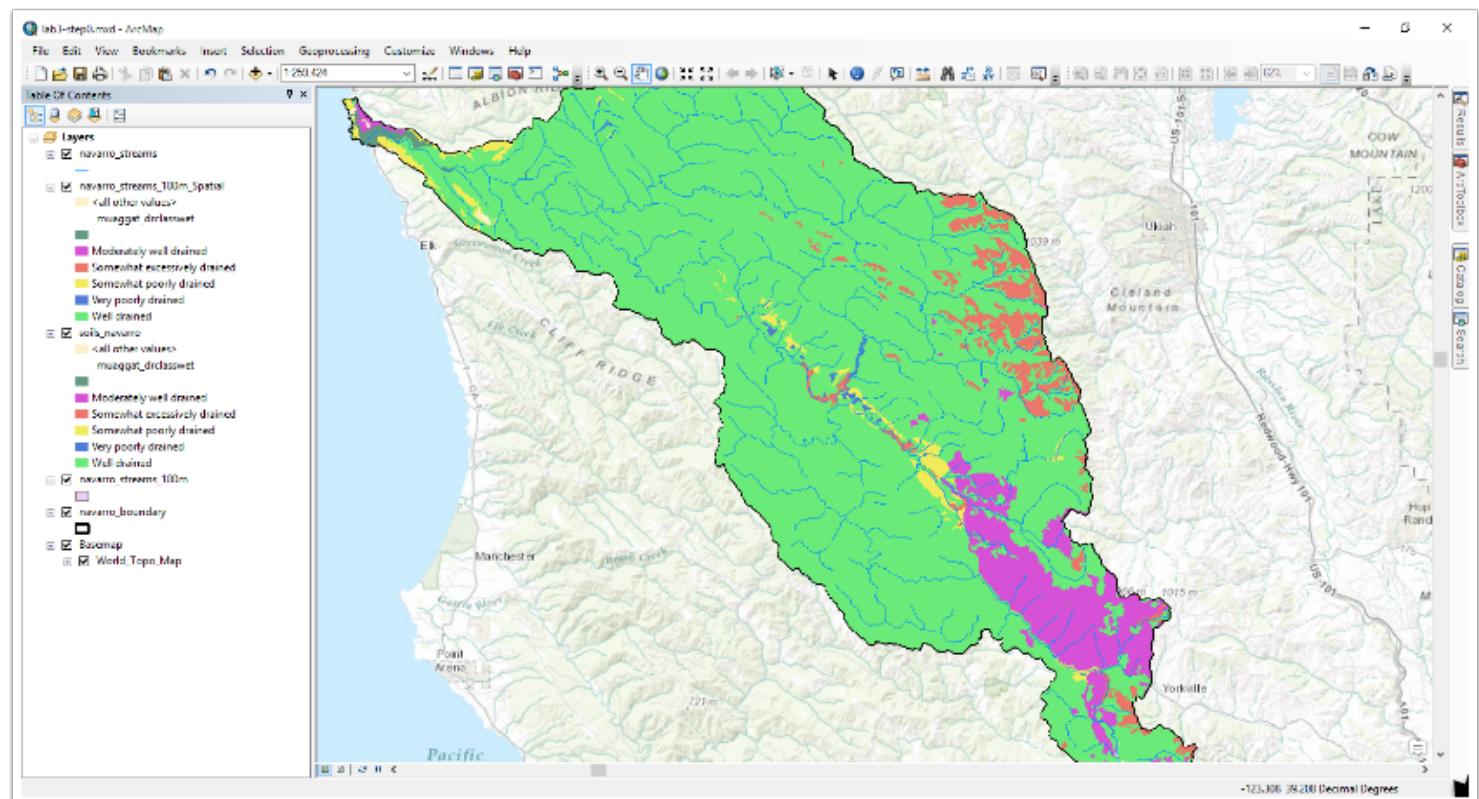


In this lab exercise, you will take the map you worked on last time, and turn it into a complete, ready to print or share PDF map. You will add all of the core components of complete maps, including a title, legend, north arrow and scale bar. You will also list your name and the date the map was edited. Finally, you will add an inset map to provide context about the location of the main map, and you will link that inset map to the main map.

Cartography can be a very involved process, but also incredibly rewarding as you see your analysis work become a broadly-usable product!

1. Getting started again

To start off, open up your map document from the last lab exercise, where you had processed soils data for the Navarro River Watershed. If you aren't already in Data View, make sure to switch back to Data View, so your screenshot matches the one below.

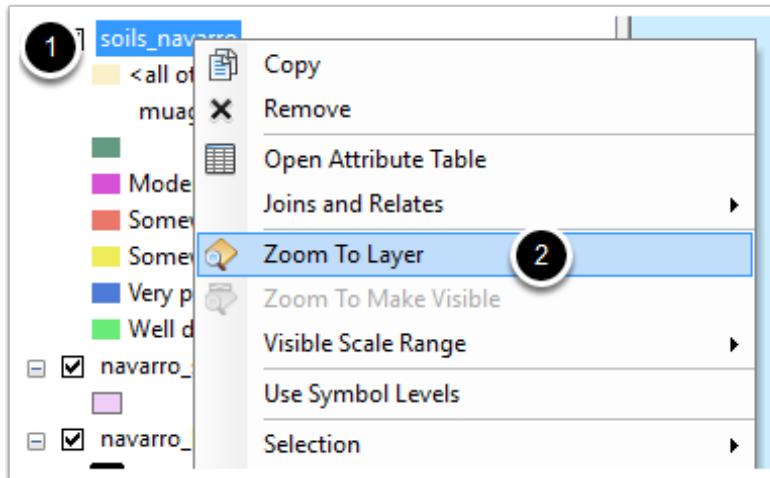


1.1 Focusing back on the soils layer

Since we have been focusing this map on the soils layer, let's zoom to that layer to both make your map consistent with the screenshots, but also to provide a good view of the data.

1. Right click on the *soils_navarro* layer
2. Click *Zoom to Layer*

Your view of the data should change to show all of the data (and maybe some of the surroundings)



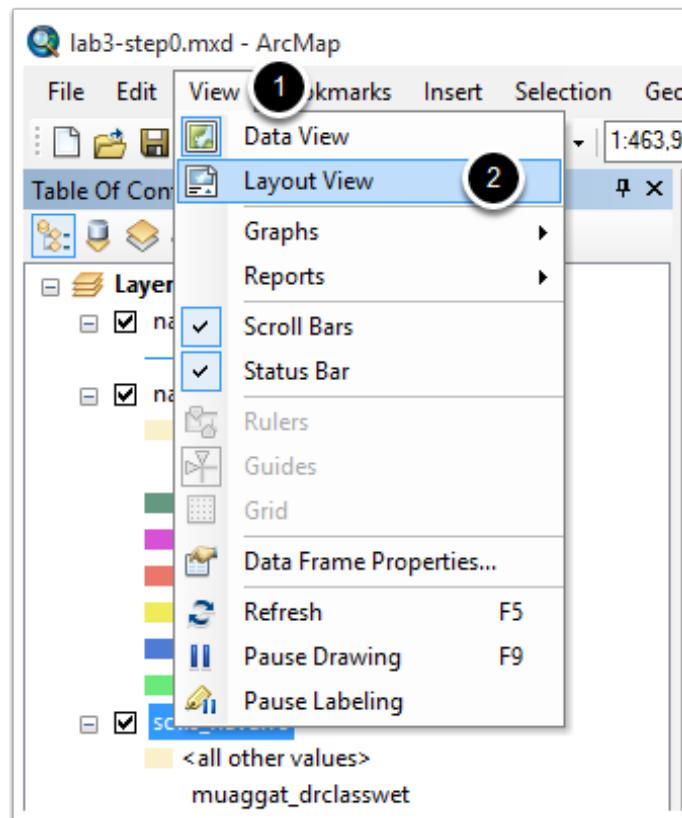
1.2 Switch to Layout View

Now, switch your map document to Layout View. This view of the document is the way we can develop complete maps for printing and sharing in non-ArcGIS formats - images, PDFs, and even files that are ready to edit in graphics packages like Adobe Illustrator (or the free Inkscape).

To use layout view, we need to switch into that mode, which will change the tools available to us in ArcGIS.

1. Open the *View* menu
2. Click on *Layout View*

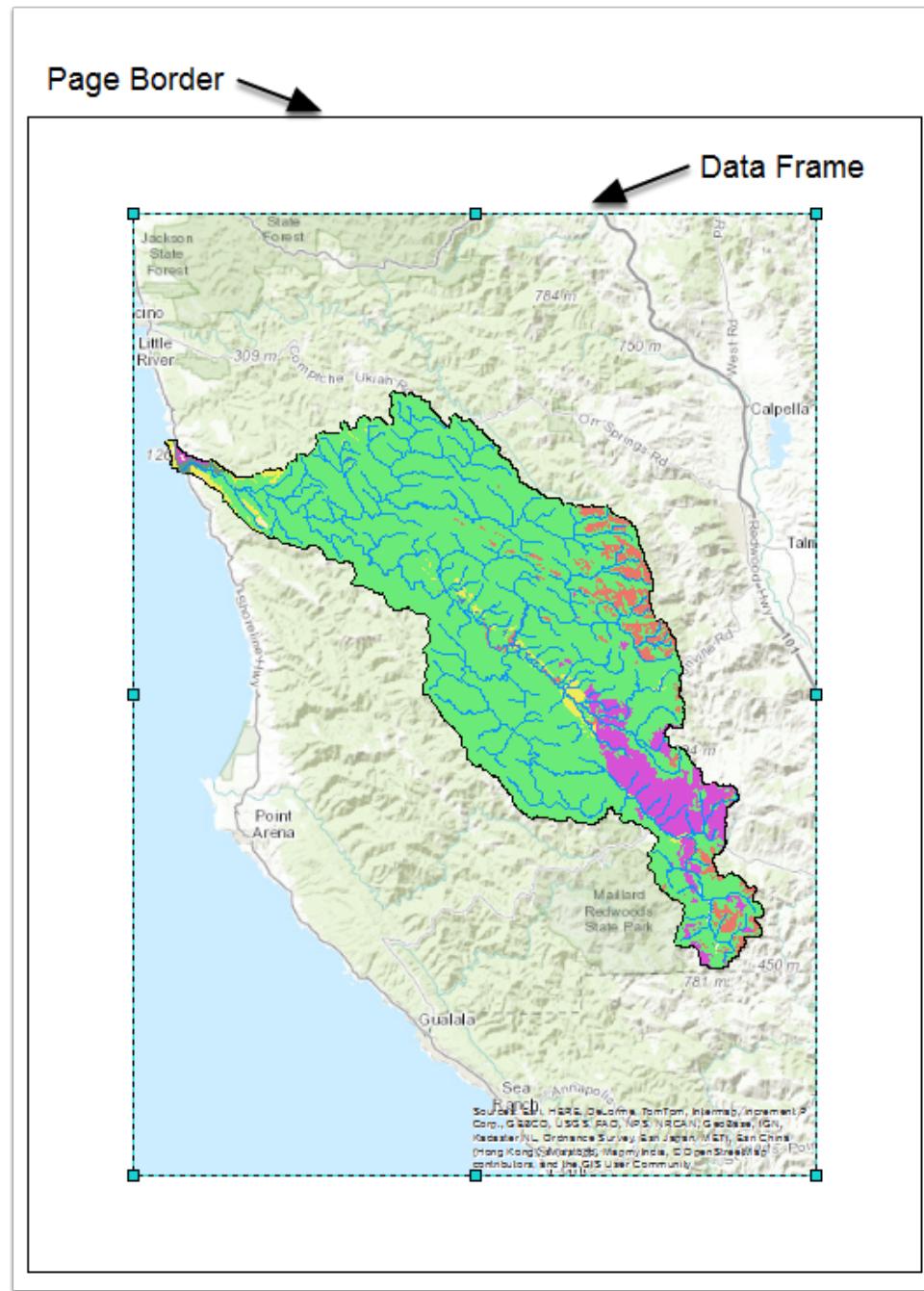
As a bonus, can you find the other location that you can switch the map document between layout and data views?



1.3 A new view where the data frame was

Your perspective in the main area of ArcMap will change. Instead of just showing your data, it will now show the main page layout, using a default page size of 8.5x11 inches, and your data frame will be a box whose size you can adjust, no longer filling the whole screen.

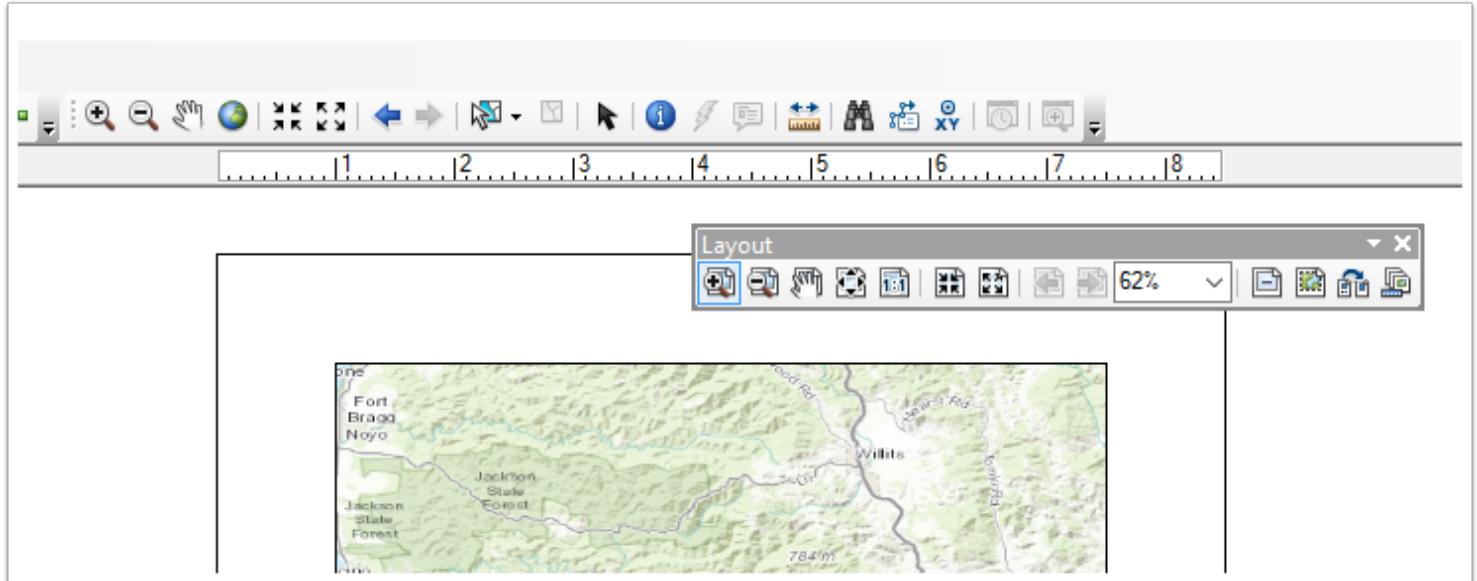
This is a core part of layout view. While in Data View, the whole space is dedicated to allowing you to explore and work with your data. Once in Layout View, the focus is now on designing your page for a print layout. Your page will look something like the below image by default.



1.4 Layout Tools show up

You will also see a new toolbar appear called *Layout*. When you switch to layout view, these tools appear by default. You can also add and remove them the usual way (by right clicking on a blank space on the toolbar).

It will likely appear floating the first time. I like to dock Layout Tools to the main toolbar by dragging it up onto the toolbar. This is a personal preference and not something you need to do.

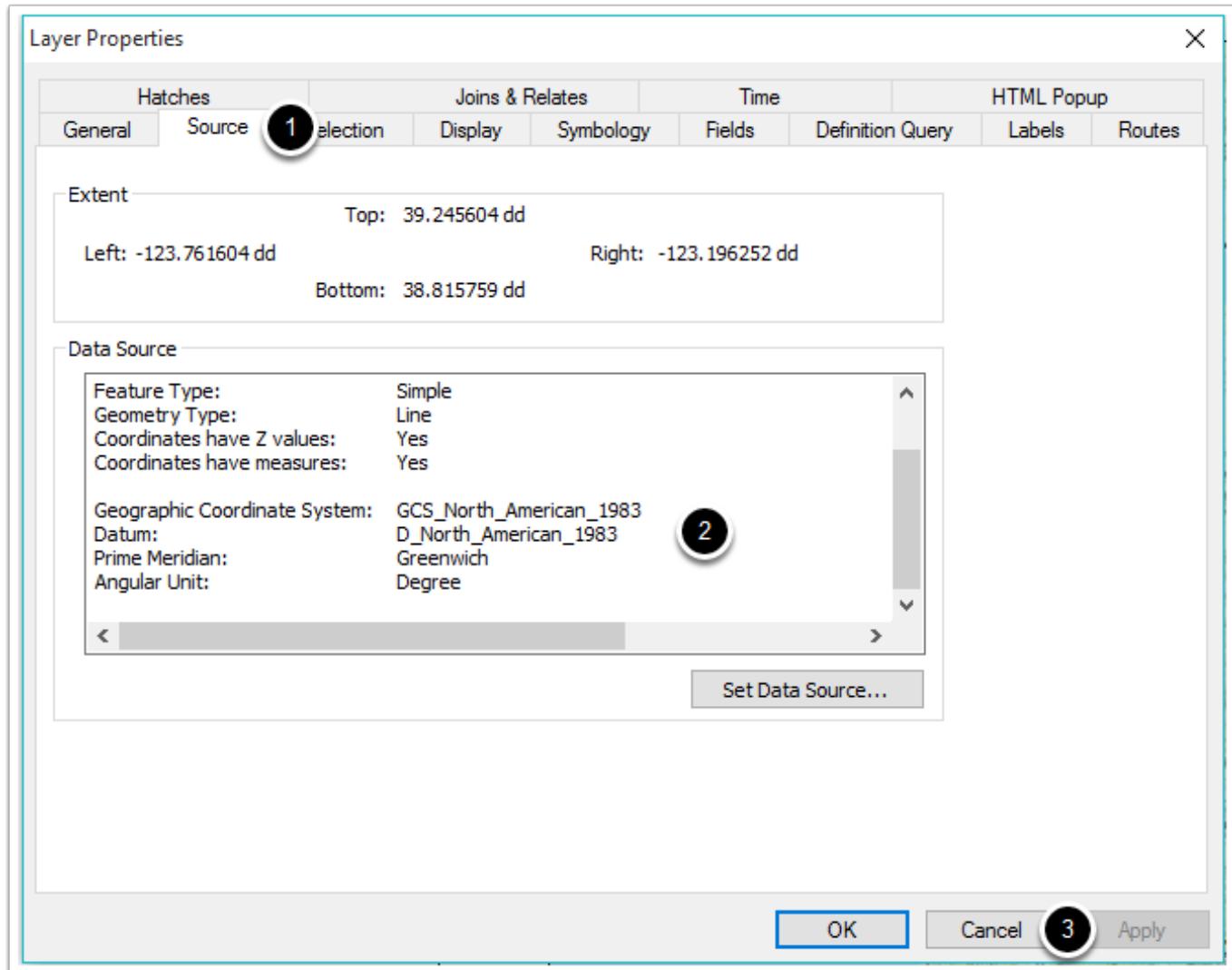


2. Changing the Coordinate System again

Remember in the last lesson how we changed the coordinate system so that the basemaps would appear faster (by not having to reproject the tiles). Now that we're planning to export our map, it's worth changing our coordinate system back so that we use a one more appropriate to our data. Exporting a map in the coordinate system of the basemap is *fine* and people around the world are now accustomed to this projection, but we can get a map with less local distortion by changing the coordinate system to one more appropriate to our data or the local area.

To start, we need to determine the appropriate coordinate system - the most appropriate for this data would likely be one of the California-specific coordinate systems or the *State Plane* coordinate system. But in this case, you'll instead set it to the coordinate system of one of the data layers so that it matches your data again. We need to find that coordinate system now.

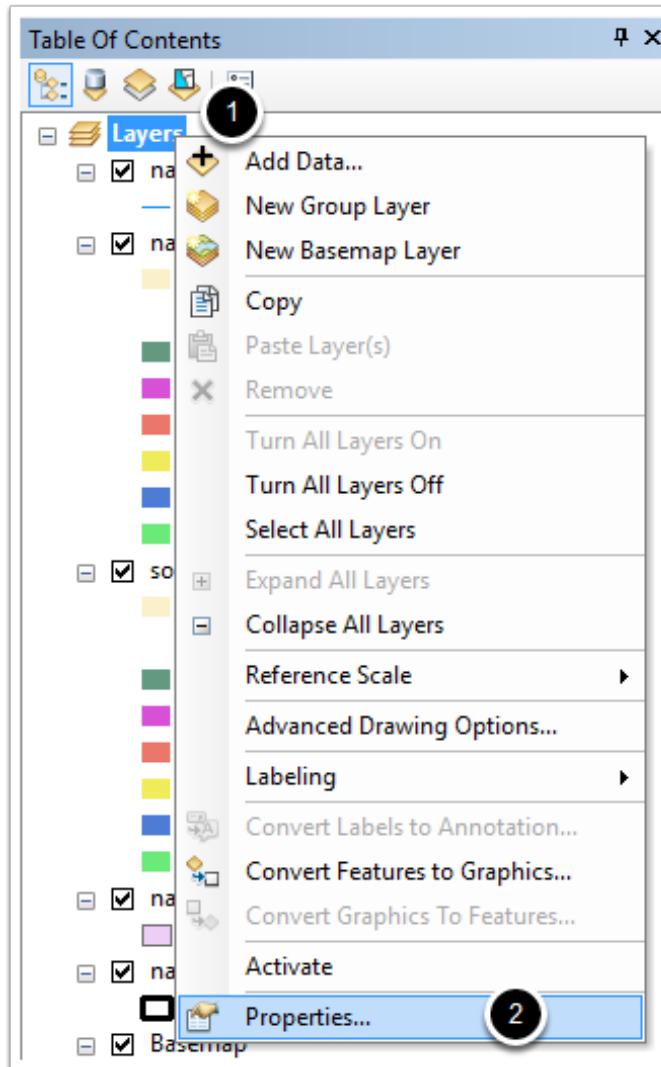
Bring up the layer properties for the *navarro_streams* layer and navigate to the *Source* tab (1). If you scroll down in the box, you will see the coordinate system, in this case, named "GCS_North_American_1983" (2). Note that down, because we'll need that information in a moment. Click Cancel to close out the box (3).



2.1 Setting the coordinate system of the data frame

Remember how we did this before? You need to access the data frame's properties.

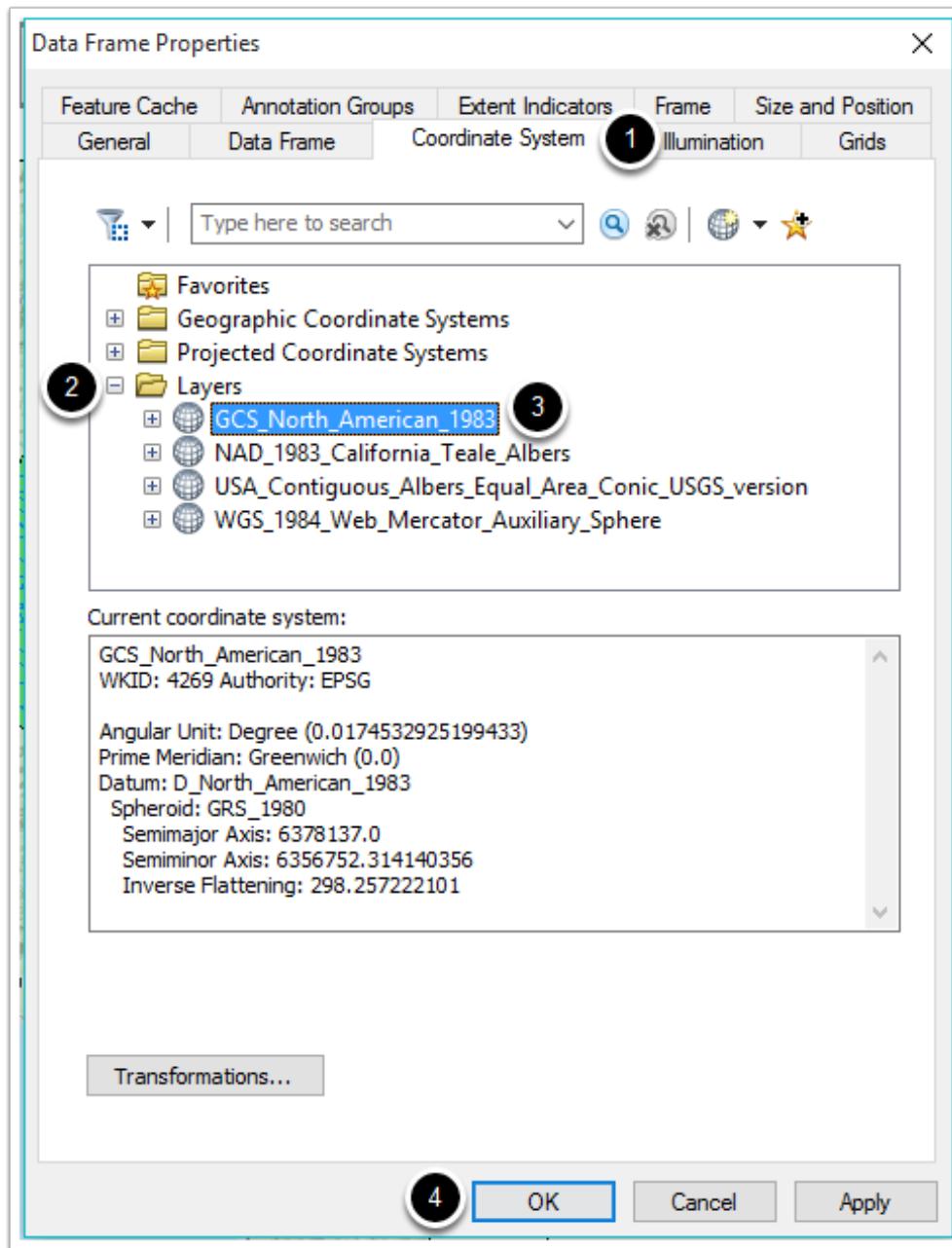
1. To do that, you'll need to right click on the data frame (named *Layers*) in the Table of Contents
2. Then click on *Properties*



2.2 Finishing the change

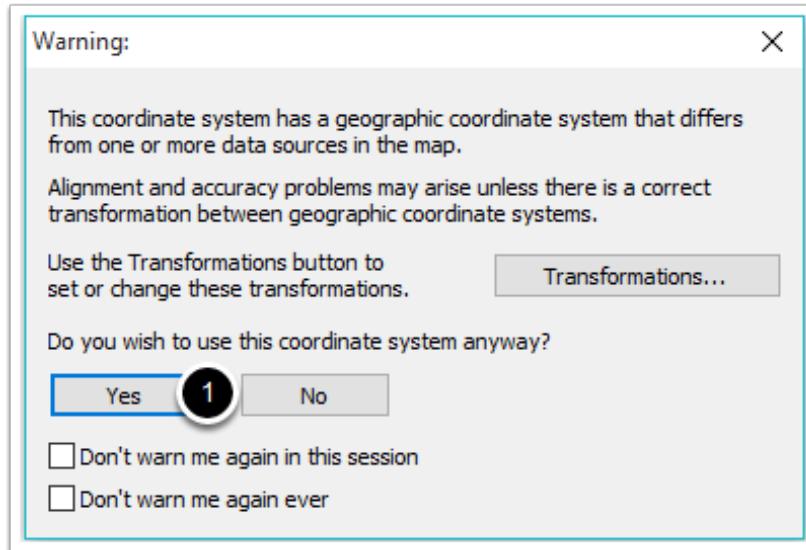
You've done something similar to this before, but let's review and we'll take an easier way this time:

1. Navigate to the *Coordinate System* tab, where we can change the coordinate system the data frame is displayed in.
2. Since we're trying to make our data frame's coordinate system match a layer in our map document, expand the *Layers* folder by clicking the plus sign control (+) next to it.
3. Select the coordinate system (by clicking on it) that matches the one on *navarro_rivers* layer that we looked up earlier (*GCS_North_American_1983*).
4. Click *OK* to change the coordinate system of the data frame.



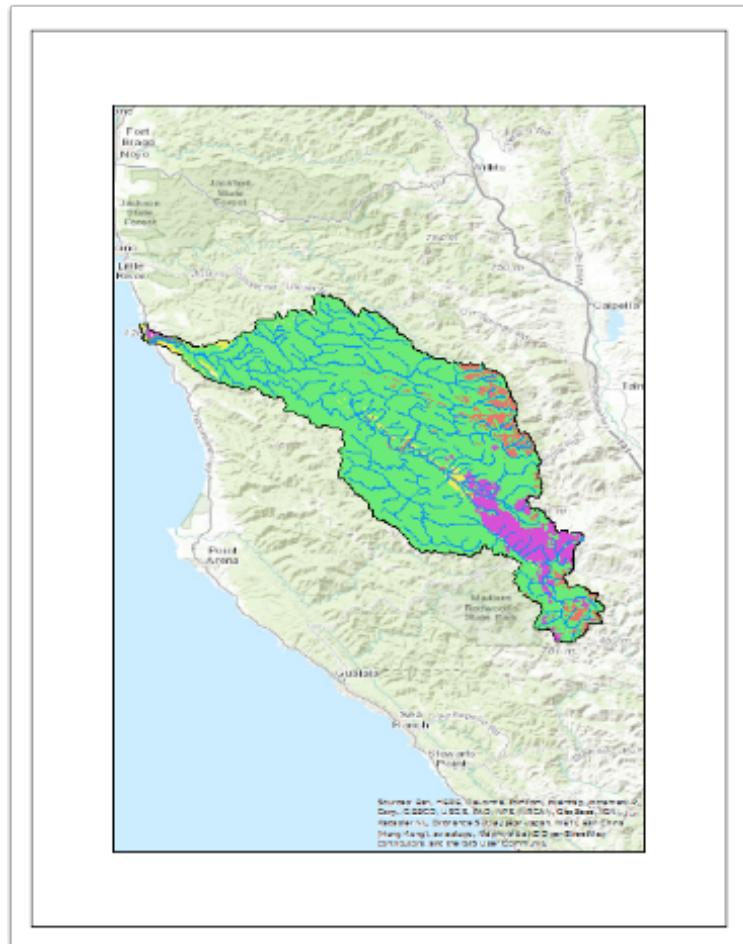
2.3 A familiar warning

You will see a warning indicating that you will have alignment and accuracy problems - since we aren't editing any data, this is ok. Click Yes (1) to use the new coordinate system anyway.



2.4 A slightly different view

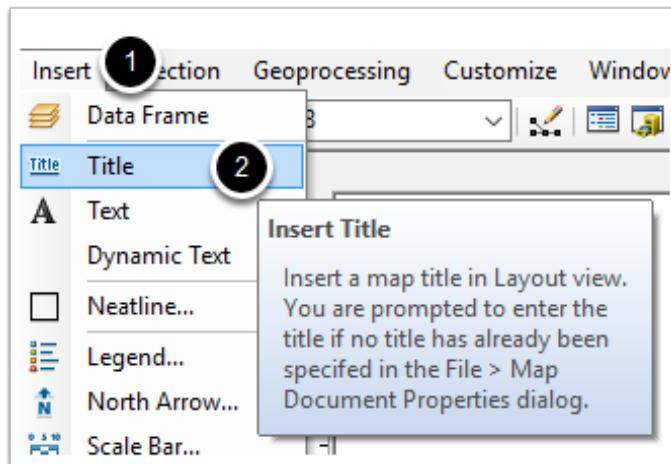
Your data frame will update to use the new coordinate system. It might look like it's distorted now in comparison to before, but in reality, it's somewhat less distorted compared to reality now that we're using a coordinate system that is optimized for North America.



3. Adding Core Map Elements

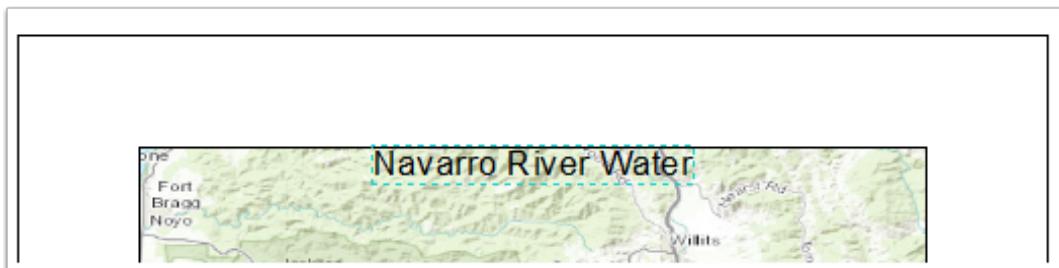
Now we'll start adding some of the important elements of the map to our map document. We'll start with a title, which is always important to tell people viewing the map what they are looking at.

1. Open the *Insert* menu
2. Click *Title* to add a title to your map



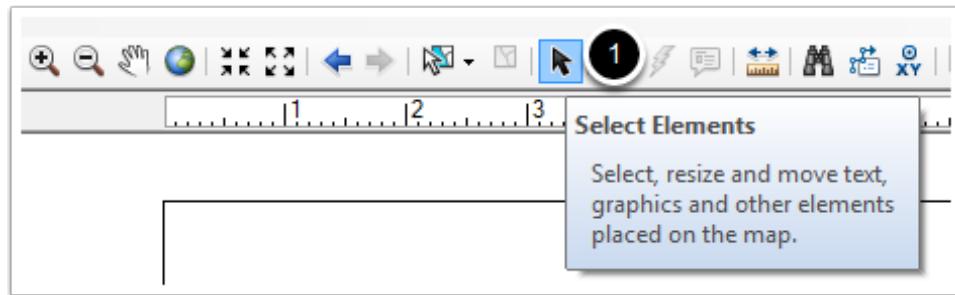
3.1 A title appears

A title will be added to your map - sometimes you may have to find it on top of your data. This is easier for titles but harder for smaller text.



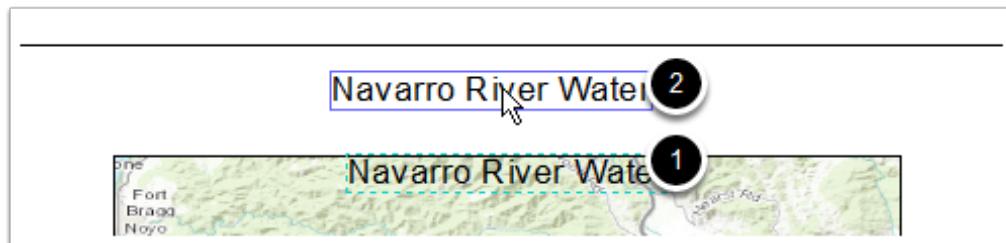
3.2 Moving the title

Let's move the title to a more appropriate location. Activate the Select Elements tool (1), which allows you to control items and boxes on your layout - it **does not** create the kinds of selections we've been working with earlier in this lab!



3.3 Click and Drag

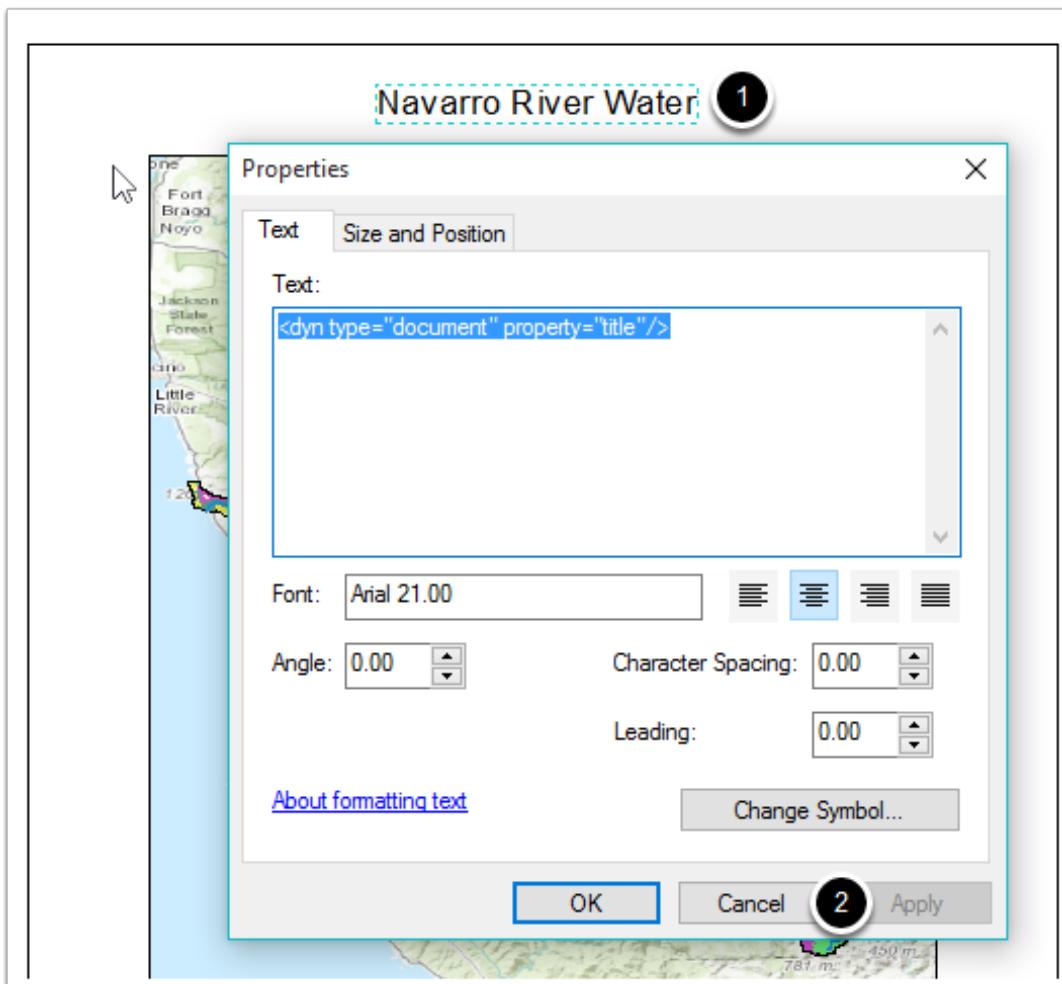
1. Click on the title and leave the mouse button down,
2. Then drag the title to a new location at the top of the page



3.4 Editing the title

The title isn't particularly descriptive anymore. While we are looking at waterways in the Navarro River, that just gives us location context, but not a whole lot else. We should make a more descriptive title that indicates information about the soils layer.

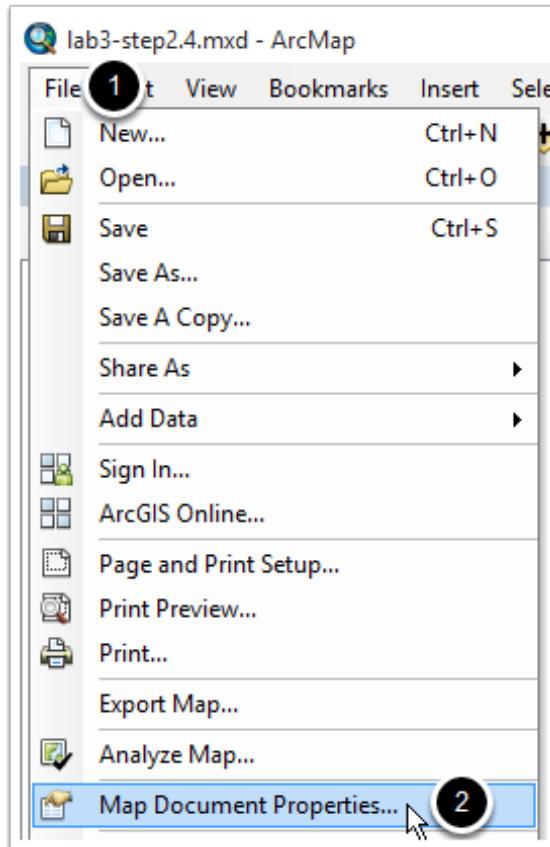
1. Double click on the title text. A properties box will appear to allow you to edit the title text and size. The title text is currently a special attribute that pulls the *title* property from the map document and places it here. In order to keep things consistent across our map, wherever our title might be used, we should update the property instead of changing this *dynamic text* tag.
2. Click *Cancel* to close the properties box.



3.5 Editing the document title instead

We now need to go find the document properties.

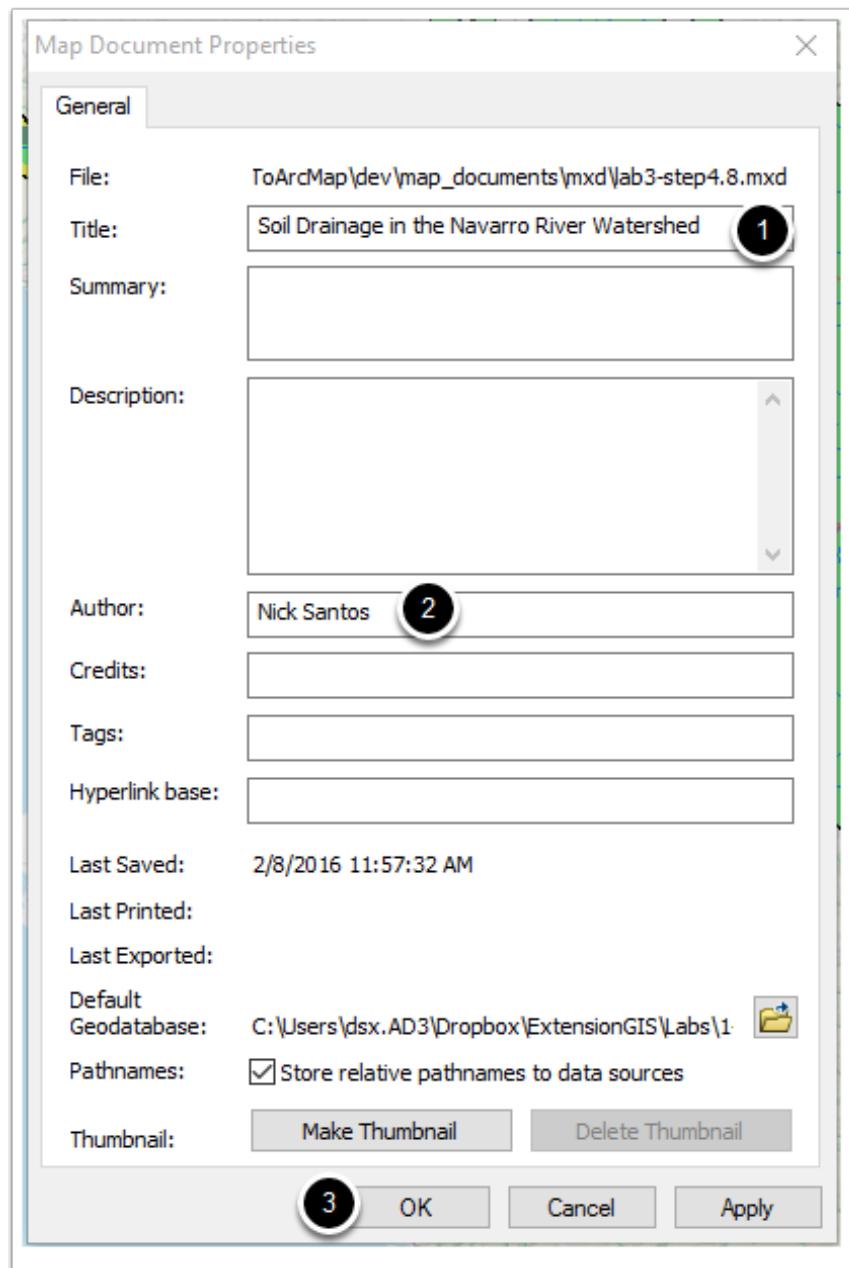
1. Open the *File* menu
2. Click *Map Document Properties* to open up the properties pane.



3.6 Changing the title to match current themes

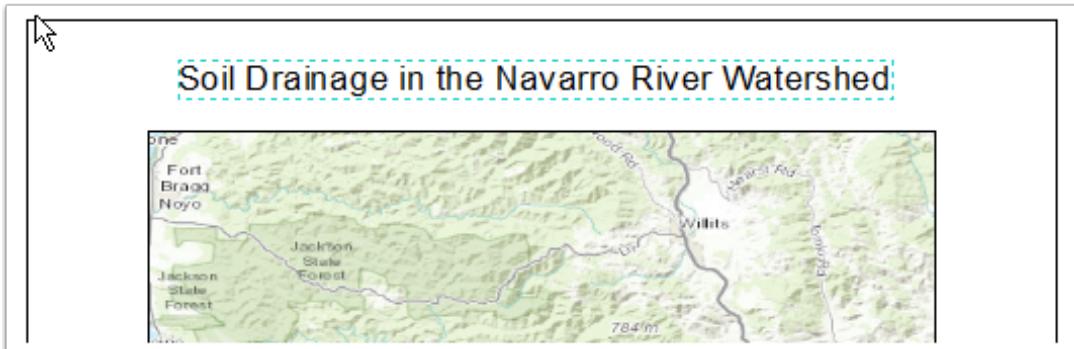
At the top is a field to input the title information. It will match the title currently displayed on your map. Let's edit it.

1. Click into the title field and change it so it says "Soil Drainage in the Navarro River Watershed"
2. While you're here, enter your name in the *Author* field - we'll make use of it later.
3. Click **OK** to save your change and close the box.



3.7 The title updates

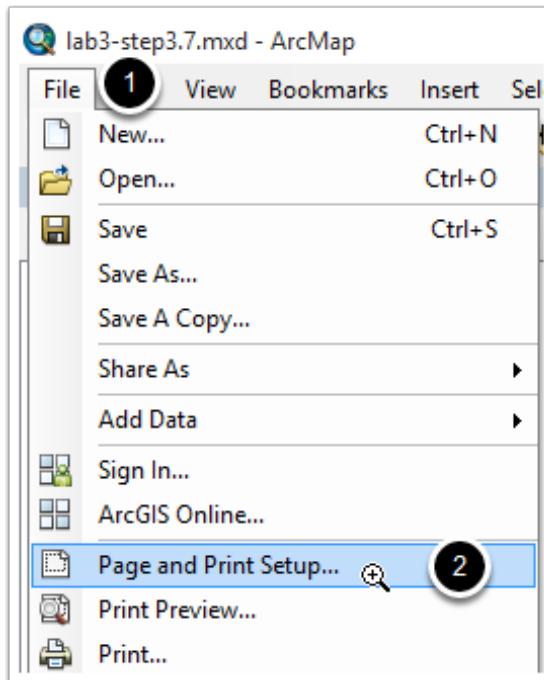
Since we left the dynamic text tag in place that pulls the title property from the map document, the title on the map automatically updated when we changed the property! Our title is now set!



4. Changing the page layout

Looking at the map, you might notice that the data we're interested in is much wider than it is tall. We have a lot of wasted space on the map in terms of showing our information of interest - the soils layer! This map would much better serve the viewer if we changed the page layout from *Portrait* to *Landscape*.

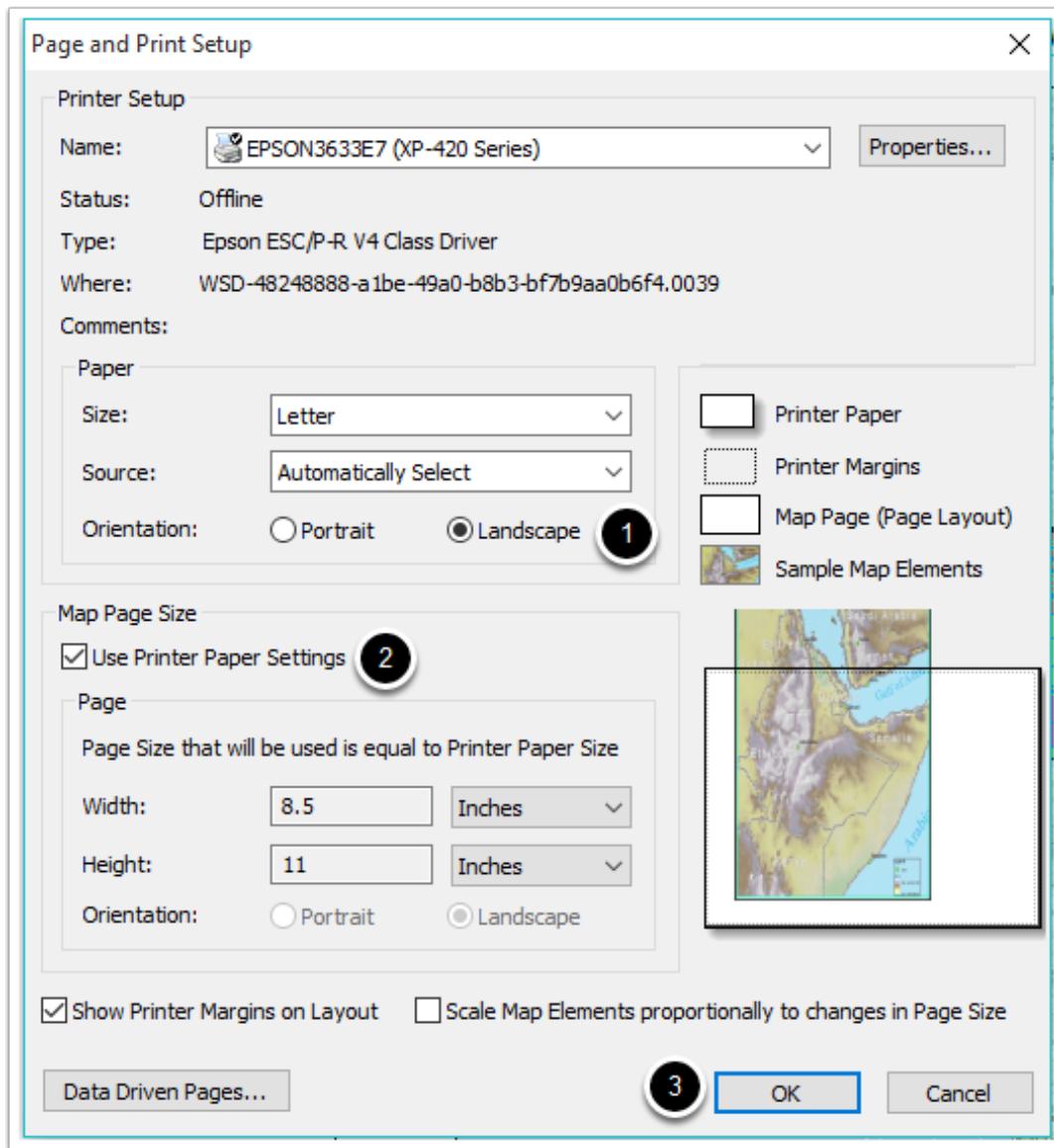
1. Open the *File* menu again
2. Click *Page and Print Setup*



4.1 Switch to Landscape

Now, we need to change the page layout to *Landscape* mode, to flip the paper orientation and allow us to resize our data frame to better accommodate our data.

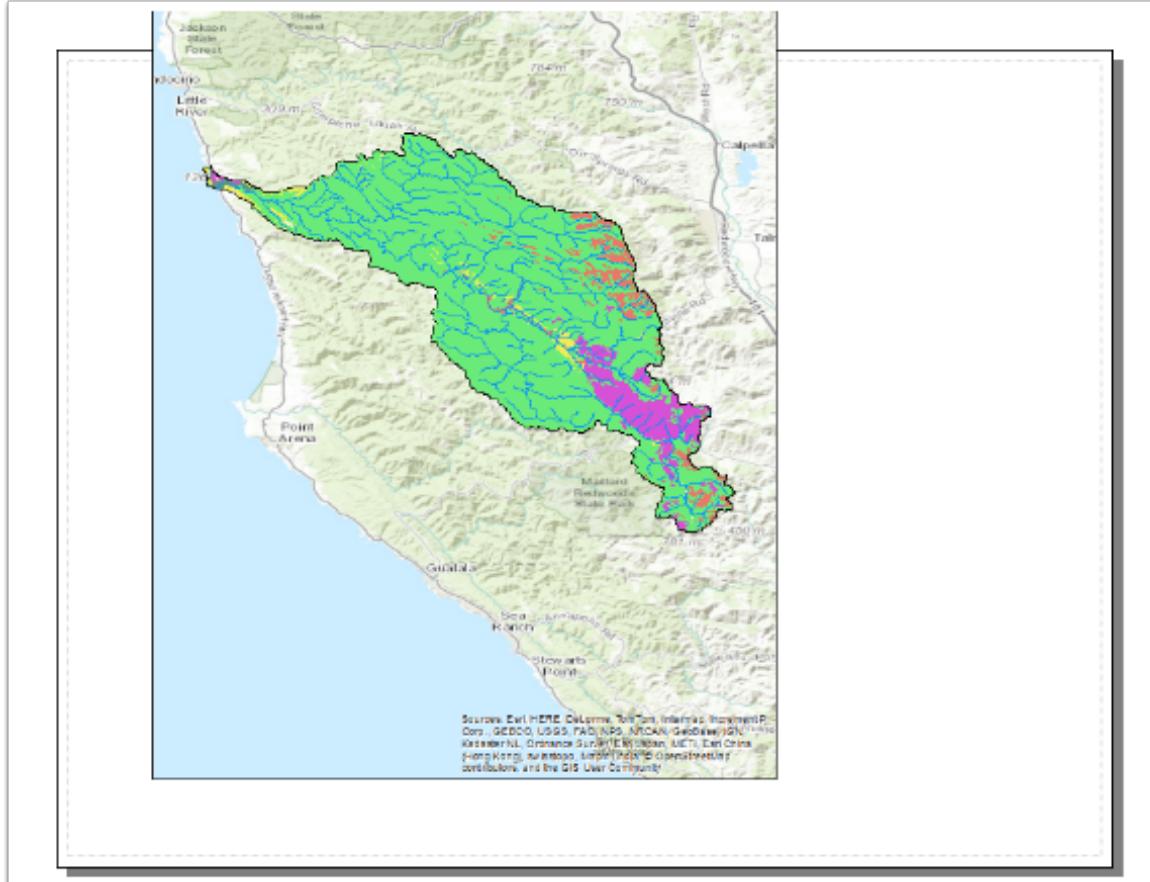
1. In the *Paper* section, change *Orientation* to *Landscape*
2. In the *Map Page Size* box make sure the box for *Use Printer Paper Settings* is checked so that the page layout changes to match, and we develop a page layout that matches what we plan to print or export.
3. Click *OK* to save the settings and close the dialog.



4.2 A mismatched data frame

Our page layout changes, but our data frame didn't change size. We'll need to manually resize it now.

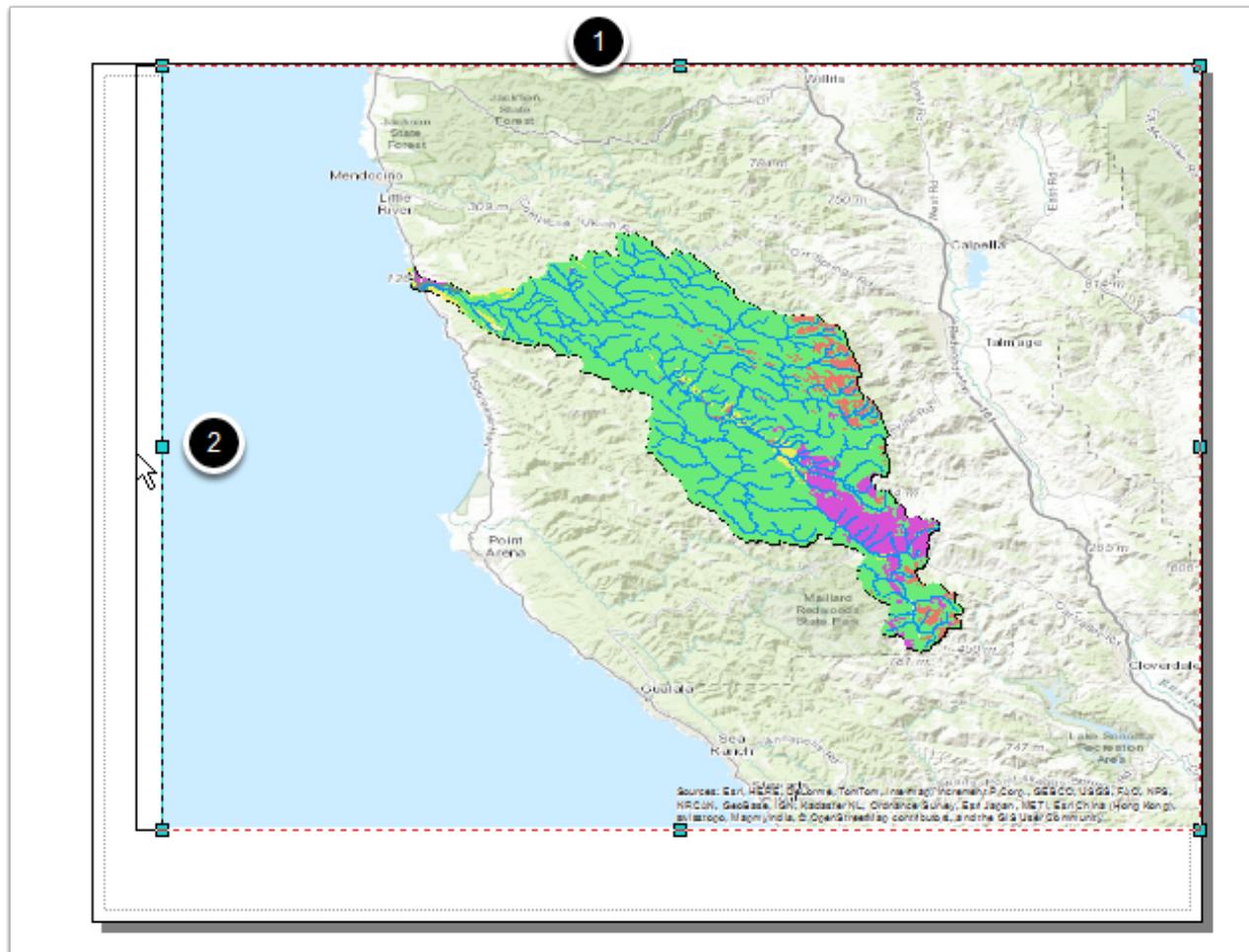
Note: An option in the previous dialog can mitigate the need to do some of this resizing - can you find it?



4.3 Resize the data frame to match the new page

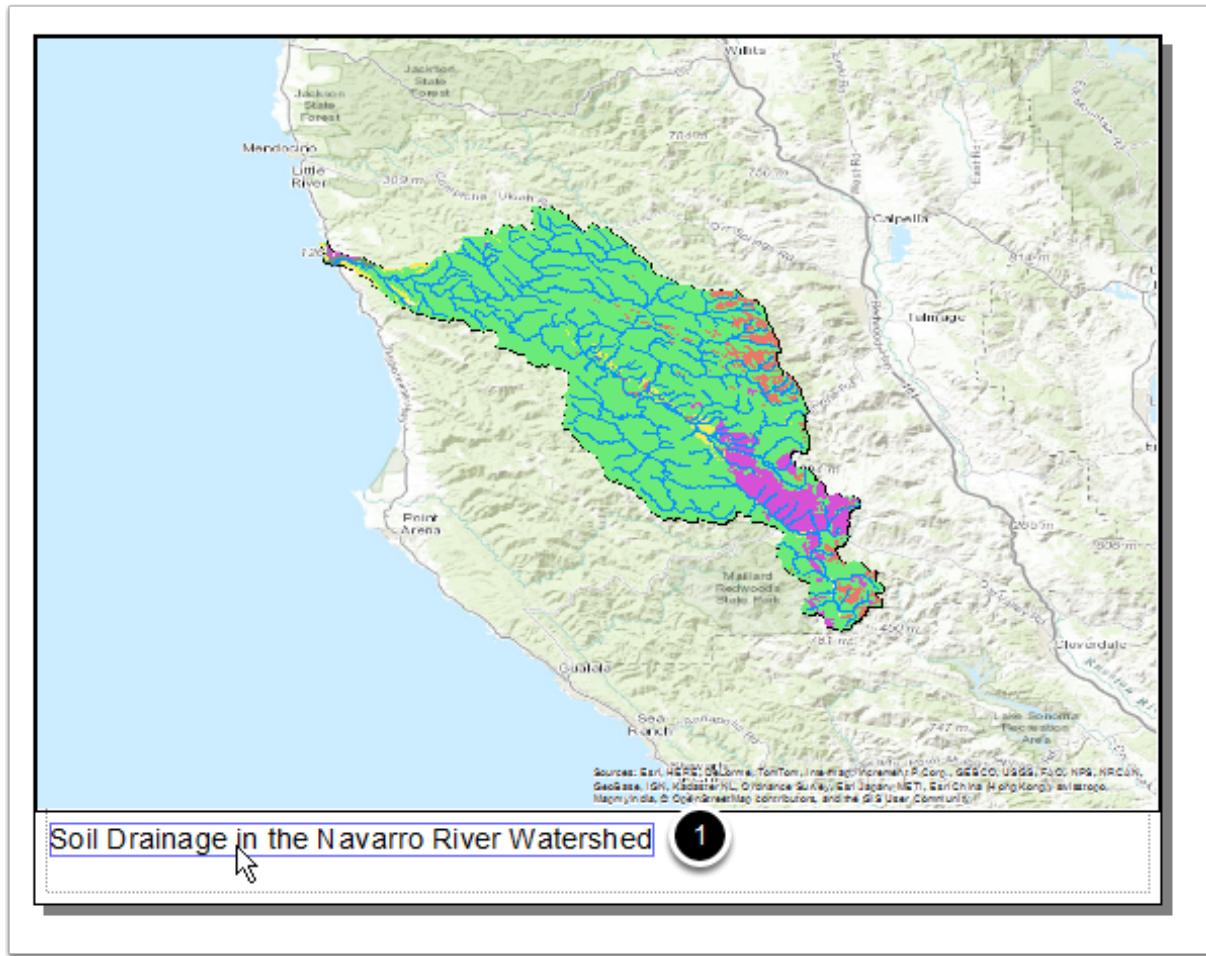
Now, let's resize the data frame. Activate the *Select Elements* tool again.

1. Click on the data frame. A box indicating it is active will be added.
2. Use the controls at the corners and in the middle of the sides to resize the data frame to fit most of the page, leaving space at the bottom.



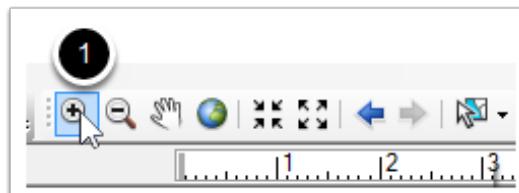
4.4 Move the title again

The title will still be way above the page since it will remain in the location it was in before we changed the page layout. Drag the title down into the bottom area. If you can't see it, use the layout view panning and zooming tools to zoom out until you find it.



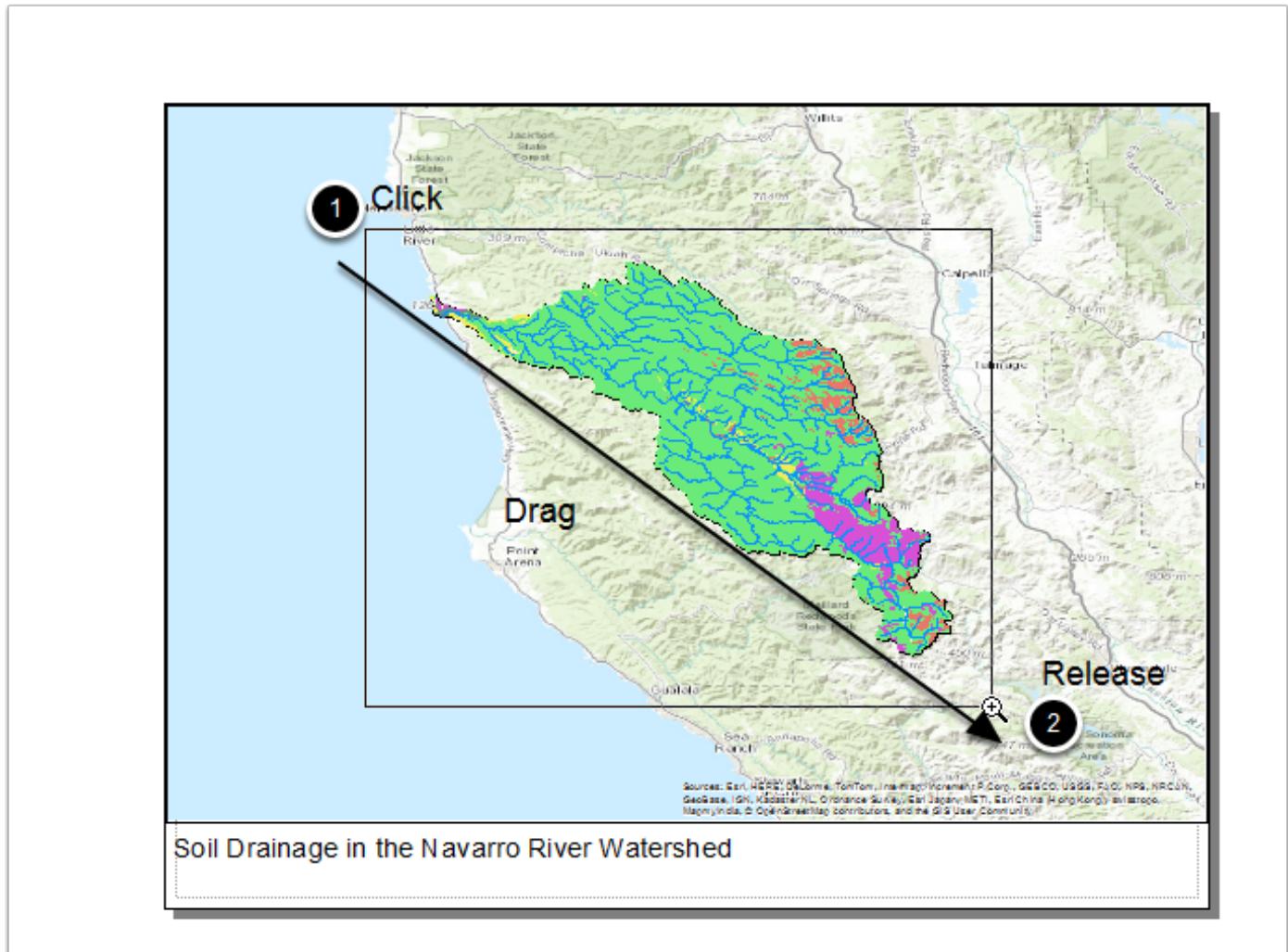
4.5 Zooming in

Now, let's zoom so our data is more useful on this page. Activate the *Zoom In* tool to work with the data.



4.6 Zoom closer to the layer

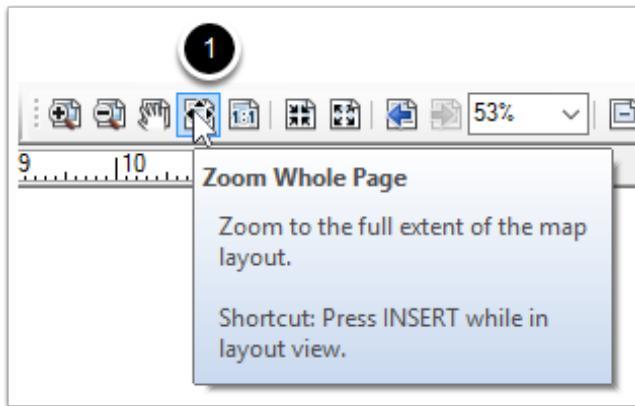
Click (1) and drag (2) a box close around the Navarro River watershed. Your data frame should now zoom in close.



4.7 Fill the view with the whole page

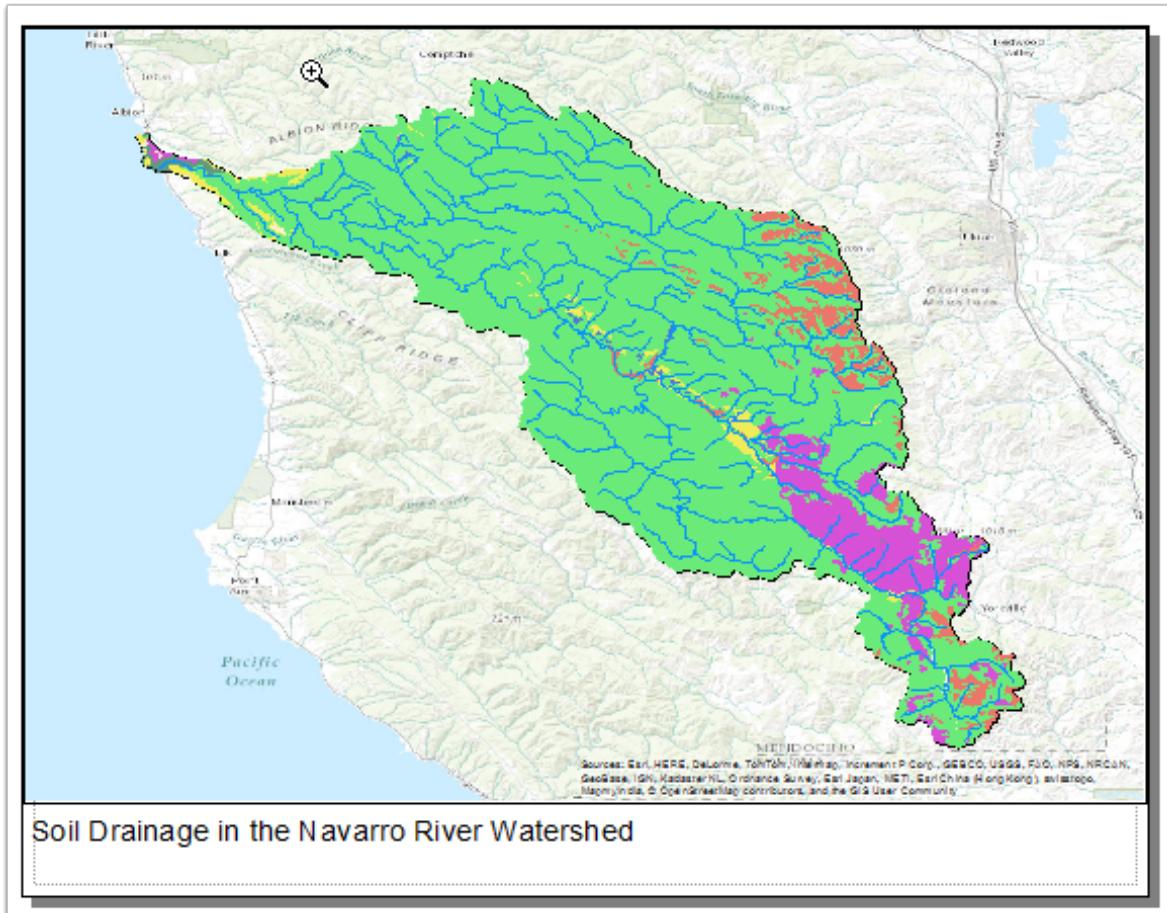
Now, after finding the title on your layout canvas, your page might be smaller than you'd like to view.

Click the *Zoom Whole Page* button on the Layout toolbar in order to make the page as large as possible on your screen.



4.8 Checkpoint

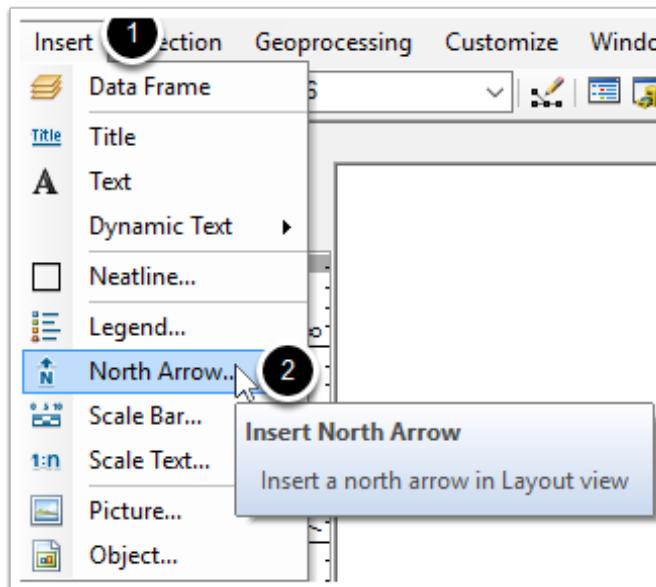
You should now have a large view of the data occupying most of your layout and a title at the bottom. Nice work!



5. Adding more elements

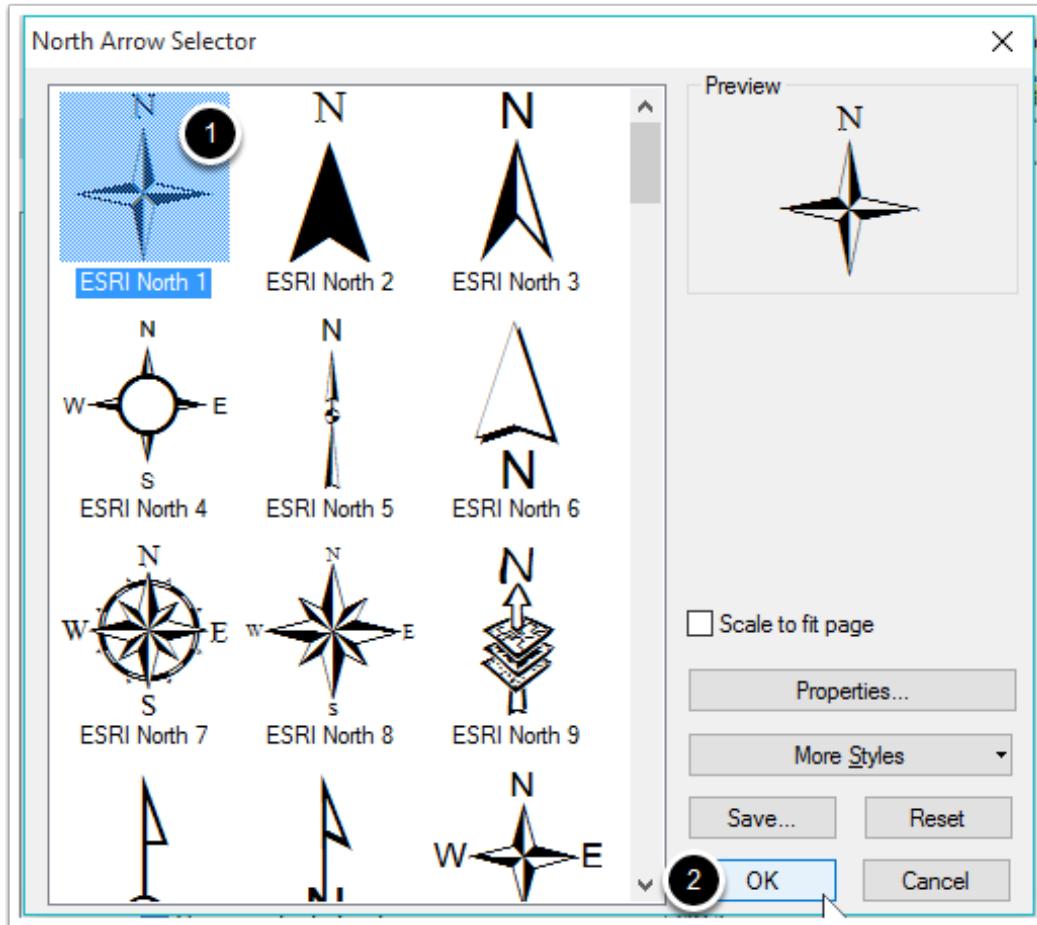
Next, we'll add a North Arrow to a map. North arrows help orient the viewer of a map to the rest of the world by showing them where north is located on the map. While they are becoming less necessary on maps where north is at the top since viewers are accustomed to this convention, it's still good practice to include one.

1. Open the *Insert* menu
2. Click *North Arrow* to bring up the *North Arrow Selector* dialog



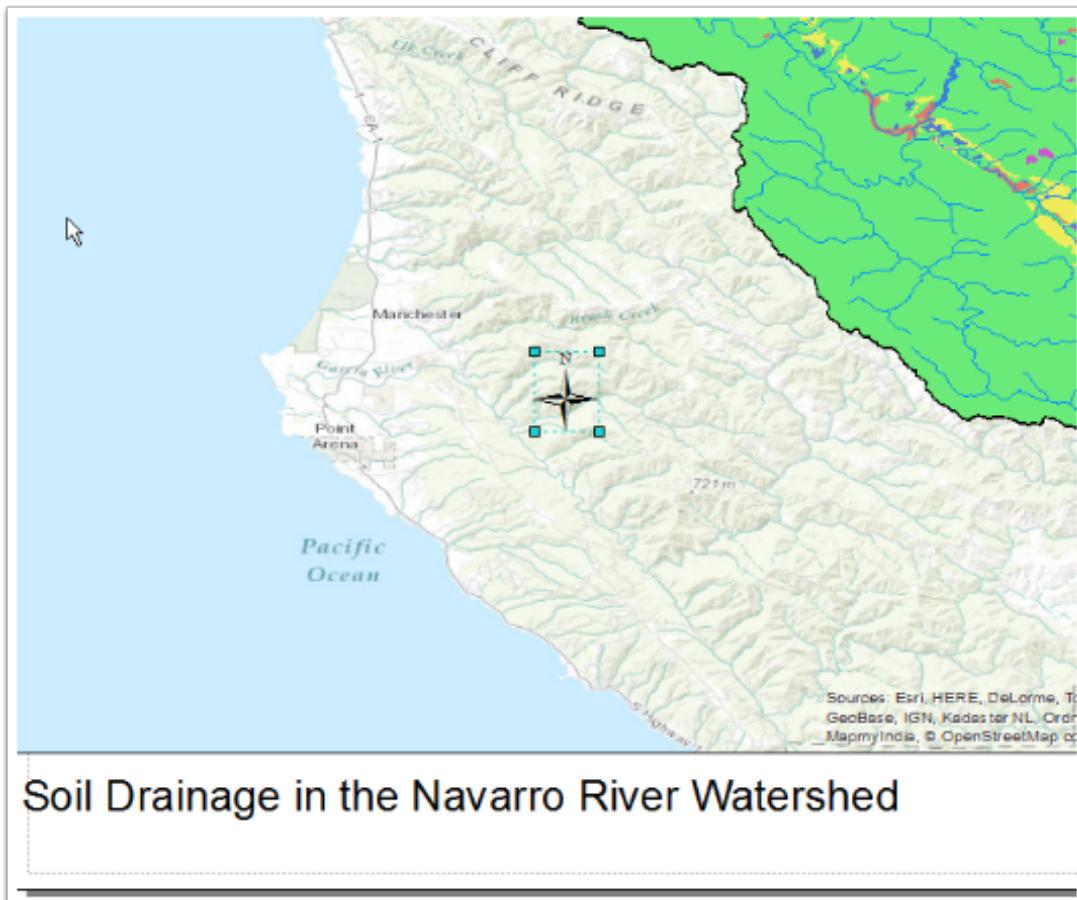
5.1 Choose an arrow

1. Select any arrow you like by clicking on it
2. Click OK to add that north arrow to your map.



5.2 Move it to an appropriate spot

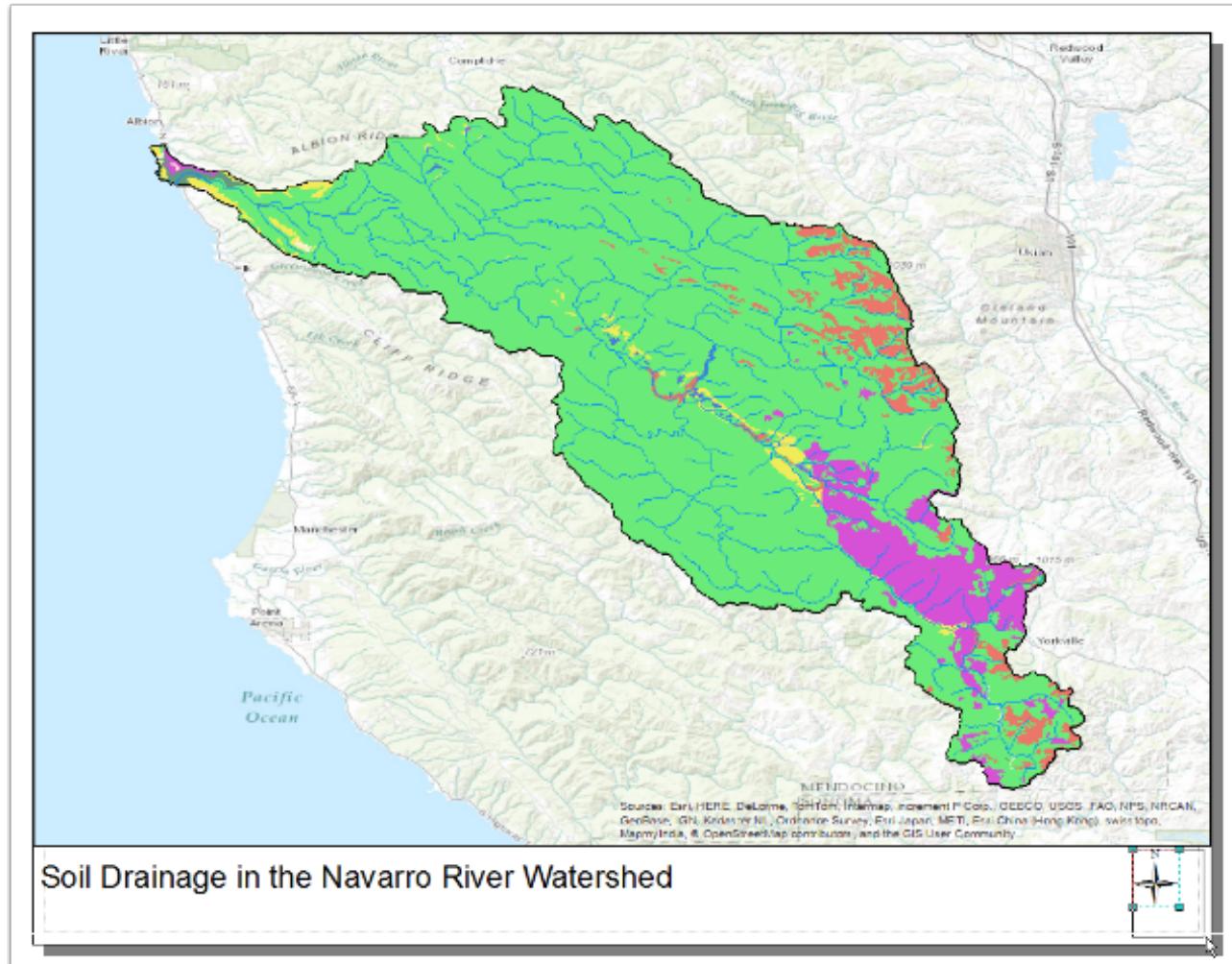
It will be added to a location on your map. You can now use the *Select Elements* tool to move and resize it.



5.3 Move and resize

Using the *Select Elements* tool, move the arrow to the bottom right corner of the map, and resize it to fit.

Optional: North Arrows have properties accessible by double clicking on the arrow. Feel free to open those up and change some settings.

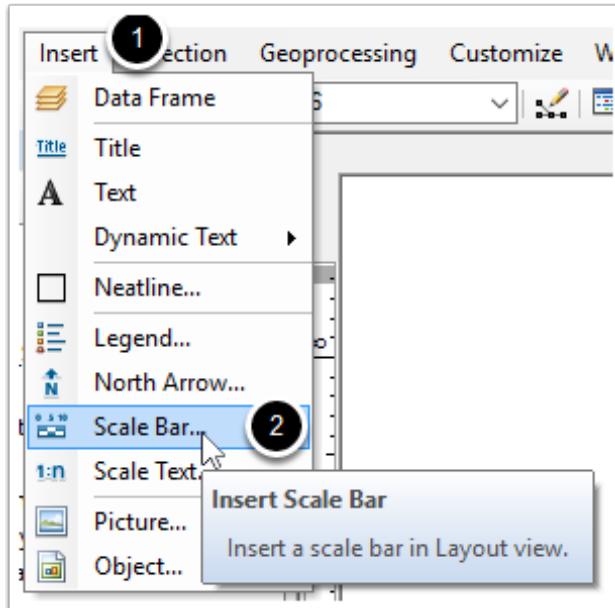


5.4 Add a scale bar

The next element we need is a scale bar. Scale bars help viewers understand the geographic extent they are looking at by showing a distance on the map, and indicating the corresponding on-the-ground distance.

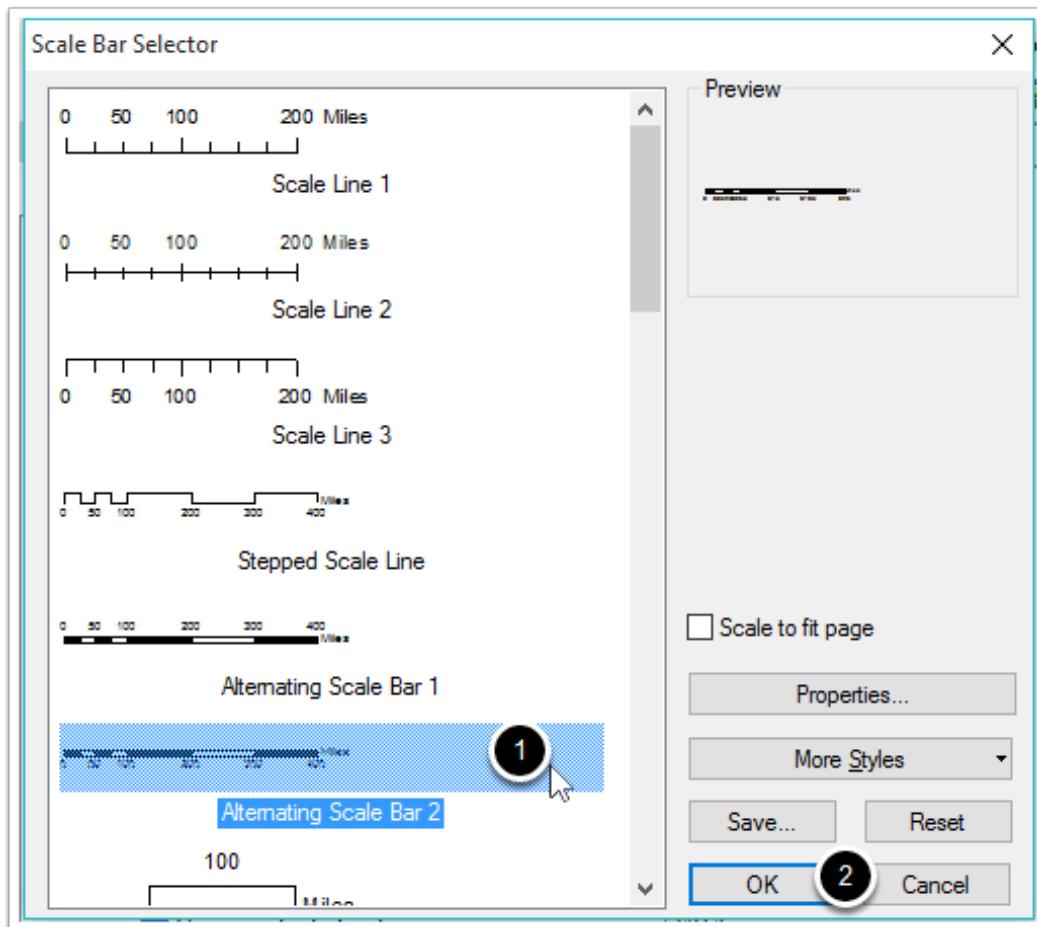
1. Open up the *Insert* menu again

2. Click *Scale Bar* to open the *Scale Bar Selector* dialog.



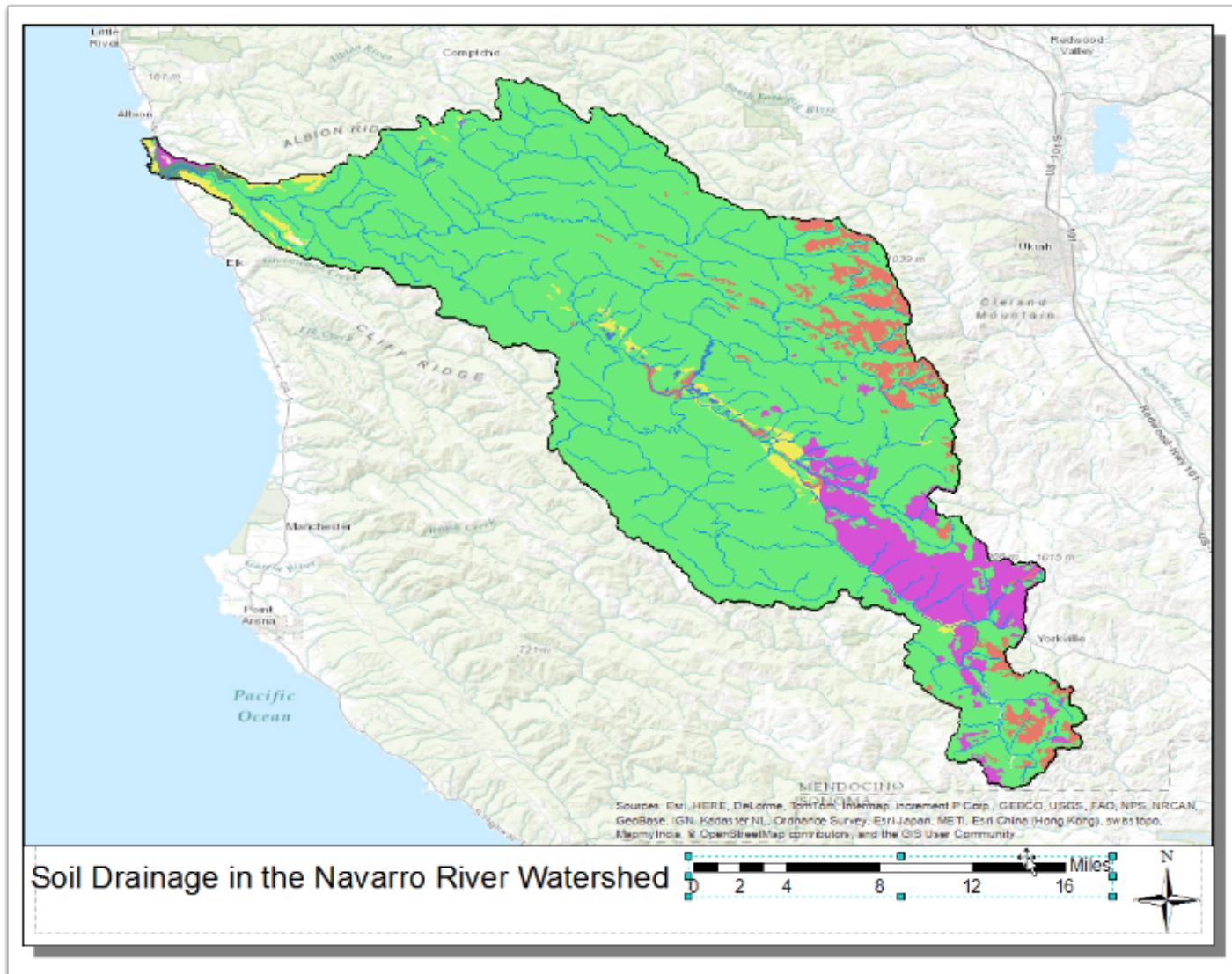
5.5 Select a scale bar to add

1. Now, choose a scale bar that you like for your map. It doesn't have to be the same one I choose, but if you want your map to match the screenshots, then choose *Alternating Scale Bar 2* by clicking on it.
2. Click *OK* to save your choice and close the dialog.



5.6 Move the scale bar into place

Again, move the scale bar to the bottom area of the page, and resize it as you see fit. As you resize it, you will see that the values on the scale bar change to match its new size.



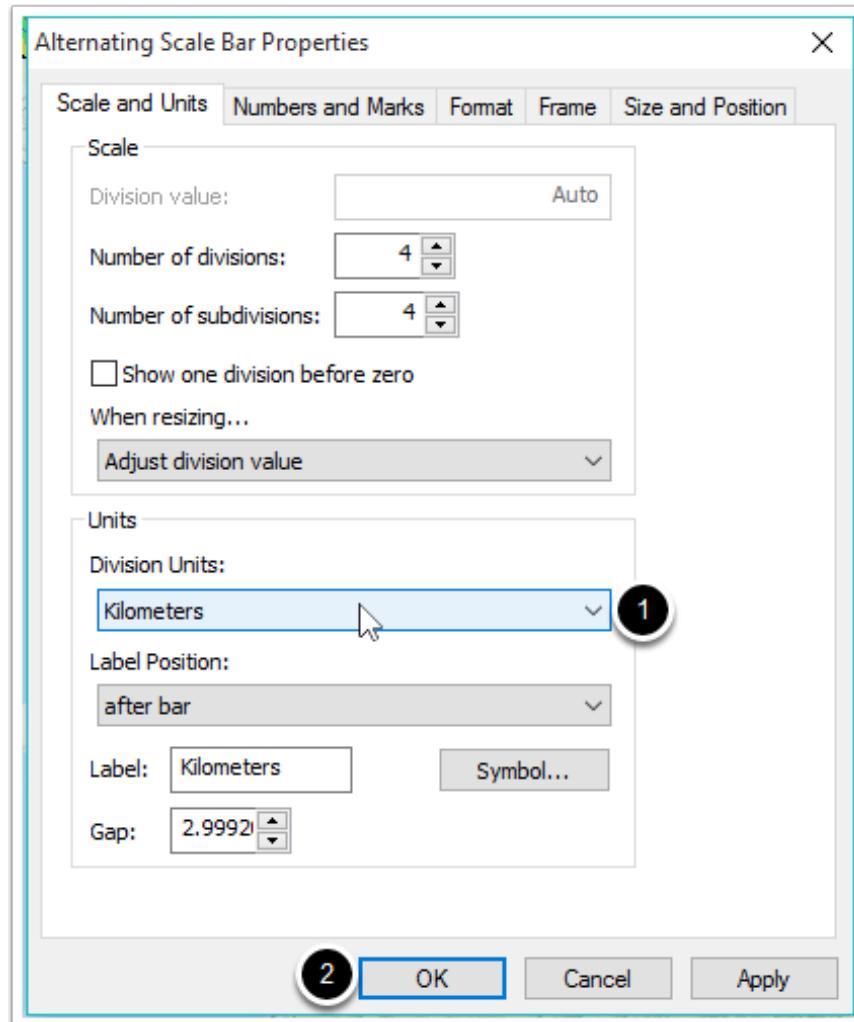
5.7 Change the scale bar units

Since this is a scientific map, I'd like to change the units from Miles to Kilometers. Double click the scale bar to open its properties.

1. In the *Units* section, change the *Division Units* setting to Kilometers

- Click **OK** to save and close the dialog. The scale bar will update to use Kilometers instead of miles, and the units of division will change

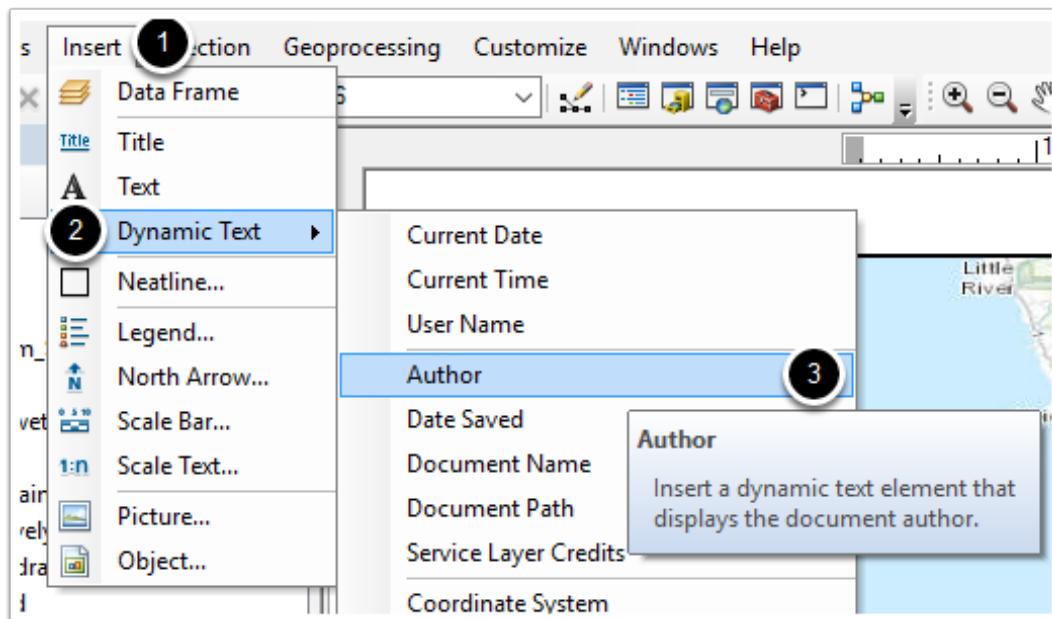
Note: If we wanted to manually change how many different splits of distance the scale bar had, we could do that in the **Scale** box by altering the number of *divisions* and *subdivisions*. Feel free to play with those settings to make a scale bar you think is appropriate for your map.



5.8 Insert your name

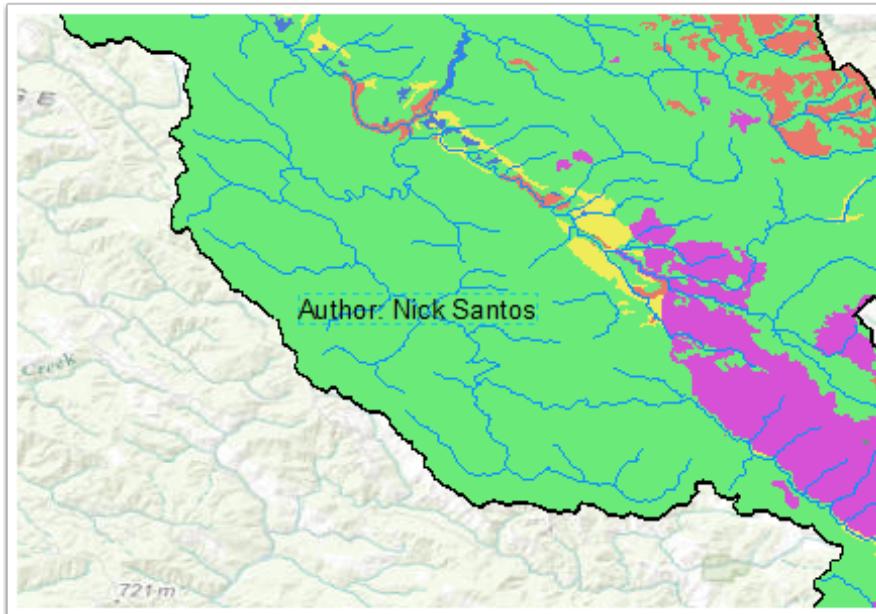
Now, let's add credits to our map. Start by adding your name in. We'll do this with dynamic text again too, and pull the name from the document properties.

1. Open the *Insert* menu again
2. Go down to *Dynamic Text* and hover your mouse until the menu flies out to the right
3. Click on *Author* to insert your name as a text field on the map.



5.9 Find the text!

When you add text, it can sometimes be hard to find it on your map. Typically, it's added near the center of the current view, but if you're zoomed out far enough, have eyesight troubles, or have dark colored data on your map, it can be hard to spot the text. Hunt around and find it, then move it to the bottom left of the map.

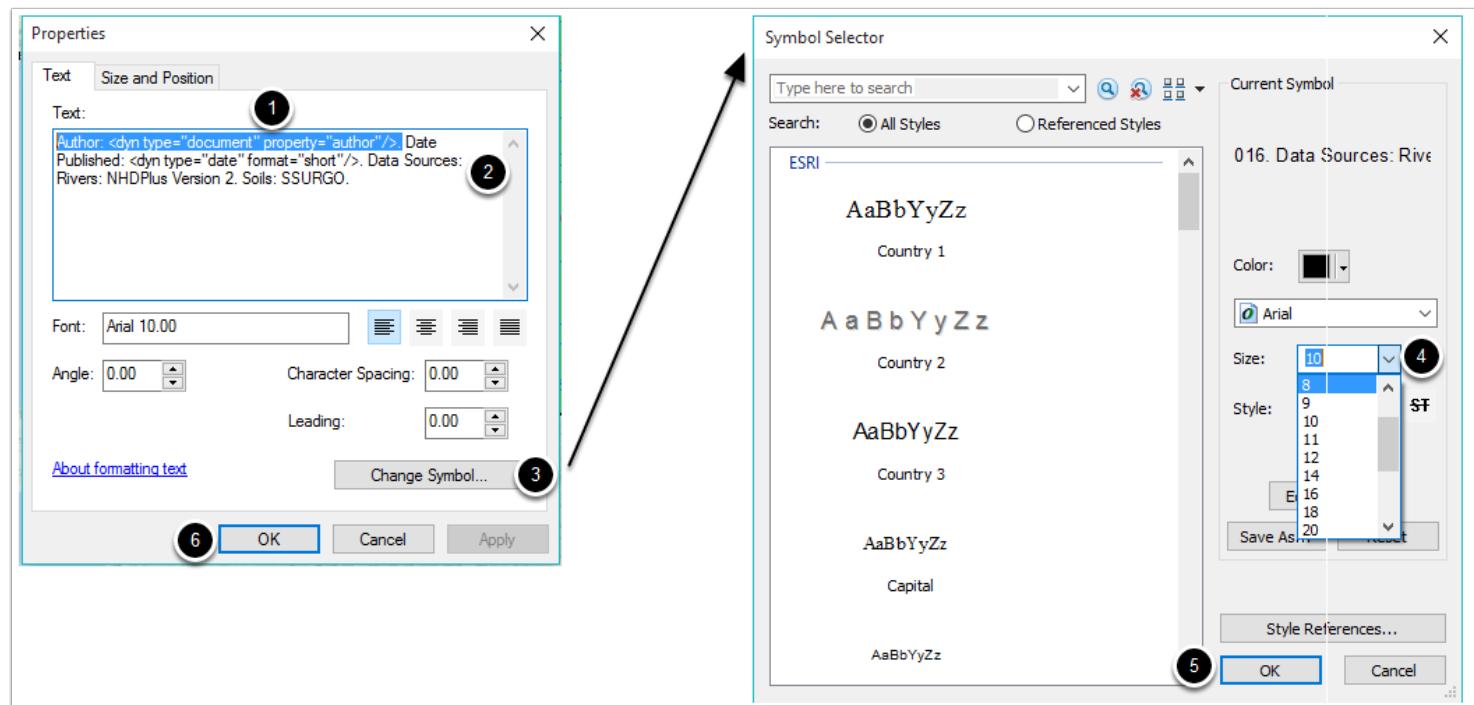


5.10 Modify the text

Now that we have the author text on the map, containing your name, let's add more text to it. Double click on it to open its properties box

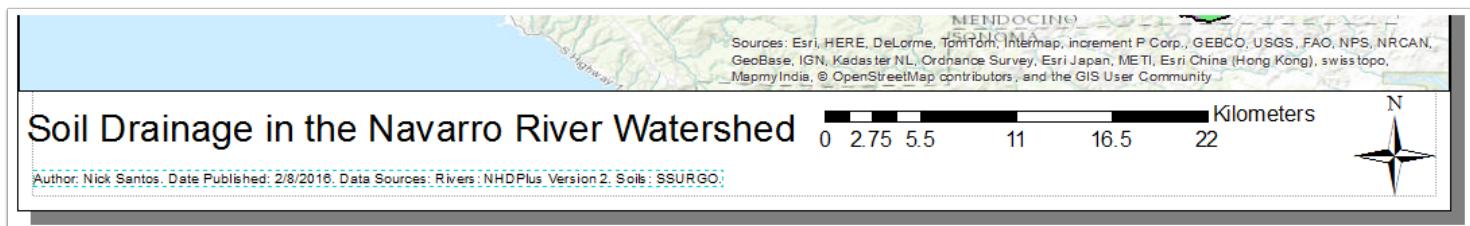
1. Note that what's already populated is *Author*: `<dyn type="document" property="author"/>`. Like the title tag, this code pulls the *Author* property that we set for the map document earlier on, and then displays it for us on the map.
2. Add some addition text to populate the date the map is exported. Since we might be working on it today, but could come back and update it in the future, we'll add the date as dynamic text too. Type in the box *Date Published*: `<dyn type="date" format="short" />`. That dynamic text tag will give us just the date in month/day/year format (this may vary based on your locale). If you didn't remember that tag's code, you could add it via the dynamic text menu too, but it can be handy to type them in as well. The first part of the tag just indicated that it's a dynamic text replacement variable. Then, the `type="date"` part helps ArcMap know where to look for the variable. Finally, the `format="short"` component tells ArcGIS how to format the date. Finally, add information about data sources to the text. Add *Data Sources*: *Rivers: NHDPlus Version 2. Soils: SSURGO*.

3. I personally think that font size 10 (see the *Font* box) is a little big for this information, so let's shrink it. We can't just click on the text in the *Font* box to change it, unfortunately. So, click *Change Symbol* to bring up the *Symbol Selector*.
4. In the right hand side of the box, click the dropdown next to size and select 8 or simply type 8 in the *Size* box.
5. Click *OK* to save and close the *Symbol Selector*.
6. Click *OK* again on the text properties box to save your text and close the dialog.



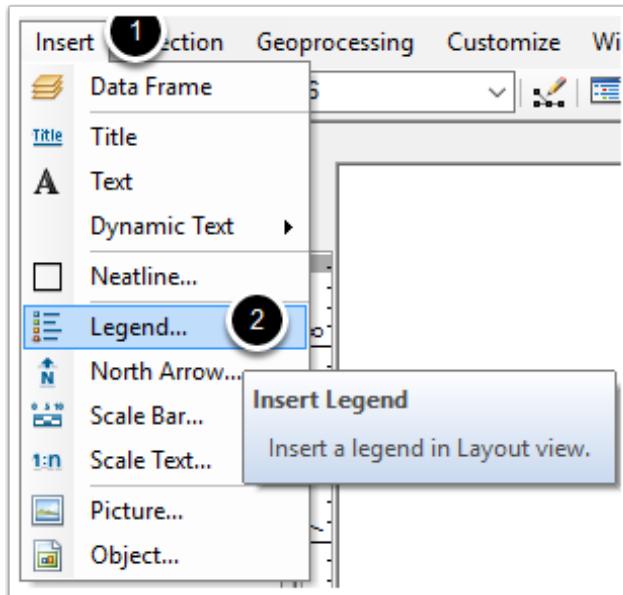
5.11 Your text updates

Now, the bottom of your map will look similar to this screenshot. It's ok if some things are different, just make sure to tinker with each so you understand *why* your map might look different from mine.



6. Add a legend

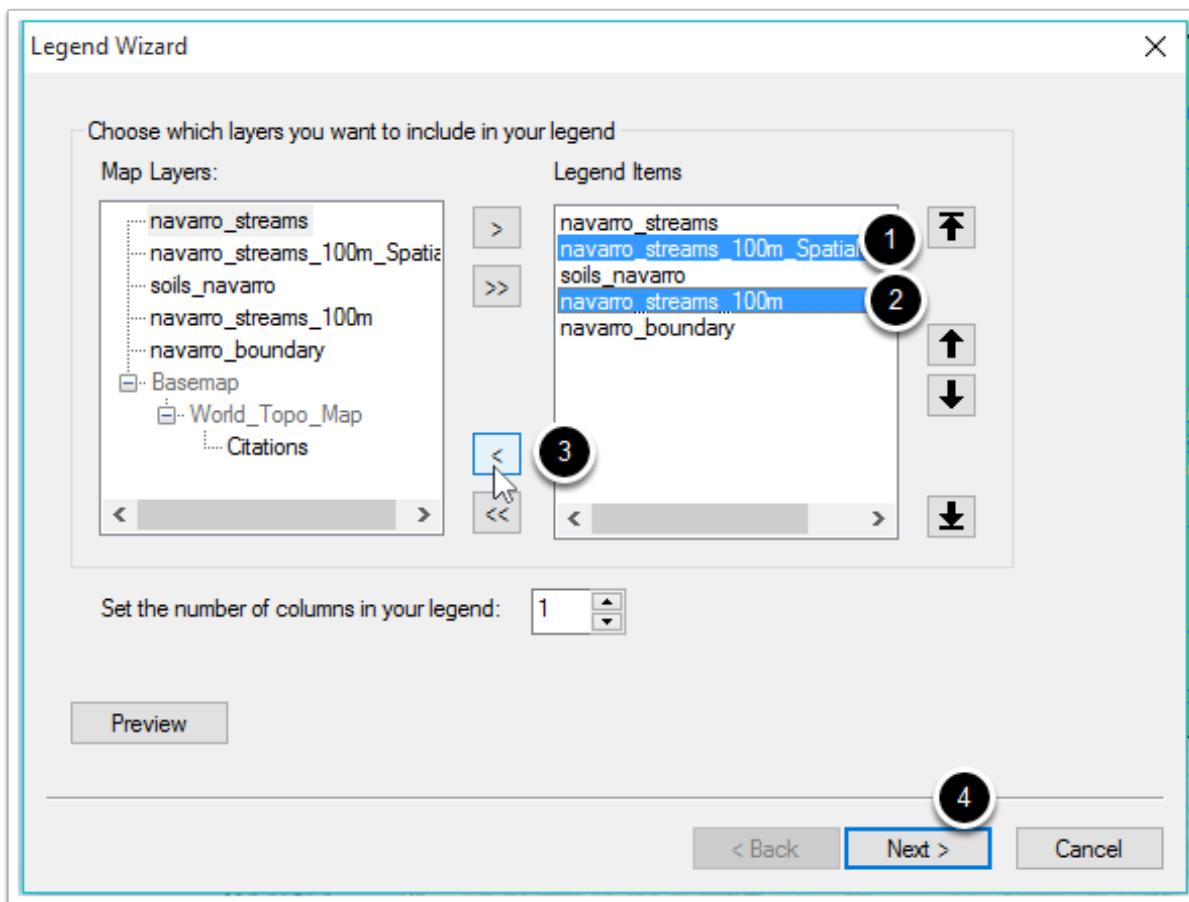
Next, we want to add a legend. A legend helps viewers to understand the information on the map by defining symbols - it will show a symbol on the map and then provide the layer name to indicate to the viewer what they are looking at.



6.1 Select the layers for your legend to display

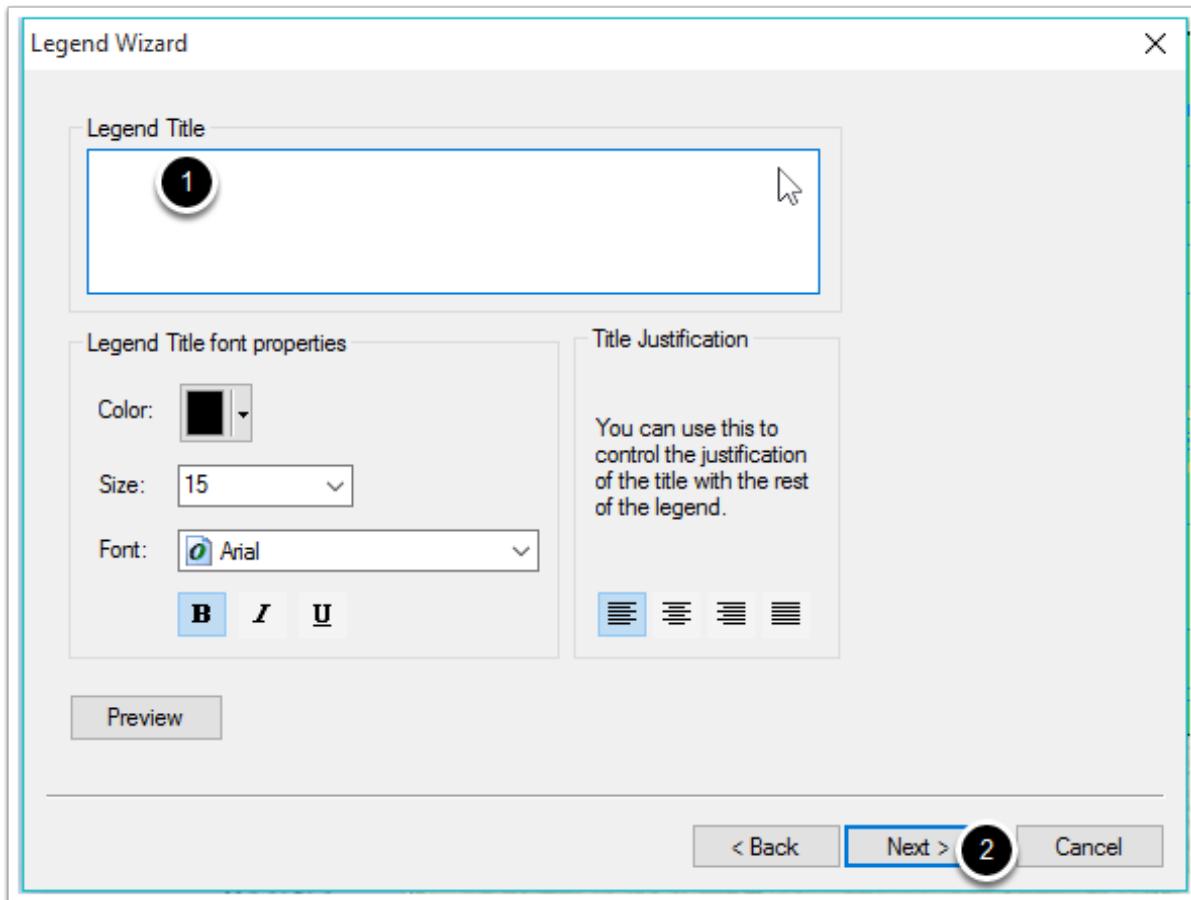
The *Legend Wizard* will appear. A legend can display many layers - by default, ArcMap will include many layers for you. Now we want to remove some that aren't relevant on the map.

1. Click on *navarro_streams_100m_Spatial* in the *Legend Items* pane
2. While holding the *Ctrl* key down to enable selecting multiple items, click on the *navarro_streams_100m* item as well.
3. Click on the left arrow (<) in between *Map Layers* and *Legend Items* to remove those items from the legend. To add items to the map, we'd do the reverse, selecting items on the left, and clicking the right arrow to move them into the *Legend Items* control.
4. Click *Next* to continue building the legend



6.2 Remove the title

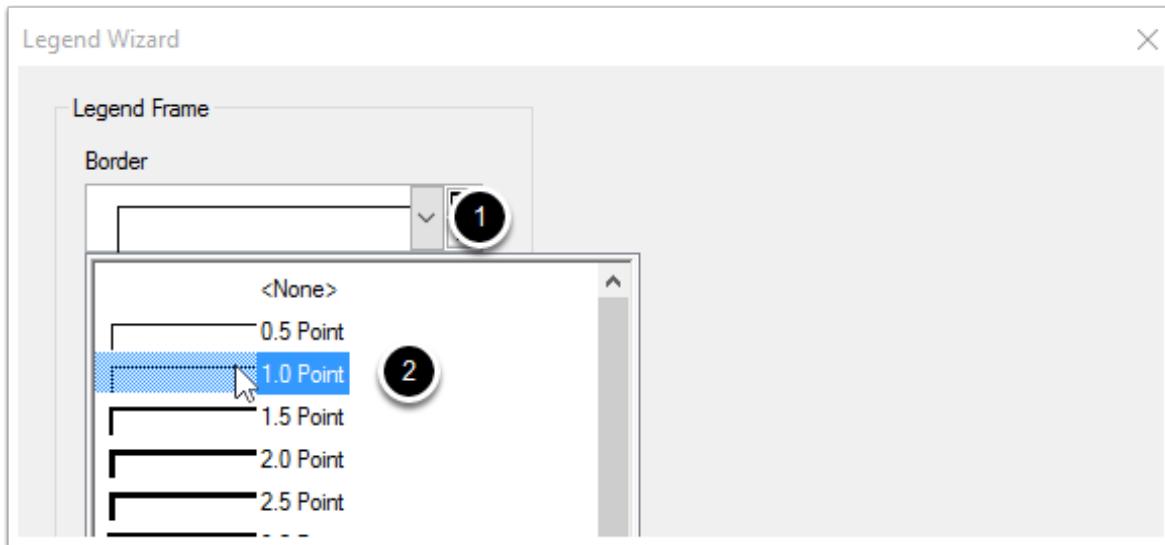
By default, a legend will have a title saying *Legend*. Most people know what a legend is intuitively, and you often don't need a title, so let's remove ours. Click in the *Legend Title* box and remove the text (1). Then click *Next* (2).



6.3 Add a border

Now, we plan to put our legend on top of the basemap in the bottom left corner, so let's give it a border and a background so it's easier to read while it's there.

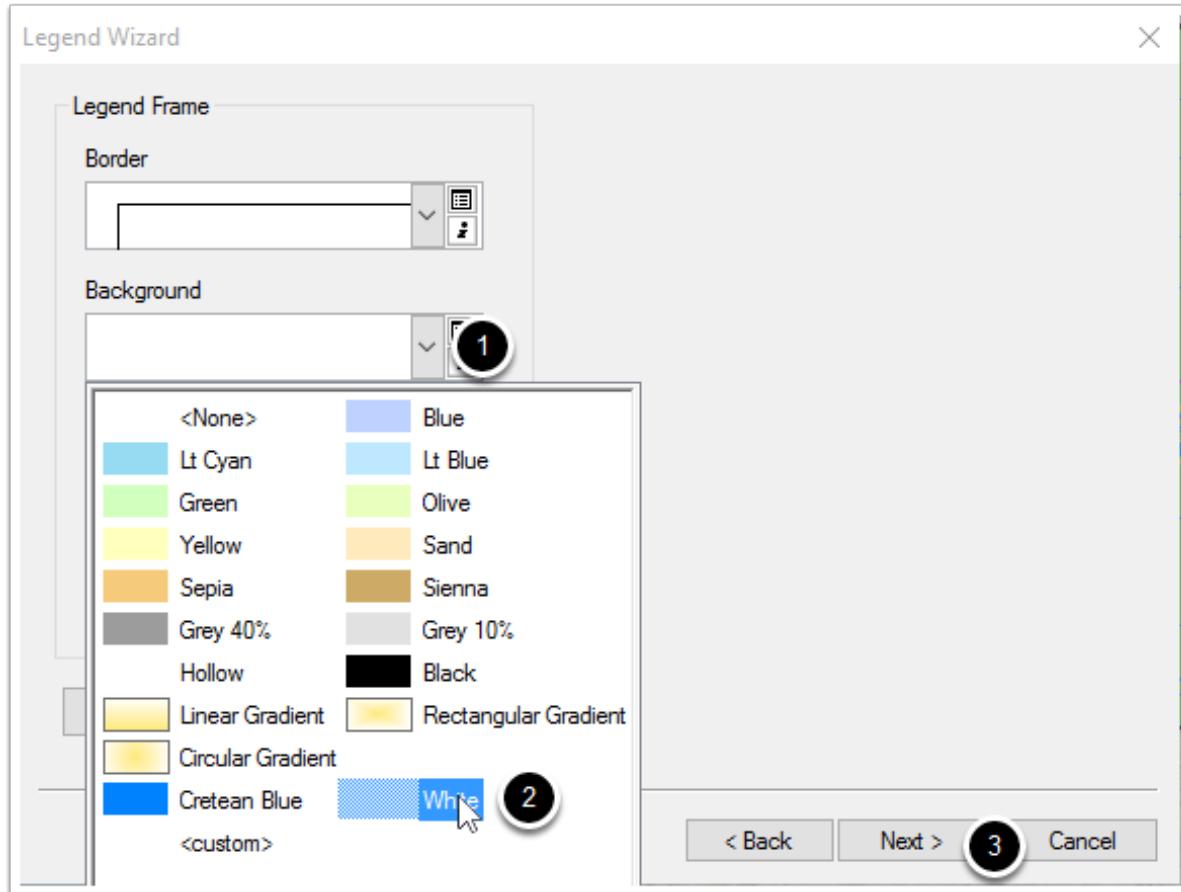
1. Open the dropdown for *Border*.
2. Select a border - I selected *1.0 Point* for this example



6.4 Add a background

Now, let's add a background color so it can be easily seen on top of the map.

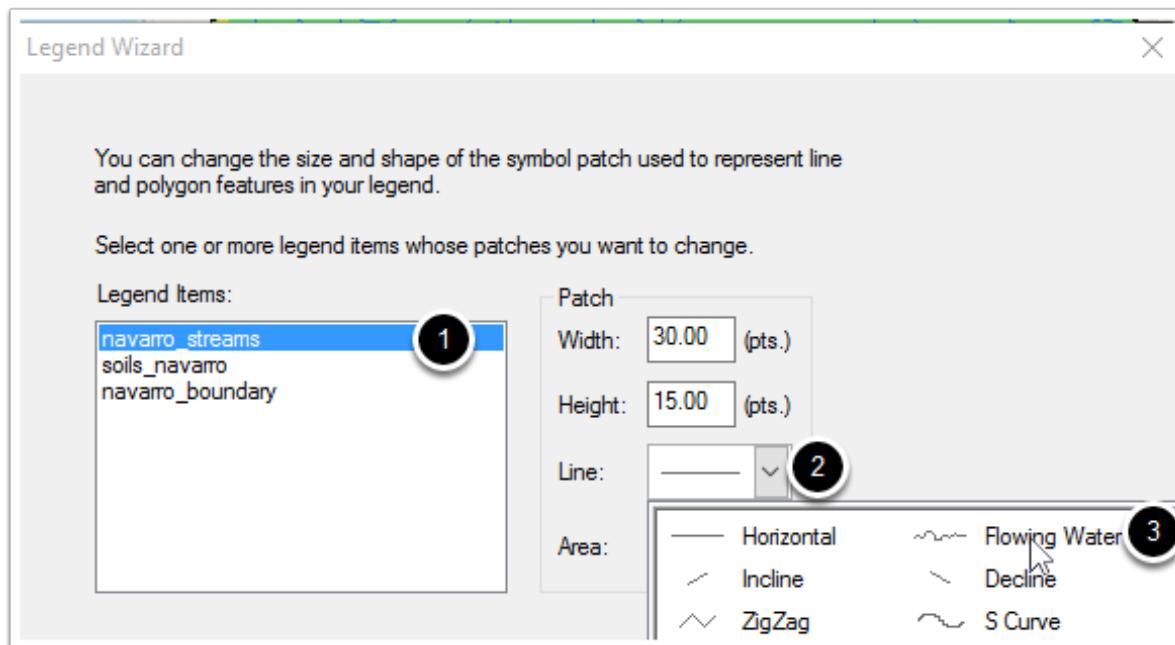
1. Click the dropdown under *Background*
2. Select the *White* background color.
3. Then click *Next* to proceed



6.5 Change the default patch for the rivers

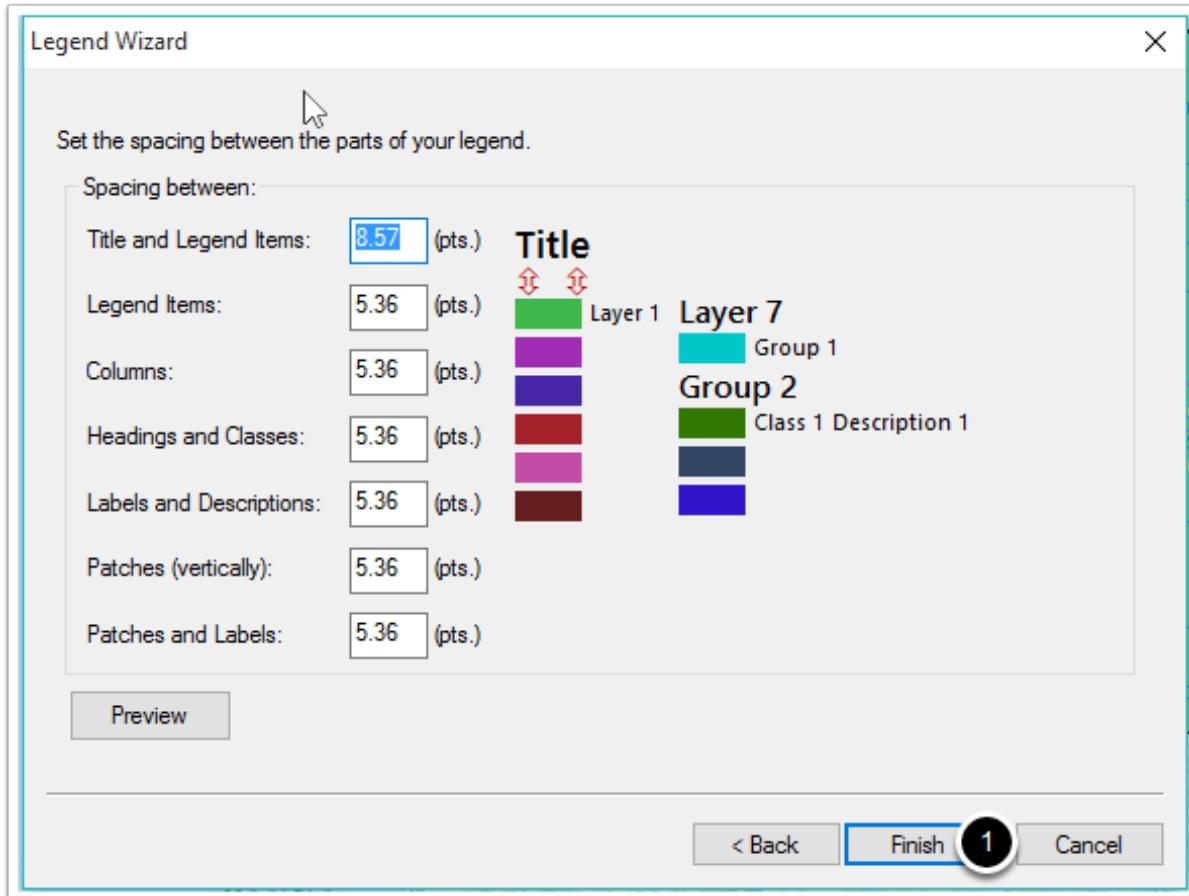
Let's also get a little creative and change it so that in the legend, the rivers aren't displayed as straight lines. Let's make them curve so it's more intuitive in the legend that they are rivers.

1. Select *navarro_streams* on the left
2. Under the *Patch* option, select the *Line* dropdown
3. Choose the *Flowing Water* patch in order to change the symbol in the legend.
4. (not pictured). Click *Next* to proceed.



6.6 Finish the legend

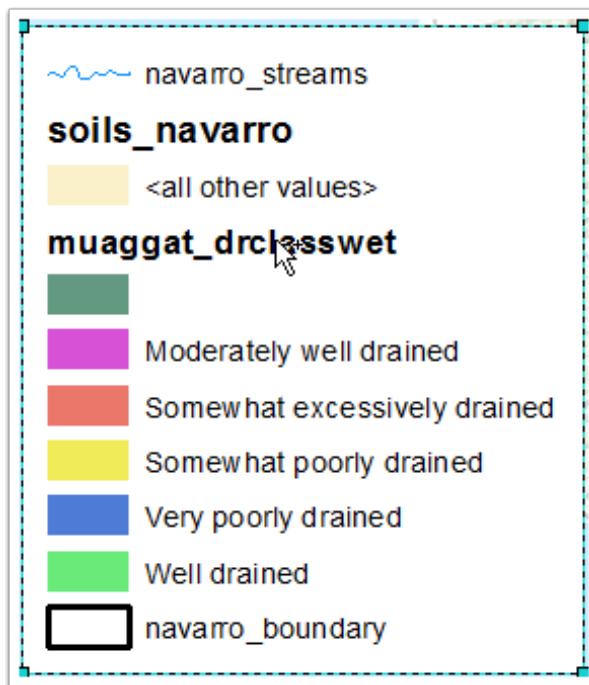
The last panel of the *Legend Wizard* gives you the option to change spacing between items. We won't adjust these for now. Click Finish (1) to add the legend to your map.



6.7 A first legend draft

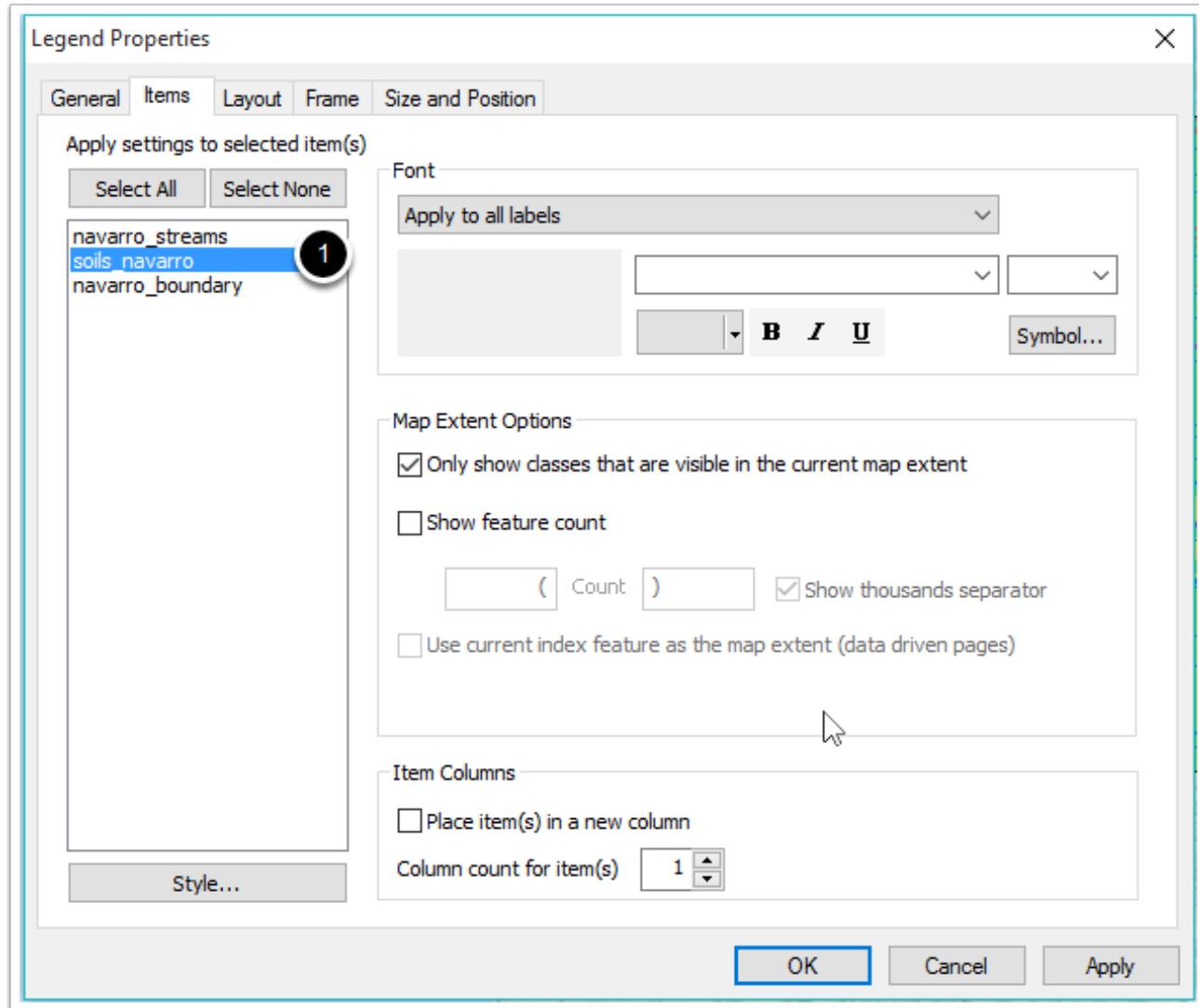
Your legend will look something like this picture. It looks good, but we should change some of the more confusing items here, by changing layer names so it is clear what they are, and removing the confusing *muaggat_drclasswet* heading that indicates the field name being symbolized on.

For now, move your legend to the bottom left corner of the map, covering some of the water and basemap in that corner.



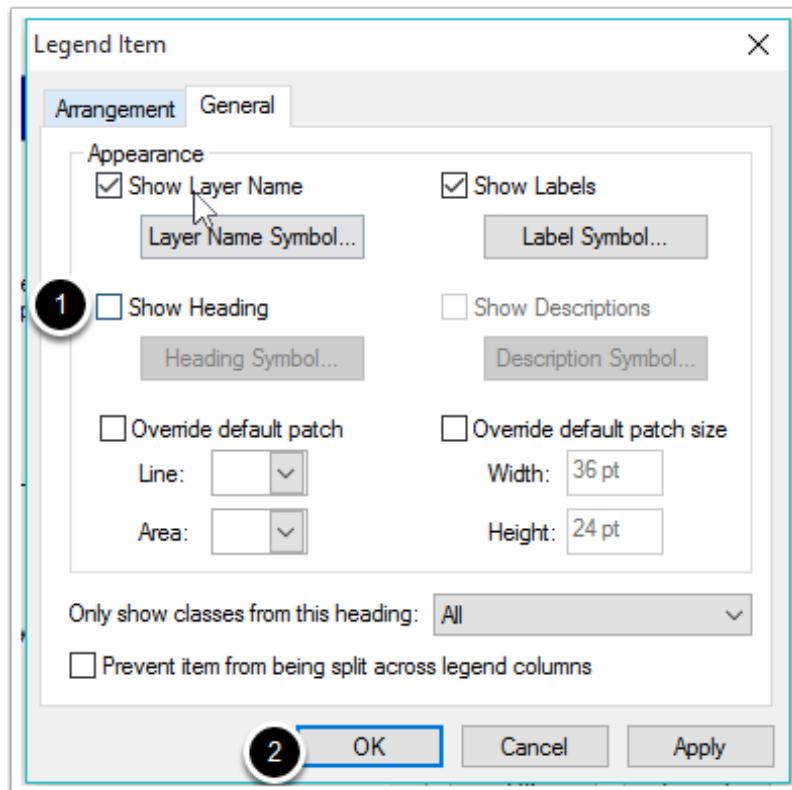
6.8 Removing the field name

Double click on your legend to bring up the legend properties. In the layers list on the left, double click on *soils_navarro* to access additional properties about that layer (1).



6.9 Remove the heading

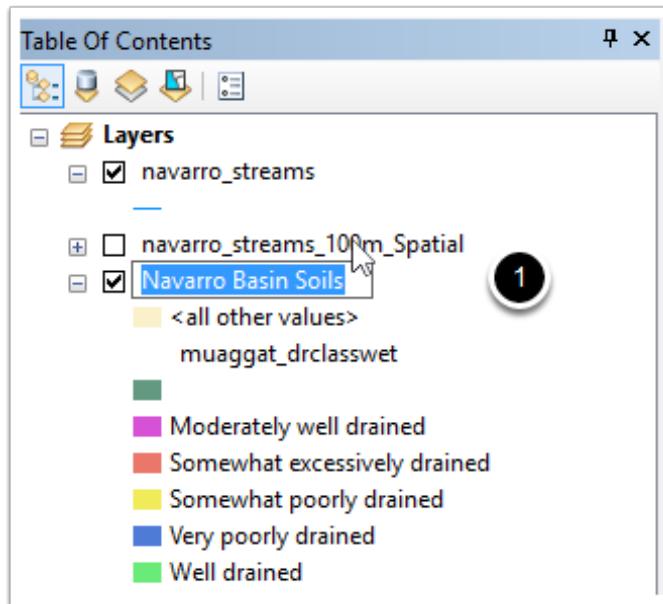
1. Uncheck the *Show Heading* box - this box controls whether or not a specified heading is shown (by default the field that a feature class is using to break out its symbols). We want to remove this.
2. Click *OK* to save and close this dialog.
3. (not pictured). Click *OK* to close out the *Legend Properties* dialog.



6.10 Change the layer name

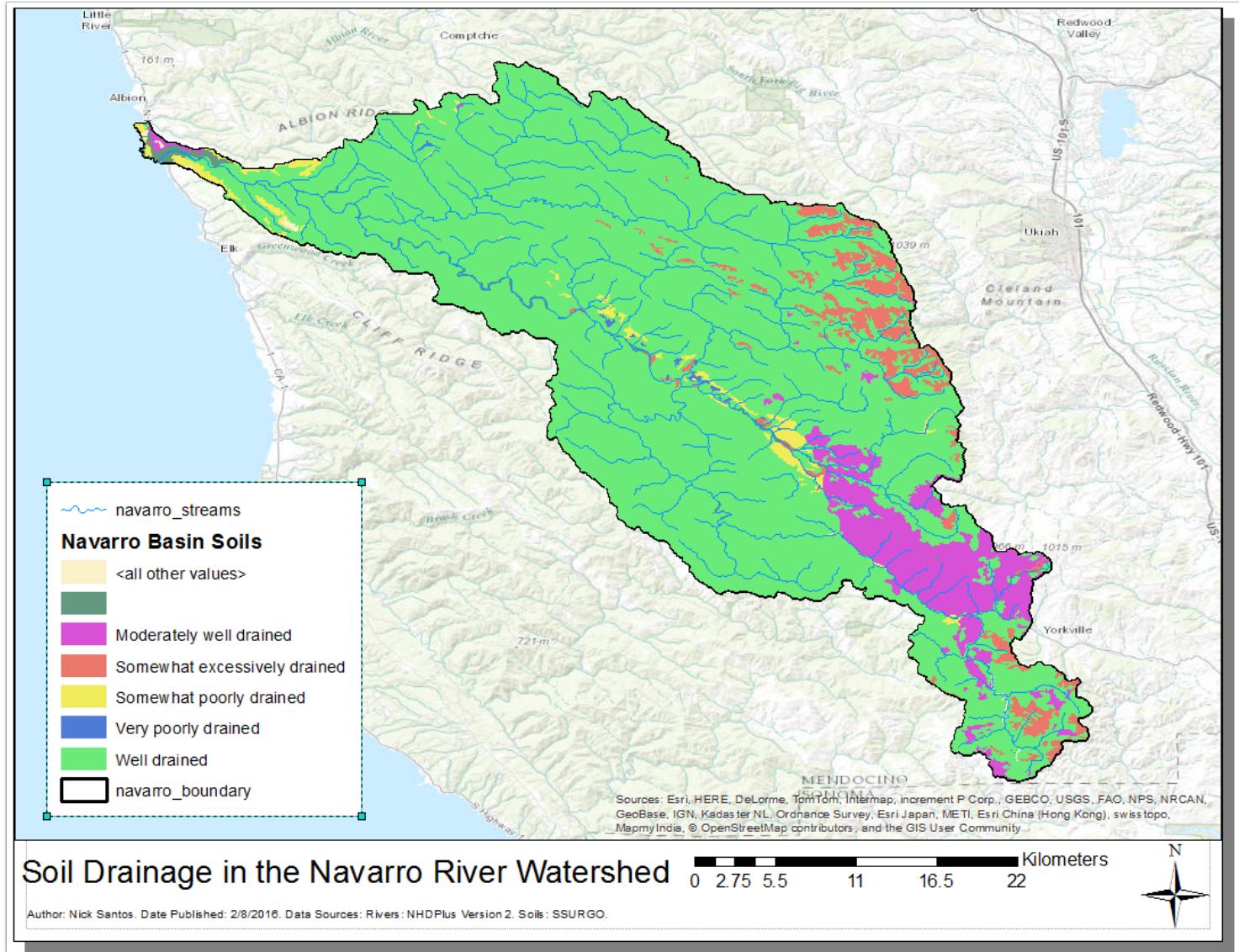
Let's rename the *soils_navarro* layer so it's clearer to viewers of our map what it is. Click on it in the table of contents (1) and hit the F2 key on your keyboard (or right click and select Rename). Then name it *Navarro Basin Soils* and hit *Enter* on your keyboard to finalize it.

Note: Feel free to do the same thing for the *navarro_streams* layer and rename it to something more appropriate.



6.11 Almost there!

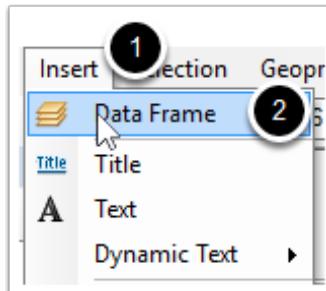
You now have a nearly complete map! It's looking really good!



7. Adding in an inset map for context

Next, we'll add an inset map. An inset helps provide context for the main map by showing where it is in relation to a larger region that you expect the viewer to be familiar with. To do so, we'll need to add another data frame so we can display another map on this same page.

1. Open the *Insert* menu
2. Select (click on) *Data Frame*



7.1 Add an Inset Map

A new data frame will appear, both in the table of contents, and on your page layout. It should already be *Activated*, which means that when you add new layers to your map, it is the data frame they will be added to. If not, click on the new data frame on the layout to activate it, and the data frame will turn bold in the table of contents.

New Data Frame

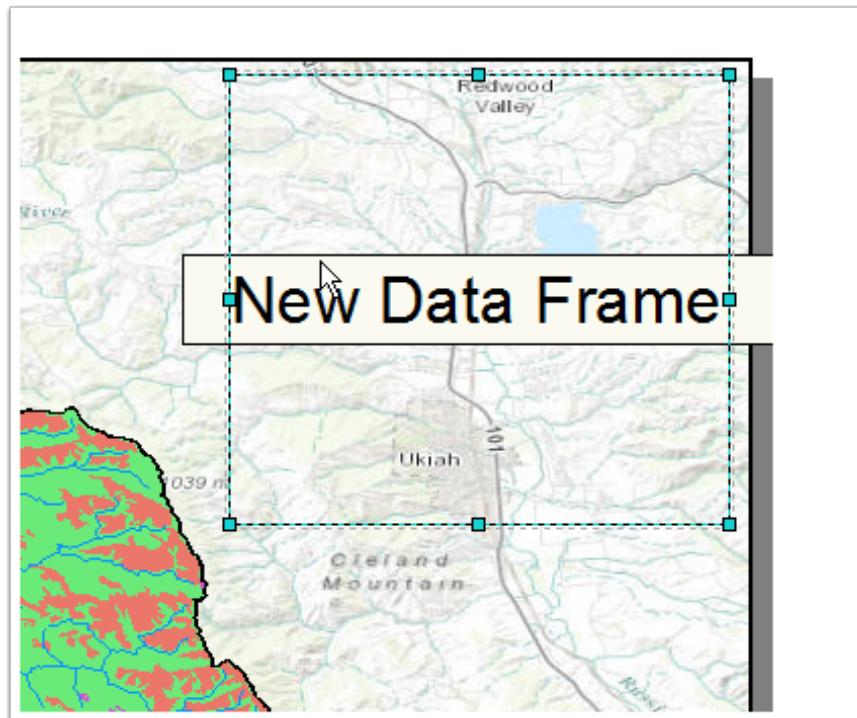
Layers

- navarro_streams
- navarro_streams_100m_Spatial
- soils_navarro
 - <all other values>
 - muaggat_drclasswet
 - Moderately well drained
 - Somewhat excessively drained
 - Somewhat poorly drained
 - Very poorly drained
 - Well drained
- navarro_streams_100m
- navarro_boundary
- Basemap
 - World_Topo_Map

New Data Frame

7.2 Move the data frame to the top right

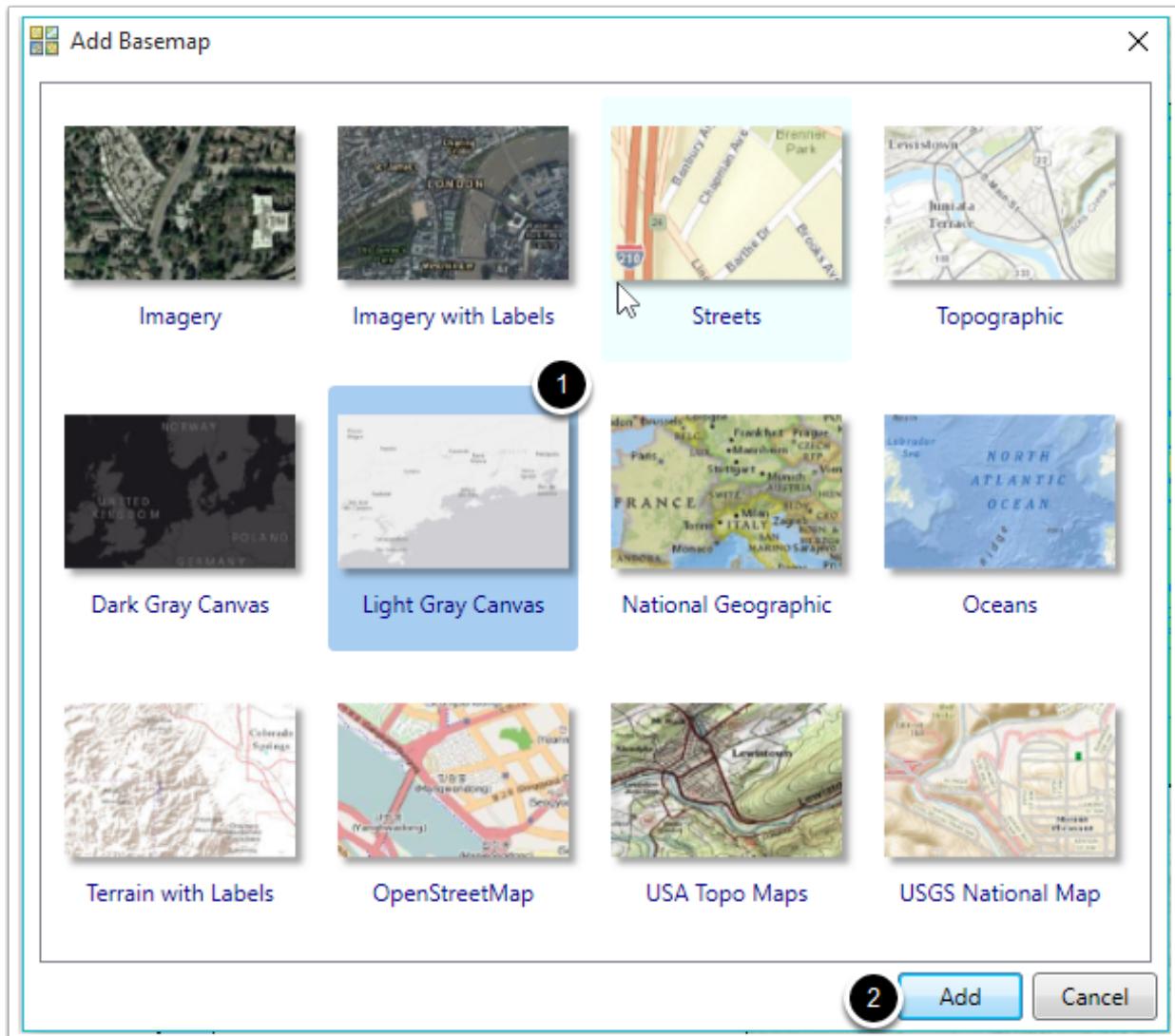
Move the new data frame to the top right corner of the map using the *Select Elements* tool. Resize it so it fits without covering any of the displayed data except the basemap.



7.3 Add a basemap to the inset map

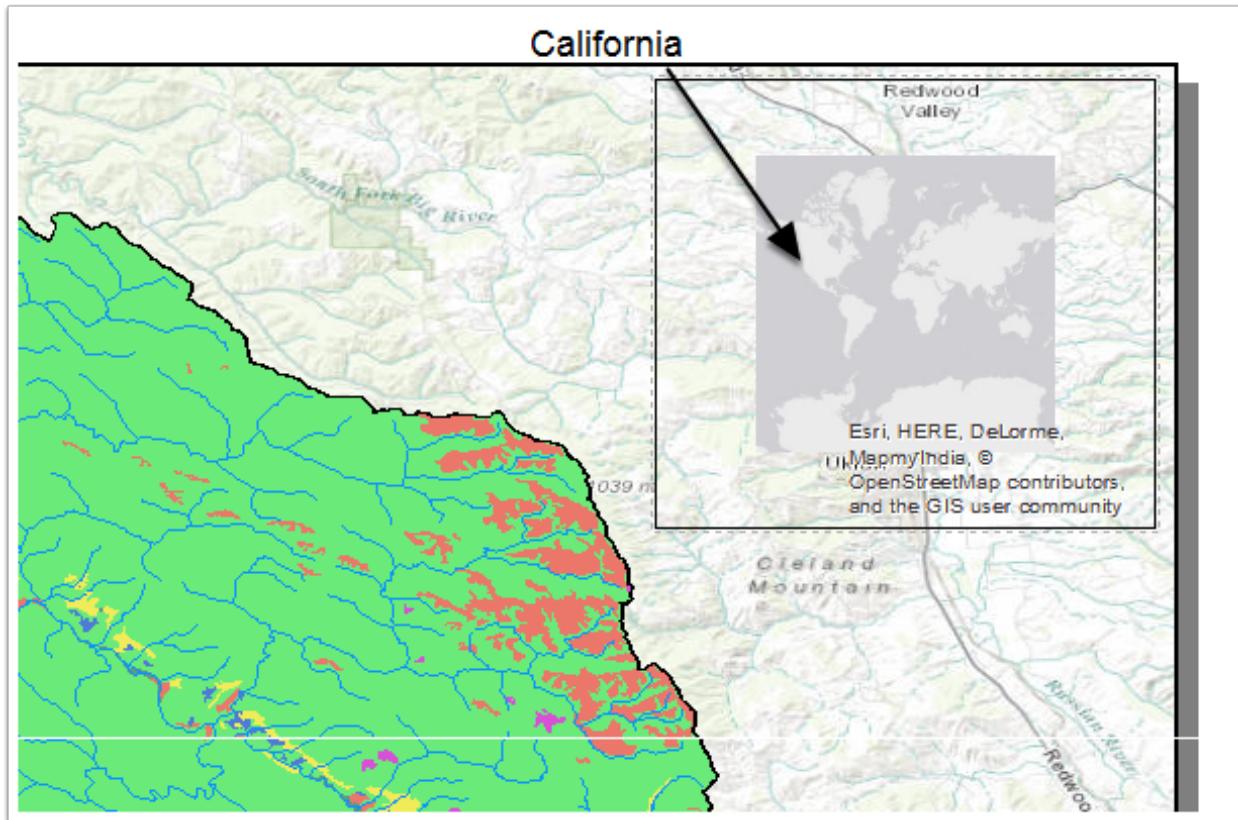
Now, let's add a basemap to provide the context - we could add our own data too, but for now we won't. Remember to use the add data menu dropdown to add a basemap.

1. Select the *Light Gray Canvas* basemap.
2. Click *Add* to add it to your map.



7.4 Zoom in

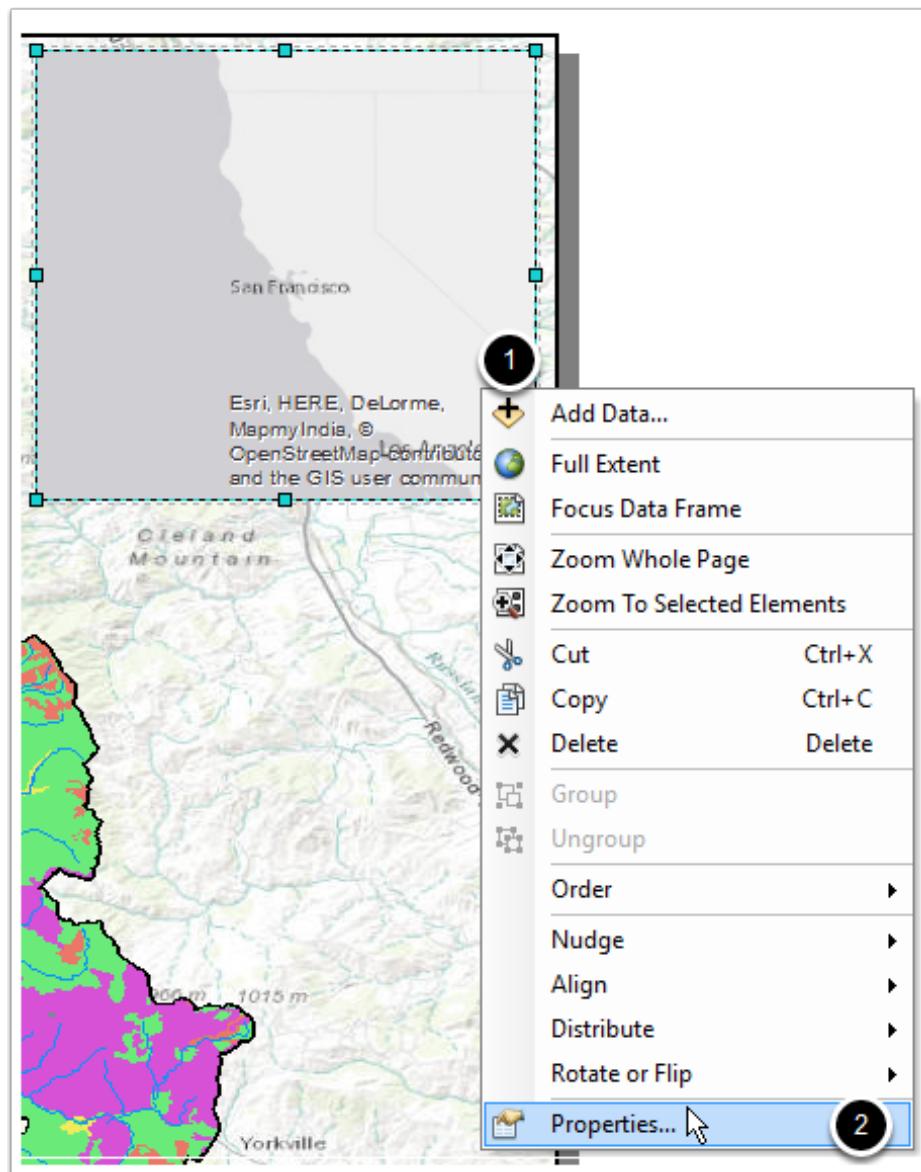
By default, the basemap will be zoomed out to display the whole world, because it has no features in the data frame already to tell it our area of interest. Use the zoom tools to zoom in on California.



7.5 Open properties

Now, we need to link our new data frame to our original data frame that contains our main map so that the new data frame can show an *Extent Indicator* that outlines the viewing window for the main map on this smaller scale overview map.

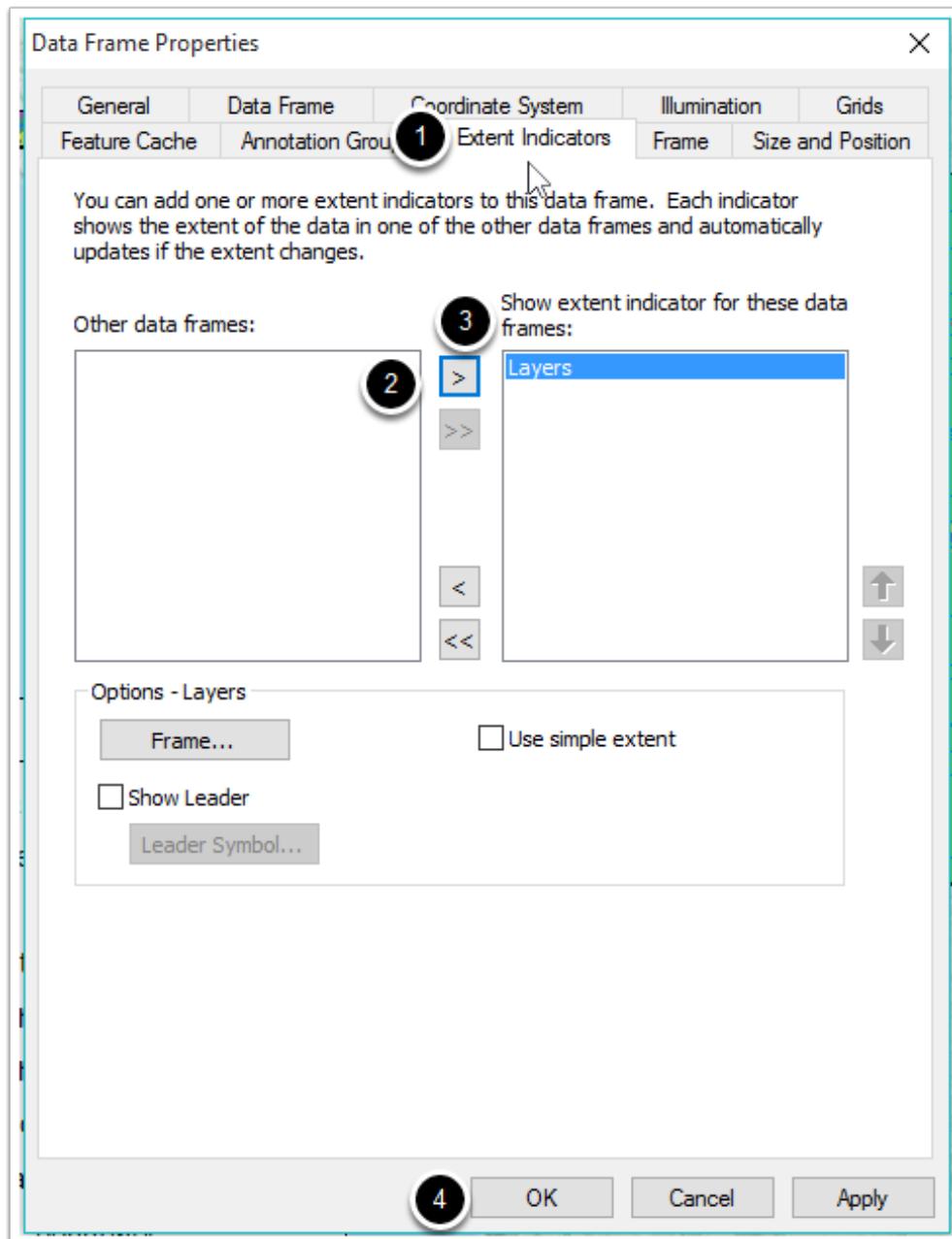
1. Right click on the data frame, either on the map, or in the table of contents.
2. Go to Properties



7.6 Add the extent indicator

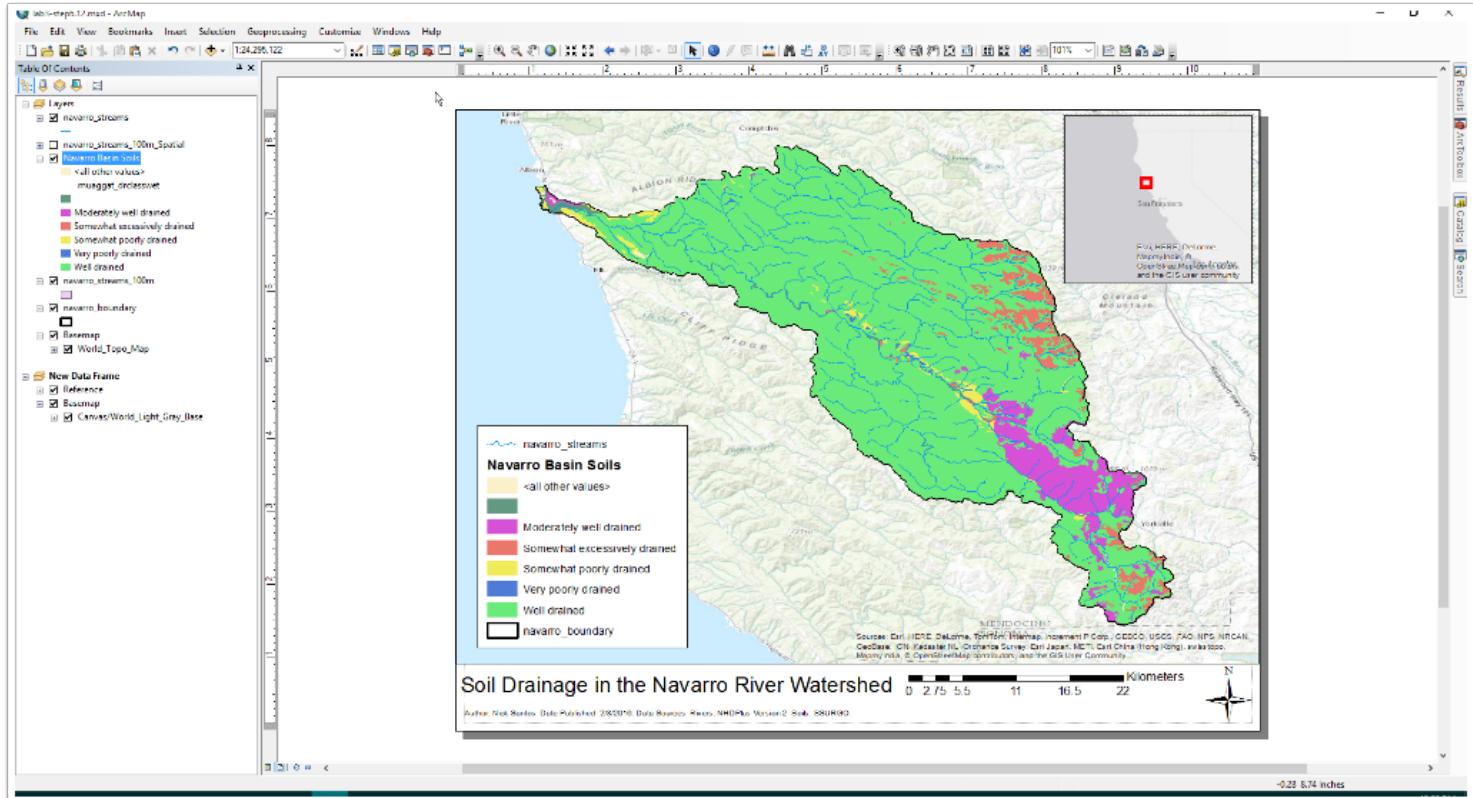
To add our extent indicator,

1. Switch to the *Extent Indicators* tab.
2. Select the *Layers* data frame in the lefthand box titled *Other data frames*
3. Click the right arrow (>) to move it to the *Show extent indicator for these data frames* box and enable the extent indicator.
4. Click *OK* to save your changes and close the dialog box.



7.7 A complete map!

We now have a complete map with data of interest, a title, legend, data sources, scale bar, north arrow, and inset map! Notice the red box on the inset map. If we changed our extent on our main map, that box would update to reflect the area we are currently viewing on our main map.

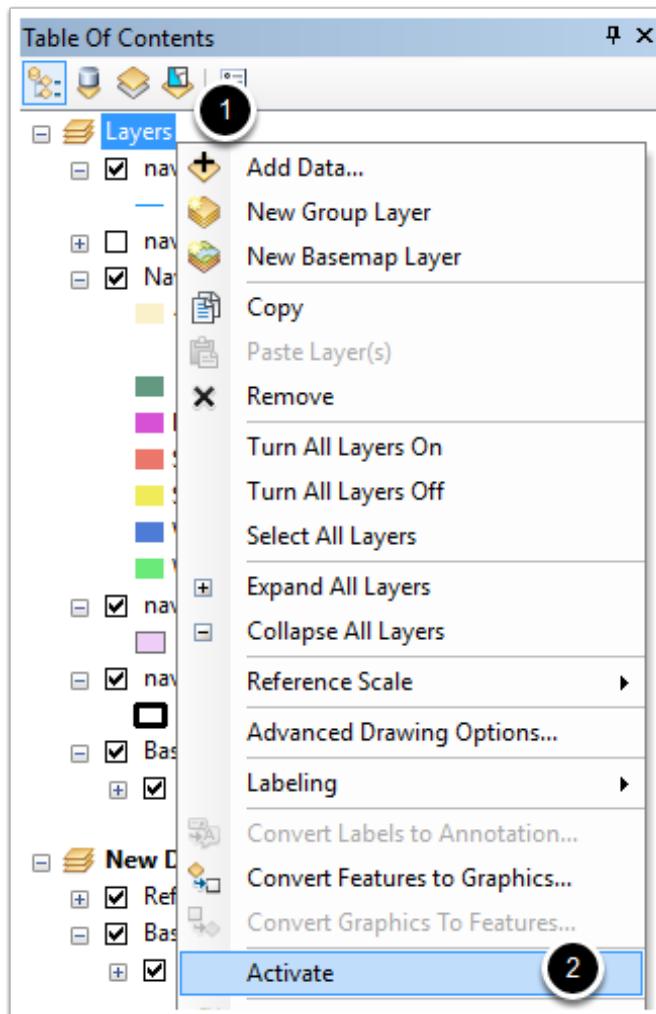


7.8 Reactivating our other data frame

As one last piece about working with multiple data frames, let's switch back to working in our other data frame. It's not necessary at this moment, but worth getting used to.

1. Right click on the *Layers* data frame in the table of contents
2. Click *Activate*

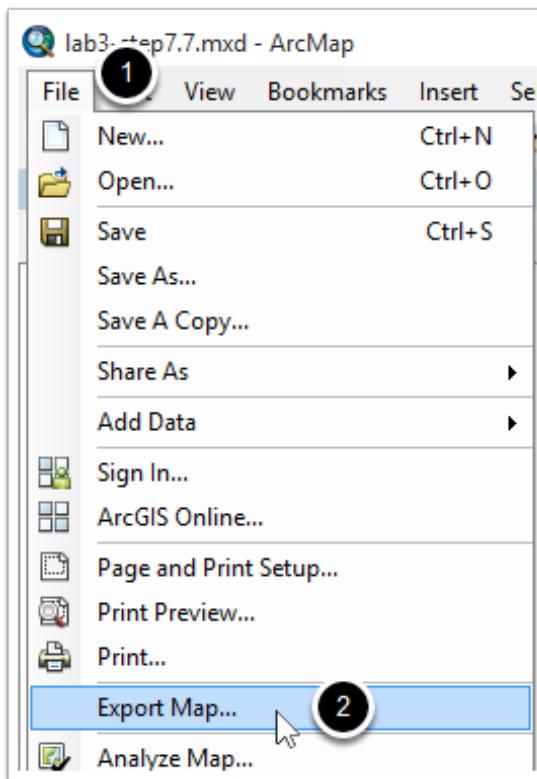
Note: Clicking on the data frame on the page layout will also activate a data frame.



8. Export your map to share!

The last phase of making a print layout map is to export it to a PDF or image file to share. We'll still maintain our editability in our MXD file (map document), but we'll export out a copy that people without ArcMap can view or print.

1. Open the *File* menu
2. Click *Export Map*

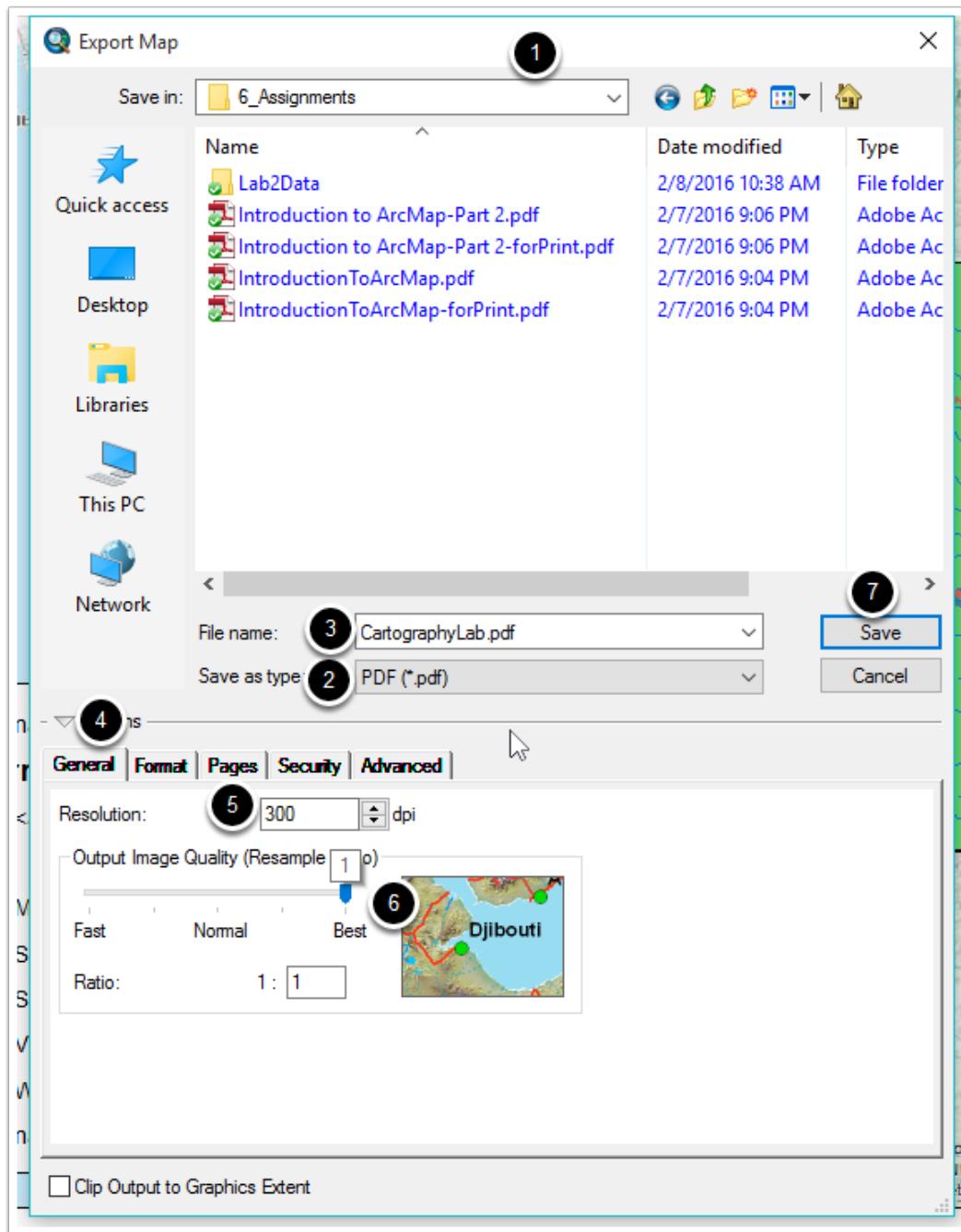


8.1 The export dialog

The *Export Map* dialog box will come up. There are lots of options, so it's important to look around, but also to do things in order.

1. Navigate to the folder you want to save your map export in
2. Select the file type to export under the *Save as type* options. Use PDF for this exercise since exporting a PDF file allows us to share with a broad audience. We choose this first because our choice of file type determines what options are available in the box below.
3. Give your exported PDF a name in the *File name* box.

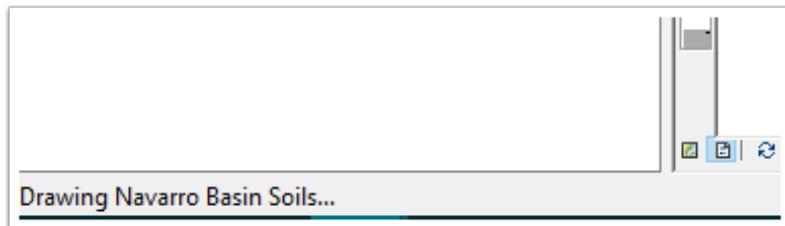
4. Switch to the *General* tab in the export options - you will likely be there by default.
5. We want the output map to be high quality and ready to print. While the default resolution of 96 dpi (dots per inch) is fine for displaying on a screen, printers need higher resolution files. Change the *Resolution* setting to 300 dpi by typing 300 in the box.
6. Make sure that *Output Image Quality* is set to *Best* to make sure that images aren't compressed to heavily.
7. Click the *Save* button to initiate the export of your map.



8.2 Drawing...

ArcMap will render your map document, and give you status updates in the bottom left corner. Depending on your map and settings, this can take anywhere from a few seconds to many hours.

Note: If you have put in some settings that take too long to export and you want to cancel it while it's exporting, just hold down the escape key on your keyboard.



8.3 View your new PDF Map

Navigate to your map on your computer, and open it up. You'll see your complete map, as laid out in ArcMap here. Nice work!

You've completed this exercise on map layouts now. In this lesson, you learned how to work in Layout View, add core map elements to your map, and change preferences and settings of those elements to design and lay out your map. If you have more time, play around with more settings and try new layouts - these tools are very flexible and there is so much you can do to make a map fit your style or a specific audience or publishing location. Have fun!

