

# MN LiDAR Data Packet Workshop

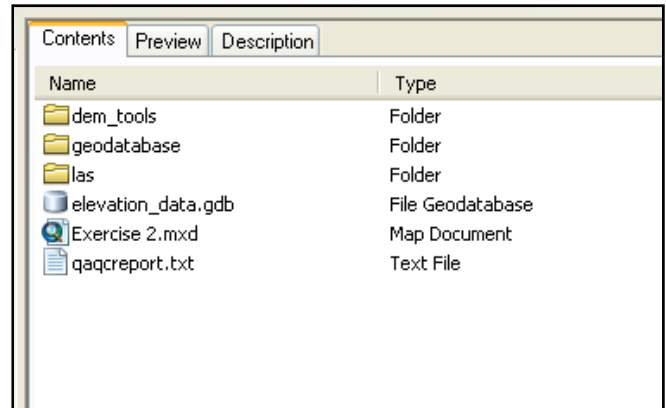
## Exercise #1 – Getting to know tiled data

The purpose of this exercise is to become familiar with the tiled Geodatabase and LAS files that comprise the core products of the Minnesota Elevation Mapping Project. You will explore the details of the data, how to access it, and how to manipulate the information.

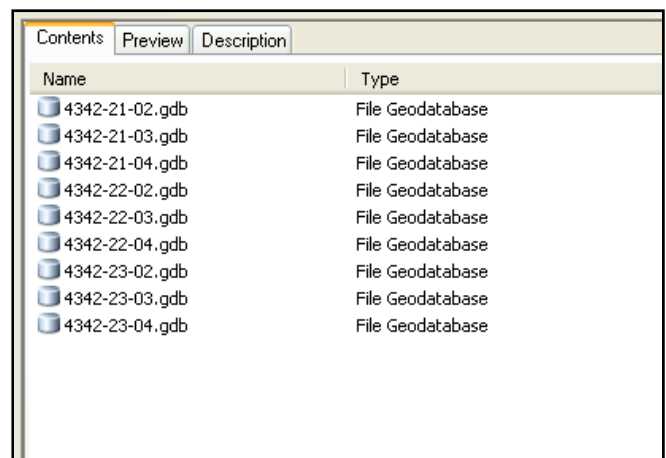
All data is stored in the **C:\temp\mn\_lidar\_packet\_workshop**. From this point forward this will be called the “**Workshop**” folder.

1) Start this exercise by going to START | Programs | ArcGIS – *ArcCatalog*.

2) Once *ArcCatalog* has opened, use the Catalog Tree to open the Workshop folder (c:\temp\mn\_lidar\_packet\_workshop). You'll notice that this folder contains a Geodatabase named **Elevation\_data.gdb** and three folders – **Geodatabase**, **LAS**, and **dem\_tools**.

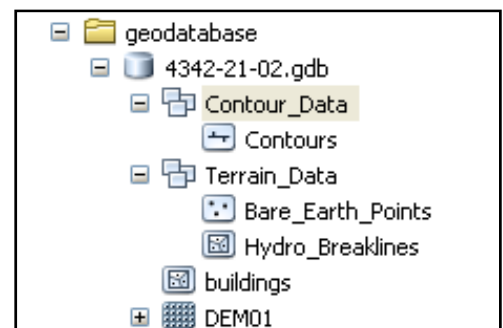


3) If you open the Geodatabase folder you'll see that there are nine individual file geodatabases representing nine tiles of information.



4) If you open a tile Geodatabase, you'll see the contents of the file that make up the tile data packets for the Minnesota Elevation Mapping Project. Notice that there are two “Feature Datasets”, one feature class and one raster.

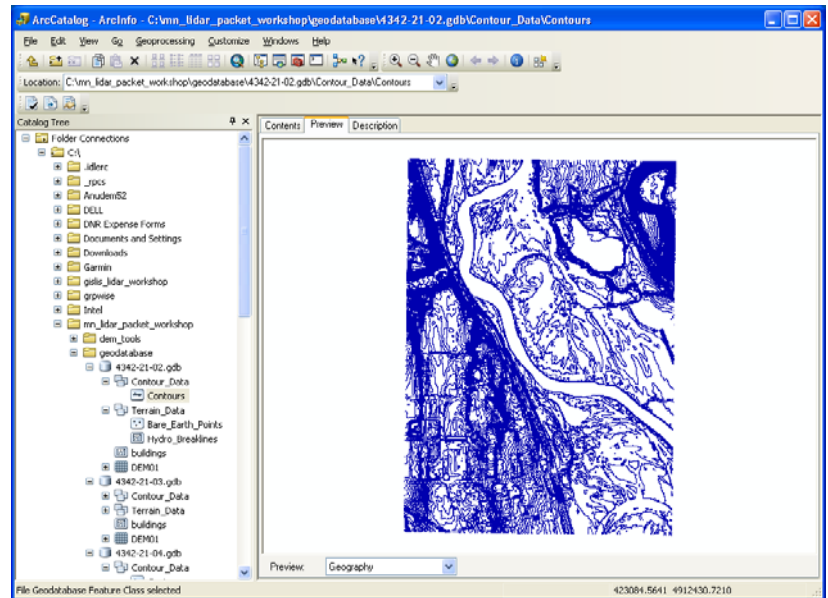
While all tiles will contain Contours, bare earth points and a DEM, not all tiles contain buildings or water features so those feature classes may, or may not exist for the tile you are examining.



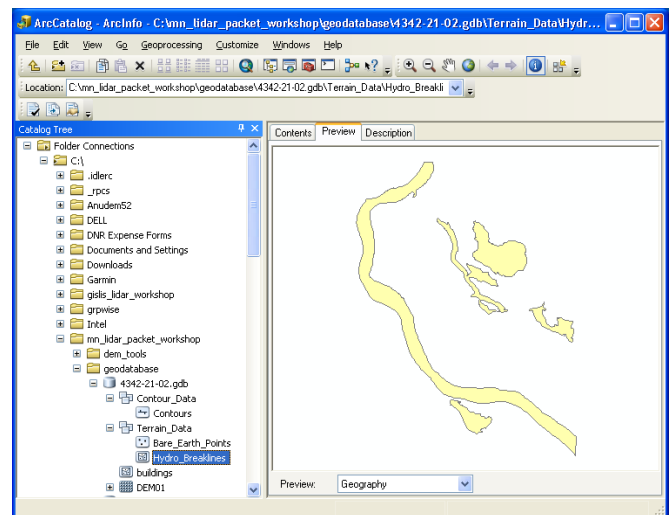
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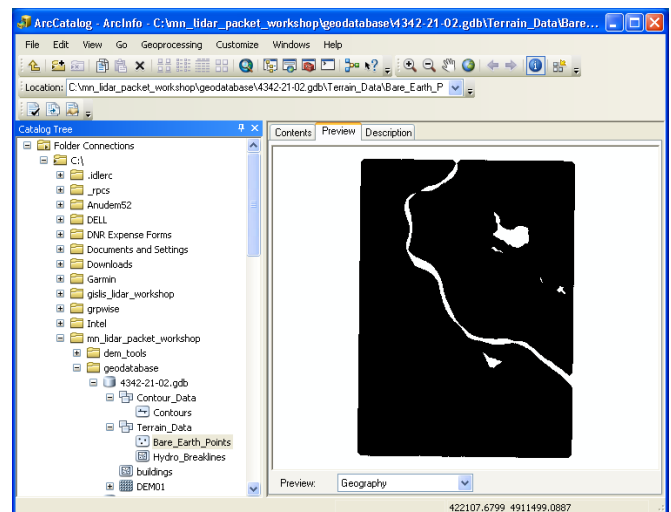
- 5) Click the **Preview** tab in the right-hand window, then in the left side of the window access a tile's 2' contours in the **Contour\_Data** feature dataset.
- 6) In *ArcCatalog* you can use the toolbars to zoom in and out, pan around, and get information about a particular line segment. Zoom into an area and retrieve information about a contour using the INFO tool. Notice the **Elevation** and **Contour\_Type** fields and the information they display.



- 7) View the **Hydro\_Breakline** feature class in the **Terrain\_Data** feature dataset.



- 8) View the **Bare\_Earth\_Points** feature class in the **Terrain\_Data** feature dataset.

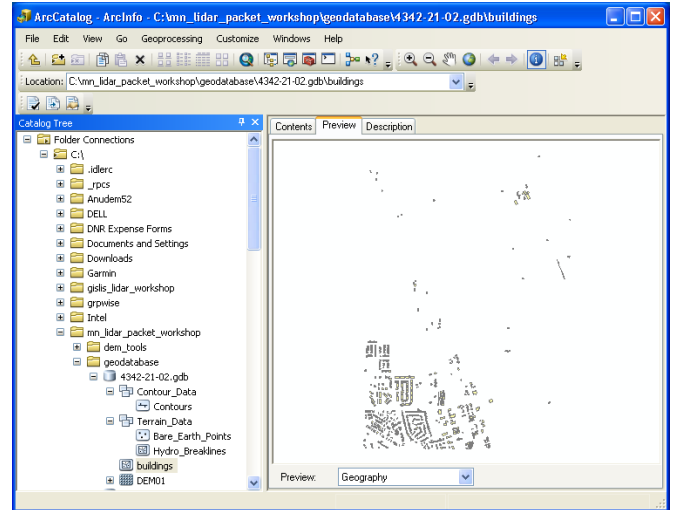


- 9) The **bare\_earth\_points** feature class appears as a black blob. That's due to the density of the points and the default marker symbol that is used to display them. If you zoom in you'll see individual points.

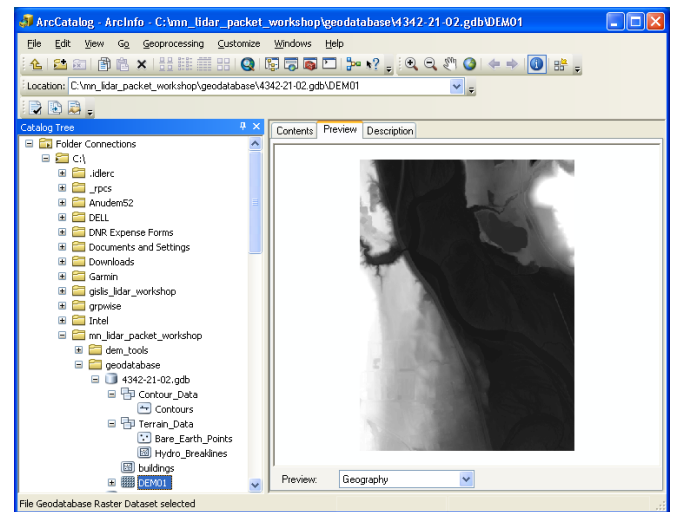
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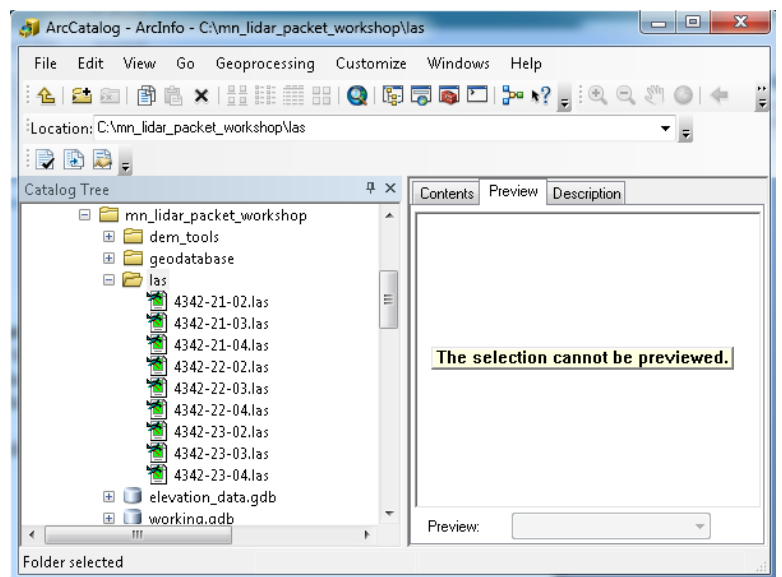
10) View the Buildings feature class.



11) View the DEM.



12) Now change the view back to the **Contents** tab and access the **LAS** folder. You'll notice that there are an equivalent number of tiled LAS files. If you change the view back to the **Preview** tab, however, you'll notice that nothing shows. That's because *ArcCatalog* does not recognize LAS files so it does not know how to display the contents . . .

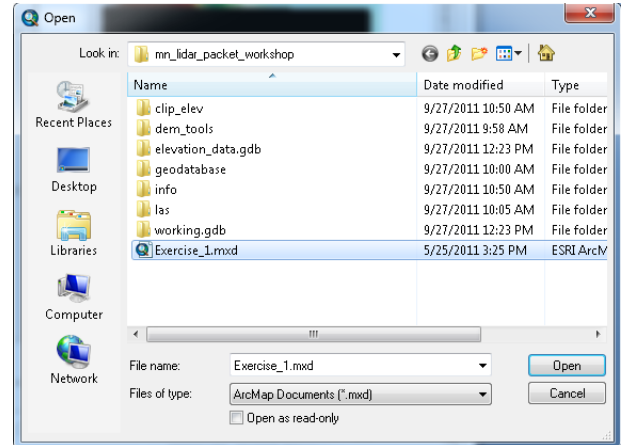


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13) Let's take a more in-depth look at the data. Close *ArcCatalog*.

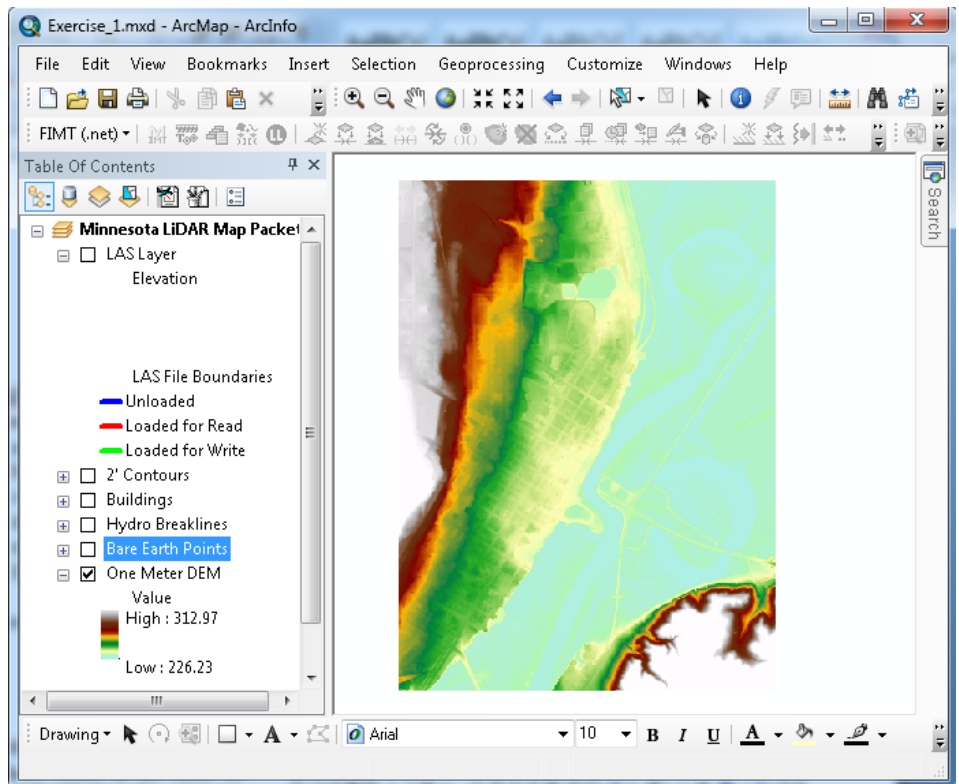
14) Start *ArcMap*. Open document called **Exercise\_1.mxd** found in the Workshop folder.



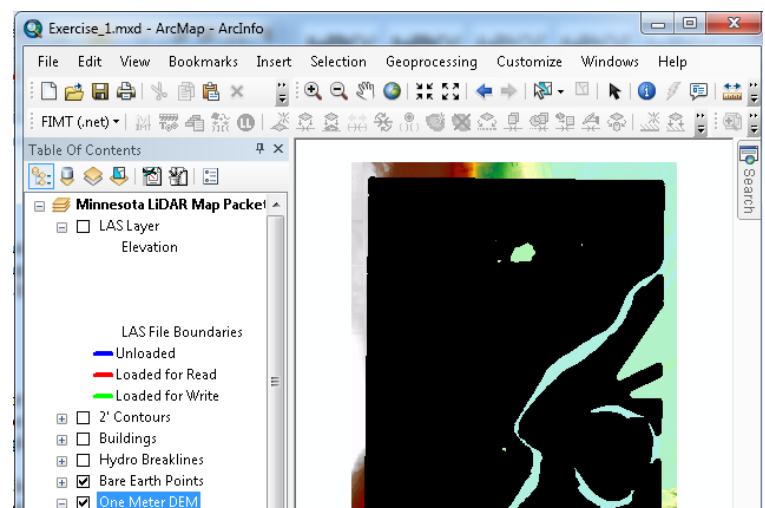
15) ArcMAP will load the contents of the map document. You'll see that there are six layers present:

- a) LAS Layer – 9 LAS files as an LP360 layer
- b) 2' Contours
- c) Buildings
- d) Hydro Breaklines
- e) Bare Earth Points
- f) One Meter DEM

The Bare Earth DEM will be displayed.



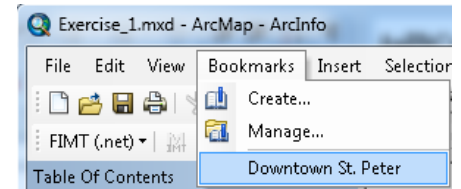
16) Make them visible in the Table of Contents (TOC). You'll notice the same thing you saw in *ArcCatalog* – a basically black display.



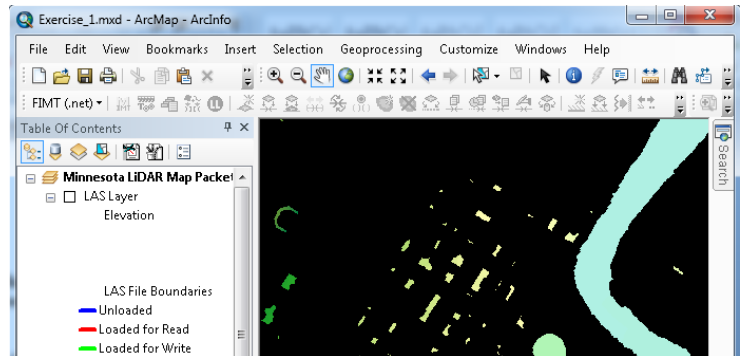
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- 17) In the **Bookmarks** menu choose the bookmark called **Downtown St. Peter**.



- 18) Notice the gaps in the Bare Earth Points – these are buildings that have been filtered out of the LAS data.

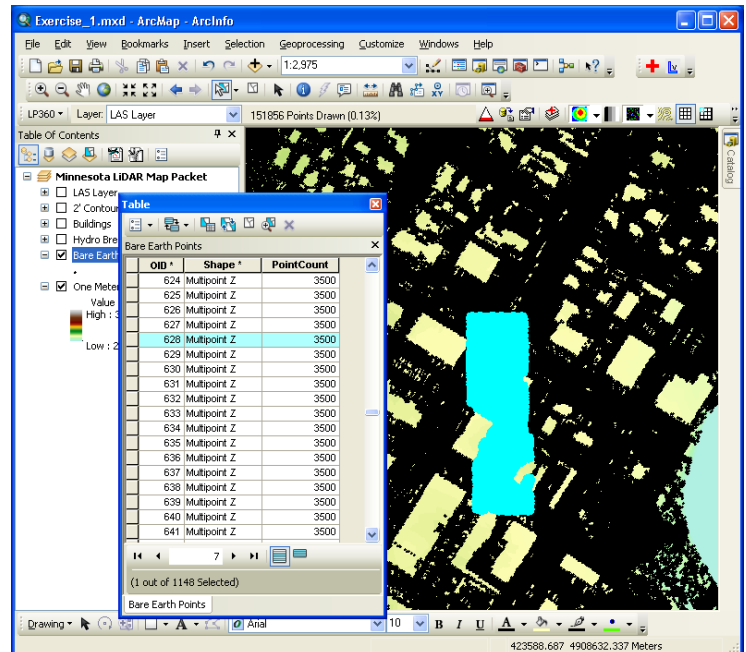


- 19) Bare earth points are stored as “MultiPoint” features. That means that for every record in the table, there are one or more points associated with it. Open the table for this feature class and what you’ll see are 1,148 points with three attributes OID, Shape, and PointCount. Notice that there are 3,500 points per record in this table.

OID *	Shape *	PointCount
1	Multipoint Z	3500
2	Multipoint Z	3500
3	Multipoint Z	3500
4	Multipoint Z	3500
5	Multipoint Z	3500
6	Multipoint Z	3500
7	Multipoint Z	3500
8	Multipoint Z	3500

(0 out of 1148 Selected)

- 20) Using the **Selection** tool, select a record in the table (click far left side of a record). A bunch of points get selected, like the image right.

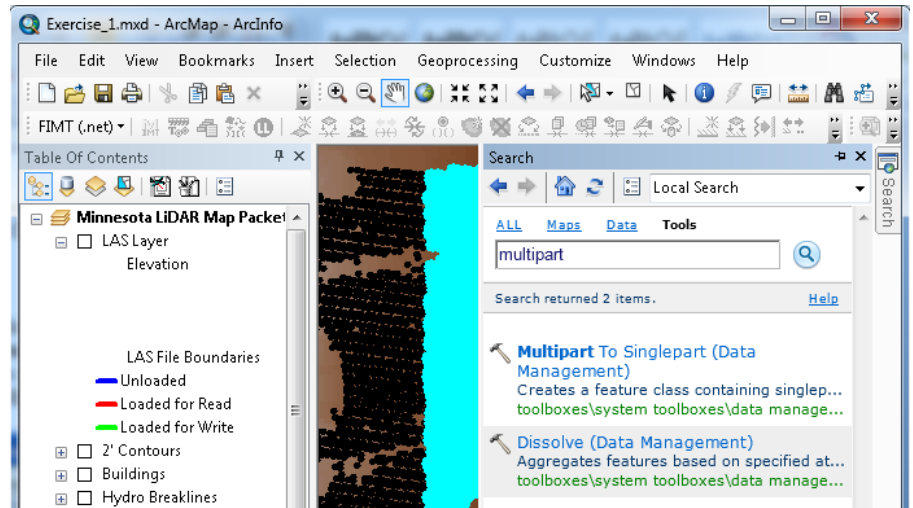


This means you cannot query the dataset or get information about a point’s elevation. You’ll have to convert the points from MultiPoint features to Point features. This is done using the **Multipart to Singlepart** tool found in ArcToolbox.

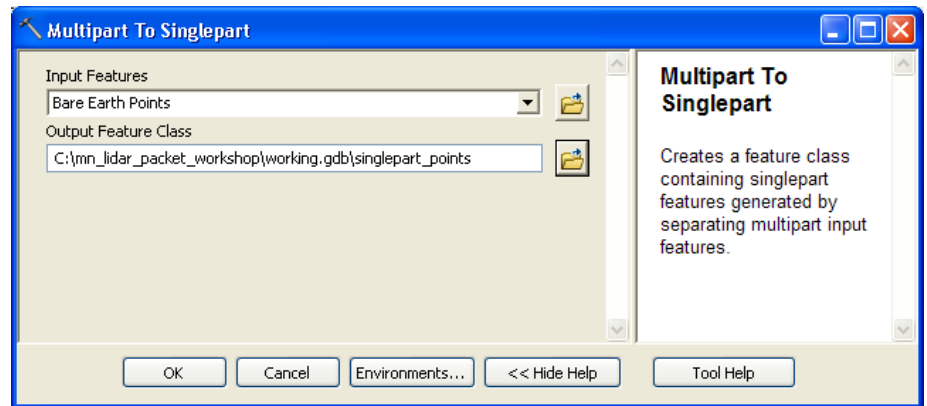
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- 21) With the one record selected click the **Search** tab in ArcMap.
- 22) Click the **Tools** category, then type in **Multipart**.
- 23) Click **Multipart to Singlepart (Data Management)**.



- 24) Drag the Bare Earth Points layer from the TOC into the Input Features box.
- 25) For the Output Feature Class, save to the **Workshop folder\Working.gdb**, calling the new feature class **singlepart\_points**.

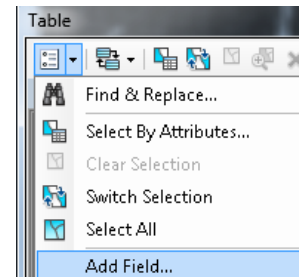


- 26) Click **OK**.
- 27) When complete, open the attribute table – how many points are there now? Notice that there is no Z (elevation) value yet. We have to add a new field to obtain this information.

The screenshot shows the attribute table for 'Bare Earth Points'. The table has three columns: 'OID', 'Shape', and 'PointCount'. The data is as follows:

OID	Shape	PointCount
1	Multipoint Z	3500
2	Multipoint Z	3500
3	Multipoint Z	3500
4	Multipoint Z	3500
5	Multipoint Z	3500
6	Multipoint Z	3500
7	Multipoint Z	3500
8	Multipoint Z	3500

- 28) In the table click the **Table Options** button and choose **Add Field**.





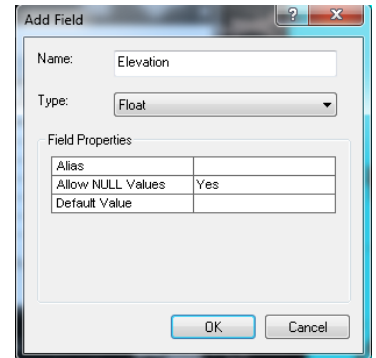
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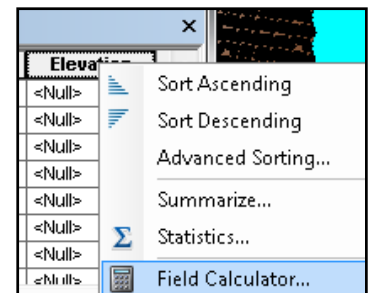
29) Type a name of **Elevation**.

30) Set the field type to **Float**.

31) Click **OK**.



32) Now that the field is established we can populate it using the elevation information stored within each Shape itself. Right-click the new field named Elevation and choose **Field Calculator**.



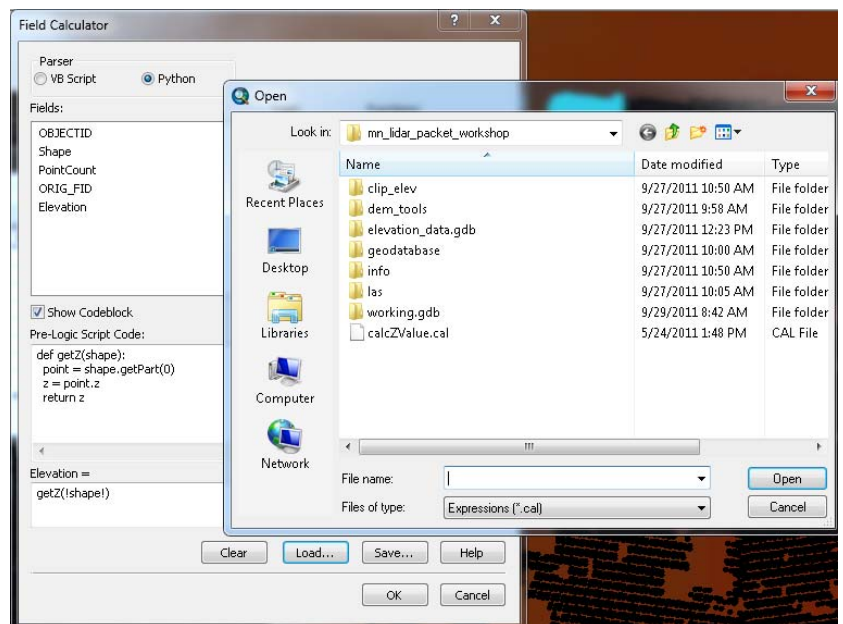
33) In the Field Calculator make the Parser **Python**.

34) Click **the Load** button.

35) Navigate to the Workshop folder and highlight **calcZValue.cal**.

36) Click **Open**.

37) **OK**.



38) The elevation field will be populated.

OID *	Shape *	PointCount	ORIG_FID	Elevation
1	Point Z	3500	624	235.03
2	Point Z	3500	624	235.03999
3	Point Z	3500	624	235.09
4	Point Z	3500	624	234.77
5	Point Z	3500	624	234.75
6	Point Z	3500	624	234.75
7	Point Z	3500	624	234.69
8	Point Z	3500	624	234.84

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39) Take a few minutes at this time to view the other data layers. Turn them on and off in the TOC. Use the **Identify** tool to examine their attributes.



40) Now create a hillshade representation of the elevation data. In the Search tab type **Hillshade**.

41) Click **Hillshade (Spatial Analyst)**.

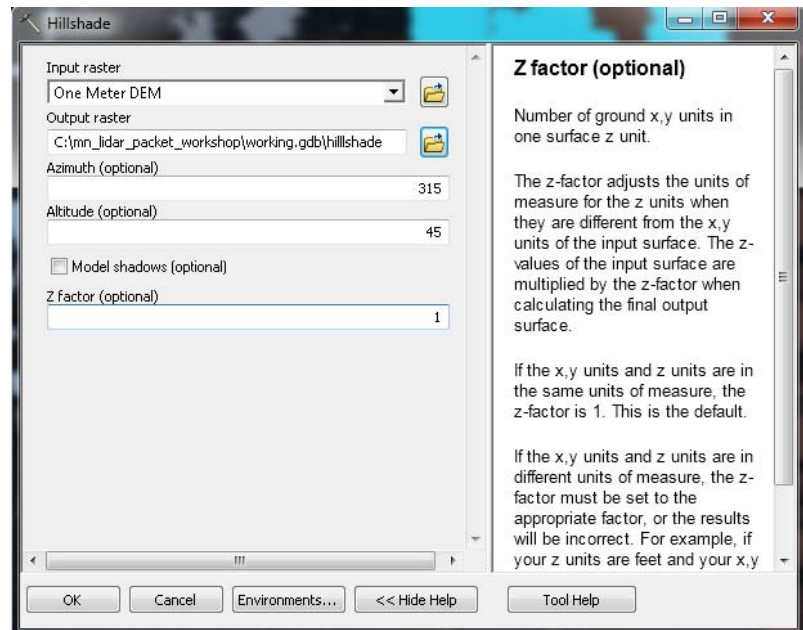
42) Drag the One meter DEM from the TOC into the Input Raster.

43) Make an output raster in the **Workshop folder\working.gdb** called **hillshade**.

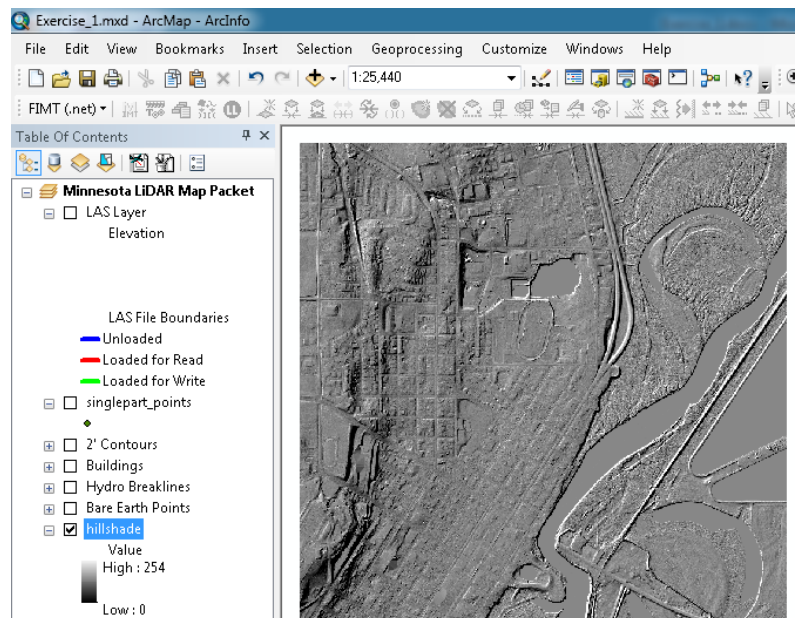
44) Keep the default azimuth and altitude values.

45) Because the vertical units are the same as the horizontal units, keep the z factor of 1.

46) Click **OK**.



47) Once complete, the tool will add the output as a grayscale image showing “the lay of the land”.



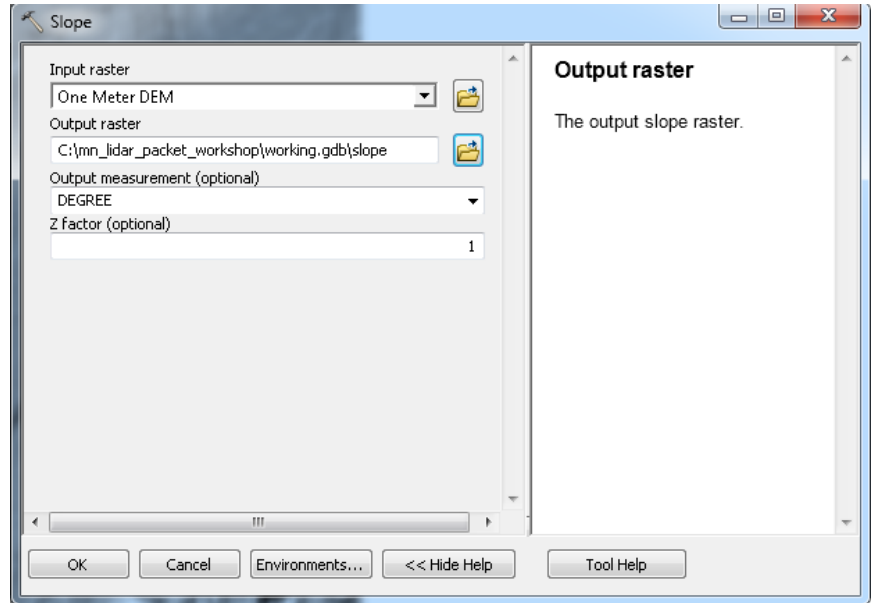
48) Now create a slope map. Use the **Search** tab to open the **Slope (Spatial Analyst)** tool wizard.



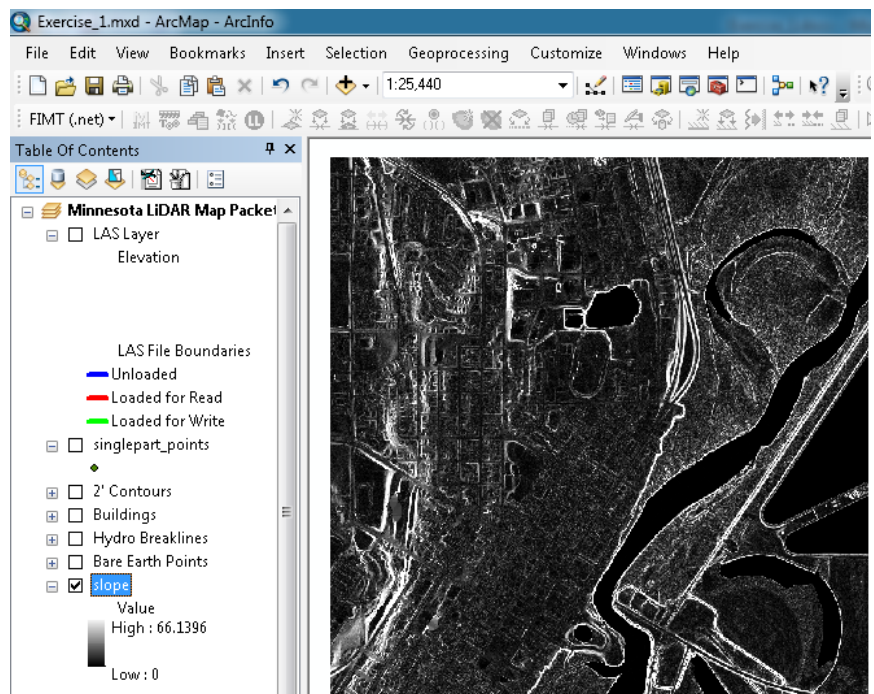
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- 49) Drag the One meter DEM from the TOC into the Input Raster.
- 50) Make an output raster in the **Workshop folder\working.gdb** called **slope**.
- 51) Keep the output measurement the default of DEGREE.
- 52) Because the vertical units are the same as the horizontal units keep the z factor of 1.
- 53) Click **OK**.



- 54) Once complete you'll get a raster layer on the screen where the colors represent the degree of slope for that cell.



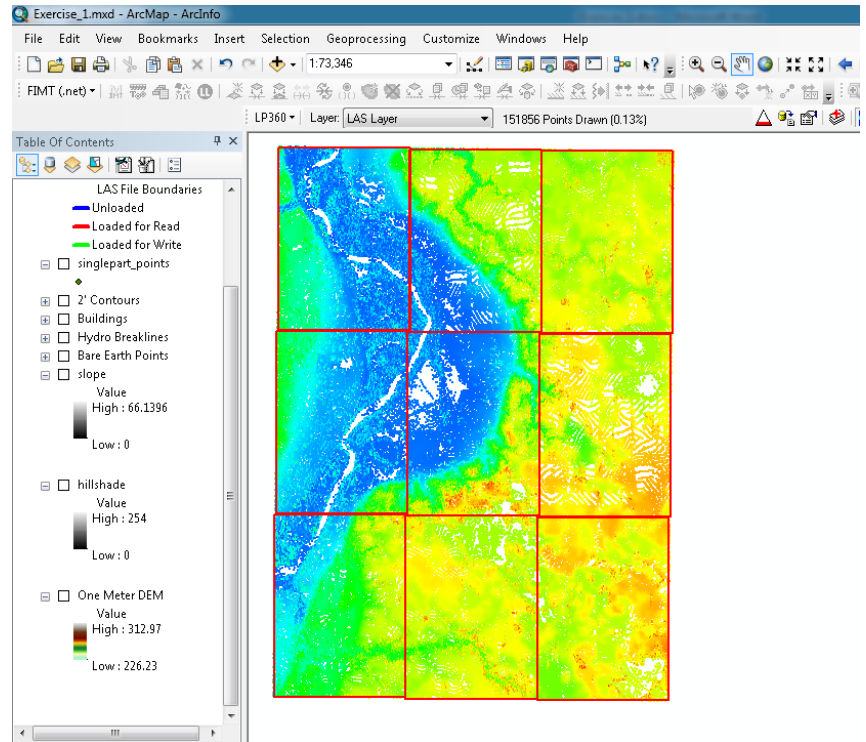
- 55) Lastly, let's have a look at the LAS files. Start by:
  - a. Making sure the LP360 Extension is turned on (**Customize | Extensions** menu option),
  - b. Turn off all other layers,
  - c. Zoom to the Full Extent
  - d. Turn on the LAS Layer

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- 56) Your screen should look like the display to the right.

What you are viewing is a set of LAS points across nine tiles of data. The red boxes represent the boundary of the individual LAS tiles.



- 57) You can turn the tile boundaries off and on using the buttons on the LP360 Toolbar.



- 58) You can view the various point classifications using the drop-down filter tool on the right side of the LP360 toolbar. By default, it is set to “All Points” but there are filters for Bare Earth, Buildings, Vegetation et cetera . . . Experiment by viewing the various filters and then zooming in to various points on the map.

- 59) You can also view these points in 3D by opening the LP360 Viewer Integration Toolbar (Customize | Toolbars | LP360 Viewer Integration).

- 60) Viewing in 3D is a two step process:
- e. Opening the 3D Viewer Window and,
  - f. Selecting an area of interest



- 61) Some hints to help you:

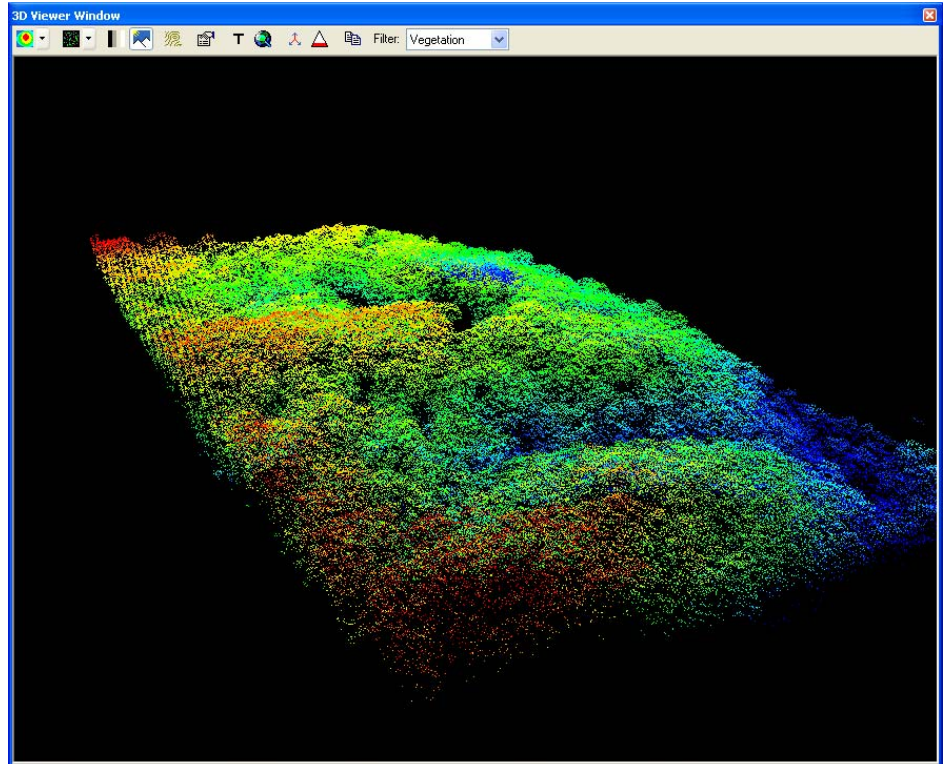
- a. Select a small area of interest for faster screen redraw.
- b. Zoom and pan using the right and left mouse buttons.

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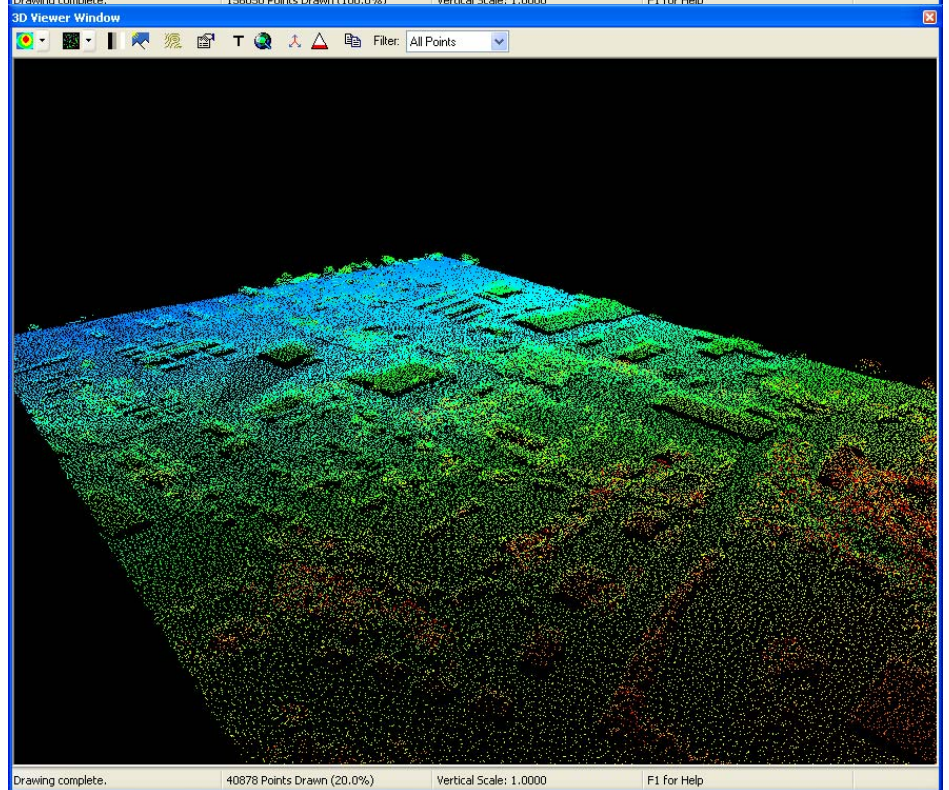
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A few sample graphics  
from the LAS files:

Vegetated area within river  
valley



Downtown St. Peter



62) You have now completed Exercise 1. Close ArcMap (there is no need to save the project) and stretch your legs.