

VERTICAL ACCURACY REPORT

Professional Management and LiDAR Data Collection and Processing Services

Block 3

PROJECT TITLE:	Professional Management and LiDAR Data Collection and Processing Services
WORK ORDER NAME:	Task Order A
WORK ORDER NUMBER:	2007058492720
CONSULTANT NAME:	3001, Inc., CH2M Hill, Inc.
PROJECT MANAGERS:	Jeremy Conner, 3001 Project Manager JoLee Gardner, CH2M Hill Project Manager



**3001, INC. THE GEOSPATIAL COMPANY
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November 2008

Florida Division of Emergency Management
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100

Re: Professional Management and LiDAR Data Collection and Processing Services,
Block 3

This photogrammetric mapping ground control survey is certified as meeting or exceeding, in quality and precision, the standards applicable for this work as set forth in Chapter 61G17-6, Florida Administrative Code.

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Signed: _____ Date: _____

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DATA ANALYSIS

This report documents the vertical accuracy of the LIDAR data as compared to the surveyed ground truth data for the Professional Management and LiDAR Data Collection and Processing Services project, Block 3. Fundamental Vertical Accuracy, Supplemental Vertical Accuracies and the Consolidated Vertical Accuracy have been calculated based on the appropriate land cover classes, and are shown in the following sections.

Data analysis was accomplished by comparing ground truth checkpoints with LIDAR points from the edited data set, which were within 3 feet horizontally from the ground truth points. The only exception to this were the ground truth points collected under tree canopy, where comparisons were made with LIDAR pulses that fell within 5 feet of the check points. This is because fewer LIDAR pulses are able to reach the ground in heavily forested areas, so the point spacing is larger than in cleared areas. Note that the edited LIDAR points are simply a subset of the raw LIDAR points. The points that fell above the ground surface on vegetation canopies, buildings, or other obstructions were removed from the data set. Comparisons were also made between the survey points and the LIDAR derived terrain surface. These comparisons provide an additional verification of the LIDAR data against the survey data.

The survey data was collected in accordance with the *FEMA FLOOD HAZARD MAPPING PROGRAM, GUIDELINES AND SPECIFICATIONS FOR FLOOD HAZARD MAPPING PARTNERS, APPENDIX A*.

Ground truth data was collected for each of the following land cover categories:

1. Bare-earth and low grass
2. Brush lands and low trees
3. Forested areas fully covered by trees
4. Urban areas

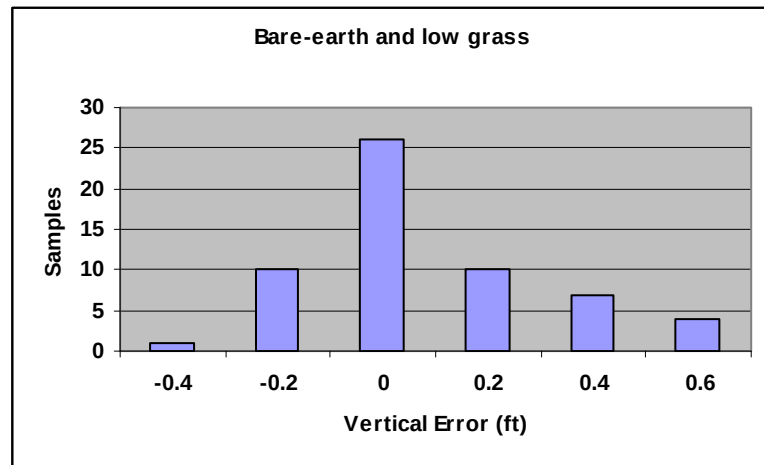
The accuracy assessment was performed using a standard method to compute the root mean square error (RMSE) based on a comparison of ground control points (GCP) and filtered LiDAR data points. Filtered LiDAR data has had vegetation and cultural features removed and by analysis represents bare-earth elevations. . The RMSE figure was used to compute the vertical National Standard for Spatial Data Accuracy (NSSDA). Ground control was established by 3001, Inc. A spatial proximity analysis was used to select edited LiDAR data points contiguous to the relevant GCPs. A search radius decision rule is applied with consideration of terrain complexity, cumulative error and adequate sample size. Cumulative error results from the errors inherent in the various sources of horizontal measurement. These sources include the airborne GPS, GCPs and the uncertainty of the accuracy of the LiDAR data points. This accuracy is achieved prior to the sub-sampling that occurs through integration with the inertial measurement unit (IMU) positions that are recorded. It is unclear at this time whether the initial

accuracy is maintained. The horizontal accuracy of the GCPs is estimated to be in the range of approximately 1 to 1.6 inches. Finally, sample size was considered. The specification for the National Standard for Spatial Data Accuracy is a minimum of 20 points to conduct a statistically significant accuracy evaluation (Minnesota Planning, 1999, Positional Accuracy Handbook, Minnesota Planning Land Management Information Center, St. Paul, Minnesota., p.3). Most statistical texts indicate that a minimum of 30 sample points provide a reasonable Approximation of a normal distribution. The intent of the NSSDA is to reflect the geographic area of interest and the distribution of error in the data set (Federal Geographic Data Committee, 1998, Geospatial National Standard for Spatial Data Accuracy, Federal Geographic Data Committee Secretariat, Reston, Virginia, p.3-4). Additional steps were taken to ensure the vertical accuracy of the LiDAR data including: Step 1: Precision Bore sighting (Check Edge-matching) Step 2: Compare the LiDAR data to the Field Survey (Field survey is to FEMA specifications and more stringent internal specifications) Step 3: Automated Filtering Step 4: Manual Editing (Quality Control) Step 5: 3-D digitizing and photogrammetric compilation of hydrographic breaklines. Data analysis was accomplished by comparing ground truth checkpoints with LIDAR points from the edited data set, which were within 3 feet horizontally from the ground truth points. Note that the edited LIDAR points are simply a subset of the raw LIDAR points. The points that fell above the ground surface on vegetation canopies, buildings, or other obstructions were removed from the data set. Comparisons were also made between the survey points and the LIDAR derived terrain surface. These comparisons provide an additional verification of the LIDAR data against the survey data. The survey data was collected in accordance with the FEMA FLOOD HAZARD MAPPING PROGRAM, GUIDELINES AND SPECIFICATIONS FOR FLOOD HAZARD MAPPING PARTNERS, APPENDIX A.

FUNDAMENTAL VERTICAL ACCURACY

The Fundamental Vertical Accuracy is calculated using the bare-earth and low grass land class. A comparison of these values indicated a Vertical Root Mean Square Error (RMSEz) of 0.24 feet, which equates to a Vertical Accuracy of 0.47 feet at the 95 percent confidence level. Descriptive statistics and a histogram of the vertical error distribution are shown below.

Bare-earth and low grass (ft)	
RMSEz	0.24
Mean	0.09
Standard Error	0.03
Median	0.06
Mode	0.07
Standard Deviation	0.22
Sample Variance	0.05
Kurtosis	-0.19
Skewness	0.31
Range	0.89
Minimum	-0.30
Maximum	0.59
Count	58



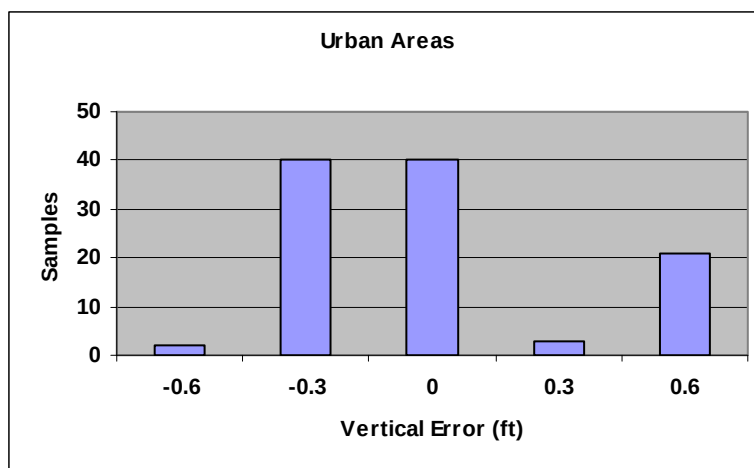
SUPPLEMENTAL VERTICAL ACCURACIES

The Supplemental Vertical Accuracies are calculated using each of the land cover classes, except for the bare-earth and low grass land class. The remaining land cover classes that are used for comparisons are brush lands and low trees, forested areas fully covered by trees, and urban areas. The RMSEz values and Vertical Accuracies are shown with each respective land class, along with histograms of vertical error distribution.

Urban Areas

This set includes only those points that were collected in areas of urban land cover. The resulting RMSEz is 0.31 feet, which equates to a Vertical Accuracy of 0.61 feet at the 95 percent confidence level.

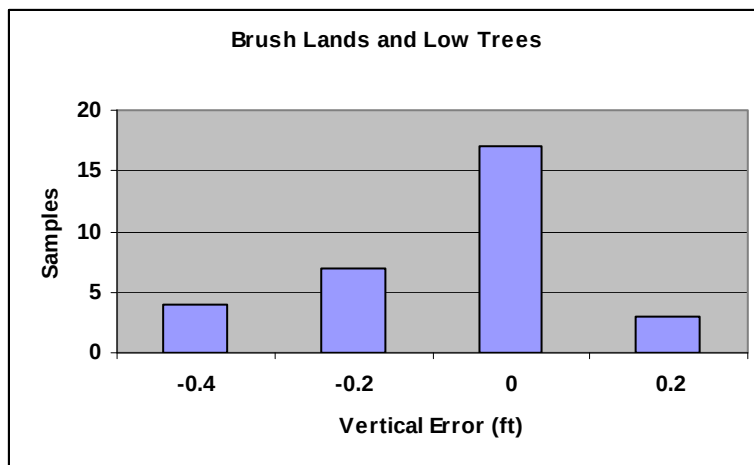
Urban Areas (ft)	
RMSEz	0.31
Mean	0.01
Standard Error	0.03
Median	-0.10
Mode	-0.23
Standard Deviation	0.32
Sample Variance	0.10
Kurtosis	-0.46
Skewness	0.87
Range	1.13
Minimum	-0.47
Maximum	0.66
Count	106



Brush Lands and Low Trees

This set includes only those points that were collected in areas of brush lands and low trees. The resulting RMSEz is 0.18 feet, which equates to a Vertical Accuracy of 0.35 feet at the 95 percent confidence level.

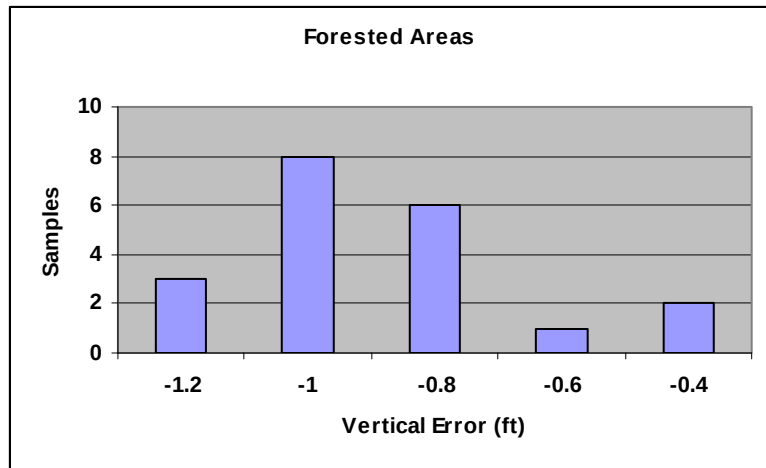
Brush Lands and Low Trees (ft)	
RMSEz	0.18
Mean	-0.05
Standard Error	0.03
Median	0.00
Mode	0.00
Standard Deviation	0.16
Sample Variance	0.03
Kurtosis	0.27
Skewness	-0.96
Range	0.67
Minimum	-0.49
Maximum	0.18
Count	31



Forested Areas

This set includes only those points that were collected in forested areas fully covered by trees. The resulting RMSEz is 0.91 feet, which equates to a Vertical Accuracy of 1.78 feet at the 95 percent confidence level.

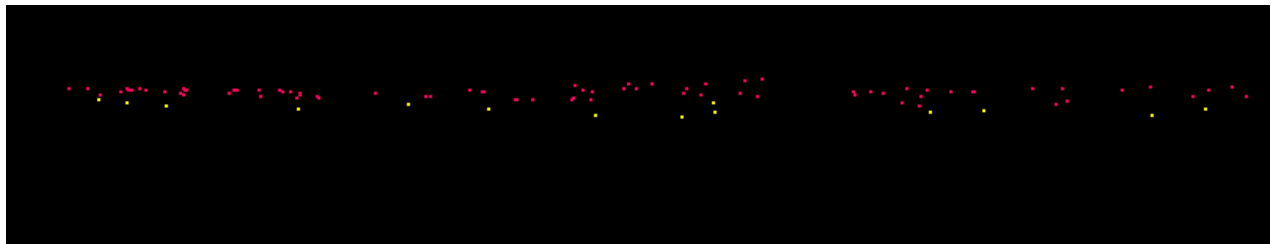
Forested Areas (ft)	
RMSEz	0.91
Mean	-0.88
Standard Error	0.05
Median	-0.94
Mode	-0.97
Standard Deviation	0.22
Sample Variance	0.05
Kurtosis	0.33
Skewness	0.67
Range	0.83
Minimum	-1.22
Maximum	-0.39
Count	20



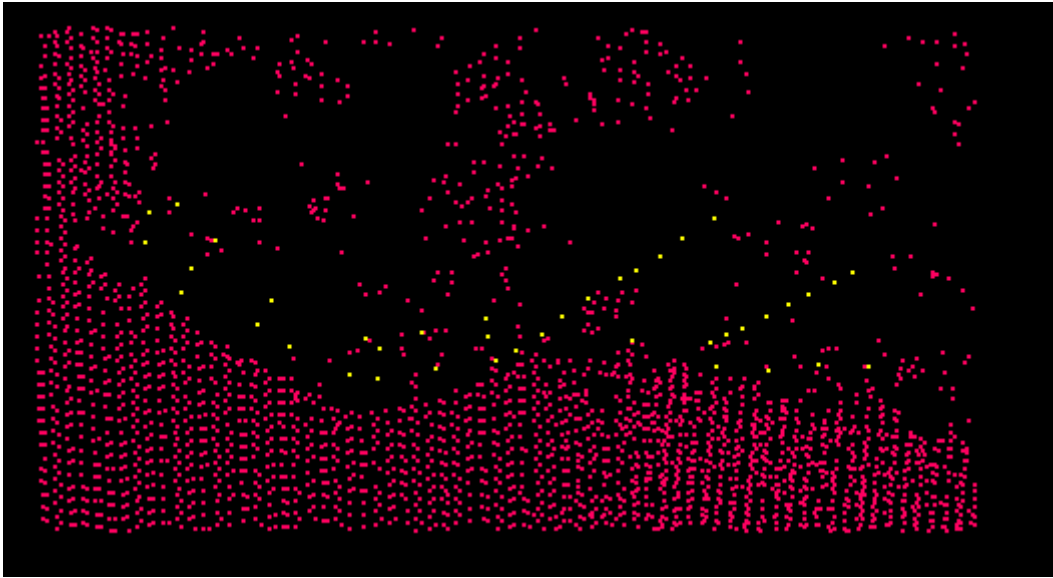
The high RMSEz value for this class indicates that the LIDAR data did not penetrate the thick vegetation in this area. The picture of the ground truth location (right) where these survey shots were taken shows that there is a lot of shrubbery and thick high grass at this site.



The cross section view of this land class (below) shows the survey data (yellow) below the LIDAR data (pink).



This overview of this site shows that most of the LIDAR points were edited out of this area because they reflected off the tree canopy. Notice the large voids around the survey points.

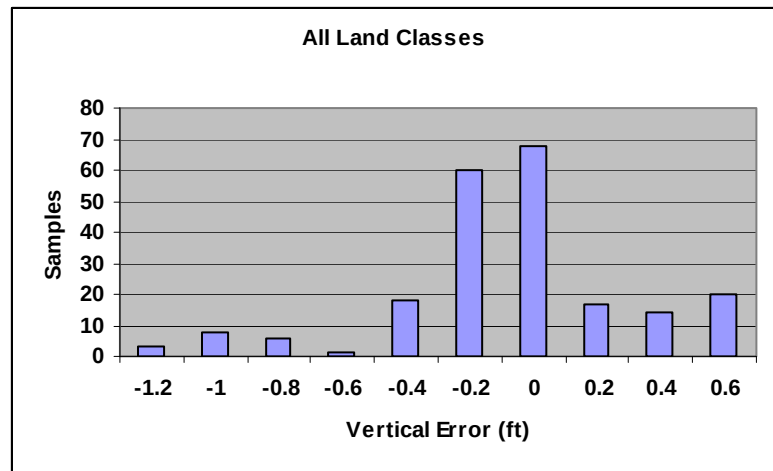


Based on these results it was determined that the survey points correctly identify the ground surface location, but the LIDAR points were reflected off the shrubbery and thick high grass (dense undergrowth). While the RMSEz value of this land class is high, the consolidated vertical accuracy (which was calculated using all land classes) is still well within range. See the next section for the results of the consolidated vertical accuracy analysis.

CONSOLIDATED VERTICAL ACCURACY

The Consolidated Vertical Accuracy is calculated using all land cover classes. The result of these comparisons of these values indicated a Vertical Root Mean Square Error (RMSEz) of 0.38 feet, which equates to Vertical Accuracy of 0.74 feet at the 95 percent confidence level. Descriptive statistics and a histogram of the vertical error distribution for all comparisons are shown below.

All Land Classes (ft)	
RMSEz	0.38
Mean	-0.06
Standard Error	0.03
Median	-0.02
Mode	0.00
Standard Deviation	0.38
Sample Variance	0.14
Kurtosis	1.07
Skewness	-0.59
Range	1.88
Minimum	-1.22
Maximum	0.66
Count	215



GROUND TRUTH ANALYSIS
Comparison of LIDAR Points to Ground-Truth Points

Horizontal units = US Survey Feet [US State Plane, Florida East, NAD83 (1999)]

Vertical units = US Survey feet [NAVD88 – Geoid03]

Name	Survey X	Survey Y	Survey Z	LIDAR X	LIDAR Y	LIDAR Z	dx	dy	dz	dist	Code
2A1	709811.45	323527.04	3.15	709812.03	323526.12	3.31	-0.58	0.92	-0.16	1.09	Urban
2A2	709807.38	323534.31	3.36	709806.88	323535.64	3.58	0.5	-1.33	-0.22	1.42	Urban
2A3	709804.82	323541.85	3.2	709806.62	323541.97	3.41	-1.8	-0.12	-0.21	1.8	Urban
2A4	709818.34	323551.46	3.17	709817.74	323552.04	3.35	0.6	-0.58	-0.19	0.84	Urban
2A5	709823.5	323545.01	3.34	709822.63	323544.3	3.48	0.87	0.71	-0.14	1.12	Urban
2A6	709826.76	323537.45	3.17	709827.65	323537.94	3.38	-0.89	-0.49	-0.21	1.01	Urban
2A7	709840.61	323545.94	3.12	709841.36	323545.51	3.35	-0.75	0.42	-0.23	0.86	Urban
2A8	709836.9	323554.12	3.33	709838.74	323553.72	3.44	-1.84	0.4	-0.11	1.88	Urban
2A9	709832.83	323561.55	3.16	709833.82	323561.56	3.28	-0.99	-0.01	-0.12	0.99	Urban
2A10	709848.64	323571.5	3.15	709849.5	323570.55	3.31	-0.86	0.95	-0.16	1.28	Urban
2A11	709852.57	323564.66	3.31	709852.29	323564.15	3.51	0.28	0.51	-0.2	0.58	Urban
2A12	709858.01	323557.81	3.11	709857.27	323558.64	3.31	0.74	-0.83	-0.2	1.11	Urban
2A13	709873.13	323567.86	3.13	709872.86	323568.45	3.38	0.27	-0.59	-0.25	0.65	Urban
2A14	709868.72	323575.41	3.3	709867.87	323574.68	3.48	0.85	0.73	-0.18	1.12	Urban
2A15	709863.61	323582.2	3.18	709862.92	323582.26	3.41	0.69	-0.06	-0.23	0.69	Urban
2A16	709881.08	323593.89	3.15	709881.09	323593.61	3.28	-0.01	0.28	-0.13	0.28	Urban
2A17	709886.01	323586.48	3.32	709886.08	323586.43	3.44	-0.07	0.05	-0.12	0.08	Urban
2A18	709890.06	323579.84	3.14	709891.07	323578.91	3.25	-1.01	0.93	-0.11	1.38	Urban
2A19	709907.5	323591.21	3.14	709907.21	323592.17	3.38	0.29	-0.96	-0.24	1	Urban
2A20	709904.01	323599.19	3.32	709904.19	323598.89	3.54	-0.18	0.3	-0.22	0.35	Urban
2A21	709907.83	323587.79	3.11	709909.47	323587.64	3.22	-1.64	0.15	-0.11	1.64	Brush
2A22	709916.17	323593.25	3.08	709916.49	323592.79	3.22	-0.32	0.46	-0.14	0.56	Brush
2A23	709924.28	323598.1	3.07	709922.96	323598.6	3.38	1.32	-0.5	-0.31	1.41	Brush
2A24	709933.03	323604.03	3.01	709932.24	323600.7	2.92	0.79	3.33	0.09	3.42	Brush
2A35	709936.39	323600.07	2.43	709932.24	323600.7	2.92	4.15	-0.63	-0.49	4.2	Brush
2A36	709938.77	323596.57	2.03	709937.29	323593.38	2.2	1.48	3.18	-0.17	3.51	Brush
2A37	709923.73	323592.41	2.56	709923.28	323592.3	2.79	0.45	0.11	-0.23	0.47	Brush
2A38	709926.92	323588.22	2.03	709926.17	323587.87	2.17	0.74	0.35	-0.14	0.82	Brush
2A39	709914.4	323585.36	2.42	709914.2	323585.74	2.76	0.2	-0.38	-0.34	0.43	Brush
2A40	709905.35	323579.45	2.39	709905.11	323580.03	2.66	0.24	-0.58	-0.27	0.63	Brush
3A1	721833.5	331661.65	2.83	721834.05	331661.74	3.02	-0.55	-0.09	-0.19	0.56	Urban
3A2	721838.97	331656	3.16	721838.91	331655.41	3.25	0.06	0.59	-0.09	0.59	Urban
3A3	721844.03	331650.11	3.44	721843.7	331651.14	3.64	0.33	-1.03	-0.2	1.08	Urban
3A4	721835.39	331642.07	3.47	721834.48	331642.18	3.64	0.91	-0.11	-0.17	0.92	Urban
3A5	721830.2	331647.46	3.2	721829.76	331646.48	3.41	0.44	0.98	-0.21	1.07	Urban
3A6	721824.34	331652.71	2.84	721824.84	331652.62	2.99	-0.5	0.09	-0.15	0.51	Urban
3A7	721816.19	331645.56	2.85	721815.65	331646.02	2.95	0.54	-0.46	-0.1	0.71	Urban
3A8	721821.08	331640.31	3.19	721820.47	331639.66	3.41	0.61	0.65	-0.23	0.89	Urban
3A9	721825.42	331634.6	3.44	721825.2	331635.26	3.54	0.22	-0.66	-0.1	0.69	Urban
3A10	721817.01	331625.41	3.5	721816.11	331624.34	3.67	0.9	1.07	-0.17	1.39	Urban
3A11	721812.12	331630.8	3.25	721811.25	331630.47	3.51	0.87	0.33	-0.26	0.93	Urban

3A12	721807.71	331635.8	2.94	721806.56	331634.93	3.22	1.15	0.87	-0.28	1.44	Urban
3A13	721799.01	331628.31	2.96	721797.24	331628.11	3.12	1.77	0.2	-0.16	1.78	Urban
3A14	721802.94	331624.19	3.23	721802	331623.84	3.44	0.94	0.35	-0.21	1	Urban
3A15	721807.22	331619.4	3.44	721806.92	331619.81	3.61	0.3	-0.41	-0.17	0.51	Urban
3A16	721796.78	331610.6	3.47	721797.64	331610.75	3.74	-0.86	-0.15	-0.27	0.87	Urban
3A17	721793.13	331615.13	3.25	721792.78	331616.89	3.38	0.35	-1.76	-0.13	1.79	Urban
3A18	721788.2	331619.34	2.97	721787.93	331618.63	3.22	0.27	0.71	-0.25	0.76	Urban
3A19	721779.04	331610.2	3.01	721778.71	331610.06	3.18	0.33	0.14	-0.17	0.36	Urban
3A20	721781.9	331604.84	3.28	721781.82	331605.08	3.51	0.08	-0.24	-0.23	0.25	Urban
3A21	721787.42	331594.25	3.53	721786.68	331598.42	3.84	0.74	-4.17	-0.31	4.24	Brush
4A2	779819.57	392122.45	5.43	779820.95	392124.08	4.82	-1.38	-1.64	0.61	2.14	Urban
4A3	779813.45	392117.15	5.33	779812.02	392117.69	4.79	1.43	-0.54	0.54	1.53	Urban
4A4	779821.72	392112.13	5.33	779821.21	392111.22	4.82	0.51	0.91	0.51	1.04	Urban
4A6	779828.9	392124.29	5.36	779829.05	392126.64	4.72	-0.15	-2.35	0.64	2.36	Urban
4A8	779831.42	392115.1	5.42	779832.76	392116.83	4.86	-1.34	-1.73	0.56	2.18	Urban
4A9	779828.3	392109.14	5.32	779828.33	392109.22	4.86	-0.03	-0.08	0.46	0.08	Urban
4A10	779839.19	392102.71	5.29	779839.25	392102.33	4.82	-0.06	0.38	0.47	0.39	Urban
4A11	779843.75	392108.07	5.41	779844.11	392105.58	4.89	-0.36	2.49	0.52	2.52	Urban
4A12	779847.1	392114.17	5.33	779846.01	392113.68	4.89	1.09	0.49	0.44	1.2	Urban
4A14	779850.13	392104.32	5.36	779849.16	392102.66	4.79	0.96	1.66	0.57	1.92	Urban
4A15	779846.5	392097.52	5.28	779845.98	392098.03	4.89	0.52	-0.51	0.39	0.73	Urban
4A16	779855.67	392092.2	5.25	779854.87	392090.72	4.79	0.8	1.48	0.46	1.68	Urban
4A17	779859.64	392099.44	5.39	779858.09	392098.1	4.86	1.55	1.34	0.53	2.05	Urban
4A18	779863.66	392105.93	5.29	779862.91	392106.6	4.69	0.75	-0.67	0.6	1	Urban
4A19	779870.89	392100.64	5.28	779873.47	392102.53	4.79	-2.58	-1.89	0.49	3.2	Urban
4A20	779866.47	392089.44	5.33	779866.78	392086.88	4.76	-0.31	2.56	0.57	2.58	Urban
4A21	779859.72	392115.93	5.01	779860.41	392114.9	4.92	-0.69	1.03	0.09	1.24	Bare-earth
4A22	779862.78	392120.38	4.58	779864.09	392120.87	4.2	-1.31	-0.49	0.38	1.4	Bare-earth
4A23	779867.63	392117.63	4.62	779868.62	392117.06	4.43	-0.99	0.57	0.19	1.15	Bare-earth
4A24	779872.44	392114.69	4.66	779871.04	392113.85	4.56	1.4	0.84	0.1	1.64	Bare-earth
4A25	779876.69	392111.98	4.59	779877.47	392112.7	4.23	-0.78	-0.72	0.35	1.06	Bare-earth
4A26	779881.08	392109.4	4.61	779881.18	392109.48	4.23	-0.1	-0.08	0.38	0.13	Bare-earth
4A27	779885.65	392106.82	4.54	779886.63	392107.16	4.23	-0.98	-0.34	0.31	1.04	Bare-earth
4A28	779891.35	392103.91	4.51	779890.66	392103.64	4.33	0.69	0.27	0.18	0.74	Bare-earth
4A29	779897.56	392100.89	4.45	779897.26	392098.92	4.4	0.3	1.97	0.05	1.99	Bare-earth
4A30	779902.48	392098.34	4.42	779902.51	392097.64	4.36	-0.03	0.7	0.06	0.7	Bare-earth
4A31	779899.27	392092.93	4.96	779899.42	392091.57	4.92	-0.15	1.36	0.04	1.37	Bare-earth
4A32	779895.11	392095.53	4.93	779894.08	392095.34	4.66	1.03	0.19	0.27	1.05	Bare-earth
4A33	779890.38	392098.32	4.92	779890.5	392098.4	4.76	-0.12	-0.09	0.17	0.14	Bare-

											earth
4A34	779885.36	392100.9	4.99	779886.01	392100.13	4.72	-0.65	0.77	0.27	1	Bare-earth
4A35	779880.42	392103.99	4.98	779880.56	392102.5	4.89	-0.14	1.49	0.09	1.5	Bare-earth
4A36	779875.23	392106.98	4.98	779874.88	392107.32	4.99	0.35	-0.34	-0.01	0.49	Bare-earth
4A37	779870.49	392109.71	5	779870.75	392110.3	4.79	-0.26	-0.59	0.21	0.64	Bare-earth
4A38	779865.54	392112.69	5	779867.11	392112.63	4.82	-1.57	0.05	0.18	1.57	Bare-earth
4A39	779860.31	392115.67	5.05	779860.41	392114.9	4.92	-0.1	0.77	0.13	0.78	Bare-earth
4A40	779854.72	392118.82	5.04	779853.49	392119.43	4.82	1.23	-0.61	0.22	1.37	Bare-earth
5A1	829245.28	403144.27	6.3	829244.96	403144.04	6.23	0.32	0.23	0.07	0.39	Bare-earth
5A2	829240.47	403145.96	6.28	829240.86	403144.57	6.23	-0.39	1.39	0.05	1.44	Bare-earth
5A3	829234.8	403147.73	6.25	829234.95	403147.16	6.23	-0.15	0.58	0.02	0.6	Bare-earth
5A4	829229.58	403149.76	6.26	829229.18	403150.74	6.27	0.4	-0.98	-0.01	1.06	Bare-earth
5A5	829223.74	403152.08	6.29	829225.18	403151.69	6.2	-1.44	0.39	0.08	1.5	Bare-earth
5A6	829218.42	403154.3	6.29	829217.11	403152.93	6.23	1.31	1.37	0.06	1.89	Bare-earth
5A7	829212.96	403156.84	6.26	829213.37	403157.95	6.27	-0.41	-1.11	0	1.19	Bare-earth
5A8	829207.25	403158.82	6.29	829209.23	403158.81	6.27	-1.98	0.01	0.02	1.98	Bare-earth
5A9	829201.94	403160.9	6.31	829201.29	403161.23	6.27	0.65	-0.33	0.04	0.73	Bare-earth
5A10	829195.81	403163.33	6.28	829194.93	403164.81	6.23	0.88	-1.48	0.05	1.72	Bare-earth
5A11	829197.69	403171.45	6.24	829197.45	403173.08	6.17	0.24	-1.63	0.07	1.65	Bare-earth
5A12	829203.33	403170.41	6.23	829203.26	403171.54	6.23	0.07	-1.13	0	1.14	Bare-earth
5A13	829209.12	403168.59	6.21	829209.53	403167.11	6.14	-0.41	1.48	0.07	1.53	Bare-earth
5A14	829214.77	403166.96	6.23	829213.66	403166.29	6.17	1.11	0.67	0.06	1.3	Bare-earth
5A15	829221.7	403165.22	6.22	829221.63	403165.14	6.2	0.07	0.08	0.02	0.11	Bare-earth
5A16	829228.13	403163.47	6.23	829229.57	403163.24	6.23	-1.44	0.23	0	1.46	Bare-earth
5A17	829235.04	403161.58	6.24	829233.71	403162.64	6.23	1.33	-1.07	0.01	1.71	Bare-earth
5A18	829241.79	403159.87	6.27	829241.39	403161.23	6.2	0.4	-1.36	0.07	1.42	Bare-earth
5A19	829248.41	403157.68	6.31	829247.03	403157.56	6.33	1.38	0.12	-0.02	1.39	Bare-earth
5A20	829255.38	403155.09	6.33	829256.94	403154.57	6.3	-1.56	0.52	0.03	1.64	Bare-earth

5A21	829314.48	403151.23	6.38	829313.73	403149.52	6.53	0.75	1.71	-0.15	1.87	Brush
5A22	829314.42	403156.44	6.43	829313.96	403157.82	6.36	0.46	-1.38	0.07	1.46	Brush
5A23	829314.35	403162.05	6.39	829314.09	403161.96	6.36	0.26	0.09	0.03	0.28	Brush
5A24	829314.36	403167.74	6.38	829312.38	403166.29	6.33	1.98	1.45	0.05	2.46	Brush
5A25	829314.04	403174.5	6.39	829312.61	403174.59	6.36	1.43	-0.09	0.03	1.43	Brush
5A26	829313.92	403180.83	6.45	829312.84	403182.92	6.27	1.08	-2.09	0.18	2.36	Brush
5A27	829313.59	403186.83	6.35	829312.97	403187.05	6.3	0.62	-0.22	0.05	0.66	Brush
5A28	829313.26	403192.9	6.39	829313.1	403191.22	6.3	0.16	1.68	0.09	1.68	Brush
5A29	829313.55	403201.9	6.36	829313.47	403203.69	6.3	0.08	-1.79	0.06	1.8	Brush
5A30	829312.81	403210.38	6.34	829311.92	403209.79	6.33	0.89	0.59	0.01	1.06	Brush
5A31	829327.51	403209.23	6.23	829325.54	403209.07	6.1	1.97	0.16	0.13	1.98	Brush
5A32	829327.53	403203.26	6.21	829329.61	403204.25	6.07	-2.08	-0.99	0.14	2.31	Brush
5A33	829327.63	403196.72	6.22	829327.28	403195.78	6.17	0.35	0.94	0.05	1	Brush
5A34	829327.69	403191.09	6.19	829327.67	403192.63	6.17	0.02	-1.54	0.02	1.54	Brush
5A35	829328.03	403183	6.18	829326.88	403183.35	6.1	1.15	-0.35	0.08	1.2	Brush
5A36	829327.1	403176.54	6.23	829326.65	403175.08	6.23	0.45	1.46	0	1.52	Brush
5A37	829326.95	403169.42	6.2	829328.62	403170.98	6.2	-1.67	-1.56	0	2.29	Brush
5A38	829326.74	403162.49	6.23	829328.39	403162.68	6.23	-1.65	-0.19	0	1.66	Brush
5A39	829325.79	403154.07	6.25	829326	403154.48	6.3	-0.21	-0.41	-0.05	0.46	Brush
5A40	829326.43	403145.27	6.26	829327.9	403146.04	6.27	-1.47	-0.77	-0.01	1.65	Brush
7A1	799639.13	380243.92	2.98	799641.87	380242.58	2.59	-2.74	1.34	0.39	3.06	Bare-earth
7A2	799640.45	380241.29	3.15	799641.81	380240.94	2.66	-1.36	0.35	0.49	1.41	Bare-earth
7A3	799643	380238.53	3.14	799642.23	380240.09	2.69	0.77	-1.56	0.45	1.73	Bare-earth
7A5	799647.57	380234.01	2.99	799648.63	380233.56	2.4	-1.06	0.45	0.59	1.15	Bare-earth
7A6	799650.59	380231.34	2.98	799651.19	380232.01	2.46	-0.6	-0.67	0.52	0.9	Bare-earth
7A7	799655.32	380234.24	3.07	799652.37	380233.69	2.53	2.95	0.55	0.54	3	Bare-earth
7A10	799649.71	380241.92	3.09	799652.24	380240.09	2.56	-2.53	1.83	0.53	3.12	Bare-earth
7A14	799490.45	380406.02	4.17	799490.95	380404.55	3.54	-0.5	1.47	0.63	1.55	Urban
7A18	799489.65	380428.94	4.13	799489.02	380429.46	3.48	0.63	-0.52	0.65	0.82	Urban
7A19	799489.7	380433.3	4.13	799489.12	380432.8	3.48	0.58	0.5	0.65	0.77	Urban
7A36	799504.98	380415.74	4.17	799505.42	380417.32	3.51	-0.44	-1.58	0.66	1.64	Urban
7A41	799506.21	380448.71	4.07	799504.99	380449.11	3.44	1.22	-0.4	0.63	1.28	Urban
8A1	850029.77	366648.56	3.58	850028.91	366647.56	3.51	0.86	1	0.07	1.32	Urban
8A2	850020.79	366645.23	3.77	850023.23	366646.12	3.74	-2.44	-0.89	0.03	2.6	Urban
8A3	850015.72	366640.85	3.65	850017.62	366640.9	3.54	-1.9	-0.05	0.11	1.9	Urban
8A4	850021.27	366631.56	3.64	850020.08	366631.45	3.61	1.19	0.11	0.03	1.19	Urban
8A5	850027.2	366622.59	3.66	850027.53	366622.63	3.71	-0.33	-0.04	-0.05	0.33	Urban
8A6	850024.8	366641.29	3.72	850025.5	366641.82	3.71	-0.7	-0.53	0.01	0.88	Urban
8A7	850032.62	366644.13	3.57	850033.24	366643.23	3.48	-0.62	0.9	0.09	1.09	Urban
8A8	850036.68	366635.31	3.63	850036.16	366634.11	3.54	0.52	1.2	0.09	1.3	Urban
8A9	850030.44	366629.8	3.78	850031.7	366629.06	3.74	-1.26	0.74	0.04	1.46	Urban
8A10	850049.73	366615.51	3.62	850049.91	366614.69	3.54	-0.18	0.82	0.08	0.84	Urban
8A11	850042.18	366609.77	3.79	850041.97	366608.45	3.64	0.21	1.32	0.15	1.33	Urban

8A12	850035.97	366606.64	3.72	850032.52	366605.76	3.25	3.45	0.88	0.47	3.56	Urban
8A13	850042.61	366597.28	3.73	850041.77	366596.97	3.71	0.84	0.31	0.02	0.89	Urban
8A14	850048.05	366599.71	3.83	850045.71	366600.41	3.71	2.34	-0.7	0.12	2.45	Urban
8A15	850053.83	366602.42	3.71	850055.55	366601.86	3.64	-1.72	0.56	0.07	1.81	Urban
8A16	850065.28	366586.36	3.69	850064.51	366584.86	3.71	0.77	1.51	-0.02	1.69	Urban
8A17	850053.61	366579.56	3.77	850052.89	366578.83	3.64	0.72	0.73	0.13	1.03	Urban
8A18	850059.16	366567.87	4.33	850058.83	366567.87	3.67	0.33	0	0.66	0.33	Urban
8A19	850065.21	366570.68	3.9	850064.21	366569.44	3.81	1	1.24	0.09	1.59	Urban
8A20	850072.44	366574.94	3.72	850072.09	366576.07	3.71	0.35	-1.14	0.01	1.19	Urban
9A1	839802.72	348041.11	3.13	839802.58	348040.64	4.07	0.14	0.47	-0.94	0.49	Forest
9A3	839770.75	348038.05	2.26	839771.12	348034.21	3.41	-0.37	3.84	-1.15	3.86	Forest
9A4	839686.92	348068.91	2.55	839685.62	348068.82	3.35	1.3	0.09	-0.8	1.3	Forest
9A7	839698.72	347986.1	2.77	839698.42	347987.76	3.05	0.3	-1.66	-0.28	1.69	Bare-earth
9A8	839667.62	348068.12	1.88	839663.44	348068.56	2.59	4.18	-0.44	-0.71	4.21	Forest
9A9	839744.05	348043.27	2.67	839748.39	348043.89	3.64	-4.34	-0.62	-0.97	4.39	Forest
9A9	839689.14	347972.39	2.97	839688.05	347972.11	3.18	1.09	0.28	-0.21	1.12	Bare-earth
9A10	839679.33	347964.43	3.06	839680.64	347963.28	3.35	-1.31	1.15	-0.29	1.74	Bare-earth
9A11	839621.15	348119.1	2.18	839620.99	348119.84	2.59	0.16	-0.74	-0.41	0.76	Urban
9A12	839614.43	348117.53	2.18	839613.31	348117.91	2.49	1.12	-0.38	-0.31	1.18	Urban
9A13	839840.7	348032.42	2.58	839843.99	348036.08	3.51	-3.29	-3.66	-0.93	4.92	Forest
9A13	839607.61	348116.78	2.02	839608.85	348116.3	2.36	-1.24	0.48	-0.34	1.33	Urban
9A14	839868.55	348033.87	2.91	839867.68	348033.49	3.51	0.87	0.38	-0.6	0.95	Forest
9A14	839606.58	348121.9	1.94	839608.65	348122.01	2.4	-2.07	-0.11	-0.46	2.07	Urban
9A15	839748.01	348033.37	2.51	839748.71	348034.08	2.99	-0.7	-0.71	-0.48	0.99	Forest
9A15	839613.42	348123.95	2.17	839613.08	348123.75	2.46	0.34	0.2	-0.29	0.4	Urban
9A16	839620.22	348126.04	2.2	839619.91	348125.88	2.53	0.31	0.16	-0.33	0.36	Urban
9A17	839762.47	348041.91	2.52	839759.64	348038.9	3.54	2.83	3.01	-1.02	4.13	Forest
9A17	839618.02	348132.44	2.26	839616.86	348131.65	2.59	1.16	0.79	-0.33	1.4	Urban
9A18	839728.96	348041.4	2.77	839729.85	348040.74	3.61	-0.89	0.66	-0.84	1.11	Forest
9A18	839611.1	348132.29	2.15	839611.94	348133.19	2.62	-0.84	-0.9	-0.47	1.23	Urban
9A19	839605.08	348131.93	1.95	839605.5	348133	2.3	-0.42	-1.07	-0.35	1.15	Urban
9A20	839603.64	348139.54	1.97	839604.32	348140.31	2.36	-0.68	-0.77	-0.39	1.02	Urban
9A21	839676.1	348078.92	2.32	839674.3	348076.8	3.54	1.8	2.12	-1.22	2.78	Forest
9A23	839698.33	348045.26	2.32	839700.29	348042.51	3.18	-1.96	2.75	-0.86	3.38	Forest
9A24	839790.71	348052.75	2.73	839789.4	348050.12	3.51	1.31	2.63	-0.78	2.94	Forest
9A26	839846.56	348051.27	2.79	839847.83	348046.45	3.61	-1.27	4.82	-0.82	4.99	Forest
9A27	839777.91	348042.63	2.72	839778.31	348040.87	3.9	-0.4	1.76	-1.18	1.81	Forest
9A30	839764.94	348035.59	2.17	839764.99	348032.37	3.12	-0.05	3.22	-0.95	3.22	Forest
9A34	839799.52	348058.27	2.93	839799.8	348054.26	3.9	-0.28	4.01	-0.97	4.02	Forest
9A35	839816.77	348069.44	3.68	839813.21	348072.53	4.07	3.56	-3.09	-0.39	4.72	Forest
9A37	839840.45	348047.89	2.66	839842.84	348043.69	3.74	-2.39	4.2	-1.08	4.84	Forest
9A39	839826.03	348034	2.57	839821.97	348031.36	3.54	4.06	2.64	-0.97	4.84	Forest
10A16	844257.78	328085.79	1.46	844257.2	328084.35	1.57	0.58	1.44	-0.11	1.55	Urban
10A17	844255.32	328079.99	1.57	844255.86	328079.49	1.87	-0.54	0.5	-0.3	0.73	Urban
10A18	844252.82	328074.09	1.45	844252.94	328073.72	1.54	-0.12	0.37	-0.09	0.39	Urban
10A19	844250.16	328067.81	1.34	844248.02	328067.06	1.38	2.14	0.75	-0.04	2.27	Urban

10A20	844244.93	328070.97	1.38	844245.46	328069.32	1.54	-0.53	1.65	-0.16	1.74	Urban
10A21	844247.27	328077.44	1.48	844247.98	328077.17	1.51	-0.71	0.27	-0.03	0.76	Urban
10A22	844247.79	328086.12	1.59	844246.05	328083.37	1.64	1.74	2.75	-0.05	3.26	Urban
10A23	844249.27	328094.82	1.54	844249.03	328093.73	1.57	0.24	1.09	-0.03	1.12	Urban
10A24	844241.87	328098.56	1.58	844241.62	328099.34	1.57	0.25	-0.78	0.01	0.82	Urban
10A25	844239.36	328091.88	1.65	844239.65	328095.6	1.67	-0.29	-3.72	-0.02	3.73	Urban
10A26	844237.12	328085.69	1.53	844237.39	328084.97	1.67	-0.27	0.72	-0.14	0.77	Urban
10A27	844234.56	328078.58	1.46	844235.15	328078.51	1.44	-0.59	0.07	0.02	0.59	Urban
10A28	844228.58	328083.43	1.44	844226.92	328083.86	1.44	1.66	-0.43	0	1.72	Urban
10A29	844232.82	328094.75	1.69	844233.55	328094.26	2.07	-0.73	0.49	-0.38	0.88	Urban
10A30	844235.26	328103.53	1.7	844233.81	328105.18	1.77	1.45	-1.65	-0.07	2.19	Urban
10A32	844241.91	328264.14	1.29	844242.63	328262.66	1.57	-0.72	1.48	-0.28	1.65	Bare-earth
10A33	844236.74	328263.3	1.28	844234.92	328260.14	1.41	1.82	3.16	-0.13	3.65	Bare-earth
10A35	844247.49	328275.37	1.54	844246.54	328273.52	1.8	0.95	1.85	-0.26	2.08	Bare-earth
10A36	844246.73	328284.47	1.59	844246.44	328284.94	1.71	0.29	-0.47	-0.12	0.55	Bare-earth
10A37	844239.61	328284.92	1.49	844240.04	328285.69	1.77	-0.43	-0.77	-0.28	0.88	Bare-earth
10A38	844239.26	328290.48	1.43	844238.24	328289.99	1.57	1.02	0.49	-0.14	1.14	Bare-earth
10A39	844246.26	328292.17	1.59	844244.37	328290.42	1.77	1.89	1.75	-0.18	2.58	Bare-earth
10A40	844242.71	328297.7	1.54	844242.37	328296.92	1.84	0.34	0.78	-0.3	0.85	Bare-earth