

LiDAR Quality Assessment Report

The USGS National Geospatial Technical Operations Center, Data Operations Branch is responsible for conducting reviews of all Light Detection and Ranging (LiDAR) point-cloud data and derived products delivered by a data supplier before it is approved for inclusion in the National Elevation Dataset. The USGS recognizes the complexity of LiDAR collection and processing performed by the data suppliers and has developed this Quality Assessment (QA) procedure to accommodate USGS collection and processing specifications with flexibility. The goal of this process is to assure LiDAR data are of sufficient quality for database population and scientific analysis. Concerns regarding the assessment of these data should be directed to the Chief, Data Operations Branch, 1400 Independence Road, Rolla, Missouri 65401.

New England CMGP SANDY LiDAR

New England CMGP Sandy LiDAR with MOD1 2,240 total sq mi @ 0.7m NPS v.1 (QL2) A 73°0'0''W 72°0'0"W 71°0'0''W 70°0'0'W 69°0'0"W -43°0'0"N 43*070"N -42°0'0"N 42°0'0"N -41°0'0"N 41°0'0"N 73'0'0'W 71°00"W 70'0'0"W 72°00"W ShrewsburyGep muniBuys arthasV_Nan (214 sigmi) iew_England_footprint_LFS_proj (1901 som) Gilette Stadium POI (5 µgmi)

NGTOC 2015-03-30

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Pro	lect	Infor	mation
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Project:

Contractor:

Woolpert, Inc.

New England CMGP SANDY LIDAR

Project	Туре:
GPSC	

Applicable Specification: NGP LiDAR Base Specification V 1.0

Project Points of Contact:

ame: Ty	pe:		Email:			
Pat Emmett C	РТ		pemmett@u	isgs.g	ov	
REPORT QUALIFICATION SUM	MARY:	Project De	elivery Lots:		Lots	
Task Order Overall:		1				
Meets Requirements						
Motodata		List Lots:				
1 of 1 Reviews Accented						
0 Reviews Not Accepted		ot: 1				
Vertical Accuracy:						
1 of 1 Reviews Accepted						
0 Reviews Not Accepted		Dates Coll	ected Range:			
Swath/Raw LAS:		Collection	Start: 11/16/.	2013		
1 of 1 Reviews Accepted		Collection	End: 12/31/2	014		
0 Reviews Not Accepted			-			
Tiled/Classified LAS:		Project Al	iases:			
1 of 1 Reviews Accepted		n/a				
0 Reviews Not Accepted		Licensing				
Breakline:		Licensing: Public Do	main			
1 of 1 Reviews Accepted		Proiect De	escription:			
0 Reviews Not Accepted			1.			
DEM(s):				1.	This task order is for	
1 of 1 Reviews Accepted					Planning, Acquisition,	
0 Reviews Not Accepted					processing, and derivativ	e
NED Review:					products of lidar data to b	be
1 of 1 DEM tile reviews recommend	nded for NED				collected at a nominal pu spacing (NPS) of 0.7	Ise
1 of 1 DEM tile reviews recommen	ndod for NED				meters including overlar	,
1/9th					Lidar data, and derivative	e
-,					products produced in	
					compliance with this task	C
					order are based on	
					the "U.S. Geological Survey National	
					Geospatial Program Lie	dar
					Base Specification Vers	ion
					1.0", which is incorporat	ed
					by reference into this tasl	ĸ

order. This specification

may be viewed at http://pubs.usgs.gov/tm/11b 4/. These lidar specifications are required baseline specifications. In addition to the Specification Requirements, this task order shall meet NEEA QL2. For any item which is not specifically addressed, the referenced Specification Version 1 will be the required specification authority.

This task order requests LiDAR surveys be collected over several areas in central to eastern Massachusetts. These areas represent slivers of areas that were missed by previous lidar acquisitions. The data is to be acquired and processed under the requirements identified in this task order. The total area of the Massachusetts SANDY LIDAR AOI is approximately **2,246 square** miles. This data will assist in the evaluation of storm damage and erosion of the local environment as part of USGS Hurricane Sandy response. This project will require hydro-flattening.

Review Information

3rd Party QA	Date	11/6/2014
Performed:	Delivered:	

Action To Contractor Date:	Issue Description:	Return Date:
12/16/2014	See sections below for itemized listing of errors that need to be corrected.	2/25/2015
3/27/2015	Requested changes to metadata	3/30/2015
Review Complete:		

3/30/2015

Project Materials Received

All project deliverables must be supplied according to collection and processing specifications. The USGS will postpone the QA process when any of the required deliverables are missing. When deliverables are missing, the Contracting Officer Technical Representative (COTR) will be contacted by the Elevation Section supervisor and informed of the problem. Processing will resume after the COTR has coordinated the deposition of remaining deliverables.

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
Collection Report:	V		✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Survey Report:	V		✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Processing Report:	V		✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
QA/QC Report:			✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Project Level XML Metadata:	7		✓	XML	1	preliminary version delivered
Project Extent:		<		<u>.shp</u>	2	in Tile_Index folders for UTM18 and UTM19
Tile Scheme:				.shp		in Tile_Index folders for

METADATA

	✓	✓			2	UTM18 and UTM19
Control (Calibration) Points:	>	✓	V	.shp	2	in UTM18 and UTM19 folders
Check (Validation) Points:	>	<	V	.shp	2	in UTM18 and UTM19 folders
Additional Comments:	Project is s folders. Some smal and task le completed	plit between UTI l number of refli _t vel. The final me	M Zone 18 & 1 ghts are neces tadata and fina	9; Files are split sary on this task al reports will be	between UTM1 so the metada sent ASAP whe	8 & UTM19 ta is preliminary en the reflights are

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
Swath Data:	V	v	V	<u>.las</u>	1,146	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Classified/ Tiled Data:	V	7	Y	<u>.las</u>	3,760	UTM18 = 799; UTM19 = 2940; Due to necessary reflights, metadata is still in production at contractor; they will ftp to CPT POC when completed
Additional Comme	ents:					

LIDAR DATA

DERIVED DELIVERABLES

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
DEM Tiles:		✓		IMG	3,760	UTM18 = 799; UTM19 = 2945;
Breaklines:	✓	✓	>	<u>.shp</u>	2	for UTM18 and UTM19
Additional Comme	ents:					

OTHER

Additional Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
Intensity	~	~	\checkmark	.tif	3,760	

Г

Geographi	c Information		
Area Extent:	2441.5	<u>Sq. Miles</u>	
Tile Size:	1500 x 1500	<u>Meters</u>	
DEM/DTM Grid Spacing: Coordinate Refer	1 rence System:	<u>Meters</u>	
NAD_83_201 NAD_83_201	1_UTM_Zone_18N 1_UTM_Zone_19N		
Projection:	UTM		
Horizontal Datum:	NAD83 2011		 Meters U.S. Feet Int'l Feet
Vertical Datum:	NAVD88		 Meters U.S. Feet Int'l Feet
	COORDINATE REFERENC		S THE FOLLOWING DELIVERABLE
Project Ext	tent	✓ Tiled/Classified XML	. Metadata
Project Ext	tent XML Metadata	✓ Tiled/Classified LiDA	IR
Project Til	e Scheme XMI Metadata	Swath/Raw LiDAR	
Control Po	ints	\checkmark DEM(s)	
Control Po	ints XML Metadata	DEM XML Metadata	z .
🗹 Checkpoin	ts	✓ Breakline(s)	
🗹 Checkpoint	XML Metadata	🗹 Breakline XML Meta	adata
🗹 Project Lev	vel XML Metadata		

Additional Comments:

Collection Information

Configured Project Nominal Pulse Spacing:

0.7

Meters

Sensor Information: Sensor Type: <u>Aerial</u>

Sensor Used:

Leica ALS70

Configured Scan Angle ± from nadir:

42.3 Degrees

Sensor Type:

GPSC

	<u>Aerial</u> Sensor Used:	
	Optech Gemini	
	Configured Scan Ang	gle ± from nadir:
	46	Degrees
etadata		

Additional Comments:

2 sensors are listed in the preliminary project-level metadata

Metadata Review Accepted

Vendor provided metadata files have been parsed using 'mp' metadata parser. Any errors generated by the parser are documented below for reference and/or corrective action. Parser can be located @ <u>http://geo-nsdi.er.usgs.gov/validation/</u>

The Project Level XML Metadata parsed withouterrors.

Check if 'Best Use' metadata for NED:

The Project Extent XML Metadata parsed without errors.

Check if 'Best Use' metadata for NED: 🗌

The Project Tile Scheme XML Metadata parsed select...errors.

Check if 'Best Use' metadata for NED:

The Control Point XML Metadata parsed <u>without</u>errors.

Check if 'Best Use' metadata for NED:

The Check Point XML Metadata parsed <u>select...</u>errors.

Check if 'Best Use' metadata for NED: 🗌

The Swath XML Metadata parsed without errors.

Check if 'Best Use' metadata for NED:

The Classified XML Metadata parsed without errors.

Check if 'Best Use' metadata for NED:

The DEM XML Metadata parsed <u>without</u>errors.

Check if 'Best Use' metadata for NED: 🗹

The Breakline XML Metadata parsed <u>without</u>errors.

Check if 'Best Use' metadata for NED: 🗌

Additional Comments:

Only project metadata was delivered for both areas and labeled Preliminary Metadata by the vendor. No vertical accuracy reporting is completed in the metadata at this point.

*3/24/2015 Contractor sent complete metadata.

- UTM18 metadata issues:
 - 1. Classified LAS metadata is mis-labeled. The <title> tag has USGS New York CMGP Sandy Lidar.
 - 2. Lidar Data Extent metadata has a UTM Zone of 19 instead of 18 and a value of -69 under

the <longcm> tag value than all the other metadata files (-75).

3. Metadata for the Classified LAS, Project Level and Intensity report swath fva as 0.101 m under the <rawfva> tag, but as 0.084 m under the <vertaccv> tag; Across all metadata (including the 35 swath metadata files) swath fva reported as 0.101 m with the <vertaccr> tag.

UTM19 metadata issues:

- 1. LAS Swath FVA does not match between report (0.101 m) and metadata (0.084 m).
- 2. Metadata for the Classified LAS, Project Level and Intensity report swath fva as 0.101 m under the <rawfva> tag, but as 0.084 m under the <vertaccv> tag; Across all metadata (including the 35 swath metadata files) swath fva reported as 0.101 m with the <vertaccr> tag.

*3/30/2015 Contractor sent corrected metadata.

Based on this review, the USGS <u>accepts</u> the xml metadata provided.

End of Metadata Review

Vertical Accuracy Review Accepted

ASPRS recommends that checkpoint surveys be used to verify the vertical accuracy of LiDAR data sets. Checkpoints are to be collected by an independent survey firm licensed in the particular state(s) where the project is located. While subjective, checkpoints should be well distributed throughout the dataset. National Standards for Spatial Data Accuracy (NSSDA) guidance states that checkpoints may be distributed more densely in the vicinity of important features and more sparsely in areas that are of little or no interest. Checkpoints should be distributed so that points are spaced at intervals of at least ten percent of the diagonal distance across the dataset and at least twenty percent of the points are located in each quadrant of the dataset.

NSSDA and ASPRS require that a minimum of twenty checkpoints (thirty is preferred) are collected for each major land cover category represented in the LiDAR data. Checkpoints should be selected on flat terrain, or on uniformly sloping terrain in all directions from each checkpoint. They should not be selected near severe breaks in slope, such as bridge abutments, edges of roads, or near river bluffs. Checkpoints are an important component of the USGS QA process. There is the presumption that the checkpoint surveys are error free and the discrepancies are attributable to the LiDAR dataset supplied.

For this dataset, USGS checked the spatial distribution of checkpoints with an emphasis on the bare-earth (open terrain) points; the number of points per class; the methodology used to collect these points; and the relationship between the data supplier and checkpoint collector. When independent control data are available, USGS has incorporated this into the analysis.

Required Vertical Accuracy

Confidence Interval Required:	95	th % Cl
Required Unit:	Centimeters	
Required # of checkpoints:	35	
Required RMSEz:	9.25	
Required Vertical Accuracy (RMSEz * .% Cl)	18.13	

GPSC

	# of Checkpoints	95 tl	SVA Required Percentile	
Brushlands & Low Trees		30	26.9	Centimeters
Forested Areas Fully Covered	by Trees	48	26.9	Centimeters
Tall Weeds & Crops		34	26.9	Centimeters
Urban Areas with Dense Man	Made Structures	34	26.9	Centimeters
CVA Statistic Required: <u>Percent</u> CVA Confidence Level/Percentil Total number of checkpoints: <mark>1</mark>	ile e Required: 95 81			
Required CVA: 26.9	Centimeters	at the 95 th Pe	rcentile	
Additional Required Vertical Accuracy Information:				

Reported Vertical Accuracy ● Yes ○ No

	# of Checkpoints	SVA Reported 95 th Percentile		
Urban Areas with Dense Man	Made Structures	25	0.116	Meters
REPORTED CONSOLIDATE CVA Statistic Reported: <u>Percent</u> CVA Confidence Level/Percentil	D VERTICAL ACCURAC tile e Reported: 95	CY FOR DEM FILES		
Reported CVA: 0.116	at the 95 th Pe	rcentile		
Additional Reported Vertical Accuracy Information:				

Reviewed Vertical Accuracy

● Yes ○ No							
CHECKPOINT REVIEW							
Checkpoints are well distributed?							
Enough checkpoints for task order?	Enough checkpoints for task order?						
Checkpoints meet USGS LiDAR base-spec i quality?	n quantity and						
REVIEWED FUNDAMENTAL VERTICAL	ACCURACY FOR S	WATH LIDAR FILES	;				
Confidence Interval Reviewed:	95	th % Cl					
Reviewed Unit:	Centimeters						
Reviewed # of checkpoints:	35						
Reviewed RMSEz:	5.3						
Reviewed Vertical Accuracy (RMSEz * .% Cl)	10.4						
REVIEWED FUNDAMENTAL VERTICAL	ACCURACY FOR D	EM FILES					
Confidence Interval Reviewed:	95	th % Cl					
Reviewed Unit:	Centimeters						
Reviewed # of checkpoints:	11						
Reviewed RMSEz:	4.2						
Reviewed Vertical Accuracy (RMSEz * .% Cl)	8.3						
REVIEWED SUPPLEMENTAL VERTICAL	ACCURACY						
SVA Statistic Reviewed: <u>Percentile</u>							
SVA Confidence Level/Percentile Reviewed: 9.	5						
Class		# of	SVA Reviewed				



Image chausing the bare earth i								
Image showing the bare earth points against the swath data (shown by classification):								
Additional Reviewed Vertical Accuracy	Vertical	Accuracy v	vill be	assessed once a c	orrected DEM i	s delivered to NGTC	DC.	
Information:	3/26/202	15: Vertica	I Accu	ıracy ran against tl	he swath and D	EM data. For this r	eport.	the
	Swath F\	/A results	werei	ran on the entire p	project area. Fo	or the DEM, the vert	ical a	ccuracy
	was asse	essed per L	JTM zo	one and reported	above. The resu	Its of both UTM18	and L	ITM19 is
	as follow	/s:	-			_		
		Rare Earth	ertical	Accuracy for the DEM	I - UTM18 and UTM	V19 data	CVA	Total Point
	UTM18	8.3	9.4	14.7	28.1	9.2	16.2	54
	UTM19	9.6	10.4	15.3	25.9	29.3	18.9	130
	Required	18.13	26.9	26.9	26.9	26.9	26.9	
				All values	are reported in cr	n		
		Druchler	J /T	a faile the CVA+	ogon for wort -			lowover
	CVA and	Brushiand	a/ i ree	the project and the	egory for vertic	ai accuracy of the L		iowever,
	UTM19	Forested F	S IOL I	rown fails the SVA	A category for v	ertical accuracy of t	he DF	M
	However	r, CVA and	FVA c	basses for the proj	ect and the oth	er 3 SVA categories	pass.	
		,	17	1 1				

Based on this review, the USGS <u>accepts</u> the vertical accuracy.

End of Vertical Accuracy Review

Raw-Swath LiDAR Review Accepted

LAS swath files or raw unclassified LiDAR data are reviewed to assess the quality control used by the data supplier during collection. Furthermore, LAS swath data are checked for positional accuracy. The data supplier should have calculated the Fundamental Vertical Accuracy using ground control checkpoints measured in clear open terrain (*see Vertical Accuracy Review Section*).

Review Required: • Yes O No

RAW-SWATH LIDAR FILE CHARACTERISTICS

Separate folder for swath/raw LiDAR files

LAS Version: <u>1.2</u>

Point Record Format: <u>1</u>

 \checkmark Each swath file \leq 2 GB and properly segmented

Correct and properly formatted georeference information is included in all LAS file headers

Adjusted GPS time used with the global encoder id set to 1

✓ Scan Angles conform to USGS base-spec recommendations

✓ All points set to class '0' (not classified)

Additional comments:

The swath was delivered as one folder and not segmented into UTM 18 and UTM 19 data. The swath has a coordinate system of NAD_83_2011_UTM_Zone_19N.

Based on this review, the USGS <u>accepts</u> the swath/raw LiDAR data.

End of Swath/Raw LiDAR Review

Tiled/Classified LiDAR Review Accepted

Classified LAS tile files are used to build digital terrain models using the points classified as ground. Therefore, it is important that the classified LAS are of sufficient quality to ensure that the derivative product accurately represents the landscape that was measured. Classified LAS Tiles are comprised as follows, "all project swaths, returns, and collected points, fully calibrated, adjusted to ground, and classified and cut, by tiles, excluding calibration swaths, cross-ties, and other swaths not used, or intended to be used, in product generation".

Review Required: • Yes 🔾 No

CLASSIFIED LIDAR TILE CHARACTERISTICS

Separate folder for classified/tiled LiDAR files

LAS Version: <u>1.2</u>

Point Record Format: <u>1</u>

Classified LAS tile files conform to project tiling scheme

There are 16 .las tiles missing from the upper portion of the project area for UTM18 data. The tile index shows tiles in this location. Are these tiles left out for a purpose?



The coral color represents the Tile Index delivered with the data. The green is the Point Cloud Statistics shapefile for every classified .las tile delivered.

3/26/2015: Contractor sent missing tiles for UTM18 data (16 tiles). Additionally, they sent 5 extra classified .las tiles that were assessed by reviewer for UTM19 data.

Quantity of classified LAS tile files conforms to project tiling scheme

See above comment and image.

3/26/2015: Contractor sent missing tiles for UTM18 data (16 tiles). Additionally, they sent 5 extra classified .las tiles that were assessed by reviewer for UTM19 data.

Classified LAS tile files do not overlap

Classified LAS tile files are uniform in size

Correct and properly formatted georeference information is included in all LAS file headers

Adjusted GPS time used with the global encoder id set to 1

Classified LAS tile files have no points classified as '12' (Overlap)

Point classifications are limited to the standard values listed below:

Code	Description	Used
1	Processed, but unclassified	✓
2	Bare-earth/Ground	✓
7	Noise(low or high, manually identified, if needed)	✓
8	Model key points	
9	Water	✓
10	Ignored ground (breakline proximity)	\checkmark
11	Withheld (if the "Withheld Bit" is not implemented in the processing software	

Additional Classes:

Class	Description
17	Overlap - unclassified
18	Overlap - ground

Additional comments:

UTM18 data: The header information shows 36 classified .las files with an intensity outside of the 0-255 range. The values range from 364-2212. UTM19 data: The header information shows 783 classified .las files with an intensity outside of the 0-255 range. The values range from 280 to 7140.

Based on this review, the USGS <u>accepts</u> classified/tiled LiDAR data.

End of Tiled/Classified LiDAR Review

Breakline Review Accepted

Breaklines are vector feature classes that are used to hydro-flatten the bare earth Digital Elevation Models.

Review Required: • Yes 🔾 No

BREAKLINE FILE CHARACTERISTICS:

Separate folder for breakline files.

✓ Breaklines contain elevation values.

Elevation values stored in Geometery (ZEnabled)

Units: Meters

✓ Waterbody Breaklines.

Polyline 🗌 Polygon 🗹

Single elevation value per waterbody feature.

Required. Waterbody Elevations were created via <u>Unknown</u>

waterbody level techniques.

Double Line Stream Breaklines (Streams Approximately > 100 ft).

Polyline 🗹 Polygon 🗌

Downstream DLS Flow is <u>Select...</u>

✓ Required.

Single Line Breaklines.

□ No missing or misplaced breaklines.

ADDITIONAL COMMENTS, ERRORS, ANOMALIES, OR OTHER ISSUES:

Several errors exist in the DEM related to floating water in which the water is at a higher elevation than the surrounding terrain.

3/26/2015: Contractor corrected errors.

Based on this review, the USGS <u>accepts</u> the breakline files.

End of Breakline Review

DEM Review Accepted

The derived bare-earth file(s) receive a review of the vertical accuracies provided by the data supplier, vertical accuracies calculated by the USGS using supplied and independent checkpoints (*see the prior Vertical Accuracy Review Section*), and a thorough visual review for any anomalies or inconsistencies in assessing the quality of the DEM(s).

BARE-EARTH DEM TILE CHARACTERISTICS:

Separate folder for bare-earth DEM files

Raster File Type: <u>IMG</u>

Raster Cell Size: 1 Meters

Tile bit depth/pixel Type: 32_BIT_FLOAT

Interpolation or Resampling Technique: Unknown

✓ DEM tiles do not overlap

DEM tiles conform to Project Tiling Scheme

There are 16 tiles of missing data in the UTM 18 data. The area encompasses several towns and the tile index shows .las tile names but no classified .las tiles or DEM tiles were delivered by the vendor. Please explain.

				and the second second	
0 18TYN3352	50 18TYN350250	18TYN365250	18TYN380250	Real Provider	
18TYN3352	35 18TYN350235	18TYN365235	18TYN380235	Jaitrog 22	A Starter
a de la contraction	20 18TYN350220	18TYN365220	18TYN380220	18TYN395220	18772
	1817-183-19551	18TYx384205	18TYN380205	18TYN395205	iki Qi
90. 18T7653351	1817Y7550190	18TTN-05-001	18TYN380190	18TYN395190	
				Contracting (ISTYN

*2/25/2015 Contractor sent missing tiles. They have been reviewed and are accepted.

✓ Quantity of DEM files conforms to Project Tiling Scheme

✓ DEM tiles are uniform in size

DEM tiles properly edge match and free of edge artifacts

UTM 19 data has a tile edge match error.



*3/26/2015 Contractor corrected issue.

Tiles are free from Spikes and Pits

There is a pit at this location in UTM18 data: 42° 33' 47.6171" N, 72° 02' 17.7015" W



*3/26/2015: Contractor corrected issue.

Tiles are free from Data Holidays (*voids due to processing or collection errors*)

There are 16 tiles missing in the UTM 18 data. Please explain if these are intentionally left out of the dataset and if so, adjust the tile index and data extent shapefile. If not, deliver the missing tiles to NGTOC for review.

3/26/2015: Contractor sent missing tiles.

Tiles do not exhibit systematic sensor error or cornrowing

There are several anomalous errors in which there is an elevation change in a pattern running in a NW-SE orientation throughout the UTM19 data. Below is a representative image of what the reviewer is seeing:



2/25/2015: Contractor Response: Offset is due to tidal variation between and within data collections. Best practice was used to eliminate this, but some offset may remain. QA Reviewer accepts these anomalous errors.

DEM tiles are properly Hydro Flattened 🔾 Yes 🖲 No

Waterbodies ² Acres or greater are flattened

Several lakes have water that is at a higher elevation than the surrounding terrain (Floating_Water errors). Below is a representative image only:



2/25/2015: Contractor fixed floating water issues. For 6 of the errors the contractor responded *elevation change is due to a naturally occurring spillway*. QA Reviewer accepts these errors (Floating_water_3, _4, _6, _7, _8, _9, _11).

In the UTM19 data there are two errors in which the elevation along the tile edge is different. Below is a representative image:



2/25/2015 Contractor corrected above errors.



*3/26/2015: Contractor corrected issue.

Streams 100 ft. or greater are flattened in a downstream manner

✓ Tidal Boundaries/Shorelines are flattened

✓ No missing islands 1 Acre or larger

Bridges/Overpasses are properly removed

Several errors exist in both UTM18 and UTM19 datasets in which a bridge was not removed or not completely removed in which the flow of water or roadway is blocked. Below is a representative image only. Refer to the error shapefile for all errors of this type.



*3/26/2015: Contractor corrected issues.

- Culverts are maintained (Not Hydro Enforced)
- Depressions, Sinks, are not filled in (Not Hydro Conditioned)
- ✓ Vegetation properly removed
- ✓ Manmade structures properly removed

ADDITIONAL COMMENTS, ERRORS, ANOMALIES, OR OTHER ISSUES:

Re-delivery of DEM tiles: UTM 19 DEM had a delivery of 5 additional tiles. QA was done and the tiles are good and will be included in the final acceptance (see image below). Original Delivery: With the additional delivery of 5 tiles:



Tiles recommended for NED 1/3rd: O Yes. \bigcirc No. Tiles recommended for NED 1/9th: O Yes. \bigcirc No.

Based on this review, the USGS <u>accepts</u> the DEM tiles.

End of DEM Review

Based on this review, the provided delivery <u>Meets</u> the Contract and/or Task Order requirements. Additional Comments:

END OF REPORT (v2.1.1)



LiDAR Quality Assessment Report

The USGS National Geospatial Technical Operations Center, Data Operations Branch is responsible for conducting reviews of all Light Detection and Ranging (LiDAR) point-cloud data and derived products delivered by a data supplier before it is approved for inclusion in the National Elevation Dataset. The USGS recognizes the complexity of LiDAR collection and processing performed by the data suppliers and has developed this Quality Assessment (QA) procedure to accommodate USGS collection and processing specifications with flexibility. The goal of this process is to assure LiDAR data are of sufficient quality for database population and scientific analysis. Concerns regarding the assessment of these data should be directed to the Chief, Data Operations Branch, 1400 Independence Road, Rolla, Missouri 65401.

New England CMGP SANDY LiDAR

New England CMGP Sandy LiDAR with MOD1 2,240 total sq mi @ 0.7m NPS v.1 (QL2) A 73°0'0''W 72°0'0"W 71°0'0''W 70°0'0'W 69°0'0"W -43°0'0"N 43*070"N -42°0'0"N 42°0'0"N -41°0'0"N 41°0'0"N 73'0'0'W 71°00"W 70'0'0"W 72°00"W ShrewsburyGep muniBuys arthasV_Nan (214 sigmi) iew_England_footprint_LFS_proj (1901 som) Gilette Stadium POI (5 µgmi)

NGTOC 2015-03-30

	•	1 C	
Pro	lect	Infor	mation
· · · · ·	,		

Project:

Contractor:

Woolpert, Inc.

New England CMGP SANDY LIDAR

Project	Туре:
GPSC	

Applicable Specification: NGP LiDAR Base Specification V 1.0

Project Points of Contact:

ame: Ty	pe:		Email:			
Pat Emmett C	РТ		pemmett@u	isgs.g	ov	
REPORT QUALIFICATION SUM	MARY:	Project De	elivery Lots:		Lots	
Task Order Overall:		1				
Meets Requirements						
Motodata		List Lots:				
1 of 1 Reviews Accented						
0 Reviews Not Accepted		ot: 1				
Vertical Accuracy:						
1 of 1 Reviews Accepted						
0 Reviews Not Accepted		Dates Coll	ected Range:			
Swath/Raw LAS:		Collection	Start: 11/16/.	2013		
1 of 1 Reviews Accepted		Collection	End: 12/31/2	014		
0 Reviews Not Accepted			-			
Tiled/Classified LAS:		Project Al	iases:			
1 of 1 Reviews Accepted		n/a				
0 Reviews Not Accepted		Licensing				
Breakline:		Licensing: Public Do	main			
1 of 1 Reviews Accepted		Proiect De	escription:			
0 Reviews Not Accepted			1.			
DEM(s):				1.	This task order is for	
1 of 1 Reviews Accepted					Planning, Acquisition,	
0 Reviews Not Accepted					processing, and derivativ	e
NED Review:					products of lidar data to b	be
1 of 1 DEM tile reviews recommend	nded for NED				collected at a nominal pu spacing (NPS) of 0.7	Ise
1 of 1 DEM tile reviews recommen	ndod for NED				meters including overlar	,
1/9th					Lidar data, and derivative	e
-,					products produced in	
					compliance with this task	C
					order are based on	
					the "U.S. Geological Survey National	
					Geospatial Program Lie	dar
					Base Specification Vers	ion
					1.0", which is incorporat	ed
					by reference into this tasl	ĸ

order. This specification

may be viewed at http://pubs.usgs.gov/tm/11b 4/. These lidar specifications are required baseline specifications. In addition to the Specification Requirements, this task order shall meet NEEA QL2. For any item which is not specifically addressed, the referenced Specification Version 1 will be the required specification authority.

This task order requests LiDAR surveys be collected over several areas in central to eastern Massachusetts. These areas represent slivers of areas that were missed by previous lidar acquisitions. The data is to be acquired and processed under the requirements identified in this task order. The total area of the Massachusetts SANDY LIDAR AOI is approximately **2,246 square** miles. This data will assist in the evaluation of storm damage and erosion of the local environment as part of USGS Hurricane Sandy response. This project will require hydro-flattening.

Review Information

3rd Party QA	Date	11/6/2014
Performed:	Delivered:	

Action To Contractor Date:	Issue Description:	Return Date:
12/16/2014	See sections below for itemized listing of errors that need to be corrected.	2/25/2015
3/27/2015	Requested changes to metadata	3/30/2015
Review Complete:		

3/30/2015

Project Materials Received

All project deliverables must be supplied according to collection and processing specifications. The USGS will postpone the QA process when any of the required deliverables are missing. When deliverables are missing, the Contracting Officer Technical Representative (COTR) will be contacted by the Elevation Section supervisor and informed of the problem. Processing will resume after the COTR has coordinated the deposition of remaining deliverables.

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
Collection Report:	V		✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Survey Report:	V		✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Processing Report:	V		<	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
QA/QC Report:			✓	<u>PDF</u>	1	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Project Level XML Metadata:	7		✓	XML	1	preliminary version delivered
Project Extent:		<		<u>.shp</u>	2	in Tile_Index folders for UTM18 and UTM19
Tile Scheme:				.shp		in Tile_Index folders for

METADATA

.

	√	v	v		2	UTM18 and UTM19
Control (Calibration) Points:	>	✓	~	<u>.shp</u>	2	in UTM18 and UTM19 folders
Check (Validation) Points:		<		<u>.shp</u>	2	in UTM18 and UTM19 folders
Additional Comments:	Project is s folders. Some smal and task le completed	plit between UTI l number of refli vel. The final me	VI Zone 18 & 1 ghts are neces tadata and fin	9; Files are split b sary on this task al reports will be	between UTM1 so the metadat sent ASAP whe	8 & UTM19 a is preliminary en the reflights are

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
Swath Data:	V	V	V	<u>.las</u>	1,146	Due to necessary reflights, this information is still in production at contractor; they will ftp to CPT POC when completed
Classified/ Tiled Data:	V	7	Y	<u>.las</u>	3,760	UTM18 = 799; UTM19 = 2940; Due to necessary reflights, metadata is still in production at contractor; they will ftp to CPT POC when completed
Additional Comme	ents:					

LIDAR DATA

DERIVED DELIVERABLES

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
DEM Tiles:		✓		IMG	3,760	UTM18 = 799; UTM19 = 2945;
Breaklines:	\	✓		<u>.shp</u>	4	2 each for UTM18 and UTM19 (polyline & polygon)
Additional Comme	ents:					

OTHER Additional Delivered XML Required Format Quantity Additional Details Deliverables Metadata ✓ ✓ ✓ .tif Intensity 3,760

Geographi	c Information		
Area Extent:	2441.5	<u>Sq. Miles</u>	
Tile Size:	1500 x 1500	<u>Meters</u>	
DEM/DTM Grid Spacing: Coordinate Refer	1 rence System:	<u>Meters</u>	
NAD_83_201 NAD_83_201	1_UTM_Zone_18N 1_UTM_Zone_19N		
Projection:	UTM		
Horizontal Datum:	NAD83 2011		 Meters U.S. Feet Int'l Feet
Vertical Datum:	NAVD88		 Meters U.S. Feet Int'l Feet
	COORDINATE REFERENC		S THE FOLLOWING DELIVERABLE
Project Ext	tent	✓ Tiled/Classified XML	. Metadata
Project Ext	tent XML Metadata	✓ Tiled/Classified LiDA	IR
Project Til	e Scheme XMI Metadata	Swath/Raw LiDAR	
Control Po	ints	\checkmark DEM(s)	
Control Po	ints XML Metadata	DEM XML Metadata	z .
🗹 Checkpoin	ts	✓ Breakline(s)	
🗹 Checkpoint	XML Metadata	🗹 Breakline XML Meta	adata
🗹 Project Lev	vel XML Metadata		

Additional Comments:

Collection Information

Configured Project Nominal Pulse Spacing:

0.7

Meters

Sensor Information: Sensor Type: <u>Aerial</u>

Sensor Used:

Leica ALS70

Configured Scan Angle ± from nadir:

42.3 Degrees

Sensor Type:

GPSC

	<u>Aerial</u> Sensor Used:	
	Optech Gemini	
	Configured Scan Ang	gle ± from nadir:
	46	Degrees
etadata		

Additional Comments:

2 sensors are listed in the preliminary project-level metadata

Metadata Review Accepted

Vendor provided metadata files have been parsed using 'mp' metadata parser. Any errors generated by the parser are documented below for reference and/or corrective action. Parser can be located @ <u>http://geo-nsdi.er.usgs.gov/validation/</u>

The Project Level XML Metadata parsed withouterrors.

Check if 'Best Use' metadata for NED:

The Project Extent XML Metadata parsed without errors.

Check if 'Best Use' metadata for NED: 🗌

The Project Tile Scheme XML Metadata parsed select...errors.

Check if 'Best Use' metadata for NED:

The Control Point XML Metadata parsed <u>without</u>errors.

Check if 'Best Use' metadata for NED:

The Check Point XML Metadata parsed <u>select...</u>errors.

Check if 'Best Use' metadata for NED: 🗌

The Swath XML Metadata parsed without errors.

Check if 'Best Use' metadata for NED:

The Classified XML Metadata parsed without errors.

Check if 'Best Use' metadata for NED:

The DEM XML Metadata parsed <u>without</u>errors.

Check if 'Best Use' metadata for NED: 🗹

The Breakline XML Metadata parsed <u>without</u>errors.

Check if 'Best Use' metadata for NED: 🗌

Additional Comments:

Only project metadata was delivered for both areas and labeled Preliminary Metadata by the vendor. No vertical accuracy reporting is completed in the metadata at this point.

*3/24/2015 Contractor sent complete metadata.

- UTM18 metadata issues:
 - 1. Classified LAS metadata is mis-labeled. The <title> tag has USGS New York CMGP Sandy Lidar.
 - 2. Lidar Data Extent metadata has a UTM Zone of 19 instead of 18 and a value of -69 under

the <longcm> tag value than all the other metadata files (-75).

3. Metadata for the Classified LAS, Project Level and Intensity report swath fva as 0.101 m under the <rawfva> tag, but as 0.084 m under the <vertaccv> tag; Across all metadata (including the 35 swath metadata files) swath fva reported as 0.101 m with the <vertaccr> tag.

UTM19 metadata issues:

- 1. LAS Swath FVA does not match between report (0.101 m) and metadata (0.084 m).
- 2. Metadata for the Classified LAS, Project Level and Intensity report swath fva as 0.101 m under the <rawfva> tag, but as 0.084 m under the <vertaccv> tag; Across all metadata (including the 35 swath metadata files) swath fva reported as 0.101 m with the <vertaccr> tag.

*3/30/2015 Contractor sent corrected metadata.

Based on this review, the USGS <u>accepts</u> the xml metadata provided.

End of Metadata Review

Vertical Accuracy Review Accepted

ASPRS recommends that checkpoint surveys be used to verify the vertical accuracy of LiDAR data sets. Checkpoints are to be collected by an independent survey firm licensed in the particular state(s) where the project is located. While subjective, checkpoints should be well distributed throughout the dataset. National Standards for Spatial Data Accuracy (NSSDA) guidance states that checkpoints may be distributed more densely in the vicinity of important features and more sparsely in areas that are of little or no interest. Checkpoints should be distributed so that points are spaced at intervals of at least ten percent of the diagonal distance across the dataset and at least twenty percent of the points are located in each quadrant of the dataset.

NSSDA and ASPRS require that a minimum of twenty checkpoints (thirty is preferred) are collected for each major land cover category represented in the LiDAR data. Checkpoints should be selected on flat terrain, or on uniformly sloping terrain in all directions from each checkpoint. They should not be selected near severe breaks in slope, such as bridge abutments, edges of roads, or near river bluffs. Checkpoints are an important component of the USGS QA process. There is the presumption that the checkpoint surveys are error free and the discrepancies are attributable to the LiDAR dataset supplied.

For this dataset, USGS checked the spatial distribution of checkpoints with an emphasis on the bare-earth (open terrain) points; the number of points per class; the methodology used to collect these points; and the relationship between the data supplier and checkpoint collector. When independent control data are available, USGS has incorporated this into the analysis.

Required Vertical Accuracy

Derwined Heite	55	
Required Unit:	Centimeters	
Required # of checkpoints:	35	
Required RMSEz:	9.25	
Required Vertical Accuracy (RMSEz * .%	18.13	

с	lass	# of Checkpoints	95 tl	SVA Required Percentile
Brushlands & Low Trees	30	26.9	Centimeters	
Forested Areas Fully Covered b	y Trees	48	26.9	Centimeters
Tall Weeds & Crops		34	26.9	Centimeters
Urban Areas with Dense Man	Aade Structures	34	26.9	Centimeters
CVA Confidence Level/Percentile Total number of checkpoints: 18	Required: 95			
Required CVA: 26.9	Centimeters	at the 95 th l	Percentile	
Additional Required Vertical Accuracy Information:				

Reported Vertical Accuracy

Confidence Interval Reported:	95	th % Cl	
Reported Unit:	Meters		
Reported # of checkpoints:	25		
Reported RMSEz:	0.05255		
Reported Vertical Accuracy (RMSEz * .% Cl)	0.103		
PORTED FUNDAMENTAL VERTICAL	ACCURACY FOR I	DEM FILES	
PORTED FUNDAMENTAL VERTICAL	ACCURACY FOR I	IFM FILFS	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported:	ACCURACY FOR E	th % Cl	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit:	ACCURACY FOR E 95 Meters	Th % CI	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit: Reported # of checkpoints:	ACCURACY FOR E 95 Meters 24	th % Cl	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit: Reported # of checkpoints: Reported RMSEz:	ACCURACY FOR E 95 Meters 24 0.06173	DEM FILES	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit: Reported # of checkpoints: Reported RMSEz: Reported Vertical Accuracy (RMSEz * .% CI)	ACCURACY FOR E 95 Meters 24 0.06173 0.121	DEM FILES	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit: Reported # of checkpoints: Reported RMSEz: Reported Vertical Accuracy (RMSEz * .% CI) EPORTED SUPPLEMENTAL VERTICAL	ACCURACY FOR D 95 Meters 24 0.06173 0.121 ACCURACY FOR D	DEM FILES	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit: Reported # of checkpoints: Reported RMSEz: Reported Vertical Accuracy (RMSEz * .% CI) PORTED SUPPLEMENTAL VERTICAL A Statistic Reported: <u>Percentile</u>	ACCURACY FOR D 95 Meters 24 0.06173 0.121 ACCURACY FOR D	DEM FILES	
PORTED FUNDAMENTAL VERTICAL Confidence Interval Reported: Reported Unit: Reported # of checkpoints: Reported RMSEz: Reported Vertical Accuracy (RMSEz * .% CI) PORTED SUPPLEMENTAL VERTICAL A Statistic Reported: <u>Percentile</u> A Confidence Level/Percentile Reported: 95	ACCURACY FOR E 95 Meters 24 0.06173 0.121 ACCURACY FOR E	DEM FILES	

		Checkpoints 95 th Percentile
Urban Areas with Dense Man	Made Structures	25 0.116 Meters
REPORTED CONSOLIDATE	D VERTICAL ACCURA	CY FOR DEM FILES
CVA Statistic Reported: <u>Percent</u>	ile	
CVA Confidence Level/Percentil	e Reported: 95	
Total number of checkpoints: 4	9	
Reported CVA: 0.116	Meters	at the 95 th Percentile
Additional Reported Vertical Accuracy Information:		

Reviewed Vertical Accuracy

~		
quantity and		
CCURACY FOR SWA	TH LIDAR FIL	ES
95	th % Cl	
Centimeters		
35		
5.3		
10.4		
CCURACY FOR DEM	FILES	
95	th % Cl	
Centimeters		
24		
4.9		
9.6		
C	# of heckpoints	SVA Reviewed 95 th Percentile
	Quantity and 95 Centimeters 35 5.3 10.4 CCURACY FOR DEM 95 Centimeters 24 4.9 9.6 CCURACY	Image: constraint of the second s

Brushlands_Trees		22	25.9	Centimeters
Forested_Fully_Grown		36	29.3	Centimeters
TallWeeds_Crops		23	15.3	Centimeters
Urban		25	10.4	Centimeters
REVIEWED CONSOLIDATED VEI	RTICAL ACCURACY			
CVA Statistic Reviewed. <u>Percentile</u> Revie	wed 95			
Total number of checkpoints: 130	ewed.			
Povioued CVA: 18.9	Centimeters	at the 95 th	Percentile	
	Checkpoint	Distribution Image	, rereentine	
Vartical Accuracy Baculta				

Image chowing the bare earth	ointe ogoi	act the own	ath da	to (chown by close	ification).			
Image showing the bare earth [oonts agair	nst the swa	ath da	ita (shown by class	sincation):			
	╡╹┓ ╡╹╹╕ ╺							
Additional Reviewed Vertical Accuracy	Vertical	Accuracy v	vill be	assessed once a c	orrected DEM i	s delivered to NGTC	DC.	
Information:	3/26/202	15: Vertica	I Accu	ıracy ran against tl	he swath and D	EM data. For this r	eport	the
	Swath F	/A results	were i	ran on the entire p	project area. Fo	or the DEM, the vert	ical a	ccuracy
	was asse	essed per L	JTM zo	one and reported	above. The resu	Its of both UTM18	and L	ITM19 is
	as follow	/s:						
		Paro Earth	/ertical	Accuracy for the DEM	I - UTM18 and UTM	M19 data	CVA	Total Doint
	UTM18	8.3	9.4	14.7	28.1	9.2	16.2	54
	UTM19	9.6	10.4	15.3	25.9	29.3	18.9	130
	Required	18.13	26.9	26.9	26.9	26.9	26.9	
				All values	are reported in cr	n		
		Durall	ı / *		· · · ·			
	CVA and	Brushland	a/ Tree	the project and the	egory for vertic	al accuracy of the L		iowever,
		Forested F	S IULI Sully G	ine project and the	category for w	ertical accuracy of t	he DF	M
	However	r, CVA and	FVA	basses for the proi	ect and the oth	er 3 SVA categories	pass.	
		,				3 2 11 34 66 66 160	12 22 20 1	

Based on this review, the USGS <u>accepts</u> the vertical accuracy.

End of Vertical Accuracy Review

Raw-Swath LiDAR Review Accepted

LAS swath files or raw unclassified LiDAR data are reviewed to assess the quality control used by the data supplier during collection. Furthermore, LAS swath data are checked for positional accuracy. The data supplier should have calculated the Fundamental Vertical Accuracy using ground control checkpoints measured in clear open terrain (*see Vertical Accuracy Review Section*).

Review Required: • Yes O No

RAW-SWATH LIDAR FILE CHARACTERISTICS

Separate folder for swath/raw LiDAR files

LAS Version: <u>1.2</u>

Point Record Format: <u>1</u>

 \checkmark Each swath file \leq 2 GB and properly segmented

Correct and properly formatted georeference information is included in all LAS file headers

Adjusted GPS time used with the global encoder id set to 1

✓ Scan Angles conform to USGS base-spec recommendations

✓ All points set to class '0' (not classified)

Additional comments:

The swath was delivered as one folder and not segmented into UTM 18 and UTM 19 data. The swath has a coordinate system of NAD_83_2011_UTM_Zone_19N.

Based on this review, the USGS <u>accepts</u> the swath/raw LiDAR data.

End of Swath/Raw LiDAR Review

Tiled/Classified LiDAR Review Accepted

Classified LAS tile files are used to build digital terrain models using the points classified as ground. Therefore, it is important that the classified LAS are of sufficient quality to ensure that the derivative product accurately represents the landscape that was measured. Classified LAS Tiles are comprised as follows, "all project swaths, returns, and collected points, fully calibrated, adjusted to ground, and classified and cut, by tiles, excluding calibration swaths, cross-ties, and other swaths not used, or intended to be used, in product generation".

Review Required: • Yes 🔾 No

CLASSIFIED LIDAR TILE CHARACTERISTICS

Separate folder for classified/tiled LiDAR files

LAS Version: <u>1.2</u>

Point Record Format: <u>1</u>

Classified LAS tile files conform to project tiling scheme

There are 16 .las tiles missing from the upper portion of the project area for UTM18 data. The tile index shows tiles in this location. Are these tiles left out for a purpose?



The coral color represents the Tile Index delivered with the data. The green is the Point Cloud Statistics shapefile for every classified .las tile delivered.

3/26/2015: Contractor sent missing tiles for UTM18 data (16 tiles). Additionally, they sent 5 extra classified .las tiles that were assessed by reviewer for UTM19 data.

Quantity of classified LAS tile files conforms to project tiling scheme

See above comment and image.

3/26/2015: Contractor sent missing tiles for UTM18 data (16 tiles). Additionally, they sent 5 extra classified .las tiles that were assessed by reviewer for UTM19 data.

Classified LAS tile files do not overlap

Classified LAS tile files are uniform in size

Correct and properly formatted georeference information is included in all LAS file headers

Adjusted GPS time used with the global encoder id set to 1

Classified LAS tile files have no points classified as '12' (Overlap)

Point classifications are limited to the standard values listed below:

Code	Description	Used
1	Processed, but unclassified	✓
2	Bare-earth/Ground	✓
7	Noise(low or high, manually identified, if needed)	✓
8	Model key points	
9	Water	 ✓
10	Ignored ground (breakline proximity)	✓
11	Withheld (if the "Withheld Bit" is not implemented in the processing software	

Additional Classes:

Class	Description
17	Overlap - unclassified
18	Overlap - ground

Additional comments:

UTM18 data: The header information shows 36 classified .las files with an intensity outside of the 0-255 range. The values range from 364-2212. UTM19 data: The header information shows 783 classified .las files with an intensity outside of the 0-255 range. The values range from 280 to 7140.

Based on this review, the USGS <u>accepts</u> classified/tiled LiDAR data.

End of Tiled/Classified LiDAR Review

Breakline Review Accepted

Breaklines are vector feature classes that are used to hydro-flatten the bare earth Digital Elevation Models.

Review Required: • Yes 🔾 No

BREAKLINE FILE CHARACTERISTICS:

Separate folder for breakline files.

✓ Breaklines contain elevation values.

Elevation values stored in Geometery (ZEnabled)

Units: Meters

✓ Waterbody Breaklines.

Polyline 🗌 Polygon 🗹

Single elevation value per waterbody feature.

Required. Waterbody Elevations were created via <u>Unknown</u>

waterbody level techniques.

Double Line Stream Breaklines (Streams Approximately > 100 ft).

Polyline 🗹 Polygon 🗌

Downstream DLS Flow is <u>Select...</u>

✓ Required.

Single Line Breaklines.

□ No missing or misplaced breaklines.

ADDITIONAL COMMENTS, ERRORS, ANOMALIES, OR OTHER ISSUES:

Several errors exist in the DEM related to floating water in which the water is at a higher elevation than the surrounding terrain.

3/26/2015: Contractor corrected errors.

Based on this review, the USGS <u>accepts</u> the breakline files.

End of Breakline Review

DEM Review Accepted

The derived bare-earth file(s) receive a review of the vertical accuracies provided by the data supplier, vertical accuracies calculated by the USGS using supplied and independent checkpoints (*see the prior Vertical Accuracy Review Section*), and a thorough visual review for any anomalies or inconsistencies in assessing the quality of the DEM(s).

BARE-EARTH DEM TILE CHARACTERISTICS:

Separate folder for bare-earth DEM files

Raster File Type: <u>IMG</u>

Raster Cell Size: 1 Meters

Tile bit depth/pixel Type: 32_BIT_FLOAT

Interpolation or Resampling Technique: Unknown

✓ DEM tiles do not overlap

DEM tiles conform to Project Tiling Scheme

There are 16 tiles of missing data in the UTM 18 data. The area encompasses several towns and the tile index shows .las tile names but no classified .las tiles or DEM tiles were delivered by the vendor. Please explain.

50 18TYN3352	50 18TYN350250	18TYN365250	18TYN380250	En la sur a	
18TYN3352	35 18TYN350235	18TYN365235	18TYN380235	Introduction	All and a second
	20 18TYN350220	18TYN365220	18TYN380220	18TYN395220	18 TTN
		4.TYX384205	18TYN380205	18TYN395205	the Gr
90. 1877(N3351	1 18(TYT350)901	187753-05 91 91 91 95 95 91 95 95 91 95 95 91 95 91 95 91 91 91 91 91 91 91 91 91 91 91 91 91	18TYN380190	18TYN395190	1ST A
- Kutzaral				and the second s	<u>1877</u> N

*2/25/2015 Contractor sent missing tiles. They have been reviewed and are accepted.

✓ Quantity of DEM files conforms to Project Tiling Scheme

✓ DEM tiles are uniform in size

DEM tiles properly edge match and free of edge artifacts

UTM 19 data has a tile edge match error.



*3/26/2015 Contractor corrected issue.

Tiles are free from Spikes and Pits

There is a pit at this location in UTM18 data: 42° 33' 47.6171" N, 72° 02' 17.7015" W



*3/26/2015: Contractor corrected issue.

Tiles are free from Data Holidays (*voids due to processing or collection errors*)

There are 16 tiles missing in the UTM 18 data. Please explain if these are intentionally left out of the dataset and if so, adjust the tile index and data extent shapefile. If not, deliver the missing tiles to NGTOC for review.

3/26/2015: Contractor sent missing tiles.

Tiles do not exhibit systematic sensor error or cornrowing

There are several anomalous errors in which there is an elevation change in a pattern running in a NW-SE orientation throughout the UTM19 data. Below is a representative image of what the reviewer is seeing:



2/25/2015: Contractor Response: Offset is due to tidal variation between and within data collections. Best practice was used to eliminate this, but some offset may remain. QA Reviewer accepts these anomalous errors.

DEM tiles are properly Hydro Flattened 🔾 Yes 🖲 No

Waterbodies ² Acres or greater are flattened

Several lakes have water that is at a higher elevation than the surrounding terrain (Floating_Water errors). Below is a representative image only:



2/25/2015: Contractor fixed floating water issues. For 6 of the errors the contractor responded *elevation change is due to a naturally occurring spillway*. QA Reviewer accepts these errors (Floating_water_3, _4, _6, _7, _8, _9, _11).

In the UTM19 data there are two errors in which the elevation along the tile edge is different. Below is a representative image:



2/25/2015 Contractor corrected above errors.



*3/26/2015: Contractor corrected issue.

Streams 100 ft. or greater are flattened in a downstream manner

✓ Tidal Boundaries/Shorelines are flattened

✓ No missing islands 1 Acre or larger

Bridges/Overpasses are properly removed

Several errors exist in both UTM18 and UTM19 datasets in which a bridge was not removed or not completely removed in which the flow of water or roadway is blocked. Below is a representative image only. Refer to the error shapefile for all errors of this type.



*3/26/2015: Contractor corrected issues.

- Culverts are maintained (Not Hydro Enforced)
- Depressions, Sinks, are not filled in (Not Hydro Conditioned)
- ✓ Vegetation properly removed
- ✓ Manmade structures properly removed

ADDITIONAL COMMENTS, ERRORS, ANOMALIES, OR OTHER ISSUES:

Re-delivery of DEM tiles: UTM 19 DEM had a delivery of 5 additional tiles. QA was done and the tiles are good and will be included in the final acceptance (see image below). **Original Delivery:** With the additional delivery of 5 tiles:



Tiles recommended for NED 1/3rd: O Yes. \bigcirc No. Tiles recommended for NED 1/9th: O Yes. \bigcirc No.

Based on this review, the USGS <u>accepts</u> the DEM tiles.

End of DEM Review

Based on this review, the provided delivery <u>Meets</u> the Contract and/or Task Order requirements. Additional Comments:

END OF REPORT (v2.1.1)