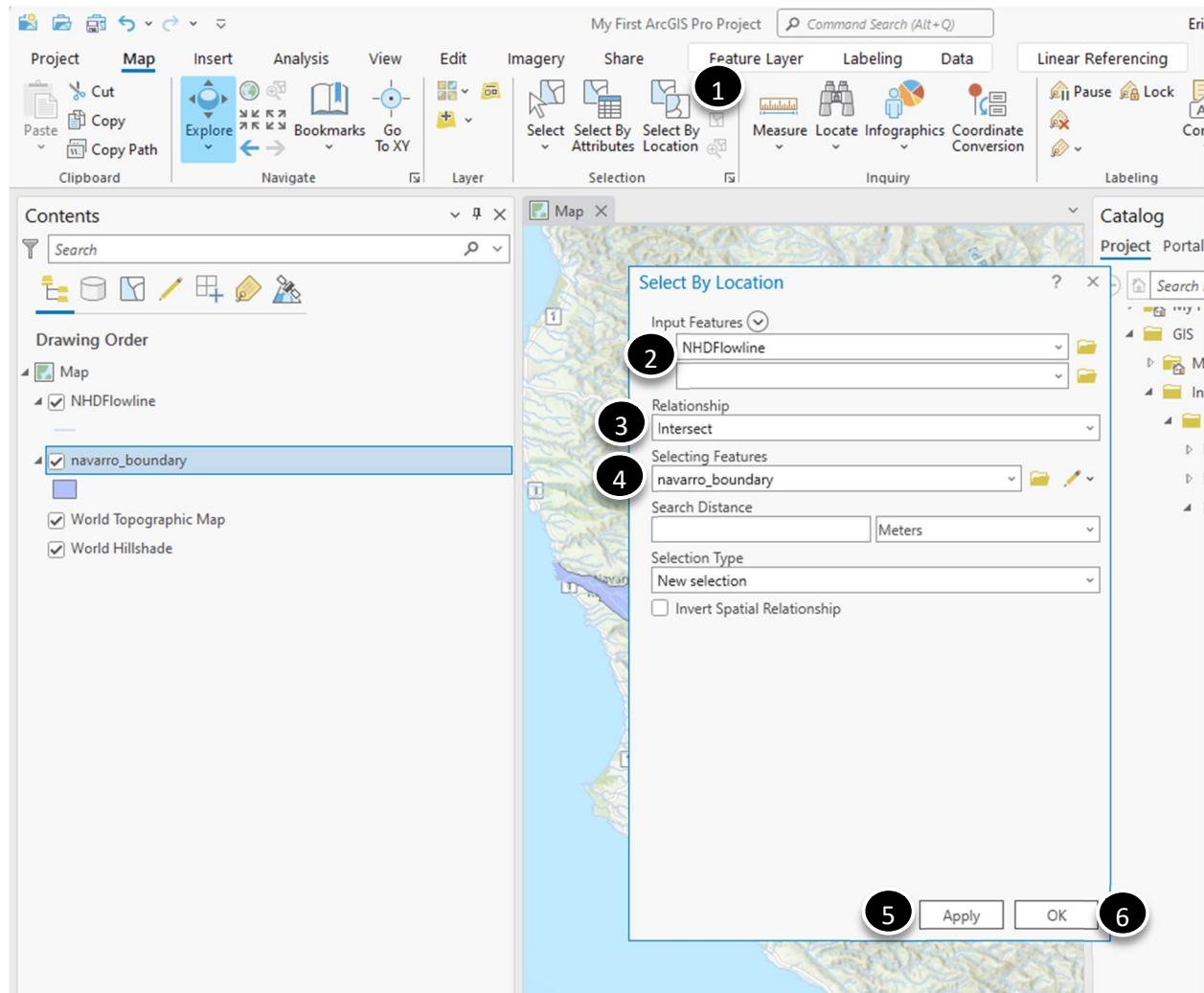
In order to subset our stream data to the Navarro river watershed, we need to first *select* the streams that are part of the watershed. A *selection* is similar to when you highlight a sentence with your cursor in a word processor – you are telling ArcGIS that you want to do operations only on that group of features (in this case, streams). Once we have a selection, we can manipulate it to make a new dataset with just the selected items.

This is where the rubber meets the road, so to speak. While we have already looked at records using the explore tool to see what is in a location, what we are doing now is the first time where we are going to **make decisions based on the spatial relationship of two separate datasets**. That is a core functionality in GIS.

7.1 Selecting by Location

Select by location gives us a selection based upon a spatial relationship with another set of features. It has *many* options, but let's start with something basic. We are going to select all of the stream lines that touch the Navarro River watershed boundary.

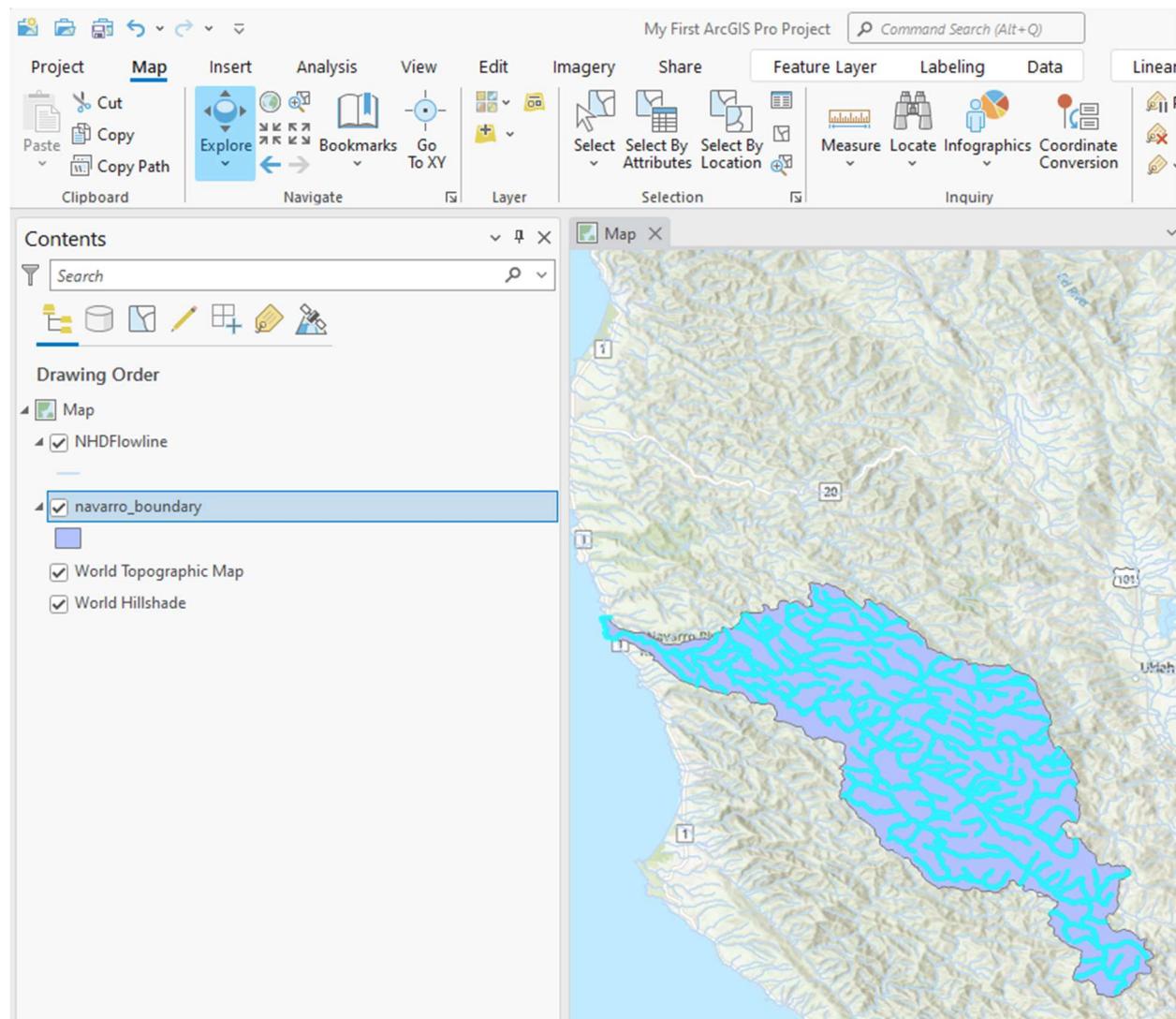
1. From the map ribbon menu click on the *Select by Location* button to open the dialog box
2. Select *NHDFlowline* as the input features
3. Leave the *Relationship* type set to the default value of *Intersect*
4. Select *navarro_boundary* as the *Selecting Features*, and leave the search distance and selection type set to their defaults.
5. Click the *Apply* button to run the tool.
6. Click the *OK* button to close the Select by Location dialog box.



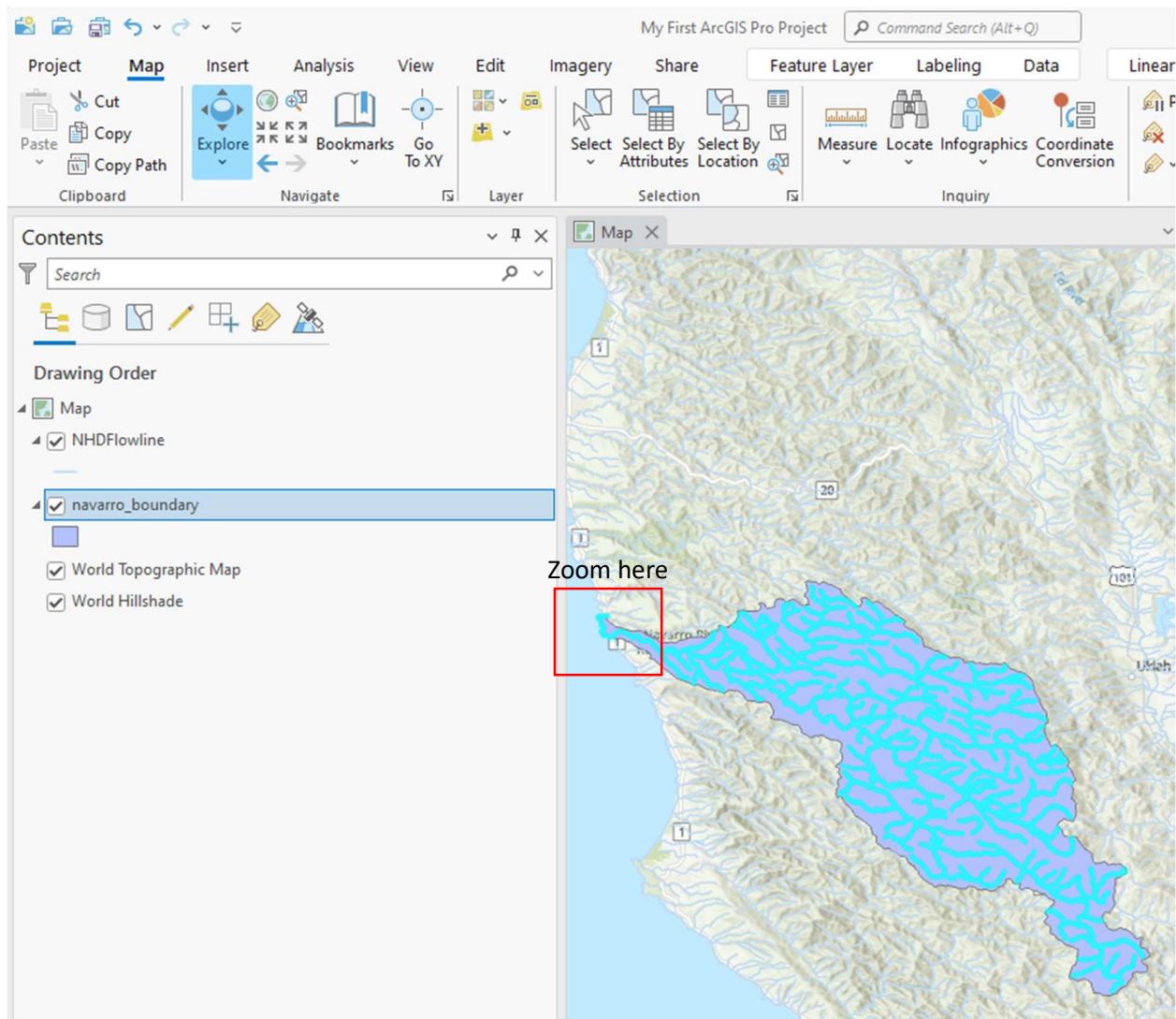
7.2 Validating Our Selection

Now, we will see in cyan any features that are part of our new selection (side note: the color that selection appear in is configurable. Can you find that option? It is not immediately obvious for someone new to GIS).

Let's verify that our selected features look appropriate. It is always good to validate GIS operations and make sure you get the expected results, and if you don't, determine whether you didn't because you expected the wrong thing, your workflow doesn't get you where you wanted to go, or you (or ArcGIS) made a minor error. Mostly, this selection looks correct, but I notice something odd on the coast – it looks like the coastline is selected and I didn't want that.

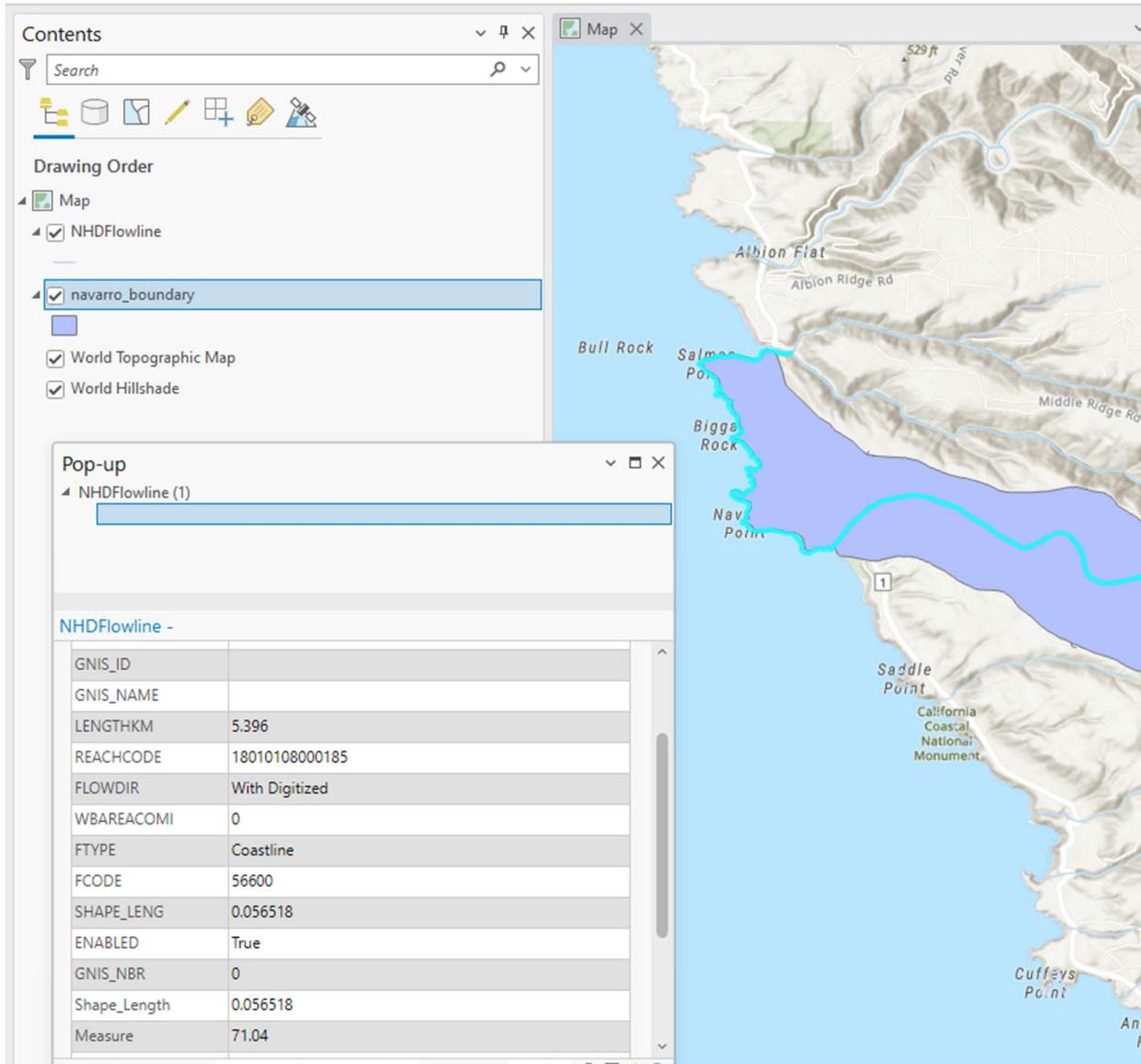


Use the explore tool to shift-click and zoom into the area on the coast.



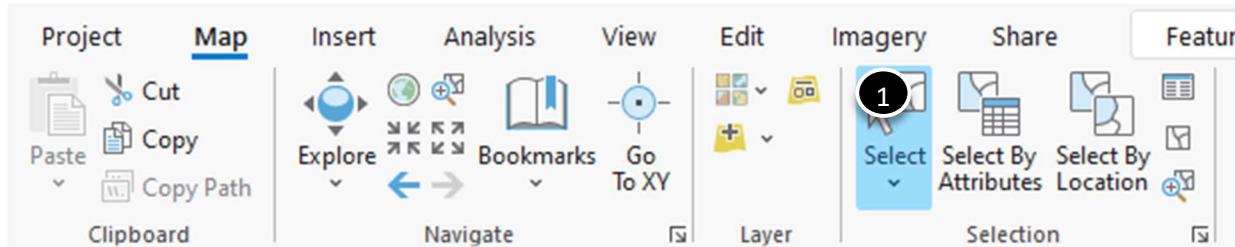
7.3 A Coastal Selection

Yep, it looks like coastline (if you want to confirm use the explore tool to see what is there). Let's remove this time from our selection using the manual selection tools.



7.4 Enabling Manual Selection

On the main toolbar under the map ribbon menu click on the *Select* button to enable manual selection (1).



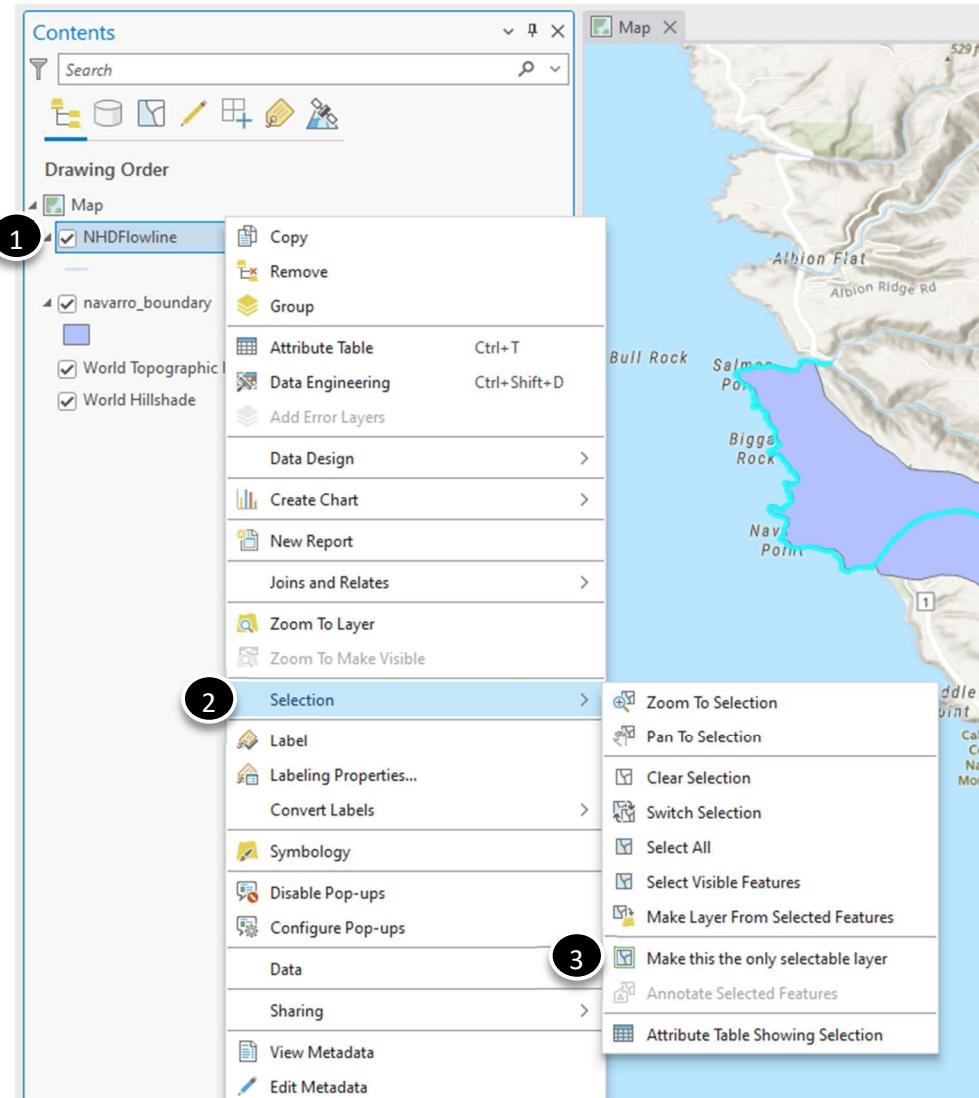
7.5 Setting up the Selection

First, let's make sure the changes we want to make occur only on the NHDFlowline layer. By default, interactive selection affects all layers, and your map display will get messy when you start clicking around!

We will set some options in this step to prevent that, but if at any time your selection becomes a problem that you can't correct click the *Clear* button next to the *Select by Location* button and then go back to the Select by Location step.

Let's make it so only the flowlines can be selected.

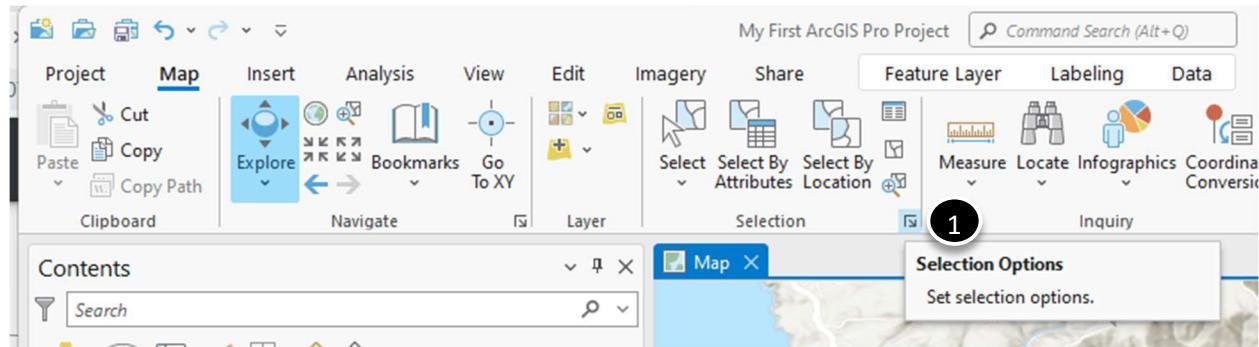
1. Right click on the *NHDFlowline* layer in the table of contents
2. Select the *Selection* menu.
3. Click on the *Make this the only selectable layer* button.



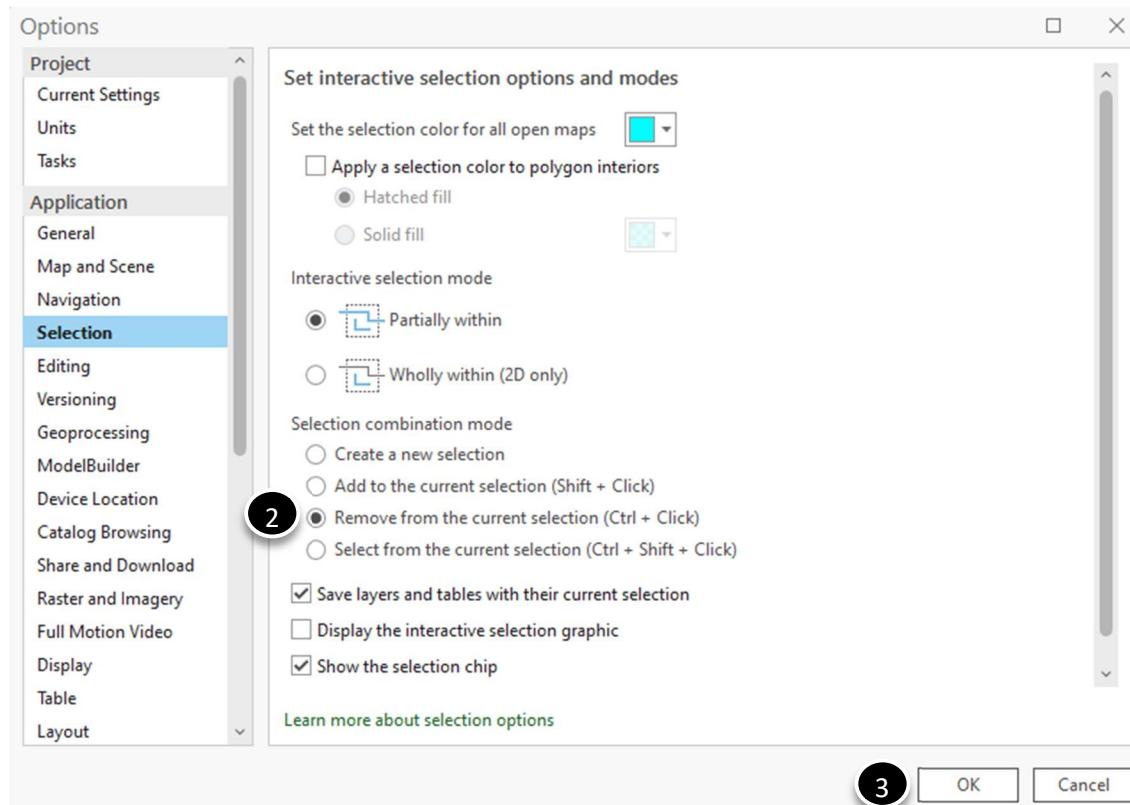
7.5 Changing the Selection Method

By default, the selection method after the *Select by Location* tool is run is to add new selections to the current selection. Since we want to remove something, we need to change the selection mode.

- From the map ribbon menu click the *selection options* button (the small arrow in the bottom right corner of the Selection section of the map ribbon menu. This will open the selection options dialog box.



- Change the *Selection combination mode* selection to *Remove from the current selection* (please note that this list also provides the keyboard short if you temporarily want to change your selection methods).
- Click *OK* to save the changes to the selection method.



7.6 Modifying the Selection

Now that we have made the *NHDFlowline* layer the only selectable layer, and we have modified our selection options to remove features from the current selection we can use the manual select tool to remove the coastline. Click and drag a box small box over any part of the coastline. This will remove the feature from the selection, and it will no longer be highlighted.

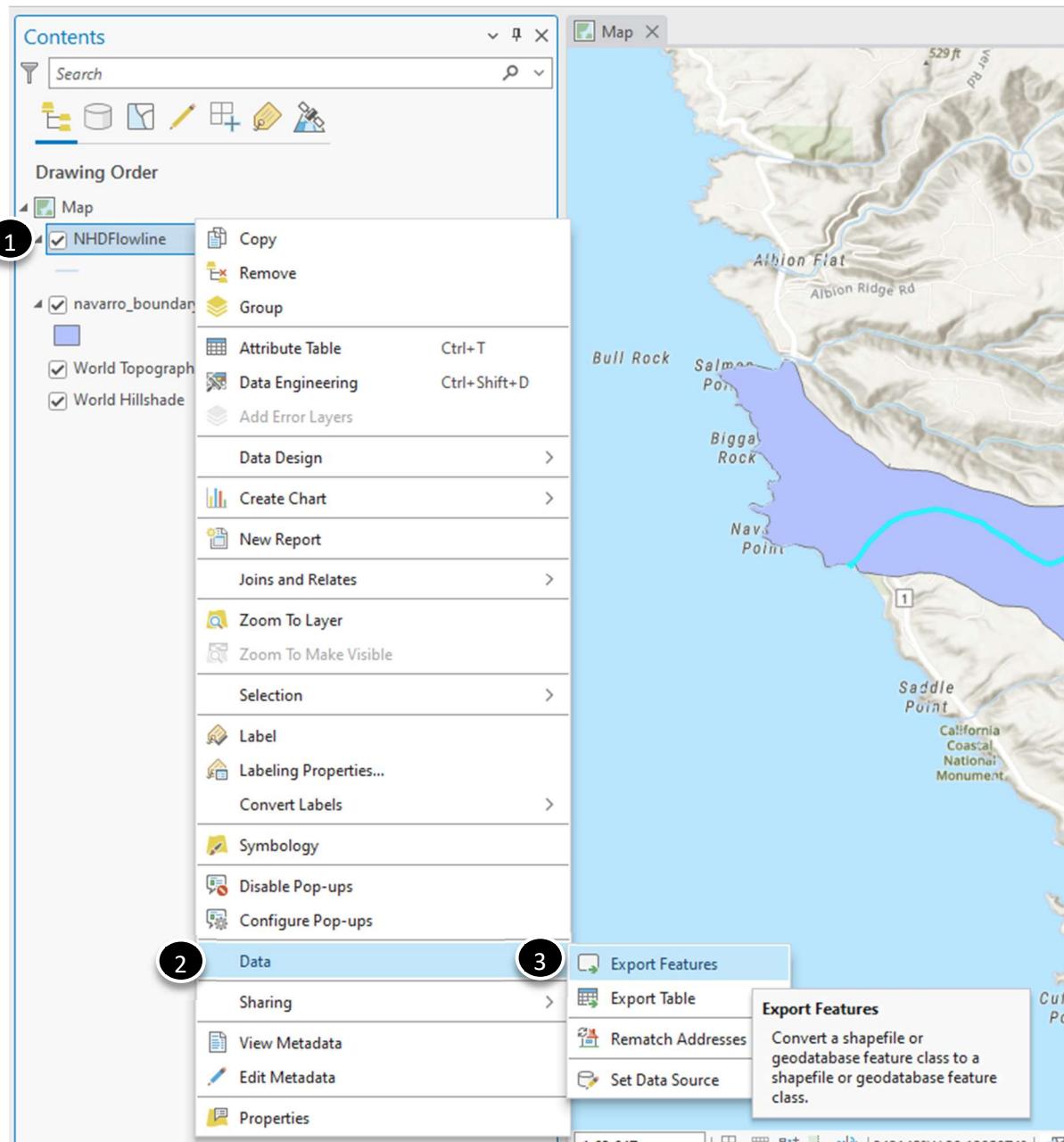
Note: You do not have to create a box around the entire feature that you want to select – your select just needs to touch each feature you want to select (or remove from the selection) somewhere. If it turns out you selected too few features, you can hold down the shift key and select another feature to add.



8. Saving Our New Layer

Now that we have a selection of the rivers in the Navarro River Watershed, let's save our selection as a new *feature class* (*NHDFlowline* and *navarro_boundary* are both feature classes) so we can use it in our map permanently. To do this we want to *export* the selection.

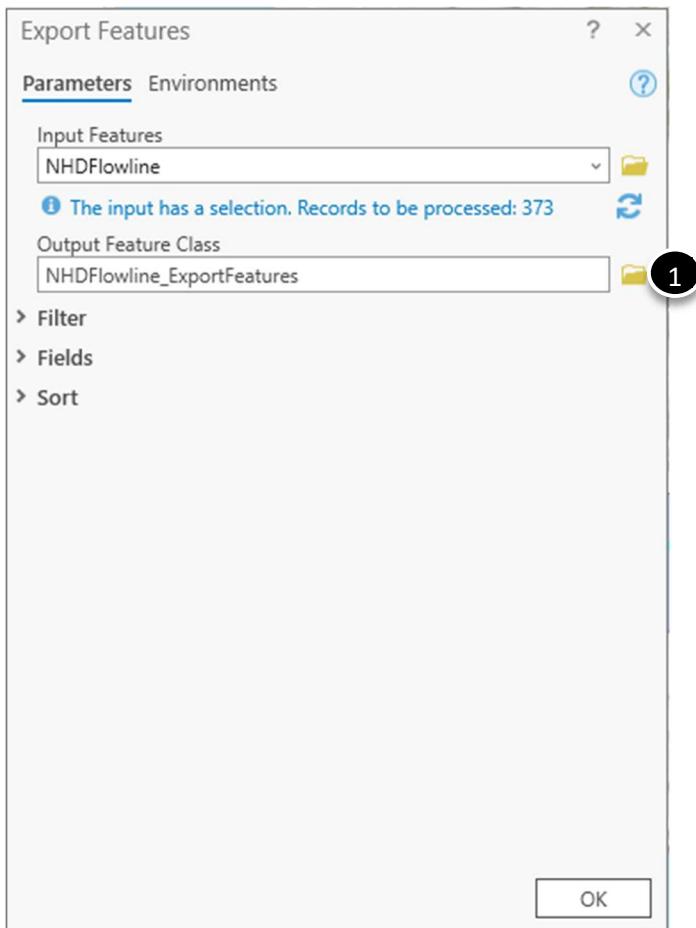
1. Right click on *NHDFlowline* in the table of contents.
2. Select the *Data* menu item.
3. Click on the *Export Features* button.



8.1 The Export Data Dialog Box

A dialog box will pop up. It is easy to want to skip over the options here, but each of theme is important to notice. First, you might notice that you can select the output location, and we will do this in a moment. But the, bring your eyes back up to the top where it says *The input has a selection. Records to be processed: 373*. This is a useful notification provided by ArcGIS Pro, letting us know that the layer we are trying to export has current selection, with 373 features selected. If we wanted to export out the entire dataset, we could go and clear the selection and run the export features tool again. But in our case we really do only want to export out the 373 selected features.

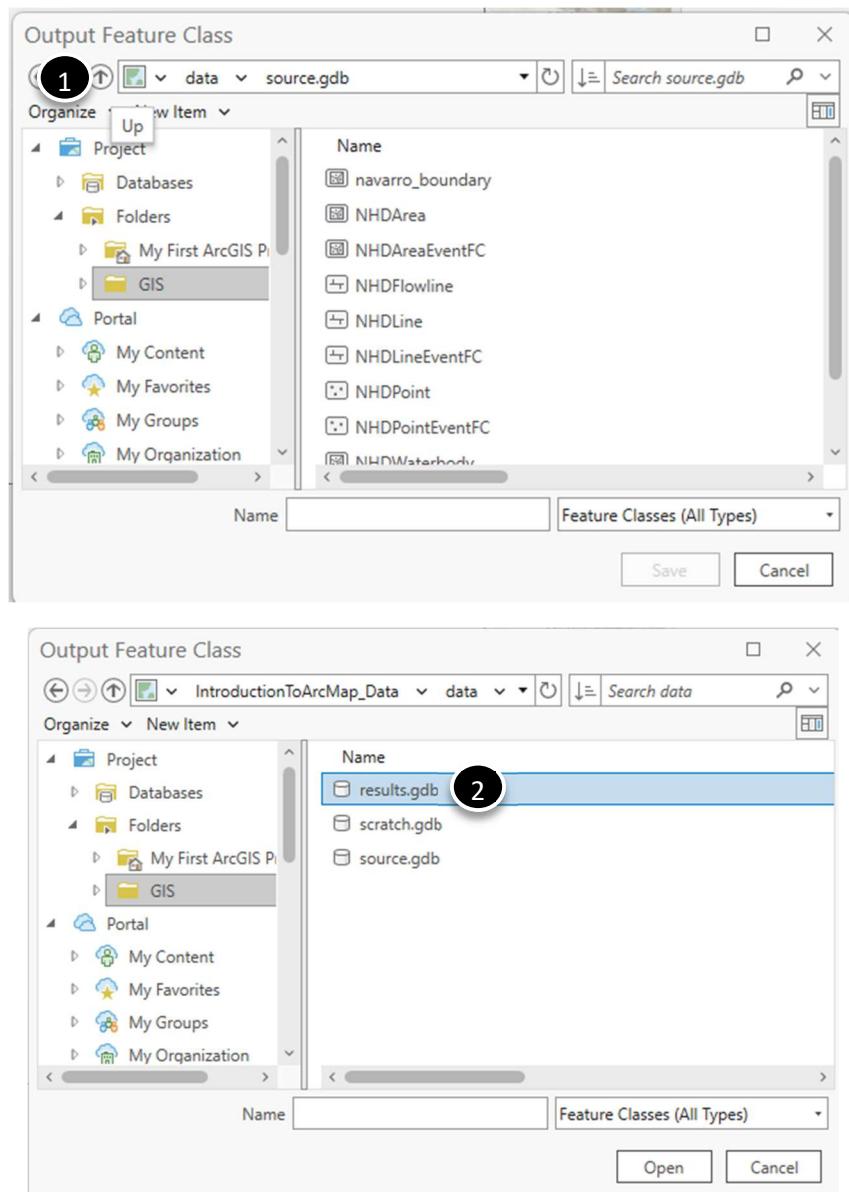
For now, lets select an option location. Click on the *Browse* button to the right of the Output Feature Class text box (1).



8.2 Finding the Right Location

ArcGIS will take use to the default geodatabase set up for the ArcGIS Pro project (we will cover what that is on our next lecture), but let's not export it there. We will keep our *derived* project data separate from our source data from third parties. You will need to navigate to the folder you stored your data in (C:\GIS, for example) and then find the geodatabase named *results.gdb* (2) inside of the *data* folder.

If it happened to take you to the *source.gdb* when you clicked browse, then you can follow these instructions. Click the *Up One Level* arrow (1). Then enter the *results.gdb* geodatabase by double clicking it (2).

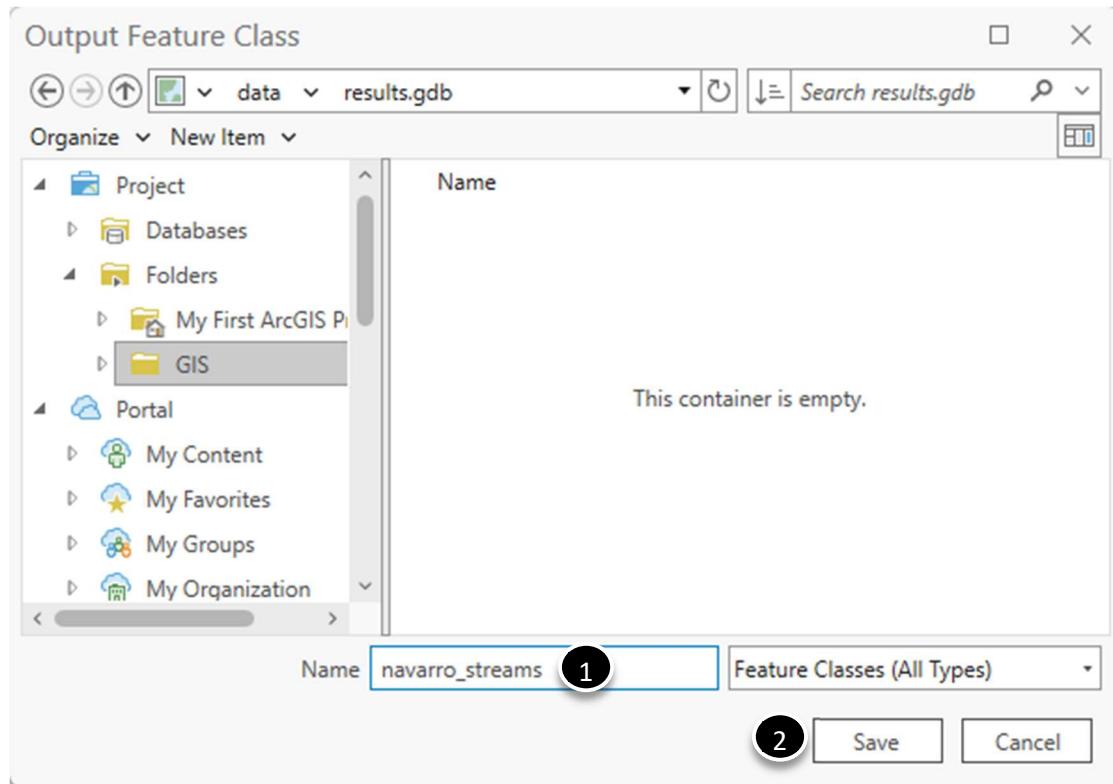


8.3 Give it a Name

Now type a name in the box near the titled *Name*. Call the layer *navarro_streams* (1). Note the underscore. Any ideas on why we might put an underscore in a name?

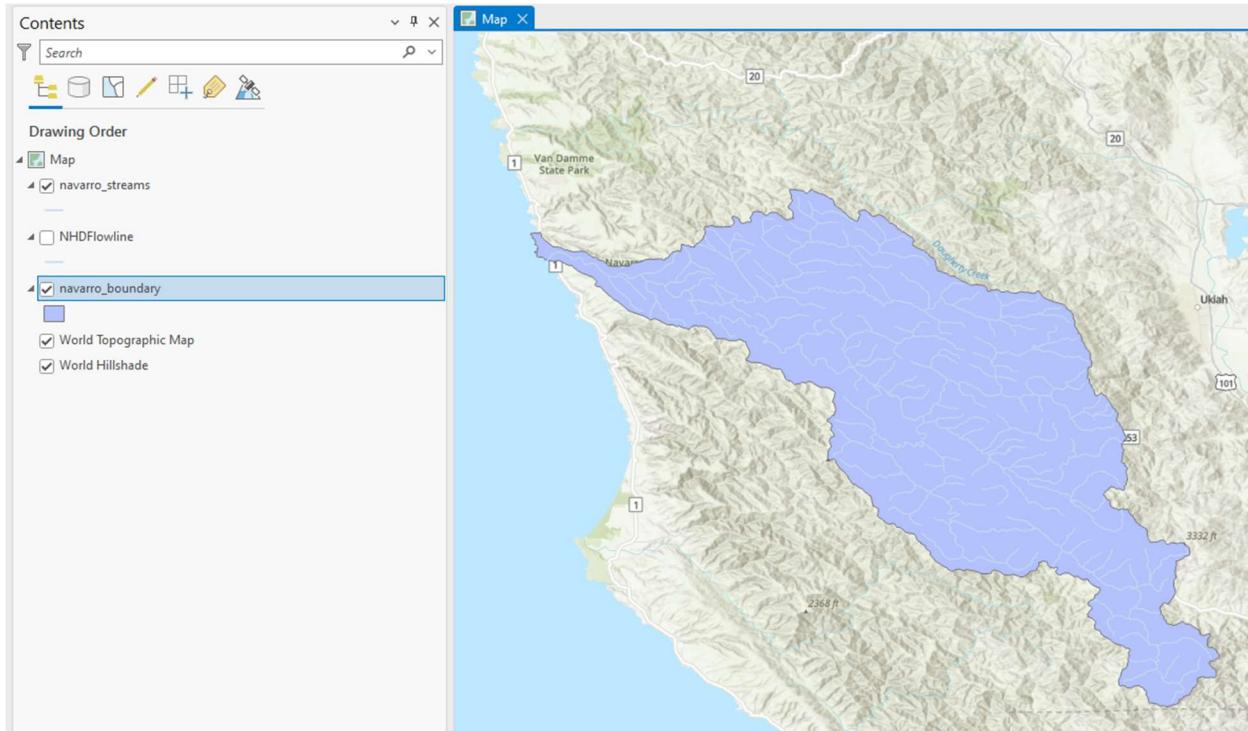
Historically, many computer programs had trouble with spaces. Some components with that trouble are still a part of ArcGIS and they create mysterious errors. It is best to avoid the problem entirely and use something like underscores in place of spaces.

Next click *Save* (2). Then click *OK* in the *Export Data* dialog box (not shown) to export a copy of our selected features. The results of the export will be added to our current map.



8.4 Verify Our Data

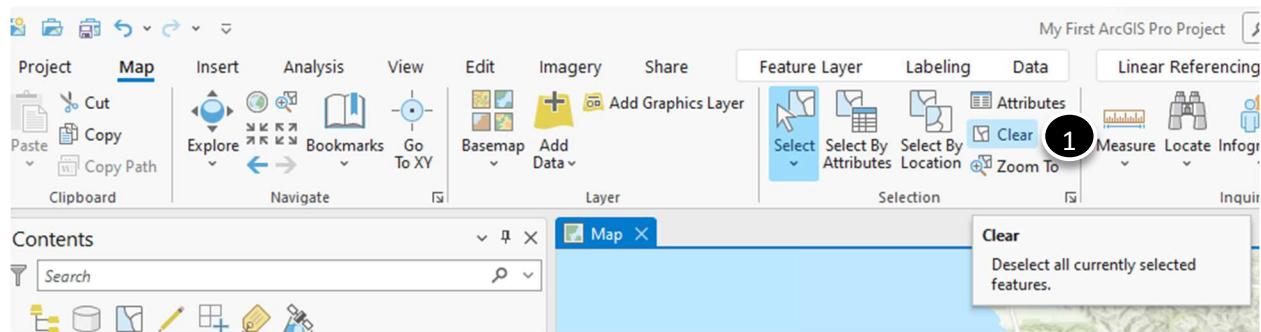
Verify your exported data looks correct by turning off NHDFlowline so that the selection temporarily disappears, and the surrounding data is hidden. Zoom around and take a look. You will also notice that the color was again set to match the color of the source layer.



8.5 Clear Selected Features

Now that we are done with our selection, let's clear our selected features

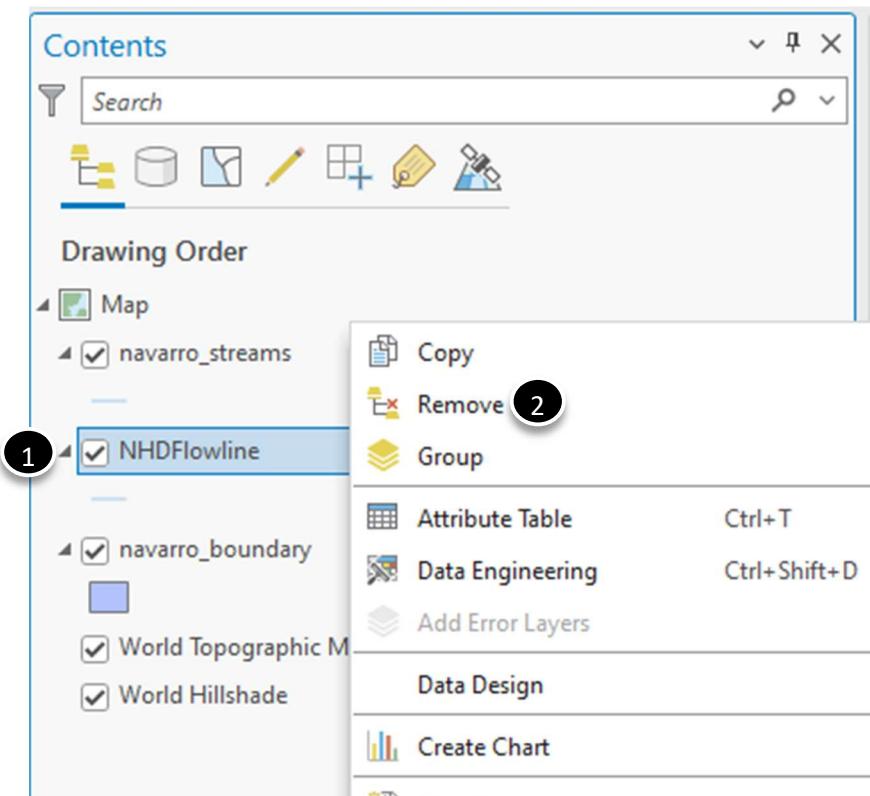
1. Click the *Clear* button in the selection section of the map ribbon toolbar. The select will disappear from your display, and you would need to recreate the selection if you wanted it back.



8.6 Remove NHDFlowline

Now that we have subsetted our data, we can remove the NHDFlowline layer from our map. We can add it back later, if we want to, but we currently do not need it in this map.

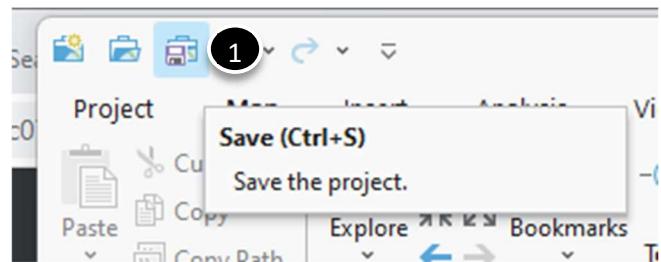
1. Right click on the *NHDFlowline* layer in the table of contents.
2. Click on *Remove*.



8.7 Save your ArcGIS Pro Project

Now, save your work!

Click the save project button that can be found in the upper left corner of the screen (1).



You now have a version of the Navarro River and its surrounding watershed to use in a future analysis – nice work! Make sure to save this ArcGIS Pro Project somewhere that you can find it. You will use it in the next lab assignment.