

Creating Contours with ArcMap and ArcScene

Digital elevation models (DEMs) are geospatial datasets that contain elevation values sampled according to a regularly spaced rectangular grid. They can be used in terrain analysis, 3D visualizations, and hydrological modelling, among other applications. DEMs can be stored in several different formats; however, conversion into a raster dataset is often required for many processes. This tutorial explains how to derive contours from DEMs using ArcMap and ArcScene.

To download a DEM file from www.geogratis.ca, as was done in this tutorial, follow this guide: <http://mdl.library.utoronto.ca/guides-help/how-to-search-geogratis>

You may also find these guides helpful to look at as you work with DEM files:

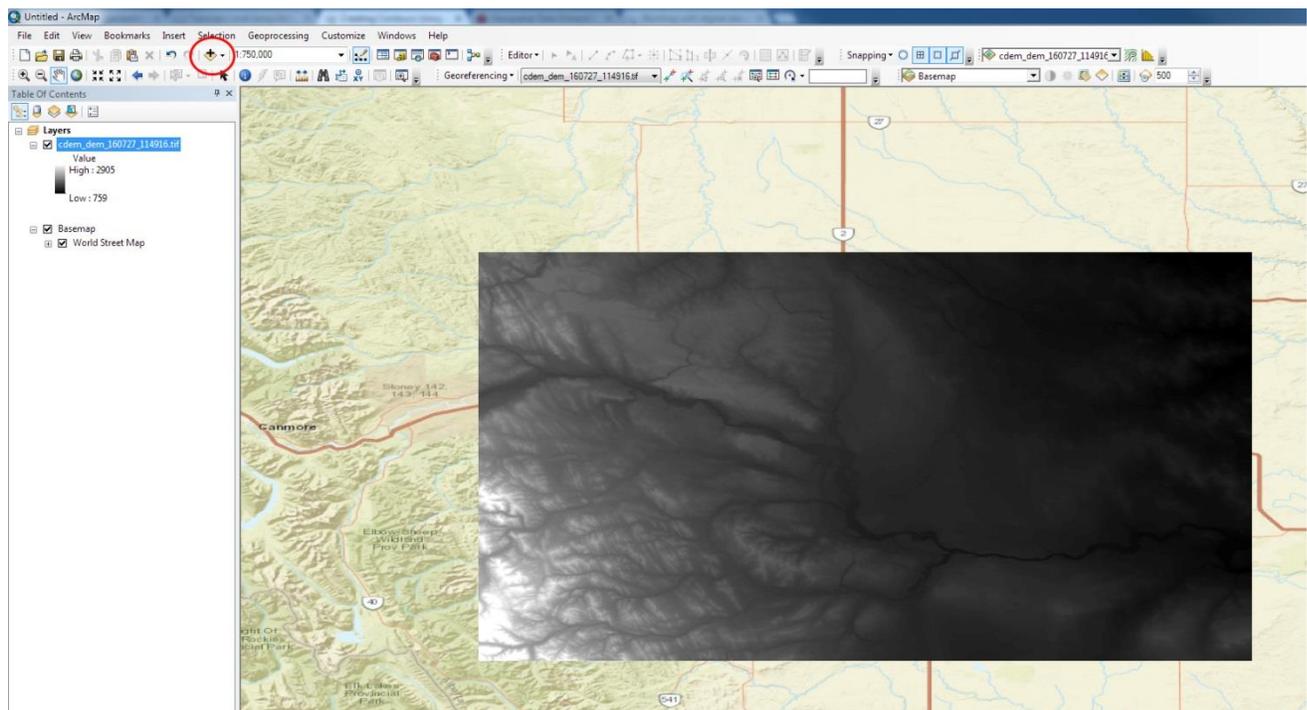
<http://mdl.library.utoronto.ca/guides-help/working-digital-elevation-models-arcgis>

<http://mdl.library.utoronto.ca/guides-help/selecting-right-projection>

<http://mdl.library.utoronto.ca/guides-help/projecting-data>

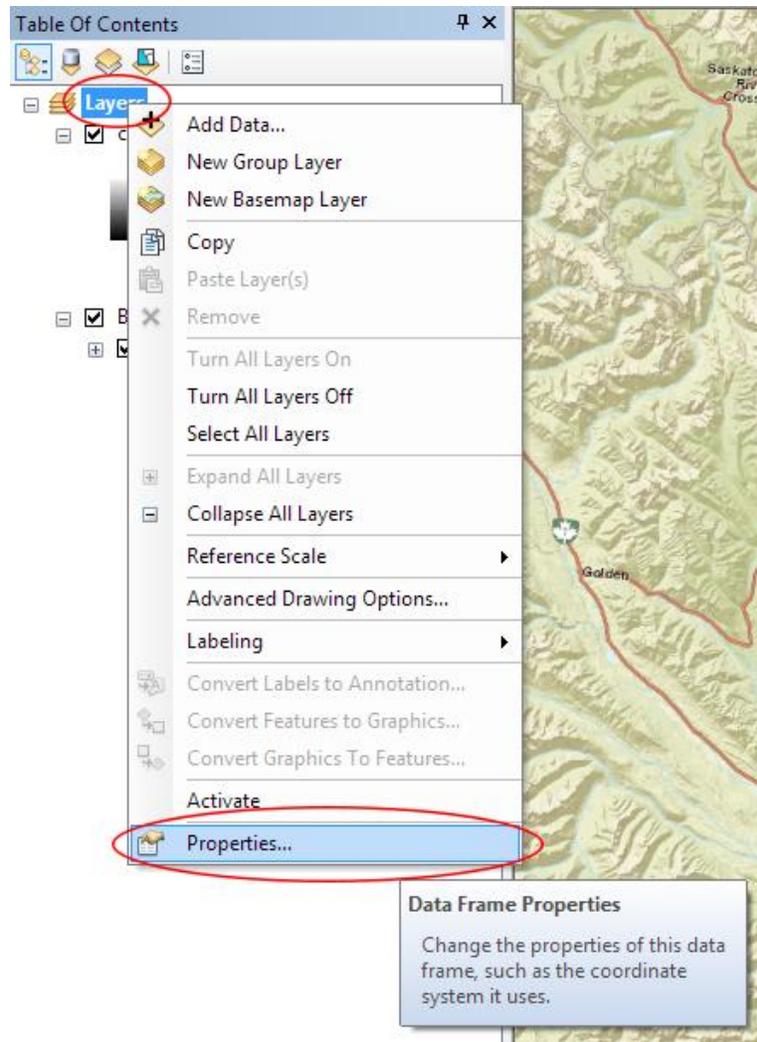
Creating Contours using ArcMap

1. Open your DEM file. You can do this by clicking the **Add Data** button  and selecting the file you downloaded from GeoGratis. You may find it helpful to ensure that the file is accurately projected and georeferenced – this can be done by adding a basemap. Click on the small black arrow beside the **Add Data** button to open the drop-down menu, then select **Add Basemap**. This is a representation of elevation in the Calgary area. The DEM file is in black and white laid over a route map of Alberta with topographic information on it. Depending on the area covered by your DEM, certain basemaps may be better suited than others. For DEMs, any basemap which shows elevation will be a good choice. For this example we used the basemap titled “Streets.”

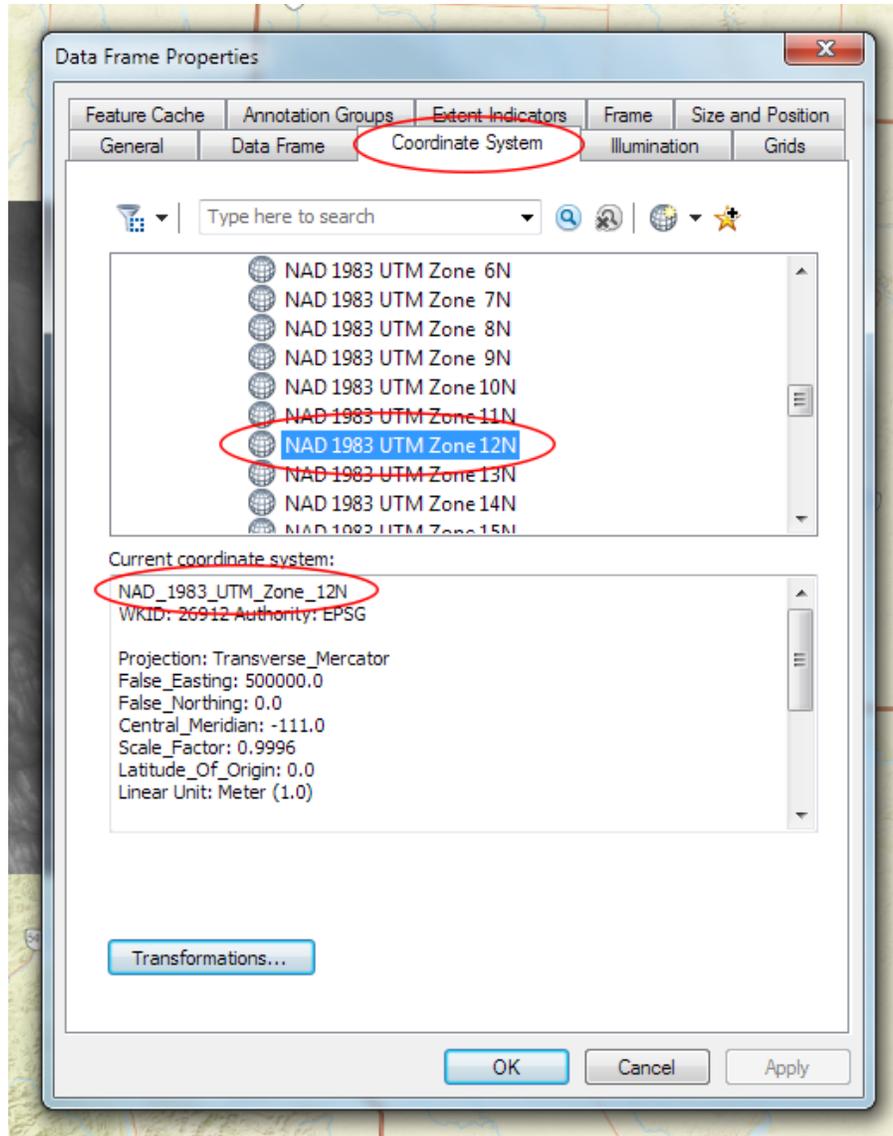


Troubleshooting Tips:

- If you are not able to find your folder while trying to add data, you may need to establish a new folder connection. You can do this by clicking the **Connect to Folder** button  on the Add Data window and then navigating to your folder.
2. Raster files, such as DEMs, are not projected when added to ArcMap, so you will need to set the projection before generating contours. Right click on **Layers** and then select **Properties** from the drop-down menu.



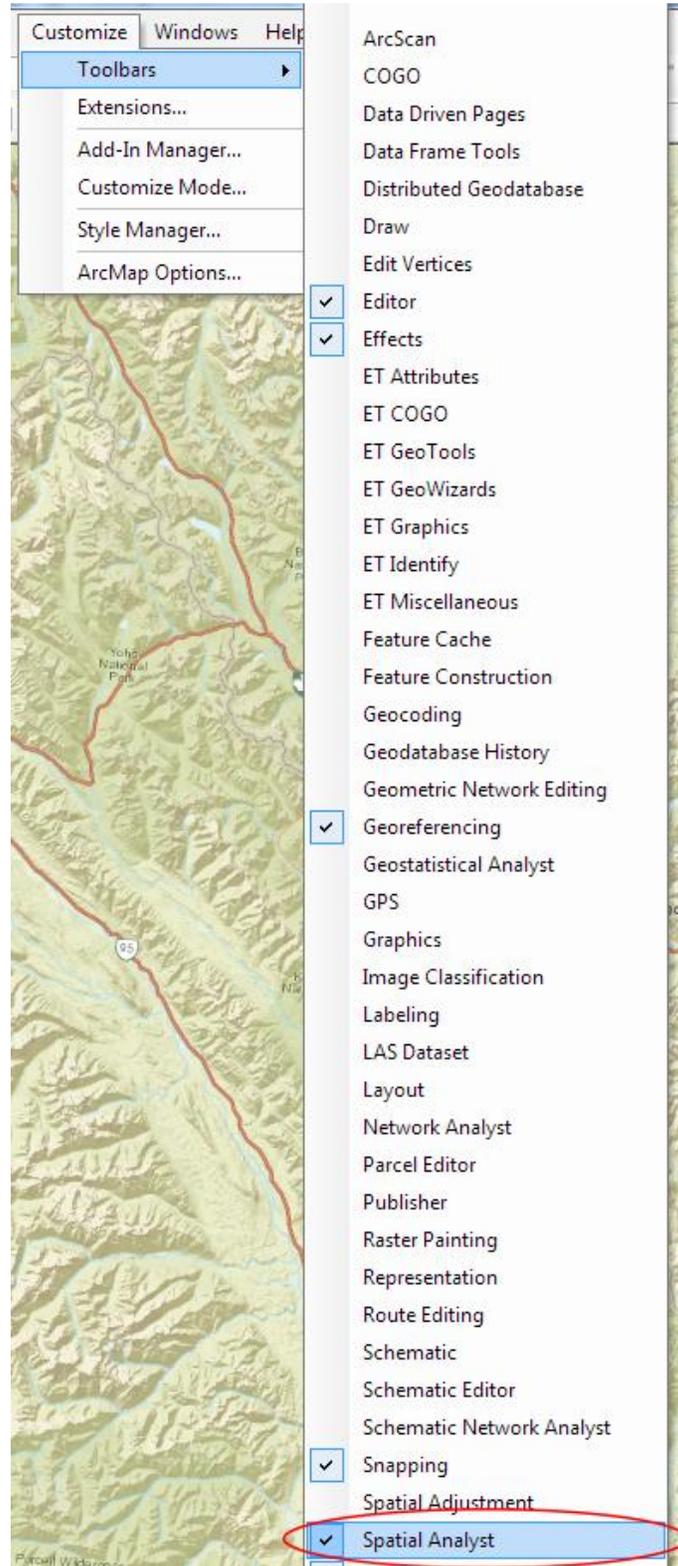
3. Within the Data Frame Properties window select the **Coordinate System** tab to ensure the correct coordinate system is selected. Most DEMs will have metadata that tells you which coordinate system to use. The Geogratias website outputs in NAD 1983 and Calgary is in zone 12N; therefore, this DEM is projected in NAD 1983 UTM Zone 12N.



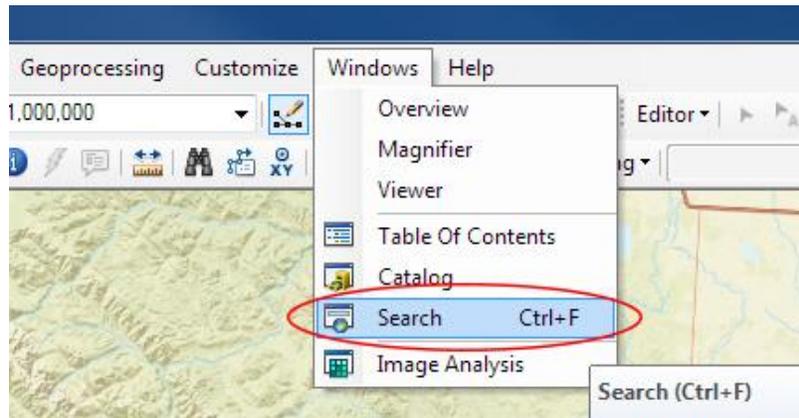
Troubleshooting Tips:

- If a different coordinate system is listed, you can select the correct one by navigating the folders: Projected Coordinate Systems > UTM > NAD 1983 > NAD 1983 UTM Zone 12N.

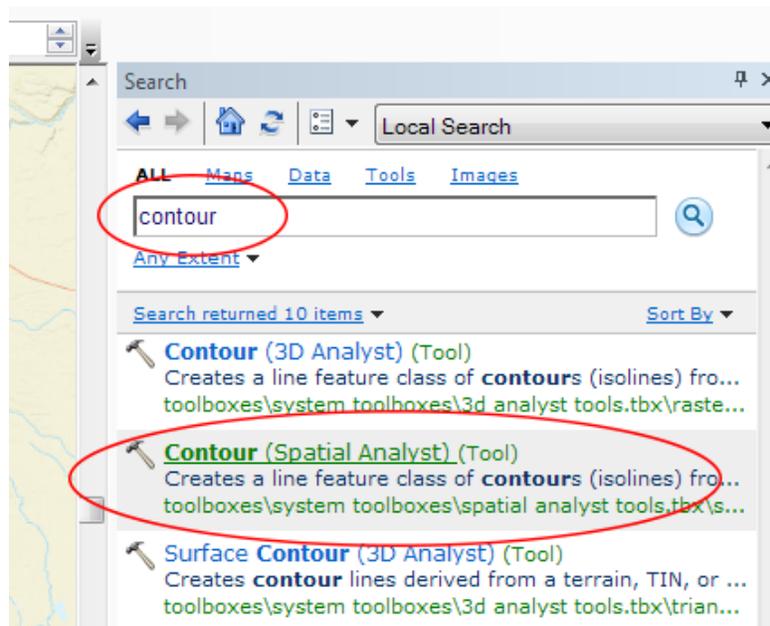
4. In order to create contours, you will need to enable the **Spatial Analyst** toolbar, which can be found by going to Customize > Toolbars > Spatial Analyst.



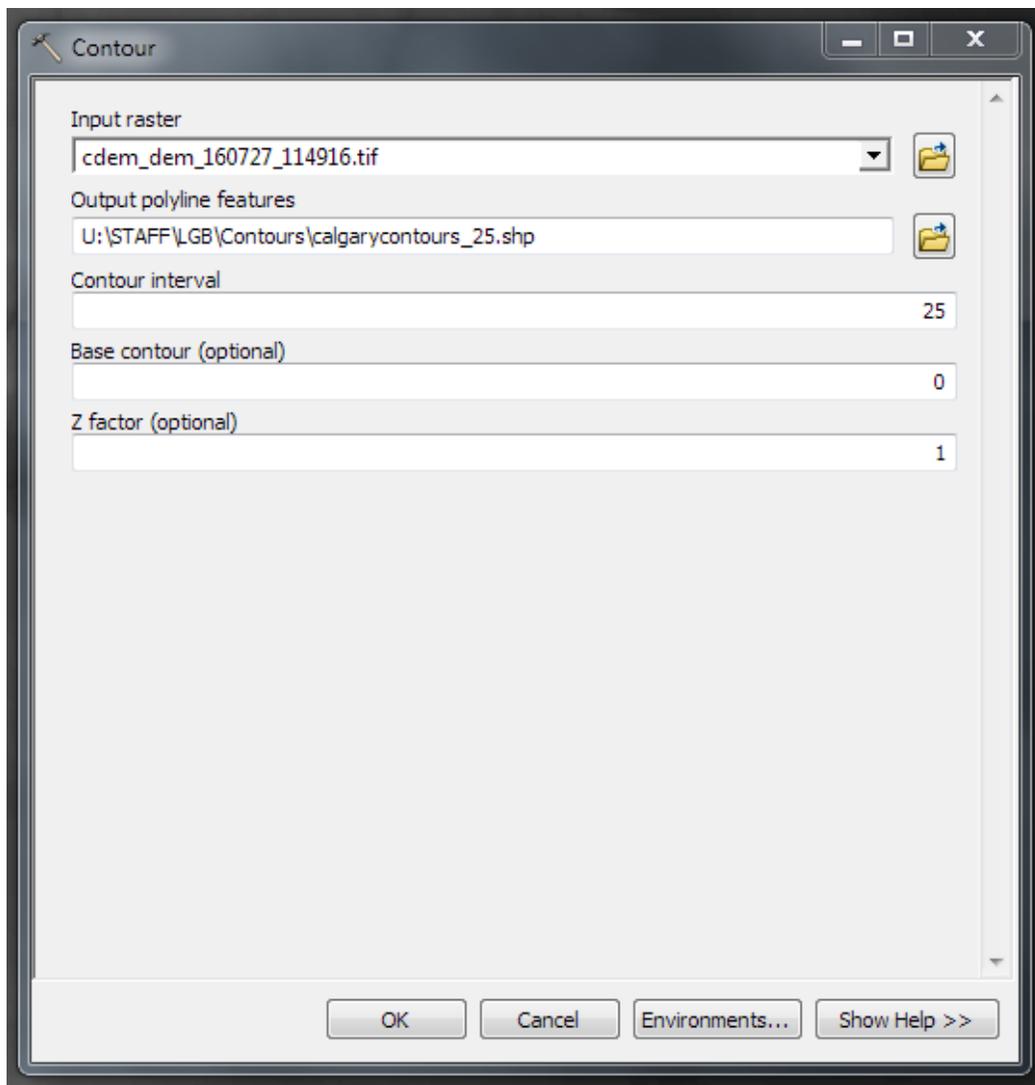
- Open the search bar. You can do this by clicking Windows > Search, or by clicking on the search icon .



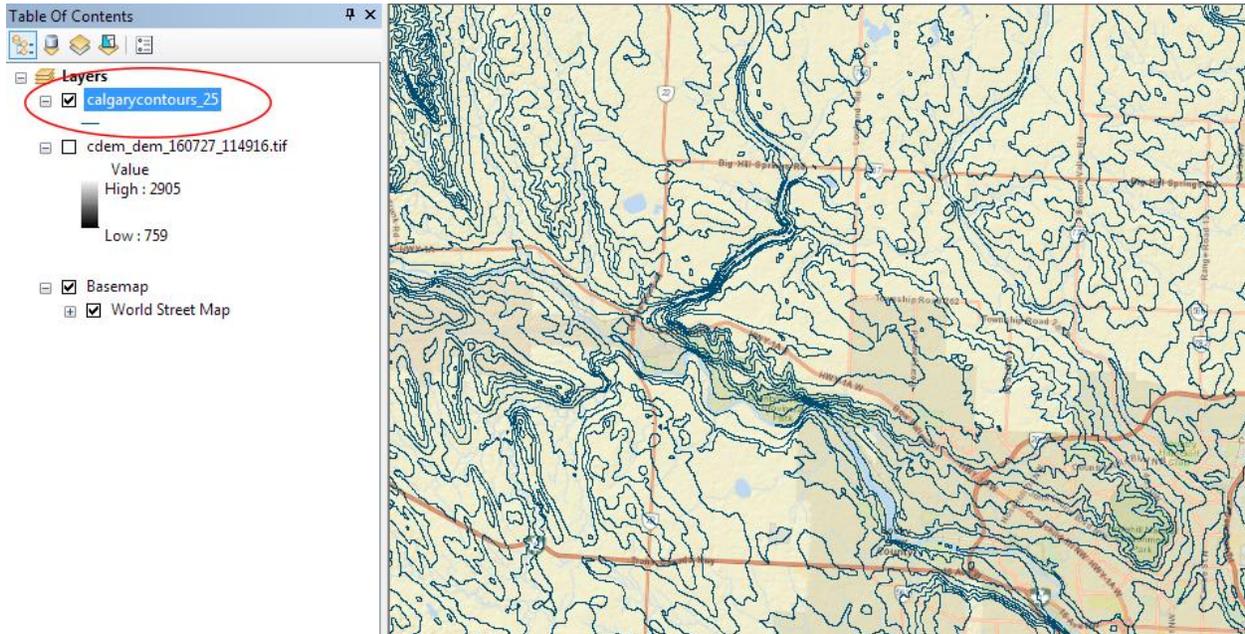
- In the search bar type **Contour**, and select **Contour (Spatial Analyst)** from the search results list.



7. After choosing **Contour**, a dialogue window will appear, prompting you for five settings:
- **Input raster:** select the DEM file from which you want to generate contours by locating it on your hard drive or in the dropdown menu, showing layers present in the Table of Contents
 - **Output polyline features:** indicate where you want to save your output contours
 - **Contour interval:** set the distance between contour lines in metres – the smaller the number, the greater the number of lines
 - **Base contour (optional):** the starting point from which the lines are generated – for example, the default is 0 so with an interval of 25 metres, the contours are generated at 25, 50, 75, 100..., but if the base contour is set at 40, then the contours are generated at 65, 90, 115, 140 and so on
 - **Z factor (optional):** can be used to adjust the units of data; for example, if you have data in metres and you want to produce your contours in feet, use a z-factor of 3.28 because 3.28 feet equals one metre



8. The generated contours will automatically be added to the map.

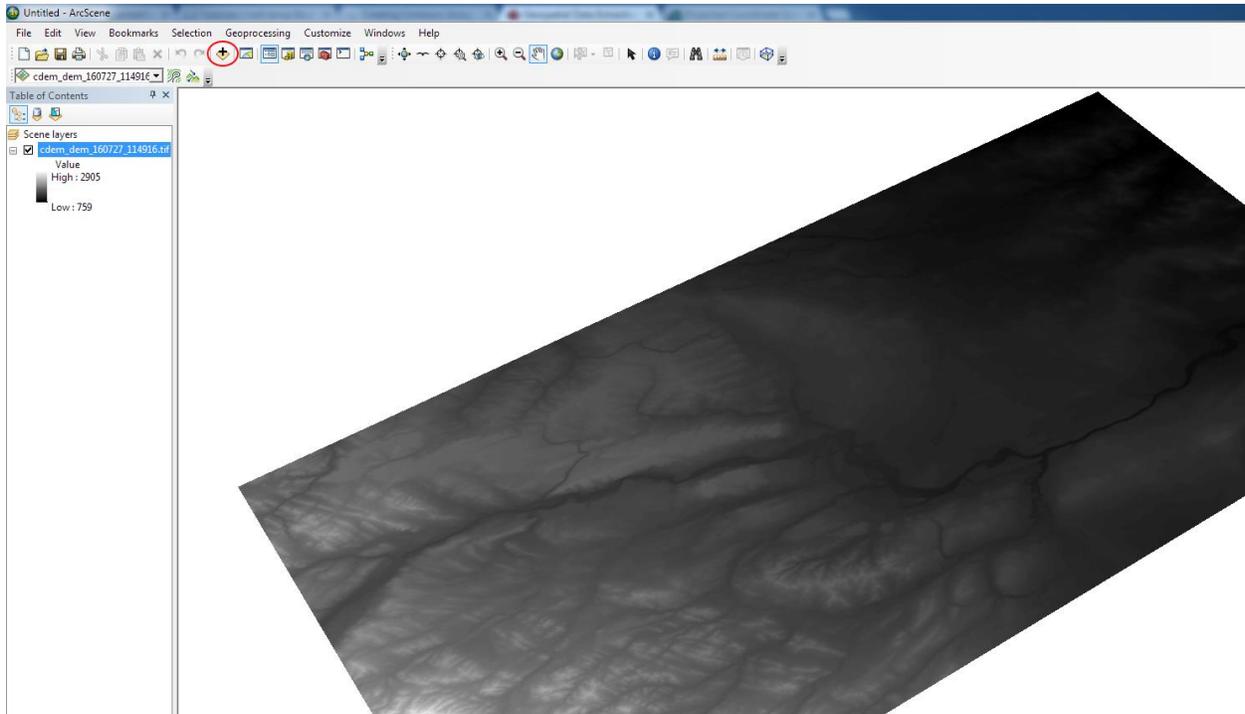


Troubleshooting Tips:

- Try experimenting with different contour intervals to find the one that works best for your needs. Always be sure to include the contour interval in filenames and any description of the image or polylines. The choice of contour interval is one that is informed by 1) how you will use the contours, 2) changes in elevation within the extent of the DEM, 3) input resolution of the DEM, and 4) storage capacity on your computer.

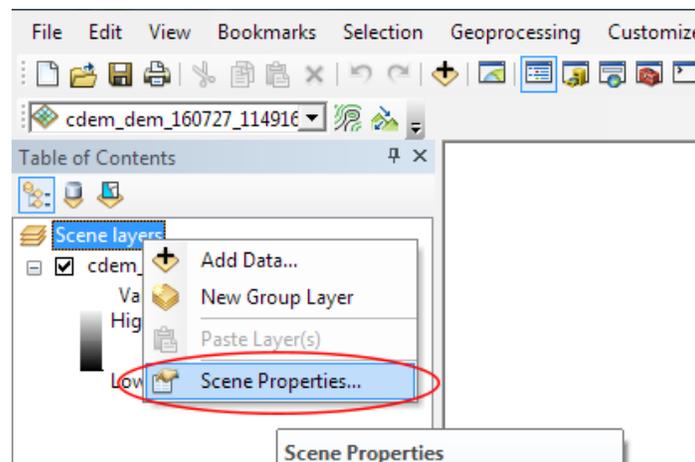
Creating 3D contours using ArcScene

1. Open your DEM file. This is a representation of elevation in the Calgary area. You can do this by clicking the **Add Data** button  and selecting the file you downloaded from GeoGratis.

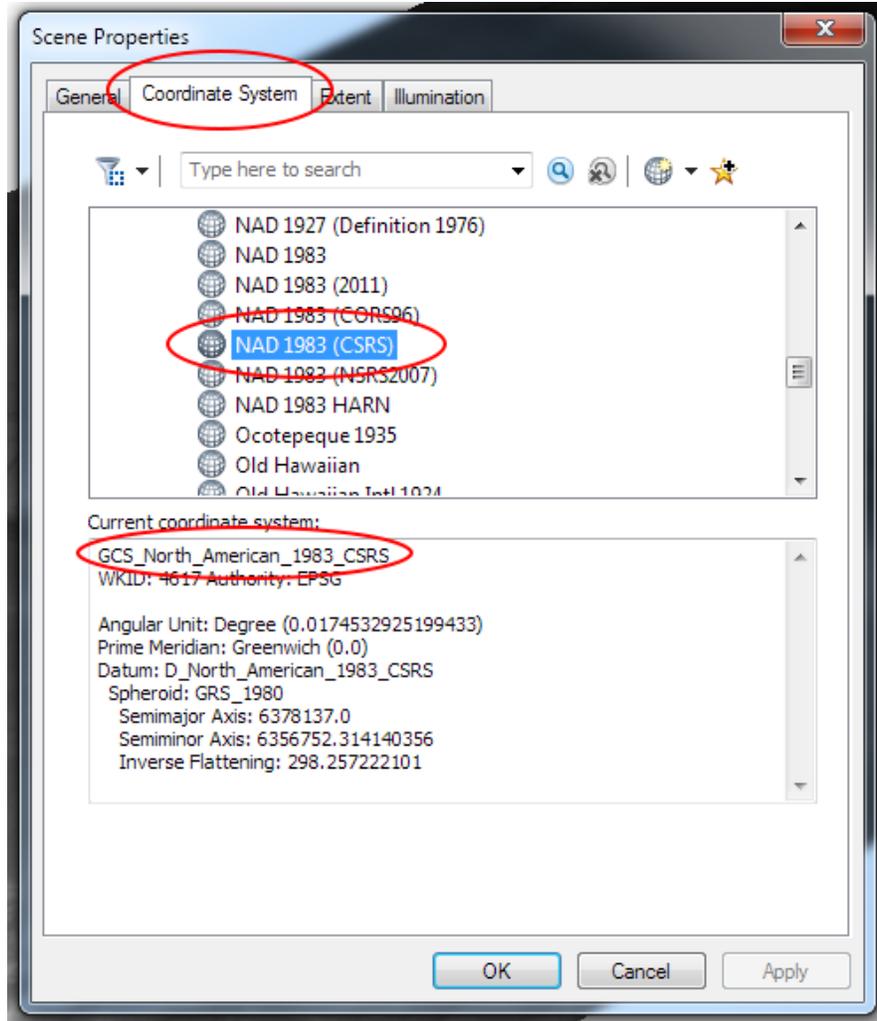


Troubleshooting Tips:

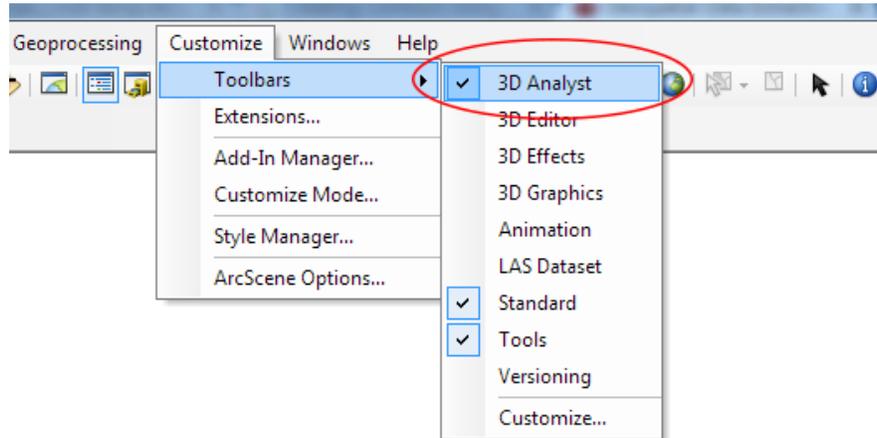
- If you are not able to find your folder while trying to add data, you may need to establish a new folder connection. You can do this by clicking the **Connect to Folder** button  on the Add Data window and then navigating to your folder.
2. Raster files, such as DEMs, are not projected when added to ArcScene, so you will need to set the projection before generating contours. Right click on **Scene Layers** and select **Scene Properties**.



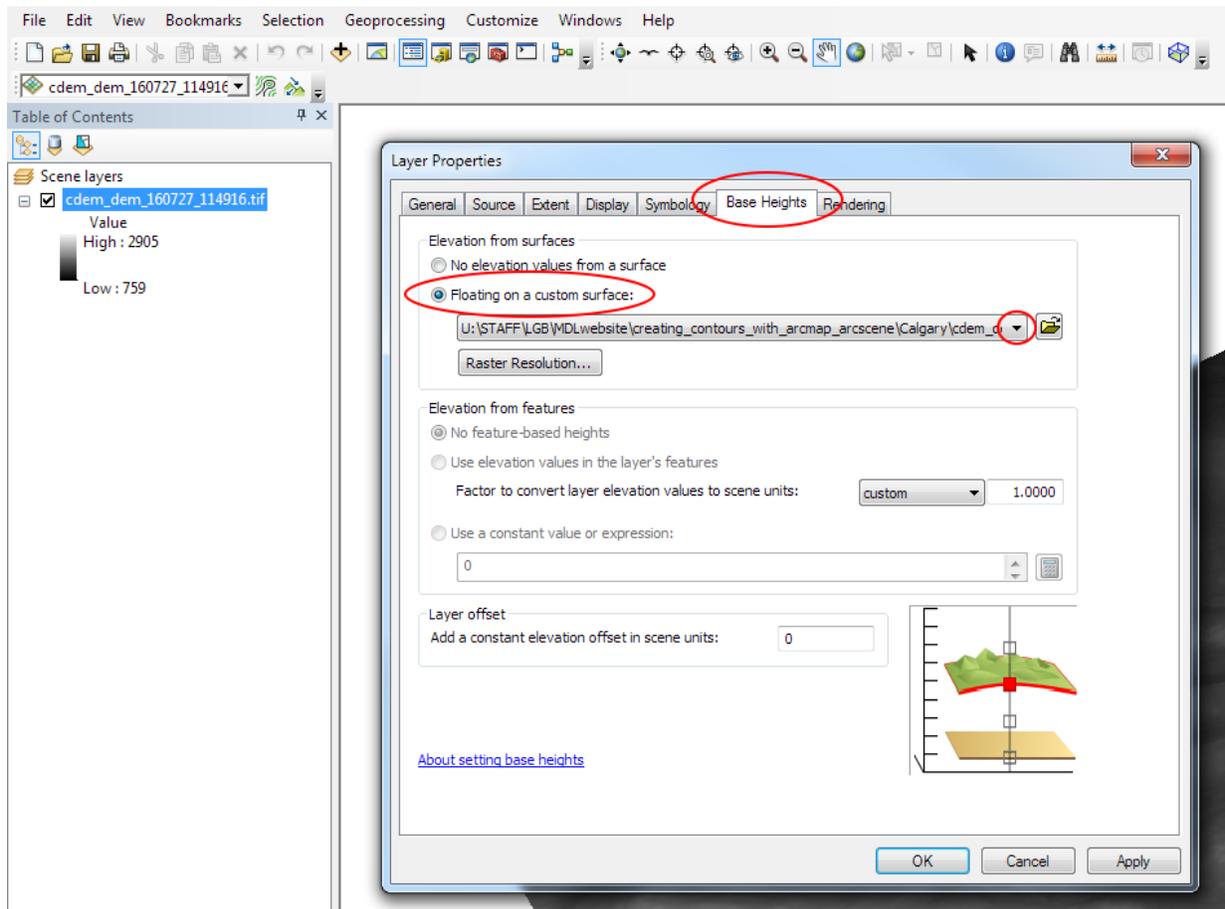
3. In the Scene Properties window select the **Coordinate System** tab, then select the correct coordinate system. Most DEMs will have metadata that tells you which coordinate system to use. The GeoGratis website outputs in NAD 1983 CSRS, so select it by navigating the folders: Geographic Coordinate Systems > North America > NAD 1983 (CSRS).



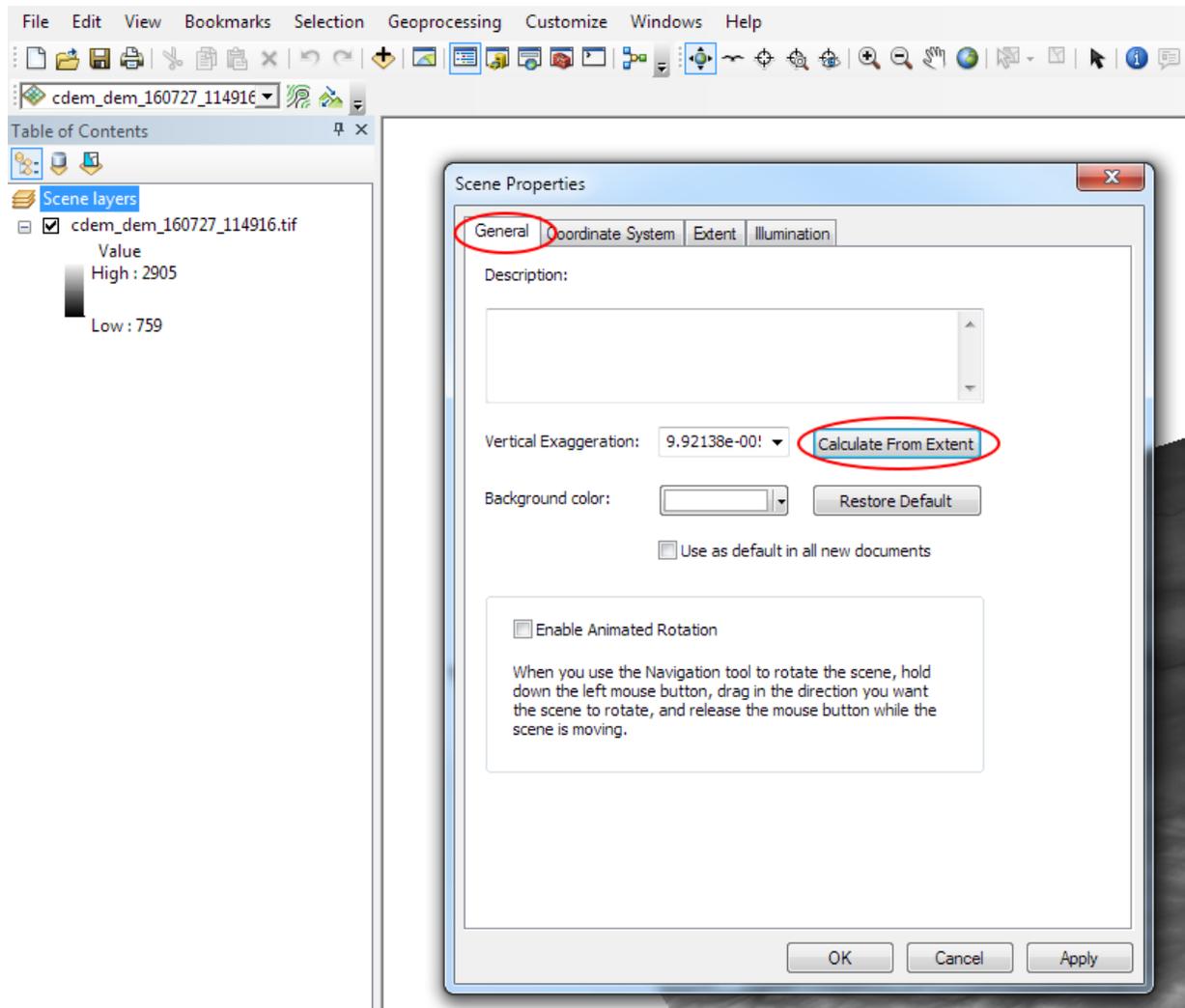
4. In order to create contours, you will need to enable the **3D Analyst** toolbar. You can find this by clicking Customize > Toolbars > 3D Analyst.



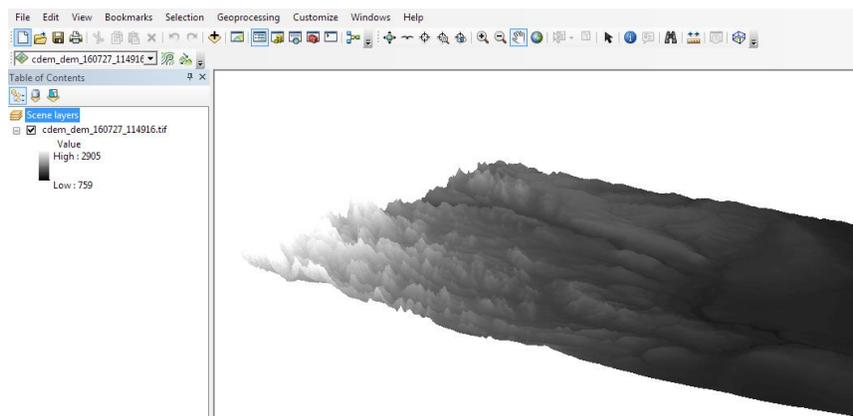
5. Go to Layer Properties by right-clicking on the DEM layer and selecting **Properties**. Then, choose the **Base Heights** tab and under **Elevation from surfaces** select **Floating on a custom surface**. Select the DEM layer from the dropdown menu. This will not create a 3D DEM, but it will prepare the DEM for the next step.



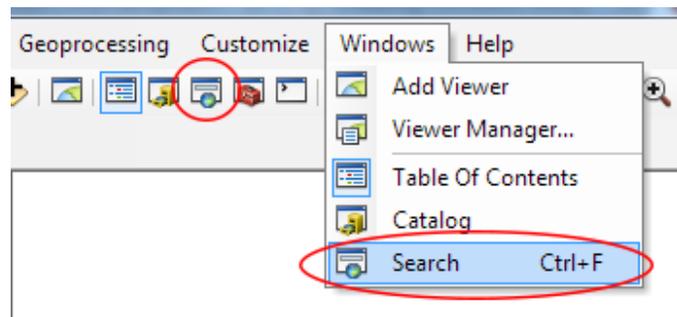
- Now, go to Scene Properties by right-clicking on **Scene layers** and selecting **Scene Properties**. Under the general tab, click the **Calculate From Extent** button next to Vertical Exaggeration. This will now raise the DEM into a 3D file.



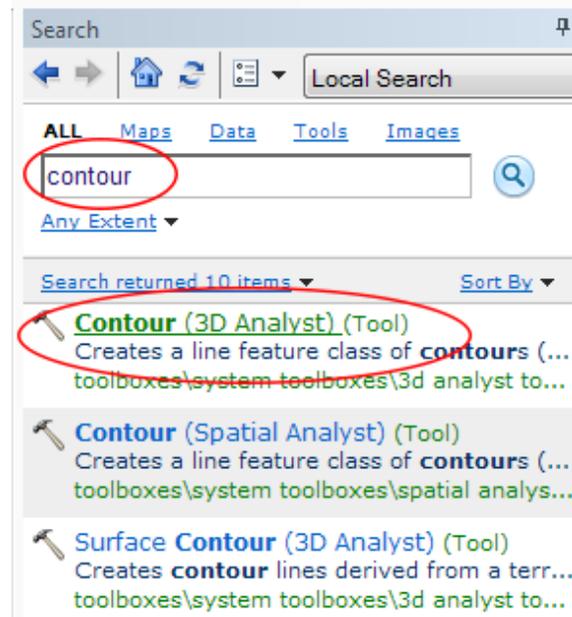
- Your DEM should now look similar to this:



8. Open the search bar. You can do this by clicking Windows > Search, or by clicking on the search icon .

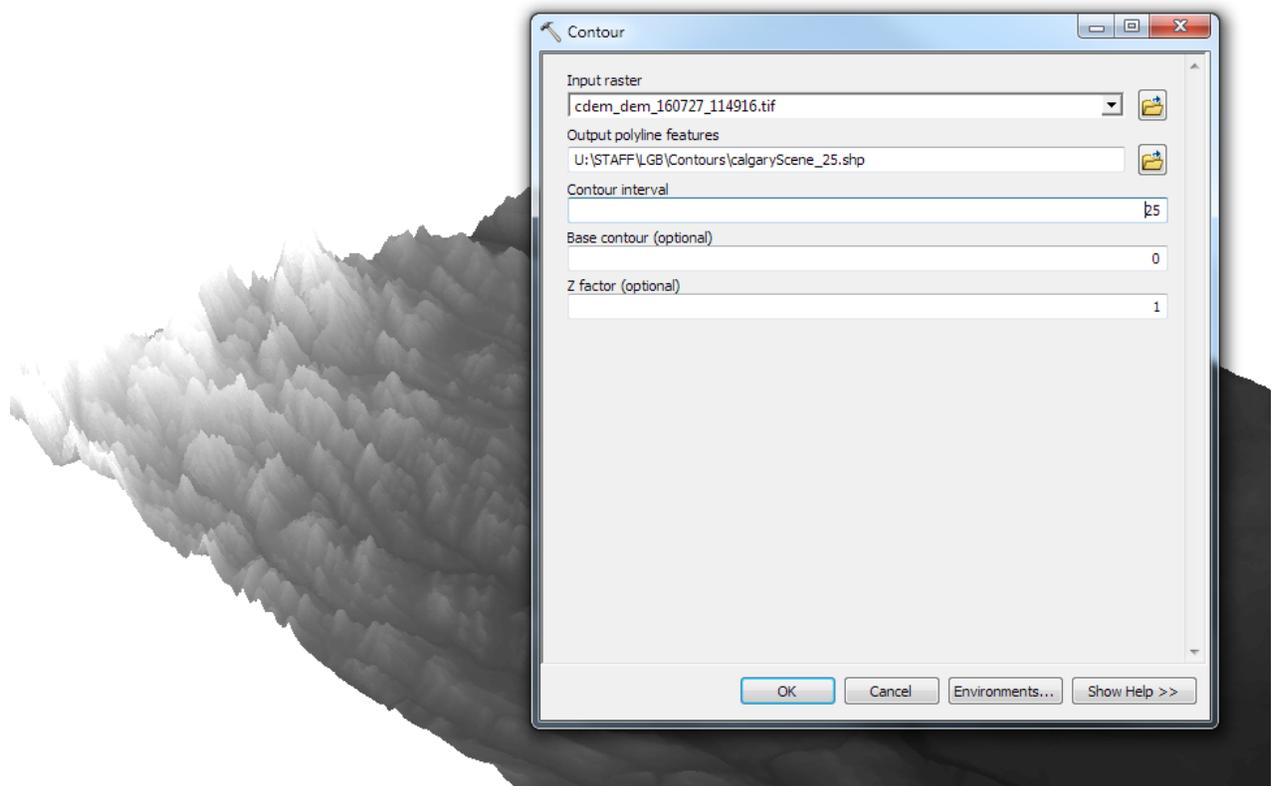


9. Use the search bar to look for **Contour**, and select **Contour (3D Analyst)**.

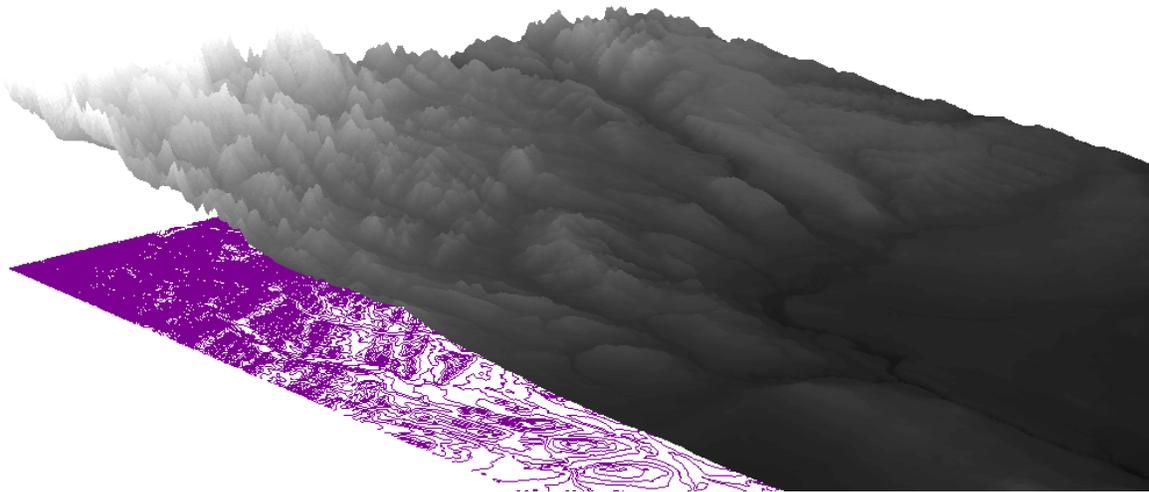


10. After choosing **Contour**, a dialogue window will appear, prompting you for five settings:

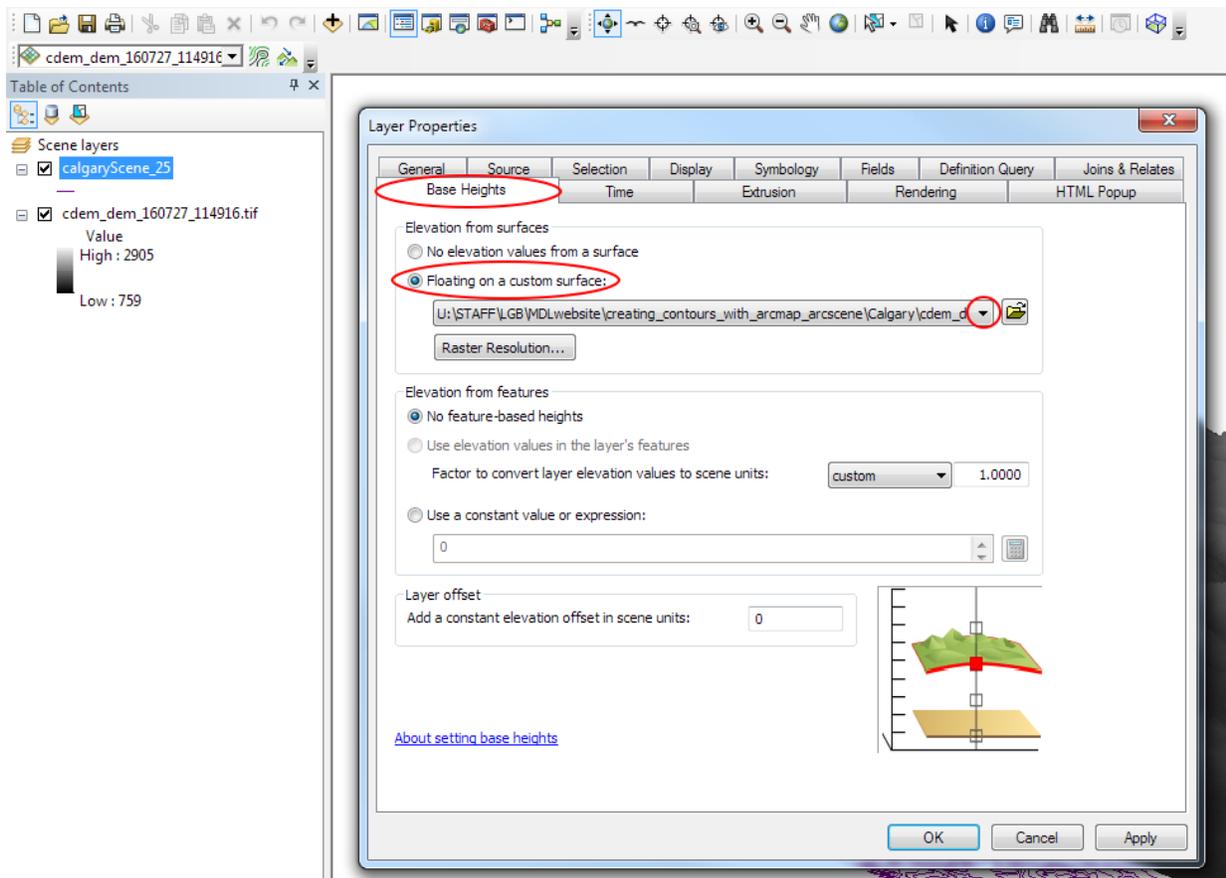
- **Input raster:** select the DEM file from which you want to generate contours by locating it on your hard drive or in the dropdown menu, showing layers present in the Table of Contents
- **Output polyline features:** indicate where you want to save your output contours
- **Contour interval:** set the distance between contour lines in metres – the smaller the number, the greater the number of lines
- **Base contour (optional):** the starting point from which the lines are generated – for example, the default is 0 so with an interval of 25 metres, the contours are generated at 25, 50, 75, 100..., but if the base contour is set at 40, then the contours are generated at 65, 90, 115, 140 and so on
- **Z factor (optional):** can be used to adjust the units of data; for example, if you have data in metres and you want to produce your contours in feet, use a z-factor of 3.28 because 3.28 feet equals one metre



11. The generated contours will automatically be added to the map. They will be 2D, and can be seen beneath the 3D DEM file.



12. You can change the contours to 3D in the same way as the DEM file in step 5. Right click on the contours layer in the Table of Contents, and select **Properties**. Then, choose the **Base Heights** tab and under **Elevation from surfaces** select **Floating on a custom surface**. Select the DEM layer from the dropdown menu.



13. You will now have 3D contours.

