ESSE-4640 Digital Terrain Modelling

ASSIGNMENT 1

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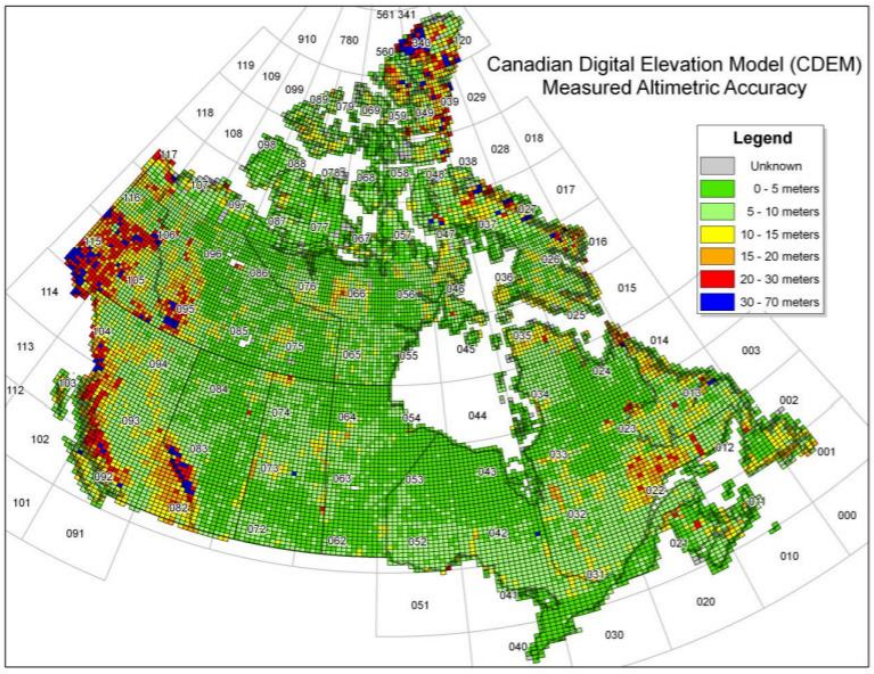
Abstract

The first assignment of ESSE-4640 tasks students with analyzing and exploring the concept of the Canadian Digital Elevation Model and manipulating CDEM datasets within ArcGIS.

Introduction

The Canadian Digital Elevation Model (CDEM) was developed by Natural Resources Canada. It covers the entirety of the Canadian Landmass as well as its surrounding waters. The model's source data is the Canadian Digital Elevation Data (CDED), which in-turn was acquired from the National Topographic Database (NTDB) and the Geospatial Database (GDB). CDEM data uses a Grid format, uses NAD83 (with units of Latitude and Longitude) as its horizontal reference system, and uses CGVD28 (expressed in metres) as its vertical reference system. The positional accuracy of CDEM is given in the following figure:[1]



[1]

The file format used by CDEM is GeoTIFF format, with a base spatial resolution of 0.75 arcseconds, a pixel depth of 8-bits for greyscale rasters (as will be used in this assignment), with the ability to go up to 32-bits of depth.[1]

The list of CDEM metadata features is as follows[1]:

1. Identification Information

2. Data Quality Information

3. Spatial Data Organization Information

4. Spatial Reference Information

5. Entity and Attribute Information

6. Distribution Information

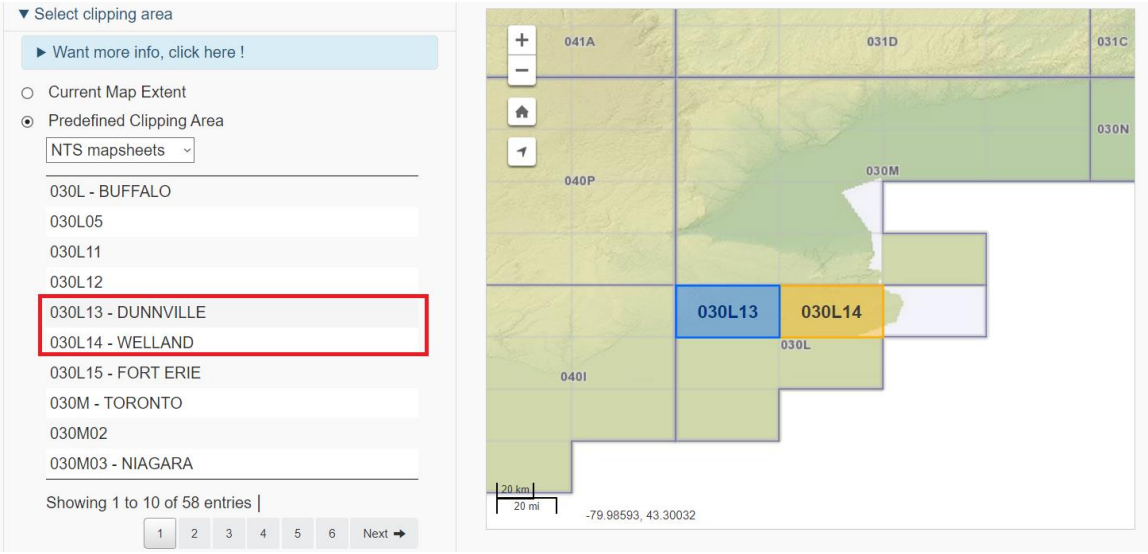
7. Metadata Reference Information

Methodology

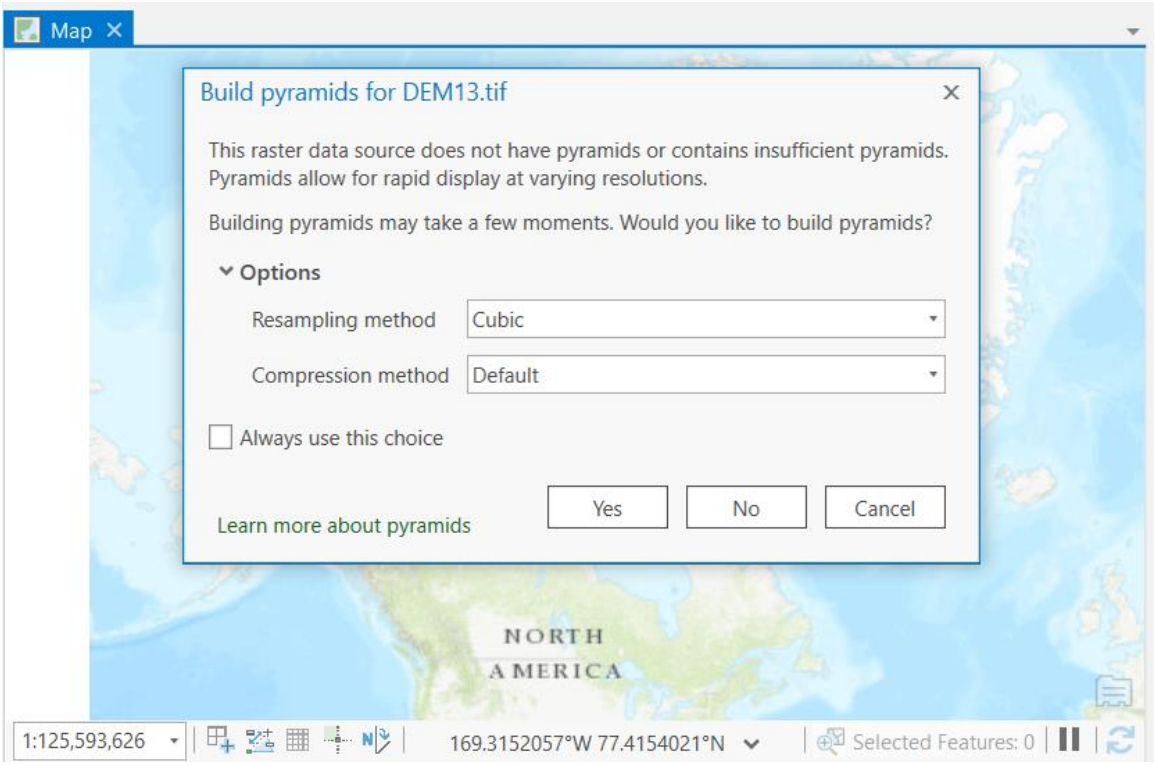
Equipment used:

- ArcGIS Pro

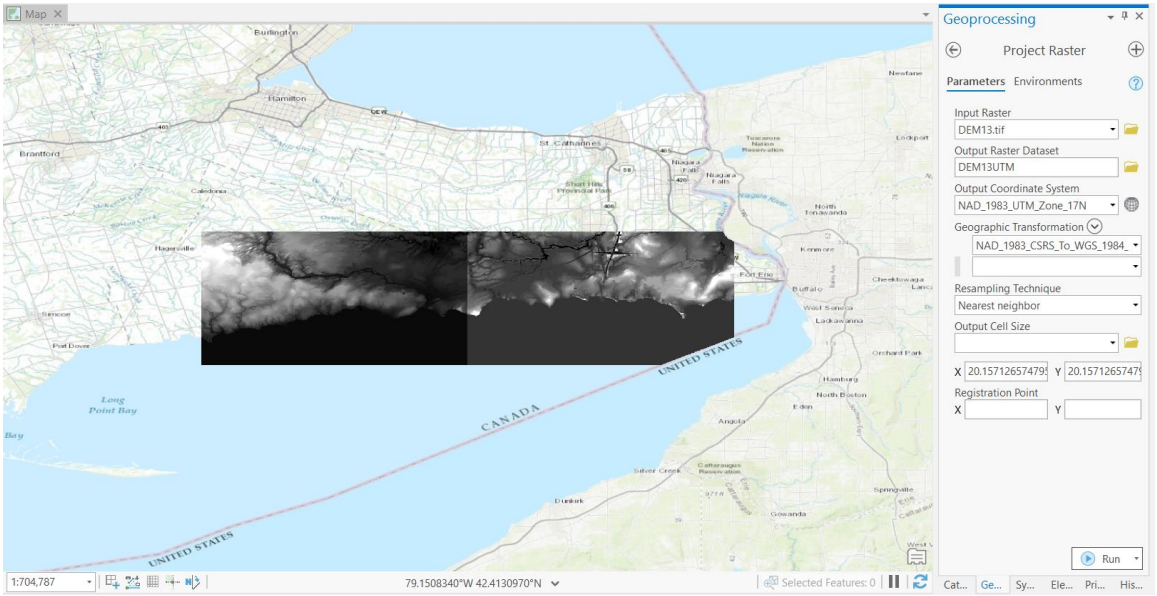
The two regions selected for this assignment are 03L0013 (Dunville) and 03L0014 (Welland). The coordinate system is NAD83 CSRS, and the resolution is 0.75 arcseconds.

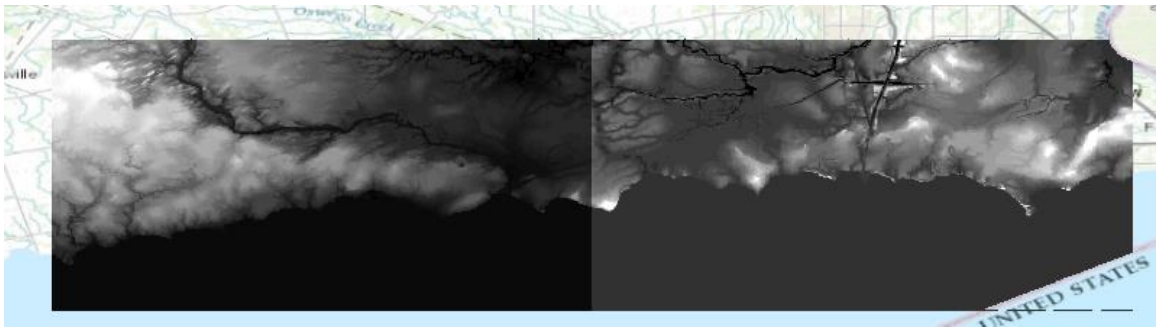


The two pieces of data are imported into a new *Map Scene* in ArcGIS Pro, whereupon the prompt to build Pyramids appears. The chosen Resampling method is Cubic.

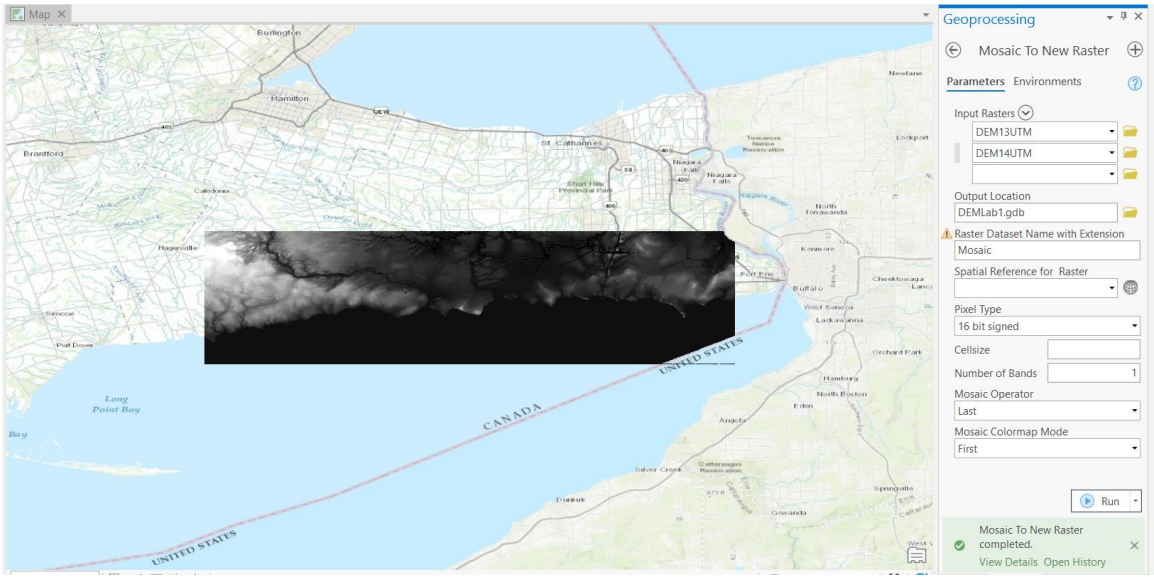


Next, the two pieces of data are reprojected into the NAD83 UTM Zone 17 coordinate system using the Project Raster tool.

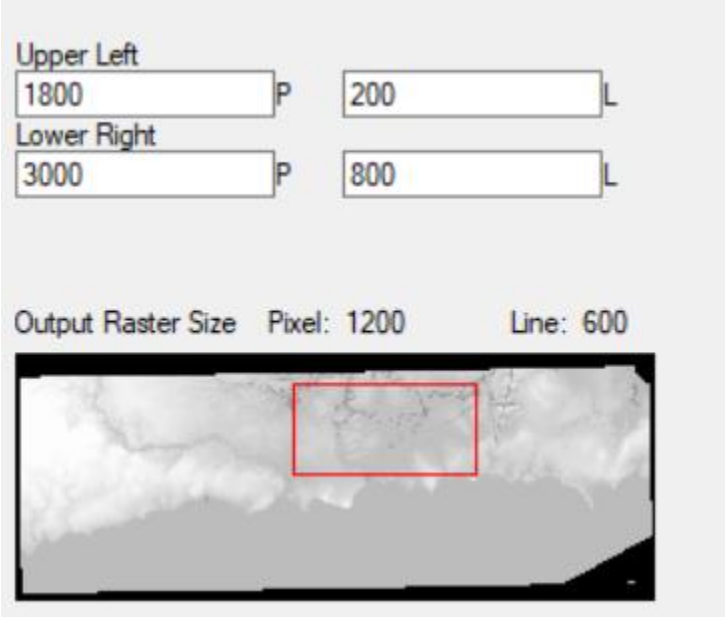




Then, the two sets of data are merged into one singular Raster using the Mosaic to New Raster tool, with 16-bit signed pixels and 1 radiometric band (as the image will be used in greyscale).

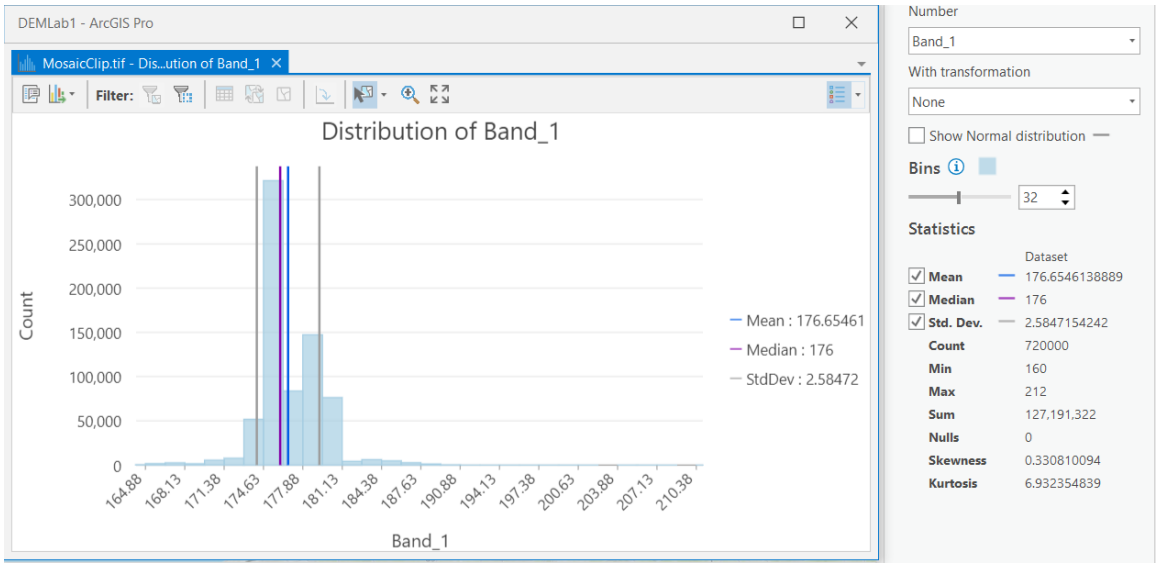


Next, a specific portion of the new raster is required to be clipped, using the coordinates of Upper Left Corner at 1800C/200R, and the Lower Right at 3000C/800R. The clipping is performed using CATALYST Focus, which allows for clipping by Upper Left and Lower Right as opposed to ArcGIS Pro.

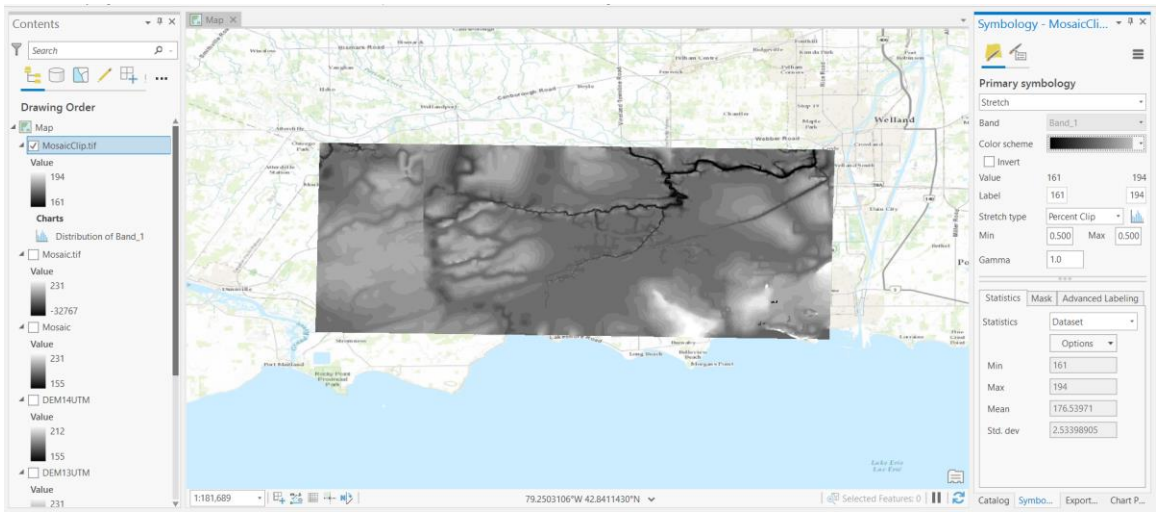


Now that the clipping is done the clipped raster is returned to ArcGIS Pro.

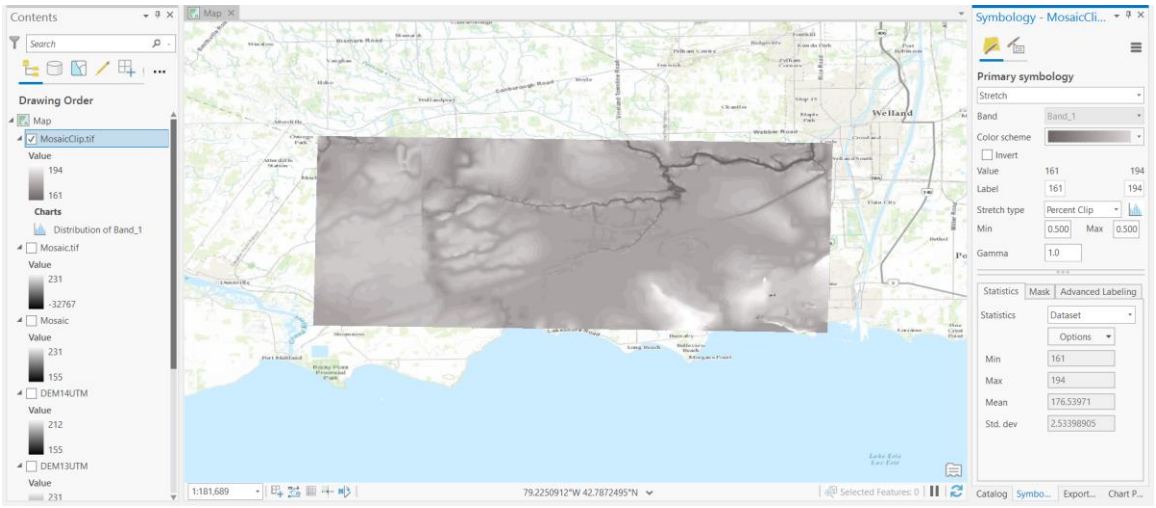
The Histogram of the clipped raster is created using *Create Chart* > *Histogram*. The requested statistics are displayed on the sidebar.



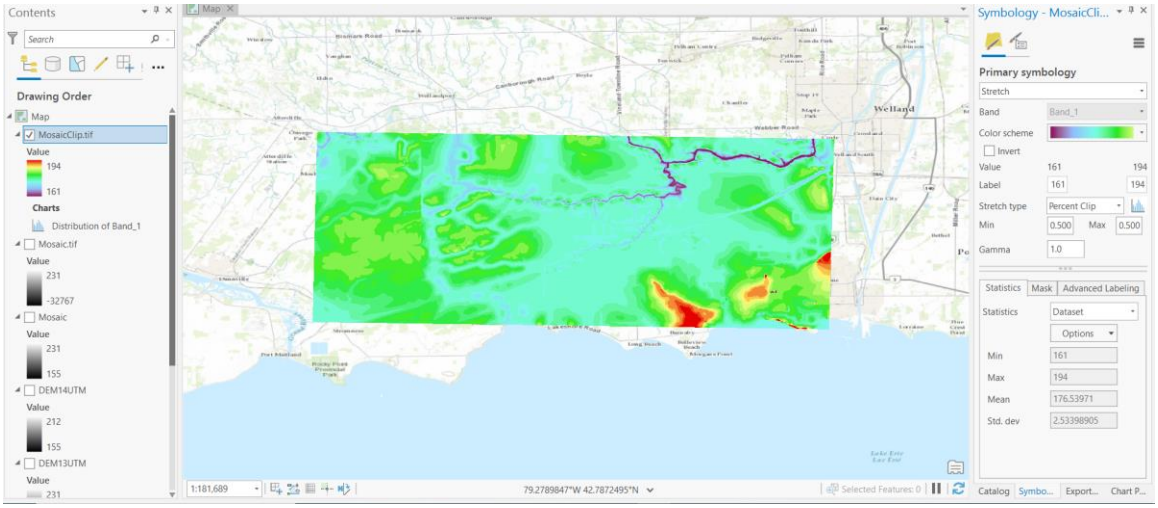
Now, the clipped raster will be displayed in different symbology styles in order to analyze how different colour mappings highlight different features of the landscape. The first mapping is the original:



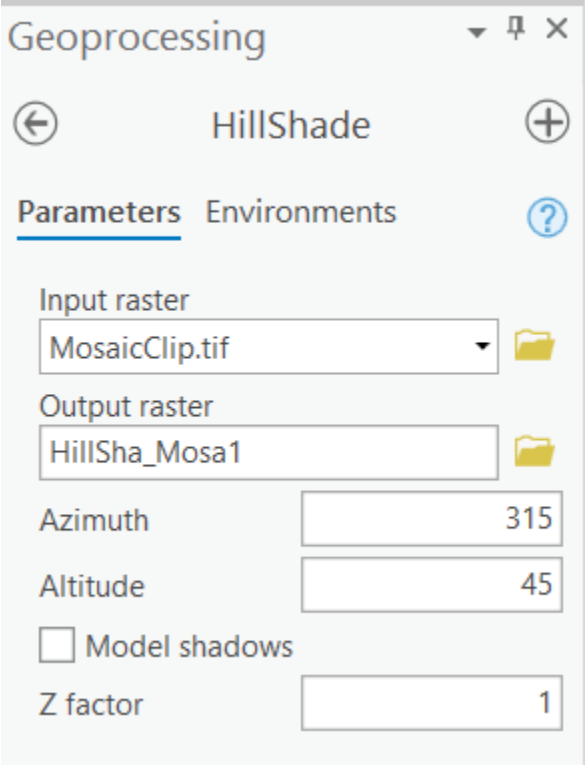
The next mapping is a lighter, warmer set of grey tones. It is now more difficult to discern contours, however it is now also harder to discern the mosaic seam line.



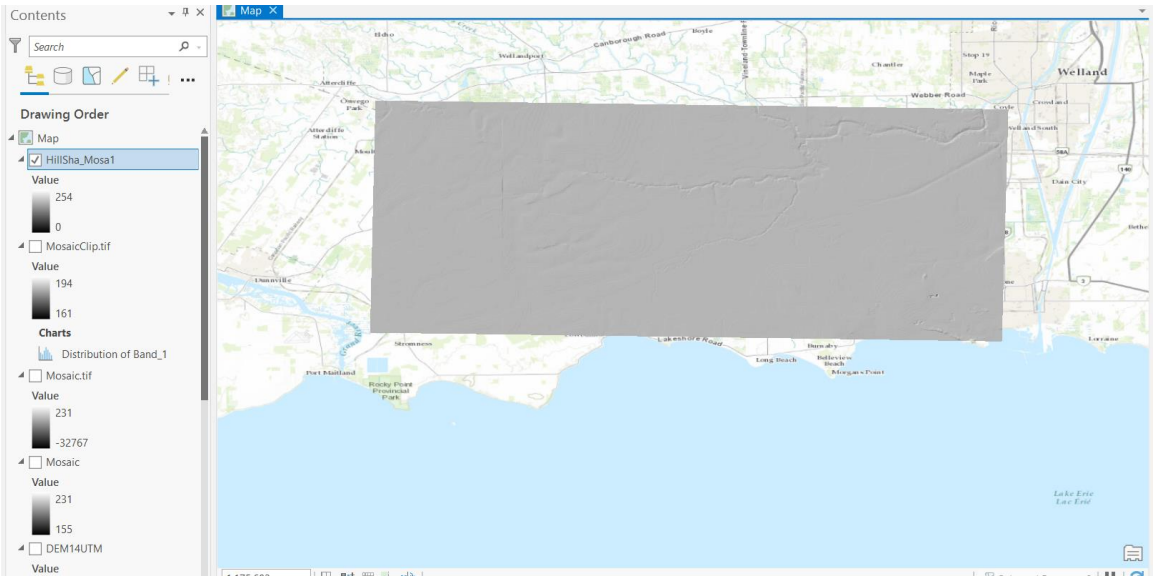
The next colour mapping is a pseudo-colour ramp. Deep trenches and tall hills are very easily discerned. Additionally it becomes very easy to determine the location of bodies of water and even smaller tributaries.



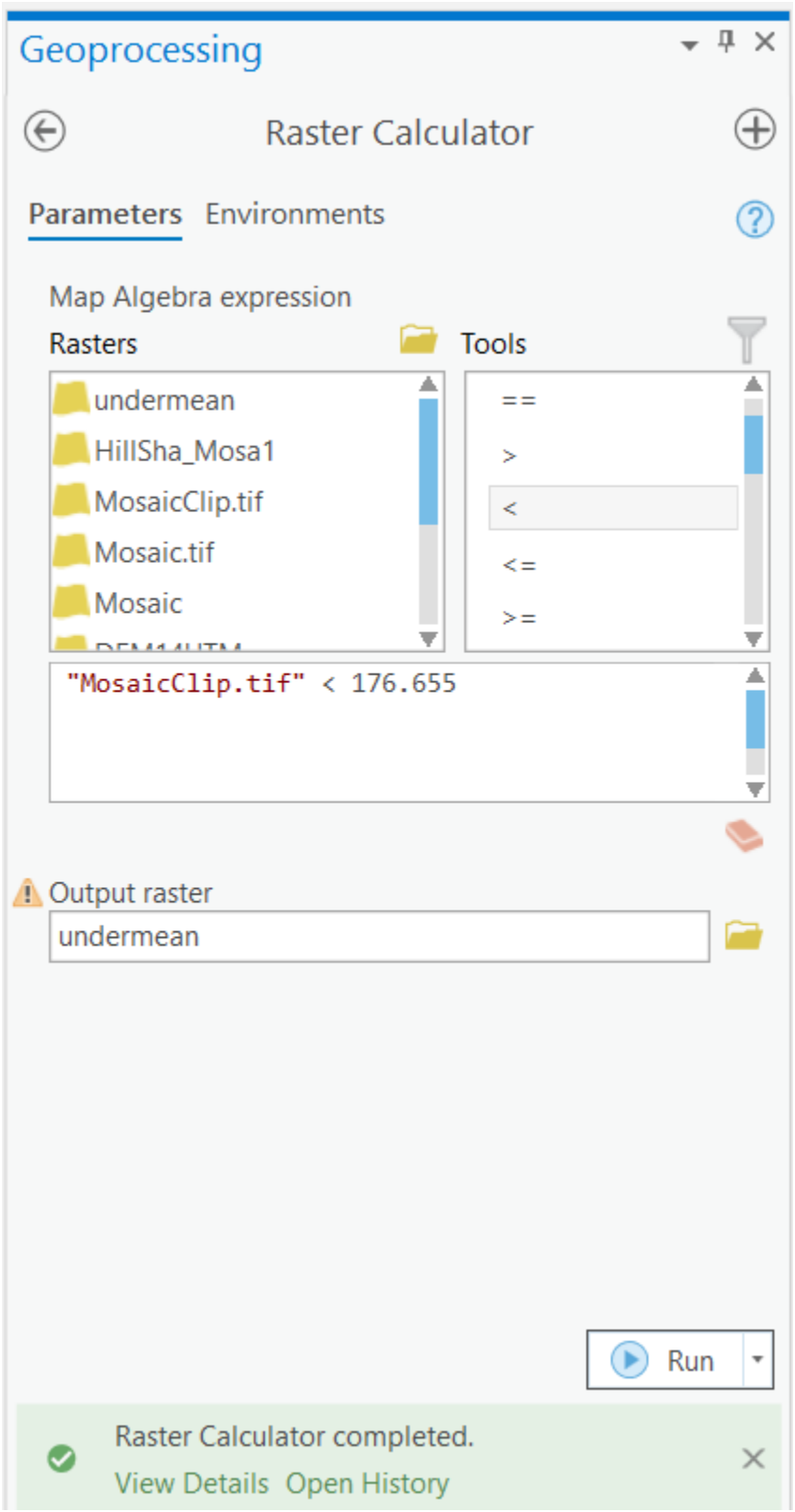
Next, a Hillshade representation will be created using the Hillshade tool with default parameters.

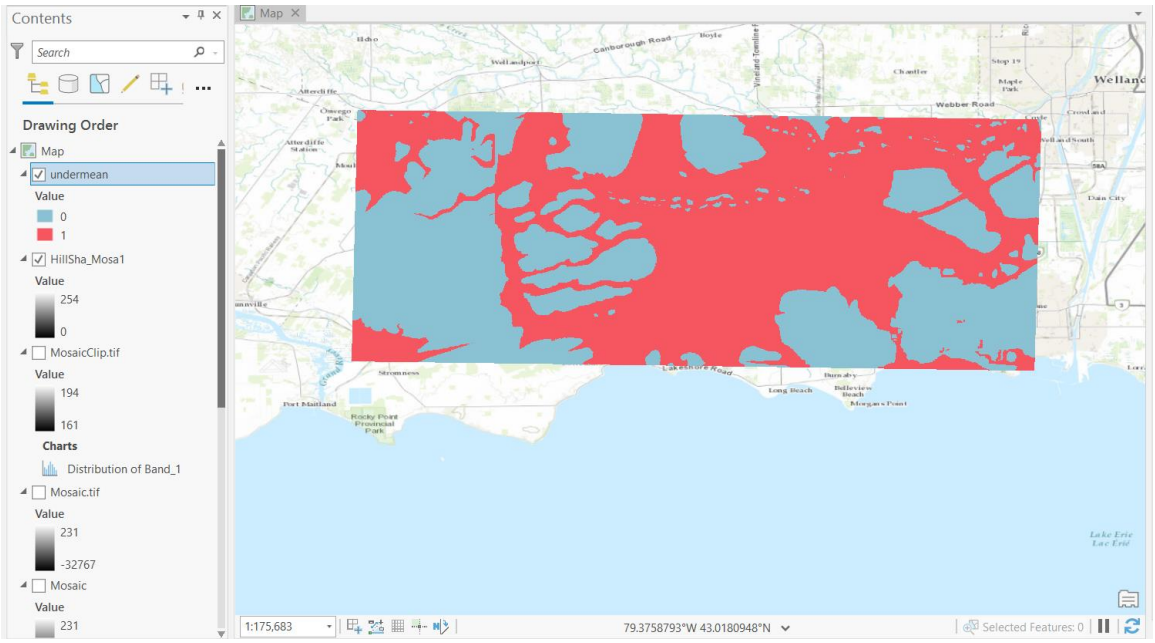


The created Hillshade is mostly flat, this seems to be an issue with the chosen sets of data as there is less variation in the landscape than what may be a more exemplary set.

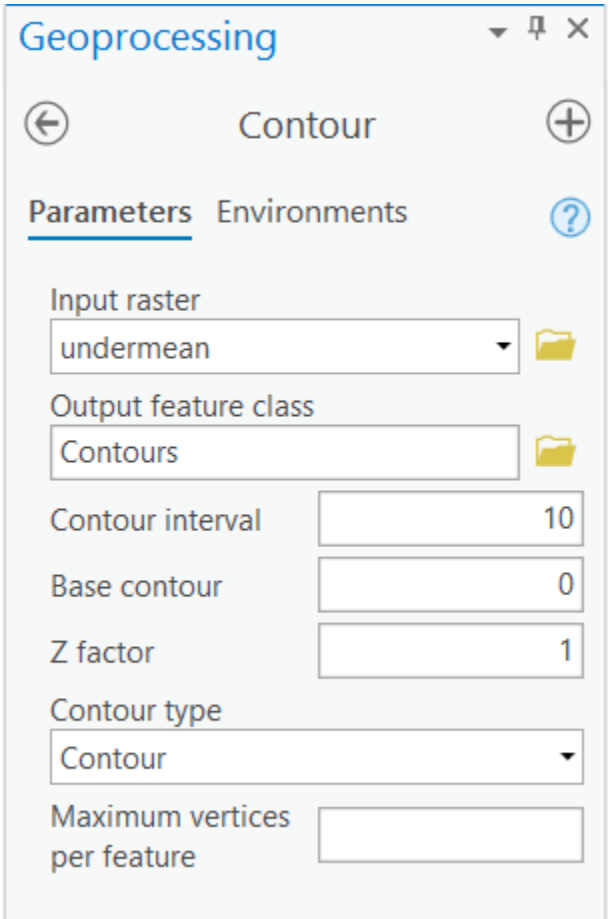


Raster Calculator is used to output a new raster layer with the same extents as the clipped raster, however only including all elevations that are lower than the mean that was shown earlier with the Histogram.

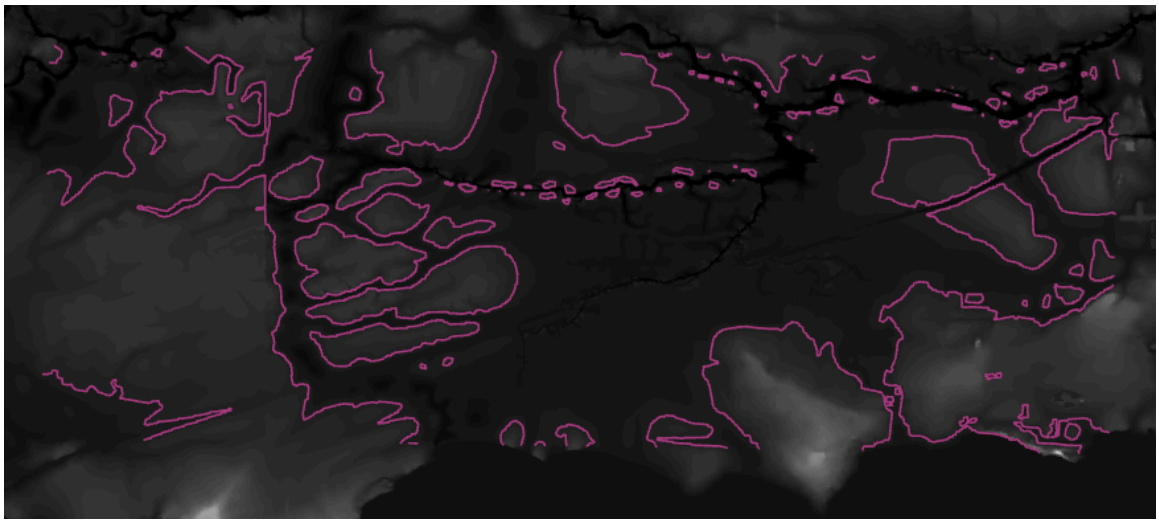

Geoprocessing
Raster Calculator
Parameters
Environments
Map Algebra expression
Rasters
Tools
undermean
HillSha_Mosa1
MosaicClip.tif
Mosaic.tif
Mosaic
==
>
<
<=
>=
"MosaicClip.tif" < 176.655
Output raster
undermean
Run
Raster Calculator completed.
View Details
Open History



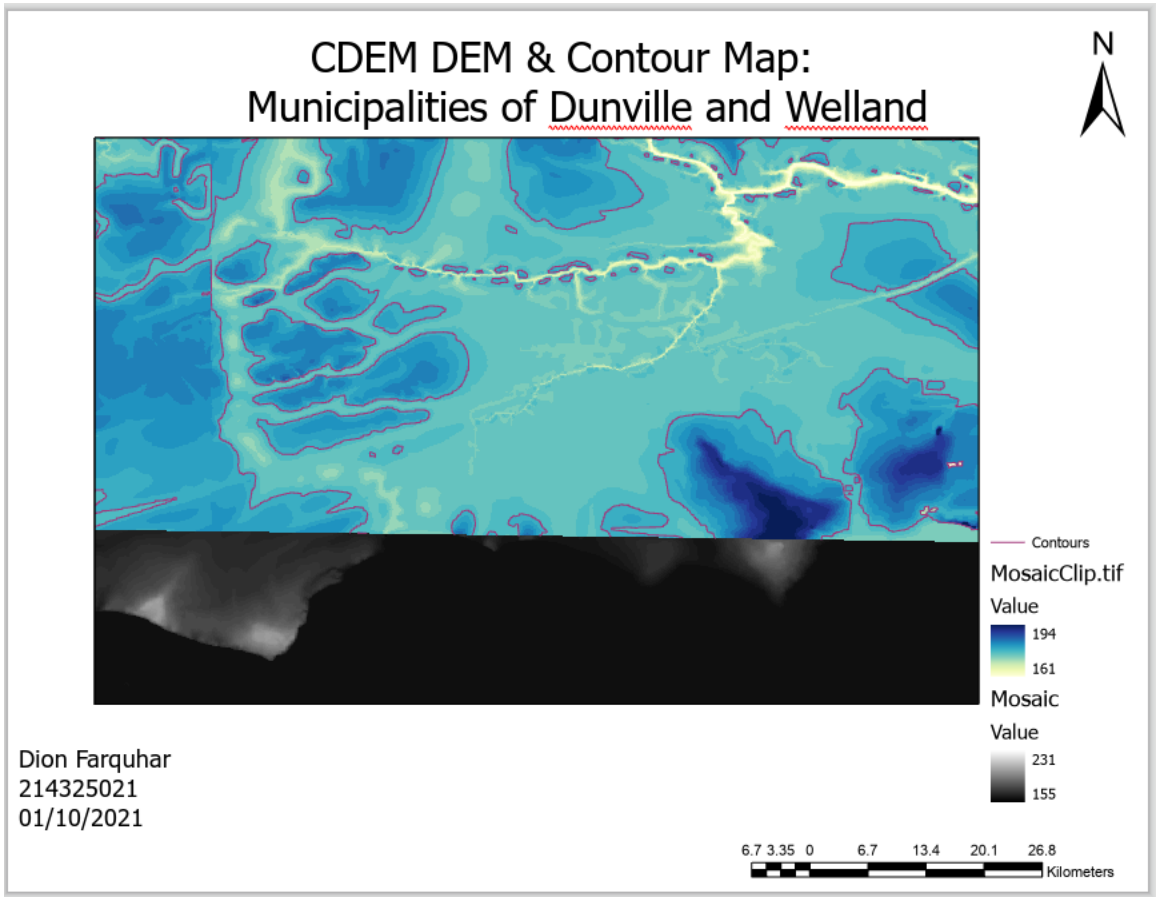
Next, the Contour tool is used with a 10m interval to generate a contour map.



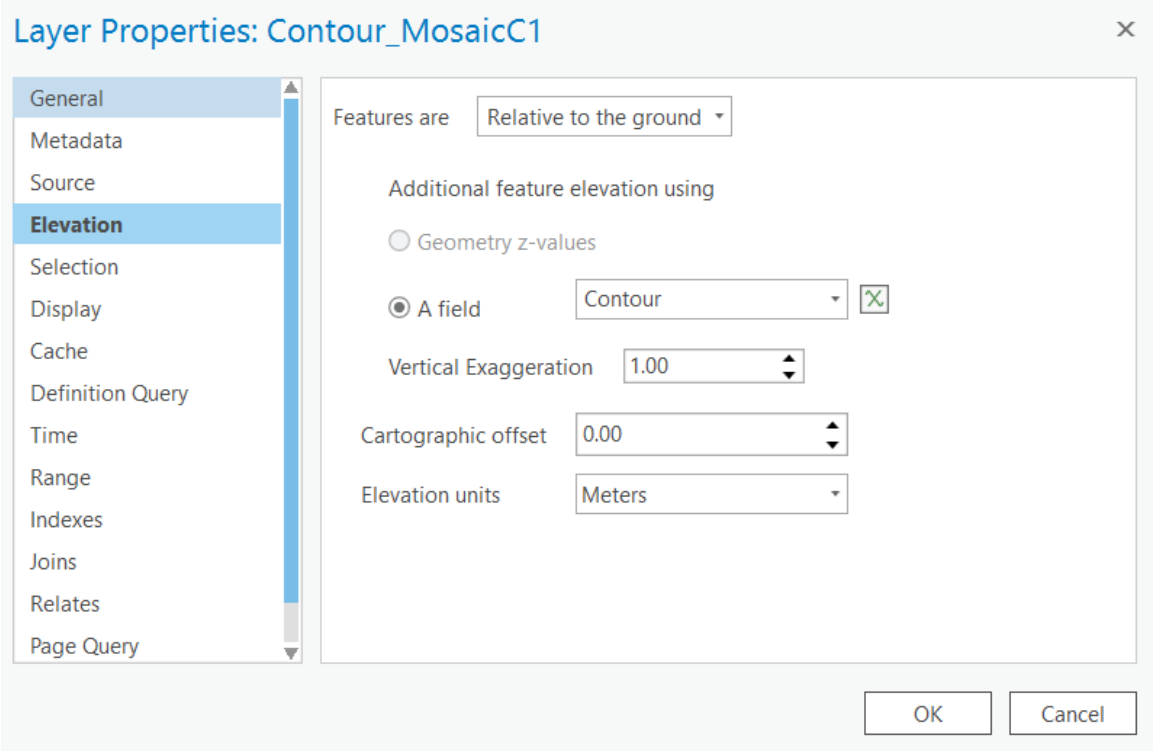
The outputted contour map only contains some hill outlines, which further proves that elevation variance of the chosen datasets is low.

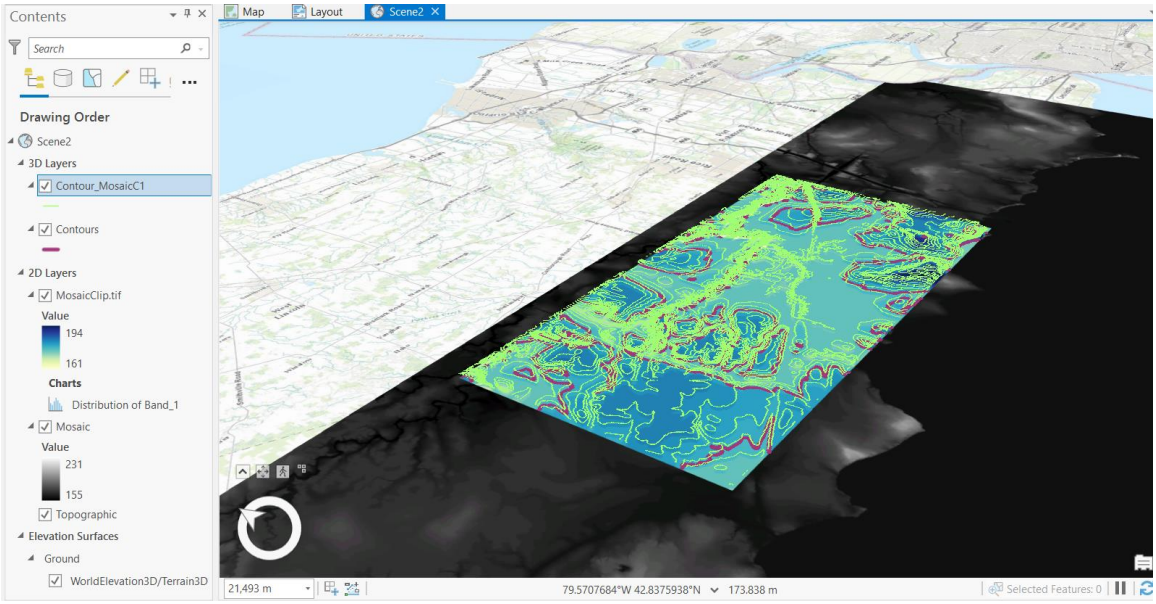


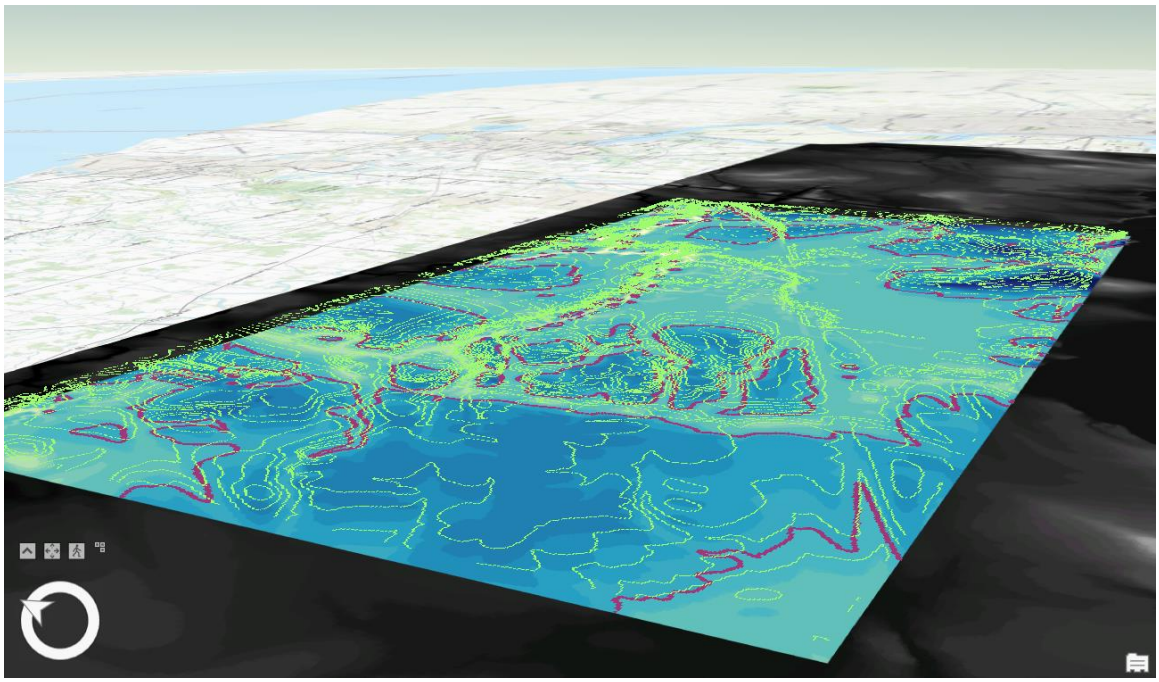
Next, a layout view map with all the usual trappings (north arrow, scale bar, legend, title) is created.



Next, a Global Scene is created. The original CDEM rasters are loaded as Elevation Sources, and the Elevation of the Contour map is set to be equal to its own internal elevation values (relative to the ground).







With a contour interval of 10m (depicted in magenta), only a few lines are produced and there is little vertical variance, giving a flatter impression of the landscape. At a 1m contour interval (depicted in green), the vertical aspect of the topography is able to be discerned a lot easier, however due to the nature of this dataset, it is still rather flat. Despite this, everything has worked as intended, and as such this assignment was successful.

WORKS CITED

1. *Canadian Digital Elevation Model Product Specifications*, Natural Resources Canada https://ftp.maps.canada.ca/pub/nrcan_rncan/elevation/cdem_mnec/doc/CDEM_product_specs.pdf