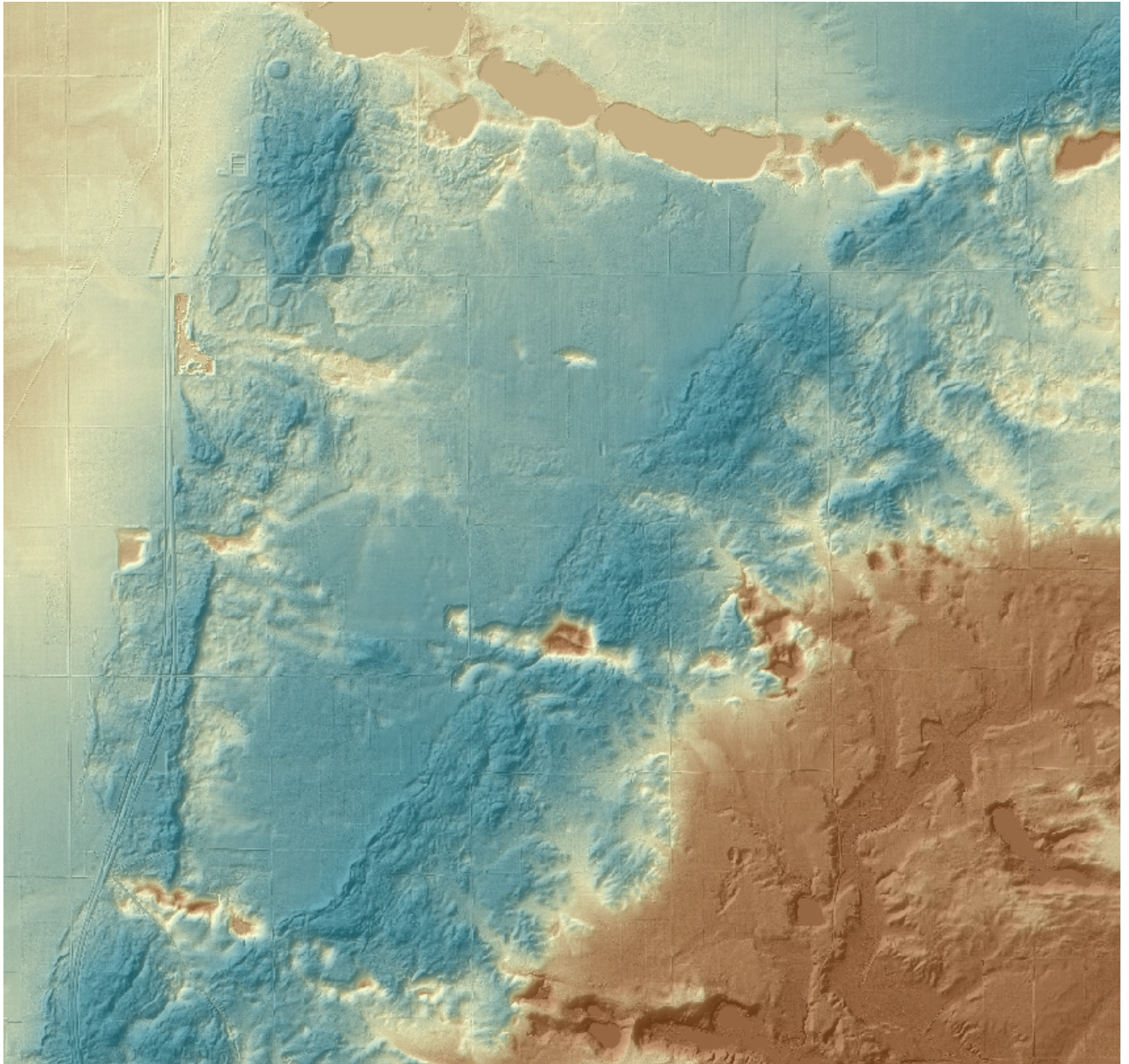


New Topographic Data TSDN Project Narrative
Waushara County, Wisconsin
November 2018



Federal Emergency Management Agency, Region V
Department of Homeland Security
536 South Clark Street
Chicago, IL 60605

TABLE OF CONTENTS

1.0 Introduction 1

2.0 Scope of Work..... 3

3.0 Issues or Comments 4

4.0 Information for the Next Mapping Partner 5

 4.1 Vertical Accuracy..... 6

 4.2 LiDAR Acquisition and Post Processing 7

 4.3 Quality Assurance 7

1.0 INTRODUCTION

To support the Risk Mapping, Assessment, and Planning (Risk MAP) program FEMA has made a commitment to acquire high-resolution LiDAR elevation data. The incorporation of more accurate topography improves the precision and reliability of flood hazard data. This, in turn, improves the quality of Flood Insurance Rate Maps and Flood Risk Assessments so communities can make informed decisions to protect their citizens and become more resilient to flood related hazards.

The purpose of this elevation dataset is to provide the basis for riverine hydrologic and hydraulic modeling and flood risk product development in Waushara County, Wisconsin.

LiDAR acquisition and post processing objectives for the Waushara County, Wisconsin project are as follows:

- Satisfy USGS 3DEP requirements for Quality Level 2 elevation data
- ASPRS LAS 1.4 format with point data record 6
- Collect raw point cloud swaths that cover the entire project area
- Obtain an Aggregate Pulse Density (ANPD) of greater than 2 pulses per square meter
- Achieve an Aggregate Point Spacing (ANPS) of less than 0.71 meters or 2.32 feet
- Provide LAS files in tiled format with the following classifications
 - Class 1 = Processed but Unclassified
 - Class 2 = Bare Earth
 - Class 7 = Low Noise
 - Class 9 = Water
 - Class 10 = Ignored Ground (Near a Breakline)
 - Class 17 = Bridge Decks
 - Class 18 = High Noise
- Meet or exceed the Non-Vegetated Vertical Accuracy Requirements for Quality Level 2
 - Less than 10 centimeters RMSE_z
 - Less than 19.6 centimeters at the 95% confidence level (Accuracy_z)
- Meet or exceed the Vegetated Vertical Accuracy Requirements for Quality Level 2
 - Less than 29.4 centimeters at the 95th percentile
- Create hydro-flattened Digital Elevation Models with Breaklines

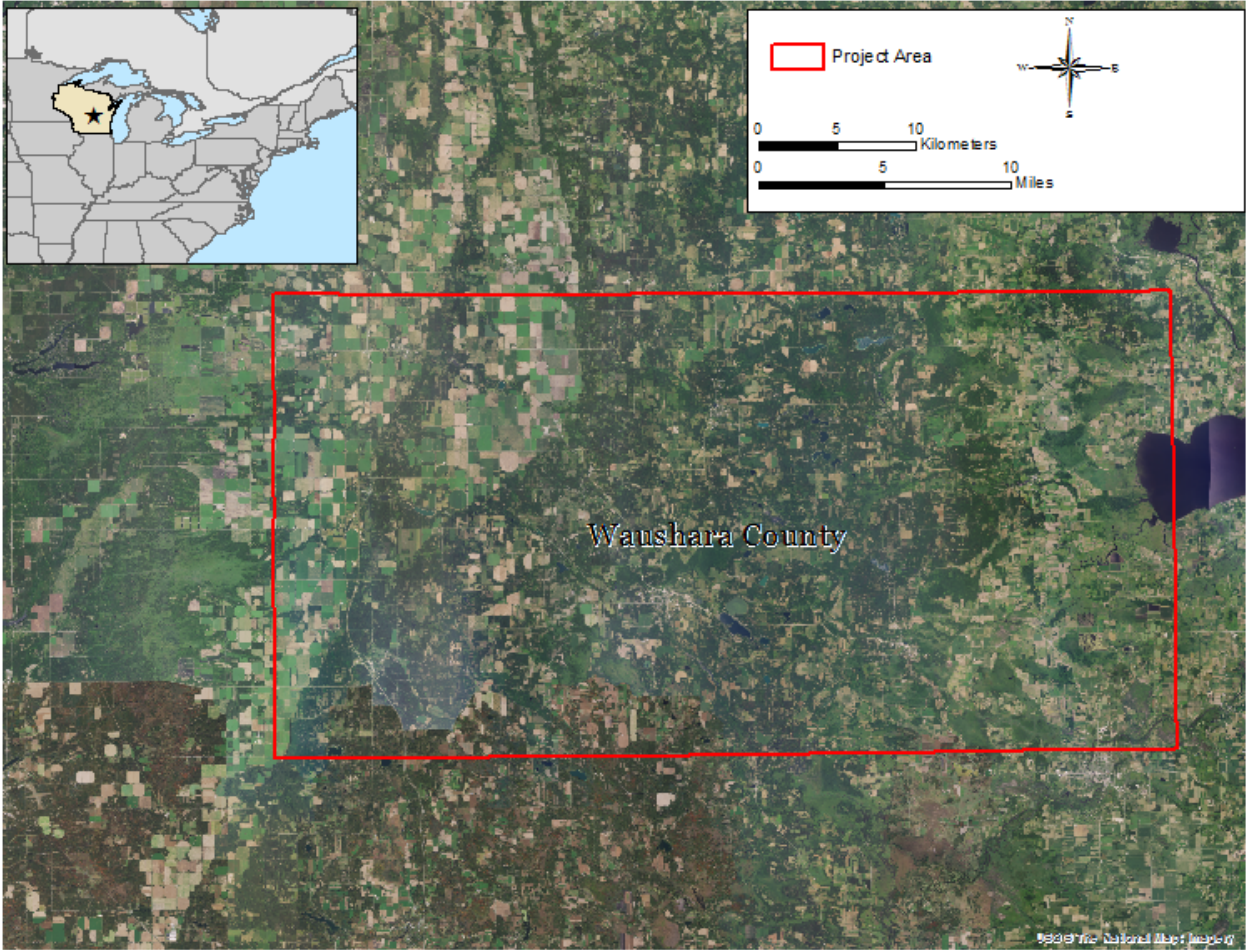


Figure 1. Waushara County, Wisconsin Project Area

2.0 SCOPE OF WORK

Task number HSFE05-17-J-0005 requires STARR II to collect and process LiDAR data for the Waushara County, Wisconsin area of interest, the scope of work is as follows:

Acquire and process 647 square miles of USGS defined Quality Level 2 LiDAR, collection of hydro-breaklines, and creation of Hydro-Flattened Digital Elevation Models.

Tasks include:

- Field Survey collection of 21 ground control points
- Field Survey collection of 40 NVA and 30 VVA vertical accuracy check points
- Aerial Acquisition of LiDAR data
- Calibration and processing LiDAR data to point cloud
- Post-processing point cloud to fully classified LAS data (including bare earth)
- Collection of breaklines for hydrographic features
- Creation of hydro-flattened DEMs
- Independent QA/QC including vertical accuracy testing and verification
 - Visual examination of 5% for unclassified raw point cloud tiles
 - Visual examination of 20% for classified point cloud tiles and Bare Earth DEMs

Activities completed under this task order will comply with the USGS LiDAR Base Specifications version 1.2 for quality level 2 data, ASPRS LAS version 1.4 requirements, and current FEMA Technical References and Guidance documents for elevation data.

Deliverables for this task are:

1. Collection Report Including Mission Planning and Flight Logs
2. Survey Report Including Ground Control Precision and Absolute Vertical Accuracy Test Results
3. Ground Control and Check Points Shapefiles
4. Point Cloud processing and product generation reports
5. Indices and Project Extent Shapefiles
6. Metadata Files in XML Format
7. Raw Point Cloud Swaths
8. Tiled Classified Point Cloud
9. 3D Breaklines
10. Hydro-flattened DEMs
11. FEMA Certificate of Compliance/Completion, Terrain Metadata XML, and Project Narrative
12. Project Independent QA/QC Report and supporting documentation.

3.0 ISSUES OR COMMENTS

No issues to report.

Comments on the point cloud Data. Due to the soil being dark muddy and saturated, in areas where there is drainage there is a lower number of returns potentially caused by a combination of water and dark muddy sediment. These areas are smaller than 6 acres and are few. Another matter to note, there are other small areas where there is no return. These areas were investigated and found to be freshly paved/tarred roadways, driveways and roofs. These examples occur through the project study area and is an acceptable condition in accordance with USGS Lidar Base Specification Version 1.2, November 2014



Figure 2. Example of an area with low point return



Figure 3. Example of an area showing low near infrared reflectivity from fresh asphalt and roof tops

4.0 INFORMATION FOR THE NEXT MAPPING PARTNER

The Waushara County, Wisconsin project covers the entire county. This project included LiDAR Acquisition, Post Processing, and LiDAR derived product development. Point cloud data is composed of LAS version 1.4 unclassified swaths and classified tiles. All data collected has the following spatial reference information:

Coordinate System: Wisconsin State Plane South, FIPS 4803
Horizontal Datum: NAD83 (2011), Epoch 2010.00
X, Y Linear Units: US Survey Feet
Vertical Datum: NAVD88, Geoid 12B
Z Linear Units: US Survey Feet

4.1 Vertical Accuracy

USGS Quality Level 2 Absolute Vertical Accuracy Requirements as published in the LiDAR Base Specifications version 1.2:

LiDAR Swath NVA Summary Statistics	Test Results (US Survey Feet /Meter)
Number of Check Points	40
Points with Swath Coverage and required accuracy	40
Average Z Error	0.096/0.029
Maximum Z Error	0.474/0.144
Minimum Z Error	-0.113/-0.034
NVA RMSEz <= 10 cm	0.157/0.048 PASS
NVA AccuracyZ <= 19.6 cm at 95% Confidence	0.308/0.094 PASS
LiDAR Swath NVA Summary Statistics (Independent QC)	Test Results (US Survey Feet /Meter)
Number of Check Points	40
Points with Swath Coverage and required accuracy	40
Average Z Error	0.041/0.012
Maximum Z Error	0.442/0.135
Minimum Z Error	-0.219/-0.067
NVA RMSEz <= 10 cm	0.146/0.045 PASS
NVA AccuracyZ <= 19.6 cm at 95% Confidence	0.287/0.087 PASS
Bare Earth NVA Summary Statistics	Test Results (International Feet /Meter)
Number of Check Points	40
Points with Swath Coverage and required accuracy	40
Average Z Error	0.10/0.03
Maximum Z Error	-.11/0.03
Minimum Z Error	-0.20/-0.06
NVA RMSEz <= 10 cm	0.157/0.048 PASS
NVA AccuracyZ <= 19.6 cm at 95% Confidence	0.308/0.094 PASS
Bare Earth VVA Summary Statistics	Test Results (International Feet /Meter)
Number of Check Points	30
Points with Bare Earth Coverage	30
Average Z Error	-0.26/0.08
Maximum Z Error	-0.89/-0.27
Minimum Z Error	-0.98/-0.30
VVA at 95 th Percentile <=29.4 cm	0.759/0.231 PASS

4.2 LiDAR Acquisition and Post Processing

LiDAR was acquired between November 07, 2017 and November 08, 2017 and covers the total task order area of 647 square miles. This collection has a point density of approximately 2.162 points per square meter and point spacing of 0.681 meters. The classified LiDAR tiles are 5,000 x 5,000-foot and classified in accordance with the scope of work.

Code	Description
1	Processed but not classified
2	Bare Earth
7	Low Noise
9	Water
10	Ignored Ground (near a breakline)
17	Bridge Decks
18	High Noise

Breaklines are created using the class 2 LiDAR. The bare earth surface model was then used to heads-up digitize 2D breaklines of inland streams and rivers with a 100-foot nominal width and Inland Ponds and Lakes of 2 acres or greater surface area. Elevation values were assigned to all Inland Ponds and Lakes, and Islands to create final 3D breaklines. Class 2 LiDAR in conjunction with the hydro breaklines were used to create the 2-foot Hydro-Flattened Raster DEMs.

4.3 Quality Assurance

Quality assurance for all elevation data delivered for this project has been completed based on the following specifications:

- USGS Lidar Base Specification Version 1.2, November 2014.
- ASPRS LAS Specification Version 1.4 – R13 July 15, 2013.
- ASPRS Positional Accuracy Standards for Digital Geospatial Data (Edition 1, Version 1.0. – November 2014).
- FEMA Data Capture Technical Reference February 2018
- Open Geospatial Consortium Geographic information-Well known text representation of coordinate reference systems Version 1.0

LiDAR elevation data created during this project are checked for compliance to the guidance and specifications before submittal to FEMA. Quality assurance results are incorporated into the *New Topographic Data, Independent QA/QC Report – Waushara County Wisconsin* included with this submission.

STARR II will provide deliverables to the FEMA Engineering Library via external hard drive. All supporting documentation (i.e., the content of the Task Documentation, Correspondence, and Spatial Files folders) has been uploaded to the MIP at this location: [Needs NEW LINK](#)