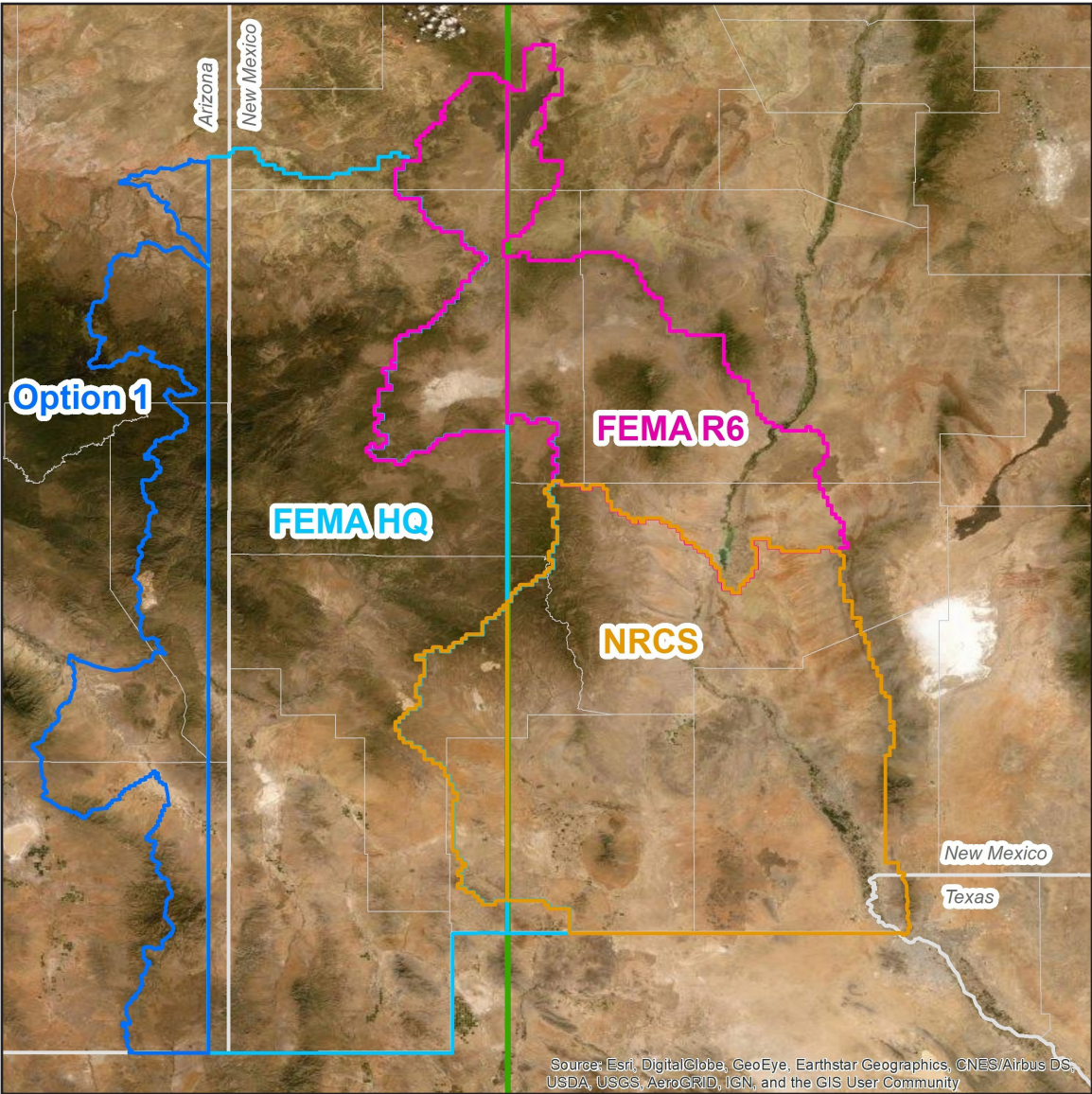


NM South Central 2018 D19

Airborne Lidar Report

December 2019



Contract # G16PC00022
Task Order # 140G0219F0008



Contractor Woolpert
Project # 79150

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1. Overview

About

This project contains a comprehensive outline of the 140G0219F0008 NM South Central 2018 D19 task order issued by the United States Geological Survey's National Geospatial Technical Operations Center (USGS-NGTOC). This task order called for the acquisition and processing of QL2 data over three areas of interest covering approximately 27,744 square miles in New Mexico, Arizona, and Texas.

Data includes the following counties:

Base Option: FEMA HQ

- Catron, Cibola, Grant, Hidalgo, Luna, Sierra Counties in New Mexico
- Apache, Cochise, Graham, Greenlee Counties in Arizona

Base Option: FEMA R6

- Catron, Cibola, Sandoval, Sierra, and Socorro Counties in New Mexico

Base Option: NRCS

- Catron, Doña Ana, Grant, Luna, and Sierra Counties in New Mexico
- El Paso County in Texas

Option 1

- Apache, Cochise, Graham, and Greenlee Counties in Arizona

Purpose

The purpose of this project was to support the 3DEP mission, the Natural Resources Conservation Service (NRCS) high resolution elevation enterprise program, and the Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment and Planning (MAP) program.

Specifications

Data for this task order was acquired and produced to meet USGS Lidar Base Specification v1.3 standards and the American Society of Photogrammetry and Remote Sensing (ASPRS) Positional Accuracy Standards for Digital Geospatial Data (Edition 1, Version 1.0).

Spatial Reference

Geospatial data products were produced using the following horizontal and vertical spatial data reference systems.

Table 1-1. Spatial Reference Systems

Blocks 2, 4, 5, 8, and 10		
Horizontal	EPSG Code	6341
	Datum	NAD83 (2011)
	Projection	UTM Zone 12
	Units	Meters
Vertical	Datum	NAVD88
	Geoid	GEOID12B
	Units	Meters
	Height Type	Orthometric

Blocks 1, 3, 6, 7, 9		
Horizontal	EPSG Code	6342
	Datum	NAD83 (2011)
	Projection	UTM Zone 13
	Units	Meters
Vertical	Datum	NAVD88
	Geoid	GEOID12B
	Units	Meters
	Height Type	Orthometric

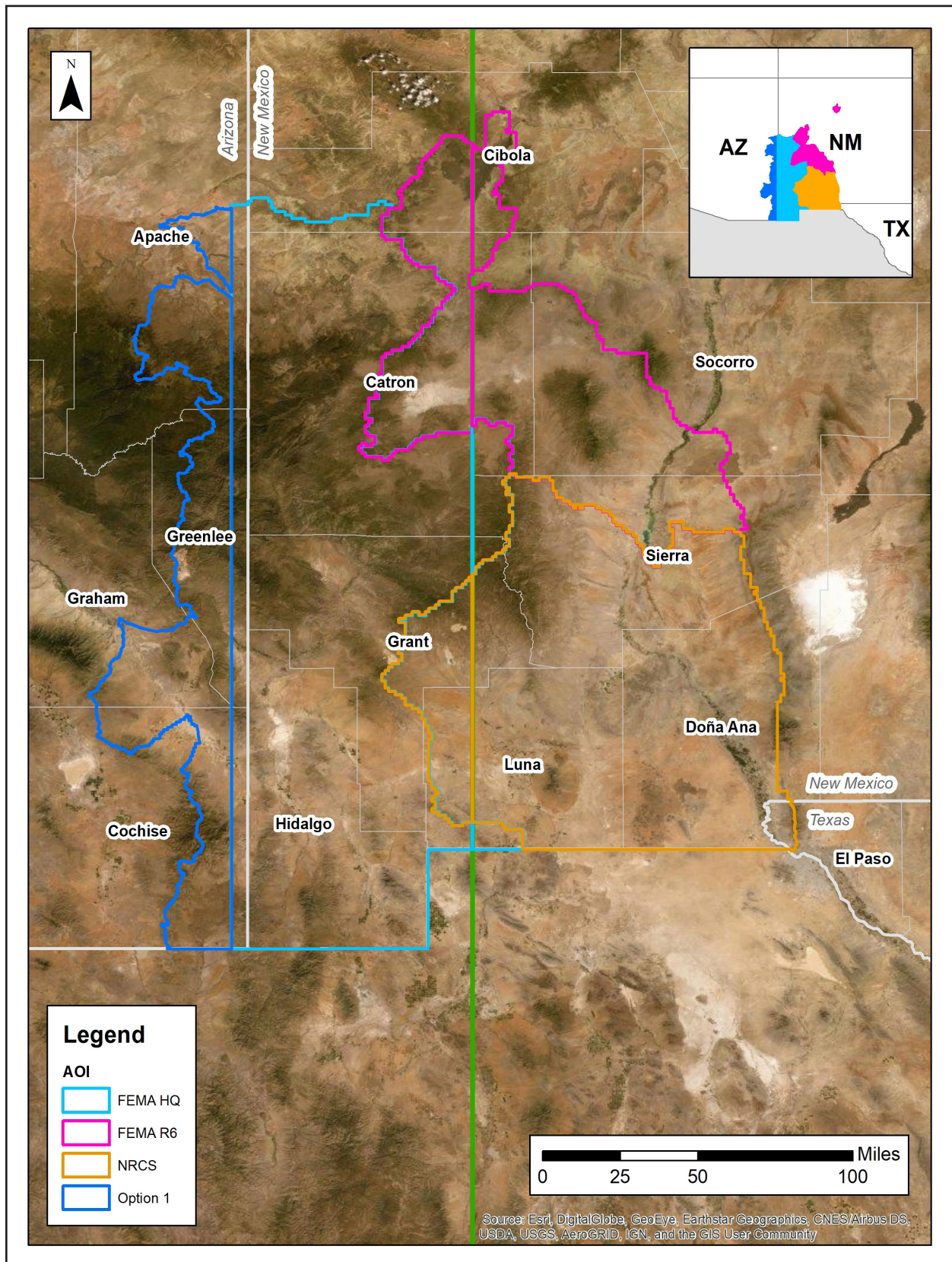
Deliverables

All data products produced as part of this task order are listed below. All tiled deliverables had a tile size of 1,500-meters x 1,500-meters. Tile names are derived from the US National Grid.

Table 1-2. Deliverables

Lidar Data	
Classified lidar point cloud data	Tiles in .las v1.4 format Classes <ul style="list-style-type: none"> • 1 – Processed, not Classified • 2 – Ground • 7 – Noise • 9 – Water • 17 – Bridge Decks • 18 – High Noise • 20 – Ignored Ground
Breaklines used for hydro-flattening	<ul style="list-style-type: none"> • Lake and River features as feature classes in an Esri file geodatabase <ul style="list-style-type: none"> • Water bodies greater than 2 acres as polygon features • Rivers 30.5 meters / 100 feet and greater in width as polyline features • Bridges used in DEM generation as point features in Esri shapefile format
Hydro-flattened bare earth digital elevation model (DEM)	1-meter pixel size, 32-bit floating-point; no bridges or overpass structures GeoTIFF format
Intensity Imagery	1-meter pixel size, 8-bit gray-scale (linear rescaling from 16-bit intensity) GeoTIFF format
Flight Line Index	Polygon features in an Esri file geodatabase
Control Data	
Lidar calibration points	Esri shapefile format
Lidar NVA checkpoints	Esri shapefile format
Lidar VVA checkpoints	Esri shapefile format
Other Data	
Data Extent	Esri shapefile format
Delivery Diagram	Esri shapefile format
Tile Index	Esri shapefile format
Metadata and Reports	
Metadata	Deliverable-level FGDC CSDGM/USGS MetaParser Compliant metadata in .xml format
Lidar Project Report	Project report with flight logs in .pdf format
Survey Report	Survey report in .pdf format

Figure 1-1. Project Area



2. Acquisition

Flight Planning

Aerial lidar data was collected using the specifications listed below.

Table 2-1. Acquisition Requirements

Specification	Target
Resolution	<ul style="list-style-type: none"> • 2 points per square meter • 0.71-meter nominal point spacing
Overlap	At contractor's discretion, but enough to ensure there are no data gaps between usable portions of the swath and nominal point density is achieved
Acquisition Window	Fall 2018/spring 2019
Acquisition Conditions	<ul style="list-style-type: none"> • Cloud and fog-free between the aircraft and ground • Ground is snow free • Ground has no unusual flooding or inundation, except in cases where the goal of the collection is to map the inundation • Preference of vegetation is leaf-off
Data Voids	Not allowed except <ul style="list-style-type: none"> • Where caused by water bodies • Where caused by areas of low near infra-red (NIR) reflectivity (i.e. asphalt or composition roofing) • Where caused by lidar shadowing from buildings or other features • Where appropriately filled-in by another swath
Control	Airborne Global Positioning System (ABGPS) and Inertial Measurement Unit (IMU) data to be used along with differentially-corrected GPS ground control points

Lidar Sensor Information

Aerial lidar data was acquired using the Leica ALS80, Leica Terrain Mapper, Optech ALTM Galaxy, and Optech Galaxy PRIME lidar sensor systems. A total of 1,736 flight lines were collected.

Table 2-2. Leica ALS80 Sensor Info

Sensor Specifications	
Operating Altitude (m AGL)	100 - 3,500 at 10% reflective target
Maximum Measurement Rate (kHz)	1,000
Field of view (degrees, full angle, user adjustable)	0 - 72
Roll stabilization (automatic adaptive, degrees)	72 - active FOV
Scan patterns (user selectable)	sine, triangle raster
Maximum Scan Rate (Hz)	<ul style="list-style-type: none"> • Scan • Triangle • Raster
Number of Returns	unlimited
Number of intensity measurements	3 (first, second, third)
Pulse Mode(s)	2 - 6 pulses in air
Laser Specifications	
Laser Beam Divergence	Dual Divergence: 0.20-0.26 mrad (1/e) and 0.8 mrad (1/e) nominal
Laser Classification	Class IV laser product (FDA CFR 21)
Eye Safe Range	400m single shot depending on laser repetition rate
Accuracy	
Range Resolution	Better than 1 cm
Elevation Accuracy	6 - 19 cm single shot (one standard deviation)
Horizontal Accuracy	1/5,500 x altitude (m AGL)
Physical Specifications	
Size (cm), Weight (kg)	<ul style="list-style-type: none"> • Scanner • Control Electronics
Operating Temperature	<ul style="list-style-type: none"> • Scanner • Control Electronics
Flight Management	Leica FlightPro
Power Consumption	922 W @ 22.0 – 30.3 VDC

Source: Leica ALS80-HP Product Specifications

https://w3.leica-geosystems.com/downloads123/zz/airborne/als80/product-specification/leica_als80_hp_productspec_en.pdf

Table 2-3. Leica Terrain Mapper Sensor Info

Sensor Specifications	
Operating Altitude (m AGL)	300 - 5,500 at 10% reflective target
Maximum Measurement Rate (kHz)	2,000
Scan Angle	20 - 40
Scan Width	Up to 70% of flight altitude
Scan Frequency	Programmable up to 125 Hz (7,500 RPM), 250 scan lines per second
Number of Returns	15
Number of intensity measurements	15
Pulse Mode(s)	Up to 35 pulses in air
Laser Specifications	
Laser Beam Divergence	0.25 mrad (1/e)
Laser Classification	Class 4 laser product
Accuracy	
Range Resolution	< 1 cm RMS
Elevation Accuracy	< 5 cm 1 σ
Horizontal Accuracy	< 13 cm 1 σ
Physical Specifications	
Size (cm), Weight (kg) • Scanner • Control Electronics	<ul style="list-style-type: none"> • 37 W x 68 L x 26 H cm, 47 kg • 45 W x 47 D x 25 H cm, 33 kg
Operating Temperature • Scanner • Control Electronics	<ul style="list-style-type: none"> • 0 - 40°C cabin-side temperature • 0 - 40°C
Flight Management	Leica FlightPro
Power Consumption	922 W @ 22.0 – 30.3 VDC

Source: Leica TerrainMapper Data Sheet

<https://leica-geosystems.com/en-US/products/airborne-systems/topographic-lidar-sensors/leica-terrainmapper>

Table 2-4. Optech ALTM Galaxy Sensor Info

Laser Configuration	
Topographic laser	1064-nm near-infrared
Laser classification	Class IV (US FDA 21 CFR 1040.10 and 1040.11; IEC/EN 60825-1)
Beam divergence	0.25 mrad (1/e)
Operating altitudes ^{1, 2, 3, 4}	150-4700 m AGL, nominal
Effective pulse repetition frequency	Programmable, 35-550 kHz
Laser range precision ⁵	< 0.008 m, 1 σ
Scan angle (FOV)	Programmable, 0-60°
Swath width	Programmable, 0-115% of AGL
Scan frequency	Programmable, 0-120 Hz advertised (0-240 scan lines/sec)
Sensor scan product	2000 maximum
Absolute horizontal accuracy ^{2, 3}	1/10,000 \times altitude; 1 σ
Absolute elevation accuracy ^{2, 3}	< 0.03-0.20 m RMSE from 150-4700 m AGL
Sensor Configuration	
Position and orientation system	POS AV™ AP60 (OEM); 220-channel dual frequency GNSS receiver; GNSS airborne antenna with Iridium filters; high-accuracy AIMU (Type 57); non-ITAR
Flight management system	Optech FMS
SwathTRAK™	Dynamic field of view
PulseTRAK™	Continuous operating envelope
Range capture	Up to 8 range measurements, including last
Intensity capture	Up to 8 intensity measurements, including last (12-bit)
Roll compensation	Programmable; $\pm 5^\circ$ at 50° FOV; increasing as FOV is reduced from 50°
Minimum target separation distance	< 0.7 m (discrete)
Data storage	Internal solid state drive SSD (SATA II)
Power requirements	28 V; 300 W; 12 A
Dimensions and weight	Sensor: 0.34 \times 0.34 \times 0.25 m, 27 kg PDU: 0.42 \times 0.33 \times 0.10 m, 6.5 kg
Operating temperature	0 to +35°C

1. Target reflectivity $\geq 20\%$

2. Dependent on selected operational parameters; assumes nominal FOV of up to 40° in standard atmospheric conditions (i.e. 23-km visibility) and use of Optech LMS Professional software suite

3. Angle of incidence $\leq 20^\circ$

4. Target size \geq laser footprint

5. Under Teledyne Optech test conditions, 1 sigma

Source: Optech ALTM Galaxy Airborne Lidar System Specification Sheet

Table 2-5. Optech Galaxy PRIME Sensor Info

Sensor Performance	
Performance envelope ^{1, 2, 3, 4}	150-6000 m AGL, nominal
Absolute horizontal accuracy ^{2, 3}	1/10,000 × altitude; 1 σ
Absolute elevation accuracy ^{2, 3}	< 0.03-0.25 m RMSE from 150-6000 m AGL
Laser Configuration	
Topographic laser	1064-nm near-infrared
Laser classification	Class IV (US FDA 21 CFR 1040.10 and 1040.11; IEC/EN 60825-1)
Pulse repetition frequency (effective)	Programmable, 50-1000 kHz
Beam divergence	0.25 mrad (1/e)
Laser range precision ⁵	< 0.008 m, 1 σ
Minimum target separation distance	< 0.7 m (discrete)
Range capture	Up to 8 range measurements, including last
Intensity capture	Up to 8 intensity measurements, including last (12-bit)
Sensor Configuration	
Position and orientation system	POS AV™ AP60 (OEM); 220-channel dual frequency GNSS receiver; GNSS airborne antenna with Iridium filters; high-accuracy AIMU (Type 57); non-ITAR
Scan angle (FOV)	10-60°
Swath width	10-115% of altitude AGL
Scan frequency	0-120 Hz advertised (0-240 scan lines/sec)
Scan product	2000 maximum
Flight management system	Optech FMS (Airborne Mission Manager and Nav) with operator console
SwathTRAK™	Dynamic FOV for fixed-width data swaths in variable terrain
PulseTRAK™	Multipulse tracking algorithm with no density loss across PIA transition zones
Roll compensation	±5° minimum
Data storage	Removable SSD (primary); internal SSD (spare)
Power requirements	28 V; 400 W
Dimensions and weight	Sensor: 0.34 × 0.34 × 0.25 m, 27 kg PDU: 0.42 × 0.33 × 0.10 m, 6.5 kg
Operating temperature	0 to +35°C

1. Target reflectivity $\geq 20\%$; 99% detection probability

2. Dependent on selected operational parameters; assumes nominal FOV of up to 40° in standard atmospheric conditions (i.e. 23-km visibility) and use of Optech LMS Professional software suite

3. Angle of incidence $\leq 20^\circ$

4. Target size \geq laser footprint

5. Under Teledyne Optech test conditions, 1 sigma

Source: Optech Galaxy PRIME Airborne Lidar Terrain Mapper Specification Sheet

<http://info.teledyneoptech.com/acton/attachment/19958/f-0278/1/-/-/-/Galaxy%20PRIME%20Brochure.pdf>

GNSS and IMU Equipment

Prior to mobilizing to the project site, flight crews coordinated with the necessary air traffic control personnel to ensure airspace access. Crews were on-site, operating a Global Navigation Satellite System (GNSS) Base Station for the airborne GPS support.

Flight navigation during acquisition was performed using IGI CCNS (Computer Controlled Navigation System). The pilots are skilled at maintaining their planned trajectory, while holding the aircraft steady and level. If atmospheric conditions are such that the trajectory, ground speed, roll, pitch and/or heading cannot be properly maintained, the mission is aborted until suitable conditions occur.

Base stations were set by acquisition staff and was used to support the aerial data acquisition. See the table below for stations operated during acquisition.

Table 2-6. GNSS Base Stations

Station Name	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height L1 Phase Center (Meters)
NMDE_CORC	32° 16' 02.14799°	107° 43' 33.82672"	1298.878
KDMN Airport	32° 15' 52.81556"	107° 43' 30.03931"	1289.396
P04_Airport	31° 22' 17.07841"	109° 53' 05.14180"	1429.24
AZSF_CORC	32° 48' 07.31616"	109° 42' 42.84603"	897.952
P026_CORC	32° 39' 32.24423"	107° 11' 41.50093"	1237.958
P034_CORC	34° 56' 44.21338"	106° 27' 33.3181"	1811.966
S408	34° 7' 45.14279"	109° 18' 31.00148"	2122.835

Timeline

Lidar data was collected from November 20, 2018 through May 27, 2019. Acquisition specifications are listed in the table below. An initial quality control process was immediately performed on to review the data coverage, airborne GPS data, and trajectory solution.

Table 2-7. Acquisition Specifications

Settings	Leica ALS80	Leica Terrain Mapper	Optech Galaxy	Optech Galaxy PRIME	Optech Galaxy PRIME
Max. Number of Returns	Infinite	15	8	8	8
Nominal Point Spacing	0.7 m	0.7 m	0.7 m	0.7 m	0.7 m
Nominal Point Density	2 ppsm	2 ppsm	2.21 ppsm	2.5 ppsm	3.45 ppsm
Flying Height Above Ground Level	1,981 m	3,500 m	1,600 m	1,670 m	2,000 m
Flight Speed	150 knots	150 knots	120 knots	160 knots	145 knots
Scan Angle	40°	8°	46°	40°	40°
Scan Rate Used	42.9 Hz	80 Hz	46 Hz	64.32 Hz	70 Hz
Pulse Rate Used	272 kHz	670 kHz	200 kHz	300 kHz	400 kHz
Multi-Pulse in Air	Enabled	Enabled	Enabled	Enabled	Enabled
Swath Width	1,443 m	2,548 m	1,358 m	1,216 m	1,331 m
Swath Overlap	25%	25%	30%	20%	30%

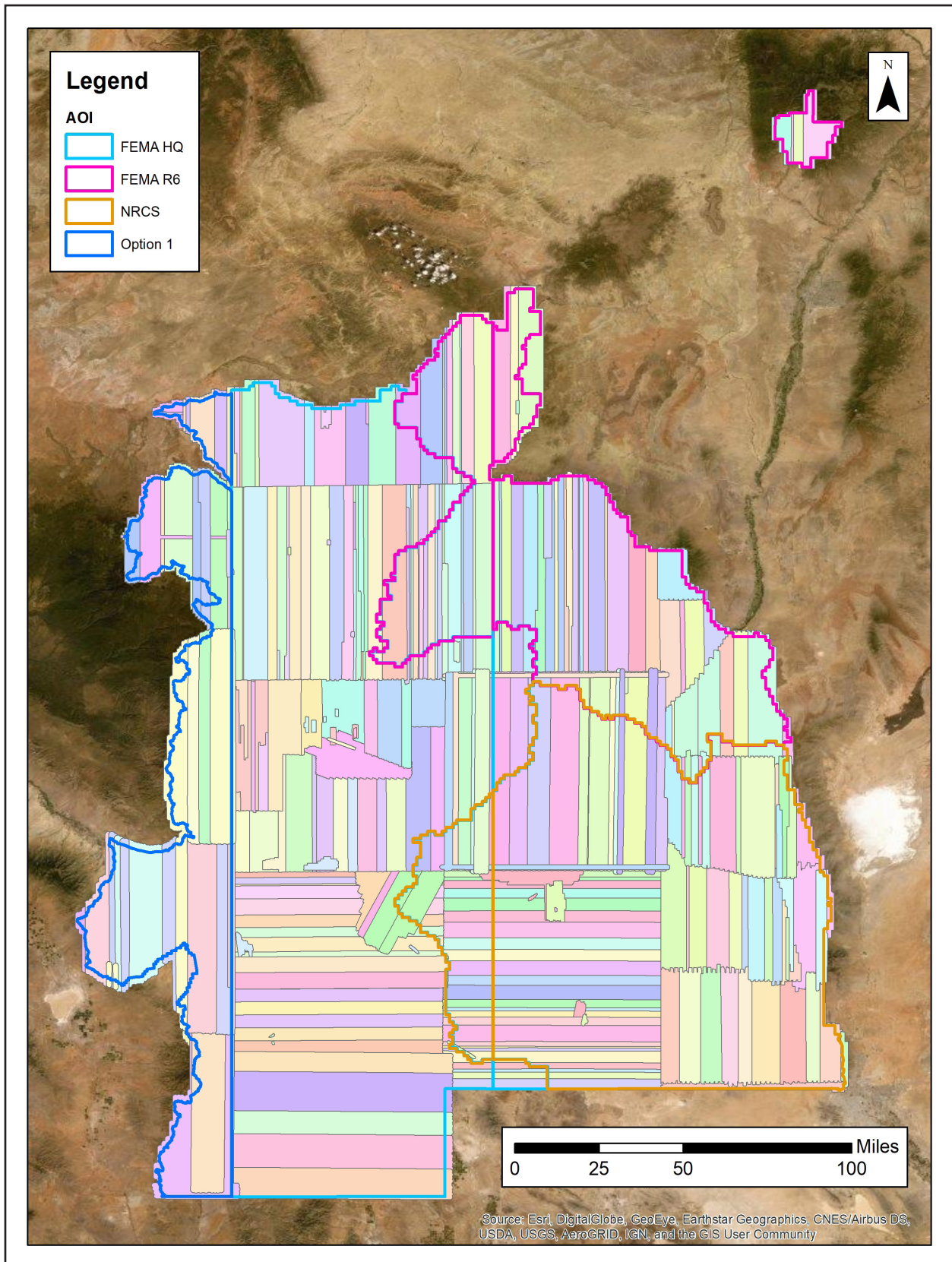
For more information, see the Flight Logs in Appendix 1.

Acquisition Quality Assurance

Woolpert developed a quality assurance and validation plan to ensure the acquired lidar data meets the USGS Base Specification Version 1.3. For quality assurance purposes, the lidar data was processed immediately following acquisition to verify the coverage has appropriate density, distribution, and no unacceptable data voids. Accompanying GPS data was post processed using differential and Kalman filter algorithms to derive a best estimate of trajectory. The quality of the solution was verified to be consistent with the accuracy requirements of the task order. Any required re-flights were scheduled at the earliest opportunity.

The spatial distribution of the geometrically usable first return lidar points was reviewed for density requirements as well as regular and uniform point distribution - verifying the lidar data is spaced so that 90% of the cells in a 2*NPS grid placed over the data contain at least one lidar point. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath. Additionally, the data was reviewed for unacceptable data voids – verifying no area greater than or equal to $(4 \times \text{ANPS})^2$ exhibited data coverage gaps.

Figure 2-1: Flown Flight Lines



3. Processing

Processing Summary

Once the lidar data passed initial QC, the dataset was corrected for aircraft orientation and movement. This process used airborne inertial, orientation, and GPS data collected during acquisition along with ground-based GPS data. The data went through a geometric calibration that further corrected each laser point. This calibrated data set was used to create the LAS point cloud. The LAS point data was initially classified into “ground” and “non-ground”, then further refined using the classes specified in this task order. Breaklines were drawn to denote hydrological features. After the hydro-flattening process, the final deliverables products were created.

GNSS-IMU Trajectory Processing

Kinematic corrections for the aircraft position were resolved using aircraft GPS and static ground GPS (1-Hz) for each geodetic control (base station) for three subsystems: inertial measurement unit (IMU), sensor orientation information, and airborne GPS data.

Post-processing of the IMU system data and aircraft position with attitude data was completed to compute an optimally accurate, blended navigation solution based on Kalman filtering technology, or the smoothed best estimate of trajectory (SBET).

Software: POSPac Software v. 5.3, IPAS Pro v.1.35., Novatel Inertial Explorer v8.60.6129

Trajectory Quality

The GNSS trajectory and high-quality IMU data are key factors in determining the overall positional accuracy of the final sensor data. Within the trajectory processing, there are many factors that affect the overall quality, but the most indicative are the combined separation, the estimated positional accuracy, and the positional dilution of precision (PDOP).

Combination Separation

Combined separation is a measure of the difference between the forward-run and the backward-run solution of the trajectory. The Kalman filter was processed in both directions to remove the combined directional anomalies. In general, when these two solutions match closely, an optimally accurate and reliable solution is achieved.

The data for this task order was processed with a goal to maintain a combined separation difference of less than ten (10) centimeters.

Estimated Positional Accuracy

Estimated positional accuracy plots the standard deviations of the east, north, and vertical directions along a time scale of the trajectory. It illustrates loss of satellite lock issues, as well as issues arising from long baselines, noise, and/or other atmospheric interference.

PDOP

The PDOP measures the precision of the GPS solution in regard to the geometry of the satellites acquired and used for the solution.

The data for this task order was processed with a goal to maintain an average PDOP value below 3.0. Brief periods of PDOP over 3.0 are acceptable due to the calibration and control process if other metrics are within specification.

Geometric Calibration

After the initial phase was complete, a formal reduction process was performed on the data. Laser point position was calculated by associating the SBET position to each laser point return time, scan angle, intensity, etc. Raw laser point cloud data was created for the whole project area in LAS format. Automated line-to-line calibrations were then performed for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift. Statistical reports were generated for comparison and used to make the necessary adjustments to remove any residual systematic error.

Software: Proprietary Software, TerraMatch v18, Leica CloudPro 1.2.4

Lidar Data Classification

LAS data was classified as ground and non-ground points with additional filters created to meet the task order classification specifications. Statistical absolute accuracy was assessed via direct comparisons of ground classified points to ground RTK survey data. Based on the statistical analysis, the lidar data was then adjusted to reduce the vertical bias when compared to the survey ground control of higher accuracy.

Calibrated LAS files were imported into the task order tiles and initially filtered to create a ground and non-ground class. Then additional classes were filtered as necessary to meet the following client-specified classes:

- Class 1 – Default / Processed, but not Classified
- Class 2 – Bare Earth Ground
- Class 7 – Low Noise
- Class 9 – Water
- Class 17 – Bridge Decks
- Class 18 – High Noise
- Class 20 – Ignored Ground

Classified LAS files were evaluated through a series of manual QA/QC steps as well as a peer-based review to eliminate remaining artifacts from the ground class. This included a review of the DEM surface to remove artifacts and ensure topographic quality.

Software: Proprietary Software, TerraScan v18

Hydrologic Flattening

The lidar task order required compilation of breaklines defining the following types of water body features:

Lakes, reservoirs, ponds	Minimum of 2-acres or greater Compiled as closed polygons, collected at a constant elevation
Rivers, streams	Nominal width of 30.5 meters / 100 feet Compiled in direction of flow, with both sides maintaining an equal elevation gradient
Bridge breaklines	Breaklines used to enforce a logical terrain surface below a bridge

Woolpert utilized the following steps to hydrologically flatten the water bodies and for gradient hydrologic flattening of the double line streams within the existing lidar data:

1. The newly acquired lidar data was utilized to manually compile the hydrologic features in a 2D environment using the lidar intensity and bare earth surface. Open Source imagery was used as reference when necessary.
2. An integrated software approach was applied to combine the lidar data and 2D breaklines. This process “drapes” the 2D breaklines onto the 3D lidar surface model to assign an elevation. A monotonic process is performed to ensure the streams are consistently flowing in a gradient manner. A secondary step within the program verifies an equally matching elevation of both stream edges. The breaklines that characterize the closed water bodies are draped onto the 3D lidar surface and assigned a constant elevation at or just below ground elevation.
3. All classified ground points from inside the hydrologic feature polygons were reclassified to water, class nine (9).
4. All classified ground points were reclassified from within a buffer along the hydrologic feature breaklines to buffered ground, class twenty (20). The buffer distance was approximately the task order designed nominal pulse spacing distance.
5. Breaklines used for bridge removal during the hydrologic flattening were included with the hydrologic breakline geodatabase deliverable. The purpose of these breaklines is for a more aesthetically pleasing DEM appearance.
6. The lidar ground points and breaklines were used to generate a digital elevation model (DEM).
7. QA/QC for this task was performed by reviewing the hydrologically flattened DEM and hydrologic breakline features. Additionally, a combined approach utilizing commercial off the shelf software and proprietary methods were used to review the overall connectivity of the hydrologic breaklines.

TerraScan was used to add the hydrologic breakline vertices and export the lattice models.

Breaklines defining the water bodies greater than 2-acres were provided as polygon features. Rivers and streams with a nominal minimum width of 30.5 meters (100 feet) were provided as polyline features. All lake and river breaklines compiled as part of the flattening process were provided in an Esri file geodatabase.

Breaklines used for DEM generation were provided as point features in Esri shapefile format.

Software: TerraScan v18, TerraModeler v18, Esri ArcMap v10.4, LP360 v2018.1.57.4

Digital Elevation Model

TerraScan was used to add the hydrologic breakline vertices and export the lattice models. Class 2 (ground) lidar points in conjunction with the hydro breaklines and bridge breaklines were used to create 1-meter hydro-flattened bare-earth raster DEM files. Using automated scripting routines within ArcMap, an 32-bit floating point raster GeoTIFF file was created for each tile. Files were clipped to the data extent. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

Intensity Imagery

Lidar intensity data derived from the acquired lidar data was linearly rescaled from 16-bit intensity and provided as 1-meter pixel, 8-bit, 256 gray scale GeoTIFF format intensity imagery files. Files were clipped to the data extent.

Software: TerraScan v18

Metadata

FGDC CSDGM/USGS MetaParser-compliant metadata was produced in XML format. The metadata includes a complete description of the task order client information, contractor information, project purpose, lidar acquisition and ground survey collection parameters, lidar acquisition and ground survey collection dates, spatial reference system information, data processing including acquisition quality assurance procedures, GPS and base station processing, geometric calibration, lidar classification, hydrologic flattening, intensity imagery development, and final product development.

Other metadata deliverables included Esri shapefiles of the ground control and QA/QC points, delivery tile index, delivery extent, and delivery diagram. A georeferenced, polygonal representation of the detailed extents of each acquired lidar swath was produced as a polygon feature class in an Esri file geodatabase.

4. Accuracy Assessment

Results Summary

The tables below show a summary of all test results. The following sections describe the testing methods used.

Software: TerraScan v18, Esri ArcMap v10.4

Horizontal Accuracy

This dataset was produced to meet ASPRS “Positional Accuracy Standards for Digital Geospatial Data” (2014) for a 10.1 cm RMSE_x / RMSE_y Horizontal Accuracy class which equates to Positional Horizontal Accuracy = +/- 24.9 cm at a 95% confidence level.

Table 4-1. Vertical Accuracy Summary

Testing Categories	Target	Measured	Minimum Points	Points Used
Raw Swath NVA RMSE _z 95% at Confidence Level	0.196 m	0.082 m	535	590
DEM NVA RMSE _z at 95% Confidence Level	0.196 m	0.066 m	535	590
DEM VVA RMSE _z at 95th Percentile	0.30 m	0.169 m	365	389

Raw Lidar Swath Testing

This project required Non-Vegetated Vertical Accuracy (NVA) to be tested on the raw lidar point cloud swath data. The dataset was required to meet a target value of 19.6 cm at a 95% confidence level using an RMSE_z target value of 10 cm x 1.9600. Testing was assessed and reported using guidelines developed by the National Digital Elevation Program (NDEP) and the American Society for Photogrammetry and Remote Sensing (ASPRS).

The raw NVA was to be calculated with a minimum of 535 independent checkpoints that were not used in the calibration or post processing of the lidar point cloud data. Checkpoints were to be distributed throughout the project area and located in bare earth and urban (non-vegetated) land cover classes.

Testing was performed using TINs created from the final calibrated and controlled swath data. For each NVA checkpoint, an elevation value was derived from the TIN at the point’s x,y location. This value was compared to the checkpoint’s surveyed elevation value.

The raw NVA was tested using 590 checkpoints. These checkpoints were surveyed using GPS techniques. See the survey report for acquisition methodologies. This dataset was tested to be 0.082 meters using an RMSE_z of 0.042 meters x 1.9600.

For full checkpoint results, see the tables in Appendix 2.

Digital Elevation Model Testing

This project required Non-Vegetated Accuracy (NVA) and Vegetated Vertical Accuracy (VVA) testing of the digital elevation model (DEM) dataset. The calculated NVA value was required to meet 19.6 cm at a 95% confidence level using an RMSEz target value of 10 cm x 1.9600. VVA was required to meet **0.30** cm at the 95th percentile error. Testing was assessed and reported using guidelines developed by the National Digital Elevation Program (NDEP) and the American Society for Photogrammetry and Remote Sensing (ASPRS).

Testing was performed using the bare earth DEM created as part of this task order. For each checkpoint, an elevation value was derived from the DEM at the point's x,y location. This value was compared to the checkpoint's surveyed elevation value.

The NVA was to be calculated with a minimum of 535 independent checkpoints falling on bare earth and urban (non-vegetated) classes. VVA had a minimum requirement of 365 independent checkpoints falling in brush/tall grass/weeds (vegetated) land cover classes. These points were not used in the calibration or post processing of the lidar point cloud data and distributed throughout the project area. Checkpoints were surveyed using GPS techniques. See the survey report for acquisition methodologies.

The DEM NVA measured 0.066 meters using an RMSEz of 0.034 meters x 1.9600 using 590 checkpoints. VVA tested 0.169 meters at the 95th percentile using 389 checkpoints.

VVA errors larger than the 95th percentile are listed below. All values are in meters.

For full checkpoint results, see the tables in Appendix 3 and 4.

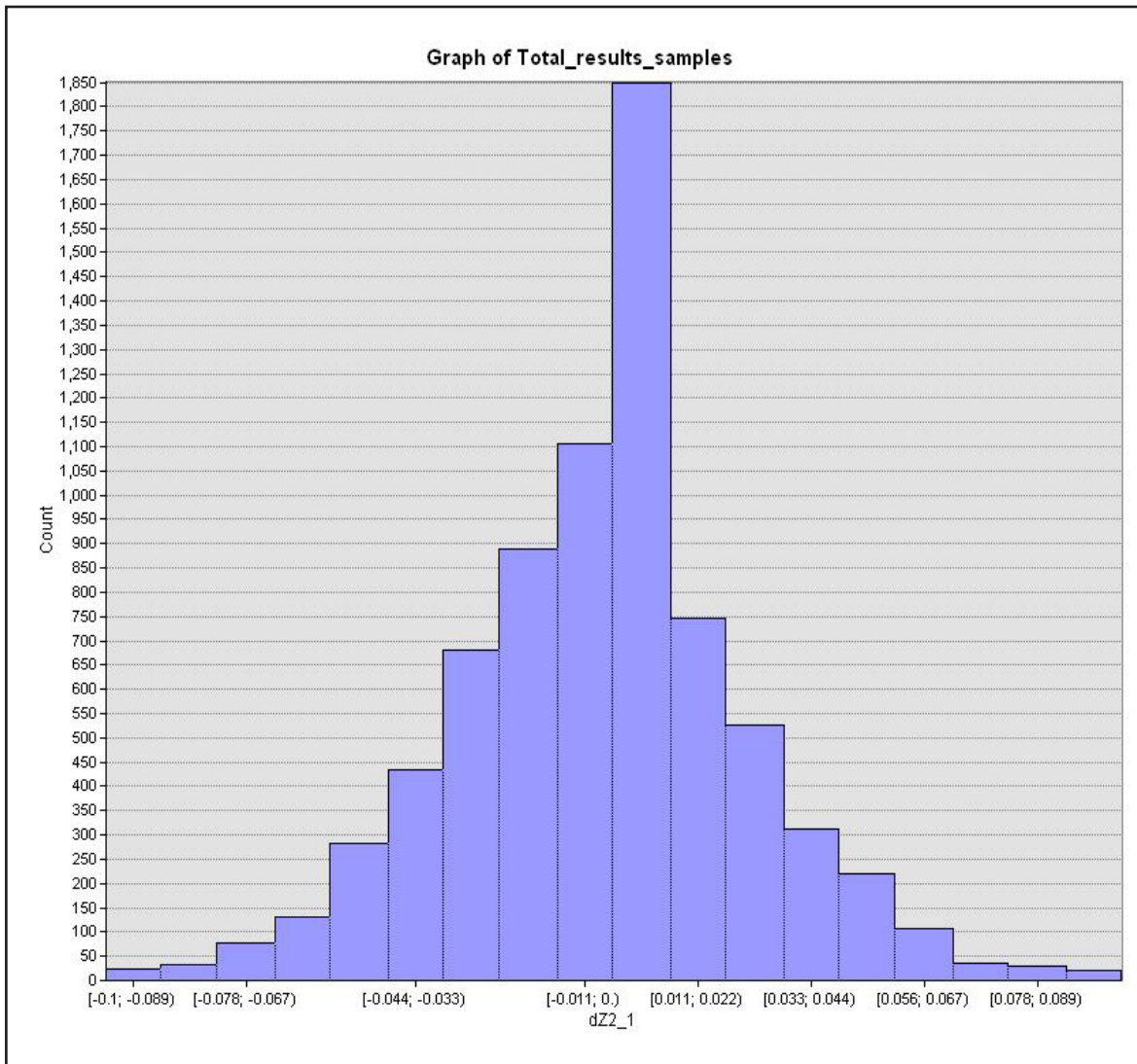
Table 4-2. VVA Errors

Point ID	Easting	Northing	Z-Error
3055_2019_NM	240327.659	3635364.008	0.177
3121_2018_NM	203448.129	3758629.768	0.218
3125_2018_NM	348656.203	3946945.749	0.288
3128_2018_NM	352699.344	3952601.806	0.193
3136_2018_NM	344109.518	3953267.747	0.288
3138_2018_NM	345394.019	3957268.730	1.040
3175_2019_NM	226271.179	3525418.665	0.208
3176_2019_NM	200340.688	3529641.403	0.180
3184_2019_NM	163877.403	3550125.347	0.207
3203_2019_NM	117498.588	3622701.108	0.245
3220_2019_NM	171667.117	3509927.204	0.186
3247_2018_NM	325401.714	3589869.419	0.414
3249_2018_NM	324970.734	3590904.979	0.206
3313_2018_NM	285624.208	3665108.279	0.261
3319_2018_NM	273028.599	3684074.357	0.202
3320_2018_NM	266869.979	3688711.590	0.236

Point ID	Easting	Northing	Z-Error
3372_2019_NM	97126.230	3792335.279	0.191
3373_2019_NM	98161.338	3801352.361	0.196
3374_2019_NM	103295.754	3803509.944	0.173

Inter-Swath Testing

Inter-swath accuracy was tested against well-distributed flight line overlap locations. The relative accuracy for the lidar measured at 0.029 meters RMSE.



Values are in meters.

Approved By	Name	Signature	Date
Associate Member, Lidar Specialist Certified Photogrammetrist #1381	Qian Xiao		December 2019

Intra-Swath Testing

Intra-swath accuracy, also known as “within swath” accuracy, was tested against single swath first return data located in flat open areas. The intra-swath accuracy for the lidar measured at 0.034 meters RMSDz.

Appendix 1: Flight Logs

Woolpert

Leica LIDAR		MM/DD/YEAR	Day of Year	Project #	Phase #	Project Name				
		11/25/2018	329	79150	92	USGS NM SouthCentral Block 7 Area A				
Operator		Aircraft		HOBBS Start	Local Start Time		ZULU Start Time	Base		
Ryan		6255Q		1420.4	8:45:00		15:45:00	Woolpert PIN		
Pilot		Sensor Type/Number		HOBBS END	Local End Time		Zulu End Time	PID		
Sanda		8170		1424	12:35		19:35			
Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure		Haze/Fire/Cloud	Departing	DMN
150 16	10+	180	FEW	8	M12	3014			Arriving	DMN
Scan Angle (FOV)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power %		Fixed Gain	Mode		Threshold Values
40		42.9		272	100		Gain - Course/Up	Single		A
							Gain - Fine/Down	Multi		B
Air Speed		AGL		MSL		Waveform Used		Waveform Mode		Pre-Trigger Dist.
150 Kts		6500 Ft		10456 Ft		Yes No		@ NS		Ft
Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments		
Test	n/a			n/a	n/a	n/a	n/a	GPS Began Logging At:		
		⇕ Times entered are Zulu / GMT ⇕						Verify S-Turns Before Mission	Yes	X No
45	E	16:12:00	16:31:00	0:19:00	17	0.6	1.1			
46	W	16:34:00	16:53:00	0:19:00	16	0.7	1.2			
47	E	16:57:00	17:17:00	0:20:00	17	0.6	1.1			
48	W	17:21:00	17:41:00	0:20:00	16	0.7	1.2			
49	E	17:44:00	18:04:00	0:20:00	17	0.6	1.1			
50	W	18:07:00	18:27:00	0:20:00	18	0.7	1.3			
51	E	18:31:00	18:50:00	0:19:00	17	0.7	1.5			
52	W	18:53:00	19:13:00	0:20:00	20	0.7	1.3			
								FLIGHT 2		
53	E	21:29:00	21:50:00	0:21:00	20	0.6	1.3			
54	W	21:53:00	22:13:00	0:20:00	22	0.6	1.1			
55	E	22:15:00	22:36:00	0:21:00	22	0.6	1			
56	W	22:39:00	22:59:00	0:20:00	18	0.7	1.3			
57	E	23:02:00	23:23:00	0:21:00	16	0.8	1.6			
58	W	23:25:00	23:45:00	0:20:00	17	0.8	1.2			
59	E	23:47:00	0:06:00	0:19:00	19	0.7	1.1			
		↑ Times entered are Zulu / GMT ↑		Page		1		Verify S-Turns After Mission	Yes	X No
Additional Comments:										Drive #
flight 1- reboot on startup for temp. error///// FLIGHT 2- reboot on startup for GPS error. Second reboot for pilot display being inop. 2 ststic sessions on ground before take off.										

Woolpert

Leica LIDAR	MM/DD/YEAR		Day of Year		Project #		Phase #		Project Name												
	11/26/2018		330		79150		92		USGS NM SouthCentral Block 7 Area A												
Operator		Aircraft		HOBBES Start		Local Start Time		ZULU Start Time		Base											
Ryan		6255Q		1427.2		10:06:00		17:06:00		Woolpert PIN											
Pilot		Sensor Type/Number		HOBBES END		Local End Time		Zulu End Time		PID											
Sanda		8170		1431.2		14:21		21:21													
Wind Dir/Speed		Visibility		Ceiling		Cloud Cover %		Temp		Dew Point		Pressure		Haze/Fire/Cloud		Departing		DMN			
060 08		10+		200		BKN		8		M13		3032				Arriving		DMN			
Scan Angle (FOV)		Scan Frequency (Hz)		Pulse Rate (kHz)		Laser Power %		Fixed Gain		Mode		Threshold Values									
40		42.9		272		100				Single		A		B							
								Gain - Course/Up		Multi											
								Gain - Fine/Down													
Air Speed		AGL		MSL		Waveform Used		Waveform Mode		Pre-Trigger Dist.											
150		Kts		6500		Ft		10456		Ft		Yes		No		@		NS		Ft	
Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments													
Test	n/a			n/a	n/a	n/a	n/a	GPS Began Logging At:													
		↑ Times entered are Zulu / GMT ↓						Verify S-Turns Before Mission		Yes		X		No							
60	E	17:33:00	17:53:00	0:20:00	17	0.6	1.1														
61	W	17:56:00	18:16:00	0:20:00	17	0.7	1.4														
62	E	18:19:00	18:39:00	0:20:00	17	0.8	1.5														
63	W	18:42:00	19:02:00	0:20:00	19	0.7	1.3														
64	E	19:05:00	19:26:00	0:21:00	21	0.6	1.1														
65	W	19:29:00	19:49:00	0:20:00	23	0.6	1.1														
66	E	19:52:00	20:12:00	0:20:00	23	0.6	1.1														
67	W	20:15:00	20:36:00	0:21:00	22	0.6	1.2														
68	E	20:39:00	20:58:00	0:19:00	20	0.7	1.4														
								FLIGHT 2													
69	E	23:14:00	23:34:00	0:20:00	17	0.7	1.2														
70	W	23:37:00	23:57:00	0:20:00	16	0.7	1.3														
71	E	0:00:00	0:20:00	0:20:00	18	0.7	1.2														
72	W	0:23:00	0:43:00	0:20:00	18	0.7	1.3														
73	E	0:46:00	1:06:00	0:20:00	16	0.8	1.4														
74	W	1:09:00	1:29:00	0:20:00	16	0.8	1.6														
		↑ Times entered are Zulu / GMT ↑						Verify S-Turns After Mission		Yes		X		No							
								Page		1											
Additional Comments:												Drive #									
FLIGHT 1 - 4-5 re-boots upon start up for low temperature error																					

Woolpert

Leica LIDAR		MM/DD/YEAR	Day of Year	Project #	Phase #	Project Name					
		11/27/2018	331	79150	92	USGS NM SouthCentral Block 7 Area A					
Operator		Aircraft		HOBBES Start		Local Start Time		ZULU Start Time		Base	
Ryan		6255Q		1434.1		10:23:00		17:23:00		Woolpert PIN	
Pilot		Sensor Type/Number		HOBBES END		Local End Time		Zulu End Time		PID	
Sanda		8170		2:24		14:43		21:43			
Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure		Haze/Fire/Cloud		Departing	DMN
000 00	10+	SKC	0	11	M09	3025				Arriving	DMN
Scan Angle (FOV)		Scan Frequency (Hz)		Pulse Rate (kHz)		Laser Power %		Fixed Gain		Mode	
40		42.9		272		100				Threshold Values	
								Gain - Course/Up		Single	
								Gain - Fine/Down		Multi	
Air Speed		AGL		MSL		Waveform Used		Waveform Mode		Pre-Trigger Dist.	
150 Kts		6500 Ft		10456 Ft		Yes No		@ NS		Ft	
Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments			
Test	n/a			n/a	n/a	n/a	n/a	GPS Began Logging At:			
		⇅ Times entered are Zulu / GMT ⇅						Verify S-Turns Before Mission		Yes	X No
75	E	17:54:00	18:14:00	0:20:00	18	0.7	1.3				
76	W	18:17:00	18:38:00	0:21:00	17	0.7	1.5				
77	E	18:42:00	19:02:00	0:20:00	20	0.7	1.3				
78	W	19:05:00	19:26:00	0:21:00	20	0.6	1.1				
79	E	19:29:00	19:48:00	0:19:00	19	0.6	1.2				
80	W	19:51:00	20:12:00	0:21:00	21	0.6	1.1				
81	E	20:15:00	20:34:00	0:19:00	19	0.6	1.2				
82	W	20:37:00	20:58:00	0:21:00	19	0.6	1.4				
83	E	21:01:00	21:21:00	0:20:00	21	0.6	1				
								FLIGHT 2			
84	E	23:01:00	23:21:00	0:20:00	17	0.8	1.2				
85	W	23:24:00	23:45:00	0:21:00	16	0.8	1.2				
86	E	23:48:00	0:08:00	0:20:00	19	0.6	1				
87	W	0:11:00	0:31:00	0:20:00	18	0.7	1.2				
88	E	0:34:00	0:55:00	0:21:00	18	0.7	1.2				
		↑ Times entered are Zulu / GMT ↑		Page		1		Verify S-Turns After Mission		Yes	X No
Additional Comments:										Drive #	
2 reboots at start up for low temp. error											

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day339_SH5060410_A		12/05/2018	339	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
McBeth	Cessna/T206H		N7269T		8418	10:30:00	17:30:00	KABQ
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Shupe	Optech Galaxy Prime		5060410		8423.7	16:25:00	23:25:00	KABQ
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
190	3	0,010	240,000	Overcast	0	-11	3022	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)	Airfield Elevation (ft)			
156		5,250		11,330	5,355			
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.7	2	46		46	200	100		
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
25	179	18:44:00	18:57:00	00:13:00	20	1.1		
26	359	19:01:00	19:11:00	00:10:00	20	1.1		
27	179	19:17:00	19:30:00	00:13:00	22	1.2		
28	359	19:33:00	19:44:00	00:11:00	22	1.2		
29	179	19:48:00	20:03:00	00:15:00	21	1.3		
30	359	20:06:00	20:18:00	00:12:00	23	1.2		
31	179	20:23:00	20:42:00	00:19:00	23	1.2		
32	359	20:44:00	20:46:00	00:02:00	22	1	Gaps	
32	179	21:00:00	21:06:00	00:06:00	22	1	Reflight: Gaps	
32	359	21:08:00	21:10:00	00:02:00	25	0.9	Reflight: Gaps	
33	179	21:12:00	21:13:00	00:01:00	25	0.9	Gaps	
33	175	21:16:00	21:17:00	00:01:00	25	0.9	Gaps	
33	175	21:21:00	21:22:00	00:01:00	25	0.9	Laser Restart	
33	175	21:49:00	22:03:00	00:14:00	23	1.1	Reflight: Gaps	
34	359	22:07:00	22:21:00	00:14:00	23	1.1		
33	175	22:25:00	02:26:00	04:01:00	21	1.2	Reflight: Gaps	
							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert

Leica LIDAR												MM/DD/YEAR		Day of Year		Project #		Phase #		Project Name			
												12/9/2018		343		79150		92		USGS NM SouthCentral Block 7 Area A			
Operator			Aircraft			HOBBS Start			Local Start Time			ZULU Start Time		Base									
Ryan			6255Q			1462.0			9:08:00			16:08:00		Woolpert PIN									
Pilot			Sensor Type/Number			HOBBS END			Local End Time			Zulu End Time		PID									
Nevo			8170			1466.6			13:58			20:58											
Wind Dir/Speed		Visibility		Ceiling		Cloud Cover %		Temp		Dew Point		Pressure		Haze/Fire/Cloud		Departing	DMN						
060 10		10+		SKC		0		7		0		3039				Arriving	DMN						
Scan Angle (FOV)		Scan Frequency (Hz)			Pulse Rate (kHz)		Laser Power %			Fixed Gain		Mode		Threshold Values									
40		42.9			272		100					Single		A									
										Gain - Course/Up		Multi		B									
										Gain - Fine/Down													
Air Speed		AGL			MSL		Waveform Used			Waveform Mode		Pre-Trigger Dist.											
150		Kts	6500	Ft	10456	Ft	Yes	No	@		NS	Ft											
Line #	Dir.	Line Start Time		Line End Time		Time On Line		SV's	HDOP	PDOP		Line Notes/Comments											
Test	n/a					n/a		n/a	n/a	n/a		GPS Began Logging At:											
		↓ Times entered are Zulu / GMT ↓											Verify S-Turns Before Mission	Yes	X	No							
99	W	16:35:00		16:55:00		0:20:00		16	0.7	1.2													
100	E	16:58:00		17:16:00		0:18:00		17	0.7	1.2													
101	W	17:19:00		17:38:00		0:19:00		16	0.7	1.4													
102	E	17:41:00		18:00:00		0:19:00		18	0.7	1.3													
103	W	18:03:00		18:22:00		0:19:00		22	0.6	1													
104	E	18:25:00		18:44:00		0:19:00		21	0.6	1.1													
105	W	18:46:00		19:06:00		0:20:00		22	0.6	1.1													
106	E	19:09:00		19:27:00		0:18:00		23	0.6	1.2													
107	W	19:30:00		19:50:00		0:20:00		22	0.6	1.2													
108	E	19:53:00		20:12:00		0:19:00		22	0.6	1.2													
109	W	20:14:00		20:34:00		0:20:00		24	0.6	1.1													
												FLIGHT 2											
95	W	22:25:00		22:44:00		0:19:00		20	0.7	1.2													
96	E	22:47:00		23:06:00		0:19:00		21	0.6	1.1													
97	W	23:09:00		23:28:00		0:19:00		20	0.6	1.1													
98	E	23:32:00		23:50:00		0:18:00		17	0.7	1.3													
110	W	23:54:00		0:12:00		0:18:00		20	0.7	1.1													
111	E	0:15:00		0:34:00		0:19:00		17	0.8	1.5													
		↑ Times entered are Zulu / GMT ↑											Verify S-Turns After Mission	Yes	X	No							
												Page		1									
Additional Comments:												Drive #											

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day17_SH5060410_B		01/17/2019	17	B
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Gearey	Cessna/T206H		N7269T		8522.3	02:30:00	21:30:00	KELP
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		8526	06:20:00	01:20:00	KELP
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
220	7	0,010	25,000	Broken	17	10	30.29	
Air Speed (kts)		Altitude AGL (ft)	Altitude MSL (ft)	Airfield Elevation (ft)				
115		5,250	9,500	3,961				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.7	2	46		46	200	100		
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
179	180	22:37:00	22:50:00	00:13:00	22	1.01		
178	360	22:55:00	23:07:00	00:12:00	22	1.05		
177	180	23:16:00	23:30:00	00:14:00	22	1.14		
175	360	23:35:00	23:48:00	00:13:00	22	1.08		
174	180	23:53:00	00:05:00	00:12:00	22	1.21		
173	360	00:10:00	00:24:00	00:14:00	23	1.13		
176								
						Page 2	Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day20_SH5060410_A		01/20/2019	20	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Gearey	Cessna/T206H		N7269T		8526	08:00:00	15:00:00	KELP
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		8531	14:30:00	20:30:00	KELP
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
330	3	0,010	22,000	Broken	0	-7	30.29	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
115		5,250		10,000		3,962		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power (%)	
0.7	2	46		46		200	100	
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
349	180	16:23:00	16:35:00	00:12:00	27	1.03		
350	360	16:44:00	16:54:00	00:10:00	25	1.13		
351	180	16:58:00	17:08:00	00:10:00	26	1.01		
352	360	17:13:00	17:21:00	00:08:00	27	0.96		
353	180	17:25:00	17:34:00	00:09:00	26	1.07		
354	360	17:38:00	17:48:00	00:10:00	24	1.13		
355	180	17:52:00	18:00:00	00:08:00	25	1.07		
356	360	18:05:00	18:11:00	00:06:00	27	0.96		
357	180	18:16:00	18:23:00	00:07:00	26	0.95		
358	360	18:28:00	18:35:00	00:07:00	24	1.06		
359	180	19:50:00	19:56:00	00:06:00	22	0.95	Flown after sys restart. "Lift2"	
							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date			
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #	
79150	NM South Central 2018 D19 USGS			Day23_SH5060410_A		1/23/19	23	A	
Crew		Equipment			Time			Airports	
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing	
Shupe	Cessna/T206H		N7269T		8507.8	09:00:00	16:00:00	KELP	
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving	
Muncer	Optech Galaxy Prime		5060410		8512.3	12:00:00	19:00:00	KELP	
Conditions									
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)		
120	4	10	25000	Clear	4	-1	30.25		
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)			
115		5,250		9500		3961			
Settings									
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power (%)		
0.7	2	46		46		200	100		
								Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/ QC Comments		
172	360	16:42:00	16:58:00	00:16:00	25	0.99			
171	180	17:03:00	17:16:00	00:13:00	24	1.04			
170	360	17:21:00	17:36:00	00:15:00	25	1.05			
169	180	17:39:00	17:52:00	00:13:00	26	1.05			
168	360	17:56:00	18:10:00	00:14:00	26	1			
167	180	18:29:00	18:33:00	00:04:00	22	1.24			
						Page 1	Verify S-Turns After Mission	Yes	
Additional Comments							Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGA			Day25_SH5060382_1		01/25/2019	25	1
Crew		Equipment			Time			Airports
Pilot		Aircraft Make/Model		Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing
WAGNER		C-335		N27EH	4709.7	13:01:00	20:01:00	KCFT
Operator		Sensor Make/Model		Sensor Serial #	Hobbs End	Local End	UTC End	Arriving
MORAN		Optech Galaxy		5060382	4712.3	16:19:00	23:19:00	KCFT
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
0	0	10	25,000	Clear	15	-9	3009	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)	Airfield Elevation (ft)			
165		5,480		9,738	####			
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.6	2.00	40		64	300	100		
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
154	N	20:54:11	21:01:54	00:07:43	9	1.54		
155	S	21:06:48	21:14:27	00:07:39	9	1.58		
145	E	21:21:08	21:24:17	00:03:09	9	1.6	Cross Flight	
146	W	21:31:12	21:34:30	00:03:18	9	1.17	Cross Flight	
156	N	21:40:00	21:47:38	00:07:38	10	1.15		
149	E	21:52:56	21:55:46	00:02:50	9	1.24	Cross Flight	
157	S	22:00:55	22:08:28	00:07:33	9	1.3		
158	N	22:13:12	22:20:54	00:07:42	9	1.19		
159	S	22:24:57	22:32:38	00:07:41	9	1.19		
160	N	22:36:48	22:44:24	00:07:36	8	1.23		
161	S	22:48:36	22:56:19	00:07:43	9	1.24		
162	N	23:00:32	23:08:07	00:07:35	9	1.32		
						Page #N/A	Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date			
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #	
79150	NM South Central 2018 D19 USGA			Day27_SH5060382_1		01/27/2019	27	1	
Crew		Equipment			Time			Airports	
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing	
Wagner	C-335		N27EH		4719.4	08:30:00	15:30:00	KCFT	
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving	
Moran	Optech Galaxy		5060382		4723.5	13:04:00	20:04:00	KSAD	
Conditions									
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)		Pressure ("Hg)	
120	12	10		Clear	11	-8		3028	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)			
165		5,480		10,732		3,798			
Settings									
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)		Laser Power (%)	
0.6	2	40		64		300		100	
							Verify S-Turns Before Mission	YES	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments		
178	360	16:16:18	16:28:38	00:12:20	10	1.29			
179	180	16:32:13	16:44:46	00:12:33	10	1.24			
180	360	16:49:00	17:01:34	00:12:34	10	1.32			
152	90	17:06:52	17:12:27	00:05:35	11	1.22	Cross Flight		
181	180	17:19:33	17:31:47	00:12:14	11	1.32			
145	90	17:38:35	17:42:17	00:03:42	12	1.26	Cross Flight		
182	360	17:47:37	18:00:04	00:12:27	11	1.42			
183	180	18:04:10	18:16:59	00:12:49	11	1.4			
184	360	18:21:10	18:33:40	00:12:30	10	1.45			
185	180	18:37:23	18:49:44	00:12:21	10	1.3			
186	360	18:54:30	19:06:46	00:12:16	9	1.38			
187	180	19:10:08	19:23:11	00:13:03	9	1.55			
188	360	19:27:41	19:40:11	00:12:30	9	1.37			
							Page #N/A	Verify S-Turns After Mission	YES
Additional Comments						Drive #			

Woolpert Lidar Acquisition Log

Project Info						Date				
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #		
79150	NM South Central 2018 D19 USGS			Day31_SH5060382_1		01/31/2019	31	1		
Crew		Equipment			Time			Airports		
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing		
wood	c-335		N27EH			09:12:00	15:12:00	K SVC		
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving		
moran	optech galaxy		5060382			13:35:00	20:35:00	K SVC		
Conditions										
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)		Pressure ("Hg)		
340	4	0,010	15,000	Scattered	6	-2		3009		
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)				
165		5,480		11,006		5,446				
Settings										
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power (%)			
0.6	2	40		64		300	100			
								Verify S-Turns Before Mission	yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/QC Comments			
527	180	16:54:33	16:56:34	00:02:01	11	1.5	Cross Flight			
526	360	17:01:32	17:03:28	00:01:56	10	1.85	Cross Flight			
525	180	17:07:39	17:09:31	00:01:52	10	1.87	Cross Flight			
528	90	17:13:26	17:15:15	00:01:49	10	1.9	Cross Flight			
529	270	17:19:53	17:22:07	00:02:14	10	1.9	Cross Flight			
530	90	17:26:50	17:28:45	00:01:55	9	2.2	Cross Flight			
531	225	17:32:19	17:34:44	00:01:55	9	2.18	Cross Flight			
470	360	18:01:02	18:12:04	00:11:02	10	1.63				
471	180	18:16:36	18:27:02	00:10:26	8	1.55				
472	360	18:31:23	18:42:15	00:10:52	8	1.8				
467	90	18:47:23	18:50:48	00:03:25	8	1.53	Cross Flight			
473	180	18:56:37	19:07:00	00:10:23	8	1.6				
462	90	19:12:22	19:16:08	00:03:46	7	1.94	Cross Flight			
474	360	19:21:22	19:32:17	00:10:55	7	1.9				
475	180	19:36:31	19:43:15	00:06:44	7	1.84	HAD TO BREAK OFF DUE TO TRAFFIC			
475	180	19:51:34	19:56:18	00:04:44	7	2.45				
476	360	20:00:50	20:11:36	00:10:46	7	2.5				
								Page #NAME?	Verify S-Turns After Mission	yes
Additional Comments						Drive #				







Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day39_SH5060382_1	02/08/2019	39	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1157 - Gregory Wood	Cessna 335 (SDX)	N27EH	N/A	09:04:00	16:04:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T500 Optech Galaxy system	5060382	N/A	12:20:00	19:20:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
		10		Clear	3	-5	30.17	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
157		5480		10,995		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
501	306	16:53:50	16:54:13	00:00:23	26	0.82		
495	0	17:11:07	17:21:21	00:10:14	23	0.92		
496	180	17:26:17	17:37:06	00:10:49	21	0.91	[17:26:46] snow north side of overlap	
497	0	17:47:19	17:57:14	00:09:55	20	0.89		
498	180	18:02:11	18:12:52	00:10:41	20	1.13	[18:03:30] snow north side of line	
524	0	18:19:51	18:26:45	00:06:54	19	1.06	[18:26:38] snow thicker than line on line	
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:52:03] N27EH20190209F1 [17:03:35] Restart camera for a shutter failure [17:41:45] overshoot line FedEx Tracking Number-8083 8751 0590 2801203				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day40_SH5060382_1	02/09/2019	40	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1157 - Gregory Wood	Cessna 335 (SDX)	N27EH	N/A	08:30:00	15:30:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T500 Optech Galaxy system	5060382	N/A	12:28:00	19:28:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
280	3	10		Clear	1	-13	30.24	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
160		5480		10,692		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
487	0	16:39:36	16:50:36	00:11:00	24	0.9		
488	180	16:54:50	17:05:58	00:11:08	25	0.9		
489	0	17:09:51	17:20:02	00:10:11	23	0.98		
490	180	17:24:41	17:34:57	00:10:16	22	0.96	[17:25:25] possible snow on 2nm of line	
462	90	17:41:03	17:46:19	00:05:16	20	0.97		
491	0	17:52:32	18:02:16	00:09:44	20	0.97		
467	90	18:09:31	18:14:17	00:04:46	20	0.98		
492	180	18:20:48	18:31:00	00:10:12	19	1	[18:21:29] Snow north	
493	0	18:34:59	18:44:51	00:09:52	19	0.97		
494	180	18:49:14	18:59:35	00:10:21	20	0.94		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:03:54] 27EH02082019 FedEx Tracking number-8083 8751 0590 2801203				Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day40_SH5060410_A		02/09/2019	40	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Larsen	Cessna/T206H		N7269T		8581	09:00:00	16:00:00	KLRU
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		8586.5	02:30:00	21:30:00	KLRU
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
290	3	0,010	25,000	Clear	6	-1	30.2	
Air Speed (kts)		Altitude AGL (ft)	Altitude MSL (ft)	Airfield Elevation (ft)				
120		5,250	10,500	4,457				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.7	2	46		46	200	100		
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
210	180	17:00:00	17:31:00	00:31:00	27	0.97	laser shutoff due to eye safety / disabled eye safety	
211	360	17:36:00	17:59:00	00:23:00	27	0.97	reflew 2 secs to cover gaps	
212	180	18:04:00	18:22:00	00:18:00	24	1.02		
213	360	18:27:00	18:40:00	00:13:00	27	0.86		
224	180	18:47:00	19:02:00	00:15:00	26	0.92		
225	360	19:07:00	19:17:00	00:10:00	24	1.05		
226	180	19:21:00	19:35:00	00:14:00	27	0.94		
227	360	19:40:00	19:49:00	00:09:00	26	0.98		
228	180	19:53:00	20:05:00	00:12:00	26	1.08		
229	360	20:08:00	20:15:00	00:07:00	25	1.12		
230	180	20:20:00	20:28:00	00:08:00	29	0.85		
231	360	20:33:00	20:37:00	00:04:00	28	0.88		
232	180	20:40:00	20:46:00	00:06:00	27	0.95		
233	360	20:51:00	20:54:00	00:03:00	27	0.96		
234	180	20:59:00	21:00:00	00:01:00	27	0.97		
235	360	21:05:00	21:06:00	00:01:00	27	1.01		
							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date					
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #				
79150	NM South Central 2018 D19 USGS	Day41_SH5060382 2	02/10/2019	41	2				
Crew		Equipment		Time			Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing			
1157 - Gregory Wood	Cessna 335 (SDX)	N27EH	N/A	09:13:00	16:13:00	CFT			
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving			
1234 - Joshua Miller	T500 Optech Galaxy system	5060382	N/A	12:43:00	19:43:00	CFT			
Conditions									
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)		
110	3	10		Clear	6	-4	30.00		
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)			
153		5480		10,484		3,799			
Settings									
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)				
0.71	2	40	64	300	100				
							Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments		
371	180	17:12:50	17:16:07	00:03:17	22	0.96			
372	0	17:20:10	17:23:09	00:02:59	22	0.94			
373	180	17:28:09	17:31:28	00:03:19	21	0.98			
374	0	17:36:00	17:38:50	00:02:50	21	0.95			
375	180	17:43:58	17:47:27	00:03:29	21	0.92			
376	0	17:51:49	17:54:48	00:02:59	21	0.89			
377	180	17:59:48	18:03:07	00:03:19	21	0.9			
378	0	18:07:20	18:10:03	00:02:43	20	0.92			
274	180	18:15:16	18:17:23	00:02:07	19	0.97			
275	0	18:21:53	18:23:59	00:02:06	19	0.96			
277	180	18:28:57	18:31:17	00:02:20	20	0.9			
278	0	18:35:25	18:37:43	00:02:18	20	0.91			
279	180	18:42:36	18:44:44	00:02:08	20	0.9			
280	0	18:49:31	18:51:29	00:01:58	19	0.91			
281	180	18:56:22	18:58:15	00:01:53	19	0.91			
282	0	19:02:54	19:04:32	00:01:38	18	1.03			
283	180	19:09:29	19:11:14	00:01:45	19	0.97			
284	0	19:15:23	19:16:40	00:01:17	19	0.98			
						Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:48:25] N27EH190210F1				Drive #			

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day43_SH5060382_1	02/12/2019	43	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1157 - Gregory Wood	Cessna 335 (SDX)	N27EH	N/A	09:10:00	16:10:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T500 Optech Galaxy system	5060382	N/A	13:36:00	20:36:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
340	3	10		Clear	5	-16	30.30	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
159		5480		11,249		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
499	180	17:46:41	17:57:33	00:10:52	18	1.03	[17:49:20] snow north end of line	
500	0	18:01:41	18:11:30	00:09:49	16	1	[18:10:00] snow north end of line	
501	180	18:15:50	18:26:43	00:10:53	16	1.02		
502	0	18:30:47	18:40:47	00:10:00	18	1.01	[18:39:18] snow north end of line	
503	180	18:45:13	18:55:40	00:10:27	18	0.98	[18:45:56] snow north end of line	
462	90	19:01:52	19:09:01	00:07:09	18	0.93		
504	0	19:16:37	19:26:26	00:09:49	16	1.1	[19:24:13] snow north end of line	
467	270	19:31:04	19:35:36	00:04:32	18	1.06	[19:31:28] snow on east side of line	
505	180	19:41:43	19:52:03	00:10:20	19	1.03	[19:41:56] snow on north side of line	
506	0	19:56:13	20:04:57	00:08:44	19	1.13	[20:00:32] snow 17nm from the north end	
506	0	20:09:24	20:11:24	00:02:00	22	0.9		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments			[17:19:20] 27EH190212F1 [20:09:23] simulated off for traffic FedEX Tracking # 8042 3510 5539			Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date						
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #					
79150	NM South Central 2018 D19 USGS	Day65_SH5060407_1	03/06/2019	65	1					
Crew		Equipment		Time			Airports			
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing				
1126 - George Duke	Cessna 206 (SDX) N72695	N72695	N/A	08:25:00	15:25:00	SVC				
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving				
1252 - Garrett Hall	T1000 Optech Galaxy system	5060407	N/A	10:16:00	17:16:00	E74				
Conditions										
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)			
				Clear	0	0	0.00			
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)				
124		5480		11,528		5,446				
Settings										
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)					
0.71	2	40	64	300	100					
							Verify S-Turns Before Mission	Yes		
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments			
527	1	16:22:57	16:25:06	00:02:09	25	0.99				
527	180	16:29:48	16:33:07	00:03:19	24	1.02				
526	359	16:36:49	16:39:43	00:02:54	24	0.96				
525	180	16:43:40	16:47:02	00:03:22	23	1.04				
528	90	16:53:27	16:55:38	00:02:11	24	0.98				
529	270	17:01:18	17:05:41	00:04:23	24	0.94				
530	90	17:10:32	17:12:53	00:02:21	25	0.91	[17:12:43] turbulence 2-3			
							Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[15:44:10] 03062019695 [16:25:17] off line fedex shipping number 785880216024				Drive #				

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day65_SH5060407_2	03/06/2019	65	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1126 - George Duke	Cessna 206 (SDX) N72695	N72695	N/A	10:17:00	17:17:00	E74		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1252 - Garrett Hall	T1000 Optech Galaxy system	5060407	N/A	10:39:00	17:39:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
120	8	10		Clear	13	-5	30.33	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
92		5480		11,549		2,953		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
531	226	17:17:04	17:21:26	00:04:22	25	0.93		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day68_SH5060407_3	03/09/2019	68	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1126 - George Duke	Cessna 206 (SDX) N72695	N72695	N/A	11:53:00	18:53:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1252 - Garrett Hall	T1000 Optech Galaxy system	5060407	N/A	15:03:00	22:03:00	E74		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
230	10	10		Clear	14	-16	29.94	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
126		5480		12,087		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
524	0	19:50:21	20:02:38	00:12:17	17	1.23		
523	180	20:07:58	20:31:31	00:23:33	25	1.03		
522	0	20:35:18	20:54:41	00:19:23	22	1.15		
521	180	20:58:28	21:19:29	00:21:01	25	1.12	[21:03:43] unkown error	
520	0	21:23:14	21:41:55	00:18:41	23	1.18		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[19:01:06] 03092019695 [19:14:56] Drive #14				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day68_SH5060407_4	03/09/2019	68	4			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
0 -	Cessna 206 (SDX) N72695	N72695	N/A	15:04:00	22:04:00	E74		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1252 - Garrett Hall	T1000 Optech Galaxy system	5060407	N/A	17:25:00	00:25:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
230	10	10		Clear	14	-16	29.94	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
114		5480		12,167		2,953		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
518	0	22:16:27	22:35:33	00:19:06	26	0.91	[22:33:31] turbulence 5-6 brief [22:33:44] turbulence 5-6 nevermind not brief	
469	267	22:43:26	22:48:28	00:05:02	28	0.9	[22:48:17] wind shear	
464	269	23:05:26	23:09:53	00:04:27	27	0.92		
462	270	23:19:14	23:24:23	00:05:09	25	1		
517	0	23:30:56	23:49:07	00:18:11	24	1.02	[23:46:57] wind shear turbulence 3-6 [23:47:23] wind shear turbulence 5-7	
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[23:49:43] Ending mission due to wind shear and associated turbulence				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day86_SH5060407_2	03/27/2019	86	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	12:06:00	18:06:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	13:56:00	19:56:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
170	6	10		Clear	22	-5	30.17	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
129		5480		12,049		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
523	0	19:31:27	19:38:09	00:06:42	27	1.05		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[18:58:49] N72695032719 [18:58:58] #drive4				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day86_SH5060407_3	03/27/2019	86	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	13:58:00	19:58:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	18:30:00	00:30:00	E74		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
280	6	10		Clear	23	-6	30.14	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
124		5480		12,086		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
523	0	21:00:17	21:19:04	00:18:47	27	0.97		
522	180	21:21:32	21:41:30	00:19:58				
521	0	21:44:13	22:02:52	00:18:39				
520	180	22:05:54	22:25:48	00:19:54			[22:09:27] Turb:3 [22:24:44] Turb:4	
462	270	22:29:57	22:33:06	00:03:09				
519	0	22:36:38	22:55:18	00:18:40			[22:47:37] Turb:4	
469	269	22:59:34	23:02:33	00:02:59				
518	180	23:05:41	23:24:27	00:18:46				
517	0	23:27:02	23:45:45	00:18:43				
524	180	23:48:13	23:59:31	00:11:18				
464	269	00:04:10	00:06:14	00:02:04				
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[20:36:58] N72695032719 [20:37:07] #drive4				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day87_SH5060407_1	03/28/2019	87	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	10:20:00	16:20:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	15:15:00	21:15:00			
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
310	14	10		Clear	21	-5	30.19	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
124		5480		12,043		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
516	0	17:38:40	17:57:05	00:18:25	23	0.99		
515	180	17:59:51	18:20:44	00:20:53	22	1.11		
514	0	18:23:06	18:40:56	00:17:50	24	1.06	[18:38:07] Turb:5	
513	180	18:43:47	19:04:28	00:20:41	24	1.09		
512	0	19:06:59	19:24:58	00:17:59	26	1.05		
511	180	19:27:39	19:48:59	00:21:20	26	1.07		
510	0	19:51:25	20:09:43	00:18:18	25	1.09		
469	269	20:59:43	21:04:05	00:04:22				
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:51:42] N72695032819 lift1 [16:51:50] #drive4 [18:22:41] partial angle adjust for swath error				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day87_SH5060407_3	03/28/2019	87	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	15:14:00	21:14:00			
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	15:51:00	21:51:00	E74		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
				Clear	0	0	0.00	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
120		5480		12,044				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
462	90	21:31:47	21:34:33	00:02:46	27	1.03		
466	271	21:43:46	21:45:46	00:02:00	27	1.02		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info				Date					
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #				
79150	NM South Central 2018 D19 USGS	Day88_SH5060407_4	03/29/2019	88	4				
Crew		Equipment		Time			Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing			
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	09:36:00	15:36:00	E74			
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving			
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	11:18:00	17:18:00				
Conditions									
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)		
270	17	10		Clear	20	-13	30.12		
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)			
130		5480		13,034		2,953			
Settings									
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)				
0.71	2	40	64	300	100				
							Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments		
656	293	15:54:45	15:58:28	00:03:43	23	1			
653	114	16:01:18	16:03:16	00:01:58	23	1.01			
655	293	16:10:17	16:23:49	00:13:32	22	0.97			
644	113	16:26:44	16:34:10	00:07:26	23	0.98			
654	293	16:37:43	16:50:56	00:13:13	23	1.04	[16:49:54] Turb:5		
642	114	16:54:40	16:56:01	00:01:21	23	1.04			
642	114	17:01:12	17:08:42	00:07:30	23	0.99			
						Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:51:26] partial angle adjust error for swath coverage				Drive #			

Woolpert Lidar Acquisition Log

Project Info				Date			
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #		
79150	NM South Central 2018 D19 USGS	Day88_SH5060407_5	03/29/2019	88	5		
Crew		Equipment		Time		Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing	
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	11:19:00	17:19:00		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving	
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	13:27:00	19:27:00	E74	
Conditions							
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)
				Clear	16	-7	30.12
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)	
132		5480		11,720			
Settings							
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.71	2	40	64	300	100		
						Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments
640	113	17:32:05	17:41:41	00:09:36	24	1.06	
661	294	17:44:52	18:02:13	00:17:21	24	1.07	
639	113	18:04:33	18:14:13	00:09:40	25	1	
660	293	18:18:55	18:36:07	00:17:12	26	1.02	
641	114	18:39:04	18:48:00	00:08:56	26	0.96	[18:41:17] Turb:4
659	293	18:51:03	19:05:36	00:14:33	25	1.02	[18:52:16] Turb:6
643	113	19:08:05	19:15:36	00:07:31	26	1.06	
				Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[20:15:12] N72695032919 lift 2 [20:15:20] #drive6			Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day88_SH5060407_6	03/29/2019	88	6			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	14:32:00	20:32:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	16:32:00	22:32:00	E74		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
260	20	10		Clear	21	-14	30.05	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
121		5480		10,850		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
643	294	20:56:34	21:00:01	00:03:27	28	0.93		
657	294	21:04:48	21:16:53	00:12:05	26	0.99	[21:05:31] Turb:6	
645	113	21:20:14	21:26:14	00:06:00	27	0.95		
652	293	21:29:17	21:36:42	00:07:25	27	1.01		
646	113	21:39:55	21:44:50	00:04:55	27	0.99		
651	293	21:47:55	21:54:11	00:06:16	26	0.98		
647	113	21:56:48	22:00:32	00:03:44	25	0.99		
650	293	22:02:52	22:07:23	00:04:31	25	0.96		
648	114	22:10:14	22:12:49	00:02:35	24	0.98		
649	293	22:15:39	22:18:38	00:02:59	24	0.97		
					Page	3	Verify S-Turns After Mission	Yes
Additional Comments			[21:19:26] #turb7			Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day89_SH5060407_1	03/30/2019	89	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	09:40:00	15:40:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	15:23:00	21:23:00			
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
170	5	10		Clear	11	-8	30.16	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
128		5480		13,131		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
638	0	17:30:13	17:38:10	00:07:57	25	1.03		
637	180	17:40:18	17:47:26	00:07:08	25	1.04		
636	0	17:50:14	17:58:17	00:08:03	25	1.04	[17:52:17] Turb:2 [17:55:34] Turb:5	
635	180	18:00:09	18:07:24	00:07:15	26	1.03		
634	0	18:11:15	18:19:23	00:08:08	27	1.01		
633	180	18:21:44	18:29:07	00:07:23	27	1.01		
632	0	18:32:04	18:39:57	00:07:53	28	0.97		
631	180	18:41:41	18:49:06	00:07:25	27	1.02		
630	0	18:51:16	18:58:43	00:07:27	28	0.95		
629	180	19:00:12	19:07:24	00:07:12	28	1.06		
628	0	19:09:12	19:16:46	00:07:34	28	1.07		
627	180	19:18:31	19:25:59	00:07:28	29	1.02		
626	0	19:27:38	19:35:12	00:07:34	29	1.01		
625	180	19:37:00	19:44:27	00:07:27	30	0.9		
534	269	19:50:15	19:55:08	00:04:53	30	0.97		
624	0	19:58:42	20:05:49	00:07:07	28	1.07		
538	269	20:11:47	20:16:43	00:04:56				
623	180	20:20:02	20:27:39	00:07:37	29	1.02		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:52:28] N72695033019 [16:52:47] #drive6				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day91_SH5060407_3	04/01/2019	91	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	16:43:00	22:43:00	E74		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	18:26:00	00:26:00			
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
190	3	10		Clear	16	-11	30.10	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
125		5480		12,839		2,953		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
622	0	22:57:49	23:10:47	00:12:58	22	1.02		
621	180	23:13:16	23:25:45	00:12:29	22	1.26		
620	0	23:28:34	23:41:00	00:12:26	21	1.29		
538	90	23:44:33	23:45:52	00:01:19	22	1.21		
534	269	23:52:33	23:55:17	00:02:44	21	1.25		
619	180	00:03:46	00:16:23	00:12:37	21	1.24		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day92_SH5060407_1	04/02/2019	92	1			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	10:21:00	16:21:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	13:06:00	19:06:00			
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
260	7	10		Clear	21	-8	30.02	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
124		5480		13,091		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
618	0	16:40:03	16:51:51	00:11:48	23	1.17	[16:45:12] Turb:5	
617	180	16:54:21	17:07:20	00:12:59	23	1.1		
616	0	17:09:44	17:21:24	00:11:40	23	1.08		
615	180	17:24:10	17:37:01	00:12:51	24	1		
614	0	17:39:21	17:51:01	00:11:40	23	1.09		
613	180	17:53:16	18:05:27	00:12:11	23	1.1		
612	0	18:07:35	18:18:54	00:11:19	24	1.06		
611	180	18:20:52	18:33:07	00:12:15	24	1.09		
610	0	18:34:46	18:46:00	00:11:14	22	1.13		
609	180	18:47:58	18:59:58	00:12:00	24	1.06		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:06:04] N72695040219 [16:06:12] #drive6 [19:59:03] N726950402 lift 2 [19:59:11] #drive6				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day92_SH5060407_2	04/02/2019	92	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	14:26:00	20:26:00			
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	15:55:00	21:55:00			
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
				Clear	15	-7	30.11	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
127		5480		13,334				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
605	0	20:36:00	20:46:50	00:10:50	27	0.94		
608	180	20:48:39	21:00:31	00:11:52	25	1.08		
607	0	21:02:35	21:13:14	00:10:39	25	1.08		
606	180	21:14:59	21:27:10	00:12:11	25	1.08		
604	0	21:28:09	21:37:57	00:09:48	24	1.09		
538	90	21:40:18	21:43:53	00:03:35	24	1.05		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day93_SH5060407_1	04/03/2019	93	1			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	10:09:00	16:09:00	E74		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1541 - Maxx Millstein	T1000 Optech Galaxy system	5060407	N/A	15:21:00	21:21:00	E74		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
260	14	10		Clear	17	-7	30.04	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
125		5480		11,061		2,953		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
568	0	16:33:15	16:43:16	00:10:01	21	1.13	[16:34:03] Turb:6	
567	180	16:45:24	16:57:20	00:11:56	22	1.04	[16:54:23] Turb:8	
566	0	16:59:41	17:09:57	00:10:16	22	1.04		
565	180	17:11:57	17:24:08	00:12:11	21	1.06		
533	90	17:30:45	17:34:26	00:03:41	23	0.95		
564	0	17:40:05	17:50:56	00:10:51	21	1.08		
537	270	17:56:41	18:02:21	00:05:40	23	1.01		
563	180	18:07:03	18:18:34	00:11:31	24	1.01		
562	0	18:20:21	18:31:00	00:10:39	25	0.98		
561	180	18:32:52	18:44:15	00:11:23	25	1.08		
560	0	18:53:39	19:10:34	00:16:55	25	1.12		
559	180	19:12:33	19:30:35	00:18:02	27	1.01		
558	0	19:32:31	19:49:28	00:16:57	26	1.13		
557	180	19:51:33	20:00:40	00:09:07	26	1.15		
559	359	20:02:04	20:03:00	00:00:56	26	1.13		
557	180	20:04:36	20:14:25	00:09:49	26	1.12		
556	0	20:16:19	20:33:40	00:17:21	27	1.01		
555	180	20:35:42	20:53:52	00:18:10	25	0.98		
555	0	20:57:07	20:57:59	00:00:52	25	0.97		
532	91	21:00:26	21:02:25	00:01:59	25	0.97		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[15:43:14] N72695040319 lift1 [15:43:21] #drive6			Drive #			

Woolpert Lidar Acquisition Log

Project Info						Date 04/04/2019		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day94_SH5060410_A		04/04/2019	94	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Shupe	Cessna/T206H		N27DV		4549.7	07:30:00	13:30:00	KABQ
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		4556.1	13:30:00	19:30:00	KABQ
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
20	5	0,010	0,230	Scattered	5	-2	30.19	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
120		5,250		10,500		4,457		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power (%)	
0.7	2	46		46		200	100	
								Verify S-Turns Before Mission
								Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
45	360	14:38:00	14:40:00	00:02:00	25	0.95	AOI1	
46	180	14:42:00	14:43:00	00:01:00	25	0.95	AOI1	
47	360	14:45:00	14:47:00	00:02:00	24	0.96	AOI1	
48	180	14:49:00	14:51:00	00:02:00	24	0.95	AOI1	
49	360	14:53:00	14:55:00	00:02:00	25	0.9	AOI1	
50	180	14:58:00	15:00:00	00:02:00	25	0.86	AOI1	
51	360	15:02:00	15:04:00	00:02:00	26	0.85	AOI1	
52	180	15:07:00	15:10:00	00:03:00	24	1	AOI1	
53	360	15:13:00	15:20:00	00:07:00	23	1.05	AOI1	
54	180	15:22:00	15:28:00	00:06:00	24	0.97	AOI1	
55	360	15:30:00	15:54:00	00:24:00	24	0.96	AOI1	
56	180	15:56:00	16:00:00	00:04:00	24	0.99	AOI1	
57	360	16:03:00	16:10:00	00:07:00	25	1.03	AOI1	
58	180	16:12:00	16:18:00	00:06:00	25	1.07	AOI1	
59	360	16:21:00	16:28:00	00:07:00	25	1.1	AOI1	
60	180	16:30:00	16:37:00	00:07:00	26	1.01	AOI1	
61	360	16:39:00	16:45:00	00:06:00	27	0.98	AOI1	
62	180	16:47:00	16:59:00	00:12:00	27	0.98	AOI1	
63	360	17:02:00	17:16:00	00:14:00	27	0.96	AOI1	
64	180	17:19:00	17:25:00	00:06:00	26	1.02	AOI1	
35	180	17:58:00	18:23:00	00:25:00	28	0.84	AOI2	
36	360	18:33:00	19:03:00	00:30:00	31	0.89	AOI2	
Page 1						Verify S-Turns After Mission	Yes	
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day101_SH5060407_3	04/11/2019	101	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	09:34:00	15:34:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	13:43:00	19:43:00	CFT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
280	21	10		Clear	13	-9	29.89	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
121		5480		11,112		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
554	0	16:52:13	17:13:31	00:21:18	23	1.08	[17:01:47] Turb: 4	
553	180	17:15:04	17:32:01	00:16:57	24	1.09	[17:24:21] Turb: 3	
552	0	17:34:35	17:54:45	00:20:10	25	0.98	[17:50:39] flew through haze [17:42:01] Turb: 3 [17:50:24] Turb: 3 [17:52:56] Turb: 4	
551	180	17:56:49	18:13:43	00:16:54	25	1.04	[18:12:11] Turb: 4	
550	0	18:15:41	18:31:40	00:15:59	23	1.13	[18:28:05] flew through haze [18:17:57] Turb: 5	
539	180	18:39:09	18:55:53	00:16:44	25	1.05		
540	0	18:58:23	19:07:30	00:09:07	27	1.12		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[15:59:56] 695041119 [19:23:43] TIM Error [20:12:51] 695041119				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day101_SH5060407_5	04/11/2019	101	5			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	13:23:00	20:23:00	CFT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	14:53:00	21:53:00			
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
270	21	10		Clear	14	-9	29.87	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
120		5480		11,164		3,799		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
540	353	20:46:04	20:46:44	00:00:40	24	0.98		
540	0	20:47:10	20:57:10	00:10:00	23	0.95		
549	176	21:00:01	21:05:18	00:05:17	23	0.94		
549	180	21:13:49	21:30:48	00:16:59	21	1.06		
548	0	21:32:44	21:52:12	00:19:28	21	1.04		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day101_SH5060407_6	04/11/2019	101	6			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	14:54:00	21:54:00			
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	15:44:00	22:44:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
260	22	10		Clear	14	-9	29.85	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
142		5480		11,259				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
547	181	21:54:03	21:55:17	00:01:14	22	0.99		
532	91	22:14:46	22:19:18	00:04:32	23	0.98		
					Page	3	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day101_SH5060407_7	04/11/2019	101	7			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	16:46:00	22:46:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	18:54:00	00:54:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
260	22	10		Clear	14	-9	29.85	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
112		5480		11,297		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
547	355	00:06:44	00:10:15	00:03:31	19	1.13		
541	359	00:15:47	00:19:50	00:04:03	20	1.05		
541	0	00:23:52	00:24:42	00:00:50	21	0.98		
					Page	4	Verify S-Turns After Mission	Yes
Additional Comments		[23:16:22] 695041119				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day103_SH5060407_1	04/13/2019	103	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	12:36:00	19:36:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	18:29:00	01:29:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
290	9	10		Clear	15	-4	29.98	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
123		5480		11,566		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
541	358	21:07:14	21:13:55	00:06:41	26	0.93		
541	0	21:20:35	21:29:01	00:08:26	24	0.97		
542	180	21:31:57	21:48:23	00:16:26	23	0.99	[21:36:44] Flew through virga [21:36:48] Flew through virga	
543	0	21:51:00	21:59:37	00:08:37	22	1.06		
543	0	22:05:40	22:11:42	00:06:02	23	0.99		
544	180	22:13:46	22:30:47	00:17:01	22	0.99		
545	0	22:33:59	22:53:48	00:19:49	21	1.08		
546	180	22:56:18	23:13:28	00:17:10	20	1.09		
547	0	23:16:33	23:34:11	00:17:38	21	1		
549	208	23:38:38	23:39:03	00:00:25	20	1.05		
546	325	23:40:00	23:40:18	00:00:18	20	1.05		
549	171	23:41:22	23:41:52	00:00:30	19	1.16		
547	356	23:43:29	23:44:39	00:01:10	19	1.16		
547	180	23:46:17	23:47:13	00:00:56	17	1.22		
536	89	23:54:54	23:57:25	00:02:31	18	1.31		
535	269	00:00:05	00:02:48	00:02:43	18	1.32		
538	89	00:08:38	00:13:41	00:05:03	19	1.21		
543	180	00:19:47	00:27:04	00:07:17	21	1.09		
542	0	00:29:34	00:37:30	00:07:56	22	1.08		
541	180	00:43:43	00:53:55	00:10:12	22	1.18		
546	357	00:57:21	01:00:13	00:02:52	23	1.03		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[20:31:16] 695041319 UPS Tracking Number: 1Z9A088R1546569619				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day104_SH5060407_1	04/14/2019	104	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emra Riek	Cessna 206 (SDX) N72695	N72695	N/A	09:54:00	15:54:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	16:16:00	22:16:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
300	9	10		Clear	18	-3	30.11	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
123		5480		13,802		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
603	0	17:10:25	17:22:37	00:12:12	24	1.1		
602	180	17:25:17	17:34:59	00:09:42	26	0.96		
601	0	17:38:19	17:50:27	00:12:08	24	1		
600	180	17:52:55	18:02:36	00:09:41	26	0.97		
599	0	18:05:33	18:16:34	00:11:01	27	0.99		
598	180	18:23:50	18:33:17	00:09:27	27	0.96		
597	0	18:35:58	18:46:46	00:10:48	28	0.96		
596	180	18:48:49	18:58:04	00:09:15	27	1.05		
595	0	19:00:24	19:11:18	00:10:54	27	1.06		
594	180	19:13:18	19:22:37	00:09:19	27	1.07		
593	0	19:24:59	19:35:39	00:10:40	28	1.02		
592	180	19:37:59	19:48:02	00:10:03	29	0.96		
590	0	19:50:09	20:01:23	00:11:14	29	0.93		
589	180	20:03:52	20:13:39	00:09:47	27	1.01		
587	0	20:16:31	20:27:41	00:11:10	27	1.03		
586	180	20:29:46	20:39:21	00:09:35	27	1.02		
584	0	20:41:21	20:46:20	00:04:59	26	1.04		
584	0	20:48:51	20:56:08	00:07:17	26	1.02		
538	269	21:02:28	21:11:24	00:08:56	27	0.9		
583	180	21:15:34	21:22:44	00:07:10	26	0.91		
583	181	21:26:03	21:30:06	00:04:03	26	0.87		
580	0	21:35:18	21:37:44	00:02:26	26	0.88		
577	180	21:39:14	21:41:37	00:02:23	27	0.84		
576	0	21:43:27	21:46:14	00:02:47	26	0.86		
574	180	21:47:56	21:50:24	00:02:28	25	0.91		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:21:01] 695041419 [22:54:26] 695041419 UPS Tracking Number: 1Z9A088R1546569619				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day104_SH5060407_3	04/14/2019	104	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	17:13:00	23:13:00	E74		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	20:03:00	02:03:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
280	11	10		Clear	21	-7	30.00	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
125		5480		12,594		2,953		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
569	0	23:35:15	23:46:29	00:11:14	21	1.18		
570	180	23:48:22	23:58:37	00:10:15	21	1.21		
573	0	00:00:33	00:11:53	00:11:20	22	1.05		
575	180	00:14:09	00:24:22	00:10:13	23	1.06		
577	0	00:26:46	00:36:56	00:10:10	24	1		
580	180	00:39:11	00:48:55	00:09:44	24	1.08		
581	0	00:51:21	01:01:24	00:10:03	24	1.1		
582	180	01:03:35	01:10:35	00:07:00	26	1.01		
582	178	01:13:18	01:17:08	00:03:50	26	1.02		
573	359	01:20:26	01:23:24	00:02:58	28	0.98		
570	180	01:25:43	01:27:03	00:01:20	28	0.93		
533	91	01:30:20	01:35:13	00:04:53	26	1.01		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day105_SH5060407_1	04/15/2019	105	1			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1162 - Emma Riek	Cessna 206 (SDX) N72695	N72695	N/A	12:49:00	18:49:00	SVC		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	16:41:00	22:41:00	SVC		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
220	10	10		Clear	22	-8	29.93	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
127		5480		13,587		5,446		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
550	0	21:18:05	21:21:32	00:03:27	26	0.88		
537	90	21:26:20	21:29:39	00:03:19	26	0.87		
591	179	21:39:12	21:42:16	00:03:04	25	0.88		
588	180	21:43:25	21:45:07	00:01:42	23	0.97		
585	357	21:51:56	21:53:18	00:01:22	24	0.94		
579	181	21:55:04	21:57:45	00:02:41	25	0.91		
578	0	21:59:45	22:01:51	00:02:06	24	1.01		
572	179	22:03:02	22:05:49	00:02:47	24	1.01		
571	1	22:06:55	22:08:08	00:01:13	24	1.01		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[20:39:44] 695041519			Drive #			

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day108_SH5060410_A		04/18/2019	108	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Shupe	Cessna/T206H		N27DV		4599.9	07:45:00	14:45:00	KABQ
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		4606.9	02:45:00	20:45:00	KABQ
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
10	5	0,010	0,200	Few	7	6	30.19	
Air Speed (kts)		Altitude AGL (ft)	Altitude MSL (ft)	Airfield Elevation (ft)				
120		5,250	12,800	5,200				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.7	2	46		46	200	100		
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
CF	270	14:55:00	15:02:00	00:07:00	21	1.06	CF	
70	180	15:11:00	15:33:00	00:22:00	22	1.09		
179	270	15:40:00	15:45:00	00:05:00	23	1.01	CF	
71	360	15:50:00	16:22:00	00:32:00	23	1.01		
72	180	16:25:00	16:47:00	00:22:00	23	1.04		
73	360	16:51:00	17:19:00	00:28:00	28	0.9		
74	180	17:22:00	17:45:00	00:23:00	26	0.97		
75	360	17:48:00	18:14:00	00:26:00	27	1		
76	180	18:17:00	18:41:00	00:24:00	26	1.1		
77	360	18:43:00	19:10:00	00:27:00	26	1.06		
78	180	19:12:00	19:35:00	00:23:00	27	1		
79	360	19:37:00	20:10:00	00:33:00	26	0.98	END	
							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day109_SH5060410_A		04/19/2019	109	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Shupe	Cessna/T206H		N27DV		4607	07:45:00	14:45:00	KABQ
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		4613.7	02:30:00	20:30:00	KABQ
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
340	5	0,010	12,000	Clear	8	2	30.27	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
120		5,250		12,800		5,200		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power (%)	
0.7	2	46		46		200	100	
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
CF	270	14:55:00	15:01:00	00:06:00	20	1.03	CF	
80	180	15:08:00	15:32:00	00:24:00	20	1.23		
179	270	15:40:00	15:42:00	00:02:00	25	0.91	System Restart	
179	270	16:05:00	16:12:00	00:07:00	24	1.07		
81	360	16:15:00	16:43:00	00:28:00	24	1.07		
CF	270	16:50:00	16:55:00	00:05:00	27	1.01		
82	180	16:58:00	17:20:00	00:22:00	26	0.97		
83	360	17:27:00	17:51:00	00:24:00	28	0.94		
84	180	17:54:00	18:18:00	00:24:00	30	0.88		
85	360	18:20:00	18:22:00	00:02:00	29	0.92	System Restart	
179	270	18:43:00	18:48:00	00:05:00	27	1.08	System Restart	
179	270	19:07:00	19:11:00	00:04:00	29	0.97		
85	360	19:15:00	19:40:00	00:25:00	28	0.91		
CF	90	19:43:00	19:48:00	00:05:00	28	0.91	END	
							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day111_SH5060407_1	04/21/2019	111	1			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	09:44:00	15:44:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	14:00:00	20:00:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
250	14	10		Clear	20	-8	30.03	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
129		5480		12,863		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
104	0	16:52:28	17:11:08	00:18:40	26	1.1		
103	180	17:15:22	17:35:34	00:20:12	25	1.11		
101	180	18:02:28	18:21:54	00:19:26	25	1.1		
1	269	18:28:18	18:33:38	00:05:20	26	1.07		
100	0	18:38:20	18:55:05	00:16:45	25	1.11		
143	45	19:02:04	19:06:39	00:04:35	27	0.99		
105	180	19:09:56	19:31:45	00:21:49	25	0.97		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:08:13] 695042119 UPS Tracking Number: 1z872X301304292417				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day111_SH5060407_2	04/21/2019	111	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	16:51:00	22:51:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	19:47:00	01:47:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
200	13	10		Clear	21	-8	30.00	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
138		5480		12,805		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
109	0	23:42:38	00:02:19	00:19:41	23	1.04		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[22:57:43] 695042119				Drive #		

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day112_SH5060410_A		04/22/2019	112	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Shupe	Cessna/T206H		N27DV		4613.7	07:45:00	13:45:00 PM	KABQ
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		4620	01:45:00	19:45:00 PM	KABQ
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
340	5	0,010	12,000	Clear	8	2	30.27	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
120		5,250		12,800		5,200		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)		Pulse Rate (kHz)	Laser Power (%)	
0.7	2	46		46		200	100	
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
CF	270	14:50:00	14:55:00	00:05:00	21	1.16	CF	
86	180	15:00:00	15:30:00	00:30:00	21	1.02		
179	270	15:35:00	15:40:00	00:05:00	21	1.02		
87	270	15:47:00	16:09:00	00:22:00	21	1.07		
88	180	16:12:00	16:38:00	00:26:00	25	0.97		
89	360	16:42:00	17:04:00	00:22:00	25	1		
90	180	17:07:00	17:38:00	00:31:00	26	0.99		
91	360	17:42:00	18:10:00	00:28:00	30	0.91		
92	180	18:13:00	18:45:00	00:32:00	28	1.06		
93	360	18:48:00	19:11:00	00:23:00	31	0.9	End	
							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day112_SH5060407_1	04/22/2019	112	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	10:05:00	16:05:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	13:47:00	19:47:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
140	13	10		Clear	18	-5	30.08	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
133		5480		12,845		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
110	0	16:57:40	17:16:30	00:18:50	25	1.03		
111	180	17:20:47	17:43:50	00:23:03	25	1.09		
112	0	17:47:45	18:06:54	00:19:09	27	1		
113	180	18:11:15	18:33:48	00:22:33	27	1.12		
1	89	18:39:24	18:43:59	00:04:35	28	1.06		
114	0	18:48:51	19:07:37	00:18:46	28	1.06		
10	90	19:14:25	19:18:42	00:04:17	30	0.93		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		UPS Tracking Number: 1z872X301304292417				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day115_SH5060407_2	04/25/2019	115	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 206 (SDX) N72695	N72695	N/A	10:47:00	16:47:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	13:59:00	19:59:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
60	3	10		Clear	18	0	30.22	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
134		5480		12,852		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
108	180	17:45:08	18:04:33	00:19:25	28	1.02		
107	0	18:08:09	18:28:42	00:20:33	25	1.15		
106	180	18:32:10	18:50:53	00:18:43	25	1.14		
1	270	18:55:01	18:57:30	00:02:29	26	0.98		
102	0	19:01:10	19:19:39	00:18:29	25	1.06		
143	45	19:25:42	19:31:13	00:05:31	26	1		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[17:00:54] 695190425			Drive #			

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day123_SH5060407_1	05/03/2019	123	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 206 (SDX) N72695	N72695	N/A	13:11:00	19:11:00	AEG		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	14:59:00	20:59:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
310	10	10		Clear	20	-6	30.08	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
136		5480		12,787		5,837		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
115	180	20:22:25	20:34:33	00:12:08	21	1	[20:33:58] Turb:2	
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[19:21:28] 695190503				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date					
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #				
79150	NM South Central 2018 D19 USGS	Day123_SH5060407_2	05/03/2019	123	2				
Crew		Equipment		Time			Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing			
1151 - Nathaniel Wagner	Cessna 206 (SDX) N72695	N72695	N/A	15:01:00	21:01:00	GNT			
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving			
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	19:55:00	01:55:00	GNT			
Conditions									
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)		
60	10	10		Clear	21	-12	30.07		
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)			
134		5480		12,829		6,535			
Settings									
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)				
0.71	2	40	64	300	100				
							Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments		
115	180	22:26:42	22:47:10	00:20:28	18	1.19	[22:30:27] Turb:3		
116	0	22:51:35	23:12:52	00:21:17	19	1.14			
117	180	23:17:12	23:37:54	00:20:42	21	1.15			
118	0	23:42:07	00:02:55	00:20:48	23	1.08			
10	270	00:07:36	00:10:36	00:03:00	26	0.97			
119	180	00:14:45	00:34:17	00:19:32	25	1			
1	89	00:38:06	00:40:26	00:02:20	26	0.95			
120	0	00:43:29	01:03:36	00:20:07	23	1.09			
121	180	01:07:19	01:26:15	00:18:56	23	1.15			
						Page	2	Verify S-Turns After Mission	Yes
Additional Comments			[21:53:30] 695190503			Drive #			

Woolpert Lidar Acquisition Log

Project Info					Date			
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day124_SH5060407_1	05/04/2019	124	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 206 (SDX) N72695	N72695	N/A	07:14:00	13:14:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	11:40:00	17:40:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
310	6	10		Clear	1	-10	30.12	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
136		5480		12,766		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
122	180	13:59:03	14:16:09	00:17:06	21	1.2		
123	0	14:20:03	14:37:17	00:17:14	22	1.2		
124	180	14:40:42	14:57:33	00:16:51	23	1.07		
125	0	15:01:46	15:18:27	00:16:41	22	1.13		
9	271	15:21:58	15:25:18	00:03:20	22	1.23		
126	180	15:29:59	15:46:46	00:16:47	23	1.12		
127	0	15:51:03	16:11:02	00:19:59	25	1.05		
128	180	16:15:38	16:36:20	00:20:42	25	1.01		
2	268	16:39:34	16:42:40	00:03:06	27	0.96		
129	0	16:48:03	17:09:02	00:20:59	27	0.98	[16:48:53] off course due to wind[16:50:50] Turb:3 [17:05:23] Turb:4	
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[13:22:21] 695190504			Drive #			

Woolpert Lidar Acquisition Log

Project Info					Date			
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day124_SH5060407_2	05/04/2019	124	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	11:42:00	17:42:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	15:03:00	21:03:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
160	4	10		Clear	20	-8	30.10	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
128		5480		12,618		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
130	0	19:09:50	19:31:15	00:21:25	24	1.06		
131	180	19:35:18	19:56:50	00:21:32	24	0.99		
132	5	20:00:51	20:01:55	00:01:04	24	0.91		
132	0	20:06:11	20:25:43	00:19:32	22	1.04	[20:13:18] moderate to severe turbulence	
12	271	20:31:15	20:35:48	00:04:33	21	1.06		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[18:32:03] 695190504				Drive #		

Woolpert Lidar Acquisition Log

Project Info					Date			
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day125_SH5060407_1	05/05/2019	125	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	07:19:00	13:19:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	12:41:00	18:41:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
		10		Clear	4	-7	30.05	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
132		5480		12,805		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
133	0	14:04:41	14:24:49	00:20:08	22	1.22		
134	180	14:29:46	14:48:21	00:18:35	24	1.01		
135	0	14:53:07	15:11:58	00:18:51	24	1		
136	180	15:17:44	15:35:01	00:17:17	23	1.08		
144	27	15:43:13	15:48:59	00:05:46	26	0.95		
3	89	15:54:19	15:57:09	00:02:50	27	0.96		
137	0	16:02:37	16:21:02	00:18:25	27	1.06		
12	91	16:25:41	16:27:54	00:02:13	27	1.01	[16:27:27] quarry sync timeout error on southern end of line 6 [16:27:29] quarry sync timeout error on southern end of line 6	
138	180	16:33:14	16:50:20	00:17:06	27	1.12	[16:37:46] Turb:4	
139	0	16:54:23	17:11:30	00:17:07	29	1.02		
140	180	17:15:56	17:30:42	00:14:46	30	1	[17:23:57] Turb:3	
141	0	17:34:07	17:46:59	00:12:52	27	1.09		
11	89	17:52:03	17:54:31	00:02:28	28	1		
142	180	17:59:09	18:12:35	00:13:26	29	0.93	[18:06:22] Turb:2 [18:07:23] Turb:4 [18:07:24] Turb:4	
5	272	18:16:56	18:19:34	00:02:38	28	0.97		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[13:27:30] 695190505			Drive #			

Woolpert Lidar Acquisition Log

Project Info					Date			
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day126_SH5060407_1	05/06/2019	126	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 206 (SDX) N72695	N72695	N/A	06:36:00	12:36:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	11:42:00	17:42:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
280	3	10		Clear	5	-8	30.04	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
134		5480		12,840		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
103	180	13:22:01	13:43:51	00:21:50	19	1.28		
101	0	13:47:05	14:03:15	00:16:10	19	1.55		
100	180	14:07:31	14:27:19	00:19:48	21	1.16		
99	0	14:30:29	14:46:22	00:15:53	22	1.14		
98	180	14:50:22	15:09:48	00:19:26	23	1.07		
97	0	15:13:16	15:27:21	00:14:05	22	1.27		
96	180	15:31:45	15:48:19	00:16:34	23	1.13		
1	269	15:53:52	15:58:15	00:04:23	28	0.91		
95	0	16:01:47	16:15:31	00:13:44	27	0.94	[16:12:26] Turb:1	
13	229	16:19:41	16:24:30	00:04:49	26	1.01		
94	180	16:30:16	16:46:15	00:15:59	27	1.08		
93	0	16:50:49	17:03:34	00:12:45	28	1.05		
143	44	17:04:19	17:09:36	00:05:17	29	1.02		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[12:44:50] 695190506			Drive #			

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day126_SH5060407_2	05/06/2019	126	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	12:51:00	18:51:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	17:27:00	23:27:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
230	9	10		Clear	21	-8	30.03	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
128		5480		12,802		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
92	180	19:39:13	19:56:19	00:17:06	24	0.91		
91	0	20:00:29	20:13:56	00:13:27	22	1	[20:03:07] Turb:3	
90	180	20:19:16	20:35:32	00:16:16	22	0.99		
89	0	20:39:58	20:52:41	00:12:43	23	1	[20:46:54] Turb:4	
88	180	20:58:39	21:12:44	00:14:05	22	1.04		
87	0	21:16:37	21:27:40	00:11:03	22	1.03		
86	180	21:32:05	21:46:52	00:14:47	21	1.12		
85	0	21:50:47	22:02:10	00:11:23	20	1.31	[21:59:31] Turb:3	
8	270	22:08:23	22:14:28	00:06:05	21	1.22		
84	180	22:21:49	22:37:21	00:15:32	22	1.06		
1	269	22:42:48	22:45:34	00:02:46	24	0.98		
83	0	22:49:32	23:00:52	00:11:20	23	1.03		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments			[18:58:25] 695190506			Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day127_SH5060407_2	05/07/2019	127	2			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	07:26:00	14:26:00	SJN		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	09:19:00	16:19:00	SJN		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
180	3	10		Clear	9	-4	29.99	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
127		5480		11,766		5,738		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
15	180	15:34:44	15:49:22	00:14:38	22	1.1		
16	0	15:53:10	16:05:04	00:11:54	25	0.95	[15:57:39] Turb:2 [16:00:35] Turb:3	
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[15:09:39] 695190507				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day127_SH5060407_3	05/07/2019	127	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	09:20:00	16:20:00	SJN		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1263 - David Hagerman	T1000 Optech Galaxy system	5060407	N/A	10:43:00	17:43:00	SJN		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
310	8	10		Clear	16	-3	29.98	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
134		5480		12,007		5,738		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
18	0	16:27:35	16:39:23	00:11:48	25	1.17	[16:32:04] Turb:3	
19	180	16:43:53	16:58:09	00:14:16	26	1.11	[16:57:03] Turb:3	
1	89	17:03:47	17:07:01	00:03:14	29	0.92		
20	0	17:11:59	17:23:07	00:11:08	26	1.03	[17:15:15] haze	
7	268	17:27:11	17:29:58	00:02:47	25	1.1		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[16:21:33] #turb4				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day133_SH5060407_3	05/13/2019	133	3			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	14:57:00	21:57:00	SJN		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1254 - Molly Moran	T1000 Optech Galaxy system	5060407	N/A	18:07:00	01:07:00	SJN		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
330	8	10		Clear	23	-1	30.01	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
130		5480		12,022		5,738		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
21	180	22:29:30	22:42:05	00:12:35	28	0.98	[22:32:14] Turb:1 [22:36:17] Turb:3 [22:38:15] Turb:3 [22:38:19] Turb:32 [22:38:21] Turb:32 [22:40:42] Turb:2 [22:41:10] Turb:3	
22	0	22:45:51	23:00:17	00:14:26	30	1.03	[22:47:40] Turb:2 [22:48:23] Turb:3 [22:49:25] Turb:3 [22:49:54] Turb:3 [22:53:50] Turb:3 [22:55:38] Turb:3 [22:57:00] Turb:2 [22:58:33] Turb:2 [22:59:32] Turb:3	
23	180	23:04:24	23:17:22	00:12:58	32	0.95	[23:10:29] Turb:3 [23:15:17] Turb:3	
24	0	23:21:32	23:36:26	00:14:54	32	0.94	[23:22:49] Turb:2 [23:31:27] Turb:2	
7	88	23:43:02	23:47:14	00:04:12	32	0.89		
25	180	23:53:12	00:06:33	00:13:21	32	0.89	[23:56:05] Turb:2 [23:59:32] Turb:3 [00:00:24] Turb:2 [00:04:51] Turb:3	
1	89	00:12:54	00:16:16	00:03:22	30	0.95		
26	0	00:20:51	00:35:02	00:14:11	29	0.96	[00:26:10] Turb:3 [00:34:04] Turb:3	
27	180	00:39:00	00:51:56	00:12:56	29	1	[00:44:22] Turb:3 [00:48:37] Turb:2	
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments			[22:05:01] 695051319			Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day134_SH5060382_2	05/14/2019	134	2			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 335 (SDX)	N27EH	N/A	09:15:00	15:15:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T500 Optech Galaxy system	5060382	N/A	14:57:00	20:57:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
240	13	10		Clear	24	-3	30.17	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
163		5480		12,408		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
132	359	16:38:48	16:41:12	00:02:24	26	0.88		
105	180	16:51:35	17:06:47	00:15:12	22	1.09		
104	0	17:11:10	17:25:44	00:14:34	22	1.04		
59	180	17:37:17	17:46:14	00:08:57	23	0.95		
58	0	17:51:05	17:59:19	00:08:14	23	0.89	[17:51:24] Turb: 3	
57	180	18:03:31	18:11:40	00:08:09	23	0.85	[18:04:36] Turb: 4 [18:04:40] Turb: 4	
1	270	18:16:24	18:19:44	00:03:20	21	1		
56	0	18:24:38	18:32:35	00:07:57	21	0.99	[18:31:32] Turb: 4	
55	180	18:36:29	18:45:08	00:08:39	20	1.02		
54	0	18:48:35	18:56:49	00:08:14	20	0.99	[18:52:07] Turb: 4	
53	180	19:01:00	19:09:24	00:08:24	20	0.88		
52	0	19:14:04	19:22:29	00:08:25	19	0.91		
51	180	19:25:54	19:34:47	00:08:53	18	0.95		
50	0	19:39:07	19:46:47	00:07:40	19	0.88		
4	90	19:50:23	19:53:46	00:03:23	19	1.04		
60	180	19:58:09	20:06:28	00:08:19	19	1.03		
61	0	20:10:21	20:19:34	00:09:13	19	0.95		
62	180	20:23:12	20:32:08	00:08:56	19	0.94		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[16:12:34] 7EH051419				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day134_SH5060407_1	05/14/2019	134	1			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	07:49:00	13:49:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1254 - Molly Moran	T1000 Optech Galaxy system	5060407	N/A	12:44:00	18:44:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
		10		Clear	22	-4	30.23	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
133		5480		12,564		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
82	180	15:01:06	15:13:19	00:12:13	26	1.12		
81	0	15:17:25	15:30:57	00:13:32	29	0.98		
80	180	15:34:53	15:47:11	00:12:18	30	0.9		
79	0	15:51:03	16:04:05	00:13:02	30	0.92		
78	180	16:08:00	16:19:52	00:11:52	31	0.92		
77	0	16:24:17	16:37:18	00:13:01	30	0.96		
76	180	16:40:51	16:52:46	00:11:55	30	1.03		
75	0	16:56:31	17:09:23	00:12:52	28	1.09		
8	90	17:13:40	17:17:16	00:03:36	31	0.99		
74	180	17:21:55	17:32:49	00:10:54	31	0.97	[17:23:58] Turb:2	
73	0	17:36:07	17:47:34	00:11:27	31	0.95	[17:45:08] Turb:2 [17:45:23] Turb:3 [17:45:44] Turb:3	
72	180	17:51:08	18:02:00	00:10:52	31	0.91	[17:52:32] Turb:2 [17:52:46] Turb:3 [17:53:18] Turb:3 [17:56:49] Turb:3 [17:59:34] Turb:3	
1	269	18:08:22	18:12:01	00:03:39	31	0.84	[18:08:55] Turb:3	
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[14:17:23] 695051419			Drive #			

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day135_SH5060382_1	05/15/2019	135	1			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 335 (SDX)	N27EH	N/A	18:40:00	00:40:00	GNT		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T500 Optech Galaxy system	5060382	N/A	19:52:00	01:52:00	GNT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
200	3	10		Clear	18	-1	30.19	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
172		5480		12,340		6,535		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
71	180	01:17:29	01:25:47	00:08:18	22	1.04		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		Drive will be flown back with aircraft tomorrow				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day135_SH5060382_3	05/15/2019	135	3			
Crew		Equipment		Time		Airports		
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1151 - Nathaniel Wagner	Cessna 335 (SDX)	N27EH	N/A	08:13:00	14:13:00	SJN		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T500 Optech Galaxy system	5060382	N/A	13:37:00	19:37:00	SJN		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
		10		Clear	16	4	30.15	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
162		5480		12,064		5,738		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
28	0	14:51:27	15:01:41	00:10:14	20	1.03		
29	180	15:05:40	15:16:23	00:10:43	21	0.99		
30	0	15:19:52	15:29:46	00:09:54	25	0.84		
31	180	15:33:55	15:44:44	00:10:49	23	0.95		
32	0	15:48:51	15:58:47	00:09:56	23	1		
7	269	16:03:48	16:06:31	00:02:43	23	1.01		
33	180	16:10:07	16:20:19	00:10:12	24	0.97		
34	0	16:24:16	16:34:07	00:09:51	23	0.97		
35	180	16:37:59	16:48:32	00:10:33	24	0.92		
36	0	16:52:36	17:02:02	00:09:26	23	0.93		
37	180	17:06:01	17:15:52	00:09:51	22	0.98		
38	0	17:19:36	17:29:06	00:09:30	24	0.93		
39	180	17:33:12	17:42:53	00:09:41	23	0.93		
40	0	17:47:15	17:56:05	00:08:50	21	1.03		
41	180	17:59:47	18:09:33	00:09:46	20	1.06		
42	0	18:13:10	18:22:32	00:09:22	21	1.02		
14	116	18:26:51	18:32:05	00:05:14	21	0.99		
43	180	18:37:02	18:46:21	00:09:19	20	1.03		
44	0	18:49:51	18:59:07	00:09:16	20	0.9		
45	180	19:03:07	19:12:28	00:09:21	20	0.88		
1	270	19:15:24	19:21:03	00:05:39	18	0.89		
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments		[14:27:40] 7EH051519				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date			
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #		
79150	NM South Central 2018 D19 USGS	Day135_SH5060407_2	05/15/2019	135	2		
Crew		Equipment		Time		Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing	
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	09:56:00	15:56:00	SJN	
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving	
1254 - Molly Moran	T1000 Optech Galaxy system	5060407	N/A	14:22:00	20:22:00	SJN	
Conditions							
Wind Dir (°)	Wind Speed (kts)	Visibility (m)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)
		10		Clear	20	6	30.15
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)	
137		5480		12,352		5,738	
Settings							
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.71	2	40	64	300	100		
						Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments
71	0	16:38:06	16:48:53	00:10:47	32	0.95	[16:41:18] Turb:2 [16:45:13] Turb:3 [16:45:29] Turb:3
70	180	16:51:50	17:03:29	00:11:39	31	0.98	[16:53:09] Turb:3 [16:56:27] Turb:3 [16:57:37] Turb:4 [16:59:48] Turb:3 [17:00:13] Turb:4 [17:01:52] Turb:4 [17:02:41] Turb:4
69	0	17:06:54	17:17:48	00:10:54	31	0.96	[17:07:24] Turb:4 [17:08:56] Turb:3 [17:12:12] Turb:3 [17:15:11] Turb:4
68	180	17:21:51	17:33:49	00:11:58	31	0.94	[17:22:47] Turb:4 [17:23:53] Turb:4 [17:27:56] Turb:3
67	0	17:37:20	17:47:19	00:09:59	30	0.94	[17:39:12] Turb:3 [17:40:41] Turb:3 [17:41:15] Turb:4 [17:42:07] Turb:3
66	180	17:50:43	18:02:26	00:11:43	29	1.03	[17:52:43] Turb:4 [17:53:14] Turb:3 [17:55:09] Turb:3 [17:55:38] Turb:3 [17:55:49] Turb:3 [17:56:37] Turb:4 [17:59:19] Turb:4 [18:00:28] Turb:4 [18:02:07] Turb:4
65	0	18:05:55	18:15:35	00:09:40	29	1	[18:06:27] Turb:4 [18:08:19] Turb:3 [18:09:35] Turb:3 [18:10:35] Turb:3 [18:11:12] Turb:3
64	180	18:19:46	18:31:14	00:11:28	30	0.97	[18:27:11] Turb:3 [18:27:33] Turb:4 [18:29:46] Turb:4 [18:30:11] Turb:4
1	269	18:37:55	18:41:09	00:03:14	28	1	[18:39:40] Turb:4 [18:40:51] Turb:4
63	0	18:45:02	18:54:46	00:09:44	28	0.98	[18:45:44] Turb:4 [18:47:22] Turb:4
6	269	19:00:25	19:04:06	00:03:41	28	0.88	
49	180	19:08:50	19:20:24	00:11:34	26	0.89	[19:11:14] Turb:3 [19:12:19] Turb:4 [19:14:28] Turb:4 [19:16:02] Turb:4 [19:18:18] Turb:4

							[19:18:45] Turb:4		
48	0	19:24:06	19:33:50	00:09:44	24	0.95	[19:25:32] Turb:4 [19:26:48] Turb:4 [19:27:11] Turb:4 [19:28:02] Turb:4 [19:29:50] Turb:3 [19:30:43] Turb:3		
47	180	19:37:08	19:48:58	00:11:50	23	0.99	[19:39:11] Turb:3 [19:39:39] Turb:4 [19:42:24] Turb:4 [19:42:50] Turb:3 [19:43:41] Turb:3 [19:43:59] Turb:3 [19:45:05] Turb:3		
46	0	19:52:35	20:02:20	00:09:45	24	0.94	[19:53:13] Turb:4 [19:53:56] Turb:4 [19:56:42] Turb:4 [19:57:18] Turb:3 [19:59:10] Turb:3		
						Page	1	Verify S-Turns After Mission	Yes
Additional Comments			[16:13:59] 695051519				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day136_SH5060407_4	05/16/2019	136	4			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	10:10:00	17:10:00	SAD		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	15:22:00	22:22:00	SAD		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
260	10	10		Clear	34	-8	29.75	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
135		5480		11,975		3,179		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
540	0	17:53:49	17:56:33	00:02:44	32	0.83		
539	0	18:01:12	18:08:52	00:07:40	28	0.99	[18:06:57] Turb: 3	
542	180	18:13:12	18:31:47	00:18:35	28	1.01	[18:27:39] Turb: 3	
544	0	18:36:43	18:50:48	00:14:05	28	0.93	[18:38:56] Turb: 3	
541	180	18:53:46	18:59:21	00:05:35	29	0.83		
543	180	19:01:11	19:08:36	00:07:25	27	0.87		
545	0	19:14:37	19:20:23	00:05:46	27	0.85	[19:17:15] Turb: 4	
546	180	19:24:26	19:32:21	00:07:55	26	0.9	[19:32:02] Turb: 2	
547	0	19:35:50	19:49:18	00:13:28	24	0.99	[19:41:26] Turb: 2 [19:47:17] Turb: 4	
547	0	19:54:26	19:56:10	00:01:44	24	1.03		
550	180	19:59:27	20:18:22	00:18:55	24	1.04	[20:15:21] Turb: 2	
551	0	20:25:45	20:33:46	00:08:01	23	1.05	[20:32:18] Turb: 3	
552	180	20:37:08	20:47:50	00:10:42	23	1.05	[20:41:39] Turb: 3	
553	0	20:51:37	20:59:36	00:07:59	22	1.14		
554	180	21:03:03	21:12:41	00:09:38	23	1.07	[21:05:00] Turb: 3	
589	359	21:21:09	21:23:42	00:02:33	23	1.07		
590	180	21:27:45	21:31:09	00:03:24	22	1.19		
599	359	21:33:43	21:35:39	00:01:56	22	1.2		
600	180	21:39:01	21:42:41	00:03:40	23	1.03		
590	0	21:48:08	21:50:15	00:02:07	23	1.04		
					Page	1	Verify S-Turns After Mission	Yes
Additional Comments		[17:30:27] 695051619				Drive #		

Woolpert Lidar Acquisition Log

Project Info				Date				
Project #	Project Name	Unique ID	Flight Date (UTC)	Day of Year	Flight #			
79150	NM South Central 2018 D19 USGS	Day136_SH5060407_5	05/16/2019	136	5			
Crew		Equipment		Time			Airports	
Pilot	Aircraft Make/Model	Aircraft Tail #	Hobbs Start	Local Start	UTC Start	Departing		
1262 - Cody Sivcovich	Cessna 206 (SDX) N72695	N72695	N/A	17:02:00	23:02:00	SAD		
Operator	Sensor Make/Model	Sensor Serial #	Hobbs End	Local End	UTC End	Arriving		
1261 - Dominick Schenewerk	T1000 Optech Galaxy system	5060407	N/A	19:40:00	01:40:00	CFT		
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
300	15	10		Clear	33	-6	29.74	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)		Airfield Elevation (ft)		
143		5480		12,643		3,179		
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)			
0.71	2	40	64	300	100			
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
642	114	23:43:21	23:47:15	00:03:54	29	0.97	[23:45:20] 695051619[23:45:37] Turb: 2	
					Page	2	Verify S-Turns After Mission	Yes
Additional Comments							Drive #	

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	South Central NM Block 11 and 10			Day138_90515_A		05/18/2019	138	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make / Model / Tail #			Hobbs Start	Local Start	UTC Start	Departing	
Sanda	Cessna 404 Titan - N475RC			1676.3	08:56:00	15:56:00	SAD	
Operator	Sensor Make / Model / Serial #			Hobbs End	Local End	UTC End	Arriving	
Ryan	Leica Terrain Mapper - 90515			1681.6	13:34:00	20:34:00	SAD	
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
220	3	10		Clear	18	-4	2992	
Air Speed (kts)		Altitude AGL (ft)	Altitude MSL (ft)	Airfield Elevation (ft)				
150		11,483	14,416	3,179				
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.7	2	40		80	670	100		
						Verify S-Turns Before Mission	Yes	
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
10	N	15:56:00	15:58:00	00:02:00	16	1.5	reflight for clouds 10k south end	
12	N	16:05:00	16:08:00	00:03:00	17	1.3	reflight for clouds 10k south end	
32	N	16:17:00	16:34:00	00:17:00	19	1.2		
33	S	16:38:00	16:57:00	00:19:00	19	1.3		
34	N	17:00:00	17:21:00	00:21:00	18	1.5		
1	N	17:28:00	17:32:00	00:04:00	19	1.5	BLOCK 10	
2	S	17:37:00	17:45:00	00:08:00	22	1.2		
3	N	17:48:00	18:04:00	00:16:00	22	1.2		
4	S	18:09:00	18:26:00	00:17:00	19	1.5		
5	N	18:30:00	18:48:00	00:18:00	19	1.4		
6	S	18:51:00	19:08:00	00:17:00	19	1.4		
7	N	19:11:00	19:30:00	00:19:00	19	1.2		
8	S	19:32:00	19:50:00	00:18:00	17	1.2		
9	N	19:54:00	20:13:00	00:19:00	18	1.2		
10	S	20:15:00	20:34:00	00:19:00	17	1.4		
						Page 1	Verify S-Turns After Mission	Yes
Additional Comments								

Woolpert Lidar Acquisition Log

Project Info						Date		
Project #	Project Name			Unique ID		Flight Date (UTC)	Day of Year	Flight #
79150	NM South Central 2018 D19 USGS			Day155_SH5060410_A		06/04/2019	155	A
Crew		Equipment			Time			Airports
Pilot	Aircraft Make/Model		Aircraft Tail #		Hobbs Start	Local Start	UTC Start	Departing
Shupe	Cessna/T206H		N27DV		4736.1	06:50:00	12:50:00	KABQ
Operator	Sensor Make/Model		Sensor Serial #		Hobbs End	Local End	UTC End	Arriving
Muncer	Optech Galaxy Prime		5060410		4743.8	10:00:00	17:00:00	KABQ
Conditions								
Wind Dir (°)	Wind Speed (kts)	Visibility (mi)	Ceiling (ft)	Cloud Cover	Temp. (°C)	Dew Point (°C)	Pressure ("Hg)	
0	4	0,010	12,000	Clear	19	7	30.11	
Air Speed (kts)		Altitude AGL (ft)		Altitude MSL (ft)	Airfield Elevation (ft)			
120		5,250		12,800	5,200			
Settings								
Point Spacing (m)	Point Density (ppsm)	Scan Angle/FOV (°)		Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power (%)		
0.7	2	46		46	200	100		
							Verify S-Turns Before Mission	Yes
Line #	Direction	Start Time (UTC)	End Time (UTC)	Time On-Line	Satellite	PDOP	Line Notes/Comments	
365	180	13:54:00	13:55:00	00:01:00	32	0.86		
366	360	13:57:00	13:52:00	23:55:00	33	0.86		
367	180	14:00:00	14:02:00	00:02:00	33	0.86		
368	360	14:05:00	14:09:00	00:04:00	32	0.91		
369	180	14:12:00	14:14:00	00:02:00	32	0.92		
370	360	14:18:00	14:22:00	00:04:00	31	0.95		
371	180	14:25:00	14:31:00	00:06:00	32	0.81		
372	360	14:34:00	14:38:00	00:04:00	32	0.96		
373	180	14:41:00	14:46:00	00:05:00	33	0.92		
374	360	14:49:00	14:53:00	00:04:00	32	0.96		
375	180	14:55:00	15:01:00	00:06:00	34	0.89		
376	360	15:04:00	15:10:00	00:06:00	34	0.9		
377	180	15:13:00	15:24:00	00:11:00	34	0.87		
378	360	15:27:00	15:36:00	00:09:00	31	0.99		
379	180	15:39:00	15:33:00	23:54:00	31	0.92		
380	360	15:55:00	16:05:00	00:10:00	31	0.9		
365	180	17:24:00	17:25:00	00:01:00	27	1.02		
366	360	17:27:00	17:28:00	00:01:00	27	1.02		
367	180	17:31:00	17:33:00	00:02:00	26	1.02		
368	360	17:35:00	17:38:00	00:03:00	27	0.91		
369	180	17:40:00	17:44:00	00:04:00	27	0.85		
370	360	17:48:00	17:54:00	00:06:00	27	0.86		
Page 1							Verify S-Turns After Mission	Yes
Additional Comments						Drive #		

Appendix 2: Raw Swath NVA Checkpoint Results

Coordinate values are listed in the following spatial reference system:

Horizontal: NAD83 (2011) UTM Zone 13, meters

Vertical: NAVD88 GEOID12B meters

Summary	
Point Count	590
Average dZ	0.007 m
Minimum dZ	-0.212 m
Maximum dZ	0.195 m
Average Magnitude	0.032 m
Root Mean Square	0.042 m
Standard Deviation	0.041 m

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2001_2018_NM	343331.035	3952069.740	1758.424	1758.550	0.126
2002_2018_NM	344283.091	3953744.691	1783.197	1783.270	0.073
2003_2018_NM	345006.702	3955173.796	1800.602	1800.710	0.108
2004_2018_NM	347208.752	3962805.478	2024.732	2024.520	-0.212
2005_2018_NM	352647.108	3968440.698	2215.539	2215.620	0.081
2006_2018_NM	349685.410	3965577.426	2049.485	2049.440	-0.045
2007A_2018_NM	351396.899	3971718.650	2351.132	2351.310	0.178
2007B_2018_NM	351397.045	3971702.523	2350.615	2350.810	0.195
2008_2018_NM	356661.278	3963925.650	2428.850	2428.790	-0.060
2009_2018_NM	350039.828	3949279.088	1898.498	1898.540	0.042
2010_2018_NM	349239.864	3947885.292	1843.228	1843.230	0.002
2011_2018_NM	343334.088	3948824.215	1786.801	1786.970	0.169
2012_2018_NM	343353.710	3950192.572	1790.791	1790.970	0.179
2013_2019_NM	235076.134	3573234.552	1334.440	1334.420	-0.020
2013A_2019_NM	235098.671	3573222.236	1334.492	1334.450	-0.042
2014_2019_NM	223220.531	3571820.024	1349.344	1349.310	-0.034
2015_2019_NM	223592.941	3570794.907	1346.447	1346.490	0.043
2016_2018_NM	350592.909	3523919.763	1143.872	1143.870	-0.002
2017_2019_NM	216579.115	3570896.474	1350.481	1350.520	0.039

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2018_2019_NM	209403.175	3569985.795	1368.946	1368.940	-0.006
2019_2018_NM	350469.614	3541536.434	1191.777	1191.730	-0.047
2020_2019_NM	194075.261	3567613.597	1391.379	1391.330	-0.049
2021_2019_NM	192885.414	3567399.318	1393.731	1393.740	0.009
2022_2019_NM	186254.571	3555382.372	1348.237	1348.300	0.063
2023_2019_NM	184869.774	3540053.428	1384.505	1384.510	0.005
2024_2019_NM	185418.296	3536042.667	1373.921	1373.950	0.029
2025_2019_NM	172699.960	3542535.376	1415.484	1415.500	0.016
2026_2019_NM	159673.503	3543041.900	1312.698	1312.660	-0.038
2027_2018_NM	356393.859	3518759.150	1193.513	1193.430	-0.083
2028_2019_NM	141514.237	3557233.938	1377.040	1377.040	0.000
2029_2019_NM	141404.963	3555492.801	1378.623	1378.690	0.067
2030_2019_NM	142618.349	3549310.882	1366.248	1366.270	0.022
2031_2019_NM	141512.259	3549668.070	1358.713	1358.730	0.017
2032_2019_NM	141201.953	3542884.175	1340.289	1340.240	-0.049
2033_2018_NM	348548.339	3524400.763	1143.303	1143.280	-0.023
2034_2018_NM	347565.682	3528183.794	1144.525	1144.490	-0.035
2035A_2019_NM	139744.907	3541343.252	1342.120	1342.050	-0.070
2035B_2019_NM	139755.694	3541336.543	1342.053	1342.050	-0.003
2036_2019_NM	137805.732	3544314.359	1330.370	1330.340	-0.030
2037_2019_NM	137749.422	3543076.733	1333.564	1333.530	-0.034
2038_2018_NM	350995.517	3531270.883	1198.822	1198.780	-0.042
2039_2018_NM	350453.461	3540446.335	1191.218	1191.200	-0.018
2040_2019_NM	130323.049	3540801.989	1349.782	1349.790	0.008
2041_2019_NM	97733.429	3715051.583	2180.691	2180.720	0.029
2041A_2019_NM	97721.736	3715060.870	2180.876	2180.930	0.054
2042_2019_NM	127235.211	3540105.344	1320.745	1320.730	-0.015
2043_2019_NM	97296.153	3689773.140	1673.066	1673.130	0.064
2044_2019_NM	124992.407	3540353.567	1286.983	1286.940	-0.043
2044A_2019_NM	125010.594	3540369.015	1289.308	1289.260	-0.048
2045_2018_NM	350599.391	3536779.400	1200.573	1200.510	-0.063
2046_2019_NM	121271.491	3539290.183	1242.181	1242.220	0.039
2047_2018_NM	348279.274	3542658.710	1159.277	1159.240	-0.037
2048_2018_NM	349891.419	3544579.079	1189.222	1189.190	-0.032

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2049_2018_NM	350327.267	3532073.289	1185.433	1185.410	-0.023
2050A_2019_NM	239741.947	3573518.326	1324.536	1324.500	-0.036
2050B_2019_NM	239758.411	3573520.252	1324.423	1324.390	-0.033
2051A_2019_NM	241931.471	3572368.716	1315.593	1315.530	-0.063
2051B_2019_NM	241932.619	3572354.943	1315.612	1315.570	-0.042
2052_2019_NM	244358.222	3573671.692	1311.640	1311.590	-0.050
2053_2018_NM	348076.047	3549332.755	1184.941	1184.930	-0.011
2054_2018_NM	336420.259	3571055.286	1205.441	1205.430	-0.011
2055_2018_NM	323005.786	3573319.522	1274.964	1274.990	0.026
2056_2018_NM	343375.984	3536300.270	1152.854	1152.830	-0.024
2057_2018_NM	285064.136	3569619.691	1303.866	1303.860	-0.006
2058_2018_NM	299258.581	3570000.690	1327.906	1327.900	-0.006
2059_2018_NM	301370.930	3570247.179	1335.562	1335.570	0.008
2060_2018_NM	310996.870	3571255.025	1349.196	1349.200	0.004
2061_2018_NM	324150.686	3573321.956	1262.493	1262.520	0.027
2062_2018_NM	327967.124	3573996.067	1184.486	1184.500	0.014
2063_2018_NM	329248.975	3574365.102	1193.393	1193.380	-0.013
2064_2018_NM	331093.910	3574154.805	1188.989	1188.980	-0.009
2065_2018_NM	333507.328	3573108.476	1183.292	1183.240	-0.052
2066A_2018_NM	334705.949	3573128.423	1187.105	1187.130	0.025
2066B_2018_NM	334715.033	3573129.441	1187.291	1187.280	-0.011
2067_2018_NM	337232.143	3570034.030	1208.278	1208.250	-0.028
2068_2018_NM	336404.386	3567653.617	1179.143	1179.170	0.027
2069_2018_NM	346079.035	3524898.896	1151.612	1151.620	0.008
2070_2018_NM	336576.747	3558784.728	1171.235	1171.280	0.045
2071_2018_NM	345516.093	3555275.437	1190.973	1190.950	-0.023
2072_2018_NM	345521.097	3544496.632	1157.531	1157.540	0.009
2073_2018_NM	350248.531	3529899.918	1173.982	1173.960	-0.022
2074_2018_NM	349008.802	3539684.470	1165.204	1165.180	-0.024
2075_2018_NM	348519.015	3535054.523	1152.953	1152.930	-0.023
2076A_2018_NM	350086.088	3522252.309	1139.748	1139.820	0.072
2076B_2018_NM	350095.309	3522252.399	1139.884	1139.910	0.026
2077_2018_NM	350216.589	3528483.195	1180.719	1180.720	0.001
2078_2018_NM	296301.967	3568448.412	1320.190	1320.240	0.050

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2079_2019_NM	249843.383	3525640.204	1249.377	1249.430	0.053
2080_2018_NM	332294.121	3578704.203	1201.905	1201.920	0.015
2081_2019_NM	110729.395	3517508.442	1304.700	1304.700	0.000
2082A_2019_NM	165739.228	3536435.403	1371.463	1371.490	0.027
2082B_2019_NM	165728.044	3536424.323	1371.289	1371.290	0.001
2083_2019_NM	114616.267	3573947.371	1196.212	1196.220	0.008
2084_2019_NM	147975.311	3585643.133	1303.446	1303.480	0.034
2085_2019_NM	139998.644	3599923.749	1300.187	1300.210	0.023
2086_2019_NM	157663.610	3582799.745	1280.826	1280.860	0.034
2087A_2019_NM	150469.880	3585179.471	1300.926	1300.960	0.034
2087B_2019_NM	150480.246	3585175.883	1300.856	1300.870	0.014
2088_2019_NM	131131.304	3608768.602	1303.149	1303.180	0.031
2089_2019_NM	127065.506	3613853.373	1266.415	1266.450	0.035
2090_2019_NM	127226.919	3622833.620	1160.152	1160.130	-0.022
2091_2019_NM	128799.855	3621643.473	1163.591	1163.570	-0.021
2092_2018_NM	333458.883	3580585.272	1252.646	1252.640	-0.006
2093_2018_NM	283747.972	3642143.098	1288.751	1288.840	0.089
2094_2019_NM	118790.464	3620532.619	1165.128	1165.170	0.042
2095_2019_NM	115821.182	3626891.978	1116.487	1116.470	-0.017
2096A_2019_NM	116626.136	3627956.169	1125.352	1125.350	-0.002
2096B_2019_NM	116642.635	3627955.480	1125.423	1125.400	-0.023
2097_2019_NM	114607.420	3631032.097	1127.484	1127.460	-0.024
2098_2019_NM	206030.680	3623751.425	1754.578	1754.540	-0.038
2099_2019_NM	206882.696	3625094.073	1722.150	1722.120	-0.030
2100_2019_NM	206194.271	3628320.259	1768.002	1767.980	-0.022
2101_2019_NM	203291.744	3631423.995	1827.627	1827.610	-0.017
2102_2019_NM	201797.383	3631372.924	1846.002	1846.000	-0.002
2103_2019_NM	199788.075	3631768.631	1854.801	1854.850	0.049
2104_2019_NM	205094.208	3631172.115	1828.296	1828.270	-0.026
2105A_2019_NM	193789.934	3633911.032	1870.452	1870.450	-0.002
2105B_2019_NM	193789.550	3633902.239	1870.296	1870.280	-0.016
2106A_2019_NM	193186.644	3631440.627	1801.660	1801.650	-0.010
2106B_2019_NM	193199.327	3631455.980	1801.670	1801.670	0.000
2107_2019_NM	191085.059	3630561.984	1898.192	1898.180	-0.012

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2108_2019_NM	193774.841	3632746.287	1833.233	1833.240	0.007
2109_2019_NM	190765.215	3624164.990	1737.650	1737.630	-0.020
2110_2019_NM	184898.707	3629253.518	1801.279	1801.230	-0.049
2111_2019_NM	174689.203	3632448.028	1524.607	1524.560	-0.047
2112_2019_NM	171819.260	3638650.354	1454.756	1454.720	-0.036
2113_2019_NM	170717.023	3643088.577	1491.083	1491.050	-0.033
2114_2019_NM	165824.276	3650192.928	1413.448	1413.490	0.042
2114A_2019_NM	165153.960	3650913.428	1410.150	1410.140	-0.010
2114B_2019_NM	165184.083	3650918.291	1410.484	1410.490	0.006
2115_2018_NM	307070.169	3617267.929	1255.493	1255.540	0.047
2116_2019_NM	163683.916	3649468.924	1364.032	1363.970	-0.062
2117A_2019_NM	160600.455	3654675.072	1386.906	1386.870	-0.036
2117B_2019_NM	160622.957	3654654.473	1386.842	1386.790	-0.052
2118_2019_NM	131069.645	3671720.814	1606.724	1606.740	0.016
2119_2019_NM	118395.765	3664401.259	1891.864	1891.860	-0.004
2120_2019_NM	139850.513	3685631.140	1480.391	1480.460	0.069
2121_2019_NM	139245.963	3686781.713	1418.562	1418.610	0.048
2122_2018_NM	354989.839	3518576.150	1139.074	1139.040	-0.034
2123_2019_NM	139479.667	3694118.916	1458.908	1458.910	0.002
2124_2019_NM	136724.788	3722147.629	1958.500	1958.550	0.050
2125_2018_NM	298209.616	3618253.052	1250.494	1250.530	0.036
2126_2019_NM	142012.127	3734810.900	1947.609	1947.690	0.081
2127_2019_NM	134888.249	3740052.616	2436.021	2436.080	0.059
2128_2019_NM	134372.427	3746897.278	2161.756	2161.810	0.054
2129_2019_NM	133899.787	3748987.848	2144.750	2144.850	0.100
2130_2018_NM	350622.056	3527086.453	1176.203	1176.210	0.007
2131_2018_NM	279393.300	3680211.494	1462.640	1462.680	0.040
2132_2018_NM	288370.451	3679904.824	1472.639	1472.660	0.021
2133_2018_NM	291243.961	3672699.071	1348.250	1348.340	0.090
2134_2018_NM	290403.475	3669992.503	1347.335	1347.380	0.045
2135_2018_NM	287184.492	3667063.611	1298.297	1298.290	-0.007
2136A_2018_NM	285860.202	3666430.514	1291.319	1291.270	-0.049
2136B_2018_NM	285873.738	3666437.247	1291.384	1291.360	-0.024
2137_2018_NM	285456.090	3660570.828	1303.391	1303.370	-0.021

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2138_2018_NM	283881.990	3648393.633	1310.655	slope	*
2139_2018_NM	283615.342	3646691.671	1292.113	1292.150	0.037
2140_2018_NM	283262.945	3644674.810	1297.409	1297.410	0.001
2141_2018_NM	284079.713	3643487.401	1299.310	1299.300	-0.010
2142_2018_NM	285564.229	3641398.672	1266.572	1266.530	-0.042
2143_2018_NM	283472.879	3640401.016	1281.156	1281.120	-0.036
2144_2018_NM	282916.755	3636902.969	1274.773	1274.810	0.037
2145_2018_NM	285437.997	3631224.233	1263.769	1263.730	-0.039
2146_2018_NM	292524.979	3620665.187	1243.150	1243.150	0.000
2147_2018_NM	297710.771	3616241.992	1236.277	1236.330	0.053
2148_2018_NM	299782.799	3615432.430	1234.353	1234.320	-0.033
2149_2018_NM	305235.935	3616439.801	1234.599	1234.650	0.051
2150_2018_NM	306554.901	3612823.646	1227.705	1227.760	0.055
2151_2018_NM	317596.754	3597304.350	1214.197	1214.190	-0.007
2152_2018_NM	319703.970	3596821.881	1223.262	1223.350	0.088
2153_2018_NM	342418.891	3561125.144	1190.222	1190.190	-0.032
2154_2018_NM	329371.559	3585021.485	1207.543	1207.610	0.067
2155_2018_NM	331279.875	3582774.261	1213.187	1213.190	0.003
2156A_2018_NM	336742.389	3577635.051	1265.245	1265.230	-0.015
2156B_2018_NM	336752.266	3577623.378	1264.944	1264.940	-0.004
2157_2018_NM	335990.119	3582850.162	1315.495	1315.490	-0.005
2158_2018_NM	339434.016	3585021.115	1345.490	1345.450	-0.040
2159_2018_NM	344630.852	3586665.544	1399.382	1399.350	-0.032
2160_2018_NM	344984.058	3589568.514	1398.882	1398.840	-0.042
2161_2018_NM	349268.854	3588591.882	1532.566	1532.500	-0.066
2162_2019_NM	164797.157	3749650.867	1957.255	1957.360	0.105
2163_2018_NM	178558.241	3805657.207	2100.555	2100.600	0.045
2164_2019_NM	167242.846	3801290.057	2305.598	2305.630	0.032
2165_2019_NM	168876.393	3801821.532	2324.747	2324.780	0.033
2166_2019_NM	165533.156	3800803.684	2307.902	2307.880	-0.022
2167_2019_NM	148544.492	3795345.079	2166.744	2166.820	0.076
2168_2019_NM	141560.031	3792812.645	2232.756	2232.710	-0.046
2169_2019_NM	138783.950	3792057.465	2307.764	2307.780	0.016
2170_2019_NM	127004.713	3788048.767	2243.668	2243.620	-0.048

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2171_2019_NM	122439.157	3787433.718	2222.375	2222.430	0.055
2171A_2019_NM	138695.454	3791993.843	2308.578	2308.610	0.032
2172_2019_NM	160893.863	3761036.882	2078.445	2078.460	0.015
2173_2019_NM	160464.181	3767863.937	2335.058	2335.090	0.032
2174_2019_NM	171790.693	3785020.554	2333.700	2333.750	0.050
2175_2018_NM	249412.493	3778799.584	2157.732	2157.730	-0.002
2176_2018_NM	195096.429	3802102.228	2192.374	2192.360	-0.014
2177_2019_NM	133220.087	3790226.153	2302.540	2302.500	-0.040
2178_2019_NM	162301.771	3652953.970	1374.785	1374.810	0.025
2179_2018_NM	172436.246	3809756.541	2087.750	2087.770	0.020
2180_2018_NM	164552.765	3814554.676	2014.761	2014.840	0.079
2181_2018_NM	159909.857	3816818.319	1983.266	1983.270	0.004
2182_2018_NM	159447.911	3820847.828	1948.680	1948.680	0.000
2183_2018_NM	165110.075	3824096.523	1978.553	1978.600	0.047
2184_2019_NM	101429.513	3628327.863	1276.536	1276.550	0.014
2185_2018_NM	175279.812	3826156.341	2055.340	2055.390	0.050
2186_2018_NM	179936.946	3825314.088	2063.035	2062.980	-0.055
2187_2018_NM	183400.955	3823975.232	2094.103	2094.160	0.057
2187A_2018_NM	183395.465	3823906.975	2094.217	2094.260	0.043
2188_2018_NM	185759.333	3820674.749	2167.162	2167.210	0.048
2188A_2018_NM	185766.371	3820672.037	2167.401	2167.420	0.019
2189_2018_NM	183592.206	3811927.314	2231.704	2231.760	0.056
2190_2018_NM	189299.335	3832318.967	2262.704	2262.690	-0.014
2191_2018_NM	188463.069	3834034.228	2285.393	2285.450	0.057
2192_2018_NM	184659.248	3836855.293	2252.584	2252.600	0.016
2193_2018_NM	172787.354	3840431.070	2222.104	2222.110	0.006
2194_2018_NM	179545.970	3839600.614	2231.386	2231.410	0.024
2195_2018_NM	160456.537	3835940.159	2228.886	2228.910	0.024
2196_2019_NM	128214.209	3540276.321	1331.189	1331.130	-0.059
2197_2019_NM	92887.255	3631179.504	1243.732	1243.740	0.008
2198_2019_NM	155734.458	3834216.596	2233.395	2233.400	0.005
2199_2019_NM	152654.279	3823910.351	1919.597	1919.650	0.053
2200_2019_NM	124736.362	3820804.252	1927.003	1926.990	-0.013
2201_2018_NM	197440.611	3834680.021	2223.996	2224.030	0.034

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2202_2019_NM	225267.914	3839127.178	2181.063	2181.050	-0.013
2203_2019_NM	222614.445	3844300.593	2159.121	2159.100	-0.021
2204_2019_NM	226032.901	3843439.410	2158.539	2158.550	0.011
2205_2019_NM	237152.826	3889563.901	1980.976	1980.980	0.004
2206_2018_NM	215982.658	3812177.583	2263.189	2263.150	-0.039
2207_2018_NM	210933.151	3804089.684	2285.398	2285.390	-0.008
2208_2018_NM	207784.913	3807630.869	2306.536	2306.520	-0.016
2209_2018_NM	206245.416	3808992.497	2298.106	2298.100	-0.006
2210_2018_NM	204568.421	3810175.305	2290.562	2290.600	0.038
2211_2018_NM	204087.473	3812752.079	2289.395	2289.400	0.005
2212_2018_NM	200586.462	3815340.131	2279.692	2279.710	0.018
2213_2018_NM	202969.948	3815117.352	2293.034	2293.070	0.036
2214_2019_NM	112045.783	3624118.039	1188.167	1188.130	-0.037
2215_2018_NM	198155.868	3819353.622	2270.595	2270.640	0.045
2216_2018_NM	194472.926	3821059.338	2206.619	2206.630	0.011
2217_2019_NM	163383.506	3487463.819	1384.616	1384.610	-0.006
2218_2018_NM	192040.397	3822434.213	2193.139	2193.180	0.041
2219_2018_NM	212426.499	3802910.638	2300.729	2300.760	0.031
2220_2018_NM	213773.782	3803999.487	2317.398	2317.480	0.082
2221_2018_NM	201150.481	3800976.957	2239.265	2239.300	0.035
2222_2018_NM	211124.753	3800086.889	2344.945	2344.980	0.035
2223_2018_NM	212548.405	3799483.847	2380.077	2380.100	0.023
2224_2018_NM	218502.367	3797637.101	2372.050	2372.030	-0.020
2225_2019_NM	109581.830	3538359.406	1425.128	1425.120	-0.008
2226_2018_NM	225521.302	3795627.995	2421.657	2421.640	-0.017
2227_2018_NM	230475.395	3790357.773	2363.394	2363.420	0.026
2228_2018_NM	224318.934	3799495.341	2463.837	2463.890	0.053
2229_2018_NM	236453.927	3783953.496	2261.861	2261.870	0.009
2230_2018_NM	237879.710	3781872.248	2249.398	2249.380	-0.018
2231_2018_NM	357384.518	3517587.112	1189.833	1189.840	0.007
2232_2018_NM	274937.418	3773036.129	2169.505	2169.500	-0.005
2233_2018_NM	260309.737	3772270.811	2140.042	2140.010	-0.032
2234_2018_NM	257446.024	3773474.840	2125.792	2125.820	0.028
2235_2018_NM	257401.490	3763359.463	2245.128	2245.120	-0.008

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2236_2018_NM	252498.558	3759506.490	2192.119	2192.110	-0.009
2237_2018_NM	250230.408	3745757.604	2201.456	2201.540	0.084
2238_2018_NM	253405.237	3734689.401	2128.611	2128.640	0.029
2239_2018_NM	252456.964	3729804.086	2015.947	2015.940	-0.007
2240_2018_NM	253227.467	3725082.737	1977.201	1977.280	0.079
2240A_2018_NM	253229.343	3725086.236	1977.392	1977.440	0.048
2241_2018_NM	253770.189	3723921.998	1964.663	1964.680	0.017
2241A_2018_NM	253778.918	3723904.885	1964.194	1964.190	-0.004
2242_2018_NM	254000.196	3721462.400	1936.358	1936.360	0.002
2243_2018_NM	256856.402	3718917.573	1911.359	1911.350	-0.009
2244_2018_NM	253581.719	3713208.455	1985.744	1985.730	-0.014
2245_2018_NM	251468.186	3706544.344	2106.011	2105.950	-0.061
2246_2018_NM	249736.509	3701475.593	1990.580	1990.660	0.080
2247_2018_NM	250257.820	3700017.997	1967.414	1967.430	0.016
2248_2018_NM	251987.053	3695946.246	1913.950	1913.960	0.010
2249_2018_NM	261419.656	3693672.917	1886.670	1886.710	0.040
2250_2018_NM	265294.079	3689518.568	1779.336	1779.390	0.054
2251_2018_NM	274116.762	3683175.284	1597.289	1597.290	0.001
2252_2018_NM	276913.078	3681932.379	1558.099	1558.120	0.021
2253_2018_NM	278488.298	3681069.820	1524.814	1524.850	0.036
2254_2018_NM	280480.040	3679815.987	1455.800	1455.810	0.010
2255_2018_NM	281474.420	3680988.253	1524.444	1524.430	-0.014
2256_2018_NM	281613.479	3681631.926	1534.318	1534.260	-0.058
2257_2018_NM	282669.644	3681797.968	1525.411	1525.420	0.009
2258_2018_NM	285250.537	3682085.212	1503.964	1504.020	0.056
2259_2018_NM	287090.538	3681715.251	1488.488	1488.470	-0.018
2260_2018_NM	288382.013	3681561.898	1477.040	1477.070	0.030
2261_2018_NM	289935.558	3675534.726	1391.692	1391.710	0.018
2262_2018_NM	291735.078	3668505.253	1318.363	1318.420	0.057
2263_2018_NM	290067.259	3669012.136	1320.207	1320.210	0.003
2264A_2018_NM	290237.671	3667884.140	1292.814	1292.790	-0.024
2264B_2018_NM	290234.777	3667877.108	1292.810	1292.790	-0.020
2265_2018_NM	285647.761	3664671.727	1292.316	1292.300	-0.016
2266_2018_NM	285335.621	3665648.363	1307.369	1307.390	0.021

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2267_2018_NM	284929.376	3657935.536	1308.477	1308.460	-0.017
2268_2018_NM	284541.711	3656896.922	1308.106	1308.120	0.014
2269_2018_NM	283414.785	3653571.654	1359.752	1359.780	0.028
2270_2018_NM	284009.993	3655356.715	1313.455	1313.490	0.035
2271_2018_NM	284673.235	3651981.188	1295.868	1295.880	0.012
2272_2018_NM	283956.527	3649805.699	1290.146	1290.170	0.024
2273_2018_NM	282270.015	3649996.492	1303.015	1303.050	0.035
2274_2018_NM	279439.451	3650801.186	1329.452	1329.380	-0.072
2275_2018_NM	276879.474	3651319.573	1358.826	1358.920	0.094
2276_2018_NM	274620.969	3651107.262	1460.530	1460.500	-0.030
2277_2018_NM	267736.416	3649582.432	1565.391	1565.420	0.029
2278_2018_NM	266737.349	3648044.834	1577.584	1577.560	-0.024
2279_2019_NM	263833.042	3647250.361	1679.124	1679.100	-0.024
2280_2019_NM	261833.823	3646674.401	1668.995	1668.980	-0.015
2281_2019_NM	261474.752	3645576.894	1598.046	1598.020	-0.026
2282_2019_NM	260339.084	3645573.249	1594.518	1594.570	0.052
2283_2019_NM	259683.507	3643946.941	1652.303	1652.340	0.037
2284_2019_NM	258224.162	3644989.061	1628.008	1627.990	-0.018
2285_2019_NM	262356.017	3639668.692	1607.651	1607.630	-0.021
2286_2019_NM	262477.817	3636776.112	1605.863	1605.840	-0.023
2287_2019_NM	262336.951	3634988.303	1595.417	1595.360	-0.057
2288_2019_NM	261989.806	3632313.348	1597.187	1597.170	-0.017
2289_2019_NM	261966.359	3630469.762	1559.548	1559.550	0.002
2290_2019_NM	261529.536	3628907.801	1570.960	1570.890	-0.070
2291_2019_NM	261159.293	3627038.887	1561.145	1561.090	-0.055
2292_2019_NM	258380.968	3623327.760	1679.836	1679.790	-0.046
2292A_2019_NM	258381.282	3623327.754	1679.829	1679.790	-0.039
2293_2019_NM	259749.153	3622527.142	1626.242	1626.190	-0.052
2294_2019_NM	262878.728	3619608.581	1539.185	1539.150	-0.035
2295_2019_NM	263952.868	3616939.787	1510.466	1510.410	-0.056
2296_2019_NM	266474.837	3610274.664	1458.979	1458.960	-0.019
2297_2019_NM	268866.976	3607601.679	1437.241	1437.180	-0.061
2298_2019_NM	268386.778	3605539.828	1427.764	1427.740	-0.024
2299_2019_NM	274513.334	3606625.533	1406.128	1406.080	-0.048

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2300_2019_NM	276291.448	3607314.955	1381.498	1381.460	-0.038
2300A_2019_NM	276054.741	3607230.828	1385.154	1385.150	-0.004
2300B_2019_NM	276054.153	3607219.873	1385.070	1385.050	-0.020
2301_2018_NM	284268.376	3610474.854	1364.950	1364.980	0.030
2302_2018_NM	285840.317	3611092.865	1371.723	1371.730	0.007
2303_2018_NM	299043.106	3616480.248	1235.924	1235.930	0.006
2304_2018_NM	290088.612	3612876.656	1353.324	1353.280	-0.044
2305_2018_NM	292264.934	3613859.538	1312.186	1312.180	-0.006
2306_2018_NM	295195.783	3615319.715	1257.406	1257.430	0.024
2307_2018_NM	294862.525	3616083.027	1242.027	1242.110	0.083
2308_2018_NM	296870.608	3617100.956	1238.313	1238.320	0.007
2309_2018_NM	295714.549	3617335.151	1238.910	1238.930	0.020
2310_2018_NM	296538.131	3615992.534	1246.654	1246.700	0.046
2311_2018_NM	294458.184	3618811.282	1239.317	1239.370	0.053
2312_2018_NM	287823.355	3626383.162	1250.683	1250.600	-0.083
2313_2018_NM	290337.600	3622535.107	1244.830	1244.850	0.020
2314_2018_NM	287229.130	3629218.271	1254.443	1254.480	0.037
2315_2018_NM	287826.646	3629801.261	1273.978	1273.980	0.002
2316_2018_NM	303565.585	3616492.167	1232.219	1232.210	-0.009
2317_2018_NM	300116.604	3617142.849	1235.500	1235.530	0.030
2318_2018_NM	302824.973	3614492.241	1234.921	1234.920	-0.001
2319_2018_NM	309847.405	3610695.112	1236.918	1236.980	0.062
2320_2018_NM	312037.474	3606216.566	1219.722	1219.750	0.028
2321_2018_NM	313500.514	3600262.645	1218.944	1219.030	0.086
2322_2018_NM	312241.540	3603112.824	1218.038	1218.100	0.062
2323_2018_NM	316060.299	3599299.725	1212.440	1212.500	0.060
2324_2018_NM	210866.436	3702583.481	2042.365	2042.320	-0.045
2325_2018_NM	210044.159	3705074.319	2071.465	2071.440	-0.025
2326_2018_NM	210097.429	3706793.562	2089.563	2089.600	0.037
2327_2018_NM	209334.140	3708612.284	2091.630	2091.690	0.060
2328_2018_NM	207796.220	3713357.924	2106.665	2106.650	-0.015
2329_2019_NM	216155.281	3721786.040	2225.561	2225.540	-0.021
2330_2019_NM	220200.123	3724065.671	2239.728	2239.750	0.022
2331_2019_NM	221594.514	3724023.570	2256.081	2256.100	0.019

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2332_2019_NM	223188.253	3724554.739	2342.030	2342.000	-0.030
2333_2019_NM	228847.947	3727239.386	2317.397	2317.250	-0.147
2334_2018_NM	234678.375	3730705.581	2362.668	2362.620	-0.048
2335_2018_NM	235881.337	3731000.674	2323.391	2323.400	0.009
2336_2018_NM	243951.416	3740625.832	2211.696	2211.670	-0.026
2337_2018_NM	244847.685	3743659.931	2190.237	2190.240	0.003
2338_2018_NM	249891.483	3752140.721	2177.702	2177.720	0.018
2339_2018_NM	250745.516	3755362.222	2206.316	2206.270	-0.046
2340_2018_NM	255532.043	3761129.963	2224.700	2224.690	-0.010
2341_2018_NM	244718.893	3779865.964	2188.555	2188.560	0.005
2342_2018_NM	258931.791	3768943.076	2208.312	2208.270	-0.042
2343_2018_NM	251823.915	3769555.783	2122.177	2122.180	0.003
2344_2018_NM	244341.531	3769886.692	2133.986	2134.050	0.064
2345_2018_NM	230209.777	3769301.423	2133.067	2133.090	0.023
2346_2018_NM	230820.996	3767815.851	2120.796	2120.810	0.014
2347_2018_NM	231404.769	3764083.985	2103.341	2103.400	0.059
2348_2018_NM	232794.617	3756935.053	2107.770	2107.750	-0.020
2349_2019_NM	213880.696	3720693.484	2204.827	2204.800	-0.027
2349A_2019_NM	220822.722	3724161.537	2263.889	2263.950	0.061
2350_2019_NM	194801.773	3716704.922	2224.902	2224.920	0.018
2351_2019_NM	192541.455	3717319.774	2253.441	2253.490	0.049
2352_2019_NM	188745.558	3718310.504	2300.503	2300.550	0.047
2353_2019_NM	101219.417	3541553.300	1646.220	1646.270	0.050
2353A_2019_NM	101252.509	3541515.494	1646.002	1646.030	0.028
2354_2019_NM	186127.555	3720349.205	2336.633	2336.620	-0.013
2355_2019_NM	179809.043	3725533.305	2308.726	2308.800	0.074
2356_2019_NM	178440.812	3727678.976	2275.824	2275.860	0.036
2357_2019_NM	176085.464	3720920.397	2548.139	2548.210	0.071
2358_2019_NM	172943.811	3715350.849	2397.930	2397.900	-0.030
2359_2019_NM	170882.623	3712241.623	2450.988	2451.040	0.052
2360_2019_NM	169596.335	3710288.237	2485.452	2485.550	0.098
2361_2019_NM	165422.196	3707579.278	2620.346	2620.440	0.094
2362_2019_NM	164656.726	3706504.927	2608.695	2608.760	0.065
2363_2019_NM	165920.866	3705182.034	2574.051	2574.150	0.099

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2364_2019_NM	146839.577	3701857.670	2001.968	2001.990	0.022
2365_2019_NM	145593.969	3701849.226	2150.780	2150.790	0.010
2366_2019_NM	144221.934	3701866.766	2011.586	2011.580	-0.006
2367_2019_NM	142624.474	3700558.285	1773.929	1773.990	0.061
2368_2019_NM	266552.785	3602647.201	1418.524	1418.490	-0.034
2369_2019_NM	263421.568	3597965.518	1404.619	1404.620	0.001
2370_2019_NM	259972.544	3592932.593	1388.787	1388.720	-0.067
2371_2018_NM	348597.905	3548091.720	1188.482	1188.470	-0.012
2372_2019_NM	255855.299	3586974.094	1368.009	1368.030	0.021
2373_2018_NM	350516.619	3542646.529	1193.189	1193.190	0.001
2374_2019_NM	253664.596	3583960.870	1356.808	1356.810	0.002
2375_2019_NM	250542.696	3580997.539	1336.376	1336.340	-0.036
2376_2019_NM	249467.104	3580174.756	1336.696	1336.660	-0.036
2377_2019_NM	249530.504	3580123.598	1334.987	1334.970	-0.017
2378_2019_NM	247413.690	3578667.400	1330.794	1330.790	-0.004
2379_2019_NM	245789.785	3577468.194	1323.271	1323.200	-0.071
2380_2019_NM	244073.566	3576703.652	1319.110	1319.060	-0.050
2381_2019_NM	242406.727	3573939.489	1317.355	1317.320	-0.035
2382_2019_NM	241078.655	3576025.461	1324.788	1324.690	-0.098
2383_2019_NM	239906.146	3575650.023	1327.067	1327.060	-0.007
2384_2019_NM	240570.331	3574064.490	1321.187	1321.160	-0.027
2385_2019_NM	239259.411	3574743.478	1326.290	1326.270	-0.020
2386_2019_NM	238354.404	3571992.728	1324.089	1324.090	0.001
2387_2019_NM	235335.111	3574565.245	1338.445	1338.440	-0.005
2388_2019_NM	236451.619	3580011.103	1350.279	1350.280	0.001
2389_2019_NM	231438.851	3585950.139	1396.970	1397.000	0.030
2390_2019_NM	232714.147	3584434.546	1383.376	1383.390	0.014
2391_2019_NM	87855.043	3492448.841	1353.039	1353.030	-0.009
2392_2019_NM	229435.356	3588306.832	1417.086	1417.090	0.004
2393_2019_NM	228547.028	3589378.212	1424.485	1424.490	0.005
2394_2019_NM	227854.679	3590200.028	1428.869	1428.890	0.021
2395_2019_NM	226489.982	3591813.997	1437.229	1437.230	0.001
2396_2019_NM	225589.145	3592879.733	1441.427	1441.390	-0.037
2397_2019_NM	223084.033	3595822.434	1452.215	1452.240	0.025

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2398_2019_NM	221857.724	3597300.933	1464.449	1464.440	-0.009
2399_2019_NM	223343.790	3598549.079	1470.060	1470.120	0.060
2400_2019_NM	220162.614	3599280.237	1481.459	1481.500	0.041
2400A_2019_NM	220149.726	3599273.907	1481.432	1481.480	0.048
2401_2019_NM	219643.577	3599914.429	1485.166	1485.180	0.014
2402_2019_NM	88193.099	3475381.093	1211.333	1211.310	-0.023
2402A_2019_NM	89968.591	3474648.269	1170.404	1170.350	-0.054
2403_2019_NM	218924.296	3600765.440	1485.418	1485.420	0.002
2404_2019_NM	217389.192	3602571.380	1492.527	1492.510	-0.017
2405_2019_NM	216431.746	3603753.082	1505.518	1505.530	0.012
2406_2019_NM	219143.395	3605768.757	1538.363	1538.390	0.027
2407_2019_NM	220643.197	3606802.739	1569.686	1569.700	0.014
2408_2019_NM	220646.148	3608090.782	1598.259	1598.260	0.001
2409_2019_NM	220928.155	3609135.315	1581.619	1581.640	0.021
2410_2019_NM	220300.100	3610125.557	1591.277	1591.300	0.023
2411_2019_NM	222797.862	3607300.605	1572.628	1572.670	0.042
2412_2019_NM	224295.270	3608024.515	1550.985	1551.010	0.025
2413_2019_NM	225636.620	3609338.712	1545.319	1545.290	-0.029
2414_2019_NM	227206.760	3610851.415	1562.748	1562.770	0.022
2415_2019_NM	228397.775	3611132.080	1556.557	1556.570	0.013
2416_2019_NM	230738.226	3613492.859	1579.852	1579.900	0.048
2417_2019_NM	231322.375	3614013.426	1586.650	1586.660	0.010
2418_2019_NM	232686.612	3616565.201	1607.754	1607.770	0.016
2419_2019_NM	233325.399	3617956.798	1616.398	1616.420	0.022
2420_2019_NM	233501.283	3619312.795	1652.614	1652.620	0.006
2421_2019_NM	233551.837	3620016.809	1634.943	1634.960	0.017
2422_2019_NM	233244.252	3620679.327	1639.644	1639.640	-0.004
2423_2019_NM	233087.679	3621450.463	1646.512	1646.600	0.088
2424_2019_NM	232999.497	3622555.641	1650.517	1650.550	0.033
2425_2019_NM	232411.473	3623704.558	1658.295	1658.280	-0.015
2426_2019_NM	231350.723	3625035.512	1668.463	1668.460	-0.003
2427_2019_NM	232268.668	3626152.099	1714.492	1714.510	0.018
2428_2019_NM	229989.627	3626124.299	1685.960	1685.990	0.030
2429_2019_NM	233921.783	3626772.576	1743.779	1743.790	0.011

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2430_2019_NM	235154.837	3626976.914	1783.092	1783.100	0.008
2431_2019_NM	232249.063	3627169.321	1758.388	1758.430	0.042
2432_2019_NM	232474.943	3628080.477	1804.386	1804.440	0.054
2433_2019_NM	232801.372	3629144.906	1868.601	1868.650	0.049
2434_2019_NM	269918.139	3606905.049	1438.358	1438.370	0.012
2435_2019_NM	234168.262	3632603.683	1972.193	1972.200	0.007
2436_2019_NM	234714.858	3633921.332	2002.003	2002.010	0.007
2437_2019_NM	234707.601	3635132.161	2018.277	2018.270	-0.007
2438_2019_NM	236061.442	3635878.069	2054.827	2054.850	0.023
2438A_2019_NM	236087.127	3635916.448	2057.085	2057.090	0.005
2439_2019_NM	226862.657	3631833.722	1728.134	1728.100	-0.034
2440_2019_NM	225076.941	3633394.467	1782.208	1782.210	0.002
2441_2019_NM	220398.889	3633777.775	1941.654	1941.660	0.006
2442_2019_NM	218352.975	3634555.880	1977.821	1977.800	-0.021
2443_2019_NM	217339.236	3634549.726	2022.186	2022.250	0.064
2444_2019_NM	216277.060	3634310.405	2049.468	2049.560	0.092
2445_2019_NM	214875.738	3634066.172	2008.082	2008.130	0.048
2446_2019_NM	212481.545	3634128.532	2008.129	2008.200	0.071
2447_2019_NM	213624.983	3633962.077	1987.597	1987.610	0.013
2448_2019_NM	210990.895	3634173.104	1926.101	1926.100	-0.001
2449_2019_NM	211121.566	3635298.253	1935.242	1935.270	0.028
2450_2019_NM	211632.169	3636575.840	1975.747	1975.760	0.013
2451_2019_NM	211681.314	3637957.163	2015.521	2015.550	0.029
2452_2019_NM	211870.079	3639098.774	2044.324	2044.320	-0.004
2453_2019_NM	212665.148	3640641.826	2111.441	2111.430	-0.011
2454_2019_NM	213928.549	3642183.831	2114.189	2114.160	-0.029
2455_2019_NM	213489.353	3641556.545	2107.379	2107.380	0.001
2456_2019_NM	206777.185	3629465.977	1777.867	1777.870	0.003
2457_2019_NM	208367.063	3634608.084	1961.193	1961.190	-0.003
2458_2019_NM	207546.362	3633634.233	1936.179	1936.160	-0.019
2459_2019_NM	205052.003	3629993.362	1801.709	1801.670	-0.039
2460_2019_NM	206861.077	3630139.037	1789.609	1789.580	-0.029
2460A_2019_NM	206854.168	3630100.100	1789.303	1789.310	0.007
2461_2019_NM	208103.908	3631026.332	1818.322	1818.270	-0.052

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2462_2019_NM	209384.554	3632612.266	1877.743	1877.760	0.017
2463_2019_NM	207145.627	3622829.728	1745.909	1745.880	-0.029
2464_2019_NM	206409.566	3621130.946	1723.506	1723.490	-0.016
2465_2019_NM	206260.613	3616398.329	1649.868	1649.880	0.012
2466_2019_NM	206609.185	3615342.993	1630.496	1630.500	0.004
2467_2019_NM	207488.327	3614354.283	1623.136	1623.170	0.034
2468_2019_NM	208869.235	3612713.254	1603.477	1603.510	0.033
2469_2019_NM	104693.735	3484196.698	1305.173	1305.170	-0.003
2470_2019_NM	203936.463	3614687.568	1638.149	1638.210	0.061
2471_2019_NM	205281.439	3614668.902	1636.004	1636.060	0.056
2472_2019_NM	202447.317	3614595.331	1615.136	1615.190	0.054
2473_2019_NM	160549.260	3580613.277	1288.066	1288.080	0.014
2474_2019_NM	201651.848	3615383.322	1638.156	1638.170	0.014
2475_2019_NM	212346.712	3608580.269	1554.732	1554.720	-0.012
2476_2019_NM	211296.059	3609826.191	1568.631	1568.590	-0.041
2477_2019_NM	209786.637	3611616.369	1588.639	1588.570	-0.069
2478_2019_NM	210573.108	3610683.654	1577.781	1577.750	-0.031
2479_2019_NM	246741.680	3539834.388	1255.163	1255.180	0.017
2480_2019_NM	246155.704	3542545.248	1260.328	1260.340	0.012
2481_2019_NM	245009.970	3541497.169	1259.393	1259.420	0.027
2482_2019_NM	242731.493	3541564.905	1261.968	1261.990	0.022
2483_2019_NM	242758.022	3542890.138	1262.911	1262.920	0.009
2484_2019_NM	241058.210	3541219.042	1267.593	1267.630	0.037
2485_2019_NM	242618.259	3550572.762	1277.060	1277.110	0.050
2486_2018_NM	357085.404	3520011.804	1245.378	1245.390	0.012
2487_2018_NM	350987.603	3525701.630	1169.069	1169.060	-0.009
2488_2019_NM	235006.329	3555917.390	1293.273	1293.300	0.027
2489_2019_NM	127129.615	3573471.537	1284.875	1284.880	0.005
2490A_2019_NM	139549.733	3541225.222	1341.903	1341.890	-0.013
2490B_2019_NM	139565.346	3541224.706	1342.115	1342.120	0.005
2491A_2018_NM	282961.789	3636883.867	1273.588	1273.610	0.022
2492B_2018_NM	282974.119	3636883.825	1273.501	1273.560	0.059
2493A_2019_NM	205985.803	3628742.867	1782.503	1782.470	-0.033
2493B_2019_NM	205996.872	3628732.459	1781.790	1781.770	-0.020

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2494A_2019_NM	204297.539	3632241.482	1856.214	1856.150	-0.064
2494B_2019_NM	204307.362	3632234.121	1855.622	1855.610	-0.012
2495_2019_NM	105935.128	3576693.956	1111.507	1111.580	0.073
2496_2019_NM	104632.237	3576851.190	1106.251	1106.210	-0.041
2497_2019_NM	102337.332	3577653.723	1102.014	1102.050	0.036
2498_2019_NM	101280.893	3577984.875	1100.263	1100.280	0.017
2500_2019_NM	80762.177	3584640.299	1130.059	1130.040	-0.019
2501_2019_NM	78091.148	3585333.628	1142.463	1142.400	-0.063
2502_2019_NM	75411.946	3586034.182	1163.581	1163.590	0.009
2503_2019_NM	84011.799	3633494.160	1095.334	1095.320	-0.014
2504_2019_NM	66266.252	3640455.020	904.698	904.680	-0.018
2505_2019_NM	100533.146	3648055.671	1301.739	1301.720	-0.019
2505A_2019_NM	103589.777	3651330.958	1126.287	1126.260	-0.027
2506_2019_NM	104469.322	3653377.665	1106.860	1106.840	-0.020
2507_2019_NM	103954.398	3655739.795	1129.139	1129.120	-0.019
2508_2019_NM	102186.077	3657266.447	1146.172	1146.180	0.008
2509_2019_NM	100422.056	3659186.739	1165.722	1165.710	-0.012
2510_2019_NM	99955.054	3660228.038	1198.432	1198.440	0.008
2511_2019_NM	98599.159	3663551.734	1080.032	1080.050	0.018
2511A_2019_NM	98623.140	3663588.232	1079.220	1079.220	0.000
2512_2019_NM	98853.631	3664943.076	1053.849	1053.850	0.001
2513_2019_NM	97067.799	3665808.807	1082.610	1082.640	0.030
2514_2019_NM	95744.194	3665333.728	1244.763	1244.820	0.057
2515_2019_NM	96111.696	3663998.141	1215.442	1215.450	0.008
2516_2019_NM	95076.473	3666811.383	1308.098	1308.100	0.002
2517_2019_NM	94802.096	3667255.032	1318.835	1318.800	-0.035
2518_2019_NM	105580.865	3652330.081	1078.037	1078.000	-0.037
2519_2019_NM	107011.280	3651100.685	1064.040	1064.030	-0.010
2520_2019_NM	107386.049	3649531.463	1067.750	1067.750	0.000
2521_2019_NM	107376.969	3648470.148	1068.603	1068.600	-0.003
2522_2019_NM	107186.512	3646550.820	1098.413	1098.420	0.007
2523_2019_NM	108887.455	3640373.663	1088.621	1088.680	0.059
2524_2019_NM	109272.317	3639042.145	1098.396	1098.380	-0.016
2525_2019_NM	109756.043	3636937.120	1108.537	1108.460	-0.077

Point ID	Easting	Northing	Known Z	Laser Z	dZ
2526_2019_NM	110585.045	3634469.516	1110.080	1110.120	0.040
2527_2019_NM	111917.799	3632535.562	1113.814	1113.820	0.006
2528_2019_NM	116274.748	3753125.085	2437.706	2437.740	0.034
2529_2019_NM	112751.287	3762958.522	2413.794	2413.800	0.006
2529A_2019_NM	112751.133	3762958.725	2413.788	2413.800	0.012
2530_2019_NM	111923.597	3767058.638	2328.364	2328.340	-0.024
2531_2019_NM	113075.028	3769979.591	2299.025	2299.050	0.025
2532_2019_NM	113354.318	3771445.776	2279.447	2279.450	0.003
2533_2019_NM	113396.943	3775324.104	2265.949	2265.970	0.021
2534_2019_NM	112790.521	3776802.111	2264.042	2264.050	0.008
2535_2019_NM	112294.994	3778286.636	2244.181	2244.170	-0.011
2536_2019_NM	112151.824	3780191.274	2228.663	2228.670	0.007
2537_2019_NM	108897.589	3780071.077	2251.678	2251.710	0.032
2538_2019_NM	107837.403	3782599.190	2177.732	2177.810	0.078
2539_2019_NM	106136.272	3785111.969	2128.882	2128.870	-0.012
2540_2019_NM	109357.593	3785264.248	2147.271	2147.270	-0.001
2541_2019_NM	104093.860	3783853.820	2141.120	2141.140	0.020
2542_2019_NM	101940.591	3790226.643	2118.245	2118.290	0.045
2543_2019_NM	100126.593	3796186.808	2025.826	2025.880	0.054
2544_2019_NM	96996.595	3804720.269	1923.168	1923.270	0.102
2545_2019_NM	107037.298	3803599.050	2010.394	2010.350	-0.044
2546_2019_NM	103182.418	3833968.909	1743.493	1743.530	0.037
2547_2019_NM	105971.922	3842809.330	1771.638	1771.630	-0.008
2547A_2019_NM	115780.181	3842572.471	1834.376	1834.410	0.034
2548_2019_NM	104641.554	3840523.975	1727.207	1727.270	0.063
2549_2019_NM	93700.115	3709429.316	2511.755	2511.720	-0.035
2550_2019_NM	86076.734	3796711.776	2222.706	2222.710	0.004

Appendix 3: DEM NVA Checkpoint Results

Coordinate values are listed in the following spatial reference system:

Horizontal: NAD83 (2011) UTM Zone 13, meters

Vertical: NAVD88 GEOID12B meters

Summary	
Point Count	590
Root Mean Square Error	0.044 m
95% Confidence Level	0.066 m
Mean of Residuals	0.034 m
Standard Deviation	0.028 m

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2001_2018_NM	343331.035	3952069.740	1758.424	1758.560	0.136
2002_2018_NM	344283.091	3953744.691	1783.197	1783.290	0.093
2003_2018_NM	345006.702	3955173.796	1800.602	1800.680	0.078
2004_2018_NM	347208.752	3962805.478	2024.732	2024.540	0.192
2005_2018_NM	352647.108	3968440.698	2215.539	2215.620	0.081
2006_2018_NM	349685.410	3965577.426	2049.485	2049.440	0.045
2007A_2018_NM	351396.899	3971718.650	2351.132	2351.290	0.158
2007B_2018_NM	351397.045	3971702.523	2350.615	2350.840	0.225
2008_2018_NM	356661.278	3963925.650	2428.850	2428.790	0.06
2009_2018_NM	350039.828	3949279.088	1898.498	1898.580	0.082
2010_2018_NM	349239.864	3947885.292	1843.228	1843.250	0.022
2011_2018_NM	343334.088	3948824.215	1786.801	1786.950	0.149
2012_2018_NM	343353.710	3950192.572	1790.791	1790.970	0.179
2013_2019_NM	235076.134	3573234.552	1334.440	1334.420	0.02
2013A_2019_NM	235098.671	3573222.236	1334.492	1334.440	0.052
2014_2019_NM	223220.531	3571820.024	1349.344	1349.300	0.044
2015_2019_NM	223592.941	3570794.907	1346.447	1346.450	0.003
2016_2018_NM	350592.909	3523919.763	1143.872	1143.860	0.012
2017_2019_NM	216579.115	3570896.474	1350.481	1350.490	0.009
2018_2019_NM	209403.175	3569985.795	1368.946	1368.940	0.006

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2019_2018_NM	350469.614	3541536.434	1191.777	1191.720	0.057
2020_2019_NM	194075.261	3567613.597	1391.379	1391.320	0.059
2021_2019_NM	192885.414	3567399.318	1393.731	1393.740	0.009
2022_2019_NM	186254.571	3555382.372	1348.237	1348.290	0.053
2023_2019_NM	184869.774	3540053.428	1384.505	1384.510	0.005
2024_2019_NM	185418.296	3536042.667	1373.921	1373.970	0.049
2025_2019_NM	172699.960	3542535.376	1415.484	1415.500	0.016
2026_2019_NM	159673.503	3543041.900	1312.698	1312.660	0.038
2027_2018_NM	356393.859	3518759.150	1193.513	1193.410	0.103
2028_2019_NM	141514.237	3557233.938	1377.040	1377.030	0.01
2029_2019_NM	141404.963	3555492.801	1378.623	1378.660	0.037
2030_2019_NM	142618.349	3549310.882	1366.248	1366.230	0.018
2031_2019_NM	141512.259	3549668.070	1358.713	1358.730	0.017
2032_2019_NM	141201.953	3542884.175	1340.289	1340.250	0.039
2033_2018_NM	348548.339	3524400.763	1143.303	1143.290	0.013
2034_2018_NM	347565.682	3528183.794	1144.525	1144.500	0.025
2035A_2019_NM	139744.907	3541343.252	1342.120	1342.080	0.04
2035B_2019_NM	139755.694	3541336.543	1342.053	1342.050	0.003
2036_2019_NM	137805.732	3544314.359	1330.370	1330.330	0.04
2037_2019_NM	137749.422	3543076.733	1333.564	1333.510	0.054
2038_2018_NM	350995.517	3531270.883	1198.822	1198.780	0.042
2039_2018_NM	350453.461	3540446.335	1191.218	1191.200	0.018
2040_2019_NM	130323.049	3540801.989	1349.782	1349.780	0.002
2041_2019_NM	97733.429	3715051.583	2180.691	2180.720	0.029
2041A_2019_NM	97721.736	3715060.870	2180.876	2180.930	0.054
2042_2019_NM	127235.211	3540105.344	1320.745	1320.710	0.035
2043_2019_NM	97296.153	3689773.140	1673.066	1673.120	0.054
2044_2019_NM	124992.407	3540353.567	1286.983	1286.950	0.033
2044A_2019_NM	125010.594	3540369.015	1289.308	1289.270	0.038
2045_2018_NM	350599.391	3536779.400	1200.573	1200.490	0.083
2046_2019_NM	121271.491	3539290.183	1242.181	1242.180	0.001
2047_2018_NM	348279.274	3542658.710	1159.277	1159.230	0.047
2048_2018_NM	349891.419	3544579.079	1189.222	1189.200	0.022
2049_2018_NM	350327.267	3532073.289	1185.433	1185.430	0.003

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2050A_2019_NM	239741.947	3573518.326	1324.536	1324.510	0.026
2050B_2019_NM	239758.411	3573520.252	1324.423	1324.390	0.033
2051A_2019_NM	241931.471	3572368.716	1315.593	1315.520	0.073
2051B_2019_NM	241932.619	3572354.943	1315.612	1315.570	0.042
2052_2019_NM	244358.222	3573671.692	1311.640	1311.590	0.05
2053_2018_NM	348076.047	3549332.755	1184.941	1184.890	0.051
2054_2018_NM	336420.259	3571055.286	1205.441	1205.420	0.021
2055_2018_NM	323005.786	3573319.522	1274.964	1274.930	0.034
2056_2018_NM	343375.984	3536300.270	1152.854	1152.850	0.004
2057_2018_NM	285064.136	3569619.691	1303.866	1303.850	0.016
2058_2018_NM	299258.581	3570000.690	1327.906	1327.920	0.014
2059_2018_NM	301370.930	3570247.179	1335.562	1335.550	0.012
2060_2018_NM	310996.870	3571255.025	1349.196	1349.210	0.014
2061_2018_NM	324150.686	3573321.956	1262.493	1262.520	0.027
2062_2018_NM	327967.124	3573996.067	1184.486	1184.500	0.014
2063_2018_NM	329248.975	3574365.102	1193.393	1193.400	0.007
2064_2018_NM	331093.910	3574154.805	1188.989	1188.980	0.009
2065_2018_NM	333507.328	3573108.476	1183.292	1183.250	0.042
2066A_2018_NM	334705.949	3573128.423	1187.105	1187.100	0.005
2066B_2018_NM	334715.033	3573129.441	1187.291	1187.290	0.001
2067_2018_NM	337232.143	3570034.030	1208.278	1208.270	0.008
2068_2018_NM	336404.386	3567653.617	1179.143	1179.160	0.017
2069_2018_NM	346079.035	3524898.896	1151.612	1151.620	0.008
2070_2018_NM	336576.747	3558784.728	1171.235	1171.240	0.005
2071_2018_NM	345516.093	3555275.437	1190.973	1190.920	0.053
2072_2018_NM	345521.097	3544496.632	1157.531	1157.530	0.001
2073_2018_NM	350248.531	3529899.918	1173.982	1173.950	0.032
2074_2018_NM	349008.802	3539684.470	1165.204	1165.170	0.034
2075_2018_NM	348519.015	3535054.523	1152.953	1152.940	0.013
2076A_2018_NM	350086.088	3522252.309	1139.748	1139.830	0.082
2076B_2018_NM	350095.309	3522252.399	1139.884	1139.900	0.016
2077_2018_NM	350216.589	3528483.195	1180.719	1180.730	0.011
2078_2018_NM	296301.967	3568448.412	1320.190	1320.240	0.05
2079_2019_NM	249843.383	3525640.204	1249.377	1249.410	0.033

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2080_2018_NM	332294.121	3578704.203	1201.905	1201.950	0.045
2081_2019_NM	110729.395	3517508.442	1304.700	1304.670	0.03
2082A_2019_NM	165739.228	3536435.403	1371.463	1371.500	0.037
2082B_2019_NM	165728.044	3536424.323	1371.289	1371.300	0.011
2083_2019_NM	114616.267	3573947.371	1196.212	1196.220	0.008
2084_2019_NM	147975.311	3585643.133	1303.446	1303.480	0.034
2085_2019_NM	139998.644	3599923.749	1300.187	1300.210	0.023
2086_2019_NM	157663.610	3582799.745	1280.826	1280.850	0.024
2087A_2019_NM	150469.880	3585179.471	1300.926	1300.970	0.044
2087B_2019_NM	150480.246	3585175.883	1300.856	1300.880	0.024
2088_2019_NM	131131.304	3608768.602	1303.149	1303.170	0.021
2089_2019_NM	127065.506	3613853.373	1266.415	1266.450	0.035
2090_2019_NM	127226.919	3622833.620	1160.152	1160.130	0.022
2091_2019_NM	128799.855	3621643.473	1163.591	1163.550	0.041
2092_2018_NM	333458.883	3580585.272	1252.646	1252.590	0.056
2093_2018_NM	283747.972	3642143.098	1288.751	1288.870	0.119
2094_2019_NM	118790.464	3620532.619	1165.128	1165.180	0.052
2095_2019_NM	115821.182	3626891.978	1116.487	1116.460	0.027
2096A_2019_NM	116626.136	3627956.169	1125.352	1125.360	0.008
2096B_2019_NM	116642.635	3627955.480	1125.423	1125.400	0.023
2097_2019_NM	114607.420	3631032.097	1127.484	1127.470	0.014
2098_2019_NM	206030.680	3623751.425	1754.578	1754.510	0.068
2099_2019_NM	206882.696	3625094.073	1722.150	1722.090	0.06
2100_2019_NM	206194.271	3628320.259	1768.002	1767.990	0.012
2101_2019_NM	203291.744	3631423.995	1827.627	1827.600	0.027
2102_2019_NM	201797.383	3631372.924	1846.002	1845.950	0.052
2103_2019_NM	199788.075	3631768.631	1854.801	1854.810	0.009
2104_2019_NM	205094.208	3631172.115	1828.296	1828.270	0.026
2105A_2019_NM	193789.934	3633911.032	1870.452	1870.440	0.012
2105B_2019_NM	193789.550	3633902.239	1870.296	1870.290	0.006
2106A_2019_NM	193186.644	3631440.627	1801.660	1801.650	0.01
2106B_2019_NM	193199.327	3631455.980	1801.670	1801.680	0.01
2107_2019_NM	191085.059	3630561.984	1898.192	1898.180	0.012
2108_2019_NM	193774.841	3632746.287	1833.233	1833.270	0.037

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2109_2019_NM	190765.215	3624164.990	1737.650	1737.620	0.03
2110_2019_NM	184898.707	3629253.518	1801.279	1801.230	0.049
2111_2019_NM	174689.203	3632448.028	1524.607	1524.580	0.027
2112_2019_NM	171819.260	3638650.354	1454.756	1454.740	0.016
2113_2019_NM	170717.023	3643088.577	1491.083	1491.050	0.033
2114_2019_NM	165824.276	3650192.928	1413.448	1413.490	0.042
2114A_2019_NM	165153.960	3650913.428	1410.150	1410.140	0.01
2114B_2019_NM	165184.083	3650918.291	1410.484	1410.480	0.004
2115_2018_NM	307070.169	3617267.929	1255.493	1255.570	0.077
2116_2019_NM	163683.916	3649468.924	1364.032	1364.010	0.022
2117A_2019_NM	160600.455	3654675.072	1386.906	1386.860	0.046
2117B_2019_NM	160622.957	3654654.473	1386.842	1386.800	0.042
2118_2019_NM	131069.645	3671720.814	1606.724	1606.760	0.036
2119_2019_NM	118395.765	3664401.259	1891.864	1891.830	0.034
2120_2019_NM	139850.513	3685631.140	1480.391	1480.450	0.059
2121_2019_NM	139245.963	3686781.713	1418.562	1418.600	0.038
2122_2018_NM	354989.839	3518576.150	1139.074	1139.060	0.014
2123_2019_NM	139479.667	3694118.916	1458.908	1458.910	0.002
2124_2019_NM	136724.788	3722147.629	1958.500	1958.540	0.04
2125_2018_NM	298209.616	3618253.052	1250.494	1250.510	0.016
2126_2019_NM	142012.127	3734810.900	1947.609	1947.670	0.061
2127_2019_NM	134888.249	3740052.616	2436.021	2436.070	0.049
2128_2019_NM	134372.427	3746897.278	2161.756	2161.820	0.064
2129_2019_NM	133899.787	3748987.848	2144.750	2144.820	0.07
2130_2018_NM	350622.056	3527086.453	1176.203	1176.150	0.053
2131_2018_NM	279393.300	3680211.494	1462.640	1462.630	0.01
2132_2018_NM	288370.451	3679904.824	1472.639	1472.630	0.009
2133_2018_NM	291243.961	3672699.071	1348.250	1348.320	0.07
2134_2018_NM	290403.475	3669992.503	1347.335	1347.390	0.055
2135_2018_NM	287184.492	3667063.611	1298.297	1298.300	0.003
2136A_2018_NM	285860.202	3666430.514	1291.319	1291.250	0.069
2136B_2018_NM	285873.738	3666437.247	1291.384	1291.360	0.024
2137_2018_NM	285456.090	3660570.828	1303.391	1303.340	0.051
2138_2018_NM	283881.990	3648393.633	1310.655	1310.710	0.055

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2139_2018_NM	283615.342	3646691.671	1292.113	1292.130	0.017
2140_2018_NM	283262.945	3644674.810	1297.409	1297.460	0.051
2141_2018_NM	284079.713	3643487.401	1299.310	1299.290	0.02
2142_2018_NM	285564.229	3641398.672	1266.572	1266.520	0.052
2143_2018_NM	283472.879	3640401.016	1281.156	1281.060	0.096
2144_2018_NM	282916.755	3636902.969	1274.773	1274.850	0.077
2145_2018_NM	285437.997	3631224.233	1263.769	1263.750	0.019
2146_2018_NM	292524.979	3620665.187	1243.150	1243.130	0.02
2147_2018_NM	297710.771	3616241.992	1236.277	1236.340	0.063
2148_2018_NM	299782.799	3615432.430	1234.353	1234.320	0.033
2149_2018_NM	305235.935	3616439.801	1234.599	1234.650	0.051
2150_2018_NM	306554.901	3612823.646	1227.705	1227.780	0.075
2151_2018_NM	317596.754	3597304.350	1214.197	1214.230	0.033
2152_2018_NM	319703.970	3596821.881	1223.262	1223.370	0.108
2153_2018_NM	342418.891	3561125.144	1190.222	1190.170	0.052
2154_2018_NM	329371.559	3585021.485	1207.543	1207.610	0.067
2155_2018_NM	331279.875	3582774.261	1213.187	1213.190	0.003
2156A_2018_NM	336742.389	3577635.051	1265.245	1265.210	0.035
2156B_2018_NM	336752.266	3577623.378	1264.944	1264.930	0.014
2157_2018_NM	335990.119	3582850.162	1315.495	1315.500	0.005
2158_2018_NM	339434.016	3585021.115	1345.490	1345.450	0.04
2159_2018_NM	344630.852	3586665.544	1399.382	1399.350	0.032
2160_2018_NM	344984.058	3589568.514	1398.882	1398.830	0.052
2161_2018_NM	349268.854	3588591.882	1532.566	1532.480	0.086
2162_2019_NM	164797.157	3749650.867	1957.255	1957.320	0.065
2163_2018_NM	178558.241	3805657.207	2100.555	2100.560	0.005
2164_2019_NM	167242.846	3801290.057	2305.598	2305.660	0.062
2165_2019_NM	168876.393	3801821.532	2324.747	2324.780	0.033
2166_2019_NM	165533.156	3800803.684	2307.902	2307.890	0.012
2167_2019_NM	148544.492	3795345.079	2166.744	2166.830	0.086
2168_2019_NM	141560.031	3792812.645	2232.756	2232.690	0.066
2169_2019_NM	138783.950	3792057.465	2307.764	2307.800	0.036
2170_2019_NM	127004.713	3788048.767	2243.668	2243.610	0.058
2171_2019_NM	122439.157	3787433.718	2222.375	2222.430	0.055

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2171A_2019_NM	138695.454	3791993.843	2308.578	2308.600	0.022
2172_2019_NM	160893.863	3761036.882	2078.445	2078.490	0.045
2173_2019_NM	160464.181	3767863.937	2335.058	2335.070	0.012
2174_2019_NM	171790.693	3785020.554	2333.700	2333.750	0.05
2175_2018_NM	249412.493	3778799.584	2157.732	2157.730	0.002
2176_2018_NM	195096.429	3802102.228	2192.374	2192.370	0.004
2177_2019_NM	133220.087	3790226.153	2302.540	2302.490	0.05
2178_2019_NM	162301.771	3652953.970	1374.785	1374.790	0.005
2179_2018_NM	172436.246	3809756.541	2087.750	2087.770	0.02
2180_2018_NM	164552.765	3814554.676	2014.761	2014.840	0.079
2181_2018_NM	159909.857	3816818.319	1983.266	1983.240	0.026
2182_2018_NM	159447.911	3820847.828	1948.680	1948.700	0.02
2183_2018_NM	165110.075	3824096.523	1978.553	1978.610	0.057
2184_2019_NM	101429.513	3628327.863	1276.536	1276.540	0.004
2185_2018_NM	175279.812	3826156.341	2055.340	2055.390	0.05
2186_2018_NM	179936.946	3825314.088	2063.035	2062.980	0.055
2187_2018_NM	183400.955	3823975.232	2094.103	2094.160	0.057
2187A_2018_NM	183395.465	3823906.975	2094.217	2094.260	0.043
2188_2018_NM	185759.333	3820674.749	2167.162	2167.210	0.048
2188A_2018_NM	185766.371	3820672.037	2167.401	2167.400	0.001
2189_2018_NM	183592.206	3811927.314	2231.704	2231.760	0.056
2190_2018_NM	189299.335	3832318.967	2262.704	2262.700	0.004
2191_2018_NM	188463.069	3834034.228	2285.393	2285.430	0.037
2192_2018_NM	184659.248	3836855.293	2252.584	2252.610	0.026
2193_2018_NM	172787.354	3840431.070	2222.104	2222.150	0.046
2194_2018_NM	179545.970	3839600.614	2231.386	2231.400	0.014
2195_2018_NM	160456.537	3835940.159	2228.886	2228.900	0.014
2196_2019_NM	128214.209	3540276.321	1331.189	1331.130	0.059
2197_2019_NM	92887.255	3631179.504	1243.732	1243.740	0.008
2198_2019_NM	155734.458	3834216.596	2233.395	2233.370	0.025
2199_2019_NM	152654.279	3823910.351	1919.597	1919.640	0.043
2200_2019_NM	124736.362	3820804.252	1927.003	1926.990	0.013
2201_2018_NM	197440.611	3834680.021	2223.996	2224.030	0.034
2202_2019_NM	225267.914	3839127.178	2181.063	2181.000	0.063

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2203_2019_NM	222614.445	3844300.593	2159.121	2159.100	0.021
2204_2019_NM	226032.901	3843439.410	2158.539	2158.570	0.031
2205_2019_NM	237152.826	3889563.901	1980.976	1981.000	0.024
2206_2018_NM	215982.658	3812177.583	2263.189	2263.170	0.019
2207_2018_NM	210933.151	3804089.684	2285.398	2285.390	0.008
2208_2018_NM	207784.913	3807630.869	2306.536	2306.530	0.006
2209_2018_NM	206245.416	3808992.497	2298.106	2298.110	0.004
2210_2018_NM	204568.421	3810175.305	2290.562	2290.610	0.048
2211_2018_NM	204087.473	3812752.079	2289.395	2289.490	0.095
2212_2018_NM	200586.462	3815340.131	2279.692	2279.730	0.038
2213_2018_NM	202969.948	3815117.352	2293.034	2293.070	0.036
2214_2019_NM	112045.783	3624118.039	1188.167	1188.120	0.047
2215_2018_NM	198155.868	3819353.622	2270.595	2270.640	0.045
2216_2018_NM	194472.926	3821059.338	2206.619	2206.630	0.011
2217_2019_NM	163383.506	3487463.819	1384.616	1384.610	0.006
2218_2018_NM	192040.397	3822434.213	2193.139	2193.170	0.031
2219_2018_NM	212426.499	3802910.638	2300.729	2300.750	0.021
2220_2018_NM	213773.782	3803999.487	2317.398	2317.460	0.062
2221_2018_NM	201150.481	3800976.957	2239.265	2239.310	0.045
2222_2018_NM	211124.753	3800086.889	2344.945	2344.990	0.045
2223_2018_NM	212548.405	3799483.847	2380.077	2380.090	0.013
2224_2018_NM	218502.367	3797637.101	2372.050	2372.050	0
2225_2019_NM	109581.830	3538359.406	1425.128	1425.130	0.002
2226_2018_NM	225521.302	3795627.995	2421.657	2421.640	0.017
2227_2018_NM	230475.395	3790357.773	2363.394	2363.420	0.026
2228_2018_NM	224318.934	3799495.341	2463.837	2463.880	0.043
2229_2018_NM	236453.927	3783953.496	2261.861	2261.890	0.029
2230_2018_NM	237879.710	3781872.248	2249.398	2249.360	0.038
2231_2018_NM	357384.518	3517587.112	1189.833	1189.860	0.027
2232_2018_NM	274937.418	3773036.129	2169.505	2169.480	0.025
2233_2018_NM	260309.737	3772270.811	2140.042	2139.990	0.052
2234_2018_NM	257446.024	3773474.840	2125.792	2125.800	0.008
2235_2018_NM	257401.490	3763359.463	2245.128	2245.120	0.008
2236_2018_NM	252498.558	3759506.490	2192.119	2192.100	0.019

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2237_2018_NM	250230.408	3745757.604	2201.456	2201.530	0.074
2238_2018_NM	253405.237	3734689.401	2128.611	2128.640	0.029
2239_2018_NM	252456.964	3729804.086	2015.947	2015.970	0.023
2240_2018_NM	253227.467	3725082.737	1977.201	1977.270	0.069
2240A_2018_NM	253229.343	3725086.236	1977.392	1977.440	0.048
2241_2018_NM	253770.189	3723921.998	1964.663	1964.700	0.037
2241A_2018_NM	253778.918	3723904.885	1964.194	1964.180	0.014
2242_2018_NM	254000.196	3721462.400	1936.358	1936.350	0.008
2243_2018_NM	256856.402	3718917.573	1911.359	1911.350	0.009
2244_2018_NM	253581.719	3713208.455	1985.744	1985.700	0.044
2245_2018_NM	251468.186	3706544.344	2106.011	2105.950	0.061
2246_2018_NM	249736.509	3701475.593	1990.580	1990.650	0.07
2247_2018_NM	250257.820	3700017.997	1967.414	1967.380	0.034
2248_2018_NM	251987.053	3695946.246	1913.950	1913.980	0.03
2249_2018_NM	261419.656	3693672.917	1886.670	1886.690	0.02
2250_2018_NM	265294.079	3689518.568	1779.336	1779.380	0.044
2251_2018_NM	274116.762	3683175.284	1597.289	1597.280	0.009
2252_2018_NM	276913.078	3681932.379	1558.099	1558.120	0.021
2253_2018_NM	278488.298	3681069.820	1524.814	1524.840	0.026
2254_2018_NM	280480.040	3679815.987	1455.800	1455.770	0.03
2255_2018_NM	281474.420	3680988.253	1524.444	1524.450	0.006
2256_2018_NM	281613.479	3681631.926	1534.318	1534.260	0.058
2257_2018_NM	282669.644	3681797.968	1525.411	1525.390	0.021
2258_2018_NM	285250.537	3682085.212	1503.964	1504.000	0.036
2259_2018_NM	287090.538	3681715.251	1488.488	1488.470	0.018
2260_2018_NM	288382.013	3681561.898	1477.040	1477.060	0.02
2261_2018_NM	289935.558	3675534.726	1391.692	1391.670	0.022
2262_2018_NM	291735.078	3668505.253	1318.363	1318.400	0.037
2263_2018_NM	290067.259	3669012.136	1320.207	1320.210	0.003
2264A_2018_NM	290237.671	3667884.140	1292.814	1292.800	0.014
2264B_2018_NM	290234.777	3667877.108	1292.810	1292.790	0.02
2265_2018_NM	285647.761	3664671.727	1292.316	1292.260	0.056
2266_2018_NM	285335.621	3665648.363	1307.369	1307.370	0.001
2267_2018_NM	284929.376	3657935.536	1308.477	1308.450	0.027

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2268_2018_NM	284541.711	3656896.922	1308.106	1308.130	0.024
2269_2018_NM	283414.785	3653571.654	1359.752	1359.760	0.008
2270_2018_NM	284009.993	3655356.715	1313.455	1313.490	0.035
2271_2018_NM	284673.235	3651981.188	1295.868	1295.870	0.002
2272_2018_NM	283956.527	3649805.699	1290.146	1290.160	0.014
2273_2018_NM	282270.015	3649996.492	1303.015	1303.040	0.025
2274_2018_NM	279439.451	3650801.186	1329.452	1329.410	0.042
2275_2018_NM	276879.474	3651319.573	1358.826	1358.870	0.044
2276_2018_NM	274620.969	3651107.262	1460.530	1460.490	0.04
2277_2018_NM	267736.416	3649582.432	1565.391	1565.400	0.009
2278_2018_NM	266737.349	3648044.834	1577.584	1577.520	0.064
2279_2019_NM	263833.042	3647250.361	1679.124	1679.140	0.016
2280_2019_NM	261833.823	3646674.401	1668.995	1668.980	0.015
2281_2019_NM	261474.752	3645576.894	1598.046	1598.000	0.046
2282_2019_NM	260339.084	3645573.249	1594.518	1594.540	0.022
2283_2019_NM	259683.507	3643946.941	1652.303	1652.360	0.057
2284_2019_NM	258224.162	3644989.061	1628.008	1627.990	0.018
2285_2019_NM	262356.017	3639668.692	1607.651	1607.600	0.051
2286_2019_NM	262477.817	3636776.112	1605.863	1605.830	0.033
2287_2019_NM	262336.951	3634988.303	1595.417	1595.410	0.007
2288_2019_NM	261989.806	3632313.348	1597.187	1597.150	0.037
2289_2019_NM	261966.359	3630469.762	1559.548	1559.510	0.038
2290_2019_NM	261529.536	3628907.801	1570.960	1570.880	0.08
2291_2019_NM	261159.293	3627038.887	1561.145	1561.080	0.065
2292_2019_NM	258380.968	3623327.760	1679.836	1679.790	0.046
2292A_2019_NM	258381.282	3623327.754	1679.829	1679.750	0.079
2293_2019_NM	259749.153	3622527.142	1626.242	1626.190	0.052
2294_2019_NM	262878.728	3619608.581	1539.185	1539.160	0.025
2295_2019_NM	263952.868	3616939.787	1510.466	1510.420	0.046
2296_2019_NM	266474.837	3610274.664	1458.979	1458.910	0.069
2297_2019_NM	268866.976	3607601.679	1437.241	1437.170	0.071
2298_2019_NM	268386.778	3605539.828	1427.764	1427.740	0.024
2299_2019_NM	274513.334	3606625.533	1406.128	1406.090	0.038
2300_2019_NM	276291.448	3607314.955	1381.498	1381.450	0.048

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2300A_2019_NM	276054.741	3607230.828	1385.154	1385.130	0.024
2300B_2019_NM	276054.153	3607219.873	1385.070	1385.020	0.05
2301_2018_NM	284268.376	3610474.854	1364.950	1364.940	0.01
2302_2018_NM	285840.317	3611092.865	1371.723	1371.740	0.017
2303_2018_NM	299043.106	3616480.248	1235.924	1235.940	0.016
2304_2018_NM	290088.612	3612876.656	1353.324	1353.290	0.034
2305_2018_NM	292264.934	3613859.538	1312.186	1312.210	0.024
2306_2018_NM	295195.783	3615319.715	1257.406	1257.440	0.034
2307_2018_NM	294862.525	3616083.027	1242.027	1242.090	0.063
2308_2018_NM	296870.608	3617100.956	1238.313	1238.320	0.007
2309_2018_NM	295714.549	3617335.151	1238.910	1238.930	0.02
2310_2018_NM	296538.131	3615992.534	1246.654	1246.700	0.046
2311_2018_NM	294458.184	3618811.282	1239.317	1239.340	0.023
2312_2018_NM	287823.355	3626383.162	1250.683	1250.600	0.083
2313_2018_NM	290337.600	3622535.107	1244.830	1244.850	0.02
2314_2018_NM	287229.130	3629218.271	1254.443	1254.460	0.017
2315_2018_NM	287826.646	3629801.261	1273.978	1273.970	0.008
2316_2018_NM	303565.585	3616492.167	1232.219	1232.220	0.001
2317_2018_NM	300116.604	3617142.849	1235.500	1235.540	0.04
2318_2018_NM	302824.973	3614492.241	1234.921	1234.930	0.009
2319_2018_NM	309847.405	3610695.112	1236.918	1236.970	0.052
2320_2018_NM	312037.474	3606216.566	1219.722	1219.780	0.058
2321_2018_NM	313500.514	3600262.645	1218.944	1219.020	0.076
2322_2018_NM	312241.540	3603112.824	1218.038	1218.100	0.062
2323_2018_NM	316060.299	3599299.725	1212.440	1212.500	0.06
2324_2018_NM	210866.436	3702583.481	2042.365	2042.310	0.055
2325_2018_NM	210044.159	3705074.319	2071.465	2071.430	0.035
2326_2018_NM	210097.429	3706793.562	2089.563	2089.590	0.027
2327_2018_NM	209334.140	3708612.284	2091.630	2091.670	0.04
2328_2018_NM	207796.220	3713357.924	2106.665	2106.630	0.035
2329_2019_NM	216155.281	3721786.040	2225.561	2225.570	0.009
2330_2019_NM	220200.123	3724065.671	2239.728	2239.740	0.012
2331_2019_NM	221594.514	3724023.570	2256.081	2256.100	0.019
2332_2019_NM	223188.253	3724554.739	2342.030	2341.990	0.04

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2333_2019_NM	228847.947	3727239.386	2317.397	2317.250	0.147
2334_2018_NM	234678.375	3730705.581	2362.668	2362.600	0.068
2335_2018_NM	235881.337	3731000.674	2323.391	2323.390	0.001
2336_2018_NM	243951.416	3740625.832	2211.696	2211.670	0.026
2337_2018_NM	244847.685	3743659.931	2190.237	2190.230	0.007
2338_2018_NM	249891.483	3752140.721	2177.702	2177.720	0.018
2339_2018_NM	250745.516	3755362.222	2206.316	2206.280	0.036
2340_2018_NM	255532.043	3761129.963	2224.700	2224.700	0
2341_2018_NM	244718.893	3779865.964	2188.555	2188.580	0.025
2342_2018_NM	258931.791	3768943.076	2208.312	2208.280	0.032
2343_2018_NM	251823.915	3769555.783	2122.177	2122.180	0.003
2344_2018_NM	244341.531	3769886.692	2133.986	2134.050	0.064
2345_2018_NM	230209.777	3769301.423	2133.067	2133.080	0.013
2346_2018_NM	230820.996	3767815.851	2120.796	2120.820	0.024
2347_2018_NM	231404.769	3764083.985	2103.341	2103.390	0.049
2348_2018_NM	232794.617	3756935.053	2107.770	2107.750	0.02
2349_2019_NM	213880.696	3720693.484	2204.827	2204.790	0.037
2349A_2019_NM	220822.722	3724161.537	2263.889	2263.940	0.051
2350_2019_NM	194801.773	3716704.922	2224.902	2224.930	0.028
2351_2019_NM	192541.455	3717319.774	2253.441	2253.470	0.029
2352_2019_NM	188745.558	3718310.504	2300.503	2300.540	0.037
2353_2019_NM	101219.417	3541553.300	1646.220	1646.270	0.05
2353A_2019_NM	101252.509	3541515.494	1646.002	1646.030	0.028
2354_2019_NM	186127.555	3720349.205	2336.633	2336.640	0.007
2355_2019_NM	179809.043	3725533.305	2308.726	2308.780	0.054
2356_2019_NM	178440.812	3727678.976	2275.824	2275.860	0.036
2357_2019_NM	176085.464	3720920.397	2548.139	2548.190	0.051
2358_2019_NM	172943.811	3715350.849	2397.930	2397.940	0.01
2359_2019_NM	170882.623	3712241.623	2450.988	2451.040	0.052
2360_2019_NM	169596.335	3710288.237	2485.452	2485.520	0.068
2361_2019_NM	165422.196	3707579.278	2620.346	2620.440	0.094
2362_2019_NM	164656.726	3706504.927	2608.695	2608.800	0.105
2363_2019_NM	165920.866	3705182.034	2574.051	2574.140	0.089
2364_2019_NM	146839.577	3701857.670	2001.968	2002.000	0.032

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2365_2019_NM	145593.969	3701849.226	2150.780	2150.820	0.04
2366_2019_NM	144221.934	3701866.766	2011.586	2011.620	0.034
2367_2019_NM	142624.474	3700558.285	1773.929	1774.010	0.081
2368_2019_NM	266552.785	3602647.201	1418.524	1418.460	0.064
2369_2019_NM	263421.568	3597965.518	1404.619	1404.620	0.001
2370_2019_NM	259972.544	3592932.593	1388.787	1388.730	0.057
2371_2018_NM	348597.905	3548091.720	1188.482	1188.500	0.018
2372_2019_NM	255855.299	3586974.094	1368.009	1368.030	0.021
2373_2018_NM	350516.619	3542646.529	1193.189	1193.190	0.001
2374_2019_NM	253664.596	3583960.870	1356.808	1356.770	0.038
2375_2019_NM	250542.696	3580997.539	1336.376	1336.350	0.026
2376_2019_NM	249467.104	3580174.756	1336.696	1336.600	0.096
2377_2019_NM	249530.504	3580123.598	1334.987	1334.970	0.017
2378_2019_NM	247413.690	3578667.400	1330.794	1330.740	0.054
2379_2019_NM	245789.785	3577468.194	1323.271	1323.150	0.121
2380_2019_NM	244073.566	3576703.652	1319.110	1319.010	0.1
2381_2019_NM	242406.727	3573939.489	1317.355	1317.300	0.055
2382_2019_NM	241078.655	3576025.461	1324.788	1324.680	0.108
2383_2019_NM	239906.146	3575650.023	1327.067	1327.030	0.037
2384_2019_NM	240570.331	3574064.490	1321.187	1321.160	0.027
2385_2019_NM	239259.411	3574743.478	1326.290	1326.270	0.02
2386_2019_NM	238354.404	3571992.728	1324.089	1324.110	0.021
2387_2019_NM	235335.111	3574565.245	1338.445	1338.410	0.035
2388_2019_NM	236451.619	3580011.103	1350.279	1350.250	0.029
2389_2019_NM	231438.851	3585950.139	1396.970	1396.990	0.02
2390_2019_NM	232714.147	3584434.546	1383.376	1383.370	0.006
2391_2019_NM	87855.043	3492448.841	1353.039	1353.020	0.019
2392_2019_NM	229435.356	3588306.832	1417.086	1417.060	0.026
2393_2019_NM	228547.028	3589378.212	1424.485	1424.460	0.025
2394_2019_NM	227854.679	3590200.028	1428.869	1428.880	0.011
2395_2019_NM	226489.982	3591813.997	1437.229	1437.200	0.029
2396_2019_NM	225589.145	3592879.733	1441.427	1441.390	0.037
2397_2019_NM	223084.033	3595822.434	1452.215	1452.210	0.005
2398_2019_NM	221857.724	3597300.933	1464.449	1464.460	0.011

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2399_2019_NM	223343.790	3598549.079	1470.060	1470.110	0.05
2400_2019_NM	220162.614	3599280.237	1481.459	1481.490	0.031
2400A_2019_NM	220149.726	3599273.907	1481.432	1481.440	0.008
2401_2019_NM	219643.577	3599914.429	1485.166	1485.180	0.014
2402_2019_NM	88193.099	3475381.093	1211.333	1211.310	0.023
2402A_2019_NM	89968.591	3474648.269	1170.404	1170.350	0.054
2403_2019_NM	218924.296	3600765.440	1485.418	1485.440	0.022
2404_2019_NM	217389.192	3602571.380	1492.527	1492.530	0.003
2405_2019_NM	216431.746	3603753.082	1505.518	1505.520	0.002
2406_2019_NM	219143.395	3605768.757	1538.363	1538.380	0.017
2407_2019_NM	220643.197	3606802.739	1569.686	1569.690	0.004
2408_2019_NM	220646.148	3608090.782	1598.259	1598.240	0.019
2409_2019_NM	220928.155	3609135.315	1581.619	1581.640	0.021
2410_2019_NM	220300.100	3610125.557	1591.277	1591.310	0.033
2411_2019_NM	222797.862	3607300.605	1572.628	1572.620	0.008
2412_2019_NM	224295.270	3608024.515	1550.985	1551.000	0.015
2413_2019_NM	225636.620	3609338.712	1545.319	1545.290	0.029
2414_2019_NM	227206.760	3610851.415	1562.748	1562.760	0.012
2415_2019_NM	228397.775	3611132.080	1556.557	1556.570	0.013
2416_2019_NM	230738.226	3613492.859	1579.852	1579.890	0.038
2417_2019_NM	231322.375	3614013.426	1586.650	1586.680	0.03
2418_2019_NM	232686.612	3616565.201	1607.754	1607.780	0.026
2419_2019_NM	233325.399	3617956.798	1616.398	1616.410	0.012
2420_2019_NM	233501.283	3619312.795	1652.614	1652.600	0.014
2421_2019_NM	233551.837	3620016.809	1634.943	1634.980	0.037
2422_2019_NM	233244.252	3620679.327	1639.644	1639.630	0.014
2423_2019_NM	233087.679	3621450.463	1646.512	1646.590	0.078
2424_2019_NM	232999.497	3622555.641	1650.517	1650.540	0.023
2425_2019_NM	232411.473	3623704.558	1658.295	1658.300	0.005
2426_2019_NM	231350.723	3625035.512	1668.463	1668.450	0.013
2427_2019_NM	232268.668	3626152.099	1714.492	1714.520	0.028
2428_2019_NM	229989.627	3626124.299	1685.960	1685.950	0.01
2429_2019_NM	233921.783	3626772.576	1743.779	1743.780	0.001
2430_2019_NM	235154.837	3626976.914	1783.092	1783.100	0.008

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2431_2019_NM	232249.063	3627169.321	1758.388	1758.400	0.012
2432_2019_NM	232474.943	3628080.477	1804.386	1804.420	0.034
2433_2019_NM	232801.372	3629144.906	1868.601	1868.630	0.029
2434_2019_NM	269918.139	3606905.049	1438.358	1438.330	0.028
2435_2019_NM	234168.262	3632603.683	1972.193	1972.190	0.003
2436_2019_NM	234714.858	3633921.332	2002.003	2002.020	0.017
2437_2019_NM	234707.601	3635132.161	2018.277	2018.270	0.007
2438_2019_NM	236061.442	3635878.069	2054.827	2054.820	0.007
2438A_2019_NM	236087.127	3635916.448	2057.085	2057.110	0.025
2439_2019_NM	226862.657	3631833.722	1728.134	1728.120	0.014
2440_2019_NM	225076.941	3633394.467	1782.208	1782.250	0.042
2441_2019_NM	220398.889	3633777.775	1941.654	1941.690	0.036
2442_2019_NM	218352.975	3634555.880	1977.821	1977.810	0.011
2443_2019_NM	217339.236	3634549.726	2022.186	2022.240	0.054
2444_2019_NM	216277.060	3634310.405	2049.468	2049.550	0.082
2445_2019_NM	214875.738	3634066.172	2008.082	2008.140	0.058
2446_2019_NM	212481.545	3634128.532	2008.129	2008.200	0.071
2447_2019_NM	213624.983	3633962.077	1987.597	1987.600	0.003
2448_2019_NM	210990.895	3634173.104	1926.101	1926.080	0.021
2449_2019_NM	211121.566	3635298.253	1935.242	1935.260	0.018
2450_2019_NM	211632.169	3636575.840	1975.747	1975.730	0.017
2451_2019_NM	211681.314	3637957.163	2015.521	2015.530	0.009
2452_2019_NM	211870.079	3639098.774	2044.324	2044.300	0.024
2453_2019_NM	212665.148	3640641.826	2111.441	2111.410	0.031
2454_2019_NM	213928.549	3642183.831	2114.189	2114.150	0.039
2455_2019_NM	213489.353	3641556.545	2107.379	2107.360	0.019
2456_2019_NM	206777.185	3629465.977	1777.867	1777.840	0.027
2457_2019_NM	208367.063	3634608.084	1961.193	1961.160	0.033
2458_2019_NM	207546.362	3633634.233	1936.179	1936.170	0.009
2459_2019_NM	205052.003	3629993.362	1801.709	1801.710	0.001
2460_2019_NM	206861.077	3630139.037	1789.609	1789.570	0.039
2460A_2019_NM	206854.168	3630100.100	1789.303	1789.280	0.023
2461_2019_NM	208103.908	3631026.332	1818.322	1818.280	0.042
2462_2019_NM	209384.554	3632612.266	1877.743	1877.780	0.037

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2463_2019_NM	207145.627	3622829.728	1745.909	1745.880	0.029
2464_2019_NM	206409.566	3621130.946	1723.506	1723.500	0.006
2465_2019_NM	206260.613	3616398.329	1649.868	1649.920	0.052
2466_2019_NM	206609.185	3615342.993	1630.496	1630.500	0.004
2467_2019_NM	207488.327	3614354.283	1623.136	1623.170	0.034
2468_2019_NM	208869.235	3612713.254	1603.477	1603.520	0.043
2469_2019_NM	104693.735	3484196.698	1305.173	1305.160	0.013
2470_2019_NM	203936.463	3614687.568	1638.149	1638.190	0.041
2471_2019_NM	205281.439	3614668.902	1636.004	1636.050	0.046
2472_2019_NM	202447.317	3614595.331	1615.136	1615.190	0.054
2473_2019_NM	160549.260	3580613.277	1288.066	1288.070	0.004
2474_2019_NM	201651.848	3615383.322	1638.156	1638.190	0.034
2475_2019_NM	212346.712	3608580.269	1554.732	1554.720	0.012
2476_2019_NM	211296.059	3609826.191	1568.631	1568.590	0.041
2477_2019_NM	209786.637	3611616.369	1588.639	1588.580	0.059
2478_2019_NM	210573.108	3610683.654	1577.781	1577.740	0.041
2479_2019_NM	246741.680	3539834.388	1255.163	1255.150	0.013
2480_2019_NM	246155.704	3542545.248	1260.328	1260.330	0.002
2481_2019_NM	245009.970	3541497.169	1259.393	1259.360	0.033
2482_2019_NM	242731.493	3541564.905	1261.968	1261.960	0.008
2483_2019_NM	242758.022	3542890.138	1262.911	1262.940	0.029
2484_2019_NM	241058.210	3541219.042	1267.593	1267.660	0.067
2485_2019_NM	242618.259	3550572.762	1277.060	1277.110	0.05
2486_2018_NM	357085.404	3520011.804	1245.378	1245.380	0.002
2487_2018_NM	350987.603	3525701.630	1169.069	1169.060	0.009
2488_2019_NM	235006.329	3555917.390	1293.273	1293.300	0.027
2489_2019_NM	127129.615	3573471.537	1284.875	1284.880	0.005
2490A_2019_NM	139549.733	3541225.222	1341.903	1341.890	0.013
2490B_2019_NM	139565.346	3541224.706	1342.115	1342.140	0.025
2491A_2018_NM	282961.789	3636883.867	1273.588	1273.610	0.022
2492B_2018_NM	282974.119	3636883.825	1273.501	1273.520	0.019
2493A_2019_NM	205985.803	3628742.867	1782.503	1782.440	0.063
2493B_2019_NM	205996.872	3628732.459	1781.790	1781.760	0.03
2494A_2019_NM	204297.539	3632241.482	1856.214	1856.150	0.064

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2494B_2019_NM	204307.362	3632234.121	1855.622	1855.600	0.022
2495_2019_NM	105935.128	3576693.956	1111.507	1111.570	0.063
2496_2019_NM	104632.237	3576851.190	1106.251	1106.150	0.101
2497_2019_NM	102337.332	3577653.723	1102.014	1102.010	0.004
2498_2019_NM	101280.893	3577984.875	1100.263	1100.290	0.027
2500_2019_NM	80762.177	3584640.299	1130.059	1130.040	0.019
2501_2019_NM	78091.148	3585333.628	1142.463	1142.400	0.063
2502_2019_NM	75411.946	3586034.182	1163.581	1163.570	0.011
2503_2019_NM	84011.799	3633494.160	1095.334	1095.320	0.014
2504_2019_NM	66266.252	3640455.020	904.698	904.650	0.048
2505_2019_NM	100533.146	3648055.671	1301.739	1301.720	0.019
2505A_2019_NM	103589.777	3651330.958	1126.287	1126.300	0.013
2506_2019_NM	104469.322	3653377.665	1106.860	1106.830	0.03
2507_2019_NM	103954.398	3655739.795	1129.139	1129.090	0.049
2508_2019_NM	102186.077	3657266.447	1146.172	1146.180	0.008
2509_2019_NM	100422.056	3659186.739	1165.722	1165.640	0.082
2510_2019_NM	99955.054	3660228.038	1198.432	1198.400	0.032
2511_2019_NM	98599.159	3663551.734	1080.032	1080.010	0.022
2511A_2019_NM	98623.140	3663588.232	1079.220	1079.200	0.02
2512_2019_NM	98853.631	3664943.076	1053.849	1053.800	0.049
2513_2019_NM	97067.799	3665808.807	1082.610	1082.620	0.01
2514_2019_NM	95744.194	3665333.728	1244.763	1244.810	0.047
2515_2019_NM	96111.696	3663998.141	1215.442	1215.430	0.012
2516_2019_NM	95076.473	3666811.383	1308.098	1308.110	0.012
2517_2019_NM	94802.096	3667255.032	1318.835	1318.830	0.005
2518_2019_NM	105580.865	3652330.081	1078.037	1078.000	0.037
2519_2019_NM	107011.280	3651100.685	1064.040	1064.060	0.02
2520_2019_NM	107386.049	3649531.463	1067.750	1067.720	0.03
2521_2019_NM	107376.969	3648470.148	1068.603	1068.650	0.047
2522_2019_NM	107186.512	3646550.820	1098.413	1098.400	0.013
2523_2019_NM	108887.455	3640373.663	1088.621	1088.680	0.059
2524_2019_NM	109272.317	3639042.145	1098.396	1098.350	0.046
2525_2019_NM	109756.043	3636937.120	1108.537	1108.470	0.067
2526_2019_NM	110585.045	3634469.516	1110.080	1110.100	0.02

Point ID	Easting	Northing	Known Z	DEM Z	dZ
2527_2019_NM	111917.799	3632535.562	1113.814	1113.800	0.014
2528_2019_NM	116274.748	3753125.085	2437.706	2437.700	0.006
2529_2019_NM	112751.287	3762958.522	2413.794	2413.760	0.034
2529A_2019_NM	112751.133	3762958.725	2413.788	2413.760	0.028
2530_2019_NM	111923.597	3767058.638	2328.364	2328.350	0.014
2531_2019_NM	113075.028	3769979.591	2299.025	2299.000	0.025
2532_2019_NM	113354.318	3771445.776	2279.447	2279.450	0.003
2533_2019_NM	113396.943	3775324.104	2265.949	2265.960	0.011
2534_2019_NM	112790.521	3776802.111	2264.042	2264.060	0.018
2535_2019_NM	112294.994	3778286.636	2244.181	2244.170	0.011
2536_2019_NM	112151.824	3780191.274	2228.663	2228.670	0.007
2537_2019_NM	108897.589	3780071.077	2251.678	2251.670	0.008
2538_2019_NM	107837.403	3782599.190	2177.732	2177.740	0.008
2539_2019_NM	106136.272	3785111.969	2128.882	2128.880	0.002
2540_2019_NM	109357.593	3785264.248	2147.271	2147.250	0.021
2541_2019_NM	104093.860	3783853.820	2141.120	2141.140	0.02
2542_2019_NM	101940.591	3790226.643	2118.245	2118.300	0.055
2543_2019_NM	100126.593	3796186.808	2025.826	2025.910	0.084
2544_2019_NM	96996.595	3804720.269	1923.168	1923.260	0.092
2545_2019_NM	107037.298	3803599.050	2010.394	2010.350	0.044
2546_2019_NM	103182.418	3833968.909	1743.493	1743.520	0.027
2547_2019_NM	105971.922	3842809.330	1771.638	1771.640	0.002
2547A_2019_NM	115780.181	3842572.471	1834.376	1834.410	0.034
2548_2019_NM	104641.554	3840523.975	1727.207	1727.210	0.003
2549_2019_NM	93700.115	3709429.316	2511.755	2511.710	0.045
2550_2019_NM	86076.734	3796711.776	2222.706	2222.69	0.016

Appendix 4: DEM VVA Checkpoint Results

Coordinate values are listed in the following spatial reference system:

Horizontal: NAD83 (2011) UTM Zone 13, meters

Vertical: NAVD88 GEOID12B meters

Summary	
Point Count	389
Root Mean Square Error	0.098 m
95th Percentile	0.169 m
Mean of Residuals	0.064 m
Standard Deviation	0.074 m

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3001_2019_NM	177410.474	3567766.403	1371.947	1372.000	0.053
3002_2019_NM	177643.003	3567804.290	1372.877	1372.950	0.073
3003_2019_NM	186101.813	3632387.902	1981.914	1981.910	0.004
3003A_2019_NM	184874.018	3631551.632	1914.200	1914.210	0.010
3004_2019_NM	184874.499	3631517.314	1912.460	1912.510	0.050
3005_2019_NM	187064.455	3631986.524	1932.817	1932.800	0.017
3006_2019_NM	187210.338	3632840.675	1983.028	1983.020	0.008
3007_2019_NM	183905.379	3639851.003	1924.593	1924.530	0.063
3007A_2019_NM	183612.347	3639901.123	1957.746	1957.760	0.014
3008_2019_NM	184208.199	3639328.169	1959.046	1959.080	0.034
3008A_2019_NM	184082.505	3639912.010	1913.949	1913.960	0.011
3009_2019_NM	184615.727	3638695.197	2043.784	2043.790	0.006
3009A_2019_NM	183669.966	3639912.489	1963.108	1963.070	0.038
3010_2019_NM	184719.827	3638288.163	2086.608	2086.580	0.028
3011_2019_NM	185014.563	3637710.353	2151.741	2151.750	0.009
3012_2019_NM	185634.628	3637376.881	2164.989	2164.970	0.019
3013_2019_NM	186062.930	3637172.132	2123.133	2123.140	0.007
3014_2019_NM	187332.057	3636728.138	2018.888	2018.880	0.008
3015_2019_NM	187913.611	3636822.356	1987.119	1987.070	0.049
3016_2019_NM	188036.630	3637057.302	1976.981	1976.970	0.011

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3017_2019_NM	188741.235	3636566.371	1975.132	1975.120	0.012
3018_2019_NM	189182.444	3636580.401	1958.116	1958.100	0.016
3019_2019_NM	190175.040	3636118.649	1901.695	1901.700	0.005
3020_2019_NM	190653.669	3636020.829	1877.858	1877.940	0.082
3021_2019_NM	191143.495	3634938.595	1856.376	1856.360	0.016
3022_2019_NM	191504.367	3634444.861	1844.411	1844.380	0.031
3022A_2019_NM	188109.279	3636379.506	2026.740	2026.770	0.030
3023_2019_NM	184769.257	3643635.433	1733.891	1733.910	0.019
3024_2019_NM	184664.494	3643549.445	1736.759	1736.810	0.051
3025_2019_NM	184728.477	3643392.072	1741.835	1741.840	0.005
3026_2019_NM	184788.933	3643389.173	1740.847	1740.860	0.013
3027_2019_NM	184016.580	3643754.270	1853.819	1853.800	0.019
3028_2019_NM	184012.151	3643657.584	1861.818	1861.840	0.022
3029_2019_NM	184092.376	3641913.738	1919.514	1919.590	0.076
3030_2019_NM	183564.185	3640652.920	1953.215	1953.260	0.045
3031_2019_NM	212395.305	3640260.712	2091.014	2091.000	0.014
3032_2019_NM	212775.040	3640773.016	2124.481	2124.530	0.049
3033_2019_NM	213214.491	3641201.134	2110.763	2110.810	0.047
3034_2019_NM	213292.385	3641342.063	2111.744	2111.730	0.014
3035_2019_NM	213372.002	3641445.358	2115.750	2115.730	0.020
3036_2019_NM	213528.319	3641657.016	2103.724	2103.740	0.016
3037_2019_NM	213734.644	3641970.371	2094.625	2094.590	0.035
3038_2019_NM	213827.417	3642123.300	2101.799	2101.780	0.019
3039_2019_NM	213949.612	3642648.161	2091.584	2091.680	0.096
3040_2019_NM	213845.634	3642859.909	2097.157	2097.210	0.053
3041_2019_NM	213621.197	3643000.119	2086.760	2086.710	0.050
3042_2019_NM	213750.825	3643220.503	2118.781	2118.760	0.021
3043_2019_NM	213391.609	3643292.884	2135.806	2135.820	0.014
3044_2019_NM	213038.766	3643367.909	2178.012	2178.020	0.008
3045_2019_NM	212878.232	3643722.619	2174.721	2174.780	0.059
3046_2019_NM	212571.675	3643802.853	2152.060	2152.040	0.020
3047_2019_NM	237778.869	3636735.310	2128.622	2128.590	0.032
3048_2019_NM	237021.354	3636331.615	2073.351	2073.410	0.059
3049_2019_NM	239089.356	3636046.972	2211.008	2211.080	0.072

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3050_2019_NM	239314.715	3636144.451	2227.136	2227.300	0.164
3051_2019_NM	239309.960	3636240.840	2231.721	2231.690	0.031
3052_2019_NM	239555.141	3635979.264	2263.294	2263.350	0.056
3053_2019_NM	239695.731	3636192.352	2312.222	2312.280	0.058
3054_2019_NM	240102.918	3635648.035	2300.998	2301.100	0.102
3055_2019_NM	240327.659	3635364.008	2299.743	2299.920	0.177
3056_2019_NM	240682.830	3635112.511	2281.855	2281.920	0.065
3057_2019_NM	240964.600	3635301.027	2264.552	2264.510	0.042
3058_2019_NM	241269.825	3635549.001	2245.607	2245.580	0.027
3059_2019_NM	241501.687	3635628.428	2230.134	2230.200	0.066
3060_2019_NM	241925.111	3635863.192	2194.590	2194.470	0.120
3061_2019_NM	242110.649	3636102.235	2188.553	2188.530	0.023
3062_2019_NM	242670.467	3636458.551	2212.985	2212.910	0.075
3063_2019_NM	243231.606	3636323.728	2167.693	2167.590	0.103
3064_2019_NM	215723.985	3651916.738	1976.465	1976.570	0.105
3065_2019_NM	214702.906	3653012.274	2017.248	2017.240	0.008
3066_2019_NM	213941.237	3654025.097	1999.922	1999.950	0.028
3067_2019_NM	212027.477	3654739.263	1947.442	1947.410	0.032
3068_2019_NM	209108.689	3657302.316	1886.504	1886.430	0.074
3069_2019_NM	207101.810	3658627.847	1863.292	1863.300	0.008
3070_2019_NM	205856.327	3658727.462	1849.302	1849.380	0.078
3071_2019_NM	205566.255	3658952.780	1844.108	1844.110	0.002
3072_2019_NM	203649.085	3659536.924	1822.210	1822.150	0.060
3073_2019_NM	201913.292	3659846.261	1799.659	1799.750	0.091
3074_2019_NM	199631.087	3660392.392	1772.768	1772.700	0.068
3075_2019_NM	200629.023	3663264.403	1882.731	1882.720	0.011
3076_2019_NM	202044.091	3666940.914	2056.811	2056.880	0.069
3077_2019_NM	200910.510	3665766.030	1975.624	1975.680	0.056
3078_2019_NM	200845.600	3664940.999	1947.512	1947.470	0.042
3079_2019_NM	199015.737	3652440.353	2168.366	2168.350	0.016
3080_2019_NM	199714.160	3651038.216	2232.443	2232.380	0.063
3081_2019_NM	199417.429	3647573.839	2117.278	2117.280	0.002
3082_2018_NM	244244.876	3708241.319	2168.122	2168.100	0.022
3083_2018_NM	242226.059	3708123.679	2214.697	2214.720	0.023

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3084_2018_NM	239617.389	3707014.429	2215.081	2215.070	0.011
3085_2018_NM	238188.920	3706236.270	2241.097	2241.030	0.067
3086_2018_NM	236910.467	3705689.466	2261.047	2261.050	0.003
3087_2018_NM	234331.870	3705402.528	2321.413	2321.440	0.027
3088_2018_NM	232516.291	3704394.164	2345.702	2345.730	0.028
3089_2018_NM	225928.231	3703347.815	2386.017	2386.120	0.103
3090_2018_NM	222995.762	3702126.075	2317.658	2317.640	0.018
3091_2018_NM	221173.229	3703499.834	2250.562	2250.600	0.038
3092_2018_NM	214105.520	3702838.546	2210.175	2210.190	0.015
3093_2018_NM	213033.178	3702529.254	2066.116	2066.160	0.044
3094_2018_NM	210639.334	3702863.606	2048.604	2048.730	0.126
3095_2018_NM	210352.585	3703085.867	2047.784	2047.740	0.044
3096_2019_NM	175359.095	3717409.805	2523.015	2523.080	0.065
3096A_2019_NM	175328.751	3717447.764	2526.244	2526.310	0.066
3097_2019_NM	177506.225	3722585.847	2398.894	2398.870	0.024
3097A_2019_NM	177495.966	3722517.329	2402.095	2402.170	0.075
3098_2019_NM	168356.209	3709209.970	2508.812	2508.860	0.048
3098A_2019_NM	168384.031	3709250.638	2506.082	2506.120	0.038
3099_2019_NM	148798.838	3700529.029	2102.961	2102.940	0.021
3100_2019_NM	148123.703	3701073.201	2061.485	2061.420	0.065
3101_2019_NM	144698.041	3701589.550	2077.478	2077.530	0.052
3102_2019_NM	164861.746	3776799.461	2450.011	2450.060	0.049
3103_2019_NM	171764.526	3785020.993	2332.210	2332.360	0.150
3104_2019_NM	162571.418	3758830.789	2042.437	2042.390	0.047
3105_2019_NM	162022.808	3759792.760	2058.290	2058.260	0.030
3106_2019_NM	160742.059	3764683.938	2275.601	2275.610	0.009
3107_2019_NM	133328.484	3744208.392	2202.603	2202.630	0.027
3108_2019_NM	134149.378	3745792.384	2172.795	2172.830	0.035
3109_2019_NM	134218.817	3746500.900	2162.782	2162.810	0.028
3110_2019_NM	123448.321	3748731.564	2447.333	2447.300	0.033
3111_2019_NM	118903.965	3751201.237	2416.503	2416.450	0.053
3112_2018_NM	290630.830	3762447.586	2252.209	2252.120	0.089
3113_2018_NM	275241.951	3711525.033	2175.817	2175.760	0.057
3114_2018_NM	275368.812	3713152.937	2174.548	2174.410	0.138

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3115_2019_NM	181184.186	3759493.835	2164.041	2164.100	0.059
3116_2019_NM	158788.337	3745574.648	1953.838	1953.820	0.018
3117_2019_NM	174657.035	3755406.854	2052.861	2052.820	0.041
3118_2019_NM	175515.376	3756042.252	2065.897	2065.880	0.017
3119_2018_NM	189224.692	3757789.198	2146.028	2146.110	0.082
3120_2018_NM	198540.592	3758118.986	2216.294	2216.320	0.026
3121_2018_NM	203448.129	3758629.768	2128.072	2128.290	0.218
3122_2018_NM	217253.112	3763333.693	2144.079	2144.080	0.001
3123_2018_NM	224770.023	3768840.459	2138.915	2138.920	0.005
3124_2018_NM	234216.193	3778949.186	2289.765	2289.750	0.015
3125_2018_NM	348656.203	3946945.749	1817.952	1818.240	0.288
3126_2018_NM	349605.822	3948864.104	1888.083	1888.200	0.117
3127_2018_NM	351157.201	3951030.940	1974.988	1975.080	0.092
3128_2018_NM	352699.344	3952601.806	2076.623	2076.430	0.193
3129_2018_NM	353182.446	3953367.006	2108.531	2108.500	0.031
3130_2018_NM	357568.941	3964529.395	2500.975	2500.900	0.075
3131_2018_NM	356173.333	3964600.191	2468.526	2468.410	0.116
3132_2018_NM	355683.873	3964689.172	2445.995	2445.840	0.155
3133_2018_NM	356255.306	3965220.153	2462.581	2462.470	0.111
3134_2018_NM	355068.884	3962441.272	2592.130	2592.100	0.030
3135_2018_NM	354043.096	3957653.984	2417.732	2417.780	0.048
3136_2018_NM	344109.518	3953267.747	1778.842	1779.130	0.288
3137_2018_NM	344695.913	3954349.533	1794.034	1793.980	0.054
3138_2018_NM	345394.019	3957268.730	1833.750	1834.790	1.040
3139_2018_NM	346565.474	3958882.542	1871.565	1871.720	0.155
3140_2018_NM	347160.736	3959974.085	1887.731	1887.850	0.119
3141_2018_NM	349299.391	3964771.307	2011.213	2011.310	0.097
3142_2019_NM	229255.429	3829810.036	2263.985	2264.010	0.025
3143_2019_NM	223936.413	3829392.082	2218.339	2218.360	0.021
3144_2019_NM	225446.154	3828495.787	2228.297	2228.350	0.053
3145_2019_NM	168810.230	3801772.452	2323.802	2323.880	0.078
3146_2018_NM	218141.882	3814559.417	2246.743	2246.730	0.013
3147_2018_NM	213337.575	3806893.814	2310.344	2310.430	0.086
3148_2018_NM	205723.188	3809276.007	2286.507	2286.640	0.133

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3149_2018_NM	200275.628	3816088.750	2293.271	2293.330	0.059
3150_2018_NM	194307.444	3821066.061	2205.099	2205.260	0.161
3151_2018_NM	192221.997	3821782.106	2194.126	2194.230	0.104
3152_2019_NM	152203.727	3830505.650	2023.728	2023.840	0.112
3153_2019_NM	155679.512	3834357.896	2240.513	2240.520	0.007
3154_2018_NM	160462.318	3834971.807	2228.407	2228.440	0.033
3155_2018_NM	161507.592	3833740.710	2241.379	2241.450	0.071
3156_2018_NM	168118.410	3825199.538	1998.690	1998.780	0.090
3157_2018_NM	158997.694	3817055.007	2003.711	2003.680	0.031
3158_2019_NM	152891.299	3796924.060	2120.142	2120.100	0.042
3159_2019_NM	124727.591	3820784.269	1926.817	1926.880	0.063
3160_2019_NM	143574.925	3828734.674	1976.408	1976.490	0.082
3161_2019_NM	125447.862	3787735.761	2209.529	2209.510	0.019
3161A_2019_NM	138681.892	3792040.295	2308.281	2308.290	0.009
3162_2019_NM	134926.019	3707945.373	1544.157	1544.270	0.113
3163_2019_NM	136528.295	3699095.596	1514.215	1514.240	0.025
3164_2019_NM	144108.665	3678698.701	1570.302	1570.270	0.032
3165_2019_NM	136902.811	3671768.965	1700.428	1700.450	0.022
3166_2019_NM	156602.128	3657809.731	1435.967	1436.100	0.133
3167_2019_NM	166207.624	3657088.268	1399.024	1399.110	0.086
3168_2019_NM	168763.217	3645505.766	1422.934	1423.090	0.156
3169_2019_NM	173544.437	3634899.644	1494.221	1494.230	0.009
3170_2019_NM	181127.728	3630569.908	1698.308	1698.360	0.052
3170A_2019_NM	182502.511	3630190.589	1758.871	1758.870	0.001
3171_2019_NM	223138.590	3724470.118	2341.742	2341.740	0.002
3172_2019_NM	220804.462	3724268.040	2263.061	2263.110	0.049
3173_2019_NM	194772.989	3716705.968	2225.090	2225.150	0.060
3174_2019_NM	245194.309	3522363.651	1279.481	1279.530	0.049
3175_2019_NM	226271.179	3525418.665	1308.682	1308.890	0.208
3176_2019_NM	200340.688	3529641.403	1398.390	1398.570	0.180
3177_2019_NM	186185.452	3536080.341	1381.474	1381.520	0.046
3178_2019_NM	178627.672	3538108.152	1411.230	1411.320	0.090
3179_2019_NM	175347.718	3541949.171	1425.946	1425.940	0.006
3180_2019_NM	170880.540	3542962.701	1396.438	1396.510	0.072

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3181_2019_NM	167049.851	3543647.931	1369.670	1369.690	0.020
3182_2019_NM	163271.276	3543362.360	1338.215	1338.270	0.055
3183_2019_NM	163829.246	3547660.904	1341.810	1341.920	0.110
3184_2019_NM	163877.403	3550125.347	1338.413	1338.620	0.207
3185_2019_NM	164468.831	3556361.997	1365.973	1365.980	0.007
3186_2019_NM	166420.400	3564495.906	1305.733	1305.750	0.017
3187_2019_NM	166552.470	3568041.413	1311.289	1311.280	0.009
3188_2019_NM	160079.050	3581028.174	1283.317	1283.440	0.123
3189_2019_NM	153186.186	3584073.319	1289.842	1289.890	0.048
3190_2019_NM	150081.897	3585570.422	1298.630	1298.700	0.070
3191_2019_NM	150038.548	3585542.571	1299.456	1299.520	0.064
3192_2019_NM	149613.956	3604062.197	1387.873	1387.950	0.077
3193_2019_NM	148632.133	3621335.842	1226.377	1226.420	0.043
3194_2019_NM	149247.616	3615291.708	1357.959	1357.990	0.031
3195_2019_NM	150179.540	3623397.594	1243.075	1243.070	0.005
3195A_2019_NM	147959.848	3626014.716	1355.069	1355.070	0.001
3196_2019_NM	150429.472	3625161.817	1253.504	1253.500	0.004
3197_2019_NM	137169.393	3602773.909	1292.730	1292.790	0.060
3198_2019_NM	135312.377	3604621.527	1293.419	1293.440	0.021
3199_2019_NM	125167.767	3616011.428	1261.860	1261.870	0.010
3200_2019_NM	122523.199	3618026.360	1239.144	1239.130	0.014
3201_2019_NM	118744.102	3620594.985	1163.368	1163.410	0.042
3202_2019_NM	121075.616	3618978.750	1209.663	1209.740	0.077
3203_2019_NM	117498.588	3622701.108	1139.035	1139.280	0.245
3204_2019_NM	117241.052	3626041.909	1122.734	1122.780	0.046
3205_2019_NM	116067.078	3626610.023	1116.949	1117.000	0.051
3206_2019_NM	114943.666	3628349.877	1110.290	1110.320	0.030
3207_2019_NM	113611.277	3629436.472	1108.774	1108.780	0.006
3208_2019_NM	162644.488	3476500.623	1432.337	1432.410	0.073
3209_2019_NM	161593.736	3480905.438	1423.375	1423.420	0.045
3210_2019_NM	162442.909	3484761.968	1400.196	1400.330	0.134
3211_2019_NM	163155.006	3486764.909	1387.877	1387.900	0.023
3212_2019_NM	163653.070	3488158.674	1379.850	1379.870	0.020
3213_2019_NM	166216.488	3495336.960	1356.039	1356.080	0.041

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3214_2019_NM	168429.921	3498445.625	1342.630	1342.690	0.060
3215_2019_NM	169863.018	3501693.779	1334.827	1334.870	0.043
3216_2019_NM	170827.110	3503641.009	1330.496	1330.610	0.114
3217A_2019_NM	170306.731	3502483.085	1333.144	1333.240	0.096
3217B_2019_NM	171066.199	3505661.083	1326.949	1327.050	0.101
3218_2019_NM	171306.418	3506194.528	1325.642	1325.800	0.158
3219_2019_NM	171420.087	3508292.274	1323.575	1323.740	0.165
3220_2019_NM	171667.117	3509927.204	1320.644	1320.830	0.186
3221_2019_NM	173194.717	3513555.839	1315.568	1315.660	0.092
3222_2019_NM	164417.820	3520280.026	1319.005	1318.980	0.025
3223_2019_NM	175268.367	3514653.216	1317.476	1317.520	0.044
3224_2019_NM	179206.208	3519920.212	1330.407	1330.400	0.007
3225_2019_NM	181338.260	3523863.865	1338.314	1338.310	0.004
3226_2019_NM	182447.543	3527110.331	1347.136	1347.170	0.034
3227_2019_NM	184795.358	3531828.610	1384.785	1384.870	0.085
3228_2019_NM	186103.983	3534507.557	1384.481	1384.540	0.059
3229_2019_NM	185679.847	3535863.685	1377.357	1377.430	0.073
3230_2019_NM	241309.274	3574382.603	1320.181	1320.100	0.081
3231_2019_NM	242594.432	3574222.789	1316.849	1316.800	0.049
3232_2019_NM	246427.647	3573473.047	1305.003	1304.900	0.103
3233_2019_NM	259023.255	3574169.581	1273.017	1273.050	0.033
3234_2019_NM	263206.133	3572557.056	1267.925	1267.880	0.045
3235_2019_NM	271008.866	3569610.224	1258.516	1258.670	0.154
3236_2019_NM	271281.597	3569567.924	1258.889	1259.000	0.111
3237_2018_NM	284589.500	3569735.229	1300.765	1300.770	0.005
3238_2018_NM	293547.358	3569188.770	1317.349	1317.400	0.051
3239_2018_NM	297660.999	3569753.453	1325.583	1325.630	0.047
3240_2018_NM	304719.216	3570572.777	1336.851	1337.000	0.149
3241_2018_NM	322521.438	3573046.656	1277.866	1277.970	0.104
3242_2018_NM	326025.543	3575576.299	1187.360	1187.470	0.110
3243_2018_NM	328987.558	3575488.354	1187.341	1187.420	0.079
3244_2018_NM	336083.624	3576951.344	1262.691	1262.710	0.019
3245_2018_NM	327583.992	3586400.297	1196.411	1196.470	0.059
3246_2018_NM	325878.436	3589101.877	1200.364	1200.460	0.096

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3247_2018_NM	325401.714	3589869.419	1202.306	1202.720	0.414
3248_2018_NM	325264.151	3590376.399	1209.887	1209.980	0.093
3249_2018_NM	324970.734	3590904.979	1217.704	1217.910	0.206
3250_2018_NM	322128.867	3595024.754	1217.441	1217.440	0.001
3251_2018_NM	321375.590	3597124.624	1239.886	1239.920	0.034
3252_2018_NM	316962.853	3609258.992	1318.629	1318.740	0.111
3253_2018_NM	314914.094	3612942.427	1332.804	1332.880	0.076
3254_2018_NM	312971.986	3615273.311	1334.678	1334.720	0.042
3255_2018_NM	354145.271	3520921.134	1180.743	1180.720	0.023
3256_2018_NM	352252.650	3526880.438	1217.897	1217.890	0.007
3257_2018_NM	351994.225	3526702.576	1207.982	1207.950	0.032
3258_2018_NM	348127.662	3528370.935	1144.809	1144.830	0.021
3259_2018_NM	345301.922	3549628.476	1160.102	1160.260	0.158
3260_2018_NM	339368.283	3561189.996	1171.324	1171.320	0.004
3261_2018_NM	331969.425	3520893.971	1246.041	1246.080	0.039
3262_2019_NM	247795.242	3534920.301	1282.864	1282.980	0.116
3263_2019_NM	245546.296	3545322.802	1267.567	1267.720	0.153
3264_2019_NM	241650.614	3551564.392	1279.004	1279.110	0.106
3265_2019_NM	240496.378	3555846.943	1286.587	1286.640	0.053
3266_2019_NM	240612.432	3564711.199	1304.134	1304.250	0.116
3267_2019_NM	226483.466	3572118.921	1348.836	1348.850	0.014
3268_2019_NM	209214.743	3570055.840	1367.656	1367.710	0.054
3269_2019_NM	233166.800	3583910.695	1378.410	1378.480	0.070
3270_2019_NM	227543.655	3590530.258	1427.536	1427.500	0.036
3271_2019_NM	221734.001	3597419.919	1464.623	1464.690	0.067
3272_2019_NM	206479.811	3615119.775	1633.421	1633.560	0.139
3273_2019_NM	207031.556	3621438.685	1725.027	1725.010	0.017
3274_2019_NM	206331.981	3625391.745	1737.300	1737.250	0.050
3275_2019_NM	206340.081	3627717.896	1760.984	1761.010	0.026
3276_2019_NM	205304.620	3629112.317	1791.401	1791.460	0.059
3277_2019_NM	197765.917	3632061.402	1855.424	1855.430	0.006
3278_2019_NM	193422.694	3629886.154	1784.783	1784.900	0.117
3279_2019_NM	189325.629	3621923.386	1792.975	1793.020	0.045
3280_2019_NM	209023.998	3632200.534	1864.211	1864.210	0.001

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3280A_2019_NM	208090.172	3631031.651	1818.794	1818.740	0.054
3281_2019_NM	212444.842	3634143.841	2006.614	2006.750	0.136
3282_2019_NM	217795.846	3634476.026	2010.728	2010.860	0.132
3283_2019_NM	225031.167	3632928.064	1796.901	1796.850	0.051
3284_2019_NM	232173.111	3624179.570	1657.866	1657.920	0.054
3285_2019_NM	230672.337	3613458.650	1581.683	1581.720	0.037
3286_2019_NM	229247.076	3611873.195	1571.151	1571.150	0.001
3287_2019_NM	226452.737	3610159.406	1549.862	1549.940	0.078
3288_2019_NM	225163.681	3608494.239	1540.386	1540.460	0.074
3289_2019_NM	222153.663	3607089.184	1561.122	1561.260	0.138
3290_2019_NM	252203.970	3582346.900	1343.907	1343.930	0.023
3291_2019_NM	256963.445	3588524.055	1370.945	1370.950	0.005
3292_2019_NM	260469.880	3593641.112	1392.593	1392.670	0.077
3293_2019_NM	262364.344	3597447.380	1406.603	1406.610	0.007
3294_2019_NM	269780.353	3606932.638	1437.203	1437.270	0.067
3295_2019_NM	263967.098	3616936.918	1509.518	1509.520	0.002
3296_2019_NM	263009.609	3637668.926	1592.797	1592.820	0.023
3297_2019_NM	261455.398	3629675.894	1570.553	1570.510	0.043
3298_2019_NM	262213.751	3646896.920	1672.431	1672.460	0.029
3299_2019_NM	252788.342	3644987.209	1718.909	1718.980	0.071
3300_2019_NM	186144.052	3720342.672	2335.991	2336.060	0.069
3300A_2019_NM	115667.217	3819435.596	2015.823	2015.880	0.057
3301_2019_NM	103228.323	3833947.854	1743.317	1743.430	0.113
3302_2019_NM	106306.645	3842855.626	1783.175	1783.180	0.005
3302A_2019_NM	122361.935	3842862.782	1925.252	1925.260	0.008
3303_2019_NM	122105.611	3837503.507	1875.642	1875.790	0.148
3304_2019_NM	120288.003	3833499.640	1804.960	1804.990	0.030
3305_2019_NM	117137.798	3831938.278	1775.789	1775.910	0.121
3306_2019_NM	104570.831	3840514.108	1725.731	1725.790	0.059
3307_2019_NM	84589.209	3777681.229	2716.920	2716.980	0.060
3308_2019_NM	108513.843	3648802.972	1085.583	1085.660	0.077
3309_2018_NM	285702.670	3631570.661	1267.590	1267.710	0.120
3310_2018_NM	290913.837	3622427.737	1245.357	1245.430	0.073
3311_2018_NM	297765.031	3617865.959	1236.488	1236.540	0.052

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3312_2018_NM	291606.454	3613587.318	1327.876	1327.900	0.024
3313_2018_NM	285624.208	3665108.279	1293.029	1293.290	0.261
3314_2018_NM	290555.233	3670758.742	1343.678	1343.750	0.072
3315_2018_NM	289811.016	3677119.662	1408.595	1408.620	0.025
3316_2018_NM	288443.272	3681473.103	1475.801	1475.890	0.089
3317_2018_NM	291704.295	3702814.992	1539.944	1540.000	0.056
3318_2018_NM	302934.755	3724410.740	1476.916	1476.960	0.044
3319_2018_NM	273028.599	3684074.357	1611.278	1611.480	0.202
3320_2018_NM	266869.979	3688711.590	1738.154	1738.390	0.236
3321_2018_NM	255405.090	3723475.827	1968.513	1968.480	0.033
3322_2018_NM	250876.054	3744733.303	2211.030	2211.030	0.000
3323_2018_NM	252486.767	3759523.005	2192.295	2192.310	0.015
3324_2019_NM	110743.849	3517566.375	1303.459	1303.580	0.121
3325_2019_NM	111757.354	3519155.200	1298.039	1298.070	0.031
3326_2019_NM	112630.929	3520602.706	1301.995	1302.020	0.025
3327_2019_NM	116671.228	3526676.038	1265.996	1265.980	0.016
3328_2019_NM	118893.204	3530707.084	1255.400	1255.460	0.060
3329_2019_NM	122301.130	3539402.103	1254.048	1254.080	0.032
3330_2019_NM	125712.303	3540346.292	1295.935	1295.880	0.055
3331_2019_NM	129179.554	3540350.209	1339.766	1339.760	0.006
3332_2019_NM	131715.674	3540822.894	1347.685	1347.650	0.035
3333_2019_NM	147168.671	3541621.911	1367.095	1367.060	0.035
3334_2019_NM	141287.497	3544299.458	1336.569	1336.640	0.071
3335_2019_NM	133965.476	3555466.584	1293.884	1293.960	0.076
3336_2019_NM	121905.672	3572309.620	1294.852	1294.890	0.038
3337_2019_NM	149882.861	3584723.649	1310.910	1311.000	0.090
3338_2018_NM	261929.418	3775929.304	2126.669	2126.750	0.081
3339_2019_NM	115834.295	3758174.810	2582.194	2582.160	0.034
3340_2019_NM	86644.580	3779678.097	2550.366	2550.440	0.074
3341_2019_NM	103496.243	3776674.695	2341.368	2341.400	0.032
3342_2019_NM	114982.041	3749146.759	2633.101	2633.030	0.071
3343_2019_NM	93472.921	3713447.962	2218.685	2218.620	0.065
3344_2019_NM	94490.246	3710121.470	2471.749	2471.800	0.051
3345_2019_NM	103098.493	3656469.357	1130.440	1130.520	0.080

Point ID	Easting	Northing	Known Z	DEM Z	dZ
3346_2019_NM	108410.628	3643388.829	1082.556	1082.580	0.024
3347_2019_NM	99417.296	3689674.149	1584.295	1584.290	0.005
3348_2019_NM	93973.052	3689887.819	1865.639	1865.650	0.011
3349_2019_NM	102409.442	3691197.445	1487.029	1487.190	0.161
3350_2019_NM	98987.181	3662310.842	1160.025	1160.110	0.085
3351_2019_NM	99817.864	3660702.097	1202.259	1202.200	0.059
3352_2019_NM	103308.216	3660563.621	1201.086	1201.060	0.026
3353_2019_NM	97429.051	3629433.453	1271.054	1271.130	0.076
3355_2019_NM	109184.491	3540214.022	1413.976	1414.110	0.134
3356_2019_NM	108244.875	3538578.408	1458.217	1458.250	0.033
3357_2019_NM	107671.003	3543132.359	1412.755	1412.750	0.005
3358_2019_NM	106978.800	3545263.233	1390.725	1390.770	0.045
3359_2019_NM	104383.072	3548886.292	1415.222	1415.290	0.068
3360_2019_NM	97428.541	3548149.199	1571.806	1571.830	0.024
3361_2019_NM	91973.526	3496380.462	1386.307	1386.370	0.063
3362_2019_NM	90083.225	3493915.856	1371.327	1371.370	0.043
3363_2019_NM	80692.881	3477142.157	1337.900	1338.010	0.110
3364_2019_NM	102704.892	3576016.552	1104.880	1104.970	0.090
3365_2019_NM	108586.174	3575871.183	1137.104	1137.150	0.046
3366_2019_NM	61256.355	3594155.417	1320.290	1320.330	0.040
3367A_2019_NM	78535.670	3634455.993	1019.446	1019.550	0.104
3368_2019_NM	66677.241	3638864.216	913.073	913.110	0.037
3369_2019_NM	98259.347	3644471.567	1435.798	1435.890	0.092
3370_2019_NM	110692.148	3755006.530	2632.342	2632.190	0.152
3371_2019_NM	113573.558	3773535.351	2271.027	2271.100	0.073
3372_2019_NM	97126.230	3792335.279	2061.919	2062.110	0.191
3373_2019_NM	98161.338	3801352.361	1930.214	1930.410	0.196
3374_2019_NM	103295.754	3803509.944	1922.437	1922.610	0.173
3375_2019_NM	111636.715	3819877.520	1959.401	1959.480	0.079