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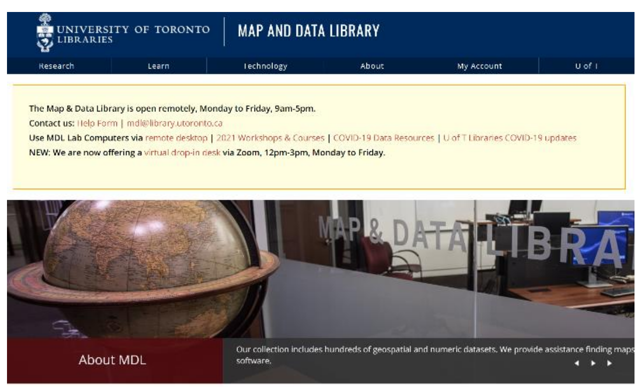
Using Lidar Data in ArcGIS Pro

February 25, 2021, 2:00pm, presented by Gerald Romme, GIS Analyst, Map and Data Library

https://mdl.library.utoronto.ca/



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Metadata Page from Toronto 2015 Lidar data

LiDAR Project Summary

Airborne Imaging
5757 4th Street SE
Calgary, Alberta, Canada
T2H 1K8
Telephone: (403) 215 2960
Fax: (403) 258 3189
www.airborneimaginginc.com
AIRBORNE IMAGING
A Clean Harbors Company

Project Information

Project Name:	Toronto
Project Number:	13968
Client:	Ontario Council of University Libraries

Project Type:	Wide Area
Project Location:	Toronto, Ontario, Canada
Project Size:	641.45 sq km

Acquisition Projects

Project Name	Project Number	Vintage
GTA2015	1453	April 2015

Acquisition Parameters

Date (MM/DD/YY)	Mission	Flying Height (m)	Flying Speed (knots)	Pulse Rate Rep (kHz)	Scan Freq (Hz)	Scan Angle (degree)	Side Lap %	Point Density (pts/m²)	LiDAR System
04/06/15	7915096a	1300	160	400	52	40	50	10.0	Leica ALS70
04/07/15	7915097a	1300	160	400	52	40	50	10.0	Leica ALS70
04/11/15	7915101a	1300	160	400	52	40	50	10.0	Leica ALS70
04/25/15	7915115b	1300	160	400	52	40	50	10.0	Leica ALS70
Multiple Return Capabilities:			YES		**Number of returns recorded:**				Maximum 4

Geodetic Control

Horizontal Datum:	Nad83 CSRS	**Vertical Datum:**	CGVD28
Geoid Model:	HT2.0	**UTM Zone:**	17

Note: We established a local geodetic network fixed to the following control:

Station ID	Lat	Long	Ellp Height
61313	43 46 05.44812	-79 38 49.15723	154.971
653196	43 35 30.99772	-79 36 11.54776	92.610

Calibration Methodology

Airborne Imaging performs a complete calibration on every LiDAR acquisition flight, data is acquired over a calibration site flown with at least two passes in opposite directions before and after the flight. Any error in the attitude of the aircraft (roll, pitch and heading) can be observed and corrected for within system specifications. To statistically quantify the accuracy, we compare the LiDAR elevations with independently surveyed ground points. A GPS mounted truck collects data while driving on an open road. The kinematic positions on the road are post-processed from a nearby base station (common to the aerial survey)

Accuracy

Horizontal Accuracy, 95% or 2σ:	30 cm

Deliverables

- **1m Grids (XYZ ASCII), Bare Earth and Full Feature**
- **Hillshade Images (Geotiffs), Bare Earth and Full Feature**
- **Point Cloud (LAS v1.2, ASPRS Classes)**
- **50cm Contours (shp)**
- **Metadata (.pdf format, LiDAR Summary)**

Summary Produced: April 5, 2017

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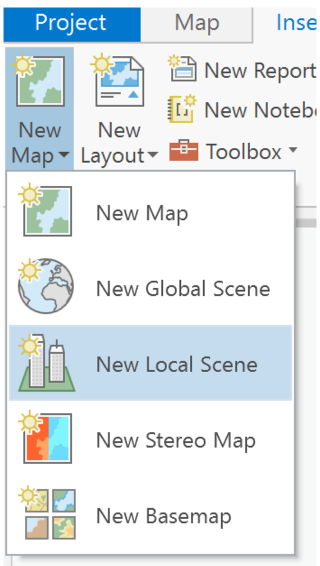

In ArcGIS Pro add a New Local Scene.

This will be for 3d data such as point clouds

Projection information from the metadata showing vertical and horizontal coordinate systems used for LAS Datasets

Geodetic Control			
Horizontal Datum:	Nad83 CSRS	**Vertical Datum:**	CGVD28
Geoid Model:	HT2.0	**UTM Zone:**	17
Note: We established a local geodetic network fixed to the following control:			
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The American Society for Photogrammetry & Remote Sensing

Classification codes: LAS format 1.1 - 1.4

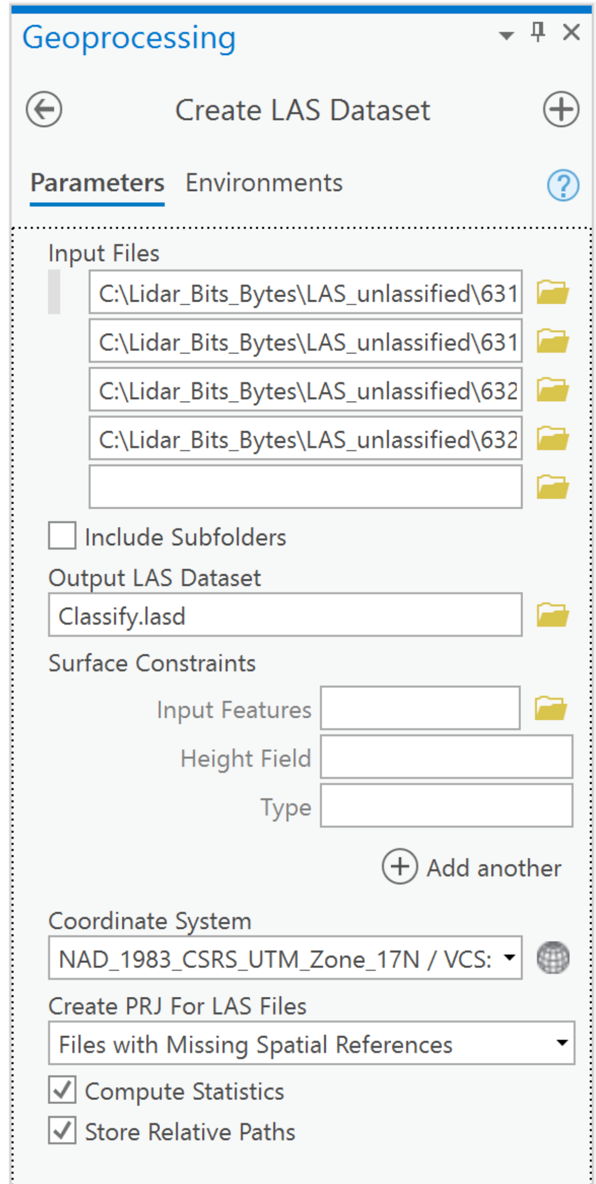
If you are working with LAS 1.1 - 1.4 specification, refer to the predefined classification schemes defined by the American Society for Photogrammetry and Remote Sensing (ASPRS) for the desired data category. The following table lists the LAS classification codes defined by ASPRS for these LAS versions:

Classification value	Meaning
0	Never classified
1	Unassigned
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point
8	Reserved *
9	Water
10	Rail
11	Road Surface
12	Reserved

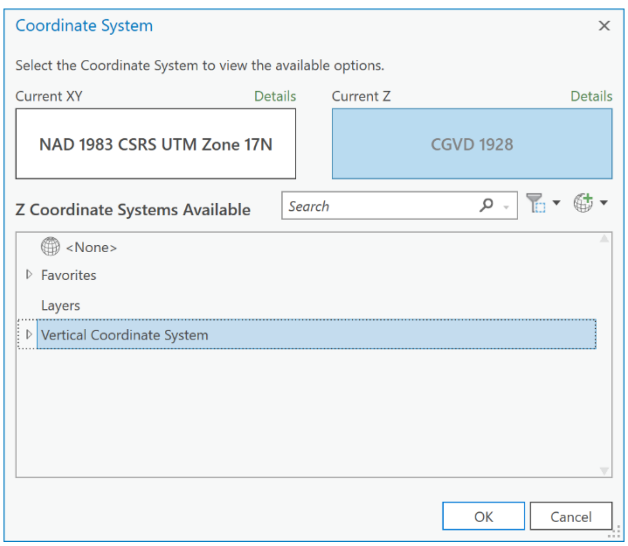
https://desktop.arcgis.com/en/arcmap/10.3/manage-data/las-dataset/lidar-point-classification.htm

Create an LAS Dataset

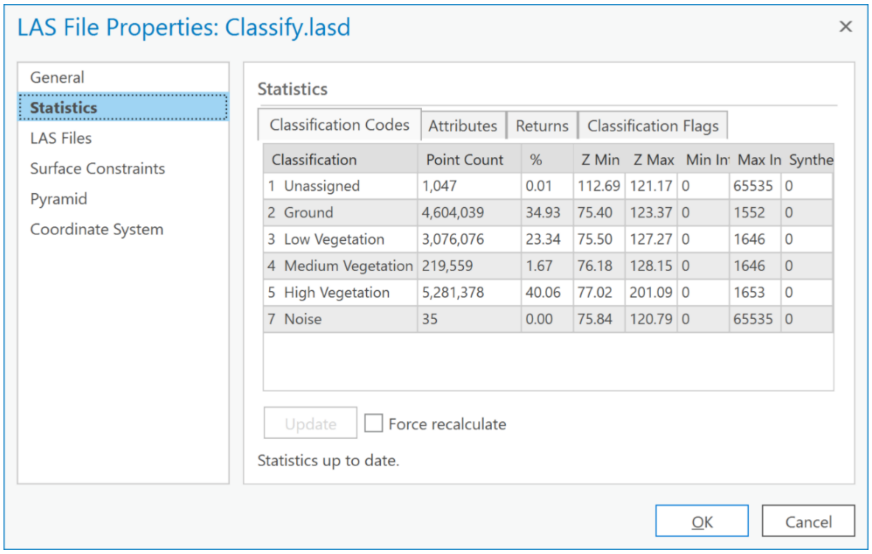
Add las file which are classified.



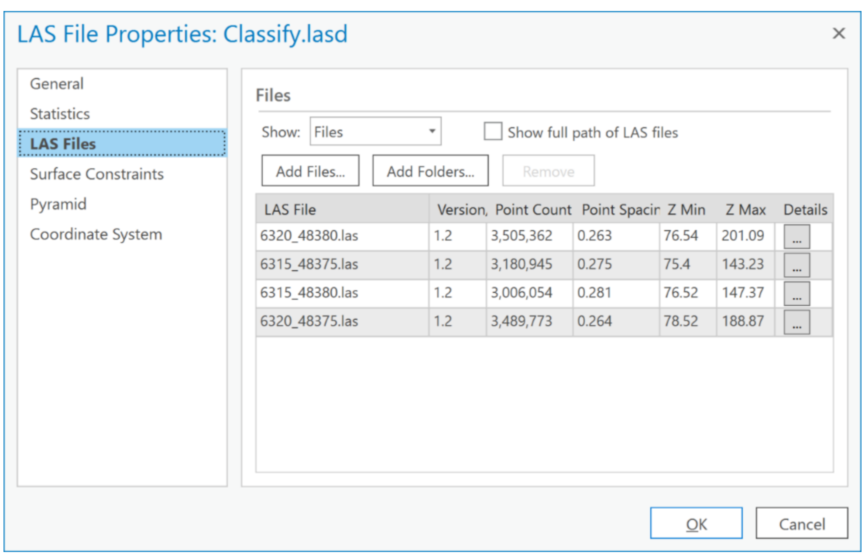
Assign the vertical and horizontal projections.



Viewing LASD Properties



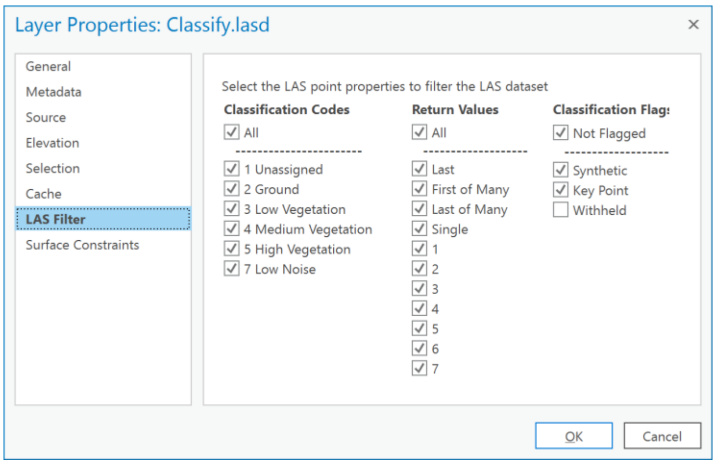
In Catalog right click on the lasd. Click on Statistics and this will show Classification codes as well as other information about the las dataset.

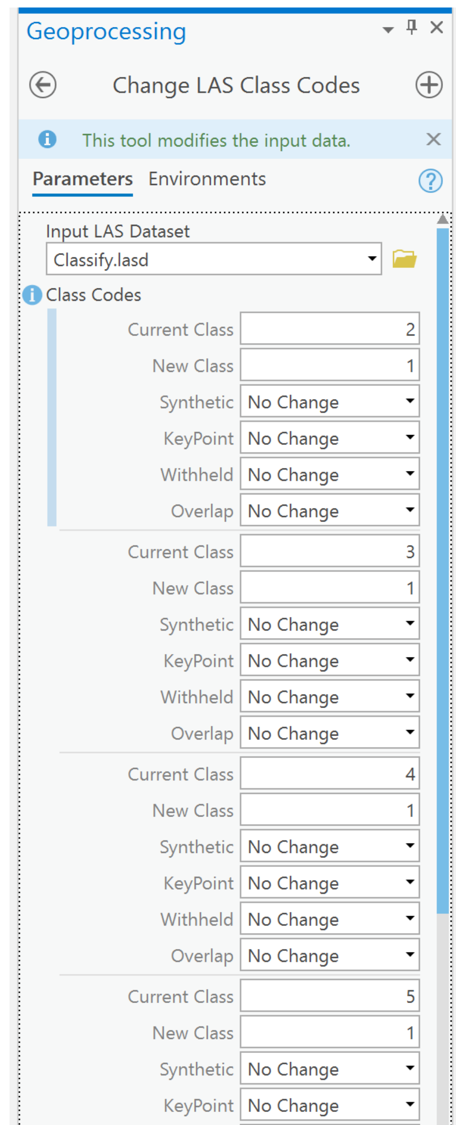


Click on LAS Files and this will show the LAS files which were added to the LASD. The Point Spacing is also shown which will be used for creating raster data.

Reclassify LAS Dataset

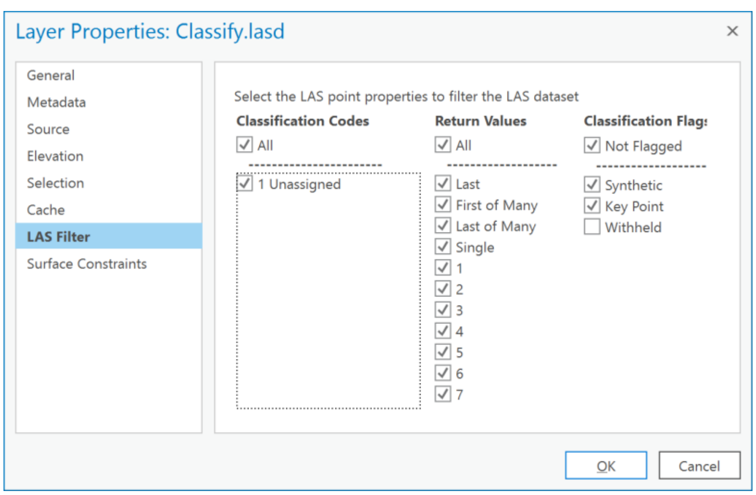
In the LAS Dataset, in the contents pane, right click on the file and open the properties. Click on LAS Filter.



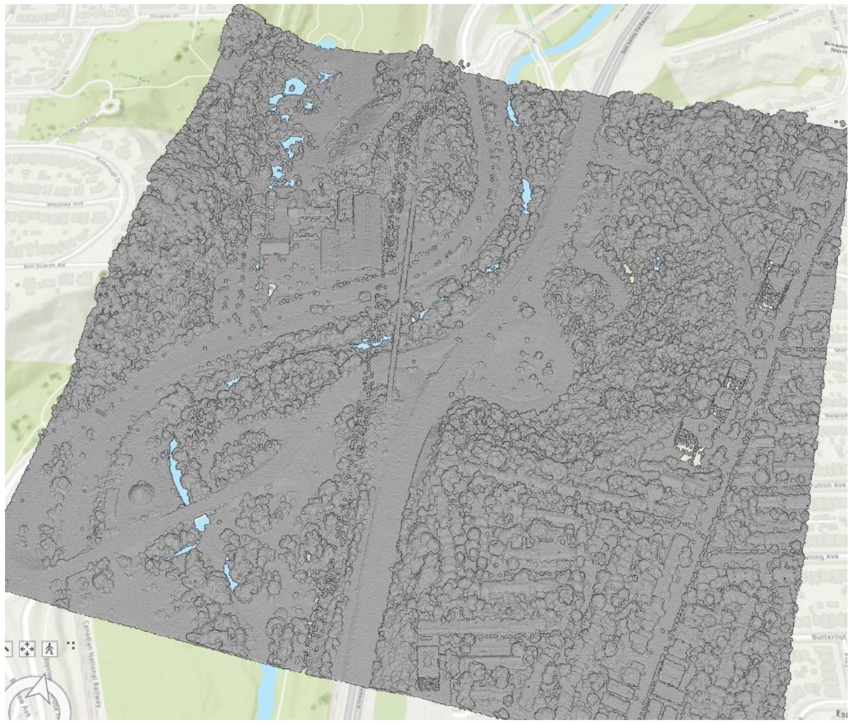


Change all LAS Codes to 1 using Change LAS Codes.

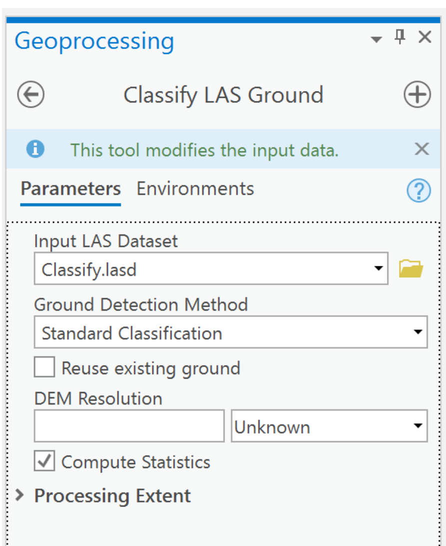
All Classes are now 1.



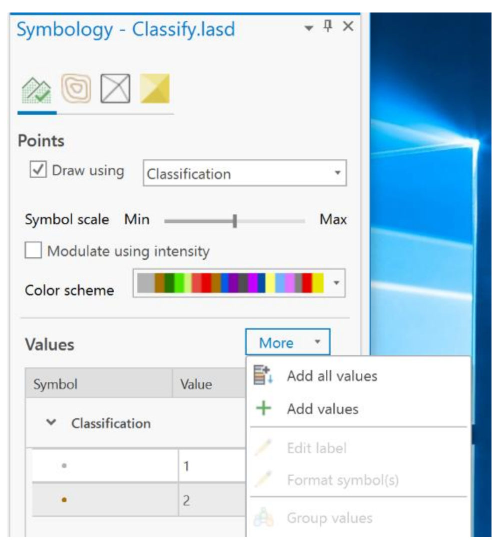
Unclassified Data



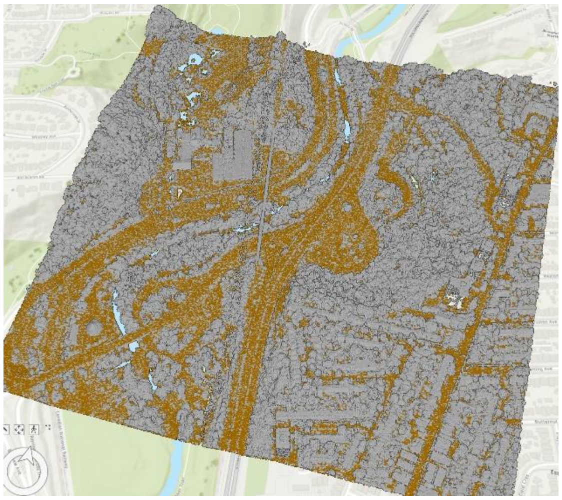
Use Classify LAS Ground to classify the ground. The classification code for ground is 2.



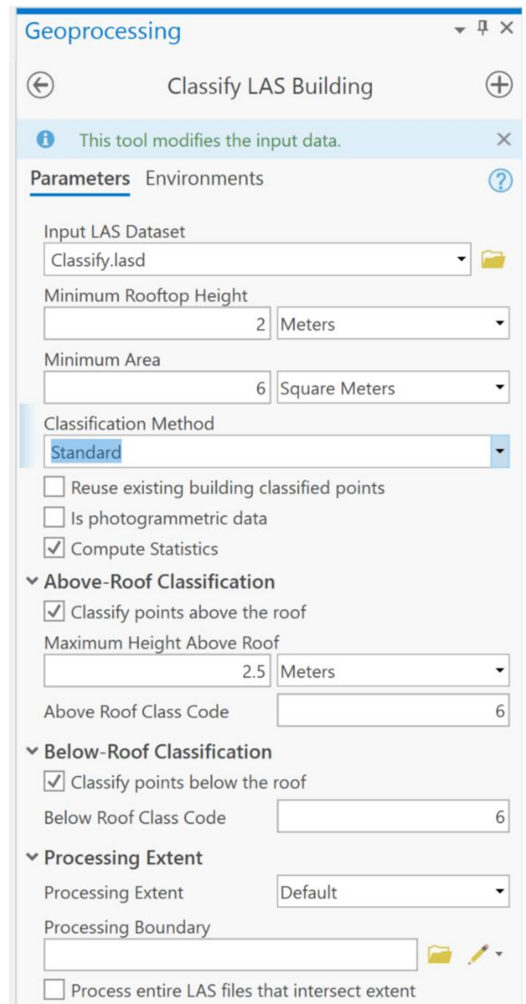
Once the Classify Ground has been run go to symbology to add all values



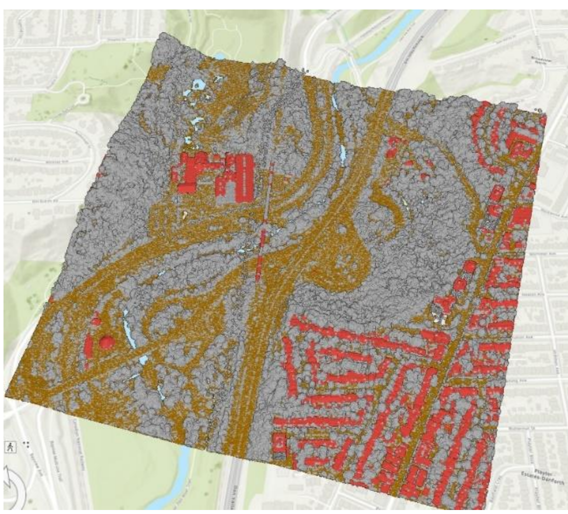
Ground Classified



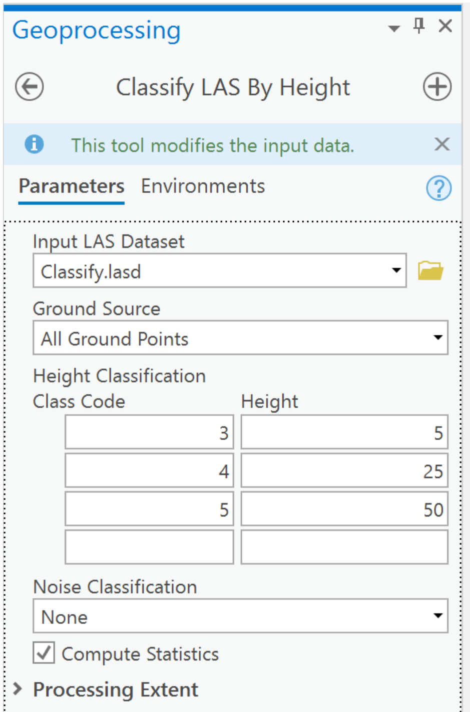
Classify buildings using the Classify LAS Building tool



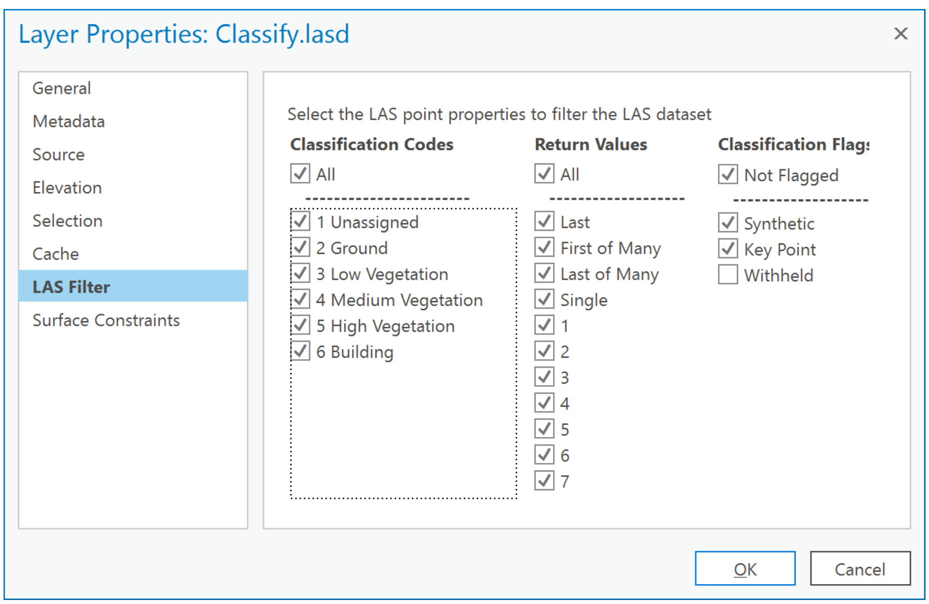
Buildings classified



Classify Vegetation using the Classify LAS By Height tool



New Classification Codes



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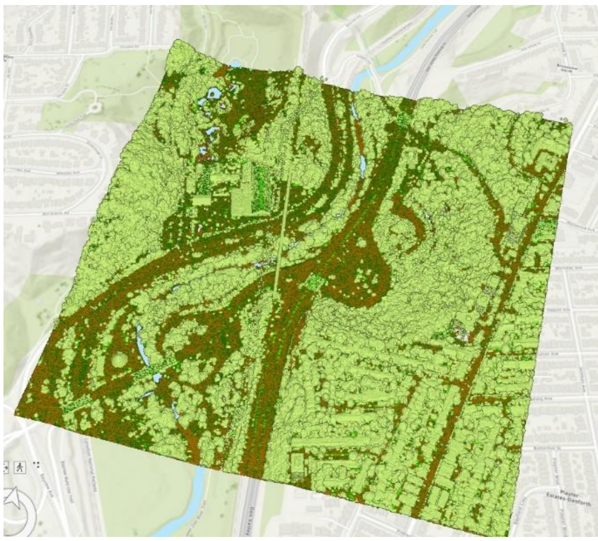
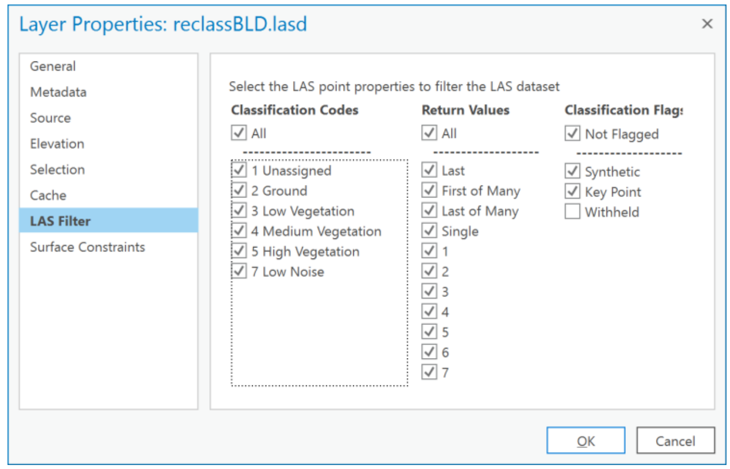
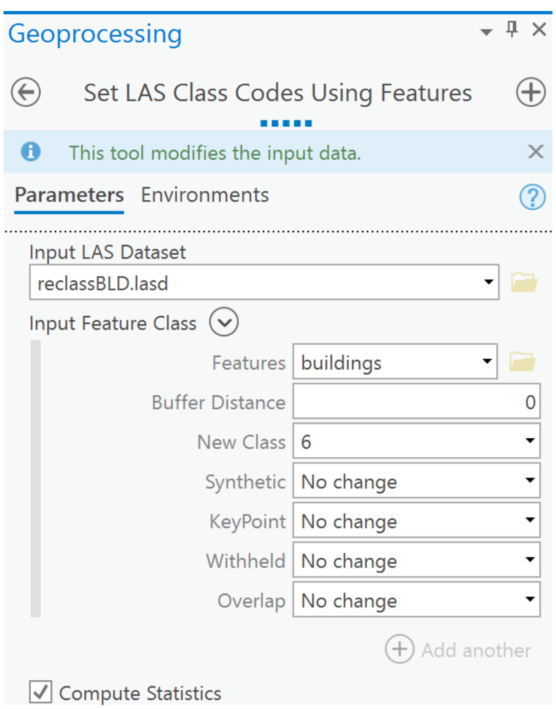
Reclassify By Feature

The original LAS data does not contain buildings





Use the Set LAS Class Codes using Features tool



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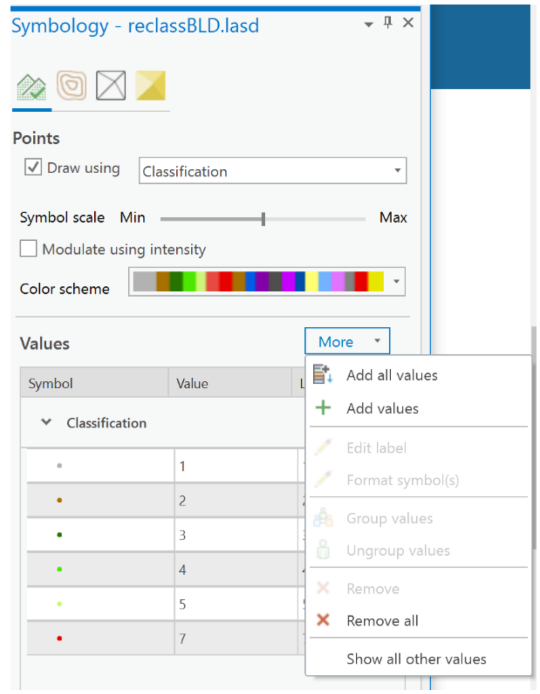
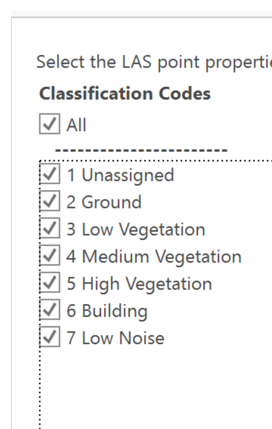
To add the new classified buildings click more then add all values



Classified buildings

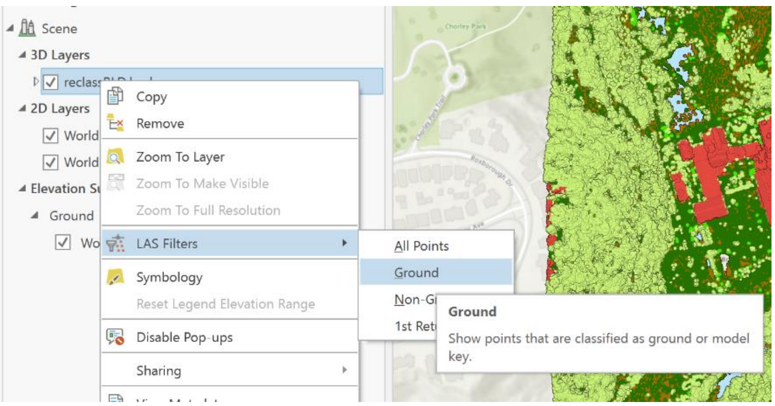
New classification codes



Create DEM

Symbolize ground points.

Right click on the LAS Dataset in the table of contents, click on LAS Filters then Ground



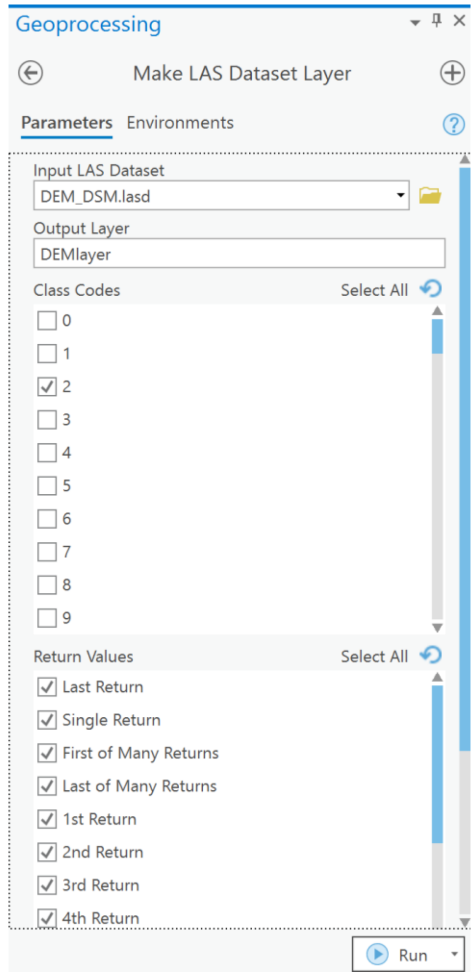
Ground points symbolized in the LAS Dataset

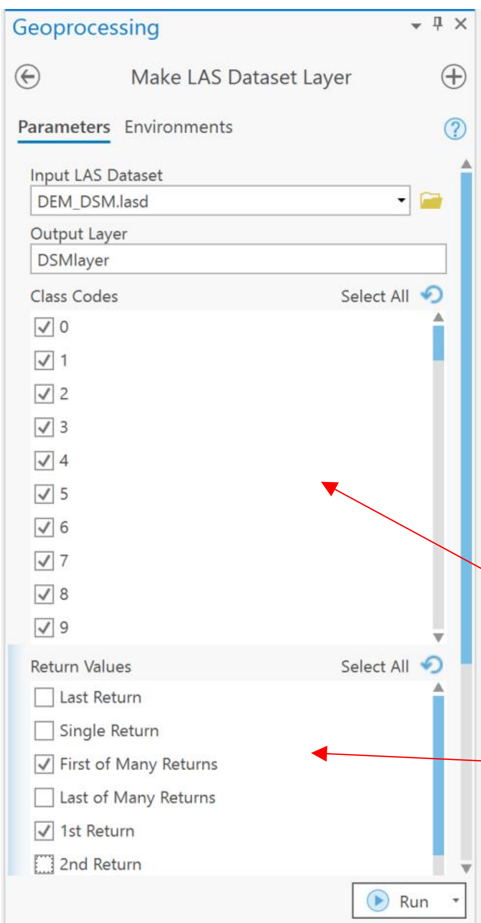
Create a Ground (DEM) LAS Dataset

Use the Make LAS Dataset Layer tool.

Check off the class code of 2 for ground and then select all Return Values

This will create an LASD of only the ground points.



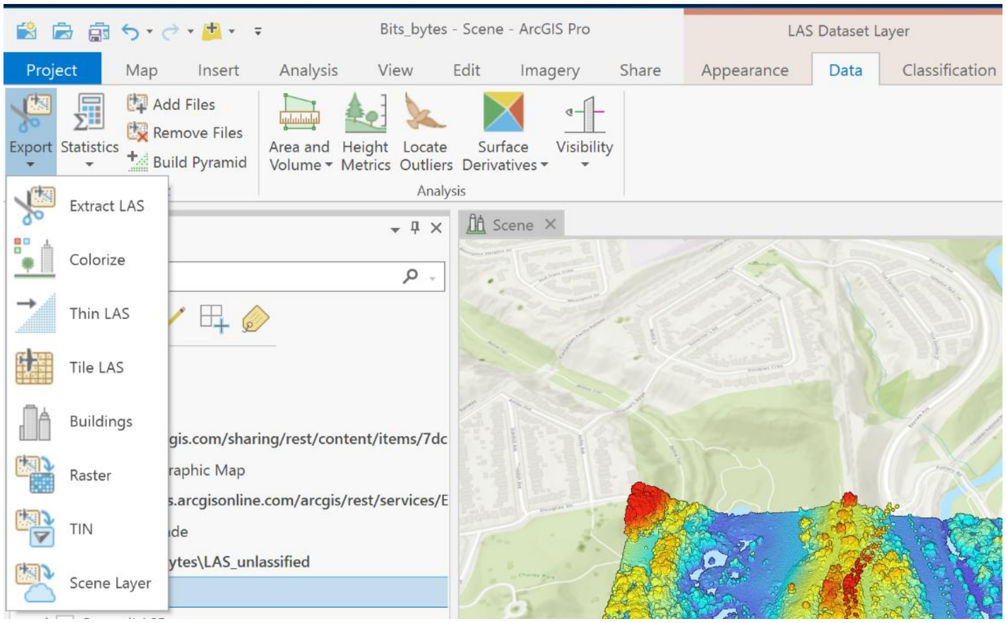


Create a Digital Surface Model (DSM) LAS Dataset

Use the Make LAS Dataset Layer tool.

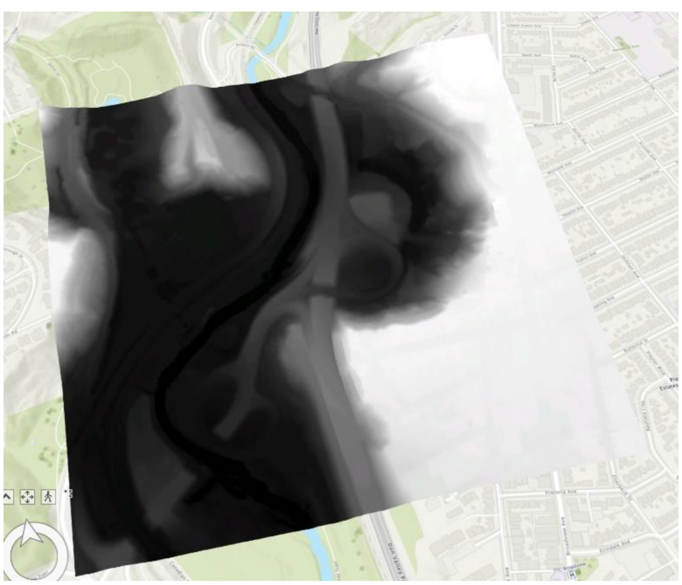
Select all Class Codes then the return values of First of Many Returns and 1st Return. This will give the first object the lidar hits. It will give tree tops as well as ground.

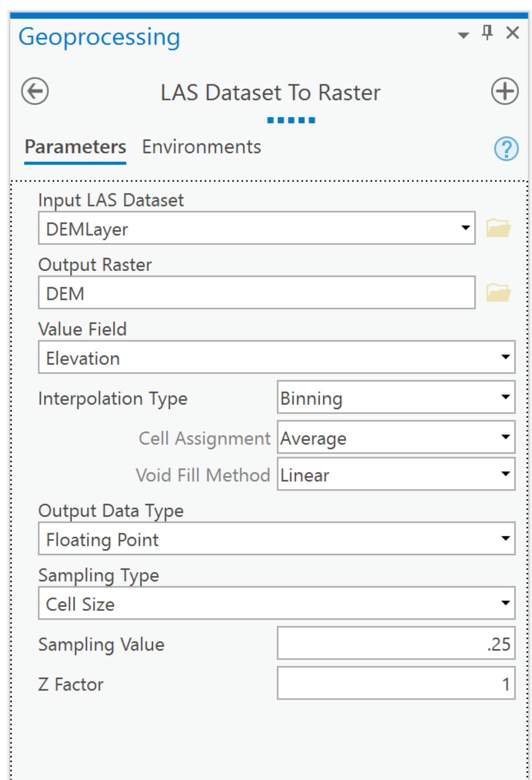
Create a DEM and DSM raster. Click on the LAS Dataset Layer ribbon, the Data tab then Export and choose Raster.



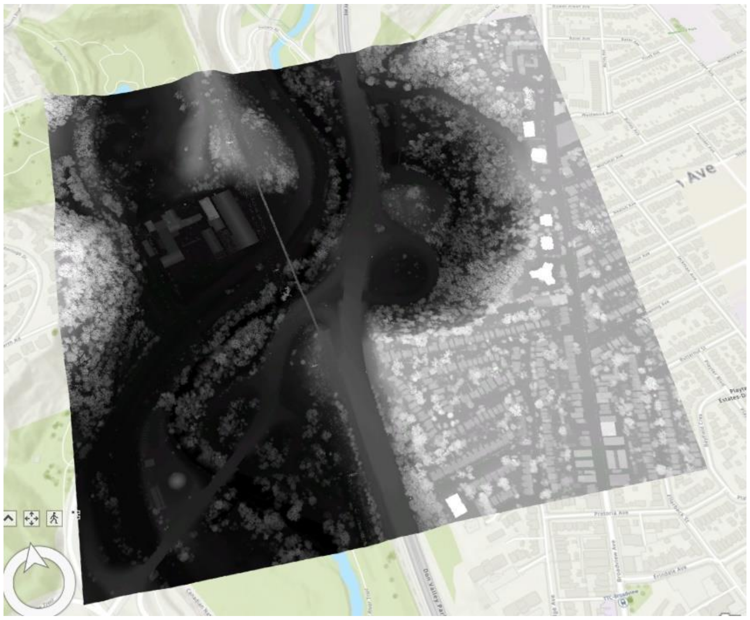
Fill out the LAS Dataset to Raster tool as shown with a cell size of 0.25 to create a DEM raster.

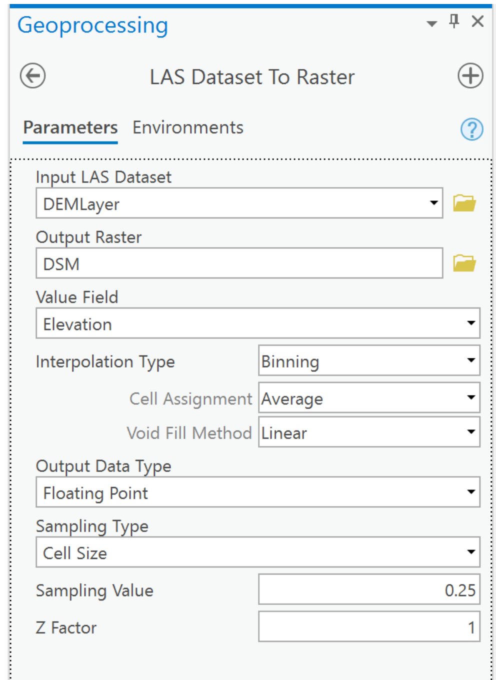
DEM Raster



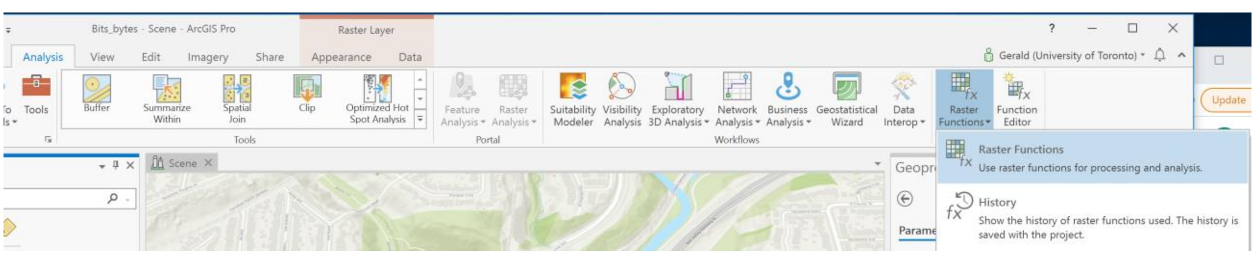


Create a DSM from the ground LAS Dataset to Raster tool.

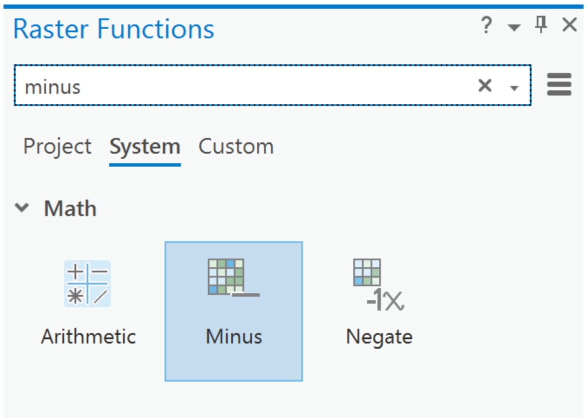


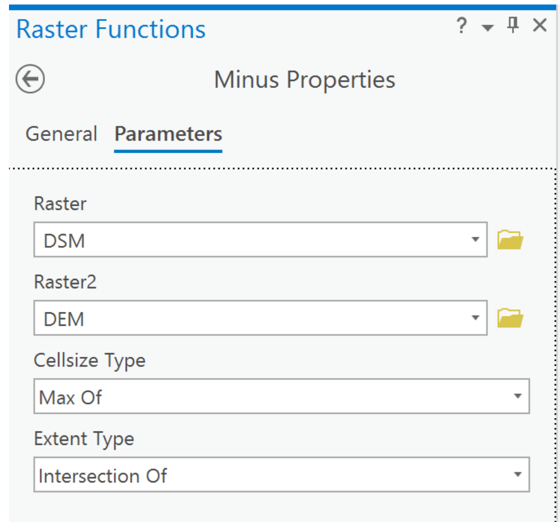


Under the Analysis tab click on Raster Functions

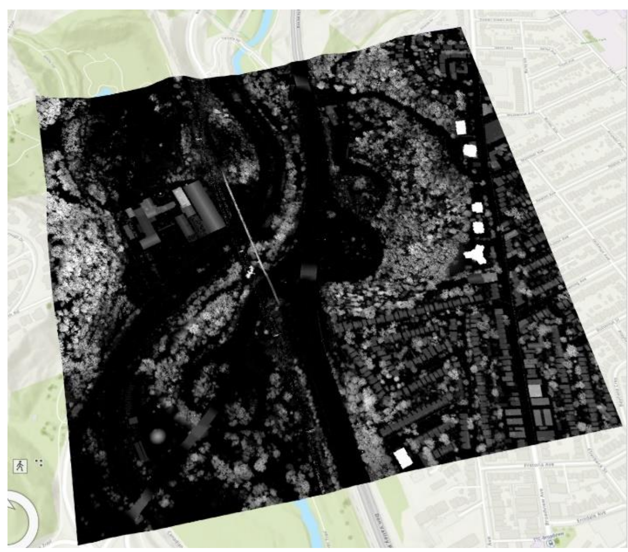


Search for Minus and create a normalized DSM by subtracting the DSM by DEM. This is useful for detecting vegetation heights and building heights and identifying features on the ground. This will create a virtual raster layer.



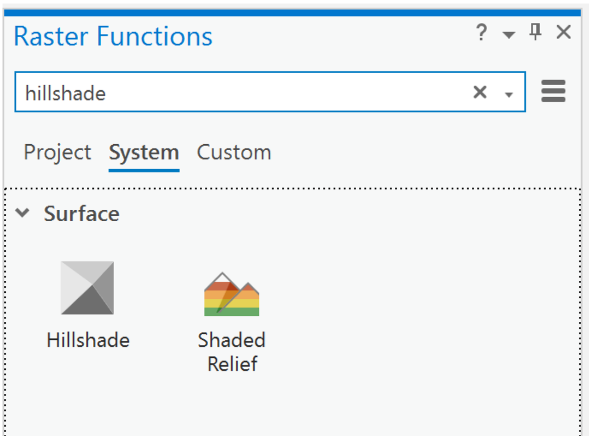


Normalized DSM, this gives height above ground of data. This will be a virtual layer.

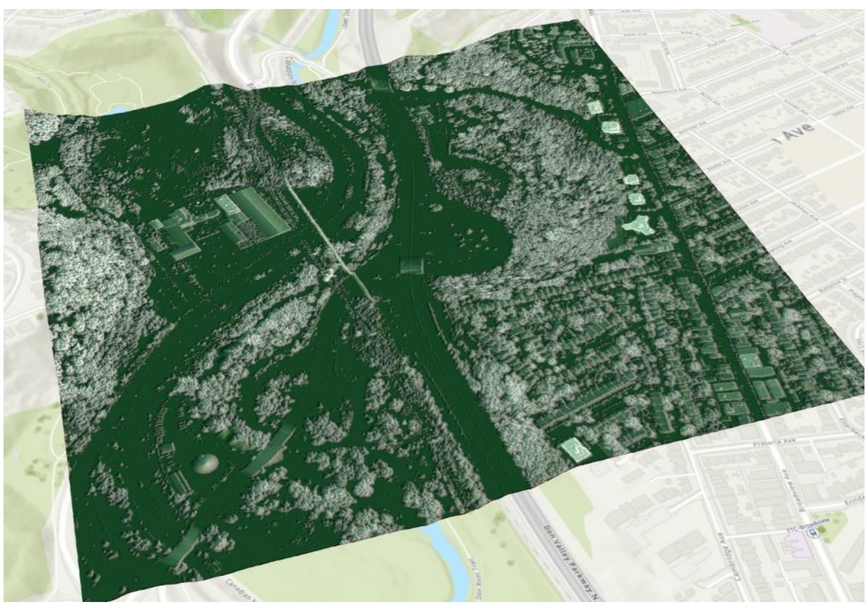


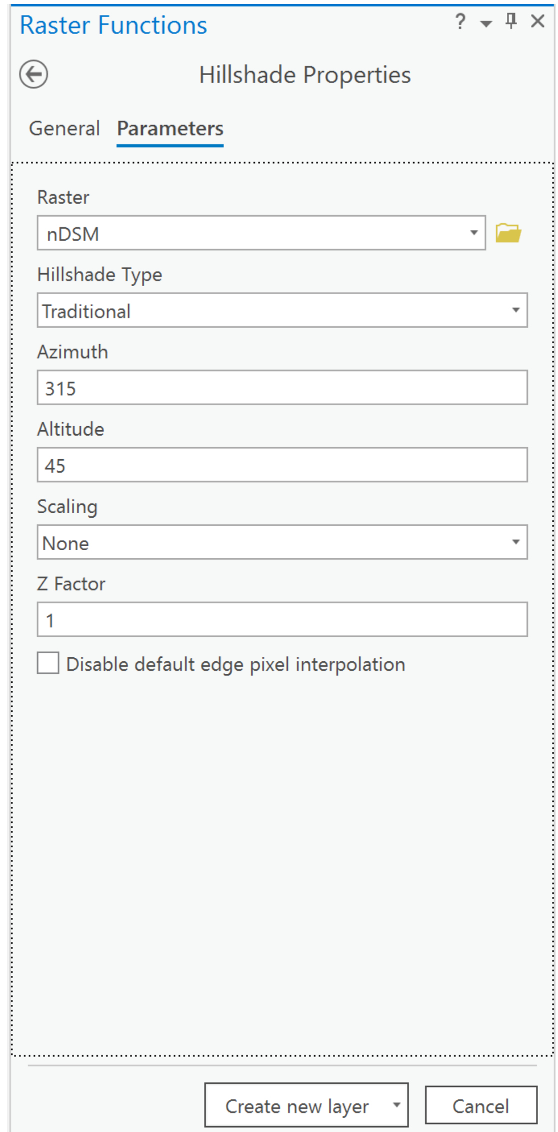
Hillshade

Type in Hillshade in the Raster Functions



A Hillshade layer will be created for the DEM, DSM and nDSM rasters.





The newly created nDSM hillshade. In the figure to the left the sDSM hillsahde was made transparent and overlayed on top of the nDSM raster layer.

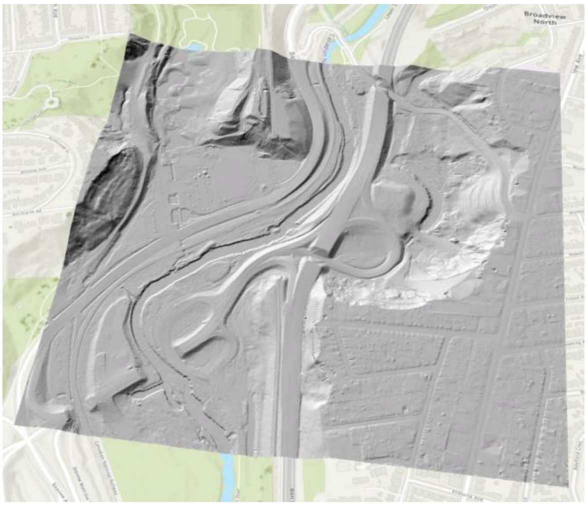
Create a hillshade for the DEM and DSM as well.

HILLSHADES

Normailzed Digital Surface Model(nDSM)

Digital Surface Model(DSM)

Digital Elevation Model(DEM)



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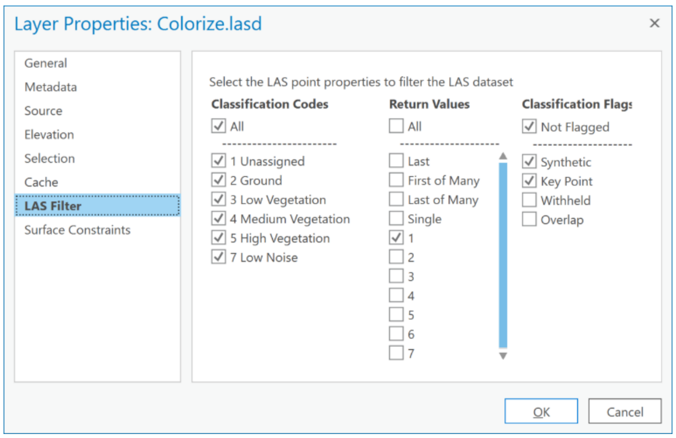
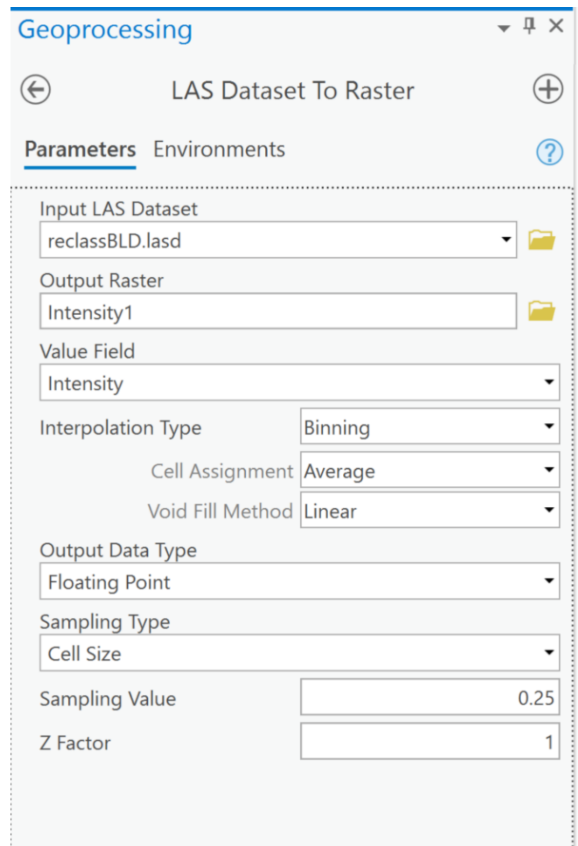
Create Intensity Image

The intensity image gives a substitute for aerial photography for the study area. It is derived from the intensity measurement which is included in this lidar dataset.



Create intensity image by converting LAS Dataset to raster



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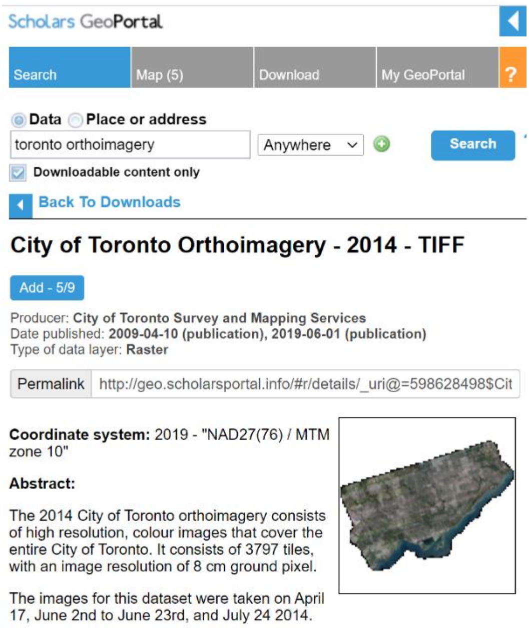
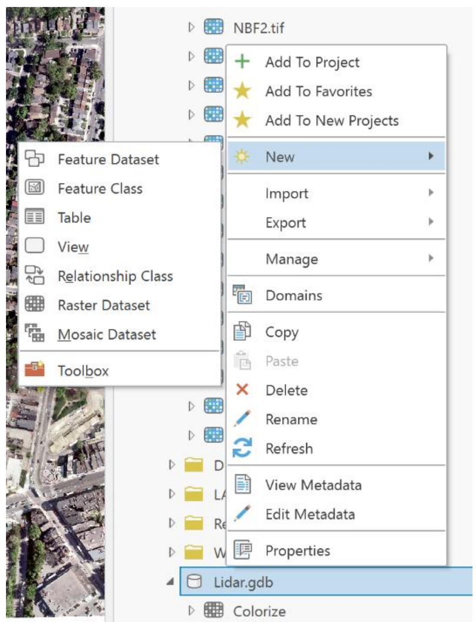
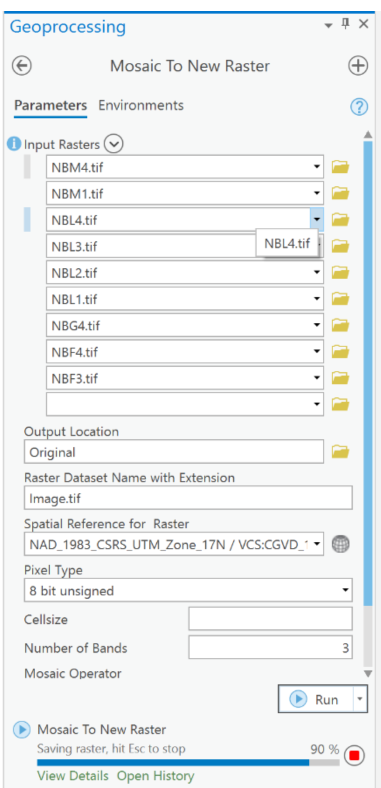
Colorize LASD



Download the Toronto Orthophoto from 2014. These will be used to colorize the LAS Dataset. These were found at the Scholars Geoportal http://geo1.scholarsportal.info/

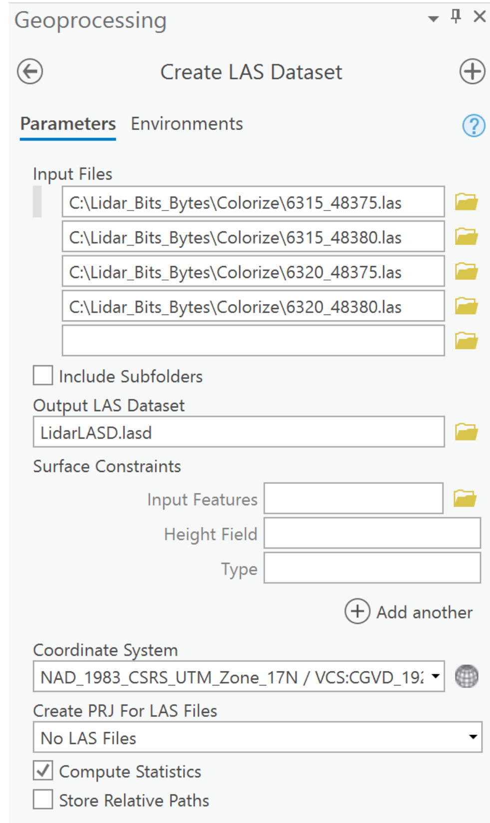
Create a geodatabase for the orthoimagery.



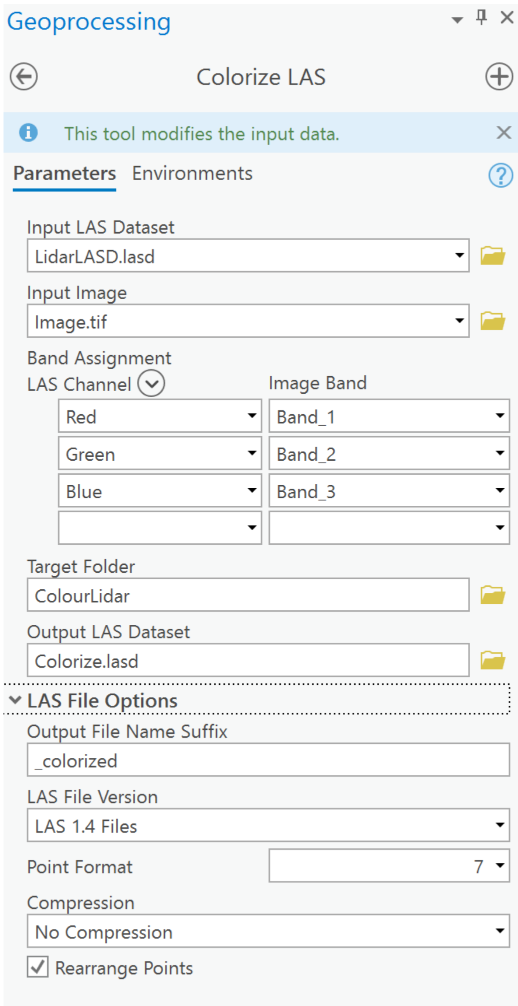


Mosaic the tif data into a new raster which will be output into the geodatabase.

Create a new LASD used to colorize LAS.



Colorize LAS tool.



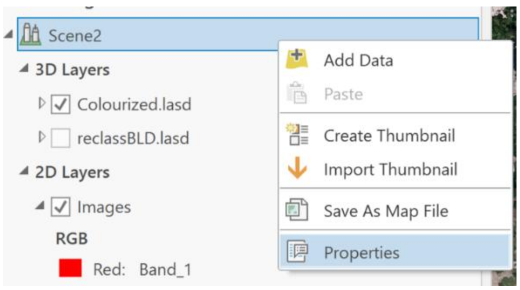
Use the raster image from above

Colorized LASD view from arcgis pro

Viewing Point Cloud data in AGOL

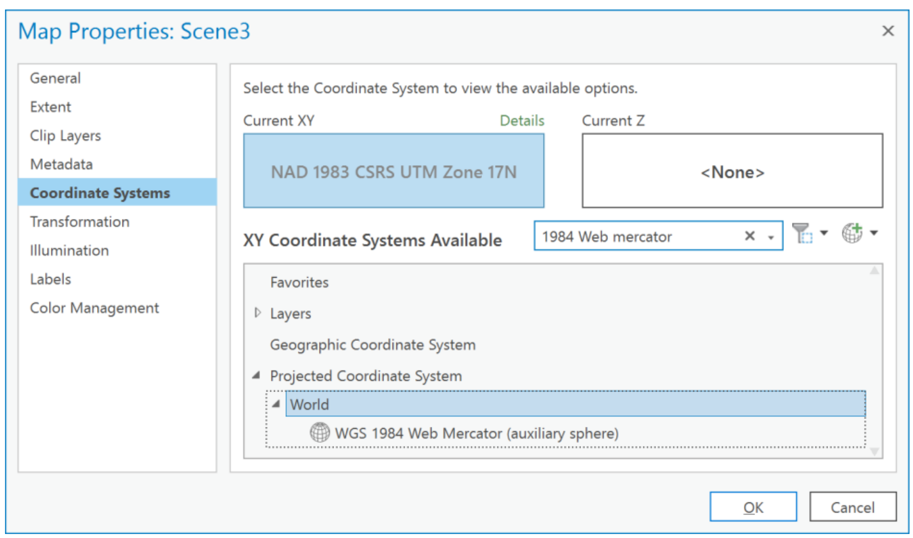
Ensure that the scene is in a Webmercator projection

Right click on the Scene and click on Properties

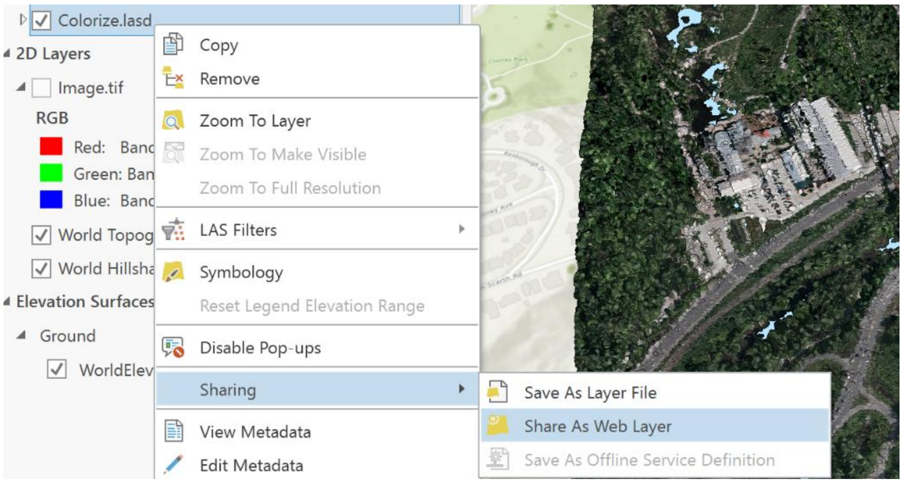


Then click on Coordinate Systems and click on Current XY

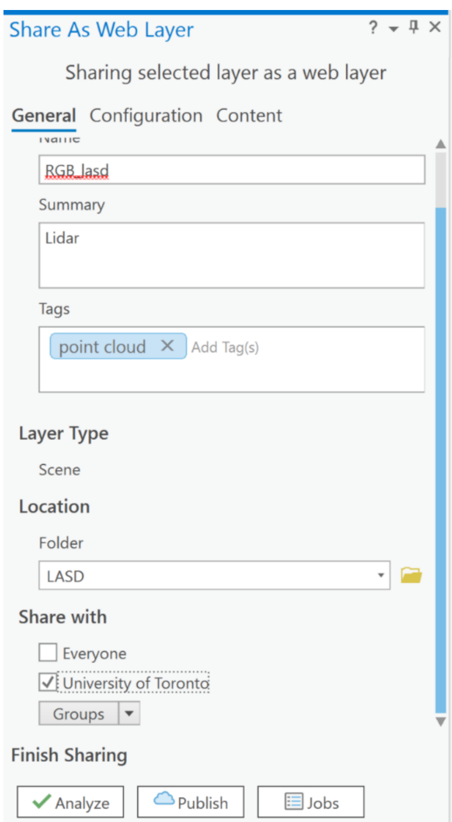
Search for 1984 Web Mercator then click on Projected Coordinate Systems, World and Choose WGS 1984 Web Mercator



Share web scene to ArcGIS Online



Fill out the Share as Web Scene dialogue.



ArcGIS Online Scene