HH_LiDAR_QAQC_July_09_2018

Compiled by: Kyo Yamagata
July 9, 2018

QA/QC Checklist:

Files	Extent (Pass/ Fail)	Point Density (Pass/ Fail) *	Pass/ Fail
Contours	Pass: Extent is larger than AoI	N/A	Pass
DEM	Pass: Extent is larger than AoI	N/A	Pass
Hillshade	Pass: Extent is larger than AoI	N/A	Pass
Ortho-ECW-FULL	Pass: Extent is larger than AoI	N/A	Pass
Ortho- GeoTiff Tiles	Pass: Extent is larger than AoI	N/A	Pass
LiDAR – BareEarth – Single Sample Tile	Pass: Extent is larger than AoI	Fail: 5.56 points per m^2	Pass**
LiDAR – BareEarth – Stitched	Pass: Extent is larger than AoI	Fail: 4.56 points per m^2	
LiDAR – NonBareEarth – Single Sample Tile	Pass: Extent is larger than AoI	Pass: 8.84 points per m^2	Pass
LiDAR – NonBareEarth – Stitched	Pass: Extent is larger than AoI	Pass: 11.23 points per m^2	

AoI = Area of Interest

*Documentation proposes that LiDAR points should be collected at 8 points per m^2

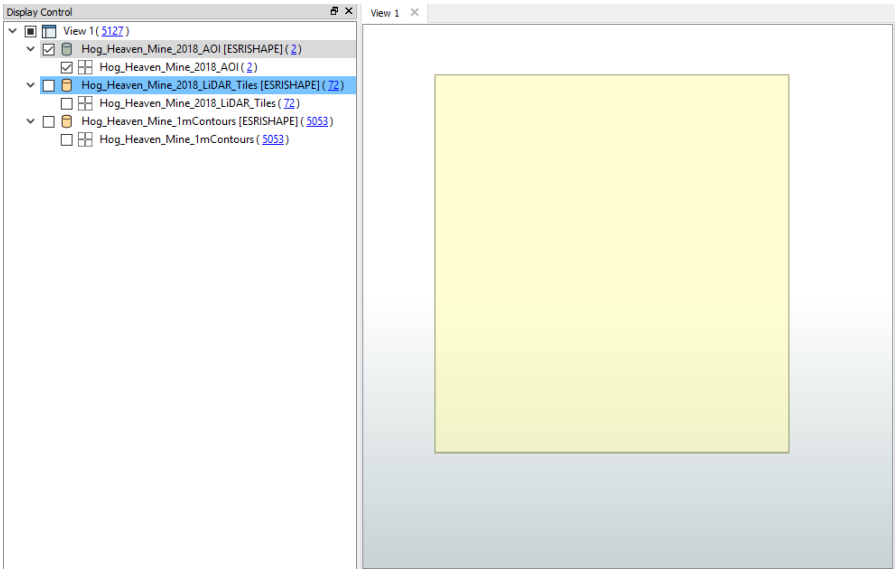
**Bare Earth model entails removal of points; thus, not subject to 8 points per m^2

The rest of the document contains screenshots and calculations used to determine whether they have met the criteria.

Contours

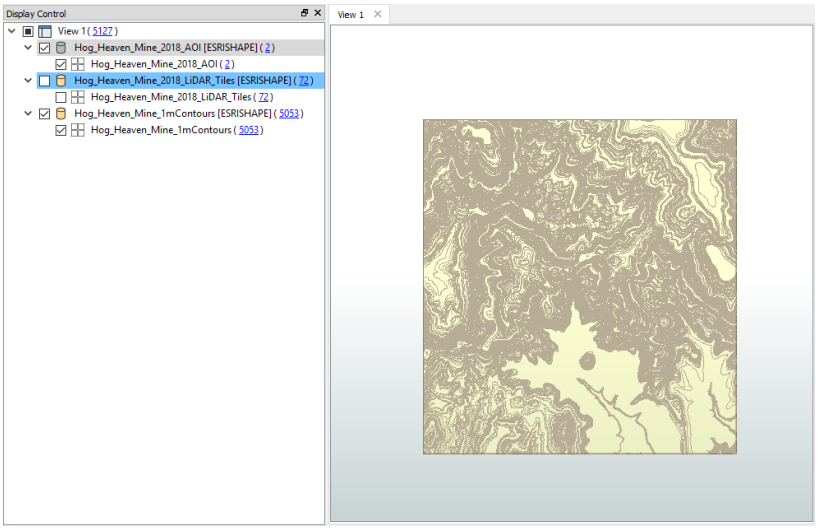
Filename: Hog_Heaven_Mine_1mContours.shp

Conclusion: Contours layer larger than the AoI



AoI Polygon for Hog Heaven

Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	_UTM83-11_0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0



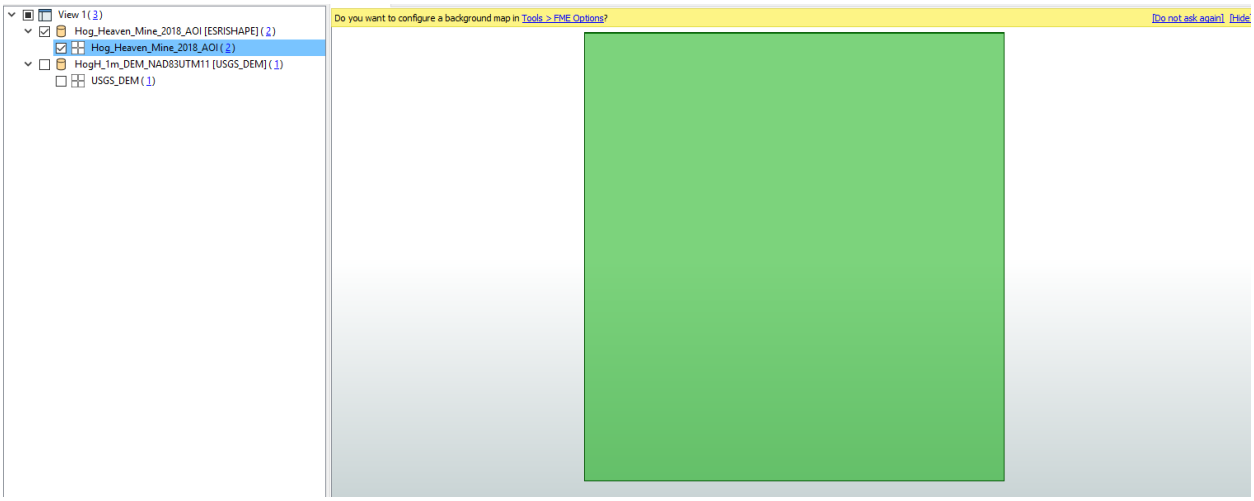
AoI overlay on contours layer

Property	Value
Feature Type	Hog_Heaven_Mine_1mContours
Coordinate System	_CSRS.UTM-11N_0
Dimension	2D
Number of Vertices	880
Min Extents	681255.5043811186, 5307089.995144157
Max Extents	681512.2113755575, 5307562.65288431

DEM

Filename: HogH_1m_DEM_NAD83UTM11.dem (USGS)

Conclusion: DEM larger than AoI



AoI Polygon for Hog Heaven

Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	_UTM83-11_0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0

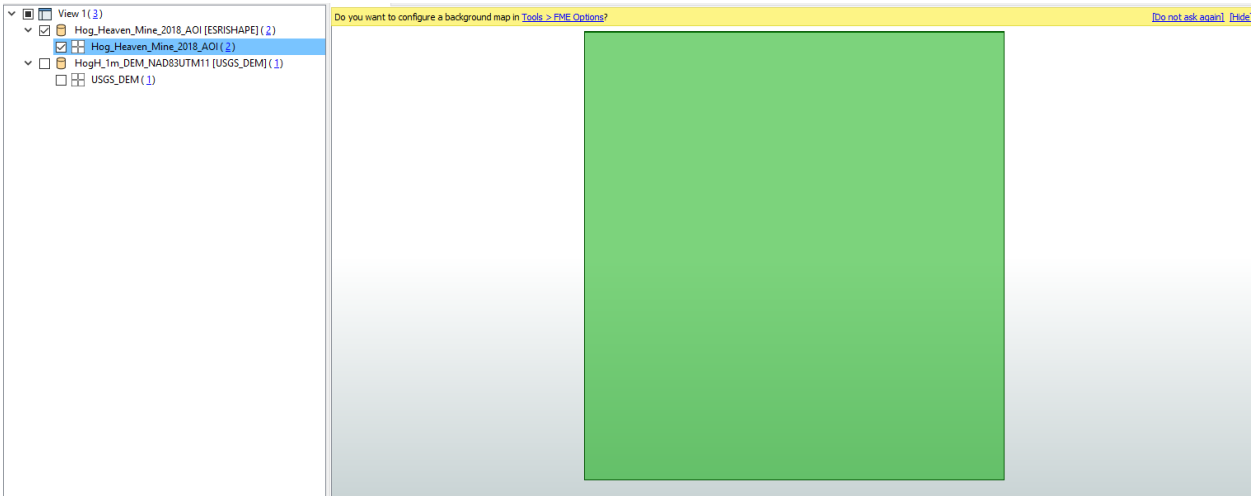
AoI overlay on DEM layer

Feature Information	
Property	Value
Feature Type	USGS_DEM
Coordinate System	UTM83-11
Dimension	2D
Number of Vertices	5
Min Extents	676099.5100006649, 5307089.489999377
Max Extents	683620.5100006649, 5315110.489999377

Hillshade

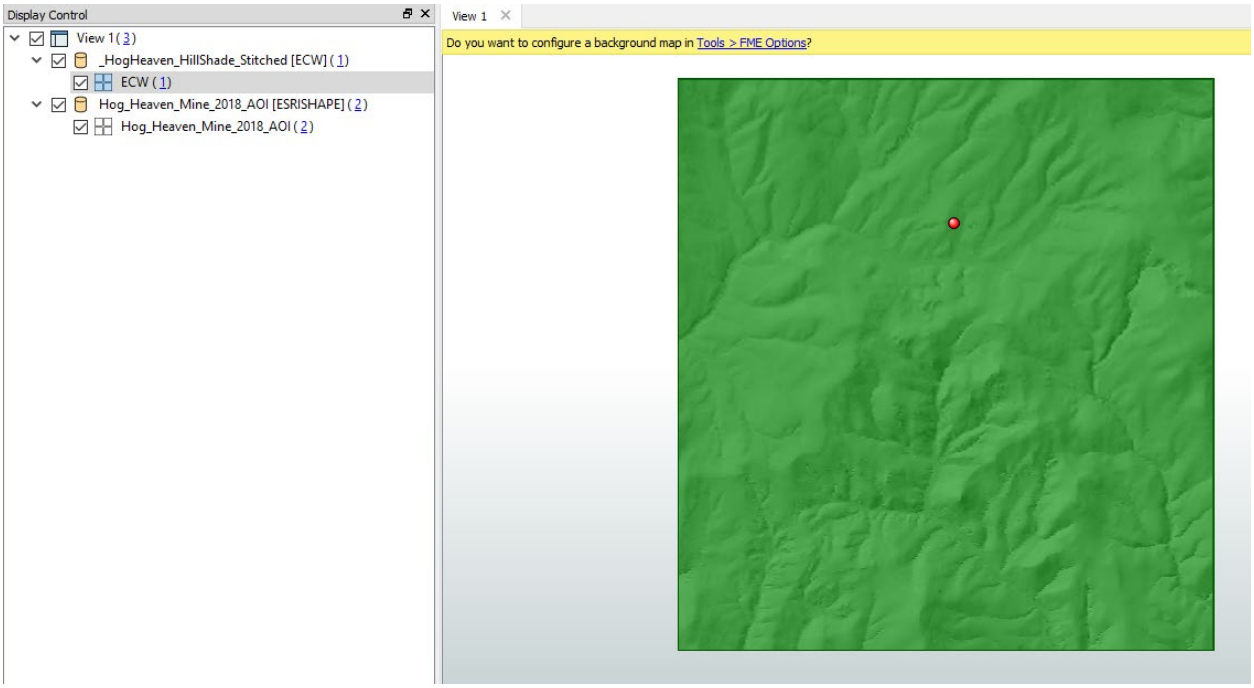
Filename: _HogHeaven_HillShade_Stitched.ecw

Conclusion: Hillshade layer larger than the AoI extent



AoI Polygon for Hog Heaven

Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	_UTM83-11_0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0



AoI overlay on hillshade layer

Feature Information	
Property	Value
Feature Type	ECW
Coordinate System	UTM83-11
Dimension	2D
Number of Vertices	5
Min Extents	676099.510001, 5307089.489999
Max Extents	683620.510001, 5315110.489999

LiDAR – BareEarth

Filename: **679000_5307000_BE.las** (single sample tile)

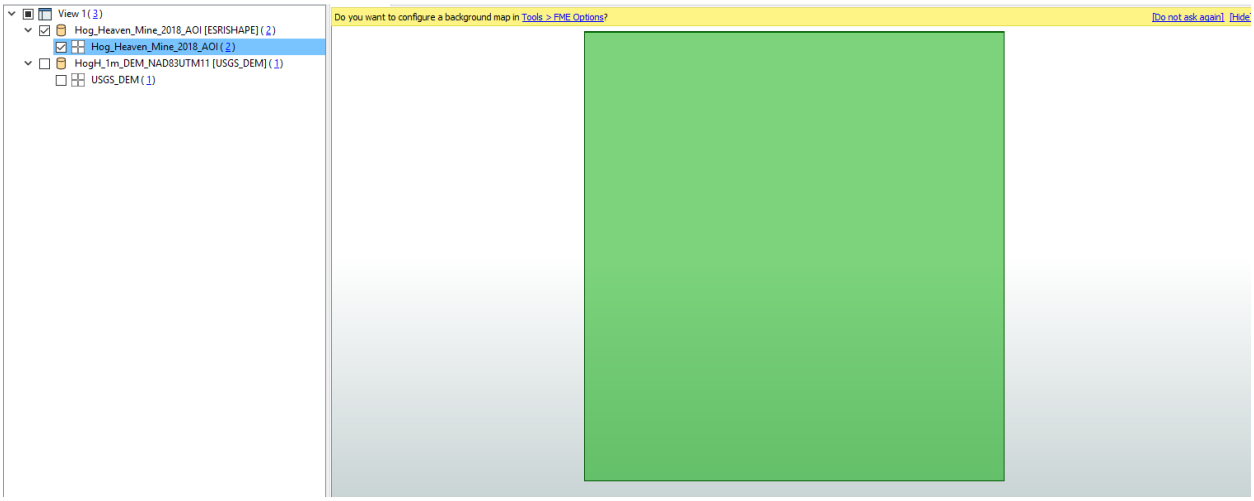
_HogHeaven_LiDAR_BareEarth_Stitched.las (stitched tile)

Conclusion:

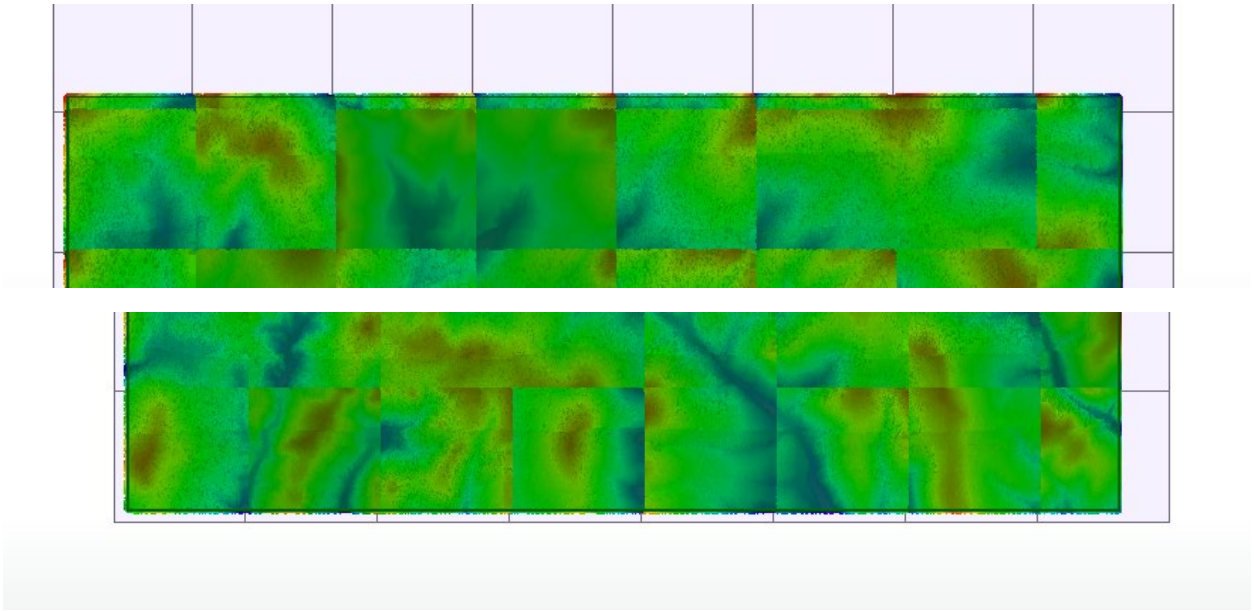
Extent: LiDAR BareEarth is larger than AoI

Point Density: 5.56 for single sample tile
x.xx for stitched

Comments: Bare Earth model will trim points from original data collection; therefore, will likely be less point density than initial data collection as proposed.



Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	UTM83-11 0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0



Conclusion:

Extent: LiDAR BareEarth is larger than AoI

Point Density:

Single LiDAR tile **679000_5307000_BE:**

Determined point density of **5.56** for single LiDAR tile **679000_5307000_BE** by dividing total points by extent area (m). Derived by using a sample tile of **679000_5307000_BE**, calculated its extent as roughly 910 * 1000 based on min/max extent values of (679000, 5307090, 1133.72), (679999.99, 5307999.99, 1326.76). Taking the total sum of points, **5101688** Points.

Extent X = 679999.99 – 679000 = 999.99 = **1000 m**
Extent Y = 5307999.99 – 5307090 = 909.99 = **910 m**

Extent = Extent X * Extent Y
Extent = 1000 * 910 = **910,000 m^2**

Total Points/ Extent (m) = Point Density
5101688 / (**910,000**) = **5.56**

Therefore: Point density is **5.56 points per m^2.**

Similarly, for the **Stitched_BE:**

Determined point density of **5.56** for single LiDAR tile **679000_5307000_BE** by dividing total points by extent area (m). Derived by using a sample tile of **679000_5307000_NBE**, calculated its extent as roughly 910 * 1000 based on min/max extent values of (676100.01, 5307090, 953), (683620, 5315109.99, 1573.65). Taking the total sum of points, **274909978** Points.

Extent X = 683620 – 676100.01 = 7519.99 = **7520 m**
Extent Y = 5315109.99 – 5307090 = 8019.99 = **8020 m**

Extent = Extent X * Extent Y
Extent = 7520 * 8020 = **60310400 m^2**

Total Points/ Extent (m) = Point Density
274909978 / (**60310400**) = **4.56**

Therefore: Point density is **4.56 points per m^2.**

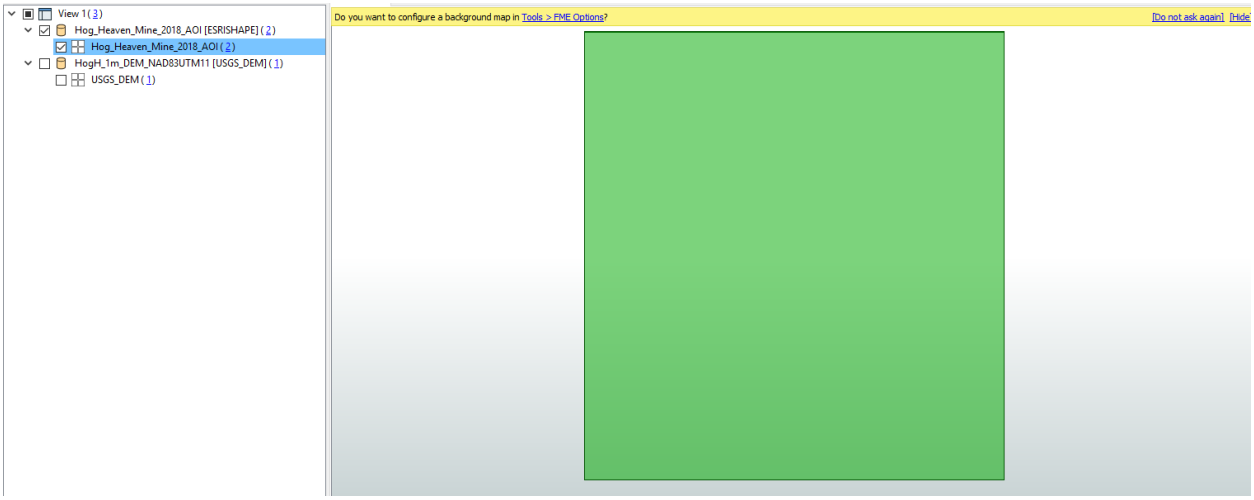
LiDAR – Non-BareEarth

Filename: **679000_5307000_NBE.las** (single sample tile)

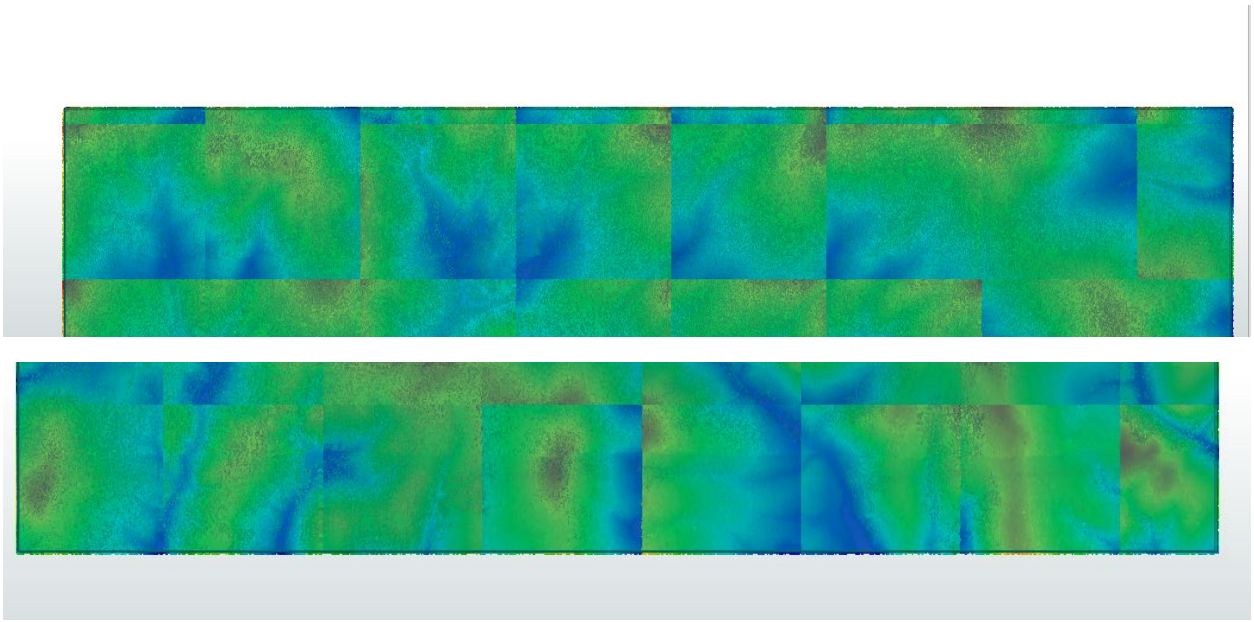
_HogHeaven_LiDAR_Non_BareEarth_Stitched.las (stitched tile)

Conclusion:

Extent:	LiDAR BareEarth is larger than AoI
Point Density:	8.84 for single sample tile 11.23 for stitched
Comments:	Non Bare Earth model should entail the proposed guidelines of 8 points per square meter.



Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	_UTM83-11_0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0



Conclusion:

Extent: LiDAR Non_BareEarth is larger than AoI

Point Density:

Single LiDAR tile **679000_5307000_NBE:**

Verified point density of 8.84 by dividing total points by extent area (m). Derived by using a sample tile of **679000_5307000_NBE**, calculated its extent as roughly 910 * 1000 based on min/max extent values of (679000, 5307090, 1133.75), (679999.99, 5307999.99, 1338.68). Taking the total sum of points, **8045719** Points.

Extent X = 679999.99 – 679000 = 999.99 = **1000 m**
Extent Y = 5307999.99 – 5307090 = 909.99 = **910 m**

Extent = Extent X * Extent Y
Extent = 1000 * 910 = **910,000 m^2**

Total Points/ Extent (m) = Point Density
8045719 / (**910,000**) = **8.84**

Therefore: Point density is **8.84 points per m^2.**

Similarly, for the **Stitched_NBE:**

Determined point density of **11.23** for stitched LiDAR tile by dividing total points by extent area (m). Calculated its extent as roughly 7520 * 8020 based on min/max extent values of (676100.01, 5307090, 953.03), (683620, 5315109.99, 1589.8600000000001). Taking the total sum of points, **5101688** Points.

Extent X = 683620 – 676100.01 = 7519.99= **7520 m**
Extent Y = 5315109.99 – 5307090 = 8019.99= **8020 m**

Extent = Extent X * Extent Y
Extent = 1000 * 910 = **60310400 m^2**

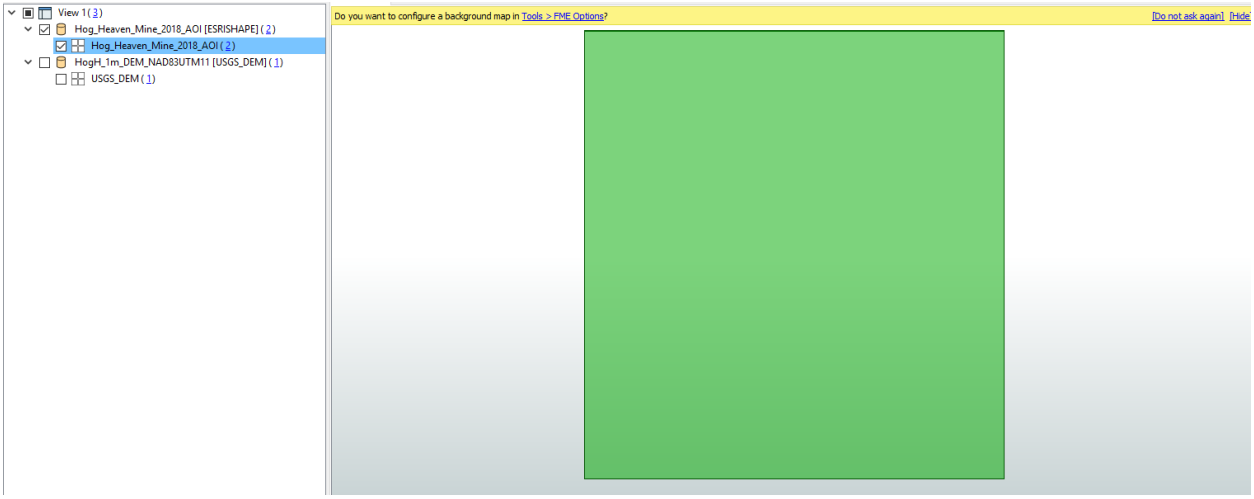
Total Points/ Extent (m) = Point Density
677415195 / (**60310400**) = **11.23**

Therefore: Point density is **11.23 points per m^2.**

Ortho – ECW FULL

Filename: HogH_2018_20cm_NAD83UTM11.ecw

Conclusion: Ortho-ECW FULL is larger than AoI



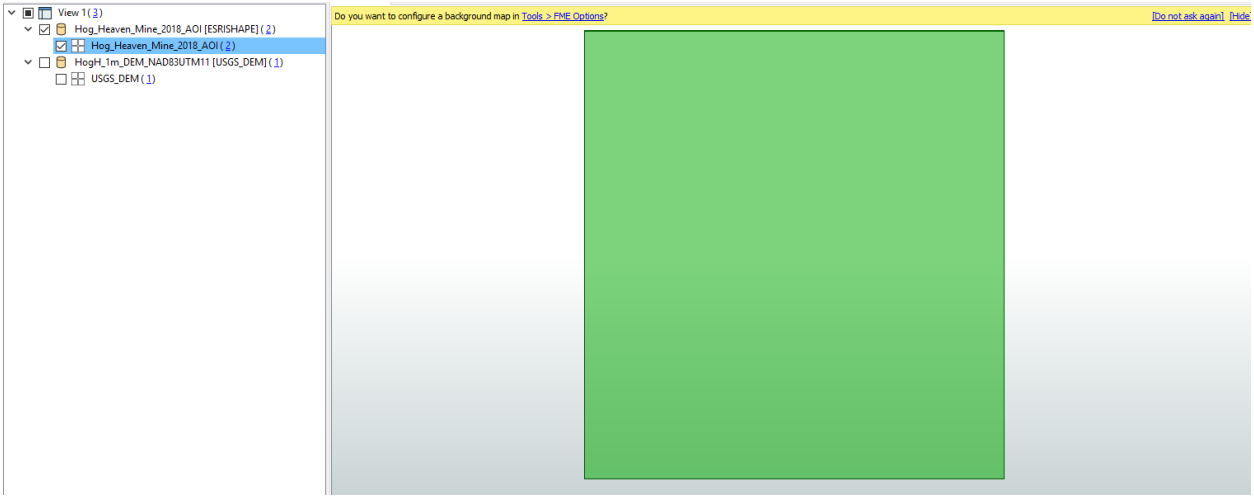
Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	_UTM83-11_0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0

Conclusion: Ortho-ECW FULL is larger than AoI

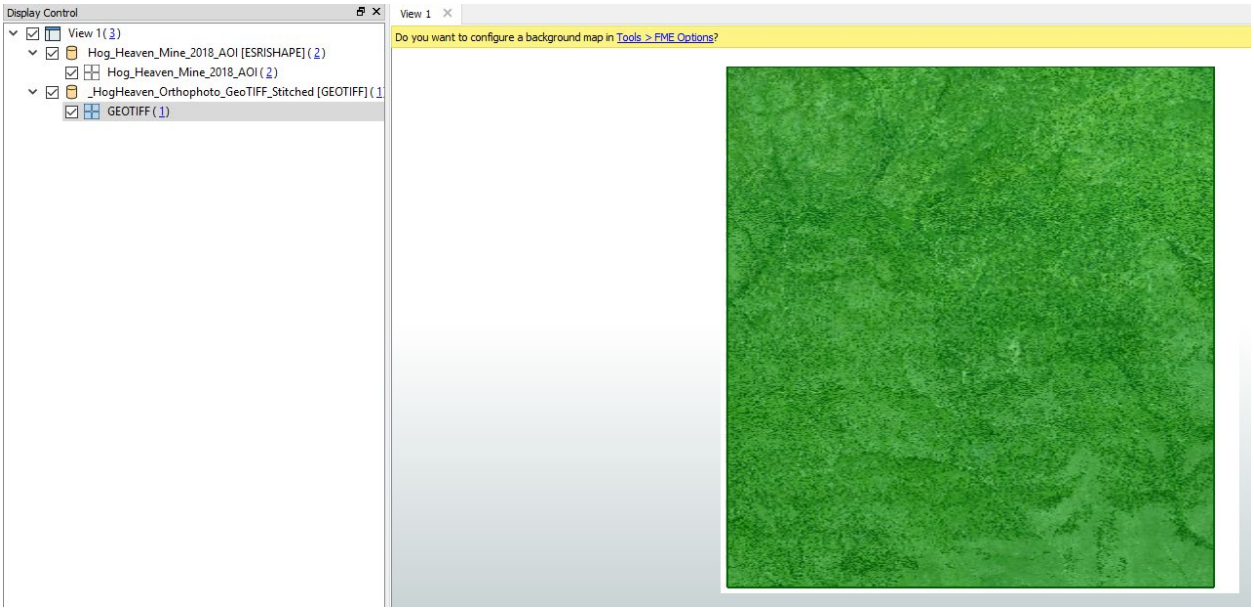
(Min/Max extent manually determined by zooming in and dropping pin as feature min/max extent includes the white NoData valules)

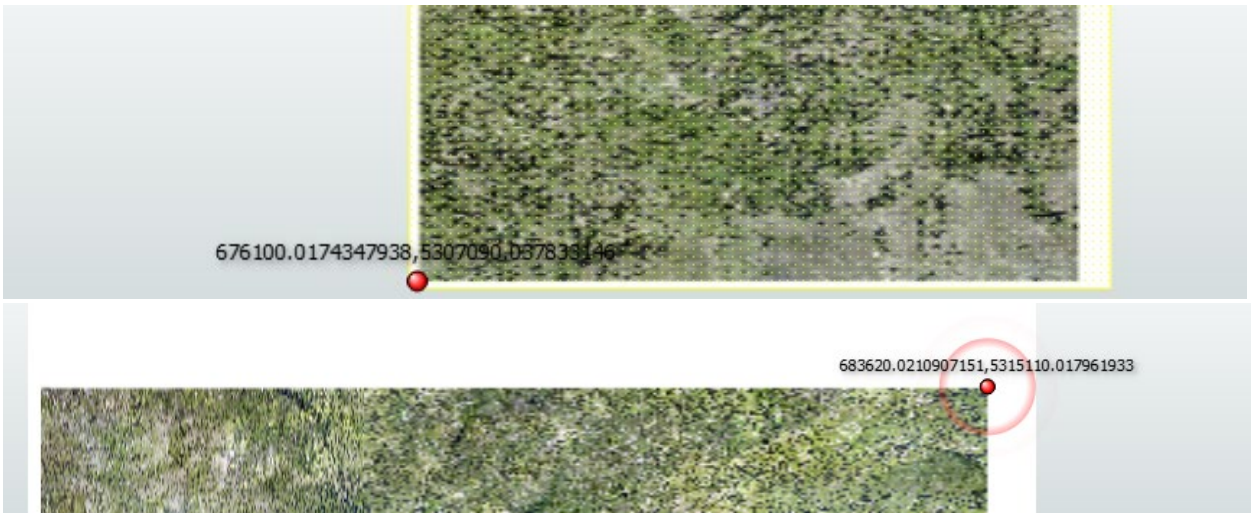
Ortho – Geotiff Tiles

Filename: _HogHeaven_Orthophoto_GeoTIFF_Stitched.tif



Property	Value
Feature Type	Hog_Heaven_Mine_2018_AOI
Coordinate System	_UTM83-11_0
Dimension	3D
Number of Vertices	5
Min Extents	676110.0011145652, 5307099.995144157, 0
Max Extents	683610.0005481931, 5315099.996766962, 0





Conclusion: Ortho-GeoTIFF is larger than AoI

(Min/Max extent manually determined by zooming in and dropping pin as feature min/max extent includes the white NoData valules)