Kriging Great Lakes Sediment Contamination Values "Cookbook" for ArcGIS 10.x

By

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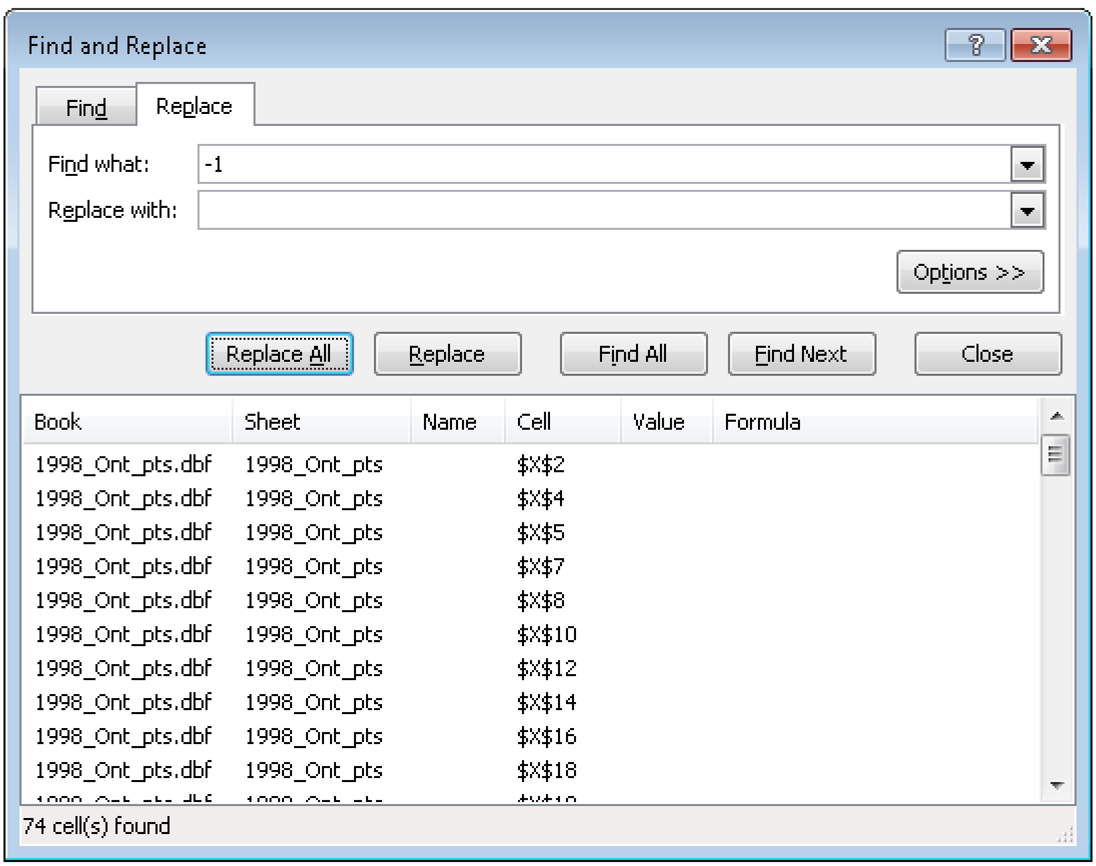
Preparing the Data

In previous versions of ArcMap, there existed an option to specify a "no data" value. Since all of the missing values found in the point data (ie. 1998_Ont_pts.shp) are labeled as -1, this option allowed for the exclusion of such points from the interpolation. However, in ArcMap 10, this option no longer exists. If a kriging model is run, it will include all the values of a variable, counting the missing data as -1, and will produce skewed results. Therefore, this data needs to be modified, and the missing values must be removed from the dataset prior to being imported into ArcMap.

Open Microsoft Excel, and click File → Open. Find the source file where the point data is located. At the bottom right of the "Open" window, ensure that "dBase Files (*.dbf)" is selected. Double click the .dbf file of the point data to open it.

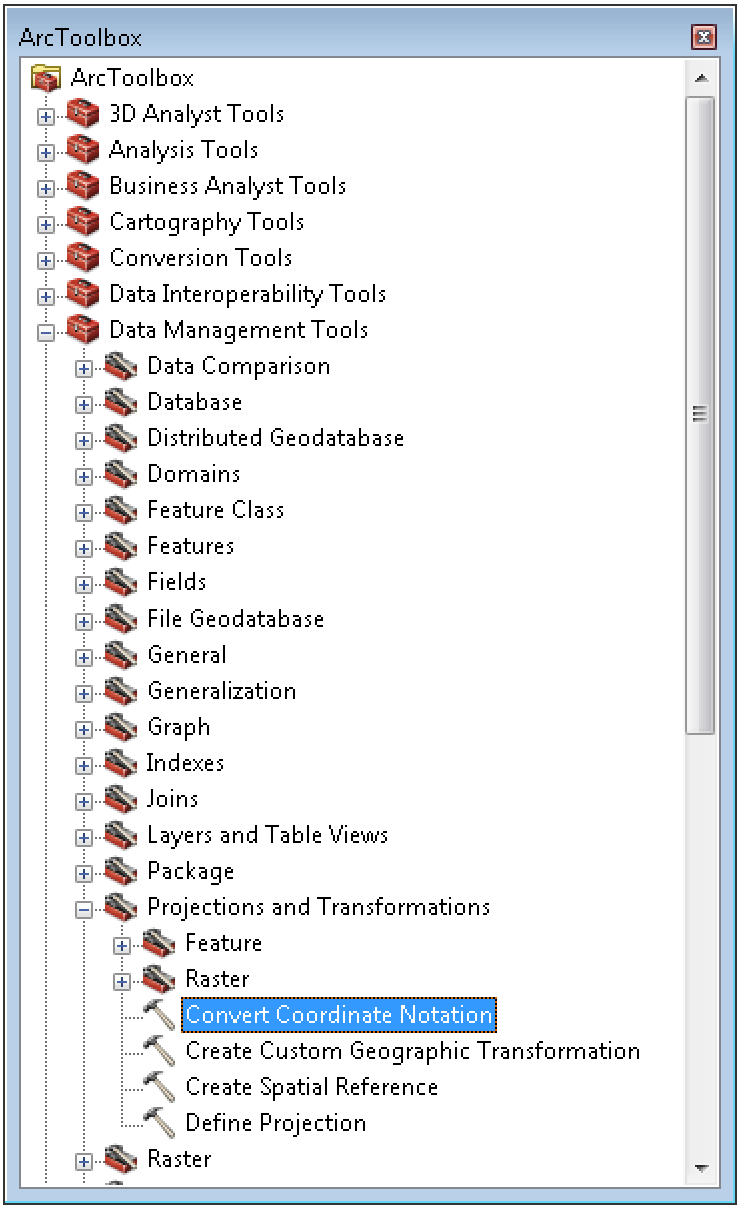
To identify all of the cells that have missing values of -1, hit Ctrl+F on the keyboard. This will open the "Find and Replace" window. Click the Replace tab at the top. Type "-1" into the "Find what:" box. Leave the "Replace with:" box empty so that the cells that have a value of -1 will become blank. Click Find All, and this will show all of the cells that have been identified. Click Replace All, and all of the cells that previously had a value of -1 will now be blank. Click "Close".



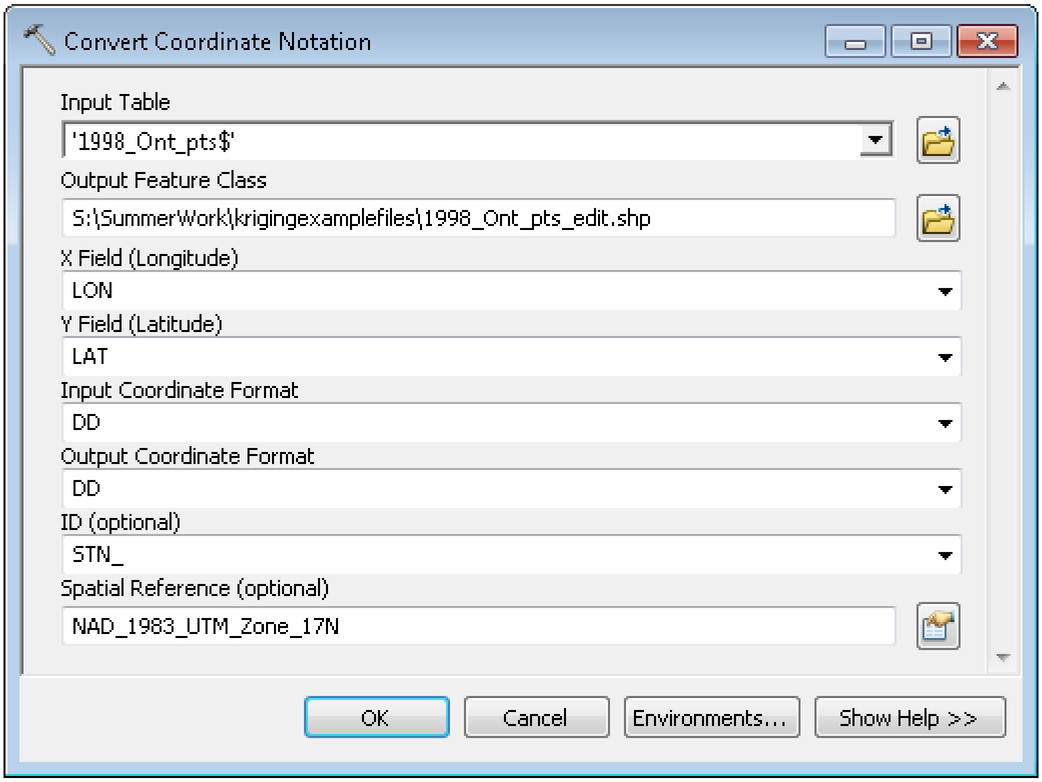
Click File → Save As, and save the file as a .xlsx to the desired destination with a suitable name (such as 1998_Ont_pts_edit). Close Excel.

Open ArcMap. Click the Add Data button and double click the recently altered .xlsx file, and double click again on the worksheet in which the data is stored (usually the file on top).

Since this is a spreadsheet file with no spatial dimension, it is necessary to create a new shapefile based on the data within. To do this, click on the ArcToolbox icon, then expand Data Management Tools → Projections and Transformations, and double click Convert Coordinate Notation.

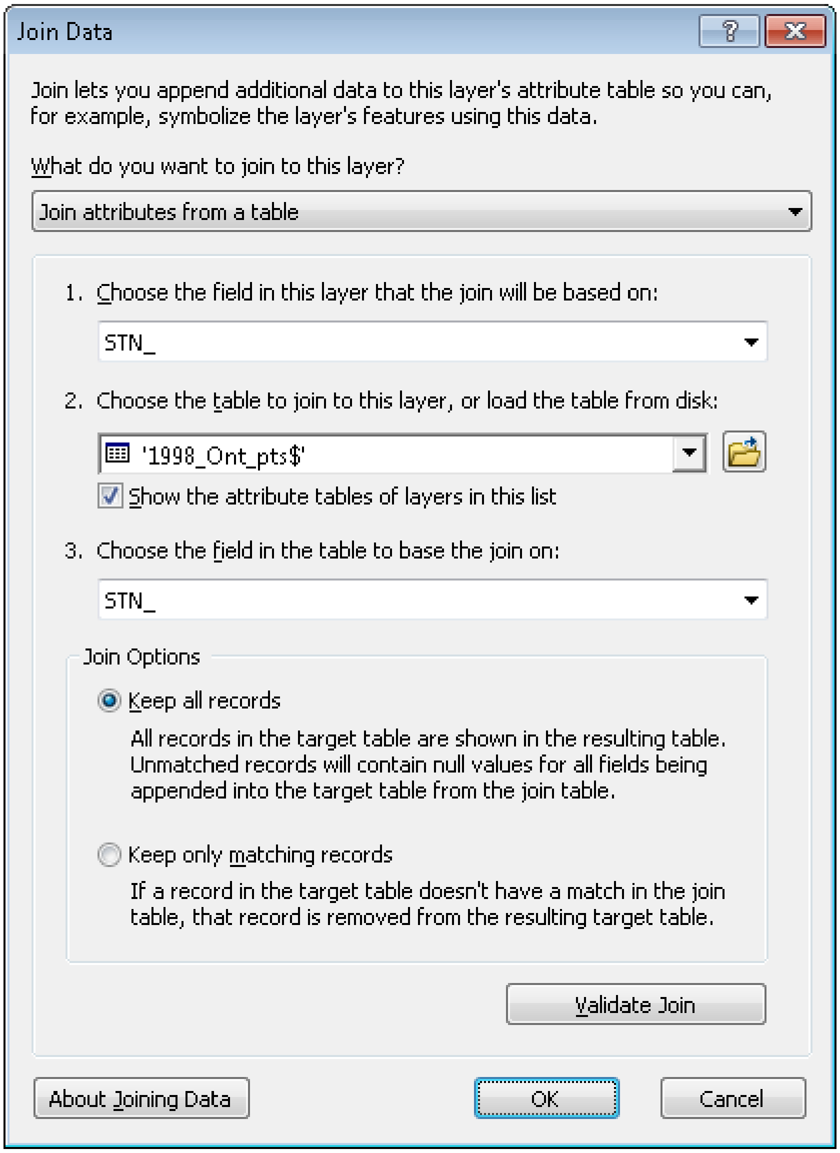


Under Input Table, select the modified .xlsx spreadsheet. Under Output Feature Class, specify the destination, and name the file appropriately. Under X Field (Longitude), select LON, and under Y Field (Latitude), select LAT. Since the coordinate formats will not be used, Input Coordinate Format and Output Coordinate Format can be left as default (DD). Under ID, select STN_, as this will be the field used to later join the spatial data to the .xlsx. Under Spatial Reference, select the appropriate projection (in this case, NAD_1983_UTM_Zone_17N).



Click "OK".

A shapefile will be produced from the latitude and longitude coordinates found in the .xlsx file. However, upon opening the attribute table for the shapefile, it can be seen that there is no contaminant data. This can be repaired by right clicking the layer in the Table of Contents, hovering over Joins and Relates and clicking "Join…" The .xlsx table should be selected by default in 2. Under 1., select the field that the join will be based on (STN_ in this example). This should automatically select the same field in 3. Ensure "Keep all records" is selected. Before clicking "OK", the window should look like the following:



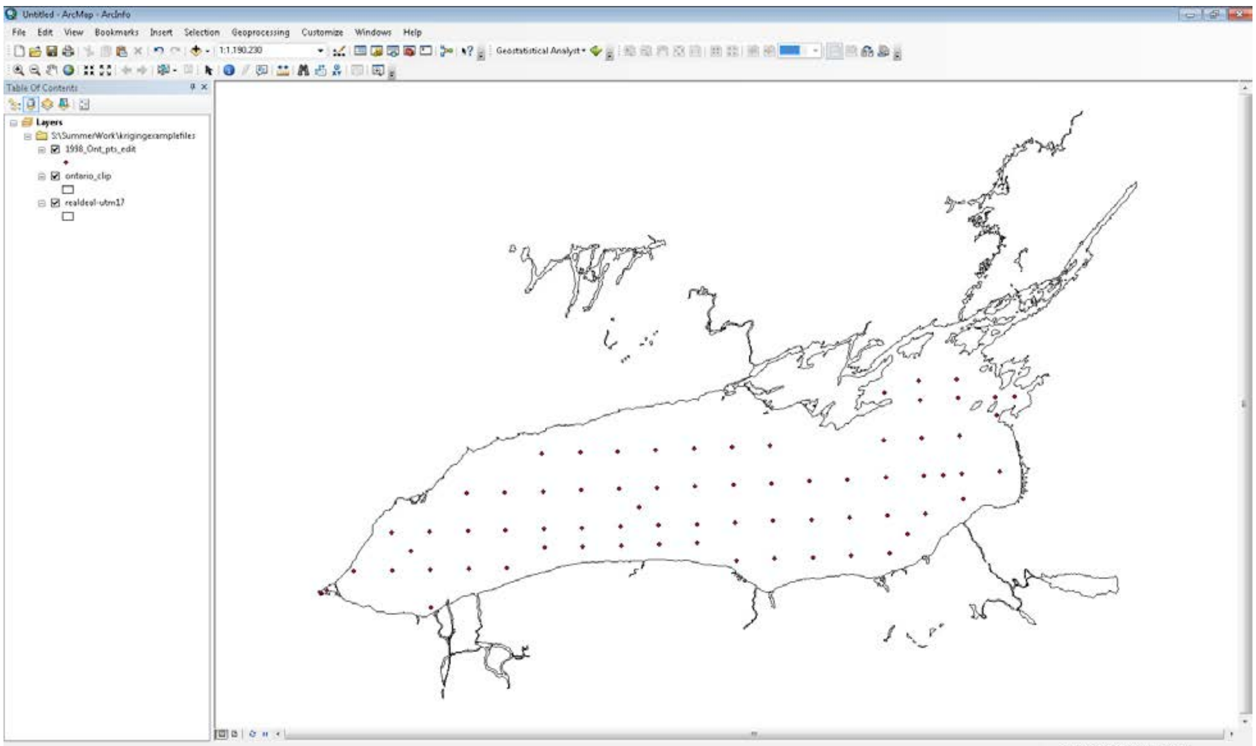
Click “OK”. Open the attribute table of the shapefile to ensure that the join worked. It should now display all of the contaminants, and show <Null> where there are missing values. The shapefile is now ready to be used for Kriging analysis.

Running the Interpolation

In ArcMap:

Add the following layers to the existing layers:

Shoreline vector (ie. realdeal_utm17.shp; Erie-UTM17.shp)
Clip layer (ie. ontario_clip.shp)



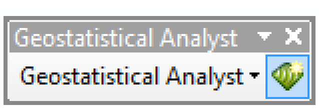
The point data contains the data used to perform kriging.

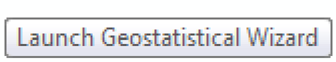
The shoreline vector layer symbology should be “Hollow”

- Click the symbol once in the Table of Contents and click on the “Hollow” option.

The clip layer does not need to be visible as it is not used in the final product.

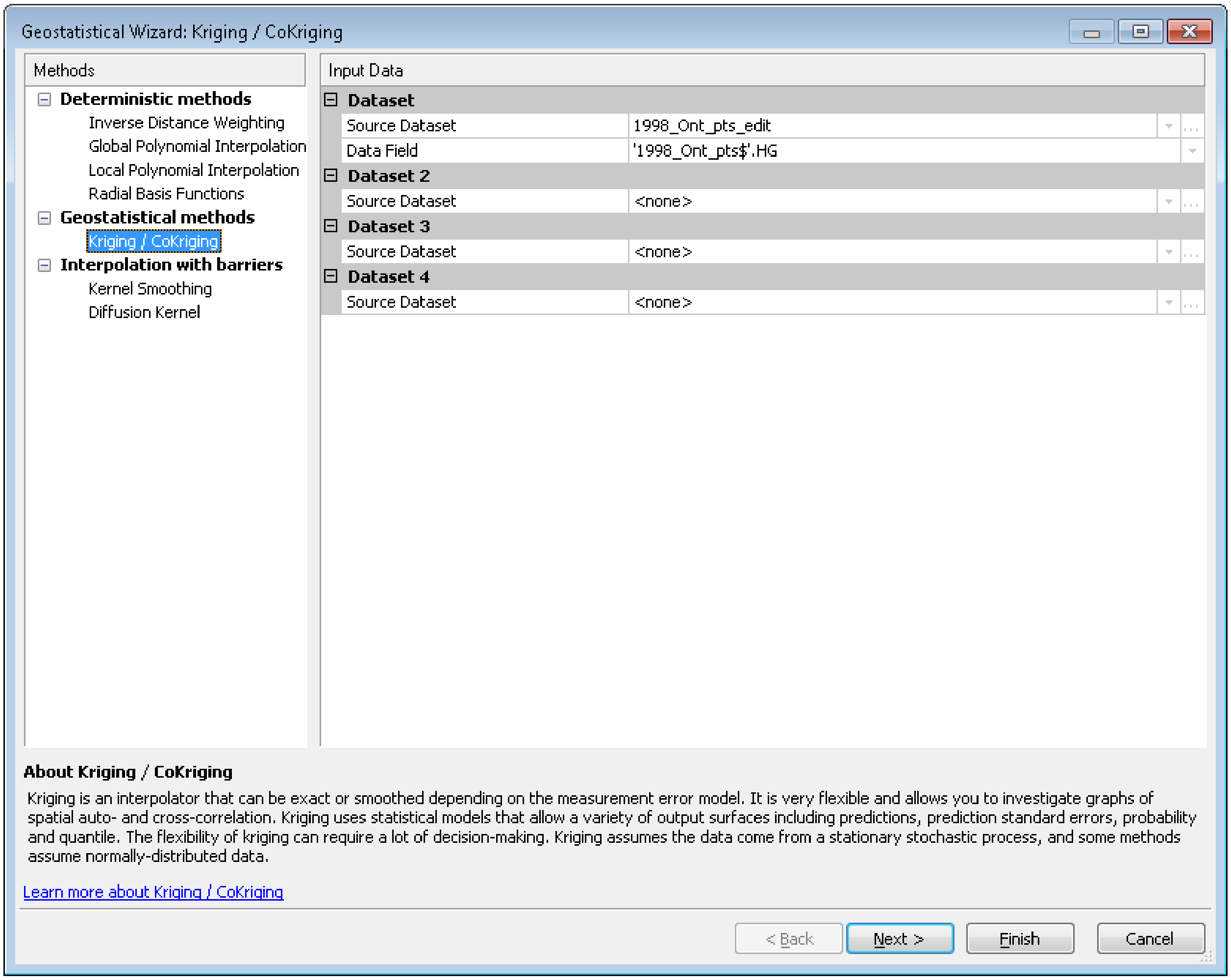
Select Customize → Toolbars → and ensure that the Geostatistical Analyst extension is active. Click “Launch Geostatistical Wizard” to open the tool.





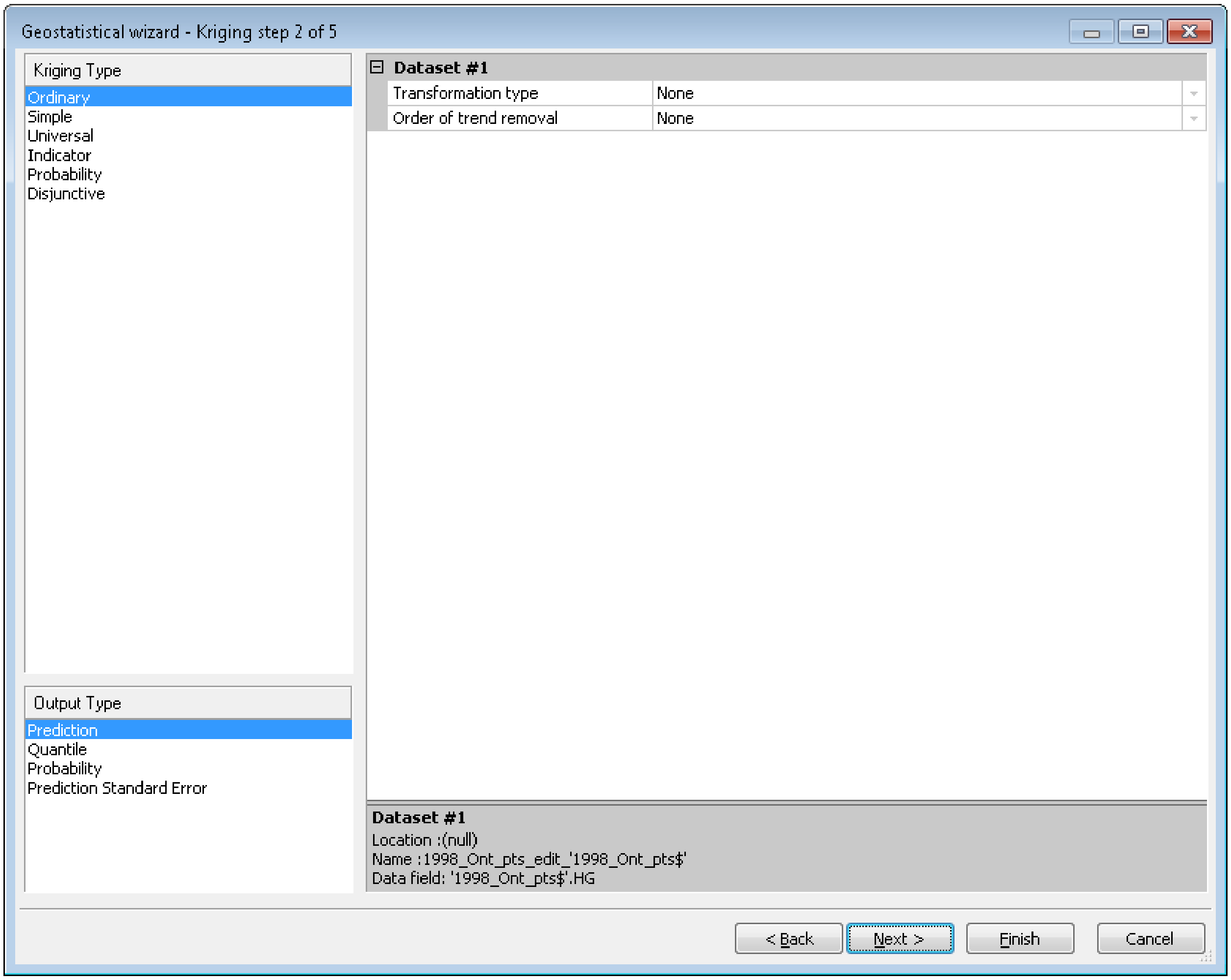
Variogram Model Selection

With “Kriging/CoKriging” highlighted under “Methods”, ensure that the “Source Dataset” is the point data (ie.1998_Ont_pts), and the “Data Field” is the contaminant that you wish to interpolate (mercury in this case).



Click “Next.”

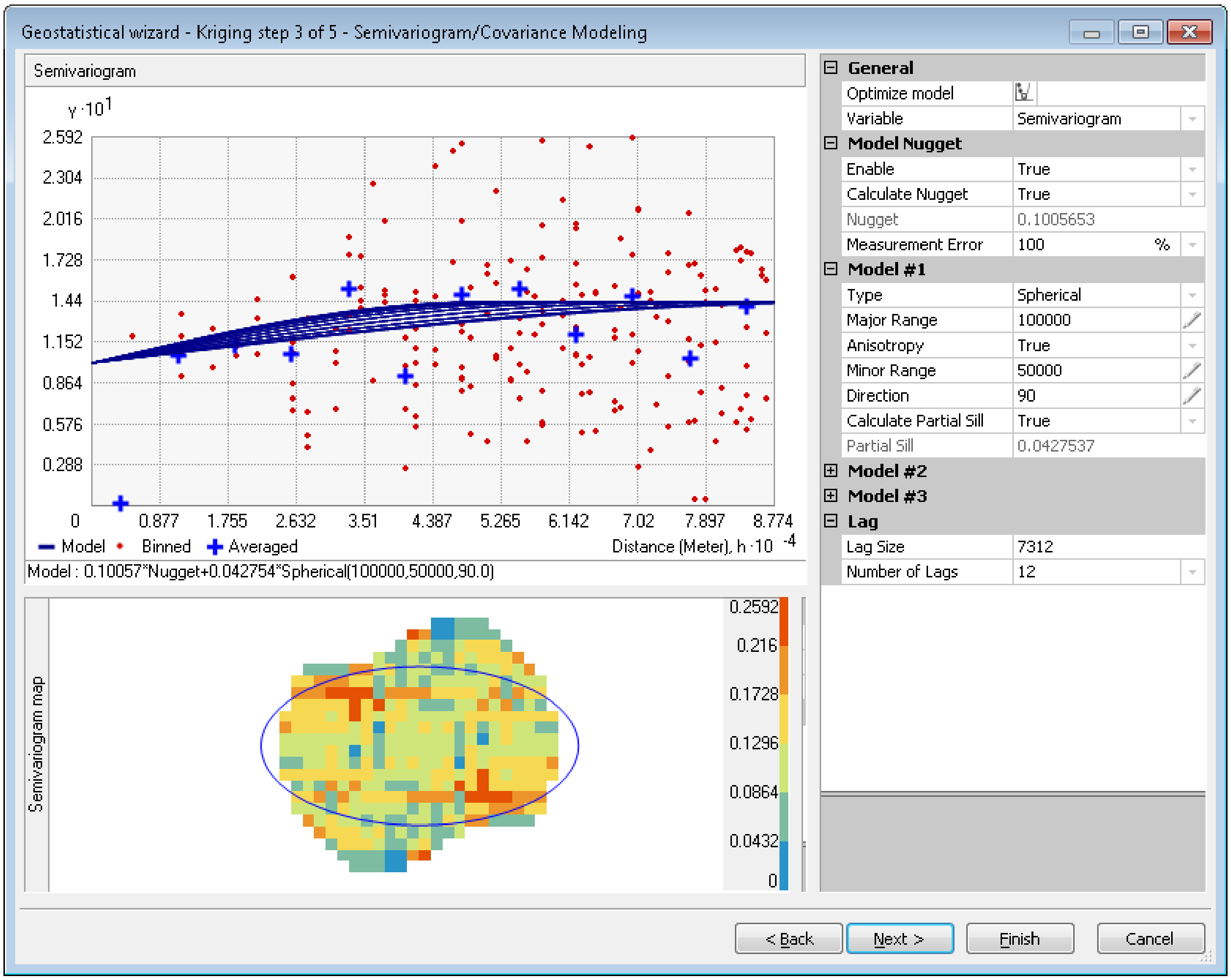
Leave everything on the next screen as the defaults:



Click “Next”.

On the next screen, “Geostatistical Wizard - Kriging Step 3 of 5 - Semivariogram/Covariance Modeling”:

- Under “Model #1”, ensure that Spherical is selected as the Type.
- Adjust the “Major Range” to 100,000 by clicking the calculator icon to the right of the value (which will change to a pencil icon), then typing in the number.
- Under “Anisotropy”, select “True”.
- Adjust the “Minor Range” to 50,000 in the same manner as the Major Range.
- Adjust the “Direction” box to 90 for Lake Ontario, or 70 for Lake Erie.
- <u>NOTE</u>: These values are determined through experimentation and the distribution characteristics of your points.

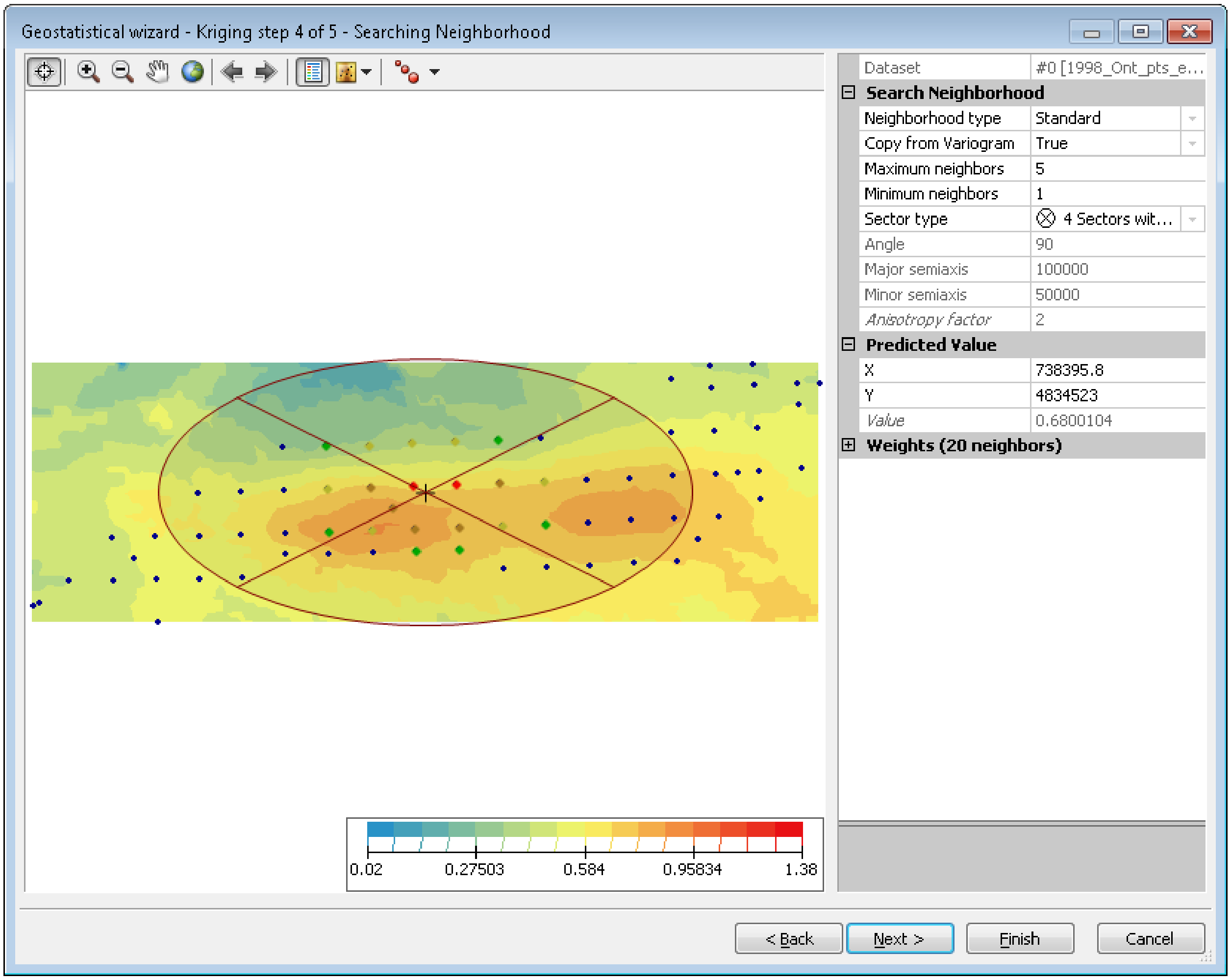


These attributes remain the same throughout model testing, which takes place next.

Click “Next”.

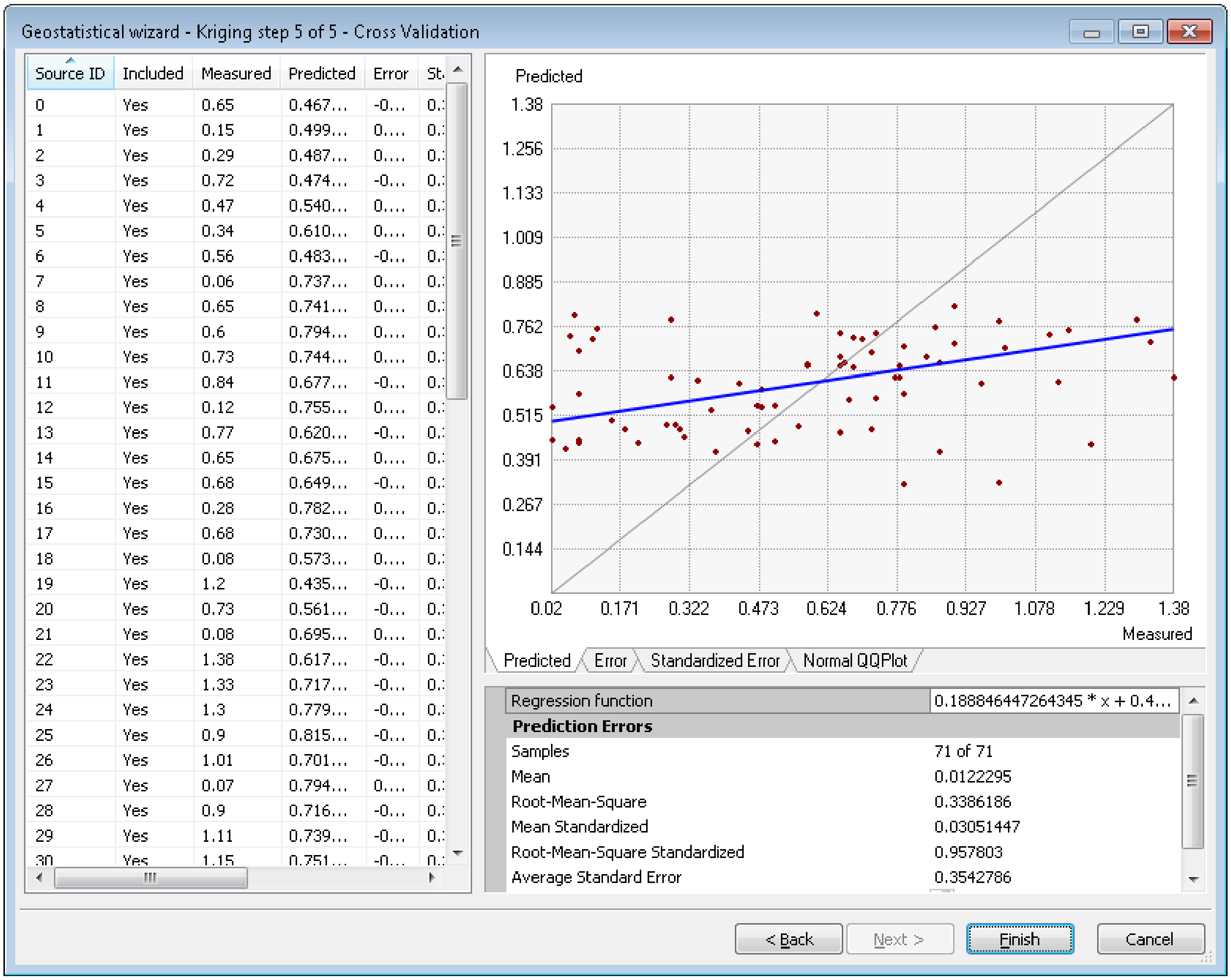
In “Geostatistical Wizard - Kriging Step 4 of 5 - Searching Neighborhood”, ensure that:

- “Maximum Neighbours” is 5
- “Minimum Neighbours” is 1
- “Sector Type” is “4 Sectors with 45 degree offset”
- NOTE: These values are determined through experimentation and the distribution of your points.



Click “Next”.

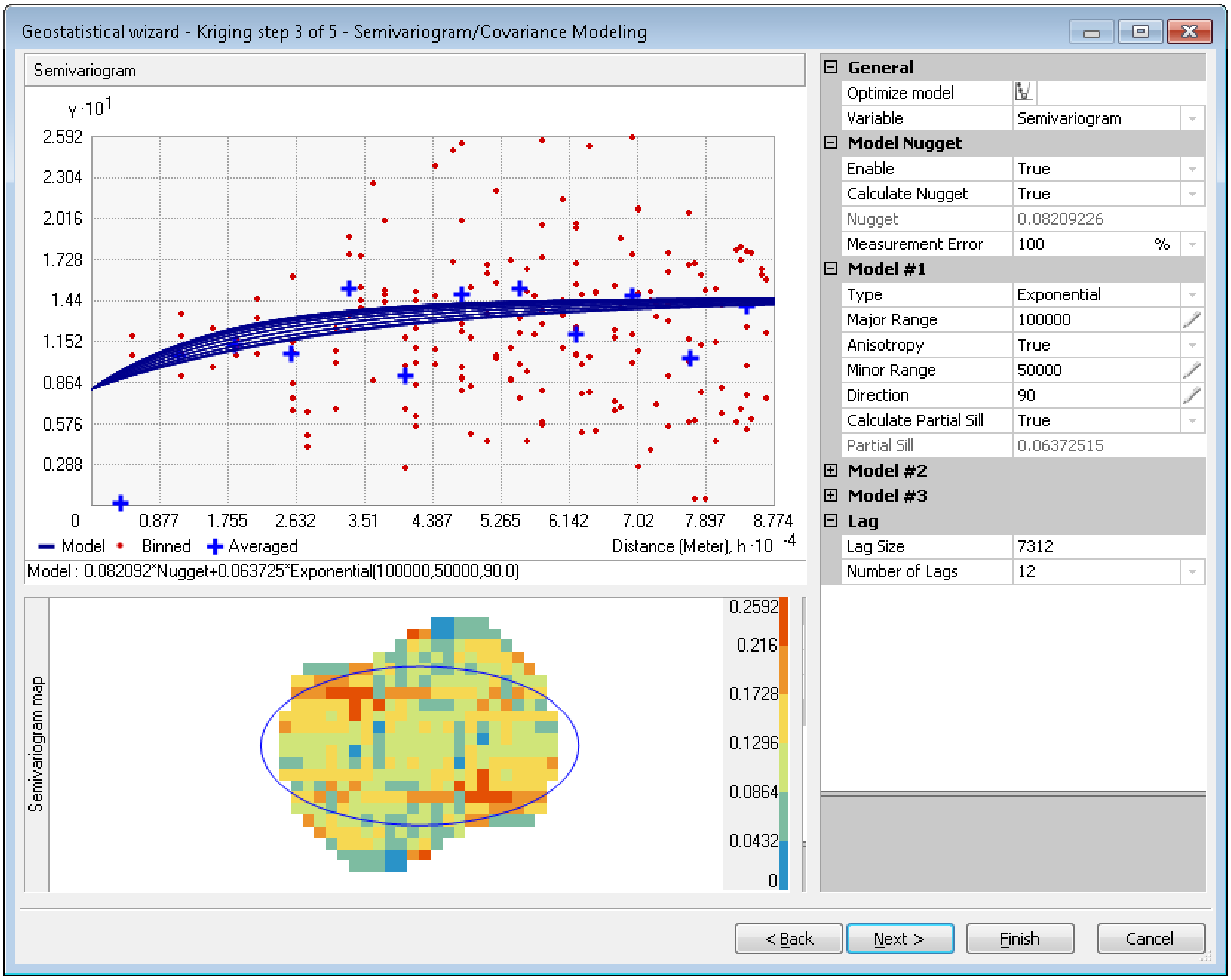
The following step performs the Cross Validation and calculates the prediction error statistics – Mean, Root-Mean-Square (RMS), Mean Standardized, Standardized Root-Mean-Square Prediction Error (SRMSPE), and Average Standard Error (ASE).



Record these values in a table such as Error Stats Table.xls.

The |RMS-ASE| is not calculated by ArcGIS, but can be set up to be calculated automatically as it has in the given table. This value is used for comparing the accuracy of the models tested.

Click “Back” until you arrive at the “Geostatistical Wizard - Kriging Step 3 of 5 - Semivariogram/Covariance Modeling” window, and change the model to “Exponential”. You will notice the blue lines on the Semivariogram graph move slightly. The Major and Minor Ranges and the Direction should all remain at the values that were entered previously.



Click "Next" until you return to "Geostatistical Wizard -Kriging Step 5 of 5 - Cross Validation" and record the error stats under the Exponential section of the table (the values in Step 4 should remain unchanged).

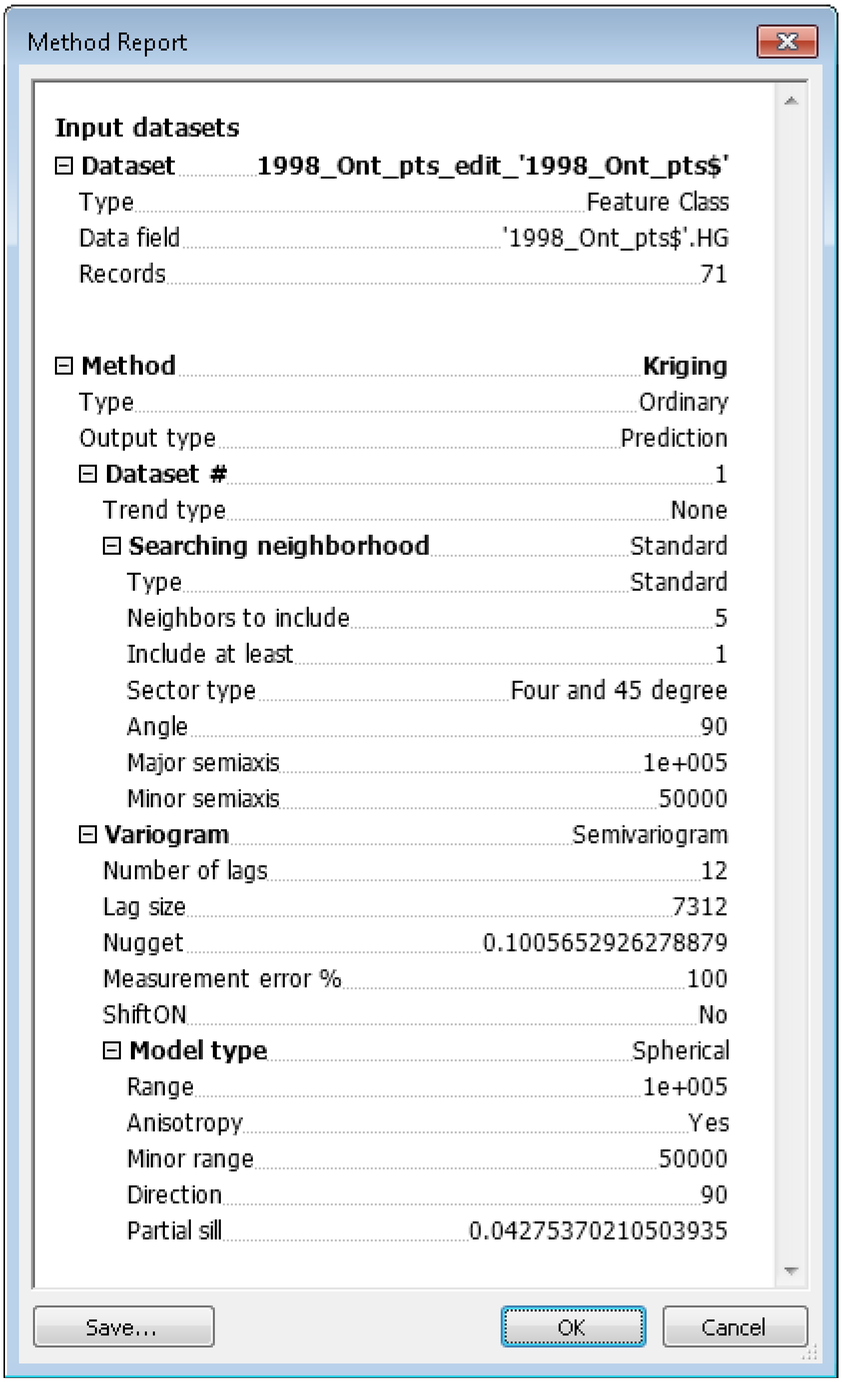
Repeat these steps with the Gaussian model.

With the error stats for the three models entered into the Excel spreadsheet, the errors can be compared between models, keeping in mind that:

- The mean should be as close to 0 as possible,
- The RMS and ASE should both be not more than 20,
- The RMS and ASE should be similar, as calculated in the |RMS-ASE| column,
- And the SRMSPE should be as close to 1 as possible.

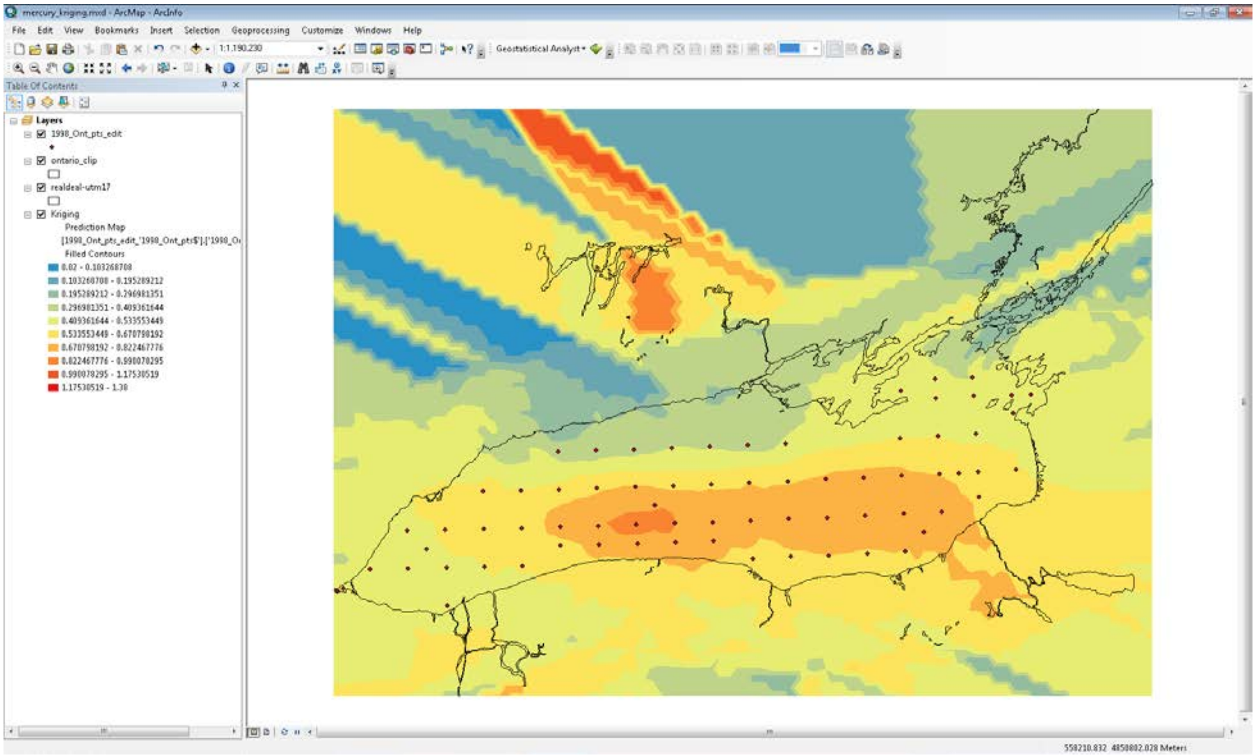
Select the model that provides the most accurate interpolation (ie. the best error stats) and record this in a new column in the table or simply highlight the model that has been selected within the table.

Return to Step 3 of the Geostatistical Wizard, and click the model that you have just selected. Click “Next” until you return to Step 5 and click “Finish”. In the “Output Layer Information” window, ensure that all parameters are, in fact, correct.



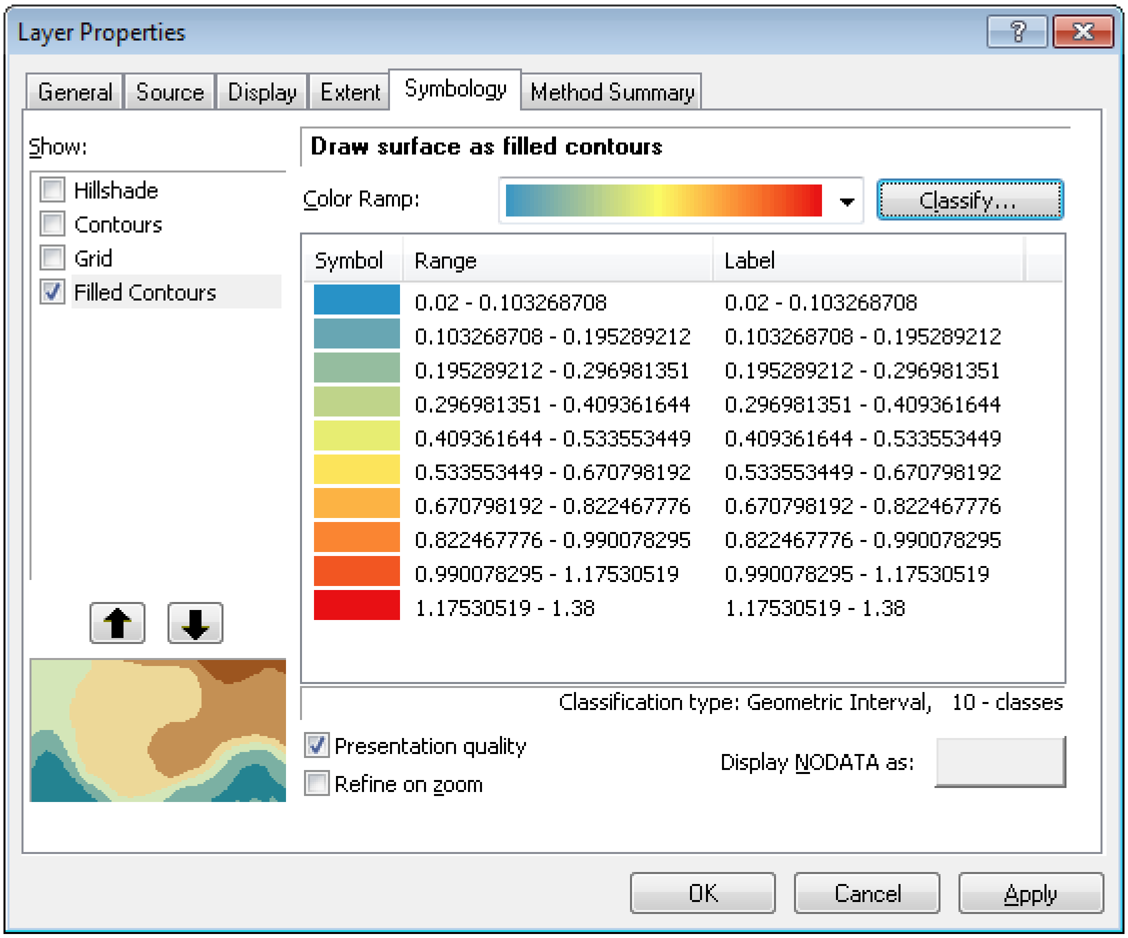
Click “OK”. The prediction surface is now generated.

In the Table of Contents, move this new layer below the shoreline vector layer. Keep in mind that this layer is temporary. Right click the layer and go to Properties. Under the Extent tab, "Set the extent to:" "the rectangular extent of realdeal-utm17". This will ensure that the Kriging layer covers the extent of the shoreline vector. Click "OK".

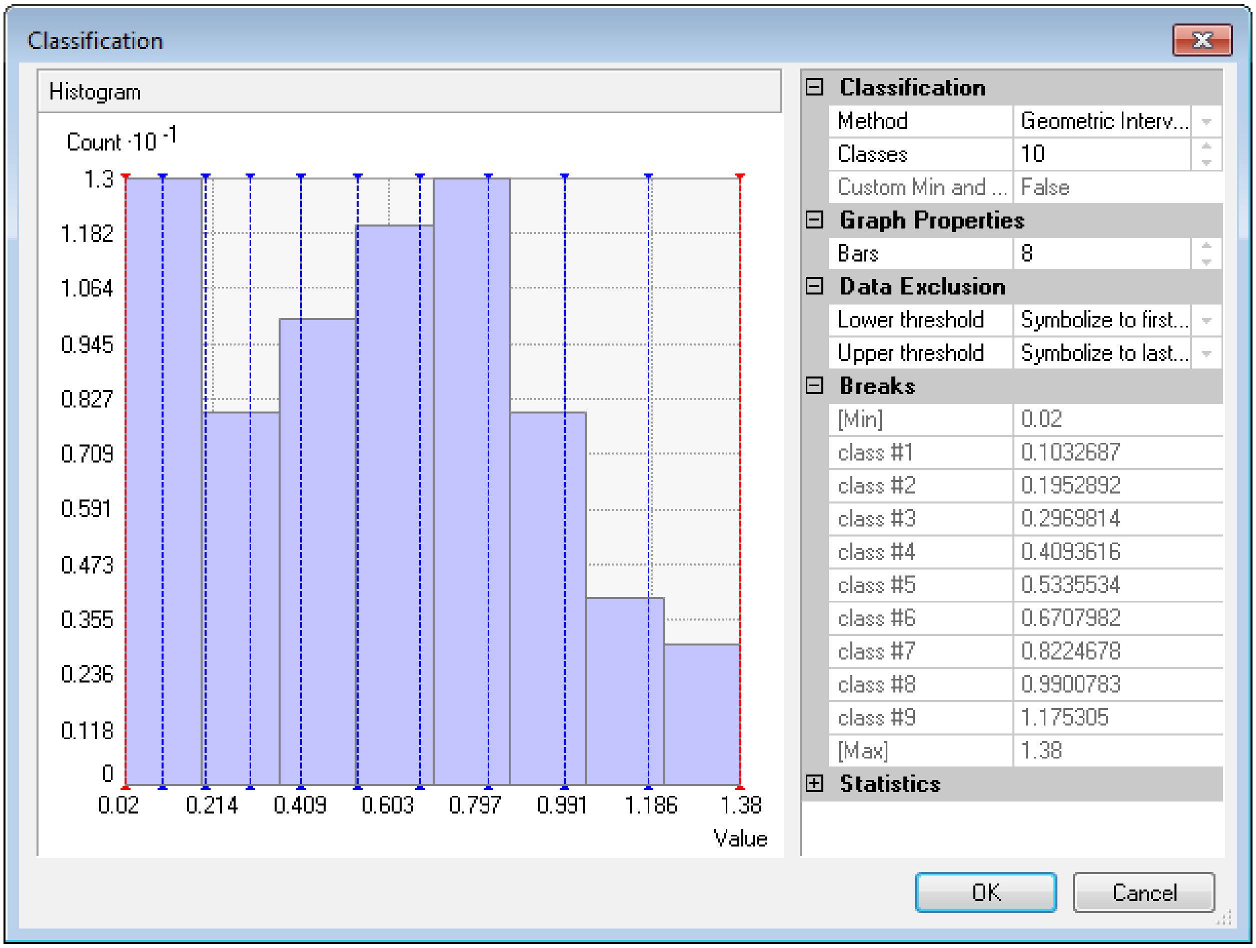


Adjusting the symbology of the Kriging layer

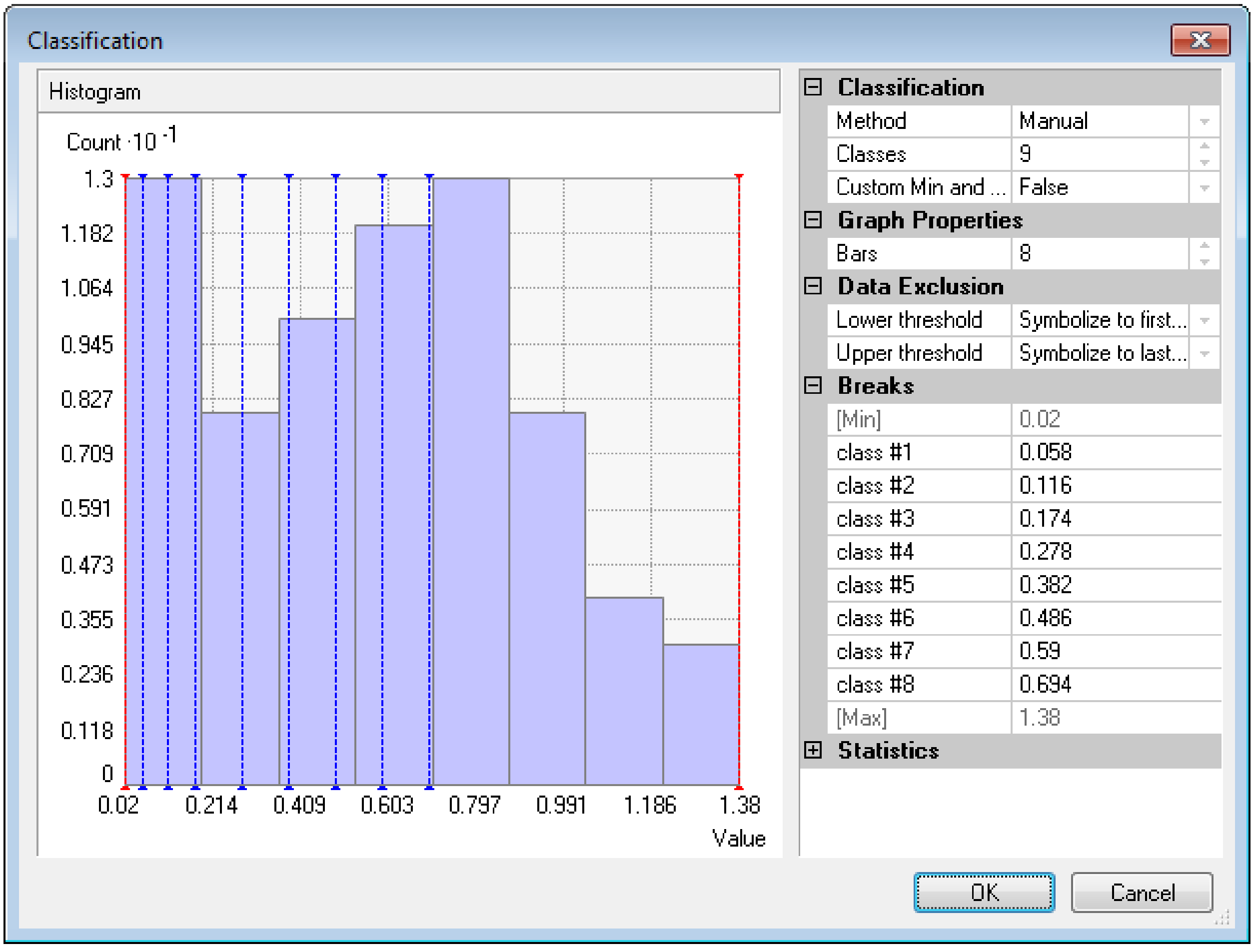
Double click on the Layer Name of the Kriging layer to open the properties window. Click the Symbology tab, and then click on "Filled Contours".



Check the "Presentation Quality" box, and then click on Classify to open the Classification window.



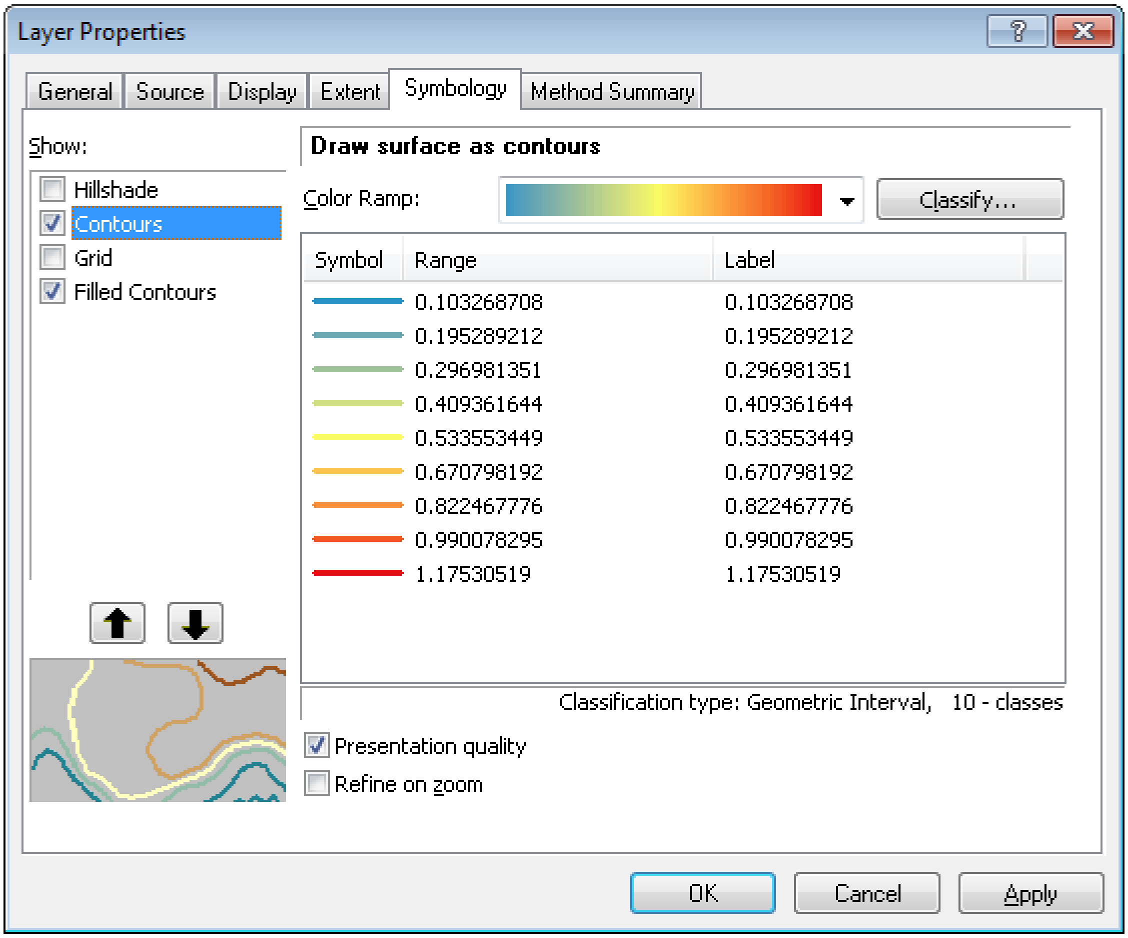
Change the Classification Method to Manual, and adjust the number of classes ("Classes") to however many are necessary. This will be determined by the minimum and maximum values and the intervals that are used. In this example of mercury, the intervals will be based on the values of the TEL (0.174) and the PEL (0.486). There will be 3 equal intervals below the TEL, 3 equal intervals between the TEL and the PEL, and 3 intervals (based on the ranges between the TEL and the PEL) above the PEL. Therefore there will be 9 custom classes, corresponding to those found in Colours.xls. Adjust the breaks (on the right side) to incorporate the necessary intervals.



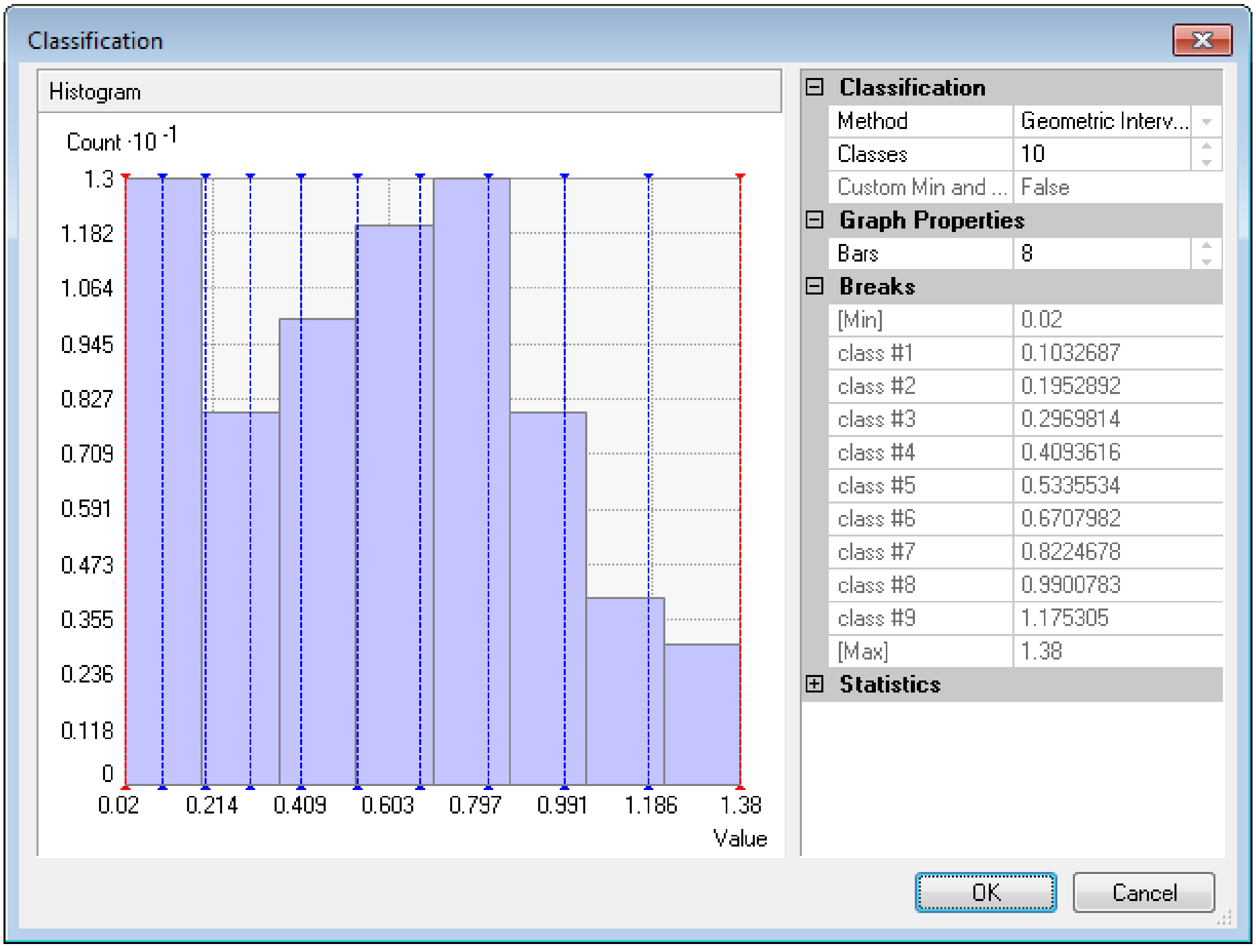
Click “OK” in the Classification window.

In the Layer Properties window, Click and check off “Contours” on the left side of the window. Both “Contours” and “Filled Contours” should be checked off.

As with the “Filled Contours”, check the “Presentation Quality” box.

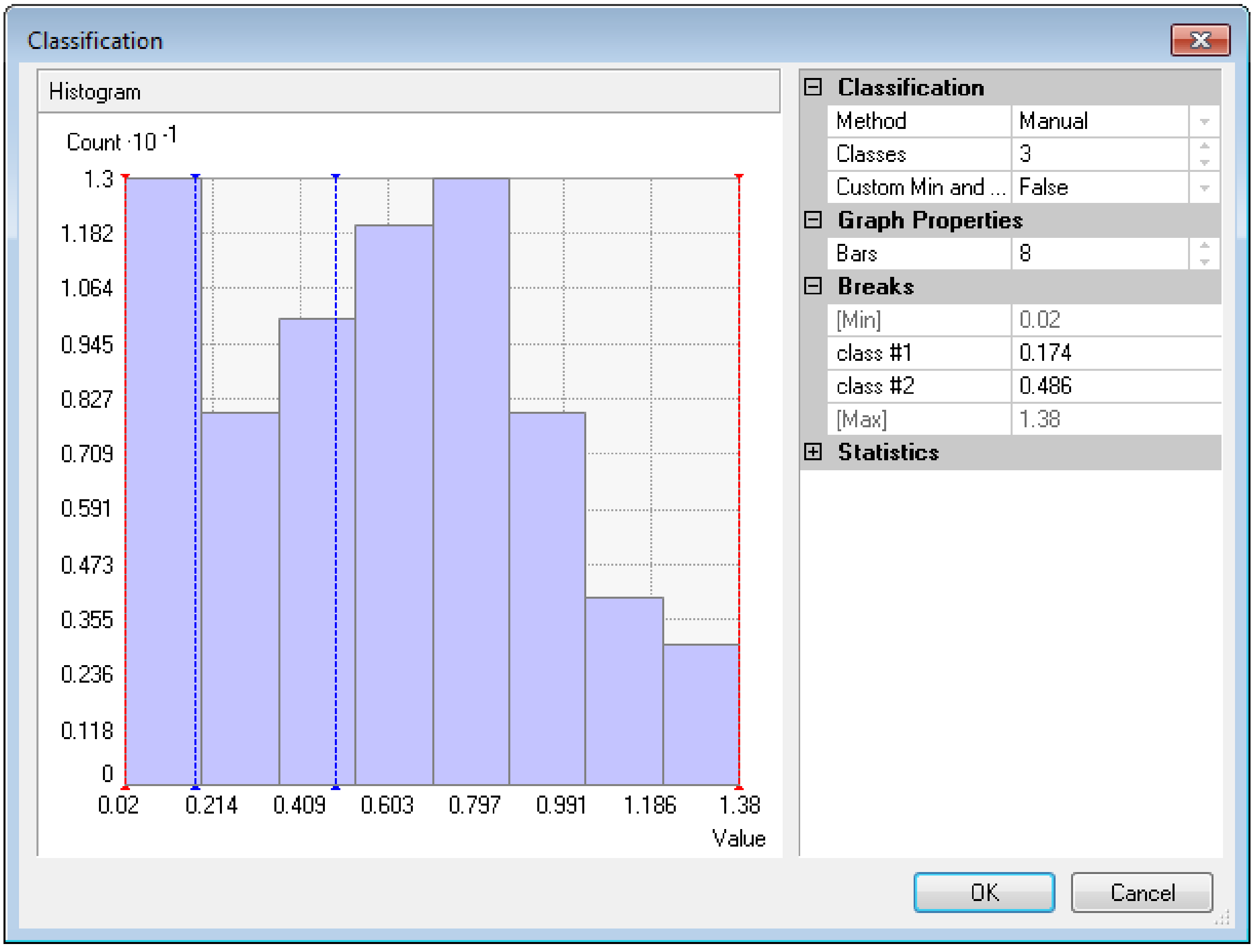


Click on the “Classify” button to open the Classification window.

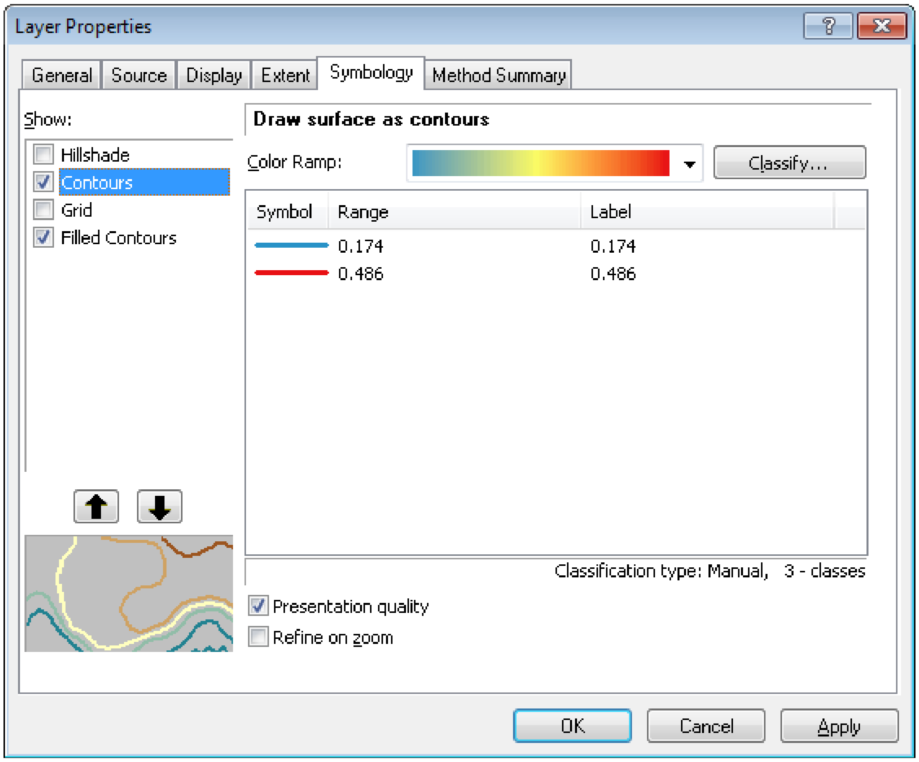


If the range of values encompasses both the TEL and the PEL values, change the number of classes to 3. If the range of values includes only one of the TEL and PEL, change the number of classes to two. In the case of mercury in Lake Ontario, both TEL and PEL are included.

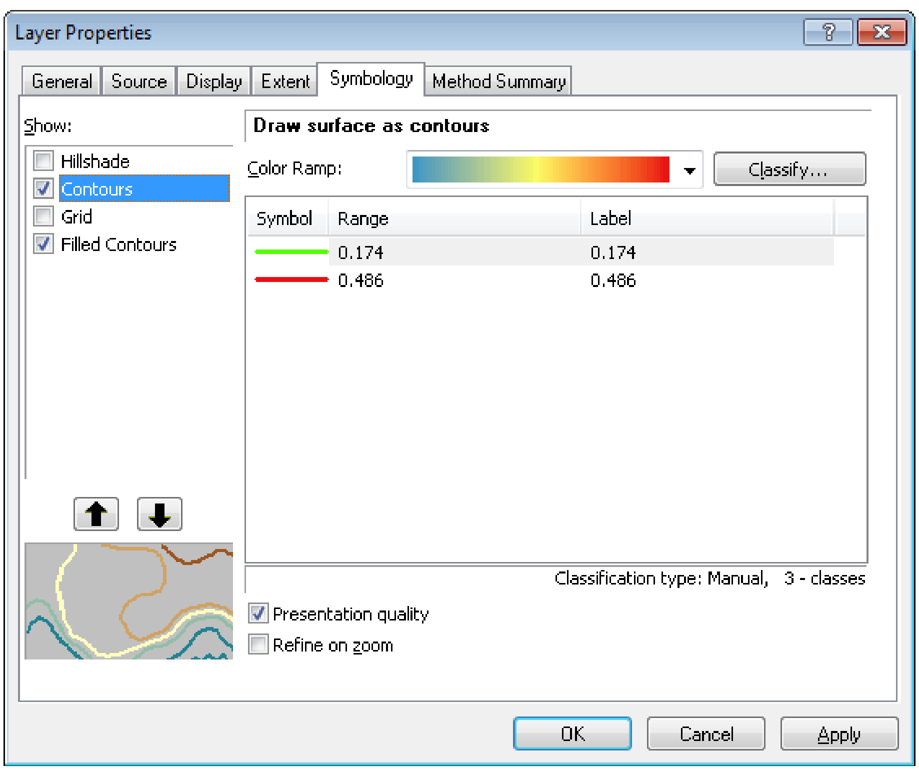
Change the Method the manual, and change the “Breaks” values to equal the TEL and PEL values:

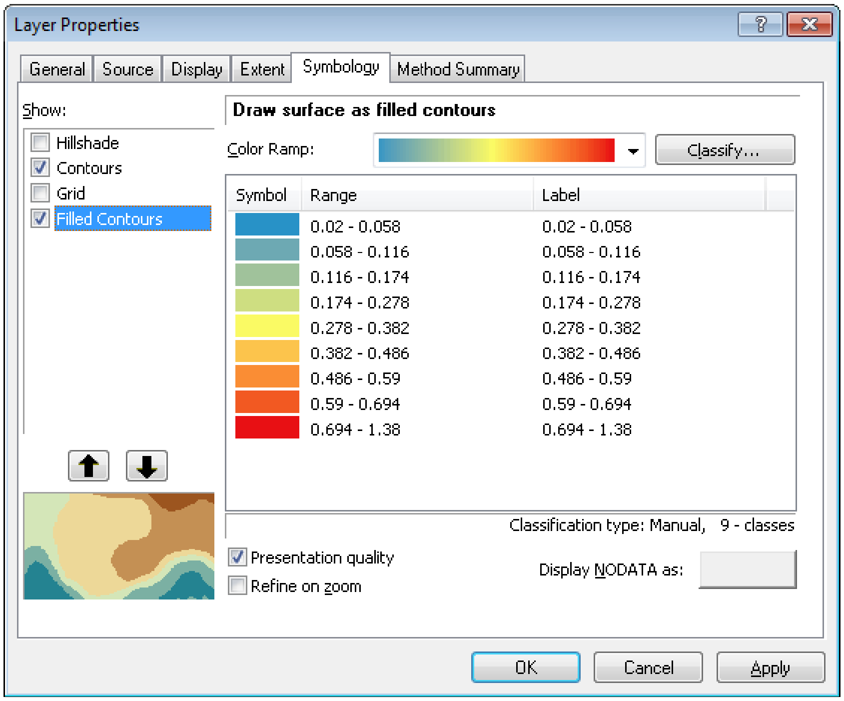


Click “OK”, and return to the Layer Properties window.

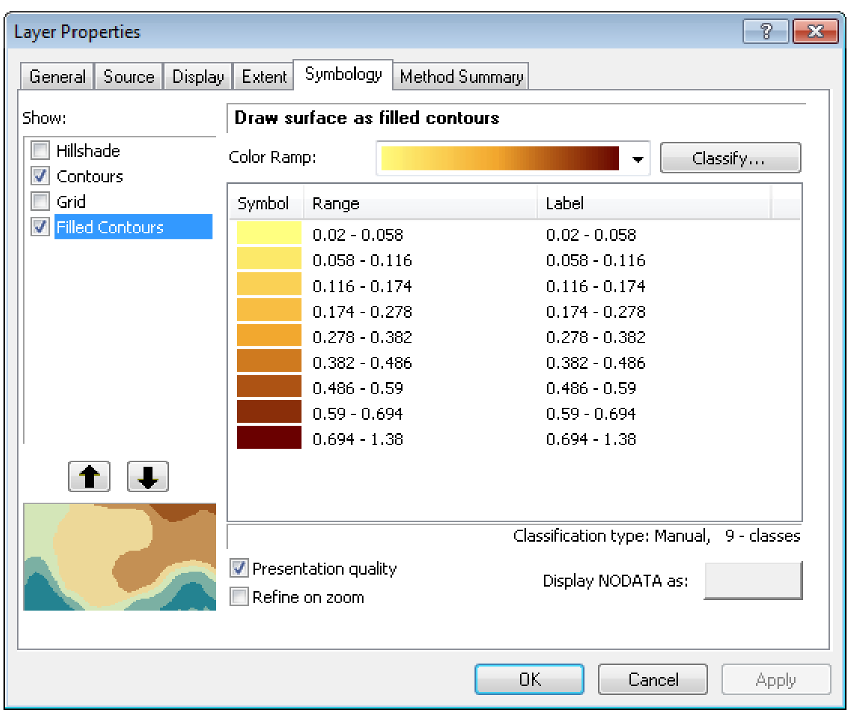


Adjust the colours of these two lines. Double click the line representing the TEL (0.174, in this case), and change its colour to green (Medium Apple, to be precise). Do the same with the PEL (0.486) and make it red (Mars Red).

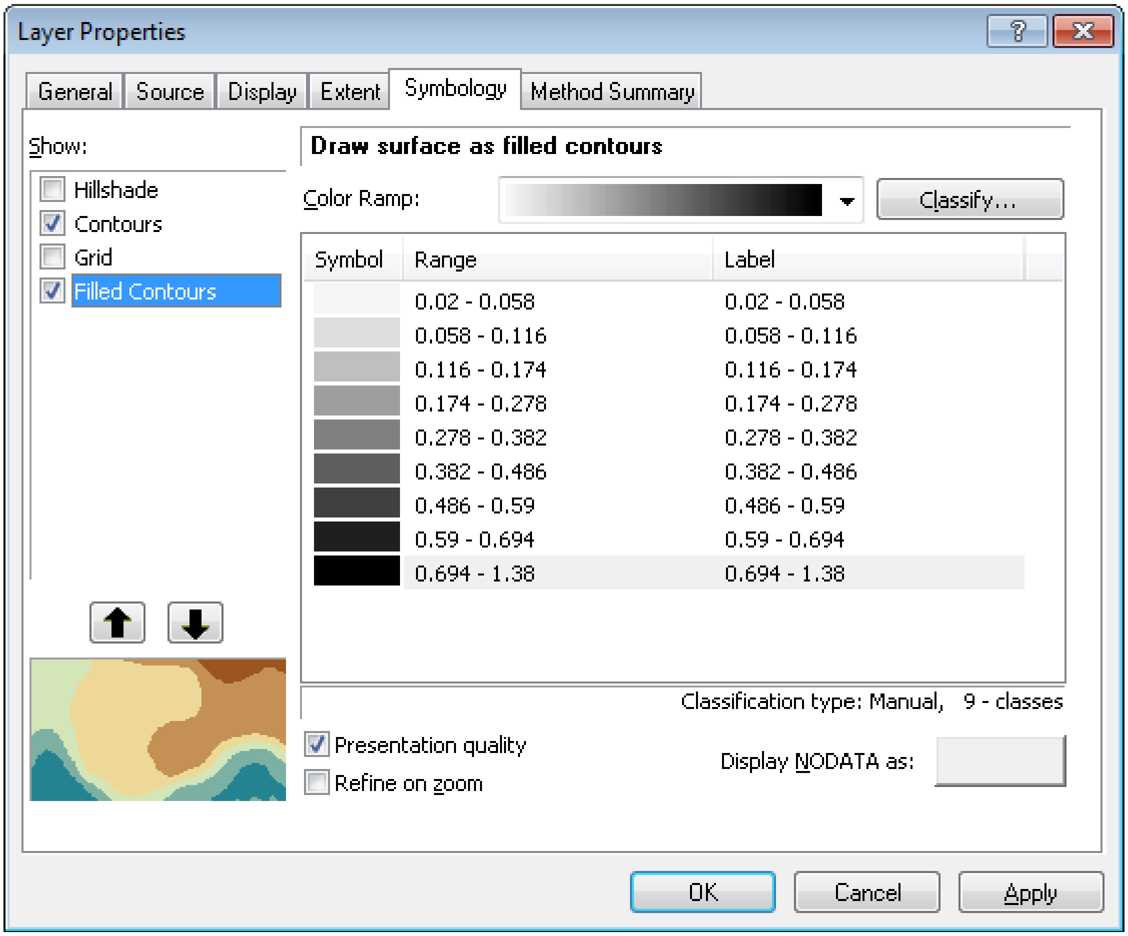




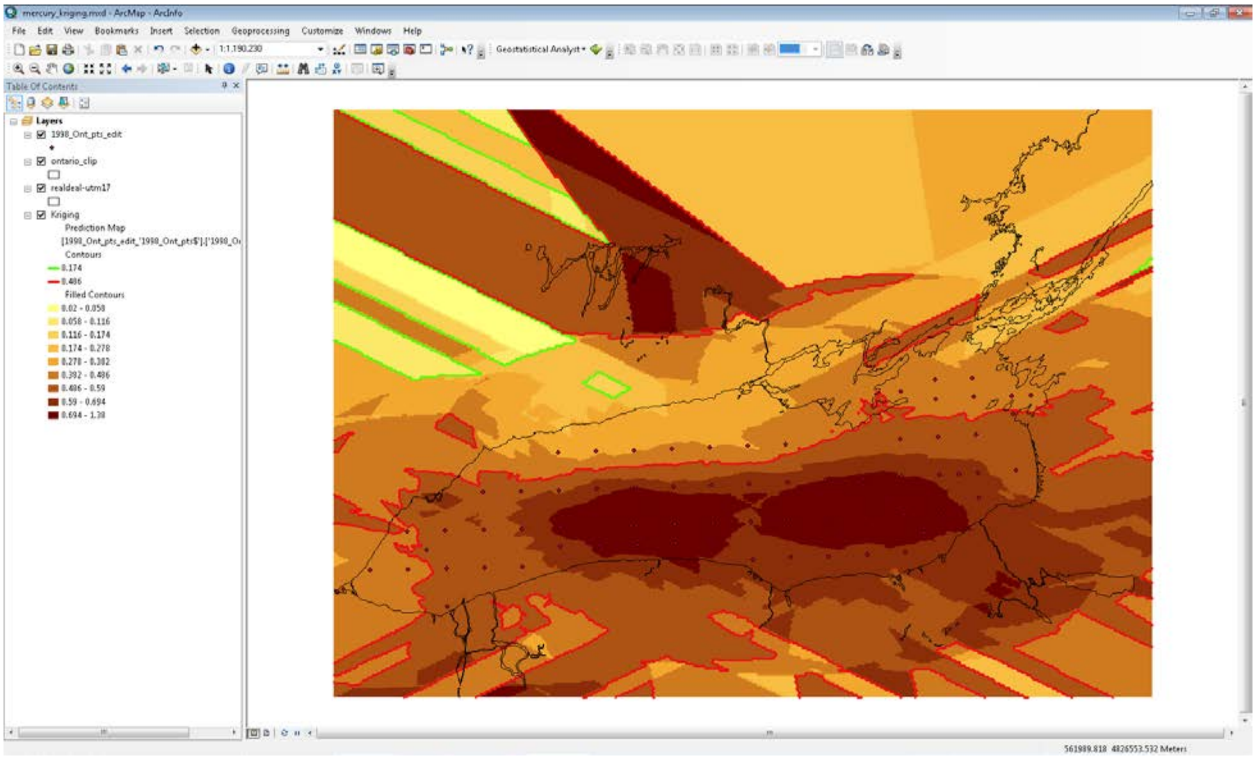
Adjust the colours for the filled contours as well. Click Filled Contours on the left menu. Based on the RGB colour settings found in Colours.xls, adjust each of the classes accordingly by double-clicking on the colour symbol. Under Fill Colour in the Symbol Selector window, select More Colour. In the new window, Colour Selector, change to RGB (in the top right corner), which will allow for the accurate input of the desired RGB values.



Alternatively, if a greyscale map is desired, while in the Colour Selector window, click the right-facing arrow in the top-right corner and click "Advanced Selection". Click the drop down menu at the top, and select Gray. The desired grayscale value can then be entered for the class (also found in Colours.xls).



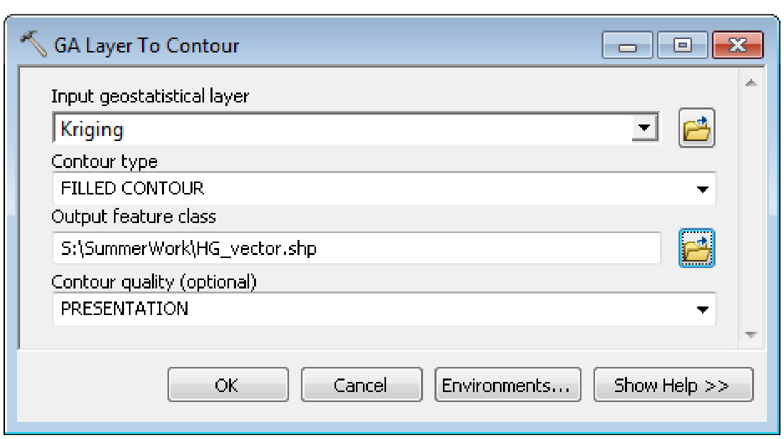
Click “OK” in the Layer Properties window. The ArcMap window should now look as follows (using the colour scheme and ranges in Colours.xlsx):



Creating the Vector Shapefiles

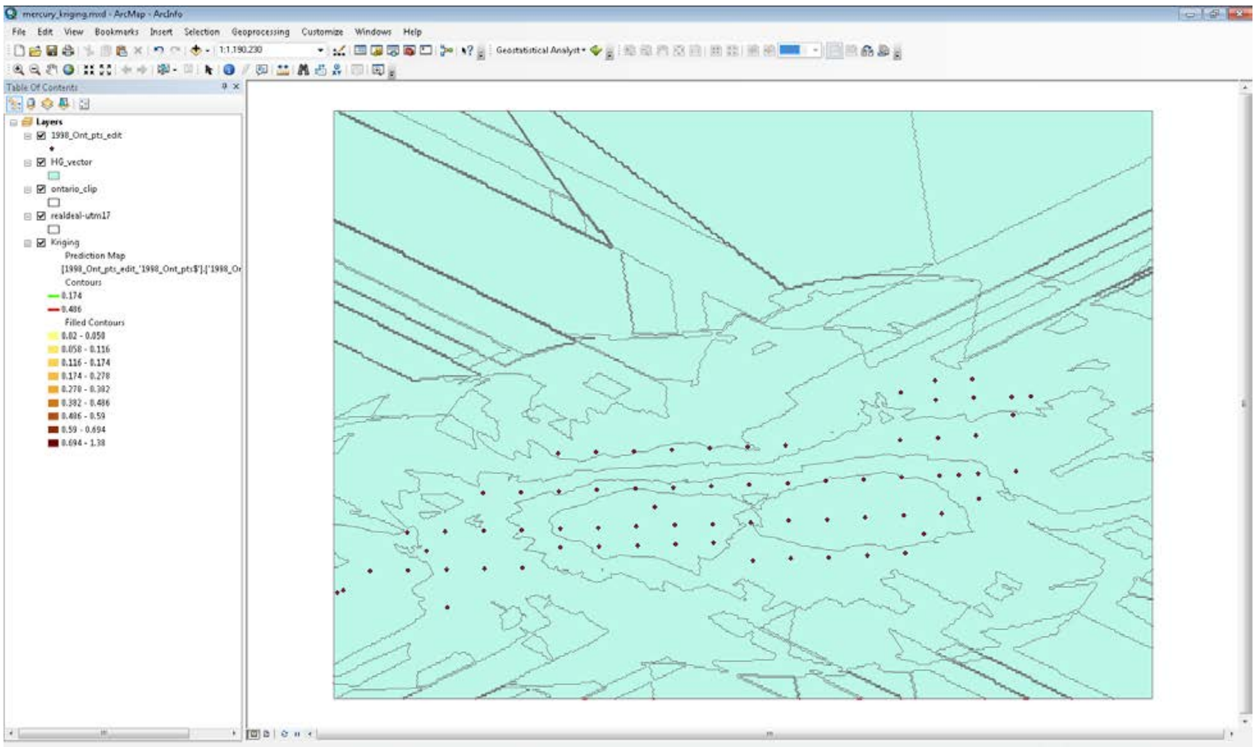
Since all predictions made outside of the lake are unnecessary, the vectors must be created from the Kriging layer, then cropped (which is where the ontario_clip.shp layer comes into play).

First, right click on the Kriging layer, and select Data → “Export to Vector…” and the “GA Layer to Contour” window will pop up.

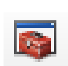


Change the “Contour Type” to Filled Contour, and ensure that the new shapefile will be exported to the proper folder and with the right file name (current convention is to name the file “HG_vector”). Change “Contour Quality” to presentation, and click “OK”.

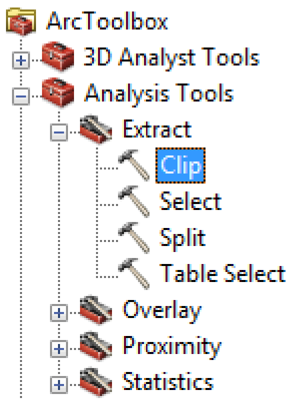
After the vector layer is added to the display, right click the layer, go to Properties → Symbology and click “Features” on the left side. Click Apply, then OK, and the ArcMap window should look as follows:



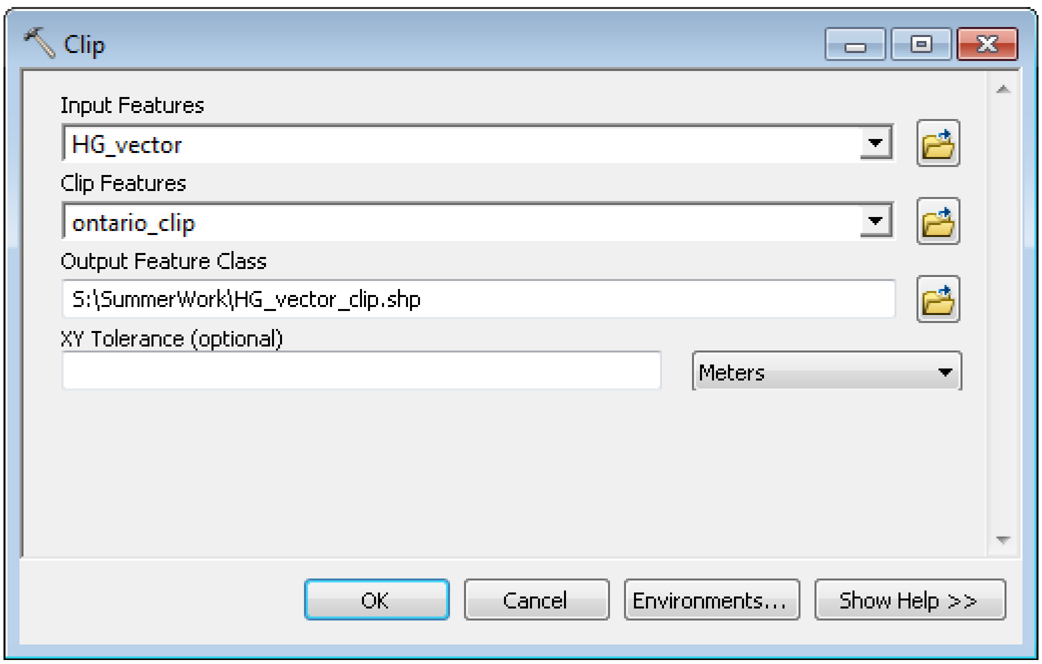
Next, you want to get rid of all data outside of the lake. You can accomplish this by using “Clip” in the ArcToolbox:



Select the ArcToolbox → Analysis Tools → Extract → Clip

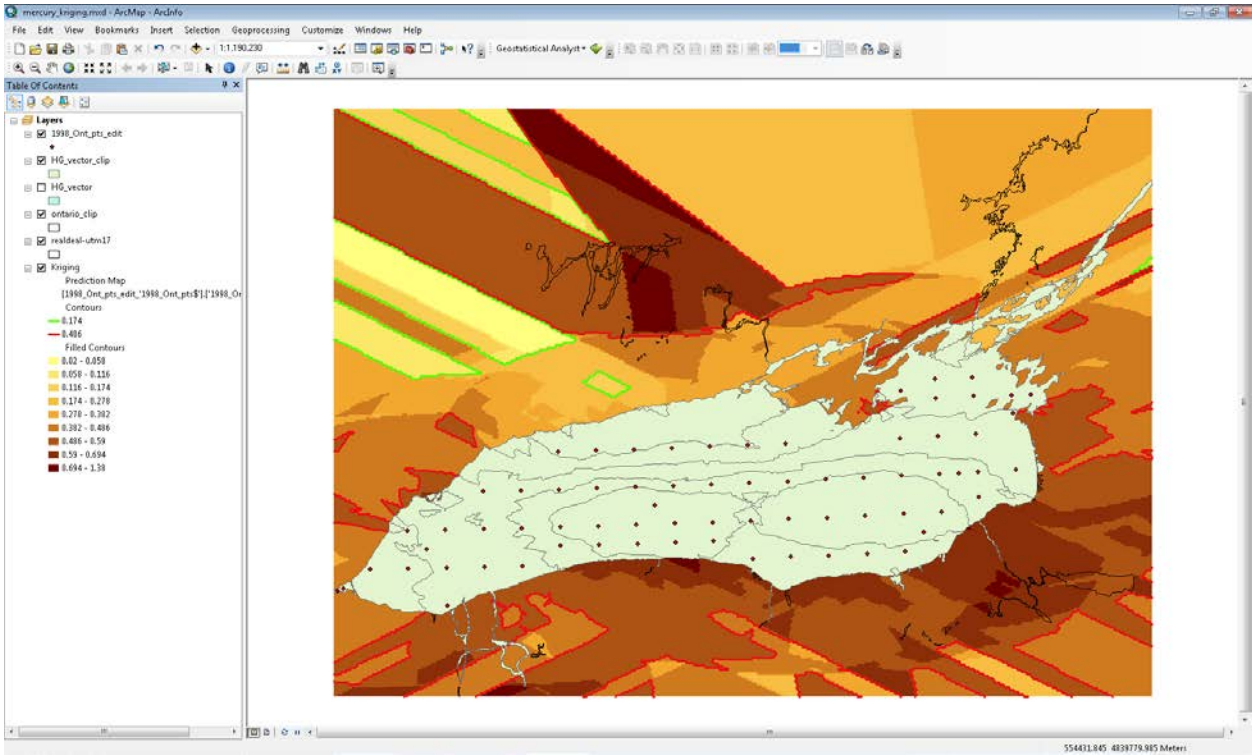


The input layer to clip is the one that was just created, HG_vector; the “clip features” is ontario_clip. Write this file to the same folder as HG_vector, calling it HG_vector_clip, for example. Leave the XY Tolerance empty, which is the default.



Click “OK”

Remove the HG_vector.shp layer. The map should now look as follows:



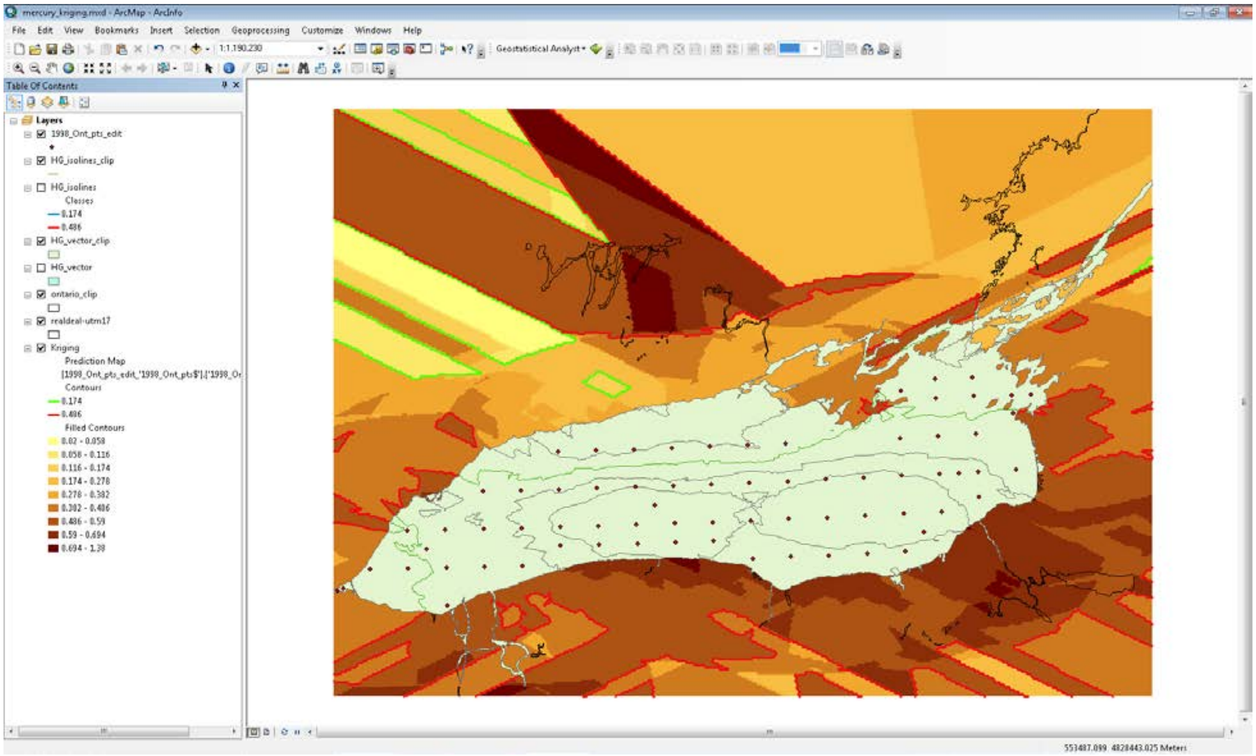
To create the isolines, right click on the Kriging Layer Name, select Data → "Export to Vector…", but this time, leave the "Contour Type" as Contour (as opposed to Filled Contour previously).

Change the filename to HG_Isolines.shp (as has been used in all analyses thus far), ensuring that the file is being written to the proper folder. Change Contour Quality to Presentation. Click "OK".

Again, the data outside of the lake must be deleted. Select the clipping tool. The input feature is now HG_Isolines, and the "clip feature" remains ontario_clip. Change the filename to HG_Isolines_clip.shp, ensuring it is written to the right folder.

Click "Finish" and remove the HG_Isolines layer from the Table of Contents.

The map should be as follows:



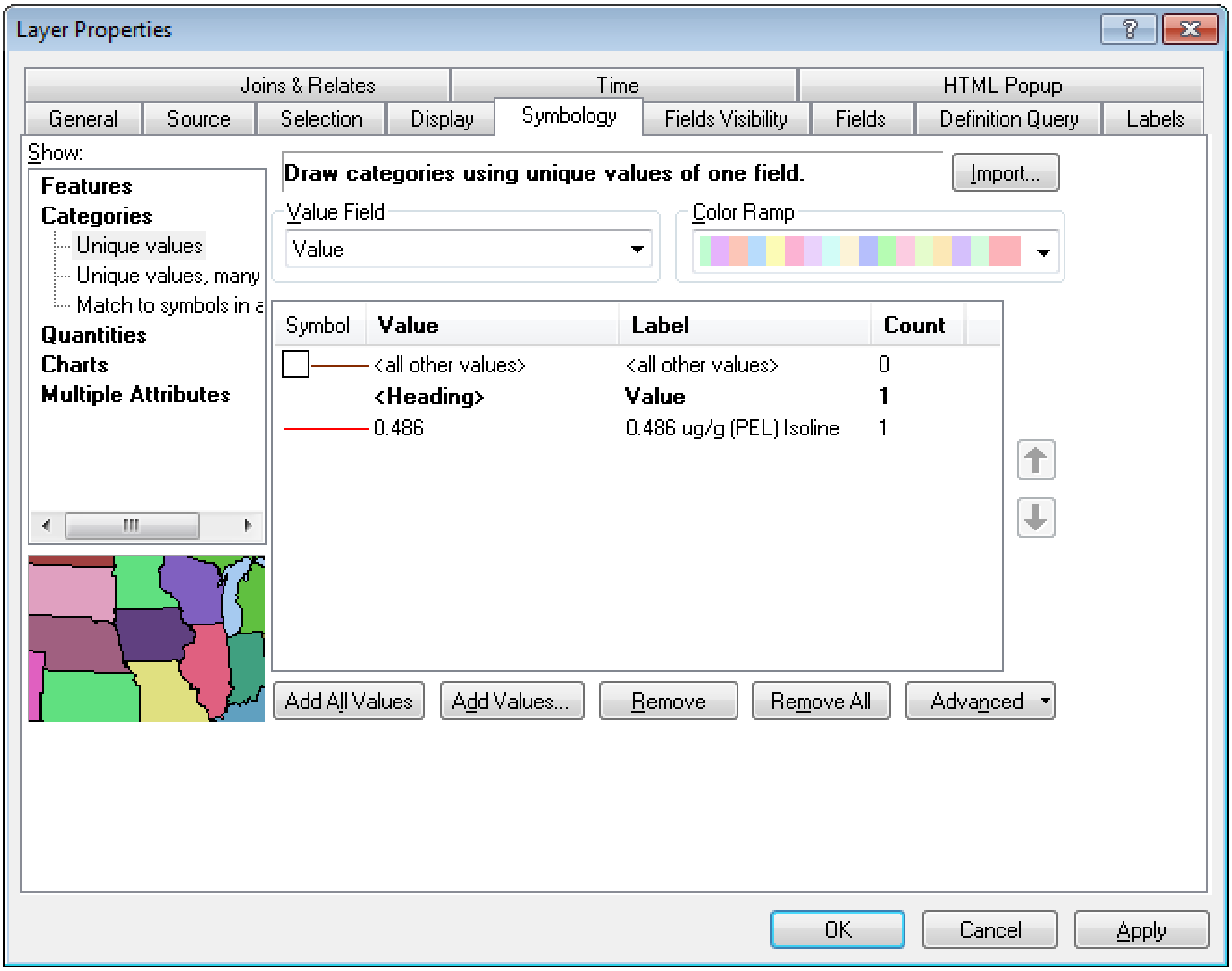
The Kriging layer can now be unchecked in the Table of Contents, making it invisible. The file of the shoreline vectors should be moved to the top of the list in the Table of Contents.

The symbology of these two new layers must now be adjusted.

Double click on the HG_Isolines_clip layer to open Layer Properties. Go to the Symbology tab.

Click “Categories” on the left side of the window. Change the “Value” field from Classes to Value and click the “Add All Values” button at the bottom of the window. In this case, only the PEL isoline appears, because all TEL values lie outside of the lake. Double click on the line, and change its colour to red (Mars Red) (or Medium Apple [green] if it is the TEL isoline). Uncheck the “<all other values>” box.

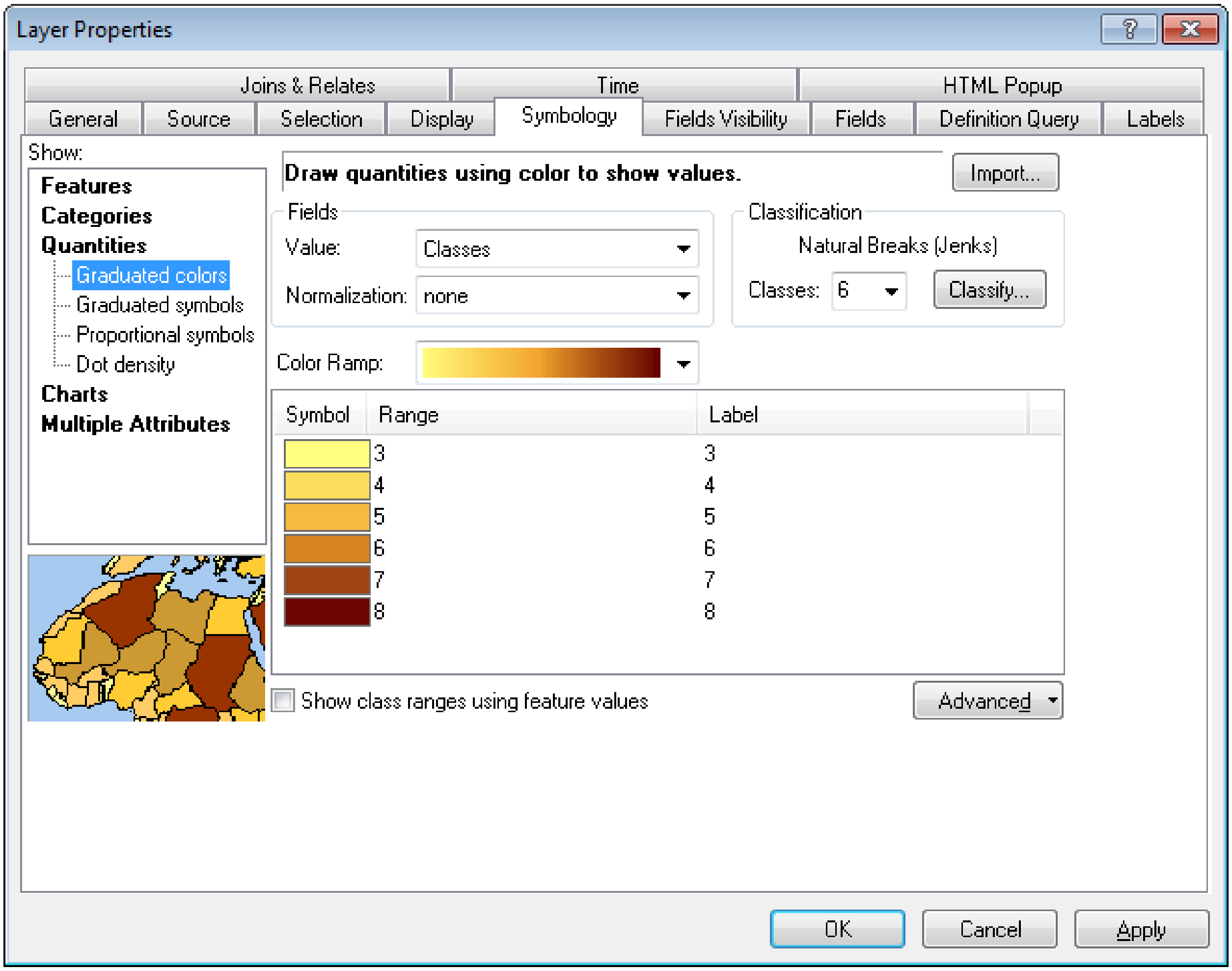
Click in the Label field of the value, and change it to “0.486 ug/g (PEL) Isoline”. These values will vary, of course, depending on the contaminant, and whether or not the value is the TEL or the PEL.



Click "OK"

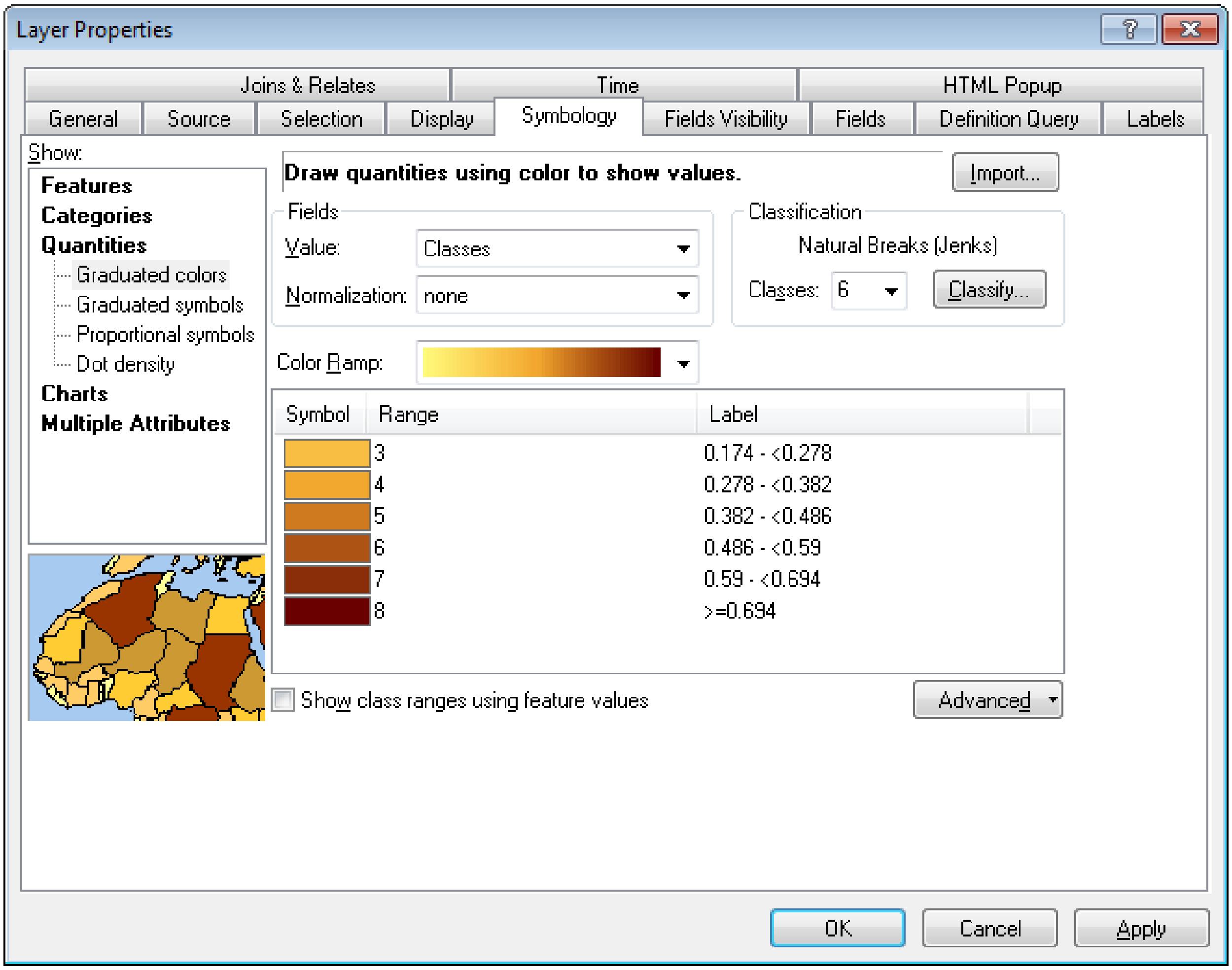
Open the Layer Properties of the HG_vector_clip layer, and go to the Symbology tab.

Click "Quantities" on the left side of the window, and in the Fields box, change the value field to "Classes". If there are classes that are grouped together when this is done (a likely scenario), simply increase the number of classes in the "Classification" box within the Symbology tab.



The classes must now be labeled.

To determine the value that each class represents, refer to the original Kriging Layer that was created. Keep in mind that the numbering of classes in the Kriging layer begins with 0. Therefore, class 3 in the HG_vector_clip represents 0.174 – 0.278 ug/g. Label each class “0.174 - <0.278” – “0.278 - <0.382” since it is always the lower break that is correct. Keep in mind that the number of classes in the clipped file may not be the same number as in the Kriging layer since some of the classes in the Kriging layer may be found exclusively outside of the lake, and therefore not included in the clipped vector layer. Make sure to adjust the colours accordingly to those found in Colours.xls.

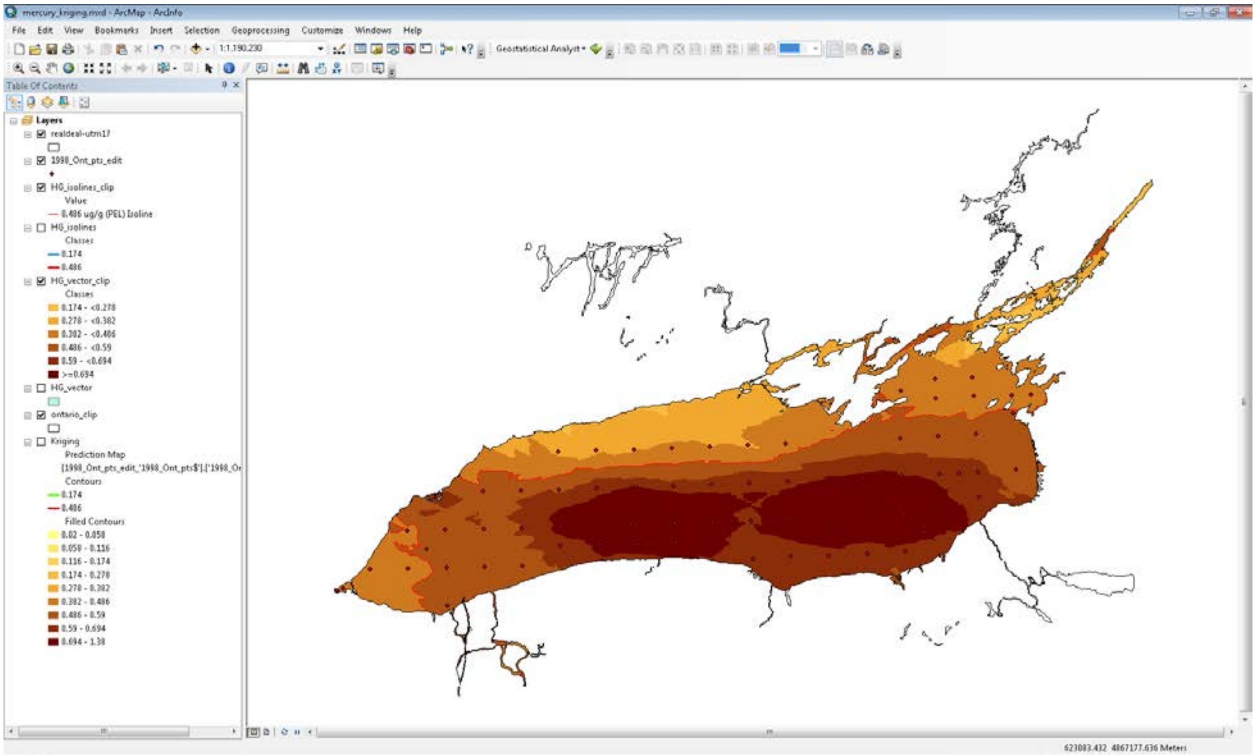


Click on the “Symbol” column heading, and select “Properties for All Symbols”. Change the “Outline Width” to 0.

Click “OK”.

Click “OK” in Layer Properties.

The map should now look as follows:



Click on the heading of the HG_vector_clip layer (where it says “Classes” right below the Layer Name), click again, and change the heading to “Prediction Intervals (ug/g)”

**It is important to remember that when working with trace metals, measurements are in ug/g, but with everything else (organochlorines and PAHs) measurements are in ng/g.

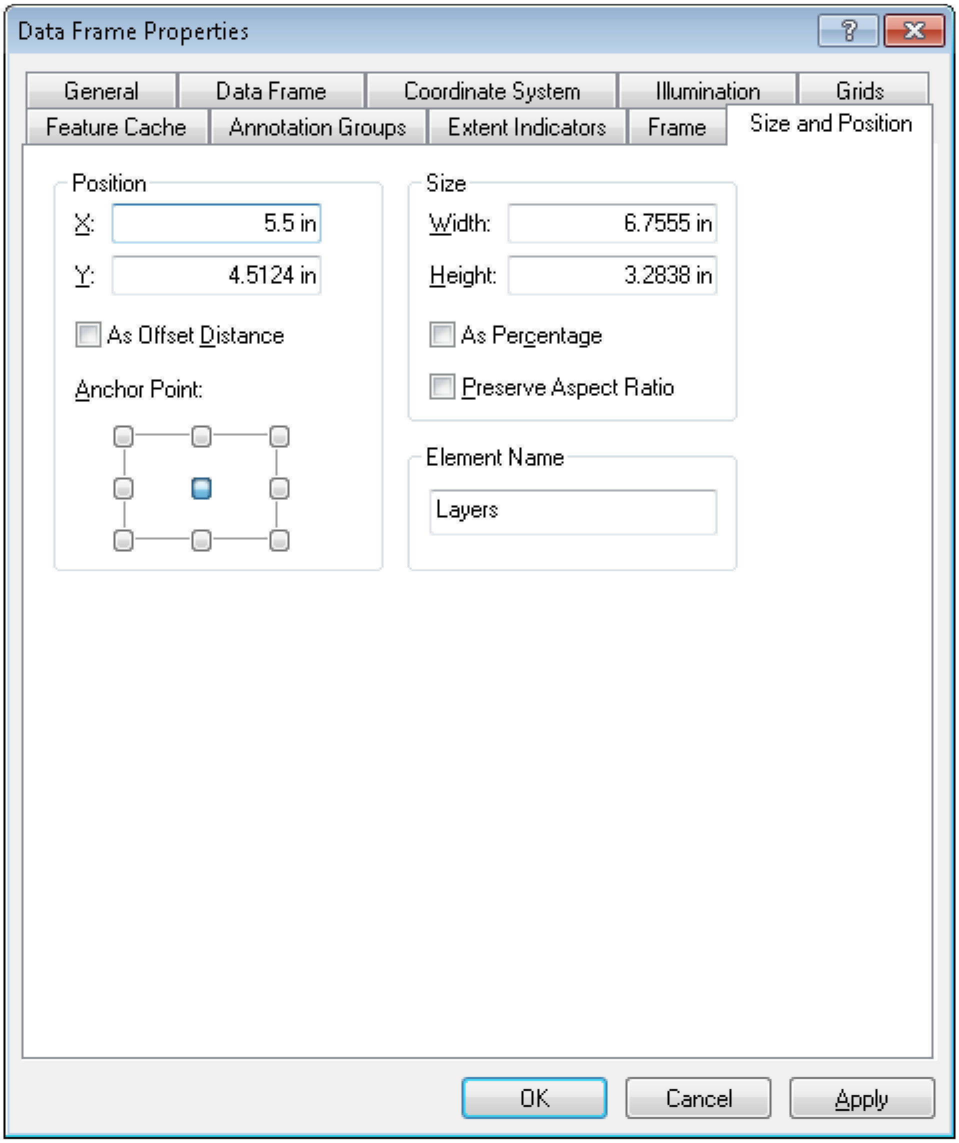
You’re finally ready to start preparing the actual layout.

Preparing the Layout

The points shapefile layer can be unchecked, as it will not be included on the final map. Click on the layout button to the bottom left of the map. 

Change the page layout to landscape by clicking File → Page and Print Setup, then click “Landscape” in the middle of the window. Click “OK”.

Right click on the data frame (the frame where the map is), select Properties, and go to the Size and Position tab. The position and size coordinates should be as follows (ensure that the centre anchor point is selected):

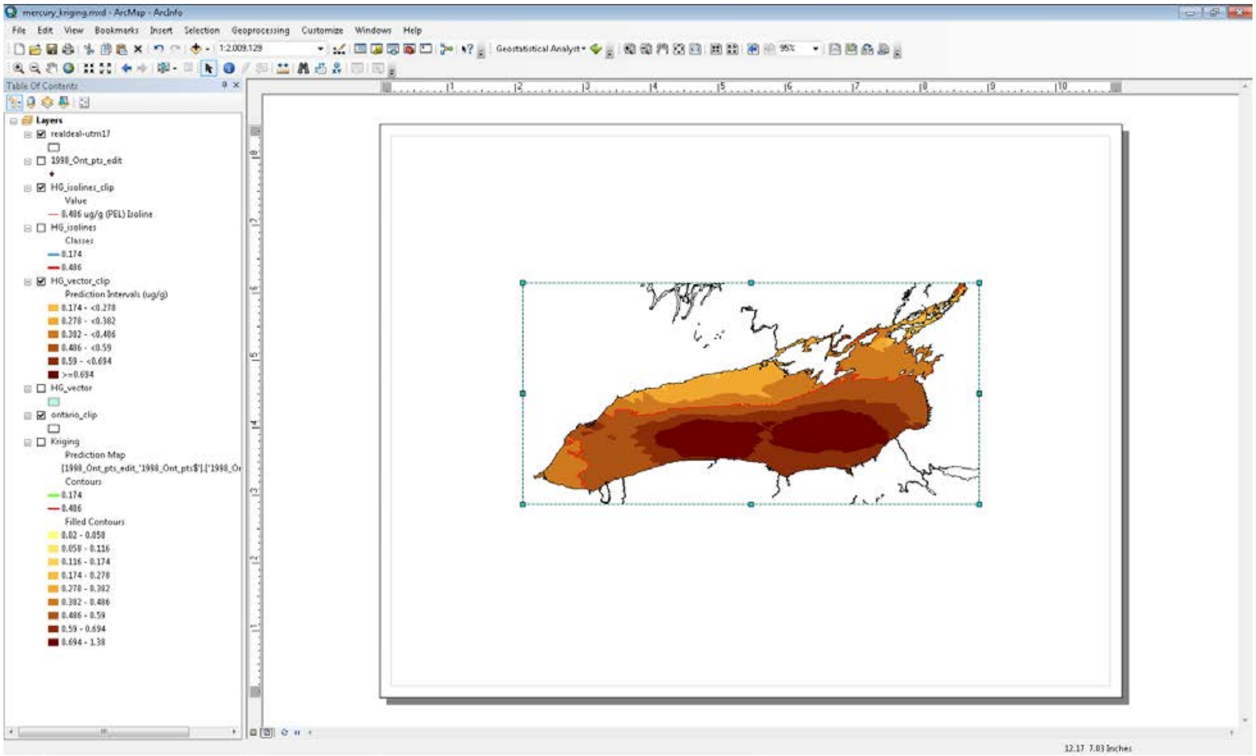


Click “OK”

On the Standard toolbar, change the zoom to 1:2,009,129.

Using the Pan tool (on the Tools toolbar), the map may need to be moved slightly.

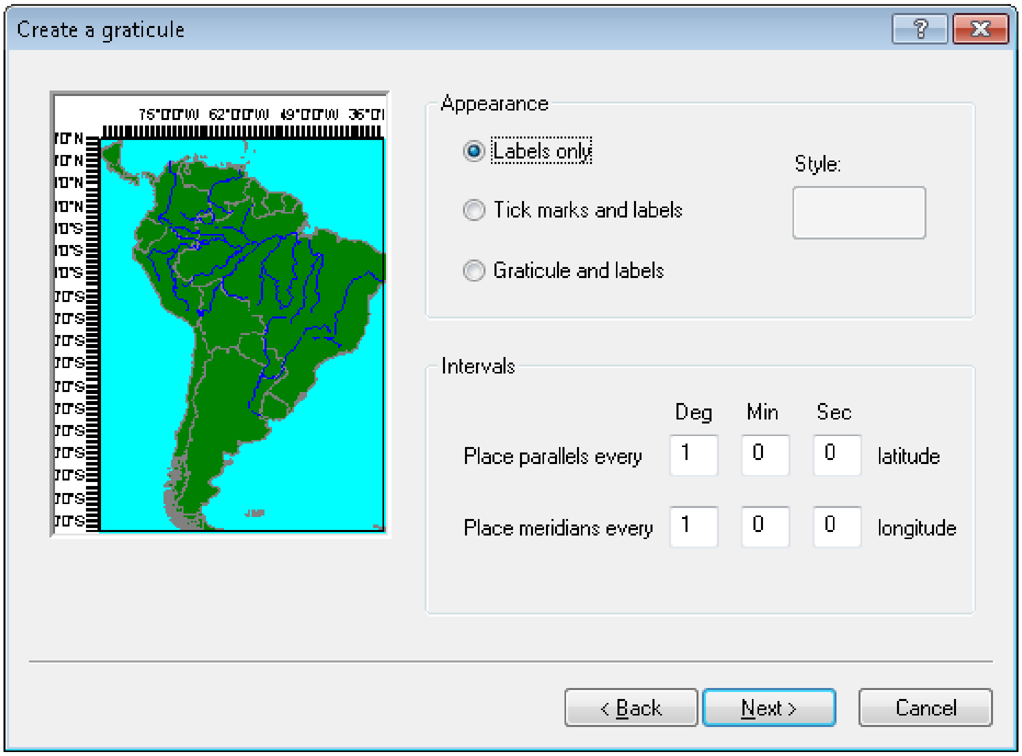
So far, the layout should look like this:



Go back into the Data Frame Properties (right click on the data frame and select Properties), and go to the Grids tab.

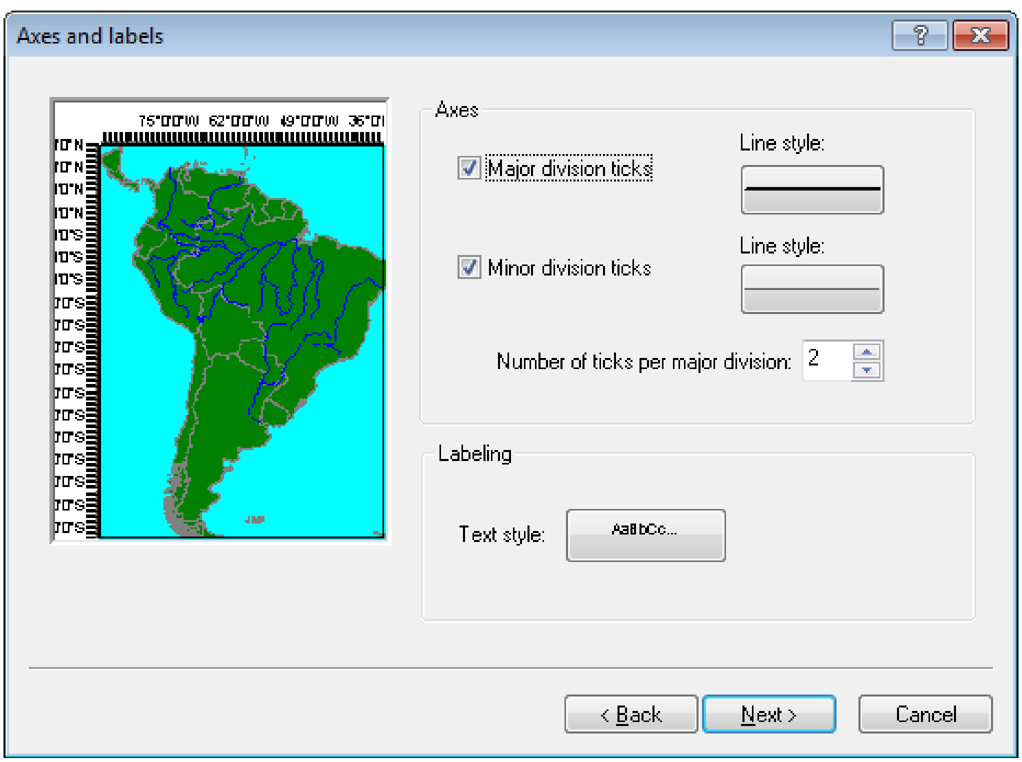
Click the “New Grid” button. Select Graticule, then “Next”.

In the Create a graticule window, select “Labels only” and change the Intervals to 1 degree for both parallels and meridians.



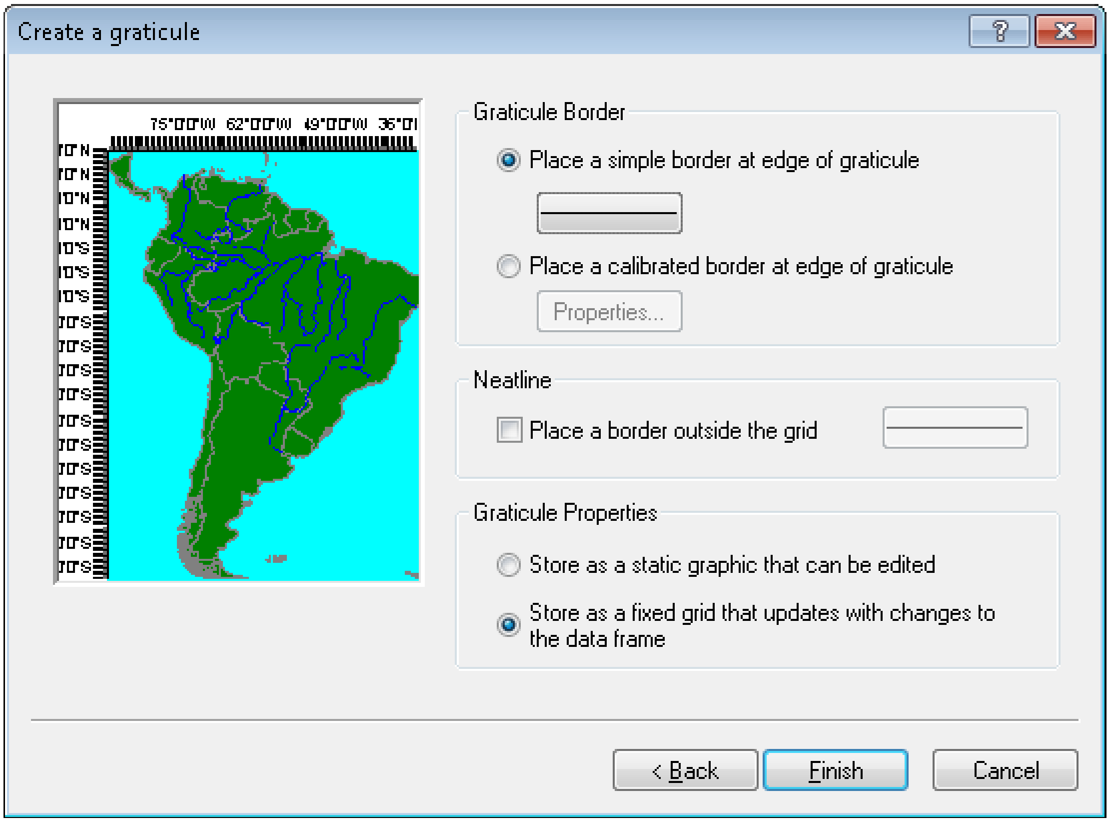
Click “Next”.

In the Axes and labels window, change the “Number of ticks per major division” to 2.



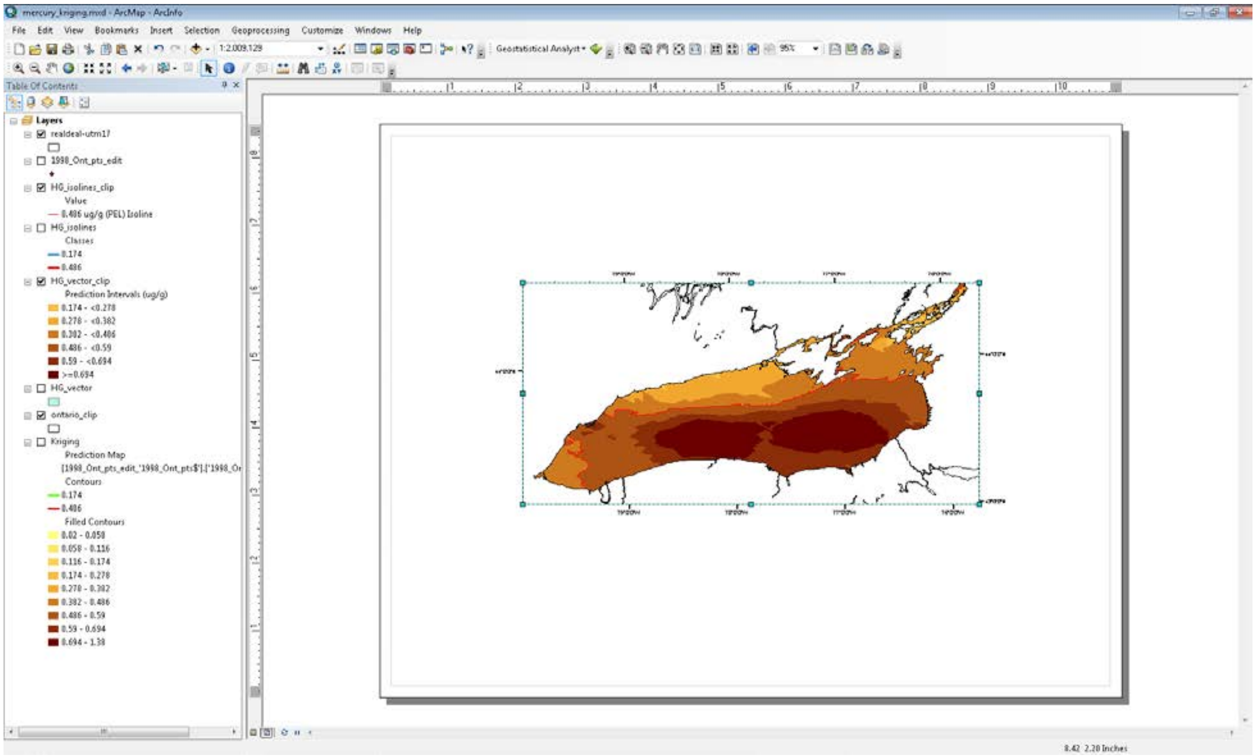
Click “Next”.

Select “Place a simple border at edge of graticule” and click on the button below to adjust its properties. Change the width of the line from 1.5 to 0.5.



Click “Finish”.

In Data Frame Properties, Click “OK”.



The title, legend, scalebar, and north arrow can now be added.

To add the title, go to Insert → Title

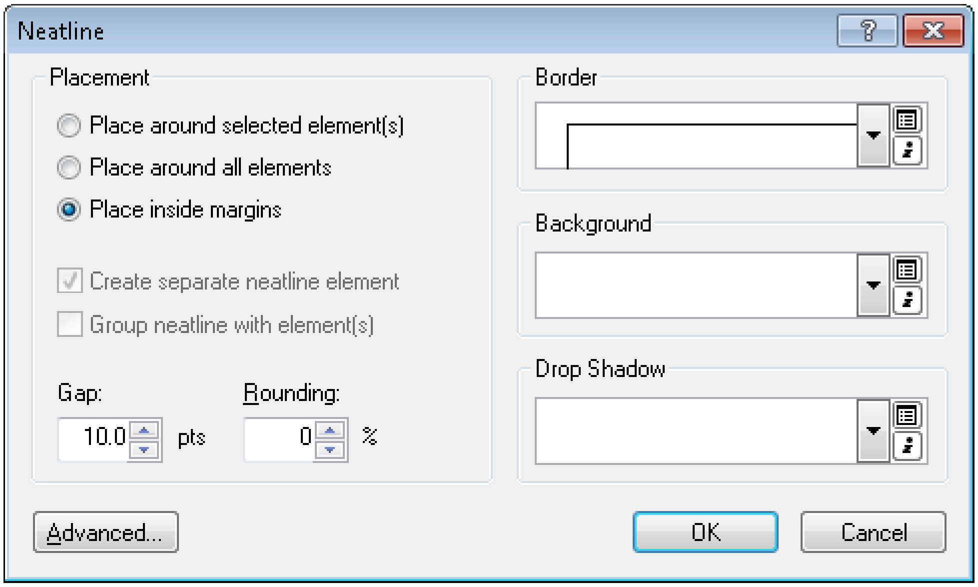
Change the title to, for example, 1998 Lake Ontario Mercury Concentrations. Click “OK”.

Double click on the text to open the Properties window. In the Text tab, click the Change Symbol button, and change the font to Times New Roman 18pt bold. Click “OK”.

Go to the Size and Position tab, ensure that the central Anchor Point is selected, and change the X and Y Position coordinates to X: 5.5, Y: 6.63.

Click “OK”.

To insert the Neatline, go to Insert → Neatline. In the Neatline window, select “Place inside margins” and ensure that the “Gap” is 10 pts. Change the “Background” colour to “Hollow” using the dropdown menu. Click “OK”.



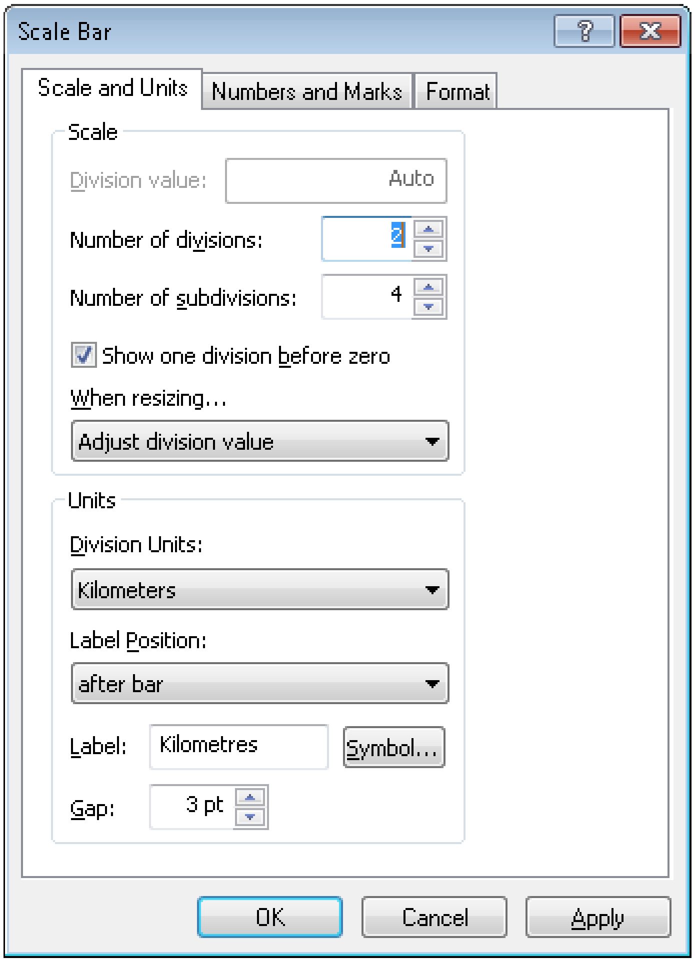
To insert the scale bar, go to Insert → Scale Bar. In the Scale Bar Selector window, click "Alternating Scale Bar 2".

Click the "Properties" button in the Scale Bar Selector window.

In the "Units" box in the Scale and Units tab, change the "Division Units" to "Kilometers". In "Label" change "Kilometers" to "Kilometres" (we are Canadian, after all). In the "Scale" box of this window, check off the "Show one division before zero" box, and change the "Number of divisions" to 2 and the "Number of subdivisions" to 4.

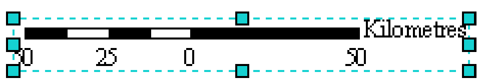
Go to the Format tab, and change the font to Times New Roman

Click "OK", and "OK" again in the Scale Bar Selector window.



Click the scale bar and drag it to below the data frame.

With the scalebar selected, adjust the width until the major division (on the right) is 50 km by clicking and dragging the box on the middle right or left.

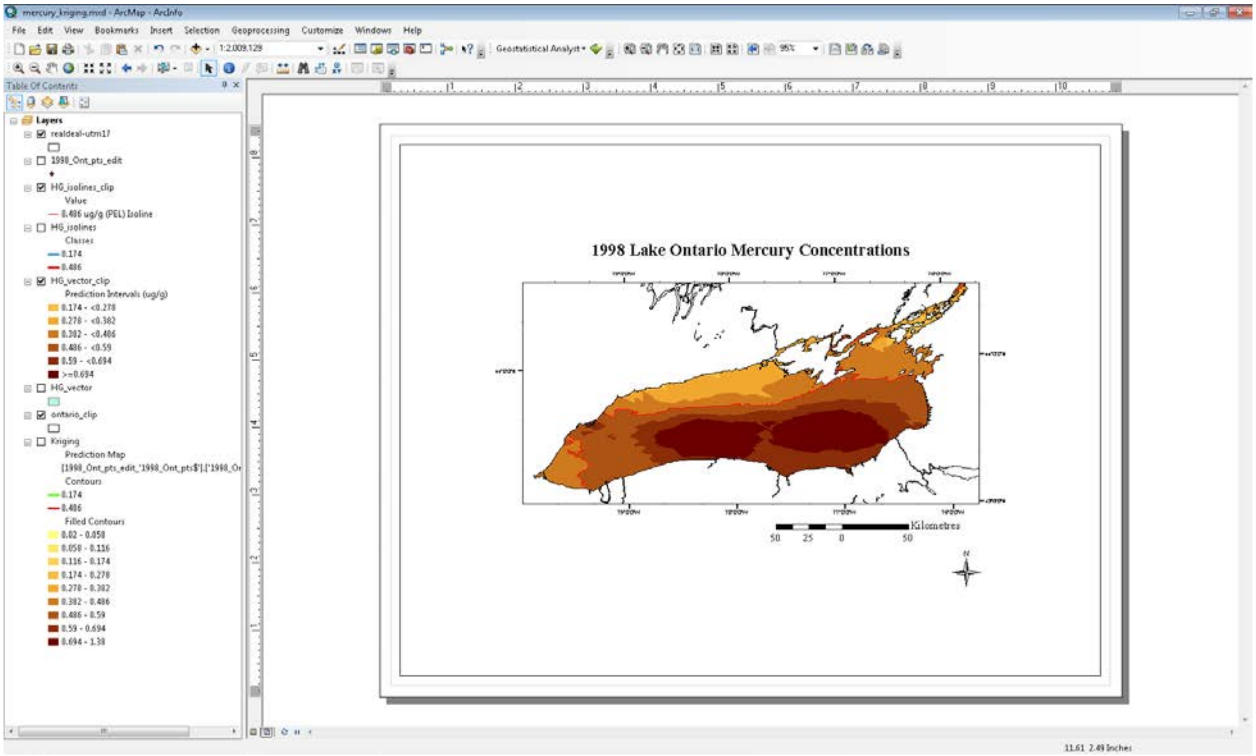


Double click on the scale bar to open the "Alternating Scale Bar Properties" window. Go to the size and position tab, and change the Position coordinates to X: 7.2, Y: 2.45, ensuring the central Anchor Point is selected. Click "OK".

To insert the north arrow, go to Insert → North Arrow. Select "ESRI North 1" and hit "OK".

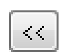
Double click on the north arrow to open the North Arrow Properties window. In the Size and Position tab, change the position to X: 8.7, Y: 1.9, again ensuring the central Anchor Point is selected. Click "OK".

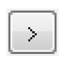
The layout should now look as follows:

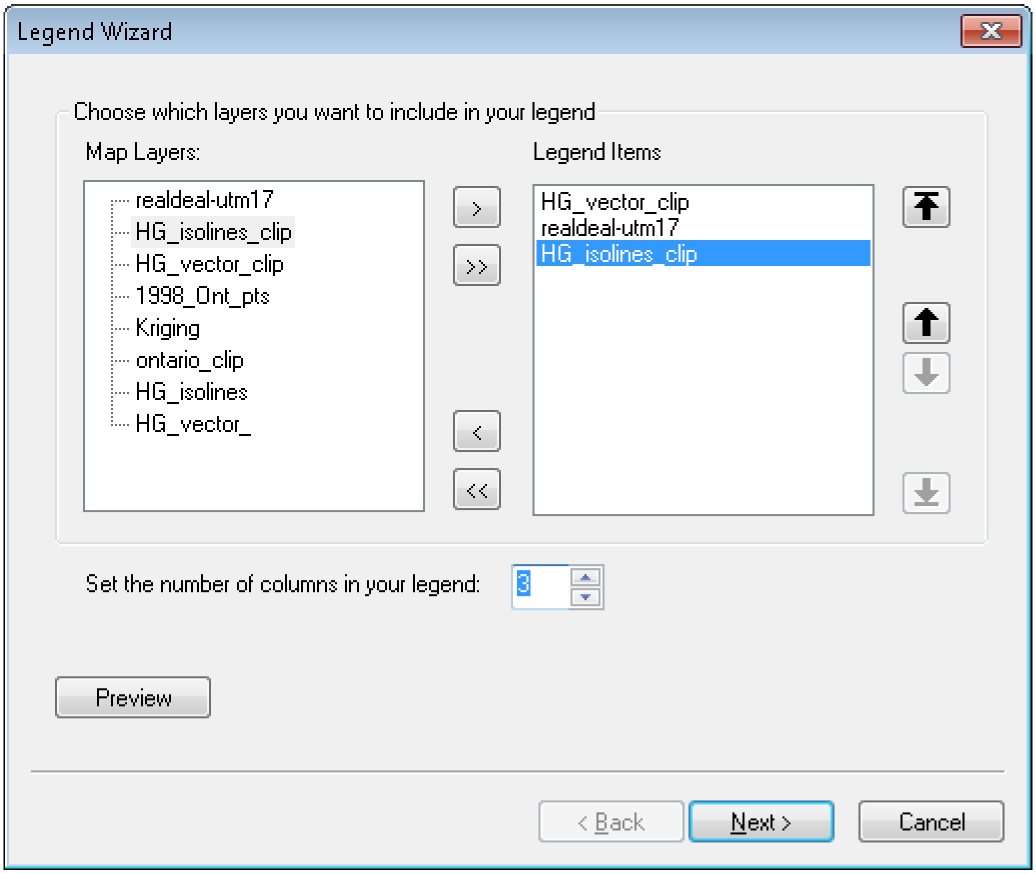


Adding the Legend

To put the legend in, go to Insert → Legend.

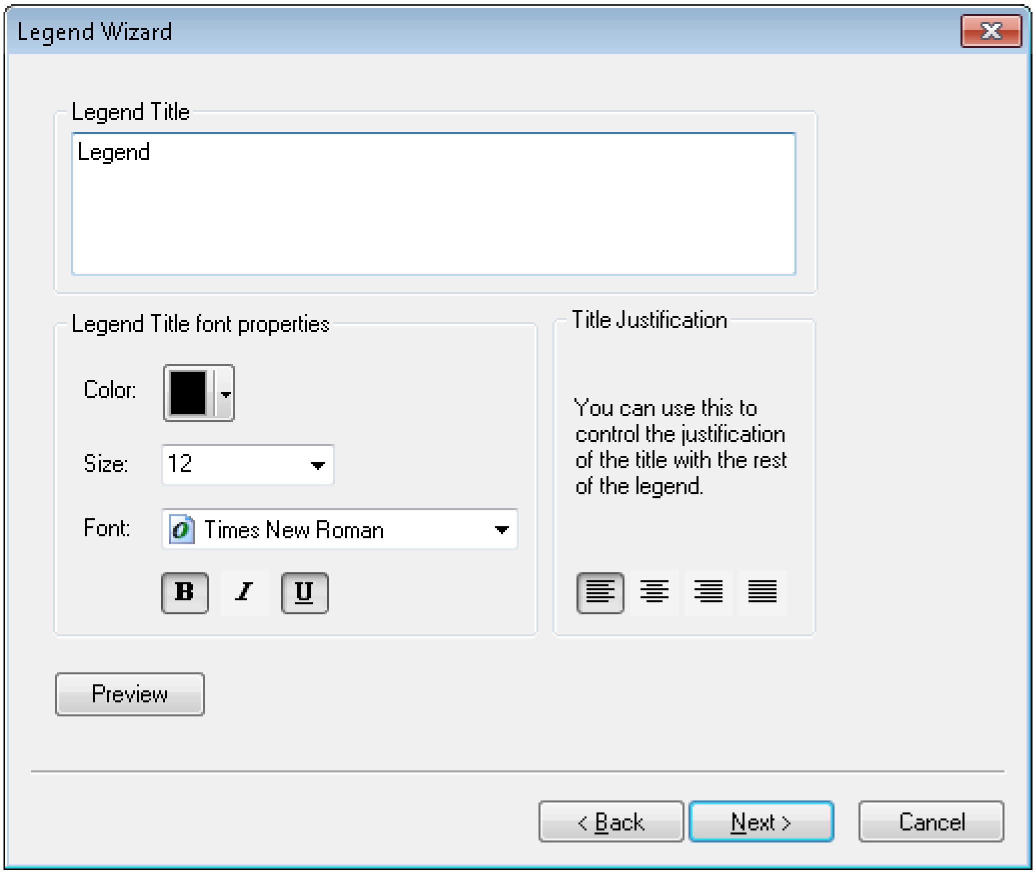
Remove all items in “Legend Items” by clicking the  button.

In “Map Layers” select HG_vector_clip and hit the  button to add it to “Legend Items”. Do the same with realdeal-utm17 (the shoreline vector – don’t ask about the naming), and HG_isolines_clip. Change the “Set the number of columns in your legend” to 3.



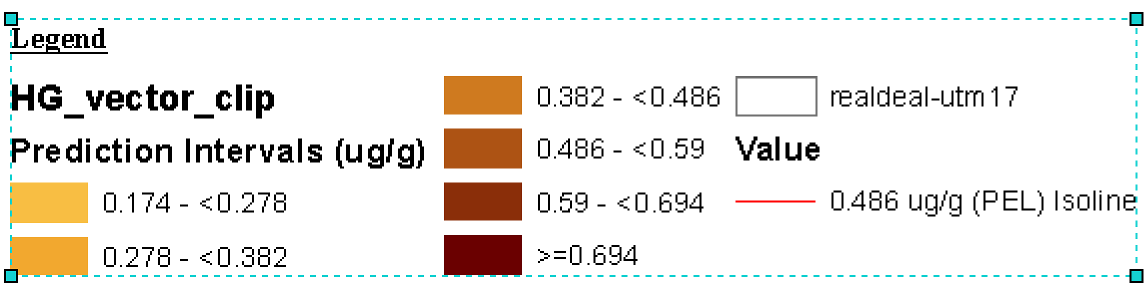
Click “Next”

In “Legend Title font properties” change the “Size” to 12, the font to Times New Roman, and make it bold and underlined.



Click “Next” until you get to the final window of the Legend Wizard, and finally click “Finish”

Move the legend to below the dataframe, and not on top of the scale bar or north arrow. The legend should currently look like this:



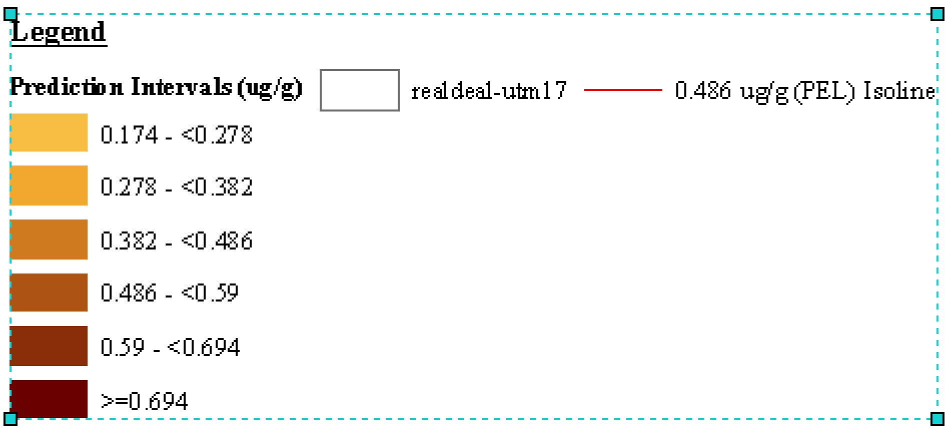
Double-click the legend to open the Legend Properties window. Under the “Items” tab, make sure each Legend Item has the “Place in a new column” box checked, and the “Columns:” for each is set at only 1 (both at the right of the window). In Legend Items, double click on HG_vector_clip, opening the Legend Item Selector window. Click the “Properties” button.

In the General tab, deselect “Show Layer Name”. Click the “Heading Symbol” button, and change the font to Times New Roman 10 pt bold, and click “OK”. Click the “Label Symbol” button, and change the font to Times New Roman 10 pt, and click “OK”. Click “OK” in the Legend Item window, and “OK” in the Legend Item Selector window, returning to legend properties.

Double click realdeal-utm17 in Legend Items. Using the same process, ensure that only “Show Labels” is selected and change the Label Symbol to Times New Roman 10 pt.

Do the same for HG_Isolines_clip.

The legend should now look like this:

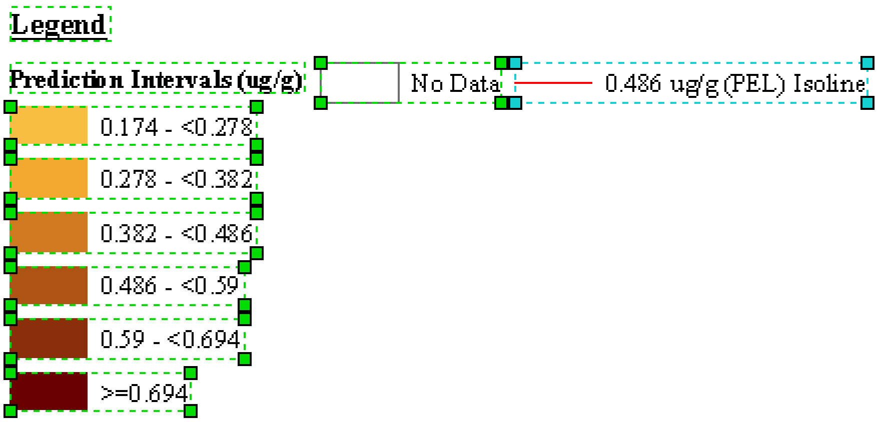


In the Table of Contents, click the Layer Name of the realdeal-UTM17 layer and change it to “No Data”. This provides the No Data symbol for the legend – a kind of round-about way of doing things, but it works…

Check to make sure that everything in the legend is correct – prediction intervals, labels, etc. and make any changes necessary.

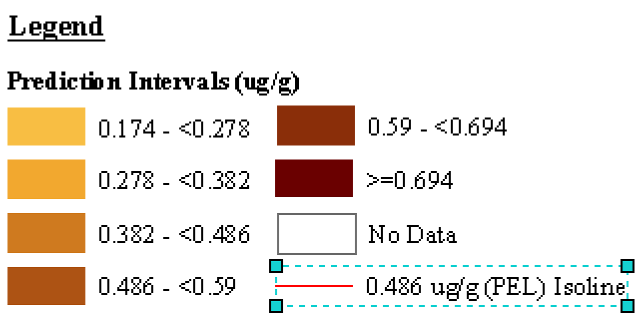
Once the legend is correct, right click on it and click “Convert to Graphics”. Right click on it again and click “Ungroup”.

The legend should now look like this:



You will want to use 4 rows of symbols (5 if there are a lot of classes). What you will need to do to properly organize the legend is first, move the No Data and Isolines out of the way for the time being by selecting and dragging them.

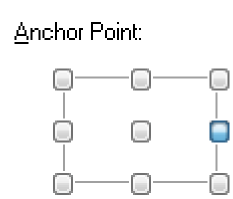
Next, in this case, you will want to move the fifth class, 0.8 -<1.0 to the top of the second column. Next, move No Data under the 0.8 - <1.0 class, and the isoline(s) below this (it may be necessary to have more than two columns, depending on the number of classes and isolines):



To ensure that all the items are properly aligned vertically, use the Y coordinates from items in the left column and copy and paste these page coordinates to those in the other columns. For example, to ensure alignment of the Isoline, in this case, double click on 0.486 - <0.59 opening the Properties window, highlight and copy the Y Position coordinate, ensuring that the Anchor Point is centred vertically. Close down this Properties window (hit "Cancel") and double click the Isoline item, opening its property window. Highlight the Y Position coordinate and paste the new one (from 0.486 - <0.59). Hit "OK". Repeat this for all remaining items.

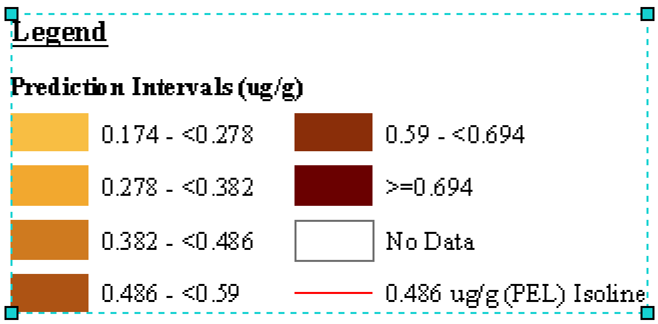
To ensure the proper spacing of columns, open the Properties window of the longest item in the left column. Select right-central Anchor Point:

Add 0.2 inches to the X Position Coordinate (ie. 3.281592" in becomes 3.481592"). Copy this coordinate, and hit "Cancel" in the Properties window (you don't actually want to



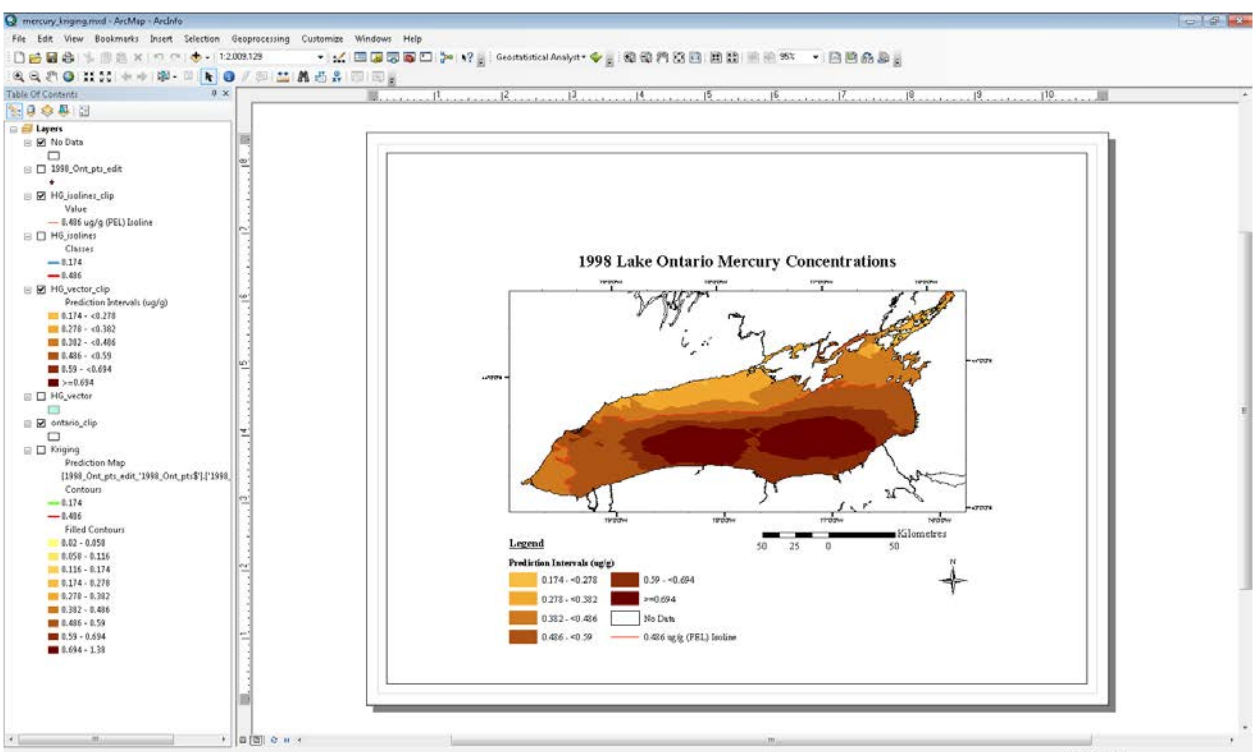
apply this change to this legend item). Open the first legend item in the column to the right, change the Anchor Point to the left-central point. Paste the coordinate that you copied from the left column to the X Position coordinate of this item. Repeat this for all legend items in this column. If there are more than two columns in the legend, these steps will need to be repeated.

Select all legend items, right click, and select “Group” to group them back into one element (this ensures that no items will be accidentally moved relative to each other).



Double click on the legend, opening its Properties window. Change the Anchor Point to the top left, and change the X Position coordinate to 2.122244 in (aligned with the left extent of the data frame), and the Y Position coordinate to 2.5. Click “OK”.

At this point, you will probably want to save your work (since the layout is now complete) if you haven’t done so already.



Go to File → Save (or Save As)…you know the rest…

This will save it as an .mxd file, so your layout and attributes will all be saved.

Advanced Layout

These Position coordinates will change, depending on the size of the map that is being produced. Generating these coordinates is not an easy task, and requires a lot of trial and error to achieve the proper size and layout of everything.

The sizes that have been produced already are 11.5cm, 13cm, and full page (ie. for Powerpoint presentations).

To change maps to the 11.5 cm or 13 cm sizes, the full page map must first be produced. Change all of the Position Coordinates and sizes ("Width" and "Height" in the Properties windows) to those included in FullPageXY.xls.

With full page maps made, the first step in making 11.5 cm or 13 cm maps is to change the page layout to portrait (File → Page and Print Setup…). Delete the neatline. Then, select all of the elements on the layout (title, dataframe, legend, north arrow, scale bar), right click and open the Common Properties for All Elements window. In the Size and Position tab, change the "Width" to i.) 4.2" for the 11.5 cm, or ii.) 4.75" for 13 cm.

Deselect all elements, and go into the Data Frame Properties window. Click on Grids, and click "Properties". Go to the Labels tab, and at the bottom, in the Label Orientation box, check off Right and Left. Hit "OK" and "OK".

With this done, change all Position coordinates and sizes to those in 11-5cmXY.xls and 13cmXY.xls.

It is important to keep in mind that when you reopen mxd's, ArcMap often likes to slightly move the layout positions of the scale bar and north arrow. Check to make sure that these are correct before producing anything for publication.

To export maps as JPEGs or TIFFS, when in layout view in ArcMap, go to File → Export. Select the file type. Click the "Options" button and change parameters as necessary (ie. if creating a JPEG, using a minimum quality of 200 dpi).

In some cases, you may need to manually alter the colours of the vector files (especially when comparing data with different years or lakes). Some of these colour schemes have already been generated, and can be found in Colours.xls. To manually change the colours, click on the symbol that you want to change in the Table of Contents. This will open the Symbol Selector window. Click the Fill Colour dropdown menu, and click "More Colours" at the bottom. Adjust the RGB values accordingly.

For the Isolines, if producing B&W maps, change the PEL isoline to a solid black line by clicking on the line in the Table of Contents, opening the Symbol Selector window. Change the colour to black, and ensure that the Width is 1. For the TEL, change the symbol type to “Dashed 4:4” (you will need to scroll down through all of the symbols in the Symbol Selector window to find it). Change the colour to black and width to one.

Log Transformations (read all sections before performing)

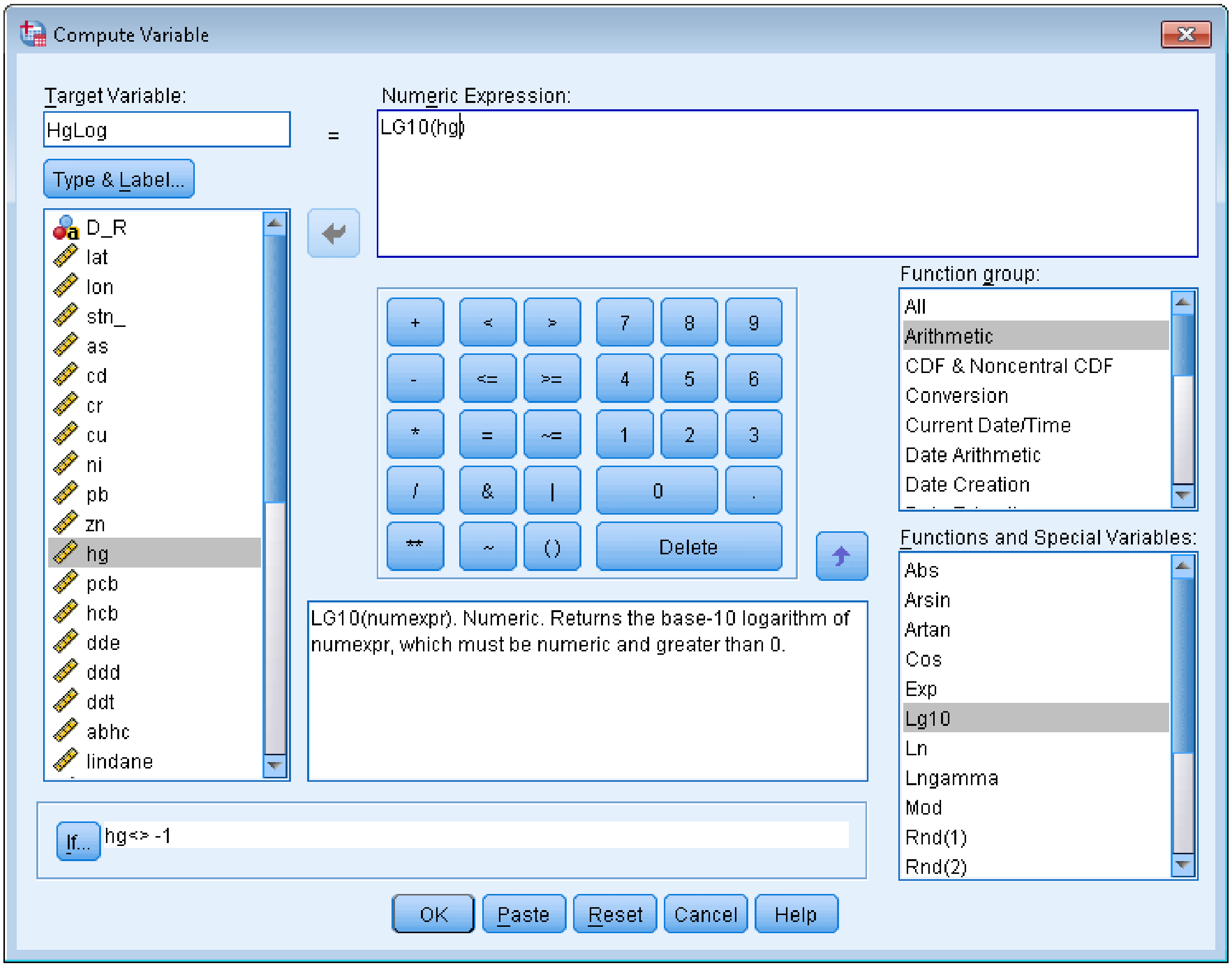
Log transformations are necessary when the value of the ASE is greater than 20. There is more to it than this but the previous statement can be used as a general rule. When the ASE is greater than 20, actual prediction values stray quite far from the original input values. To do the log transformations, <u>**do not**</u> use the log function within ArcMap. To do them, open up the .dbf file of the point data in SPSS.

*Use the original file, not the file with the missing values removed made in Preparing the Data.

In the Data View of SPSS, click on Transform → Compute Variable…. In the “Target Variable” box, enter a new variable name (ie. HgLog). In the functions, find “LG10” (found under Function Group: Arithmetic). Double click, and the function “LG10(?)” will show up in the “Numeric Expression” box, with the question mark highlighted. Replace the “?” with the variable that you want to perform the transformation on (double click the variable from the list in the left of the Compute Variable window).

Click on the “If…” button, and in the new window check off “Include if case satisfies condition:”. Double click the variable that you are performing the transformation on, entering it into the expression box. Type in “<> -1”. *Ensure that there is a space between ‘<>’ and ‘-1”*. Click “Continue”. This will stop SPSS from trying to log a negative value which, of course, is impossible.

In the Compute Variable window, click “OK”.



All of the new values will be input to the new variable that you defined, “HgLog”. However, there will be some blank spaces where there was a -1 in the original data. Fill in these spaces with -1s so that when you perform the kriging analyses on the data, these points will be omitted from the analyses. However, ensure that the points that had original data values of 0 (and not missing values) are returned to 0, and not counted as missing values (-1).

Also…when doing log-transforms, you need to do the following....

Missing values must be assigned (-1 or -9999) where the original data points have a value of 0. Reason: you can't log 0, so this will allow them to be omitted from the transformation. In some cases where a lot of 0’s are in the files….there may not be enough points left to do a kriging analysis on the log-transformed data.

Note: -1 is the number for missing values in the contemporary Erie and Ontario datasets….-9999 is used in all other files.

Click on File → change the type to .dbf, and overwrite the original dbf. It may be necessary to repeat the steps in the Preparing the Data section found at the beginning, since loading the original .dbf into ArcMap may result in the missing values being reverted into zeros, rather than blank cells. After performing the log transformation on the selected contaminant(s), repeat the steps in Preparing the Data before performing the kriging analysis.

When running the kriging analysis, be sure to remember which log values represent which non-log values so that the legends can be altered as necessary, i.e. log numbers would be represented by their non-log equivalents in the map legend.