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# LiDAR PROCESSING REPORT

# FOR

# TUCK MAPPING SOLUTIONS, INC.

# OZAUKEE COUNTY, WI

**December 29, 2010**

**AERO-METRIC PROJECT NO. 1-101025**

**Table of Contents**

**Tuck Mapping Solutions, Inc.**

**STARR**
**Ozaukee County, WI**

**AeroMetric Project No. 1101025**

# 1 INTRODUCTION

This report contains a summary of the LiDAR data acquisition and processing for **STARR – Ozaukee County, Wisconsin**.

## 1.1 Contact Info

Questions regarding the technical aspects of this report should be addressed to:

Aerometric, Inc.
4020 Technology Parkway
Sheboygan, WI 53081

Attention: Robert Merry (Geomatics Manager)
Telephone: 920-457-3631
FAX: 920-457-0410
Email: rmerry@aerometric.com

## 1.2 Purpose

Aerometric acquired highly accurate Light Detection and Ranging (LiDAR) data for an area that comprises approximately 248 square miles for Tuck Mapping. Using Aerometric, Inc. Optech Gemini LiDAR system, data was collected at an altitude to support the project area's requirement.

## 1.3 Project Location

The project area is approximately 248 square miles and is located in Ozaukee County, WI. This project area was defined and supplied by STARR on September 10, 2010.

## 1.4 Time Period

LiDAR data acquisition was completed between October 31st, 2010 and November 23rd, 2010. A total of 6 flight missions were required to cover the project area. See Section 3.3 for a sketch of the acquisition mission and Section 5 of the report for the flight logs.

## 1.5 Project Scope

Aerometric acquired highly accurate Light Detection and Ranging (LiDAR) data for an area that encompassed approximately 248 square miles in Ozaukee County, WI. Using Aerometric, Inc. Optech Gemini LiDAR system, data was collected to support the project area's requirements.

We were to achieve a TIN accuracy of 15 cm for Ozaukee County, Wisconsin. The accuracy as tested and published in this report in Section 7 has easily met both vertical accuracy requirements.

## 1.6 Conditions Affecting Progress

- None.

# 2 GEODETIC CONTROL

## 2.1 Network Scope

Base horizontal and vertical control for the Airborne GPS and ground control surveys consisted of various NGS CORS and WISCORS stations.

Horizontal control is referenced to the Universal Transverse Mercator (UTM) Coordinate System – Zone 16, based on the North American Datum of 1983/2007 (NAD83/07). Final coordinates are published in meters.

Vertical control is based on the North American Vertical Datum of 1988 (NAVD88).

## 2.2 Network Computations

The ground control survey was performed by CompassData, Inc of Centennial, CO. The detailed report can be found in section 2 and the final coordinates list in section 4 of this report.

# 3 LiDAR ACQUISITION & PROCEDURES

## 3.1 Acquisition Time Period

LiDAR data acquisition and Airborne GPS control survey was completed between October 29th, 2010 and November 23rd, 2010. A total of 6 flight missions were required to cover the project area.

## 3.2 LiDAR Planning

The LiDAR data for this project was collected with Aerometric, Inc. Optech Gemini Airborne LiDAR system (Serial Number 07SEN201). All flight planning and acquisition was completed using Optech's ALTM-Nav, version 2.1.25b (flight planning and LiDAR control software).

The following are the acquisition settings for Ozaukee County, Wisconsin:

- Flying Height (Above Ground): 1500 meters
- Laser Pulse Rate: 70 kHz
- Mirror Scan Frequency: 40 Hz
- Scan Angle (+/-): 17°
- Side Lap: 50 %
- Ground Speed: 160 kts
- Nominal Point Spacing: 1 meter

## 3.3 LiDAR Acquisition

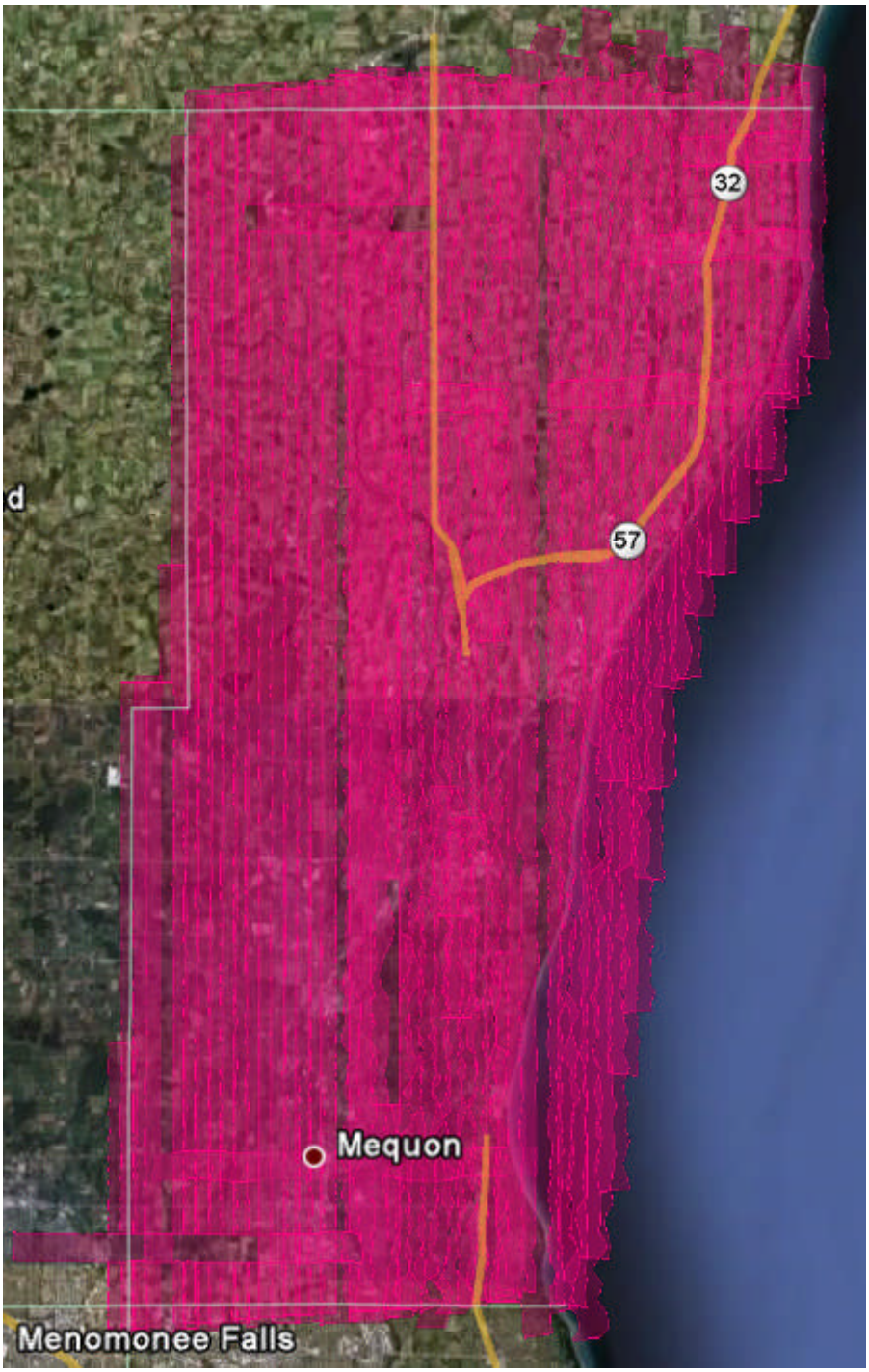
A total of 6 flight missions were required to cover the project area. The missions were flown using the above planned values. See below for a sketch of the acquisition missions and Section 5 of the report for the flight logs.

Airborne GPS and IMU trajectories for the LiDAR sensor were also acquired during the time of flight.

The missions usually average three to four hours duration. Typically, before take-off, the LiDAR system and the Airborne GPS and IMU systems were statically aligned for a period of five minutes and then again after landing for another five minutes. The missions acquired data according to the planned flight lines and included a minimum of one (1) cross flight. The cross flights were flown perpendicular to the planned flight lines and their data used in the in-situ calibration of the sensor.

### 3.4 LiDAR Trajectory Processing

The airborne positioning was processed using the following CORS stations: SHAN, WILMS, and RRW1.



# 4 QC SURVEYS

The check point survey was performed on October 29th and October 30th, 2010 using Rapid Static GPS techniques. A total of 21 check points were surveyed across the project area. These points were collected in open terrain to assess Fundamental Vertical Accuracy.

See Section 4 of the control report for a complete listing.

# 5 FINAL LiDAR PROCESSING

## 5.1 ABGPS and IMU Processing

Airborne GPS

Applanix - POSGPS
Utilizing carrier phase ambiguity resolution on the fly (i.e., without initialization). The solution to sub-decimeter kinematic positioning without the operational constraint of static initialization as used in semi-kinematic or stop-and-go positioning was utilized for the airborne GPS post-processing.

The processing technique used by Applanix, Inc. for achieving the desired accuracy is Kinematic Ambiguity Resolution (KAR). KAR searches for ambiguities and uses a special method to evaluate the relative quality of each intersection (RMS). The quality indicator is used to evaluate the accuracy of the solution for each processing computation. In addition to the quality indicator, the software will compute separation plots between any two solutions, which will ultimately determine the acceptance of the airborne GPS post processing.

Inertial Data

The post-processing of inertial and aiding sensor data (i.e. airborne GPS post processed data) is to compute an optimally blended navigation solution. The Kalman filter-based aided inertial navigation algorithm generates an accurate (in the sense of least-square error) navigation solution that will retain the best characteristics of the processed input data. An example of inertial/GPS sensor blending is the following: inertial data is smooth in the short term. However, a free-inertial navigation solution has errors that grow without bound with time. A GPS navigation solution exhibits short-term noise but has errors that are bounded. This optimally blended navigation solution will retain the best features of both, i.e. the blended navigation solution has errors that are smooth and bounded.
The resultant processing generates the following data:

- Position: Latitude, Longitude, Altitude
- Velocity: North, East, and Down components
- 3-axis attitude: roll, pitch, true heading
- Acceleration: x, y, z components
- Angular rates: x, y, z components

The Applanix software, version 4.4, was used to determine both the ABGPS trajectory and the blending of inertial data.

The airborne GPS and blending of inertial and GPS post-processing were completed in multiple steps.

1. The collected data was transferred from the field data collectors to the main computer. Data was saved under the project number and separated between LiDAR mission dates. Inside each mission date, a sub-directory was created with the aircraft's tail number and an A or B suffix was attached to record which mission of the day the data is associated with. Inside the tail number sub-directory, five sub-directories were also created: EO, GPS, IMU, PROC, and RAW.

2. The aircraft raw data (IMU and GPS data combined) was run through a data extractor program. This separated the IMU and GPS data. In addition to the extraction of data, it provided the analyst the first statistics on the overall flight. The program was POSPac (POS post-processing PACkage).

3. Executing POSGPS program to derive accurate GPS positions for all flights:

   Applanix POSGPS

   The software utilized for the data collected was PosGPS, a kinematic on-the-fly (OTF) processing software package. Post processing of the data is computed from each base station (Note: only base stations within the flying area were used) in both a forward and backward direction. This provides the analyst the ability to Quality Check (QC) the post processing, since different ambiguities are determined from different base stations and also with the same data from different directions.

   The trajectory separation program is designed to display the time of week that the airborne or roving antenna traveled, and compute the differences found between processing runs. Processed data can be compared between a forward/reverse solution from one base station, a reverse solution from one base station and a forward solution from the second base station, etc. For the Applanix POSGPS processing, this is considered the final QC check for the given mission. If wrong ambiguities were found with one or both runs, the analyst would see disagreements from the trajectory plot, and re-processing would continue until an agreement was determined.

   Once the analyst accepts a forward and reverse processing solution, the trajectory plot is analyzed and the combined solution is stored in a file format acceptable for the IMU post processor.

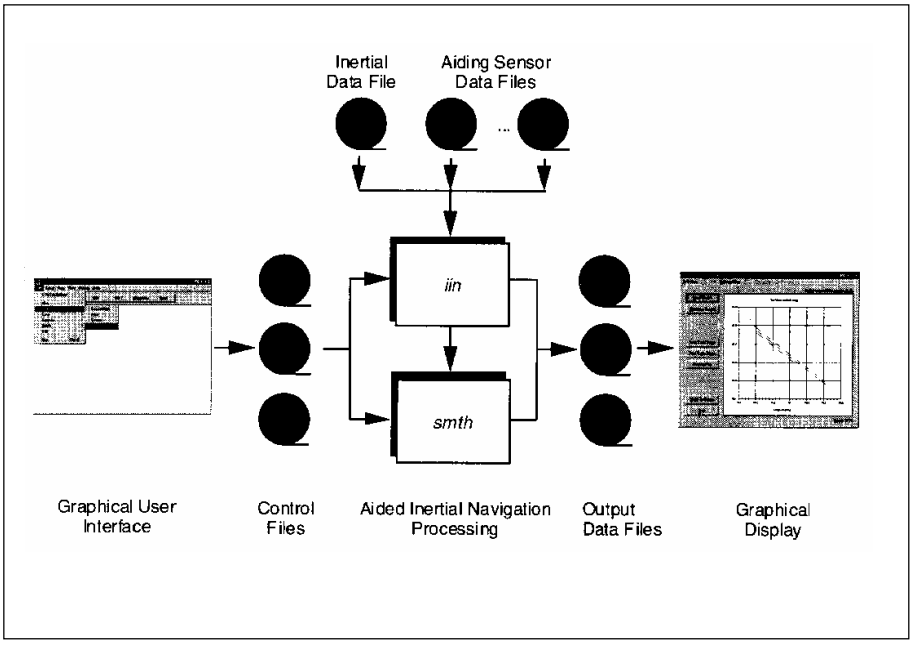
   Please see Section 6 of the control report for the final accepted trajectory plots.

1. When the processed trajectory (either through POSGPS) data was accepted after quality control analysis, the combined solution is stored in a file format acceptable for the IMU post processor (i.e. POSProc).

2. Execute POSProc.

POSProc comprises a set of individual processing interface tools that execute and provide the following functions:

This diagram shows the organization of these tools, and is a function of the




POSProc processing components.

- Integrated Inertial Navigation (*iin*) Module.

The name *iin* is a contraction of Integrated Inertial Navigation. *iin* reads inertial data and aiding data from data files specified in a processing environment file and computes the aided inertial navigation solution. The inertial data comes from a strapdown IMU. *iin* outputs the navigation data between start and end times at a data rate as specified in the environment file. *iin* also outputs Kalman filter data for analysis of estimation error statistics and smoother data that the smoothing program *smth* uses to improve the navigation solution accuracy.

*iin* implements a full strapdown inertial navigator that solves Newton's equation of motion on the earth using inertial data from a strapdown IMU. The inertial navigator implements coning and sculling compensation to handle potential problems caused by vibration of the IMU.

- Smoother Module (*smth*).
  *smth* is a companion processing module to *iin*. *smth* is comprised of two individual functions that run in sequence. *smth* first runs the *smoother function* and then runs the *navigation correction function*.

  The *smth* smoother function performs backwards-in-time processing of the forwards-in-time blended navigation solution and Kalman filter data generated by *iin* to compute smoothed error estimates. *smth* implements a modified Bryson-Frazier smoothing algorithm specifically designed for use with the *iin* Kalman filter. The resulting smoothed strapdown navigator error estimates at a given time point are the optimal estimates based on all input data before and after the given time point. In this sense, *smth* makes use of all available information in the input data. *smth* writes the smoothed error estimates and their RMS estimation errors to output data files.

  The *smth* navigation correction function implements a feedforward error correction mechanism similar to that in the *iin* strapdown navigation solution using the smoothed strapdown navigation errors. s*mth* reads in the smoothed error estimates and with these, corrects the strapdown navigation data. The resulting navigation solution is called a Best Estimate of Trajectory (BET), and is the best obtainable estimate of vehicle trajectory with the available inertial and aiding sensor data.

The above mentioned modules provide the analyst the following statistics to ensure that the most optimal solution was achieved: a log of the *iin* processing, the Kalman filter Measurement Residuals, Smoothed RMS Estimation Errors, and Smoothed Sensor Errors and RMS.

## 5.2 LiDAR “Point Cloud” Processing

The ABGPS/IMU post processed data along with the LiDAR raw measurements were processed using Optech Incorporated’s DASH MAP software. This software was used to match the raw LiDAR measurements with the computed ABGPS/IMU positions and attitudes of the LiDAR sensor. The result was a “point cloud” of LiDAR measured points referenced to the ground control system.

## 5.3 LIDAR CALIBRATION

### Introduction

The purpose of the LiDAR system calibration is to refine the system parameters in order for the post-processing software to produce a “point cloud” that best fits the actual ground.

The following narrative outlines the calibration techniques employed for this project.

### Calibration Procedures

Aerometric, Inc. routinely performs two types of calibrations on its Optech Gemini LiDAR system. The first calibration, system calibration, is performed whenever the LiDAR system is installed in the aircraft. This calibration is performed to define the system parameters affected by the physical misalignment of the system versus aircraft. The second calibration, in-situ calibration, is performed for each mission using that mission’s data. This calibration is performed to refine the system parameters that are affected by the on site conditions as needed.

### System Calibration and Correction Software

Optech has developed proprietary calibration software in December of 2009 that performs the system calibration. The results from this new software achieved excellent results and an accuracy that meets the project requirements.

This new calibration tool incorporates Optech’s proprietary optical sensor models to compute laser point positions and provide laser point calibration improvements on a per flightline basis for the entire project area. It furthermore calculates planar surfaces at different angles from each flight line and then uses a robust least squares solution to compute the orientation parameters at the optical level instead of the traditional methods relating to the ground points. Determining and correcting at the optical level is critical when correcting the data in this project. Each flight line was computed individually and output in LAS 1.2 format.

### In-situ Calibration

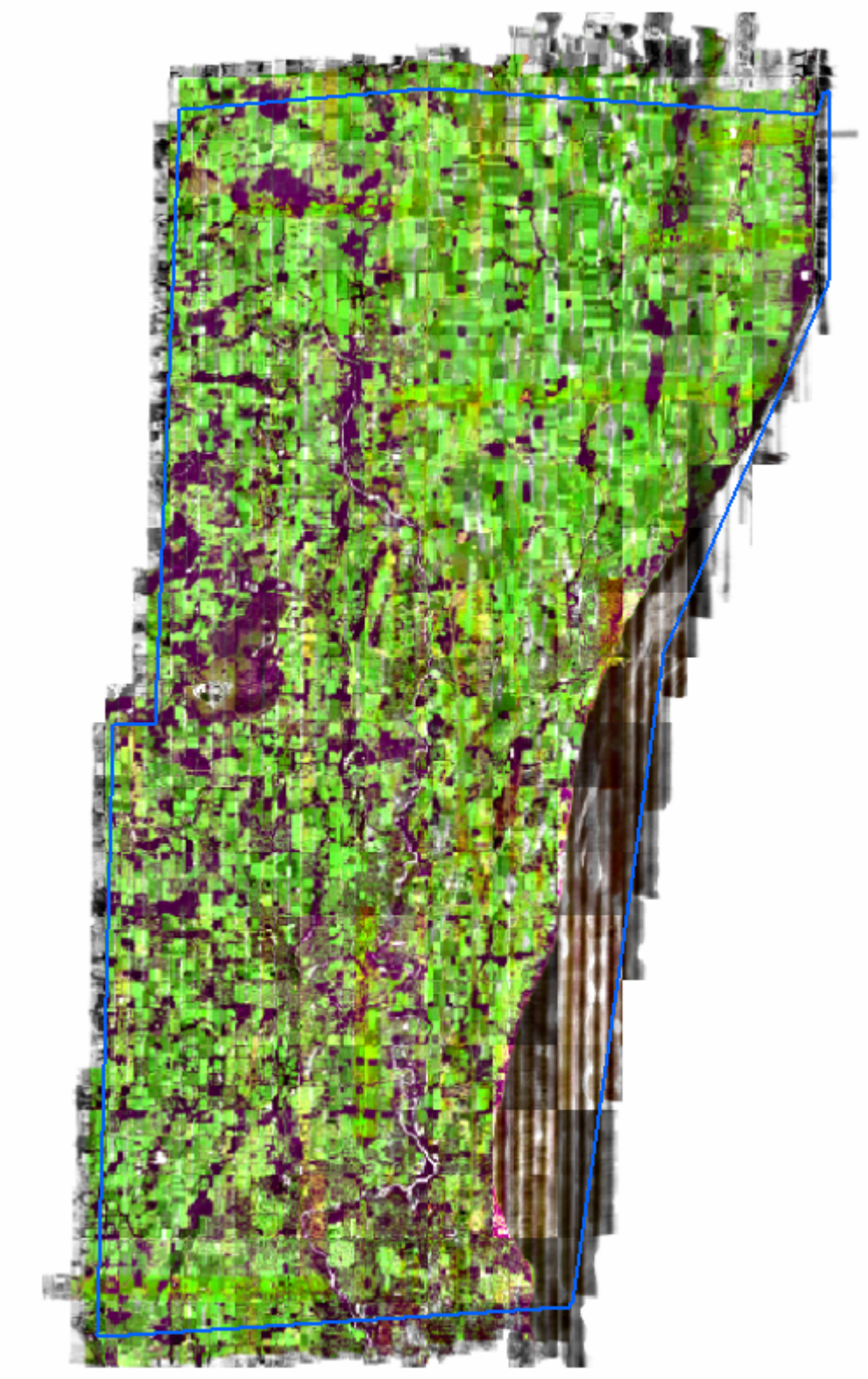
The in-situ calibration is performed as needed using the mission’s data. This calibration is performed to refine the system parameters that are affected by the on site conditions.

For each mission, LiDAR data for at least one cross flight is acquired over the mission’s acquisition site. The processed data of the cross flight is compared to the perpendicular flight lines using either the Optech proprietary software or TerraSolid's TerraMatch software to determine if any systematic errors are present. In this calibration, the data of individual flight lines are compared against each other and their systematic errors are corrected in the final processed data.

## 5.4 LiDAR Processing

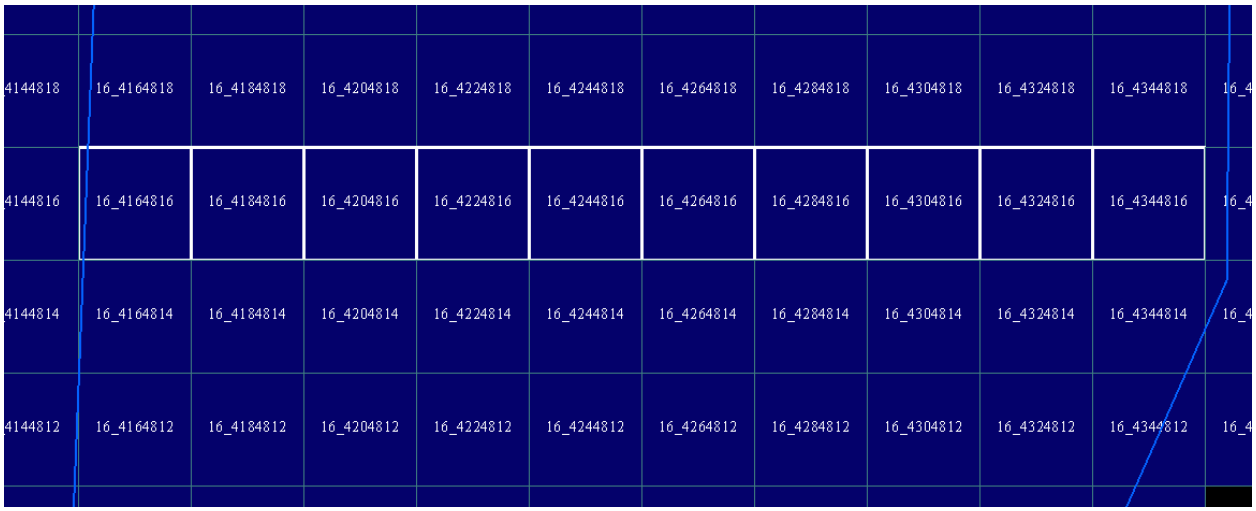
The LAS files were then imported, verified, and parsed into manageable, tiled grids using GeoCue version 7.0.34.0.

The first step after the data has been processed and calibrated is to perform a relative accuracy assessment on the flightline to flightline comparisons and also a data density test prior any further processing. To determine a proper accuracy assessment between flightlines, Aerometric uses GeoCue to create Orthos by elevation differences. The generated orthos have assigned elevation ranges that allow the technician to evaluate if the data passes the accuracy assessment and also determine if additional calibration efforts are needed based on the bias trends. Below are screen captures of the elevation orthos where green indicates a flightline comparison of less than 5 cm; yellow is 5-10 cm; orange is 10-15 cm; red is 15-20 cm, and magenta is greater than 20 cm.



**Ozaukee County Wisconsin**

In addition to the relative accuracy assessment, Aerometric also performs a sample review of tiles to ensure that the desired point density has been met. Aerometric utilized an in-house proprietary software to complete this task. Initially a grid was placed according to the version 12 specification that is based on the nominal post spacing. The results indicated that the density of the sampled tiles achieved only 94.4% of the grids meeting the specified data density criteria. However, using the latest USGS specification, version 13, which modifies the requirements to allow up to 2 times the nominal post spacing our data tests easily meets the desired density requirements with 99.6% grids containing one or more points. Below are the statistics of the results for the inspected tiles from the image shown.




Sample tiles: Ozaukee County, Wisconsin
16_4164816, 16_4184816, 16_4204816, 16_4224816, 16_4244816, 16_4264816, 16_4284816, 16_4304816, 16_4324816, and 16_4344816

(Version 12 – tiles sampled: 10 using a grid size of 1.0 meter)
Total number of cells: 40,000,000
Total number of cells with one point: 11,580,659
Percentage of tiles with 1 point or more: 94.4%

(Version 13 – tiles sampled: 10 using a grid size of 2.0 meters)
Total number of cells: 10,000,000
Total number of cells with one point: 9672
Percentage of tiles with 1 point or more: 99.6%

Once both the accuracy between swaths and data density is accepted an automated classification algorithm is performed using TerraSolid's TerraScan, version 010.017. This will produce the majority of the bare-earth datasets.

### 5.4 Check Point Validation

The data was then verified using the ground control data collected by CompassData, Inc. TerraScan computes the vertical differences between the surveyed elevation and the LiDAR derived elevation for each point.

A report listing the differences and common statistics was created and can be found in Section 7 of this report.

### 5.5 LiDAR Data Delivery

Raw point cloud data supplied is in the following format:

- LAS, version 1.2
- GPS times as Adjusted GPS
- Full swaths and delivered as 1 file per swath not to exceed 2gb.

Classified point cloud data is also being supplied using the following criteria.

- LAS, version 1.2
- GPS times as Adjusted GPS
- Classification schemed:
  - Code 1 – Processed, but unclassified
  - Code 2 – Bare-earth Ground
  - Code 7 – Noise
  - Code 12 _ Overlap

# 6 CONCLUSION

Because of the rigorous procedures and use of new technology, this project will serve STARR and all users requiring LiDAR derivative products for the project area in Ozaukee County, Wisconsin well into the future. For this project the results are extremely accurate and reliable.

CompassData

# FEMA Region 5 - Ozaukee County, WI
# Ground Control Project Report for AeroMetric Inc.

## December 6, 2010

## Project Information

| | |
|---|---|
| **CDI Project Number:** | **FSG1530** |
| **Geographic Location:** | **Ozaukee County, Wisconsin** |
| **Number of GCPs Requested:** | **20** |
| **Number of GCPs Collected:** | **21** |

## Project Specifications

| | |
|---|---|
| **Precision (Horizontal/Vertical):** | **CDI Precision-1 ≤ 8cm H/V** |
| **Coordinate System:** | **UTM** |
| **Datum:** | **NAD83** |
| **Zone:** | **16 N** |
| **Altitude Reference:** | **HAE (WGS84) and NAVD88 (09)** |
| **Units:** | **Meters** |

## RTK GPS

All Ground Control Points for this project were collected within the boundaries of the WisCors Virtual Reference Station System, which provides continuous real-time broadcast correction signals within a network of 22 base stations encompassing the South-Central and Southeast Wisconsin region.

All Control Points were observed for 180 epochs to determine a coordinate location ≤ 8cm in both Horizontal and Vertical to support subsequent LiDAR post-processing and bare earth deliverables generation.

All data collected were well within the confines of the WisCors VRS system with multiple base locations providing position and correction data for each point collected.

CompassData

## Summary

The purpose of this project was to locate and survey photo-identifiable ground control points (GCPs) in multiple areas of interest as defined by FEMA-supplied shape and kml files. The GCP coordinates are to be used to control the vertical aspect of all newly-flown LiDAR data during post-processing and subsequent deliverables creation. CompassData visited the project area, found suitable GCPs, and determined accurate coordinates for each GCP according to the customer's specifications.

## Equipment

CompassData used a Trimble R8-3 to perform the Control survey. This device is accurate to within 1 cm on a position-by-position basis per Trimble specifications. Operating within the VRS network provided accurate coordinate values at or around 3 cm H/V within 3-5 minutes observation times. CompassData has consistently demonstrated this level of accuracy on many GCP collection jobs across North and South America and Africa. Specifications for the Trimble R8 are available upon request.

## Survey Methodology

CompassData has met the required precision for this project by using a high-quality GPS receiver with differential corrections provided by a VRS network surrounding the project area. The GPS antenna sat atop a bubble-leveled, fixed-height range pole that was placed over the center of the desired GCP. At least 180 positions (captured at a rate of one per second) were geometrically averaged to calculate a single coordinate for each GCP. All required field documentation was filled out and the points were identified on web-based imagery and diagrammed on the CompassData-supplied sketch sheets. Digital pictures of each GCP location were collected in the field.

## Quality Control Procedures

CompassData collects GCPs with an unobstructed view of the sky to ensure proper GPS operation. CompassData works to avoid potential sources of multipath error such as trees, buildings, and fences that may adversely affect the GPS accuracy.

Additional quality control comes from the fact that at least 180 GPS positions are collected for each GCP. While operating within a VRS, valid solutions are reached within seconds; however, we continue to collect additional data to ensure meeting collection specifications. To ensure project integrity, a GCP will be reobserved or moved to a more suitable location if it does not meet project specifications.

In addition to the aforementioned procedures, CompassData observes existing geodetic control monuments to verify that our coordinates match the published coordinates to the required accuracy. These monuments are usually established by the National Geodetic Survey (NGS) in the United States. If it is found that our coordinates are outside the acceptable accuracy, the reason for the difference will be found or the GCPs will be reobserved under different GPS constellation constraints. There are certain geodetic considerations that must be taken into account that affect whether a GPS-derived coordinate will line up with a survey monument, especially when these monuments reference local coordinate systems or the systems of another country. Sometimes the published coordinates for a monument are not accurate, although this is very infrequent.

CompassData visited multiple survey monuments during the course of this project. The results of those monument measurements are summarized in the Accuracy Report.

## Deliverables

Deliverables for this project include:

- Coordinates (in spreadsheet format)
- Image Chips
- Sketch Sheets
- Digital Pictures
- QA/QC Data

## Project Notes

All collected points were retrieved from the Trimble Survey Controller in Decimal Degrees, NAD83, HAE Meters.

CorpsCon was used to generate files in the following format:

Degrees Minutes Decimal Seconds, NAD83 HAE (QC purposes)
UTM Meters, NAD83 HAE

Geoid09 was then used to generate the geoid separation at every Lat/Long location. NAVD88(09) orthometric heights were then generated in spreadsheet form using the formula HAE - Geoid = Orthometric Height. Those values were then included into the final delivery coordinate CSV files and have been tested against NGS monuments collected during the course of this survey and are showing millimeter-level agreement.

The Horizontal and Vertical accuracies reported in the Final Coordinates file were obtained from the Survey Report generated by Trimble Survey Controller. The report contains all points collected during each daily survey deployment, including CVAs, FVAs and Ground Control. Copies of these reports can be provided upon request once the CVA and FVA data has been redacted.

## Contact Information

Hayden Howard Phone: (303) 627-4058 E-mail: haydenh@compassdatainc.com

# CompassData

*GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK101 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |

**GPS Antenna Height: 2m**

**Comments:**

Point taken at intersection of Jay Rd and CO Rd E
in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK102 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |

**GPS Antenna Height: 2m**

**Comments:**

Point was taken at the intersection of Jay Rd and Kay K Rd
in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK103 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |

**GPS Antenna Height: 2m**

**Comments:**

Point was taken at the intersection of Jay Rd and Clay Ridge Rd in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK104 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |


**GPS Antenna Height: 2m**

**Comments:**

Point was taken at the intersection of CO HWY A and County Lane in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK105 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |


**GPS Antenna Height: 2m**

**Comments:**

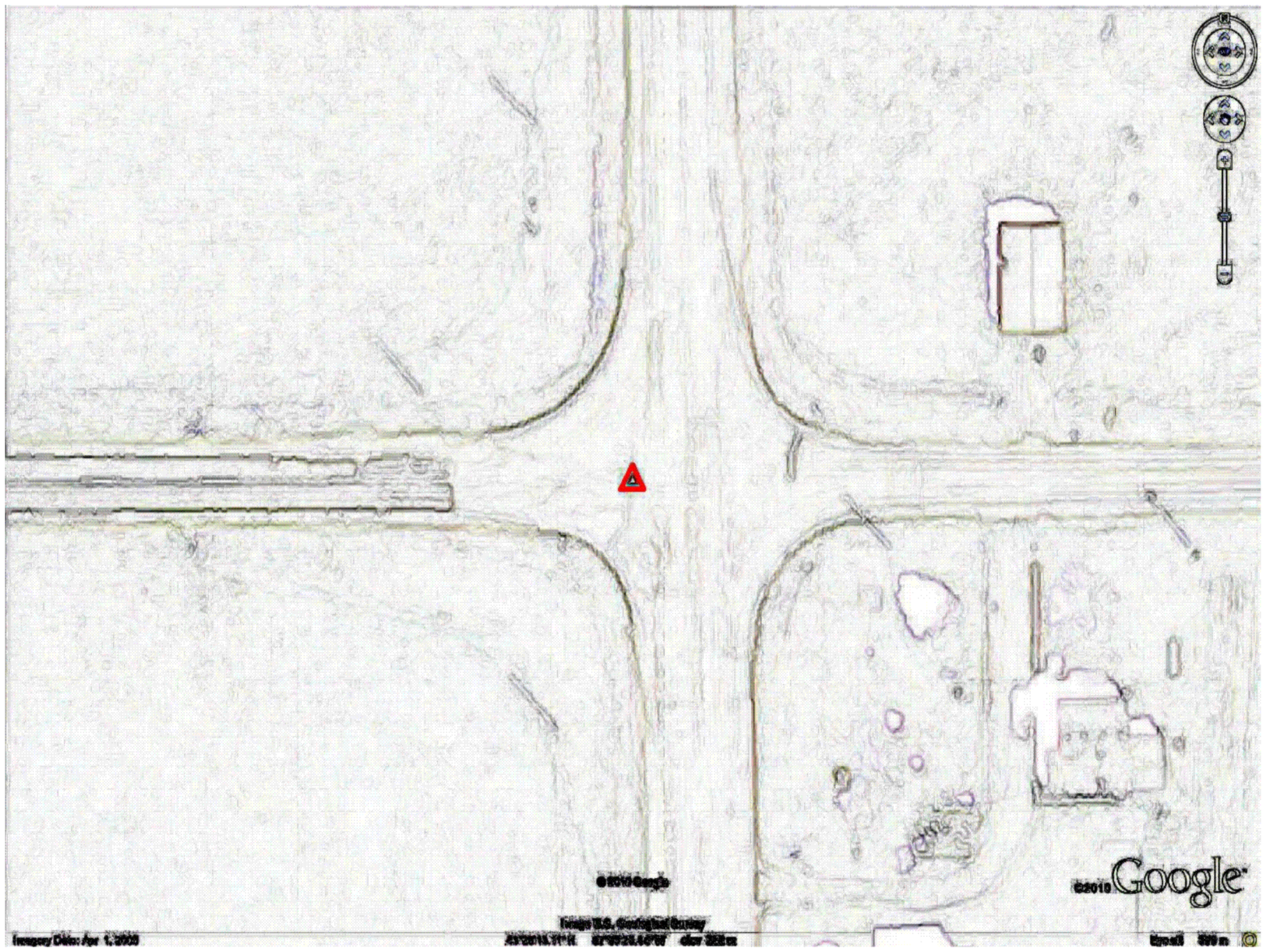
Point was taken at the intersection of CO Rd A and Kay K Rd
in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK106 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |




**GPS Antenna Height: 2m**

**Comments:**

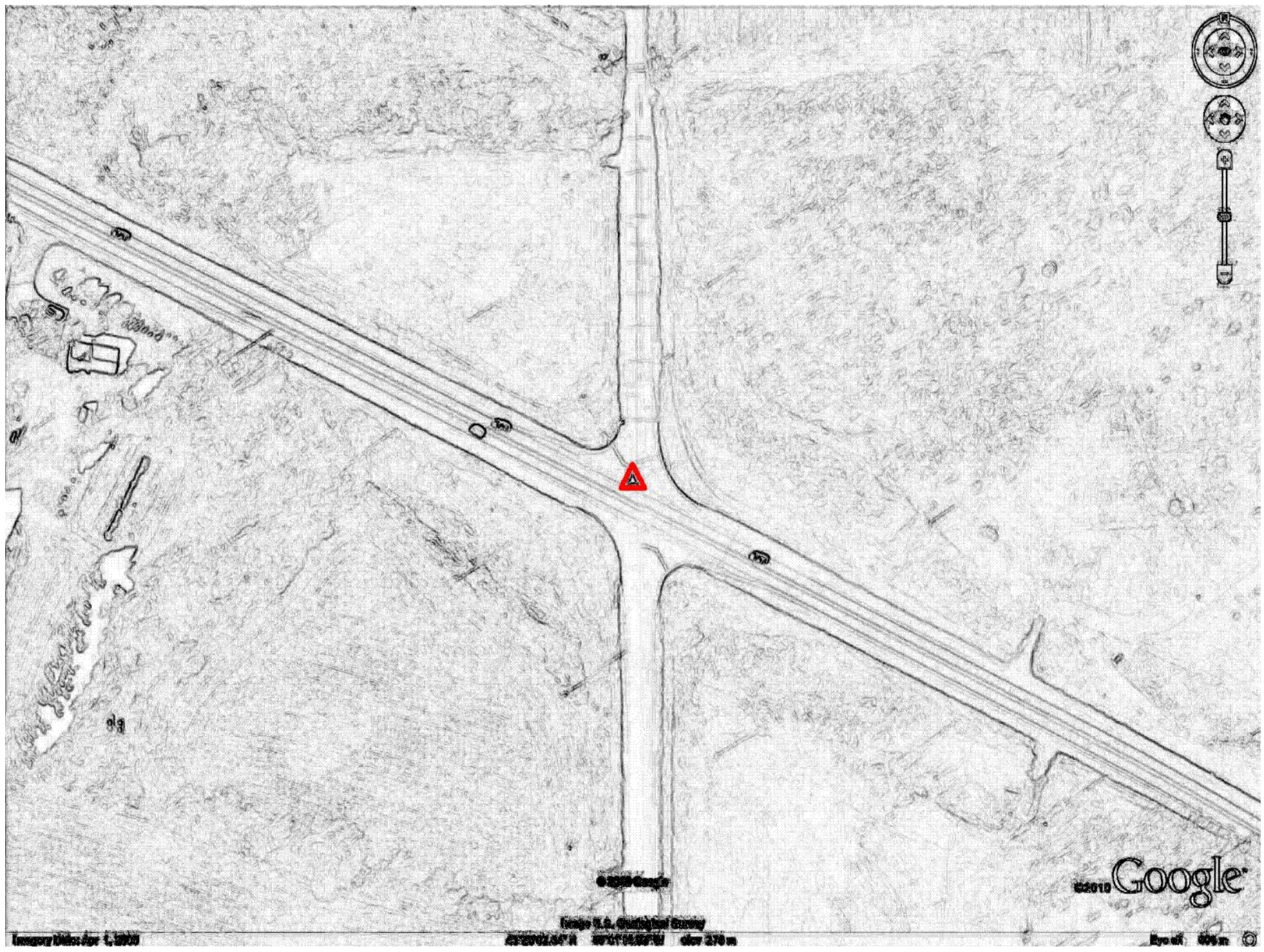
Point was taken at the intersection of CO Rd A and CO Truck HWY H in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

*GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK107 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |




**GPS Antenna Height: 2m**

**Comments:**

Point was taken at the intersection of HWY 33 and Blue Goose Rd in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

*GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK108 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |



**GPS Antenna Height: 2m**

**Comments:**

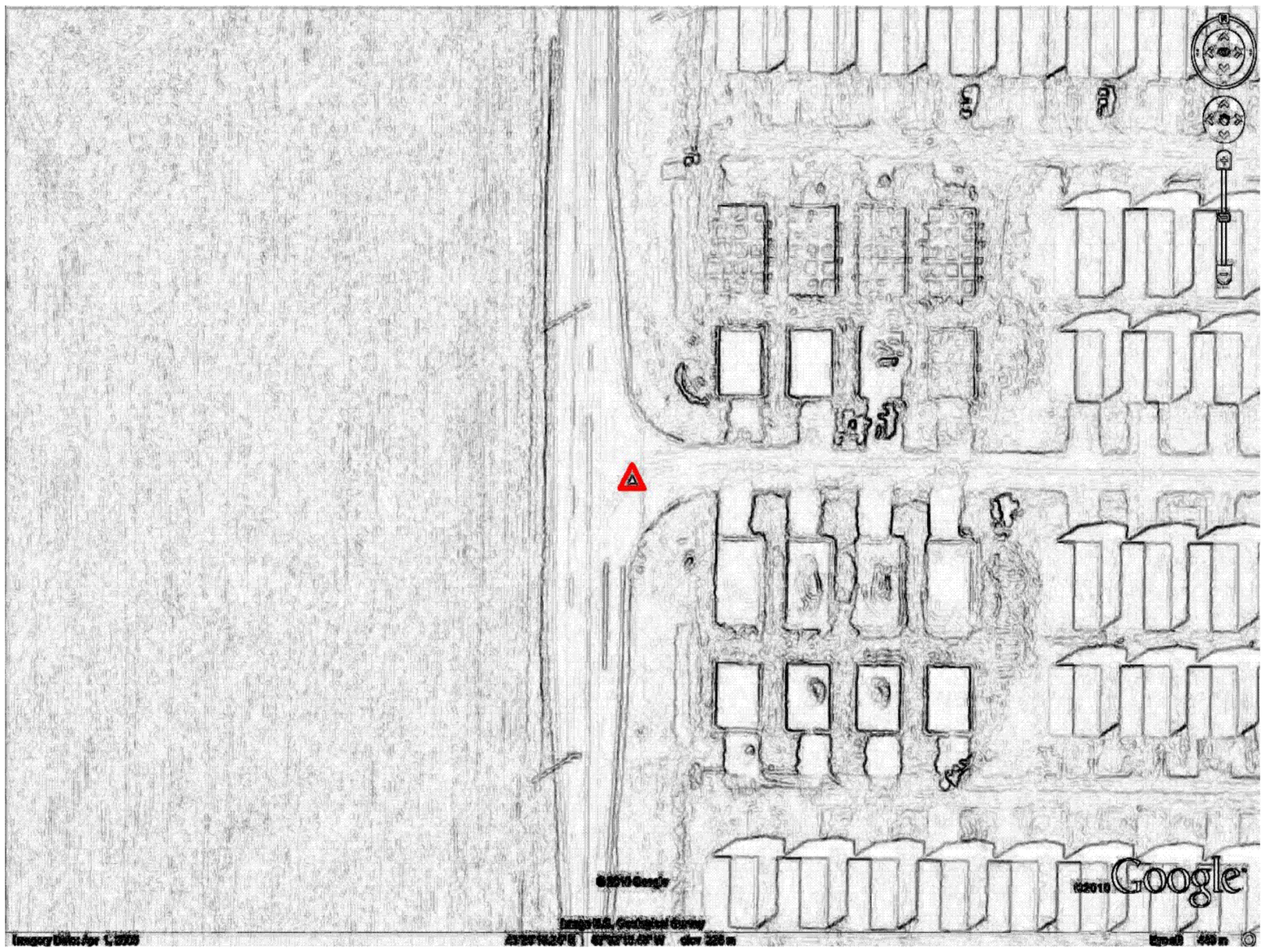
Point was taken at the intersection of Co Hwy O and the entrance to Tendick Nature Park in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

*GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK109 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |





**GPS Antenna Height: 2m**

**Comments:**

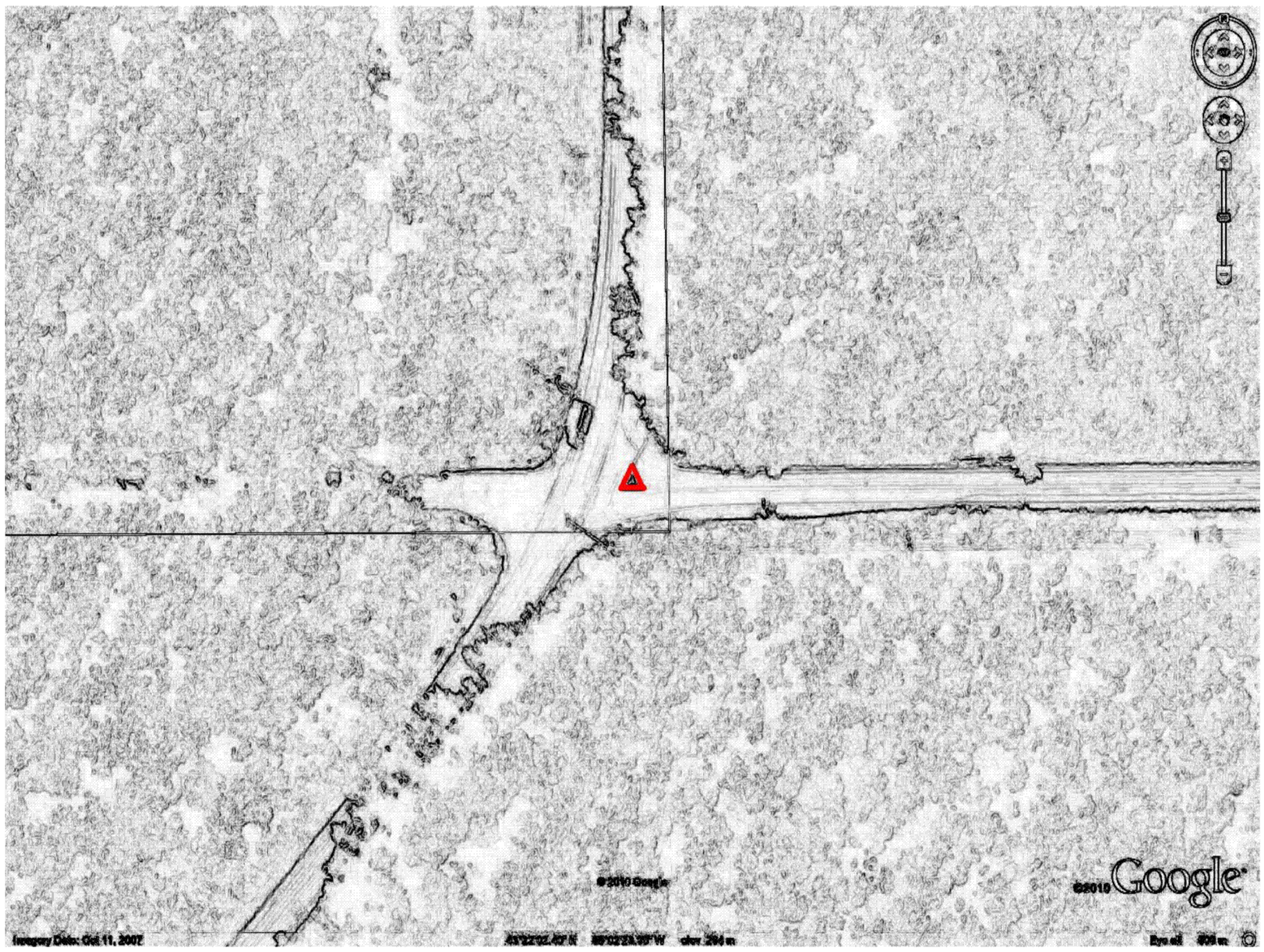
Point was taken at the intersection of Co Rd KW and entrance to a small industrial area consisting of several storage buildings with blue roofs in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK110 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |





**GPS Antenna Height: 2m**

**Comments:**

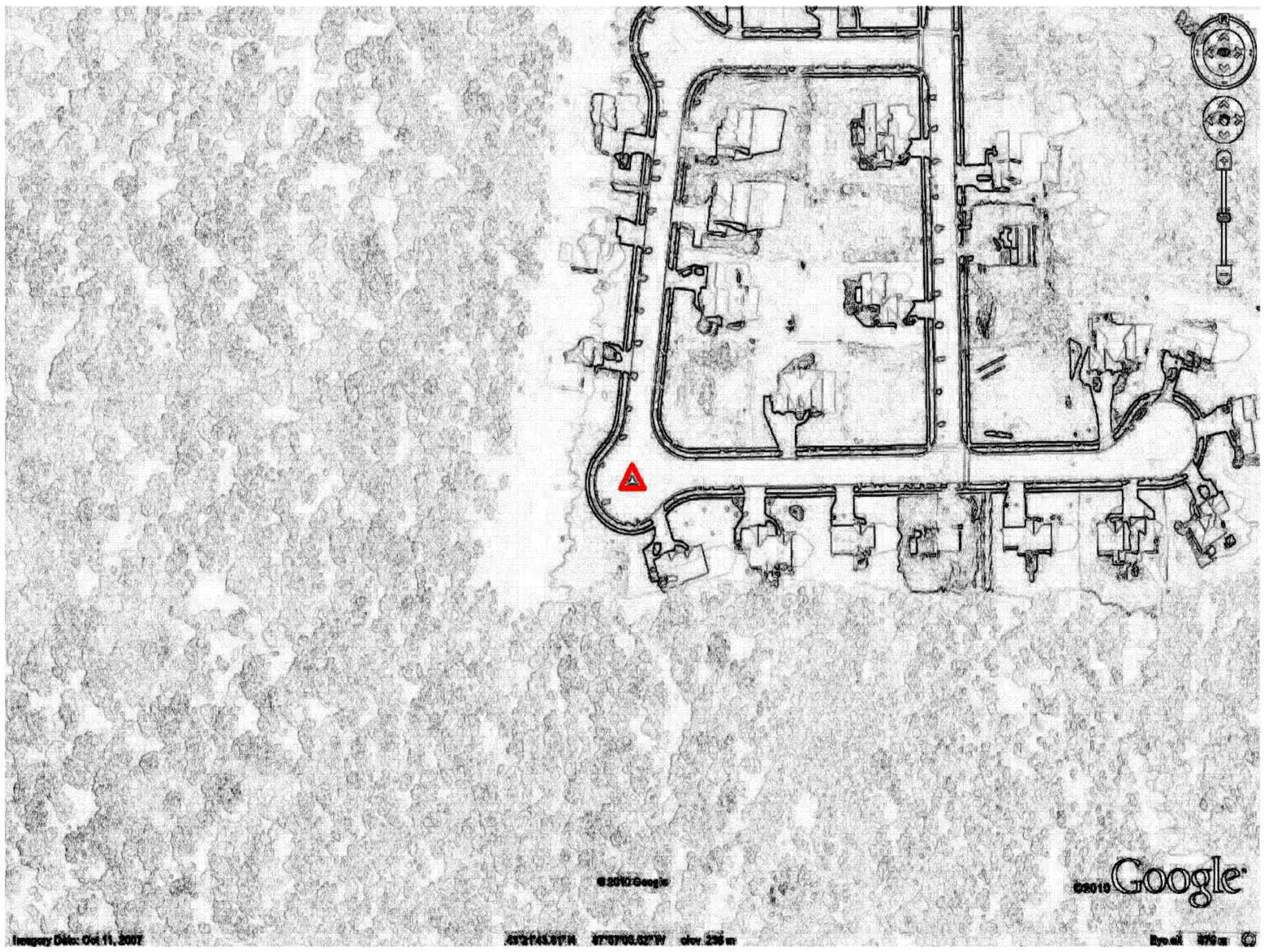
Point was taken at the intersection of Co Rd Y and Cedar Sauk Rd in Lone Island County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK111 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |




**GPS Antenna Height: 2m**

**Comments:**

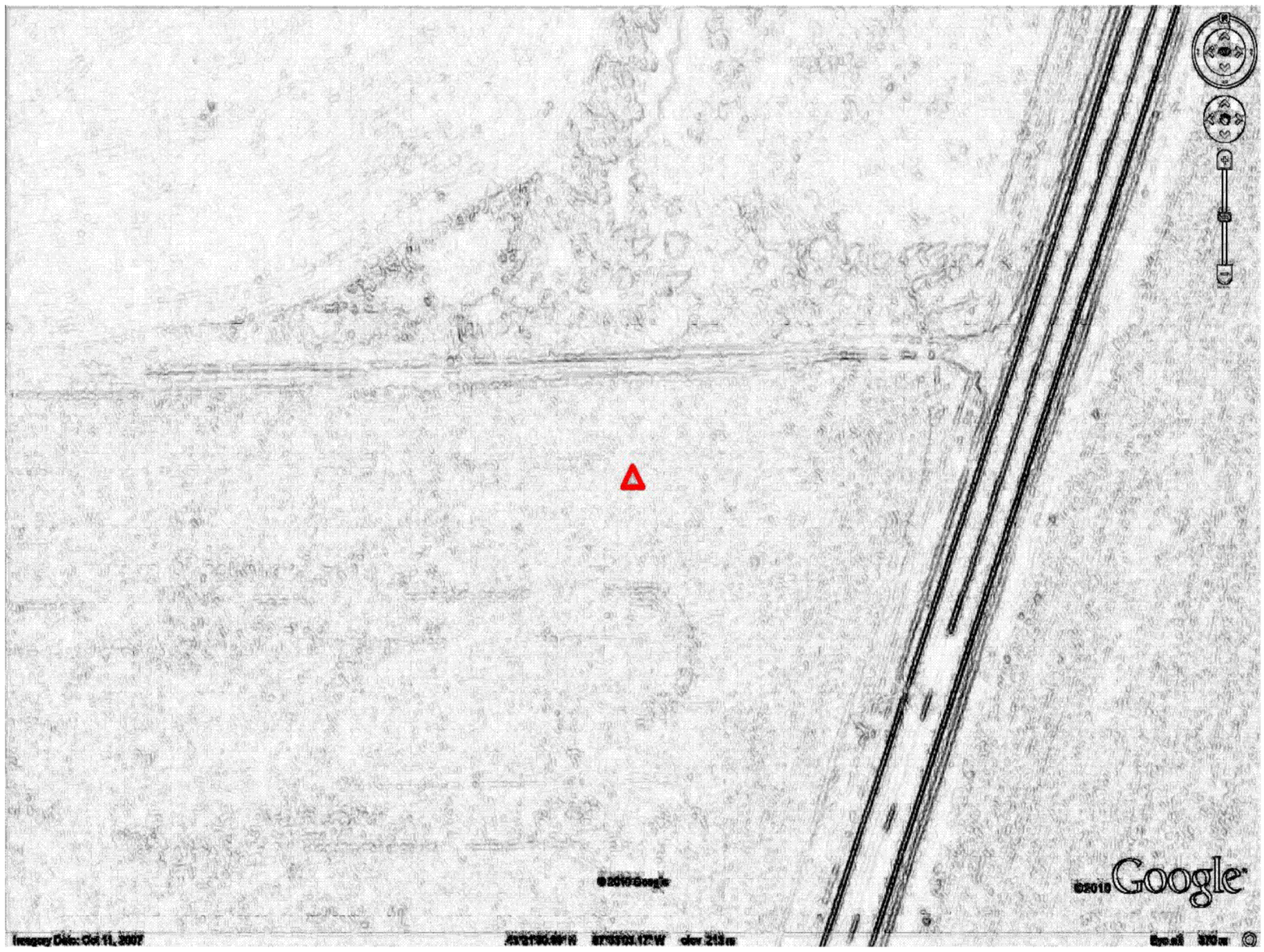
Point was taken in a cul-de-sac at W Arcadia Dr and Dahlia Ln
in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK112 |
| **CDI Project Number:** 1508 | **Date:** 10/30/2010 |




**GPS Antenna Height: 2m**

**Comments:**

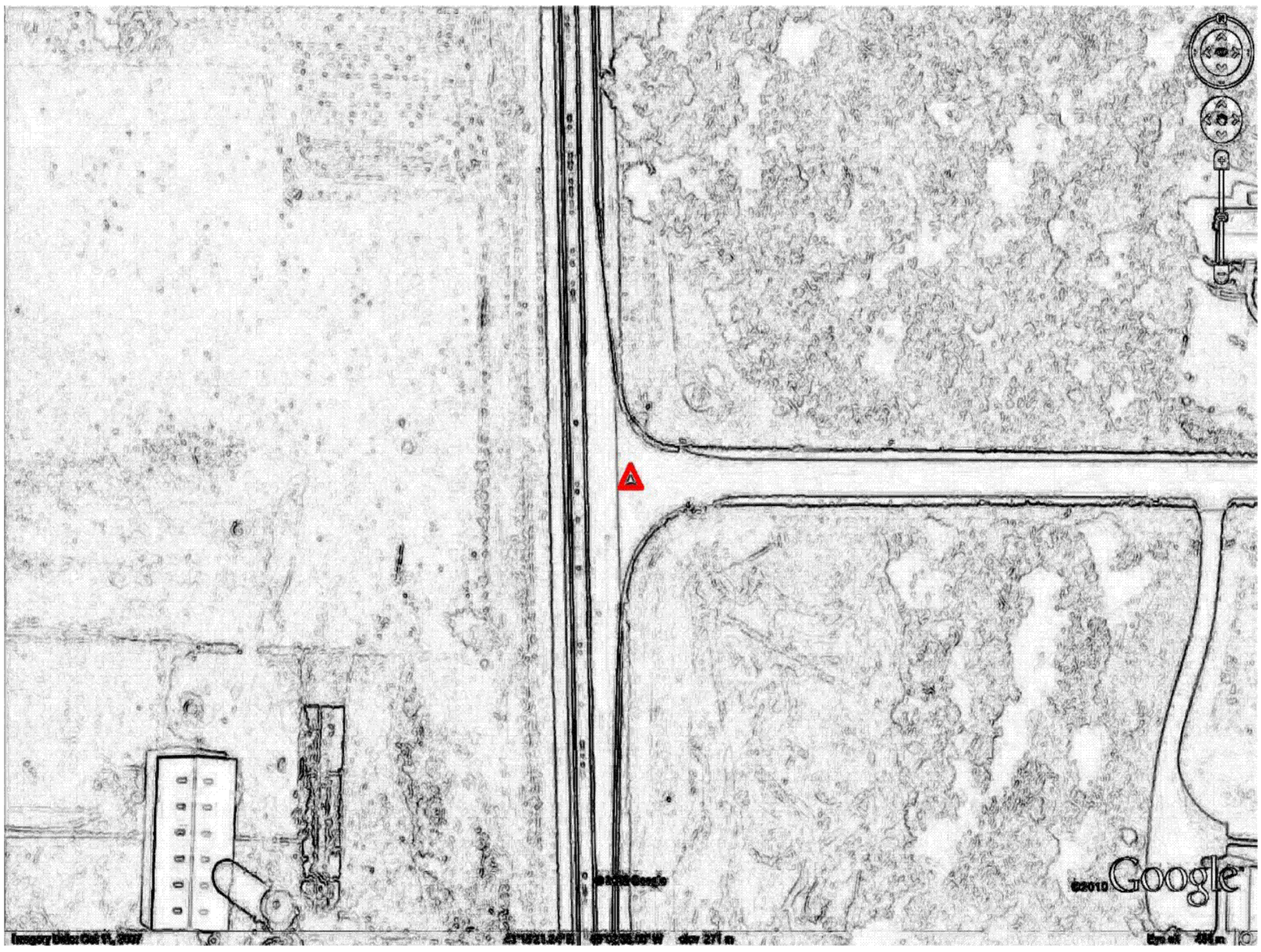
Point was taken in a field west of CO Rd C approx. .58 miles north of Stonecroft Dr in Ozaukee County, Wisconsin

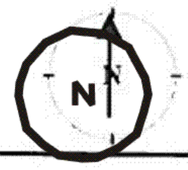
| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK113 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

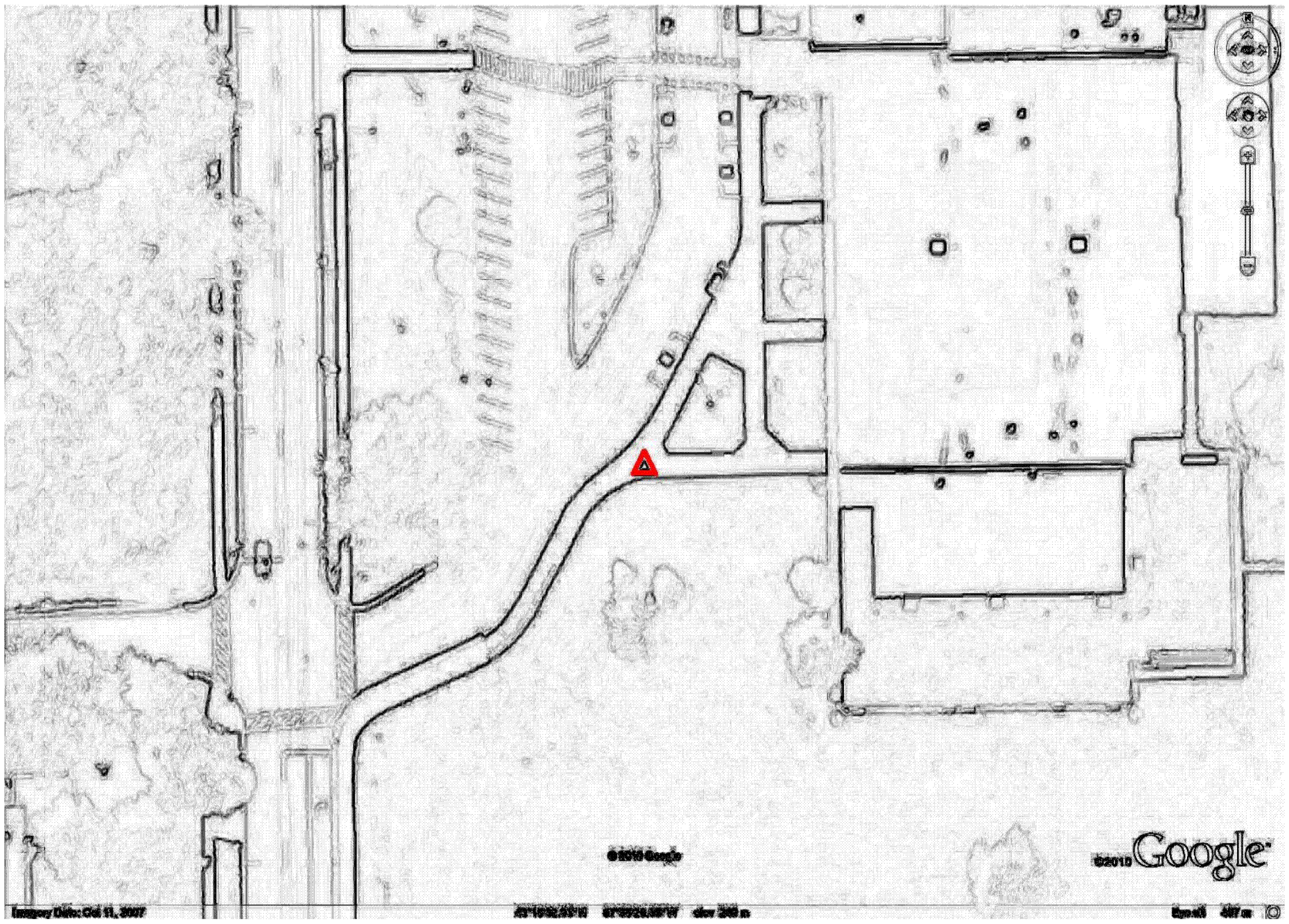
Point was taken at the intersection of Granville Rd and Ridgefield Ct in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK114 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

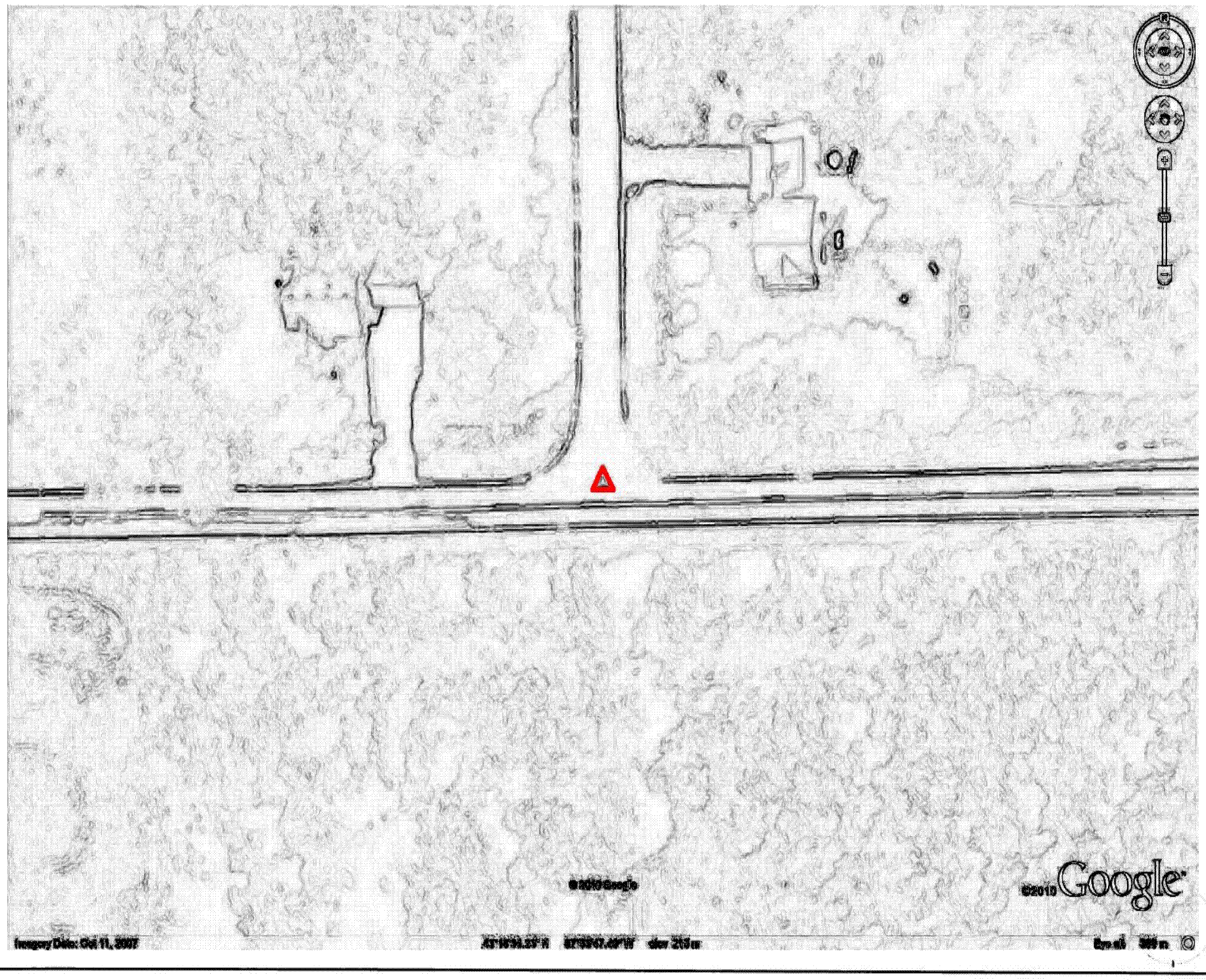
Point was taken on school property at sidewalk just southwest of flagpole east of Keup Rd.
Ozaukee County Illinois.

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK115 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

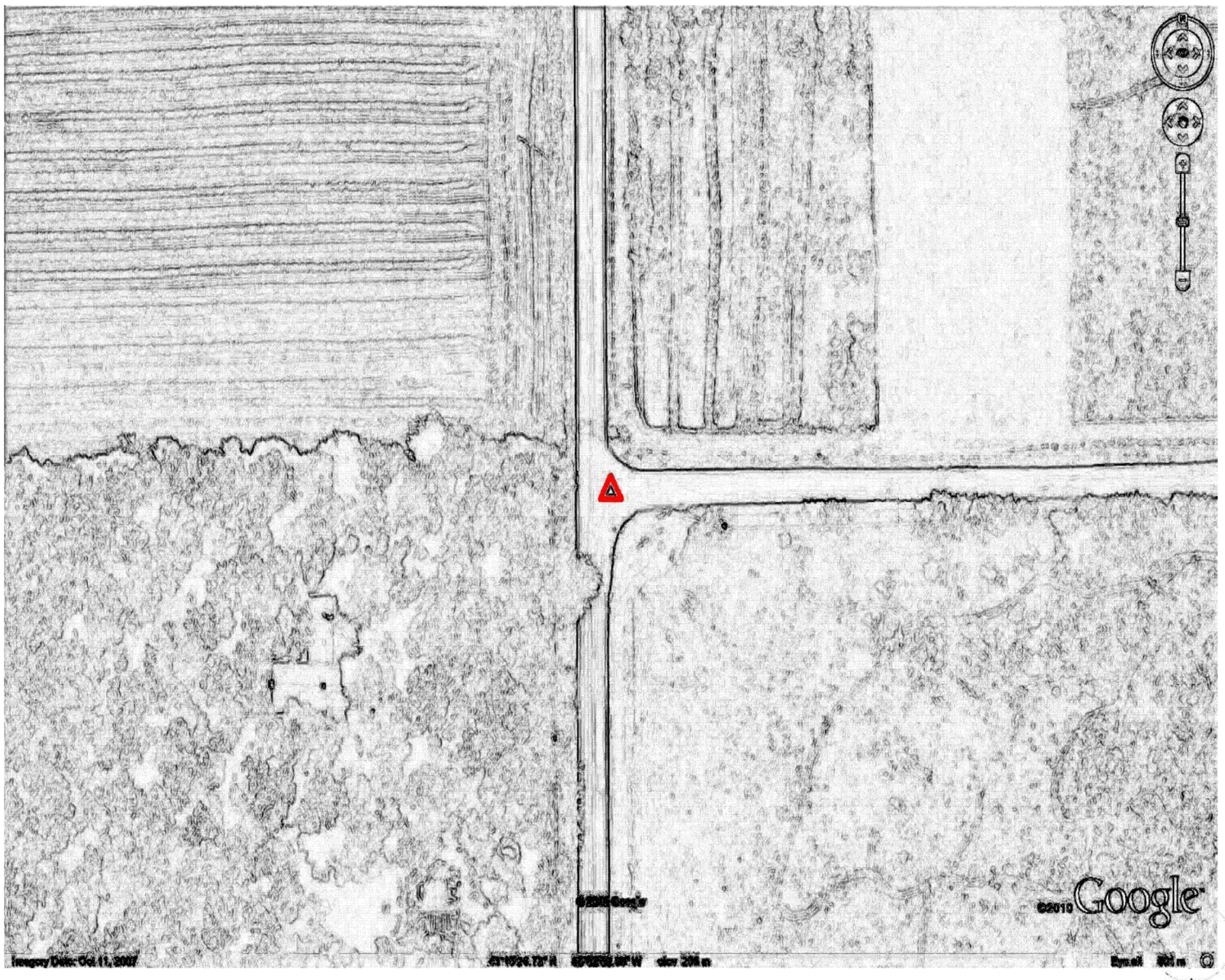
Point was taken at the intersection of Falls Rd and Lakeland Rd
in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK116 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

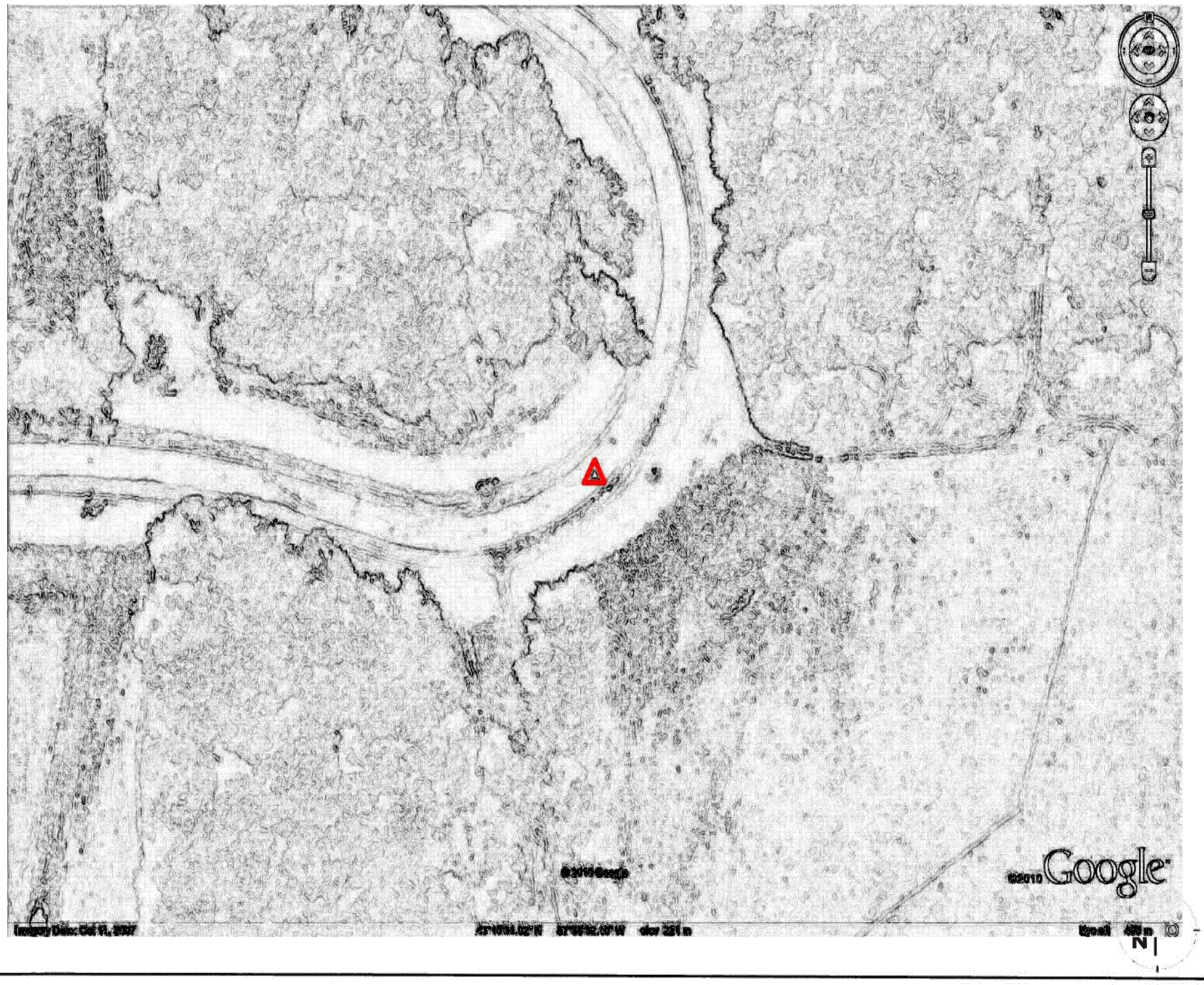
Point was taken at the intersection of N Granville Rd and Hawthrone Rd in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK117 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

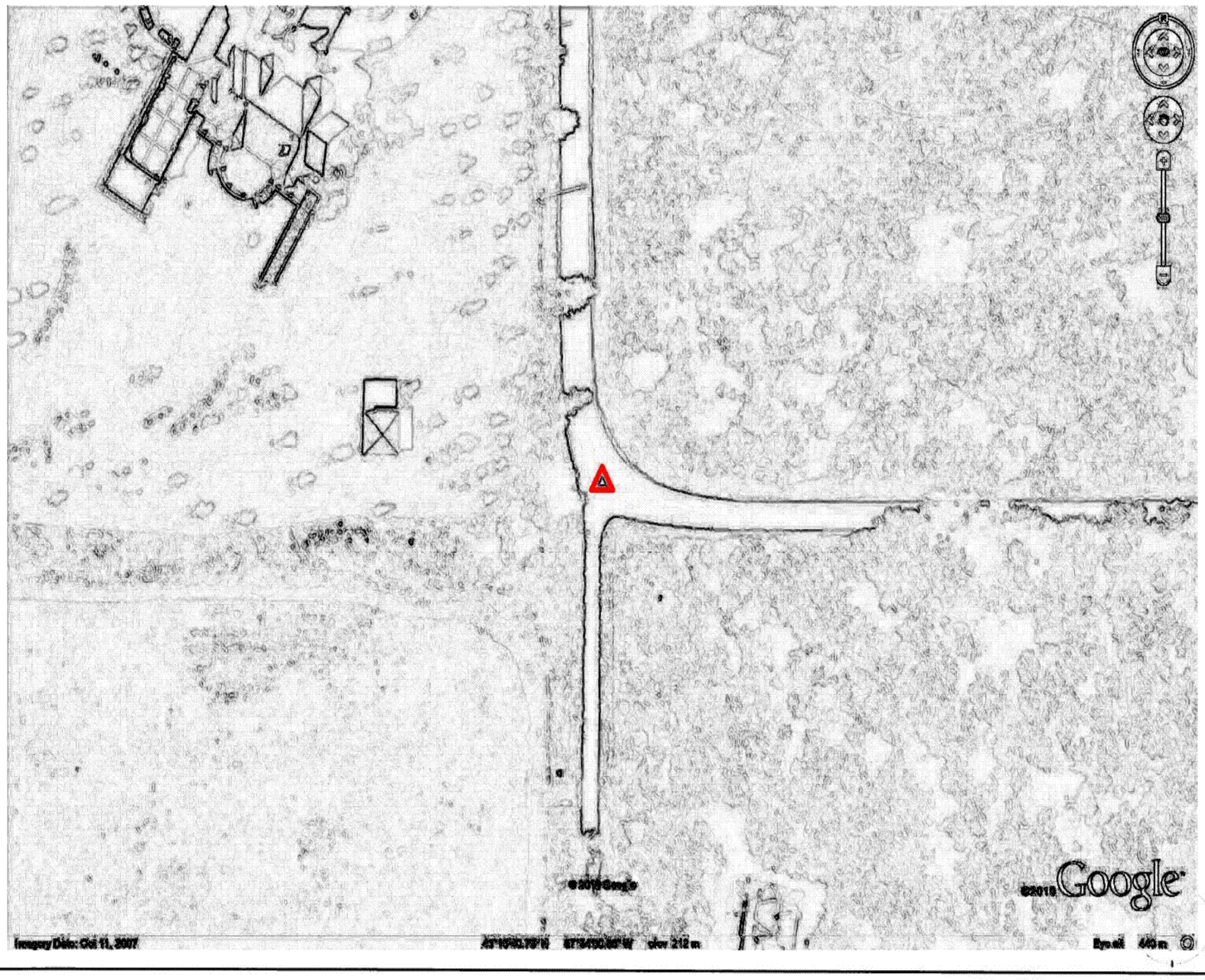
Point was taken in a new development east of Green Bay Rd and east of Mee-Kwon Park Golf Course in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK118 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

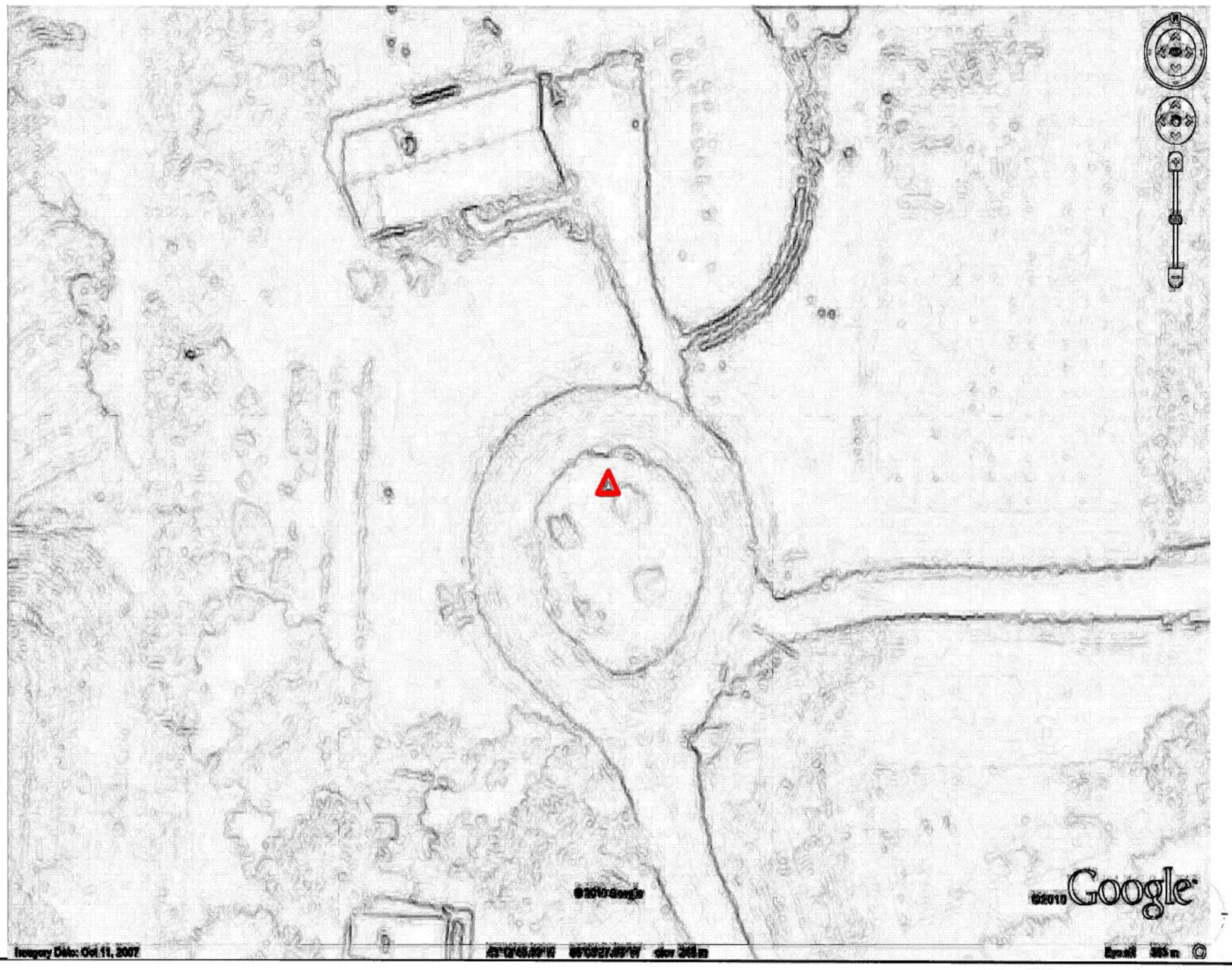
Point was taken on the corner of N Northwood Ln and W Bonness Ln in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK119 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

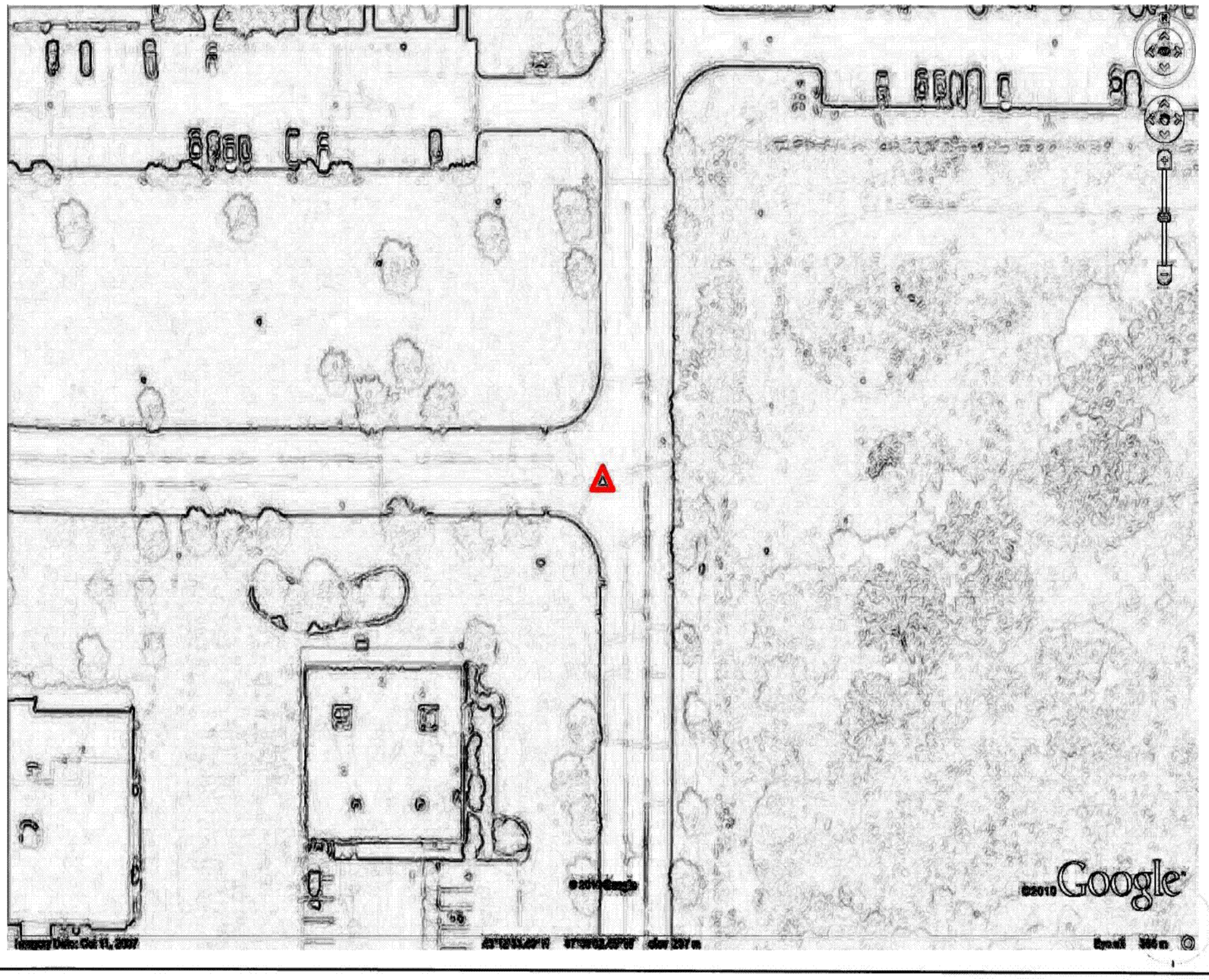
Point was taken in round-a-bout at the north end of O'Connell Ln in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK120 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |




**GPS Antenna Height: 2m**

**Comments:**

Point was taken in the intersection of Baehr Rd and W Executive Dr in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

# CompassData

## *GCP Station Diagram for LiDAR*

| | |
|---|---|
| **Project Name:** Ozaukee | **GCP Number:** OZK121 |
| **CDI Project Number:** 1508 | **Date:** 10/29/2010 |


**GPS Antenna Height: 2m**

**Comments:**

Point was taken in the intersection of Wood Crest Ct and Pine Ridge Dr in Ozaukee County, Wisconsin

| | |
|---|---|
| **Disk (Roll) / Frame Number:** | **Sketch** 1 **of** 1 |
| **Collected By:** Bryan Frazier | **Checked By:** |

| Ozaukee, Wisconsin | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **GCP** | **Date** | **Vert_Prec** | **Horz_Prec** | **Latitude** | **Longitude** | **Northing** | **Easting** | **HAE** | **MSL** |
| OZK101 | 10/30/2010 | 0.0082 | 0.0058 | 43.52734872 | -88.02055867 | 4819884.546 | 417530.639 | 234.277 | 269.469 |
| OZK102 | 10/30/2010 | 0.0098 | 0.0061 | 43.52885974 | -87.92092222 | 4819958.402 | 425583.963 | 218.248 | 253.539 |
| OZK103 | 10/30/2010 | 0.0094 | 0.0067 | 43.52850211 | -87.81086466 | 4819826.111 | 434476.92 | 177.573 | 212.986 |
| OZK104 | 10/30/2010 | 0.0058 | 0.0043 | 43.46901556 | -88.03048544 | 4813416.014 | 416648.26 | 222.098 | 257.208 |
| OZK105 | 10/30/2010 | 0.0079 | 0.0055 | 43.47048734 | -87.92060056 | 4813475.344 | 425538.249 | 212.1 | 247.35 |
| OZK106 | 10/30/2010 | 0.0091 | 0.0055 | 43.47035363 | -87.8405471 | 4813392.026 | 432013.161 | 187.542 | 222.892 |
| OZK107 | 10/30/2010 | 0.0073 | 0.004 | 43.41749422 | -88.02083121 | 4807684.542 | 417359.047 | 240.506 | 275.572 |
| OZK108 | 10/30/2010 | 0.0094 | 0.0055 | 43.41624758 | -87.95257908 | 4807480.688 | 422882.816 | 217.561 | 252.728 |
| OZK109 | 10/30/2010 | 0.0082 | 0.0061 | 43.42105918 | -87.87098181 | 4807942.795 | 429494.235 | 194.701 | 229.994 |
| OZK110 | 10/29/2010 | 0.0058 | 0.004 | 43.36733215 | -88.03998593 | 4802132.862 | 415738.901 | 228.824 | 263.83 |
| OZK111 | 10/30/2010 | 0.0076 | 0.0046 | 43.36225616 | -87.95194139 | 4801483.985 | 422866 | 205.254 | 240.4 |
| OZK112 | 10/30/2010 | 0.0088 | 0.0055 | 43.3642333 | -87.8842429 | 4801643.202 | 428353.833 | 177.475 | 212.741 |
| OZK113 | 10/29/2010 | 0.0094 | 0.0052 | 43.30598676 | -88.04396134 | 4795324.114 | 415331.605 | 236.618 | 271.595 |
| OZK114 | 10/29/2010 | 0.0082 | 0.0055 | 43.30925776 | -87.9740313 | 4795618.862 | 421007.412 | 214.679 | 249.777 |
| OZK115 | 10/29/2010 | 0.0091 | 0.0058 | 43.30963502 | -87.89659559 | 4795590.434 | 427287.823 | 180.449 | 215.694 |
| OZK116 | 10/29/2010 | 0.0094 | 0.0061 | 43.2576447 | -88.04334 | 4789954.86 | 415314.967 | 222.255 | 257.222 |
| OZK117 | 10/29/2010 | 0.0101 | 0.0061 | 43.25960921 | -87.97572771 | 4790106.757 | 420805.451 | 186.965 | 222.059 |
| OZK118 | 10/29/2010 | 0.0091 | 0.0061 | 43.26153722 | -87.91416435 | 4790264.391 | 425804.585 | 177.126 | 212.326 |
| OZK119 | 10/29/2010 | 0.0091 | 0.0058 | 43.21259612 | -88.05774167 | 4784966.722 | 414082.744 | 214.207 | 249.15 |
| OZK120 | 10/29/2010 | 0.0079 | 0.0055 | 43.20936159 | -87.98407065 | 4784534.5 | 420062.639 | 171.559 | 206.629 |
| OZK121 | 10/29/2010 | 0.0091 | 0.0058 | 43.21118305 | -87.91025348 | 4784668.905 | 426061.14 | 177.453 | 212.634 |
| | | | | | | | | | |
| **Survey Control** | | | | | | | | | |
| NGS_DE7475 | 10/30/2010 | 0.007 | 0.0043 | 43.39925018 | -87.98507883 | 4805623.585 | 420229.442 | 236.824 | 271.928 |
| NGS_DF6124 | 10/29/2010 | 0.0104 | 0.0064 | 43.25086005 | -87.99920278 | 4789157.631 | 418888.482 | 197.041 | 232.091 |
| RASN | 10/29/2010 | | | 43.03636973 | -88.12153575 | 4765463.885 | 408638.995 | 234.374 | 269.2 |
| WEBE | 10/29/2010 | | | 43.42054699 | -88.14874235 | 4808158.343 | 407008.653 | 771.58 | 188.655 |
| SHAN | 10/30/2010 | | | 43.74762833 | -87.73478486 | 4844105.415 | 440840.068 | 501.79 | 270.119 |
| | | | | | | | | | |
| **Metadata** | | | | | | | | | |
| *UTM 16 North, NAD83, NAVD88* | | | | | | | | | |
| *All units in meters where applicable.* | | | | | | | | | |
| *MSL = Geiod09* | | | | | | | | | |

# LIDAR FLIGHT LOG

Ozarka/Rock 180 / RB1

MISSION: L103110E | DATE: 10 3 10 | RUN:

PILOT: J. Billingham | OPERATOR: R Boe | AIRCRAFT: 73TM

| PROJECT NUMBER | LINE NO. & Hdg | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | | 165 | 40.3 | 17 | 70 | 1500m | 534 | 545 | 180 | STATIC / TOSBM |
| Fema Lidar | Test 1 | | | | | | 2251 | 2251 | | |
| Ozaukee Cty | Test 2 | | | | | | 2252 | 2252 | | |
| | 1 S | 165 | 40.3 | 17 | 70 | 1500m | 2253 | 2255 | | |
| | 2 N | 165 | 40.3 | 17 | | | 2259 | 2301 | | |
| | 3 S | 165 | 40.3 | | | | 2305 | 2307 | | |
| | 4 N | 165 | 40.3 | | | | 2310 | ? | | Lots of error codes declined |
| | 5 S | 165 | 40.3 | | | | 2316 | 2319 | | Lots of errors throughout line |
| | 6 N | 165 | 40.3 | | | | 2323 | ? | | Errors / Reboot |
| | 7 S | 165 | 40.3 | | | | 2334 | 2336 | | Errors. Change Settings/Slow Speed |
| | 8 N | 150 | 38.4 | | | | 2340 | 2343 | | Errors |
| | Test 3 | | | | | | | | | Errors |
| | Test 4 | | | | | | | | | Errors |
| | | | | | | | 1800 | | | RTB / STATIC |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: |
|---|---|---|---|---|---|---|---|---|
| ○ 1101025 | 8 | 8 | ALL | 1.0 | — | 1734 to | 1800. | — |
| ○ | | | | | | WX SCT 3700 | | |
| ○ | | | | | | | | |

NOTES: Range Header Errors
DT Clipped a value



AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 **FAX: 920-457-1451** E-Mail: amephoto@aerometric.com

# LIDAR FLIGHT LOG

MISSION: L1111OA | DATE: 11-10-2010 | Veteran's Day | RB1

PILOT: CAM/KELLY | OPERATOR: R. Dolce | AIRCRAFT: 73TM

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | — | | — | ≈40 | 17 | 70 | 1500m | 2114 | 2120 | 180 | STATIC / T/O SBM |
| Ozaukee | 2 Test Fms | | 152 | 39.3 | | | | 2130 | 2132 | | |
| Fema Lidar | 1 | S | 157 | 39.3 | | | | 2132 | 2134 | | |
| | 2 | N | 152 | 40.3 | | | | 2139 | 2141 | | |
| 29" | 3 | S | 155 | 39.0 | | | | 2146 | 2148 | | |
| 29" | 4 | N | 155 | 39.0 | | | | 2153 | 2155 | | |
| | 5 | S | 155 | 39.0 | | | | 2200 | 2203 | | |
| | 6 | N | 155 | 39.0 | | | | 2207 | 2210 | | [redacted] |
| | 7 | S | 155 | 39.0 | | | | 2215 | 2218 | | |
| | 8 | N | 155 | 39.0 | | | | 2222 | 2226 | | |
| | 9 | S | 155 | 39.0 | | | | 2230 | 2234 | | Virga (Laser shut off 2nm after line) |
| | 56 | S | 155 | 39.0 | | | | | | | move west side proj (Rain) |
| East | X | Tie | 153 | 39.0 | | | | 2246 | 2247 | | eye safe shut off |
| West | X | Tie | 153 | 39.0 | | | | 2251 | 2252 | | |
| | | | | | | | | 2304 | 2309 | | LAND SBM / STATIC |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: |
|---|---|---|---|---|---|---|---|---|
| ○ 1101025 | 56 | 9 | 45 | 1.7 | — | | 2114 | 2309 |
| ○ | | | | | | WX OVC 6500 | | |
| ○ | | | | | | LT RN Devlpd | | |

NOTES:

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amephoto@aerometric.com

## Flight Log

Project Number: 0
S/N : 0
Operator : ???
Pilot(s) : ???
Aircraft : ???
Airport : ???
Mission : ???
Wheels Up : ???
Flight Length :
HOBBS Start :
HOBBS End :

## Weather

Date : November 11, 2010
Julian Day : 315
Temperature : ???
Visibility : ???
Clouds : ???
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

## Statistics

Laser Time : 00:23:33

| START | STOP | LINE# | ALT | PRF | FREQ | ANGLE | MP | DIV | RC | HDG | Plan File |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21:30:44.677 | 21:31:04.078 | 1 | 1719 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 21:31:18.878 | 21:31:33.178 | 1 | 1716 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 21:32:19.978 | 21:34:24.678 | 1 | 1680 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 21:39:11.879 | 21:41:31.879 | 2 | 1662 | 70 | 40.30 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 21:46:29.08 | 21:48:56.28 | 3 | 1664 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 21:53:15.481 | 21:55:57.481 | 4 | 1662 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:00:23.382 | 22:03:16.583 | 5 | 1665 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 22:07:34.583 | 22:10:36.484 | 6 | 1663 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:15:10.385 | 22:18:37.486 | 7 | 1666 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 22:22:42.787 | 22:26:08.187 | 8 | 1662 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:51:27.393 | 22:52:38.694 | 1 | 1670 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |

# LIDAR FLIGHT LOG

RS1

MISSION: L111510A | DATE: 11-15-2010

PILOT: G. Howe / J. Billington | OPERATOR: R. Boll | AIRCRAFT: 73TM

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | | | | 40 | 17 | 70 | 1500m | 1436 | 1441 | 180 | STATIC / 1/0 SBM |
| Ozaukee | Test | | | | | | | 1452 | | | |
| Fema LIDAR | 10 | S | 160 | 40 | 17 | 70 | 1500 | 1452 | 1456 | | |
| | 11 | N | 165 | 40 | | | | 1500 | 1504 | | |
| | 12 | S | 165 | 40 | | | | 1509 | 1513 | | |
| | 13 | N | 165 | 40 | | | | 1518 | 1522 | | |
| | 14 | S | 165 | 40 | | | | 1527 | 1533 | | |
| | 15 | N | 165 | 40 | | | | 1532 | 1543 | | |
| | 16 | S | 165 | 40 | | | | 1548 | 1555 | | |
| | 17 | N | 165 | 40 | | | | 1601 | 1608 | | |
| | 18 | S | 165 | 40 | | | | 1615 | 1623 | | |
| | 19 | N | 165 | 40 | | | | 1626 | 1634 | | |
| | 20 | S | 165 | 40 | | | | 1639 | 1648 | | |
| | 21 | N | 165 | 40 | | | | 1653 | 1701 | | |
| | 22 | S | 165 | 40 | | | | 1708 | 1717 | | |
| | 23 | N | 165 | 40 | | | | 1720 | 1728 | | |
| | 24 | S | 165 | 40 | | | | 1731 | 1739 | | |
| | 25 | N | 165 | 40 | | | | 1742 | 1744 | | Cu / no Line good |
| | X | Tie | 165 | 40 | | | | 1749 | 1751 | | |
| | | | | | | | | 1849 | 1859 | | Land SBM / STATIC |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: |
|---|---|---|---|---|---|---|---|---|
| ○ 1101025 | 56 | 15 | 37 | 4.0 | — | | 1436 | 1559 |
| ○ | | | | | | WX High Cloud → cu forming > LYR @ 5500 moved in | | |
| ○ | | | | | | | | |

NOTES:

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amephoto@aerometric.com

## Flight Log

Project Number: 0
S/N : 0
Operator : ???
Pilot(s) : ???
Aircraft : ???
Airport : ???
Mission : ???
Wheels Up : ???
Flight Length :
HOBBS Start :
HOBBS End :

## Weather

Date : November 15, 2010
Julian Day : 319
Temperature : ???
Visibility : ???
Clouds : ???
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

## Statistics

Laser Time : 01:37:39

| START | STOP | LINE# | ALT | PRF | FREQ | ANGLE | MP | DIV | RC | HDG | Plan File |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14:52:06.757 | 14:52:16.657 | 10 | 1719 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 14:52:28.857 | 14:52:33.957 | 10 | 1719 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 14:52:28.857 | 14:56:09.757 | 10 | 1704 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 15:00:47.157 | 15:04:23.857 | 11 | 1706 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 15:09:34.657 | 15:13:39.657 | 12 | 1710 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 15:18:09.558 | 15:22:34.858 | 13 | 1696 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 15:27:18.858 | 15:33:08.759 | 14 | 1701 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 15:37:06.259 | 15:43:02.26 | 15 | 1702 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 15:48:17.66 | 15:55:22.961 | 16 | 1707 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 16:01:10.962 | 16:08:18.963 | 17 | 1628 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 16:15:03.364 | 16:23:23.965 | 18 | 1681 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 16:26:27.166 | 16:34:33.367 | 19 | 1675 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 16:39:55.168 | 16:48:08.17 | 20 | 1687 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16:53:39.271 | 17:01:47.672 | 21 | 1682 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 17:08:35.274 | 17:17:04.576 | 22 | 1687 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 17:19:58.876 | 17:28:07.578 | 23 | 1682 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 17:31:16.679 | 17:39:36.081 | 24 | 1687 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 17:49:27.683 | 17:51:48.484 | 9 | 1678 | 70 | 40.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |

# LIDAR FLIGHT LOG

ALTM

J51

MISSION: L111610A DATE: 11-16-10 TUE

PILOT: GLEN H. OPERATOR: JIM AIRCRAFT: N73TM

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | | | | | | | GMT | 14:40 | 14:56 | 180 | FERRY: SBM → SITE .2 |
| 02 AUKEE CO. | TEST | | | | 17 | 70 | 1500 | 14:56 | 14:57 | | |
| | TEST | | | | | | | 14:57 | 14:57 | | |
| | 25 | 180 | 155 | 39 | | | | 14:58 | 15:06 | | |
| | 26 | 360 | 〃 | 〃 | | | | 15:11 | 15:19 | | |
| | 27 | 180 | 160 | 39.6 | | | | 15:24 | 15:32 | | |
| | 28 | 360 | 〃 | 〃 | | | | 15:38 | 15:46 | | |
| | 29 | 180 | 〃 | 〃 | | | | 15:52 | 16:00 | | |
| | 30 | 360 | 〃 | 〃 | | | | 16:04 | 16:12 | | |
| | 31 | 180 | 〃 | 〃 | | | | 16:18 | 16:26 | | |
| | 32 | 360 | 〃 | 〃 | | | | 16:30 | 16:38 | | |
| | 33 | 180 | 〃 | 〃 | | | | 16:43 | 16:51 | | |
| | 34 | 360 | 〃 | 〃 | | | | 16:55 | 17:03 | | |
| | 35 | 180 | 〃 | 〃 | | | | 17:09 | 17:17 | | |
| | 36 | 360 | 〃 | 〃 | | | | 17:21 | 17:29 | | |
| | 37 | 180 | 〃 | 〃 | | | | 17:33 | 17:41 | | |
| | 38 | 360 | 〃 | 〃 | | | | 17:45 | 17:53 | | |
| | 39 | 180 | 〃 | 〃 | | | | 17:58 | 18:06 | | |
| | CROSS | ~~E~~ | 〃 | 〃 | | | | 18:10 | 18:13 | | |
| | 38.5 | 360 | 〃 | 〃 | 〃 | 〃 | 〃 | 18:18 | 18:19 | | GAP AREAS → J52 |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: |
|---|---|---|---|---|---|---|---|---|
| ⊘ 1101025 | | | | | | 4.3 | 14:40 | 19:01 |
| ⊘ 02AUKEE | 56 | 39 | 17 | 3.9 | .4 | WX BKN 6K VIS 4.5 TO OVC | | |
| ○ | | | | | | | | |

NOTES:

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amephoto@aerometric.com

# LIDAR FLIGHT LOG

JS2

**MISSION:** L111610A **DATE:** 11-16-10 TUE

**PILOT:** GLEN H. **OPERATOR:** JIM **AIRCRAFT:** N73TM

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 101025 | 35.5 | 360 | 160 | 39.6 | 17 | 70 | GMT | 18:20 | 18:23 | 180 | GAP AREAS |
| OZAUKEE CO. | 39 | 360 | | | | | | 18:24 | 18:26 | | " " |
| | 37 | 180 | | | | | | 18:30 | 18:32 | | " " |
| | 33.5 | 180 | | | | | | 18:33 | 18:34 | | |
| | 29.5 | 180 | | | | | | 18:35 | 18:36 | | |
| | 28.5 | 360 | | | | | | 18:40 | 18:42 | | |
| | 26.5 | 360 | | | | | | 18:43 | 18:44 | | |
| | 24.5 | 360 | | | | | | 18:45 | 18:47 | | |
| | | | | | | | | | 19:01 | | FERRY: SITE → SBM .2. |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: | NOTES: |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | WX | | | |
| | | | | | | | | | |

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amephoto@aerometric.com

## Flight Log

Project Number: 1101025
S/N : Ozaukee County
Operator : Jim
Pilot(s) : Glen
Aircraft : N73TM
Airport : KSBM
Mission : L111610A
Wheels Up : ???
Flight Length : 4.3
HOBBS Start : 14:40
HOBBS End : 19:01

## Weather

Date : November 16, 2010
Julian Day : 320
Temperature : ???
Visibility : 4
Clouds : BKN-OVC 6K
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

## Statistics

Laser Time : 02:15:41

| START | STOP | LINE# | ALT | PRF | FREQ | ANGLE | MP | DIV | RC | HDG | Plan File |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14:56:33.763 | 14:57:06.063 | 25 | 1725 | 70 | 40.30 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 14:57:15.663 | 14:57:36.063 | 25 | 1731 | 70 | 40.30 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 14:58:43.263 | 15:06:52.764 | 25 | 1720 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 15:11:57.865 | 15:19:31.965 | 26 | 1719 | 70 | 39.00 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 15:24:33.666 | 15:32:32.367 | 27 | 1721 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 15:38:39.268 | 15:46:43.87 | 28 | 1717 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 15:52:30.671 | 16:00:32.072 | 29 | 1721 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 16:04:33.673 | 16:12:34.374 | 30 | 1716 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 16:18:29.876 | 16:26:39.977 | 31 | 1714 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 16:30:39.178 | 16:38:39.58 | 32 | 1703 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 16:43:45.781 | 16:51:39.783 | 33 | 1703 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 16:55:43.284 | 17:03:48.086 | 34 | 1699 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 17:09:01.388 | 17:17:00.59 | 35 | 1701 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17:21:16.991 | 17:29:16.593 | 36 | 1699 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 17:33:58.094 | 17:41:58.896 | 37 | 1698 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 17:45:49.897 | 17:53:55.199 | 38 | 1695 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 17:58:21.9 | 18:06:32.603 | 39 | 1708 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 18:10:47.404 | 18:13:34.605 | 24 | 1709 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 18:18:27.106 | 18:19:35.206 | 38 | 1705 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 18:18:27.106 | 18:19:36.606 | 38 | 1705 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 18:20:24.106 | 18:23:11.107 | 35 | 1705 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 18:24:33.108 | 18:26:21.008 | 39 | 1707 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 18:30:59.309 | 18:32:14.31 | 37 | 1713 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 18:33:21.81 | 18:34:20.71 | 33 | 1711 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 18:35:33.911 | 18:36:26.811 | 29 | 1712 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 18:40:45.612 | 18:42:06.712 | 28 | 1713 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 18:43:15.413 | 18:44:56.913 | 26 | 1713 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 18:45:49.313 | 18:46:59.314 | 24 | 1712 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |

# LIDAR FLIGHT LOG

MISSION: L111610B | DATE: 11-16-10 TUE | JS3

PILOT: CAM | OPERATOR: JIM | AIRCRAFT: N73TM

ALTM

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | | | | | | | GMT | 19:37 | 19:51 | 081 | FERRY: SBA → SITE .2 |
| OZAUKEE CO. | TEST | | 160 | 39.6 | 17 | 70 | 1500 | 19:51 | 19:52 | | |
| | TEST | | | | | | | 19:52 | 19:52 | | |
| | 16.5 | 180 | | | | | | 19:52 | 19:58 | | GAP AREA (43:21:X, 87:52 CC) |
| | 35 | 360 | | | | | | 20:03 | 20:05 | | GAP AREA (43:16 - 43:18) |
| | 40 | 180 | | | | | | 20:12 | 20:21 | | |
| | 41 | 360 | | | | | | 20:25 | 20:33 | | |
| | 42 | 180 | | | | | | 20:38 | 20:46 | | |
| | 43 | 360 | | | | | | 20:50 | 20:58 | | |
| | 44 | 180 | | | | | | 21:03 | 21:11 | | |
| | 45 | 360 | | | | | | 21:15 | 21:23 | | |
| | 46 | 180 | | | | | | 21:27 | 21:35 | | |
| | 47 | 360 | | | | | | 21:39 | 21:47 | | |
| | 48 | 180 | | | | | | 21:51 | 22:00 | | |
| | 49 | 360 | | | | | | 22:04 | 22:12 | | |
| | 50 | 180 | | | | | | 22:16 | 22:25 | | |
| | 51 | 360 | | | | | | 22:29 | 22:37 | | |
| | 52 | 180 | | | | | | 22:43 | 22:48 | | |
| | 53 | 360 | | | | | | 22:52 | 22:56 | | |
| | 54 | 180 | | | | | | 23:00 | 23:04 | | → JS4 |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY |
|---|---|---|---|---|---|
| 1101025 | ~~54~~ | | | | |
| OZAUKEE | 54 | 54 | Ø | 3.6 | .6 |
| | | | | | |

| STATIC | START: | STOP: |
|---|---|---|
| 4.2 | 19:37 | 23:48 |

WX HIGH THIN CIRRUS
VIS 7+

NOTES:

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amphoto@aerometric.com

# LIDAR FLIGHT LOG

**MISSION:** L1116010B **DATE:** 11-16-10 TUE

**PILOT:** CAM **OPERATOR:** JIM **AIRCRAFT:** N73TM

ALTM

JS4

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | 55 | 360 | 160 | 39.6 | 17 | 70 | 1500 | 23:09 | 23:13 | 081 | |
| OZAUKEE CO. | 56 | 180 | 〃 | 〃 | 〃 | 〃 | 〃 | 23:18 | 23:20 | | |
| | CROSS | E | 〃 | 〃 | 〃 | 〃 | 〃 | 23:23 | 23:25 | | |
| | | | | | | | | | 23:48 | | FERRY: SITE → SBM .4 |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: | NOTES: |
|---|---|---|---|---|---|---|---|---|---|
| ○ | | | | | | | | | |
| ○ | | | | | | WX | | | |
| ○ | | | | | | | | | |

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 **FAX: 920-457-1451** E-Mail: amephoto@aerometric.com

## Flight Log

Project Number: 1101025
S/N : Ozaukee County
Operator : Jim
Pilot(s) : Cam
Aircraft : N73TM
Airport : KSBM
Mission : L111610B
Wheels Up : ???
Flight Length : 4.2
HOBBS Start : 19:37
HOBBS End : 23:48

## Weather

Date : November 16, 2010
Julian Day : 320
Temperature : ???
Visibility : 4
Clouds : Hi thick cirrus
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

## Statistics

Laser Time : 02:04:19

| START | STOP | LINE# | ALT | PRF | FREQ | ANGLE | MP | DIV | RC | HDG | Plan File |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19:51:40.618 | 19:52:00.918 | 16 | 1670 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 19:52:32.318 | 19:52:54.718 | 16 | 1665 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 19:56:45.219 | 19:58:09.719 | 16 | 1664 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 20:03:38.221 | 20:05:13.321 | 35 | 1664 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 20:12:53.123 | 20:21:07.525 | 40 | 1659 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 20:25:24.426 | 20:33:45.028 | 41 | 1657 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 20:38:20.329 | 20:46:36.231 | 42 | 1674 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 20:50:18.432 | 20:58:40.434 | 43 | 1675 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 21:02:52.135 | 21:11:01.737 | 44 | 1681 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 21:15:00.538 | 21:23:16.24 | 45 | 1682 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 21:27:27.241 | 21:35:45.443 | 46 | 1683 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 21:39:34.244 | 21:47:45.447 | 47 | 1683 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 21:51:45.548 | 22:00:06.65 | 48 | 1684 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22:04:17.151 | 22:12:30.153 | 49 | 1688 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:16:44.754 | 22:25:08.556 | 50 | 1688 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 22:29:00.957 | 22:37:02.659 | 51 | 1687 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:43:11.461 | 22:48:19.062 | 52 | 1685 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 22:52:15.464 | 22:56:41.565 | 53 | 1688 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 23:00:39.366 | 23:04:57.967 | 54 | 1688 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 23:09:07.168 | 23:13:34.569 | 55 | 1689 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 360.00 | Ozaukee_10_23_10_Fixline. |
| 23:18:17.571 | 23:20:10.071 | 56 | 1687 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |
| 23:23:11.672 | 23:25:32.672 | 39 | 1689 | 70 | 39.60 | 17.00 | NAR | OFF | OFF | 180.00 | Ozaukee_10_23_10_Fixline. |

# LIDAR FLIGHT LOG

MISSION: L112310B | DATE: 11-23-10 TUE | J53

PILOT: CAM | OPERATOR: JIM | AIRCRAFT: N73TM

| PROJECT NUMBER | LINE NO. & Hdg | | GND SPEED (KTS) | SCAN FREQ | SCAN ANGLE | PRF | ALT (m) | TIME START | TIME STOP | Tranzpak Drive | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1101025 | | | | | | | GMT | 19:55 | 20:04 | 008 WD9364 | FERRY: JVL → SITE .2 |
| ROCK | TEST | | | | 17 | 70 | 1500 | 20:06 | 20:07 | | |
| | TEST | | | | | | | 20:07 | 20:07 | | |
| | 12 | 360 | 155 | 39.0 | | | | 20:11 | 20:20 | | |
| | 13 | 180 | | | | | | 20:23 | 20:32 | | |
| | 14 | 360 | | | | | | 20:36 | 20:45 | | |
| | 15 | 180 | | | | | | 20:49 | 20:58 | | |
| | 16 | 360 | | | | | | 21:02 | 21:11 | | |
| | 17 | 180 | | | | | | 21:15 | 21:23 | | |
| | 18 | 360 | | | | | | 21:28 | 21:37 | | |
| | CROSS | E | 160 | 39.6 | | | | 21:41 | 21:42 | | |
| OZAUKEE | [redacted] | | | | | | | | | | |
| | TEST | | | | | | | 21:52 | 21:52 | | |
| | 35 | 360 | 155 | 39.0 | | | | 22:03 | 22:12 | | |
| | 36 | 180 | | | | | | 22:16 | 22:24 | | |
| | 37 | 360 | | | | | | 22:28 | 22:37 | | |
| | 38 | 180 | | | | | | 22:40 | 22:49 | | |
| | 39 | 360 | | | | | | 22:54 | 23:02 | | |
| | CROSS | E | 160 | 39.6 | | | | 23:06 | 23:07 | | .2 |
| | | | | | | | | | [illegible]:24 | | FERRY: SITE → SBM |

| STATUS | TOTAL LINES | FLOWN | LEFT | AIRCRAFT SITE | AIRCRAFT FERRY | STATIC | START: | STOP: | NOTES: |
|---|---|---|---|---|---|---|---|---|---|
| ⊘ 1101025 | [redacted] | | | | | 3.5 | 19:55 | [illegible]:24 | |
| ⊘ ROCK | 92 | 53 | 39 | 1.6 | .2 | WX SKC VIS 20 | | | |
| ⊗ OZAUKEE. | 5 RETS | 5 | Ø | 1.4 | .3 | | | | |

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amephoto@aerometric.com

## Flight Log

Project Number: 1101025
S/N : Ozaukee
Operator : Jim
Pilot(s) : Cam
Aircraft : N73TM
Airport : KJVL/KSBM
Mission : L112310B
Wheels Up : ???
Flight Length : 3.5
HOBBS Start : 19:55
HOBBS End : 23:24

## Weather

Date : November 23, 2010
Julian Day : 327
Temperature : ???
Visibility : ???
Clouds : ???
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

## Statistics

Laser Time : 00:44:11

| START | STOP | LINE# | ALT | PRF | FREQ | ANGLE | MP | DIV | RC | HDG | Plan File |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21:52:22.166 | 21:52:52.266 | 35 | 1720 | 70 | 39.60 | 17.00 | NAR | OFF | ON | 360.00 | Ozaukee_10_23_10_Fixline. |
| 21:52:22.166 | 21:52:54.866 | 35 | 1721 | 70 | 39.60 | 17.00 | NAR | OFF | ON | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:03:52.968 | 22:12:35.171 | 35 | 1685 | 70 | 39.00 | 17.00 | NAR | OFF | ON | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:16:06.872 | 22:24:29.374 | 36 | 1699 | 70 | 39.00 | 17.00 | NAR | OFF | ON | 180.00 | Ozaukee_10_23_10_Fixline. |
| 22:28:45.575 | 22:37:23.377 | 37 | 1701 | 70 | 39.00 | 17.00 | NAR | OFF | ON | 360.00 | Ozaukee_10_23_10_Fixline. |
| 22:40:57.078 | 22:49:18.08 | 38 | 1701 | 70 | 39.00 | 17.00 | NAR | OFF | ON | 180.00 | Ozaukee_10_23_10_Fixline. |
| 22:54:05.681 | 23:02:45.983 | 39 | 1696 | 70 | 39.00 | 17.00 | NAR | OFF | ON | 360.00 | Ozaukee_10_23_10_Fixline. |
| 23:06:16.884 | 23:07:33.084 | 35 | 1702 | 70 | 39.60 | 17.00 | NAR | OFF | ON | 360.00 | Ozaukee_10_23_10_Fixline. |

L111110A - POSGNSS 4.40

File View Process Settings Output Tools Window Help

Combined - Map Run (9)

Finished Differential GPS 1 - L111110A [Forward]

Status

Progress

L111110A [Combined] - Forward/Reverse or Combined Separation Plot

Separation (m)

0.50 0.45 0.40 0.35 0.30 0.25 0.20 0.15 0.10 0.05 -0.00 -0.05 -0.10 -0.15 -0.20 -0.25 -0.30 -0.35 -0.40 -0.45 -0.50

422000 422500 423000 423500 424000 424500 425000 425500 426000 426500 427000 427500 428000 428500

Week 1609

< Run (9)

GPS Time (TOW, GMT zone)

19:42:40 on 11/16/2010 >

X: 422187.2 Y: 0.498 East North Up Right click for more options

| | | | |
|---|---|---|---|
| Ch5 | 13 | 15 | 43 |
| Ch6 | 5 | 67 | 191 |
| Ch7 | 10 | 57 | 62 |
| Ch8 | 4 | 27 | 77 |
| Ch9 | 25 | 38 | 270 |
| Ch10 | | | |
| Ch11 | | | |

View Pause Close

422690.0: Doppler L1 cycle slip on PRN 13 of -5238792.60 c
421973.0: Reached end-of-file on remote (file P:\1101025\Lic
421973.0: Processing used 13.922 seconds for 7123 epochs
: Loading solution...
: Waiting for window L111110A [Forward] to comple
: Solution updating finished
: Waiting for window L111110A [Forward] to comple
: Waiting for window L111110A [Forward] to comple

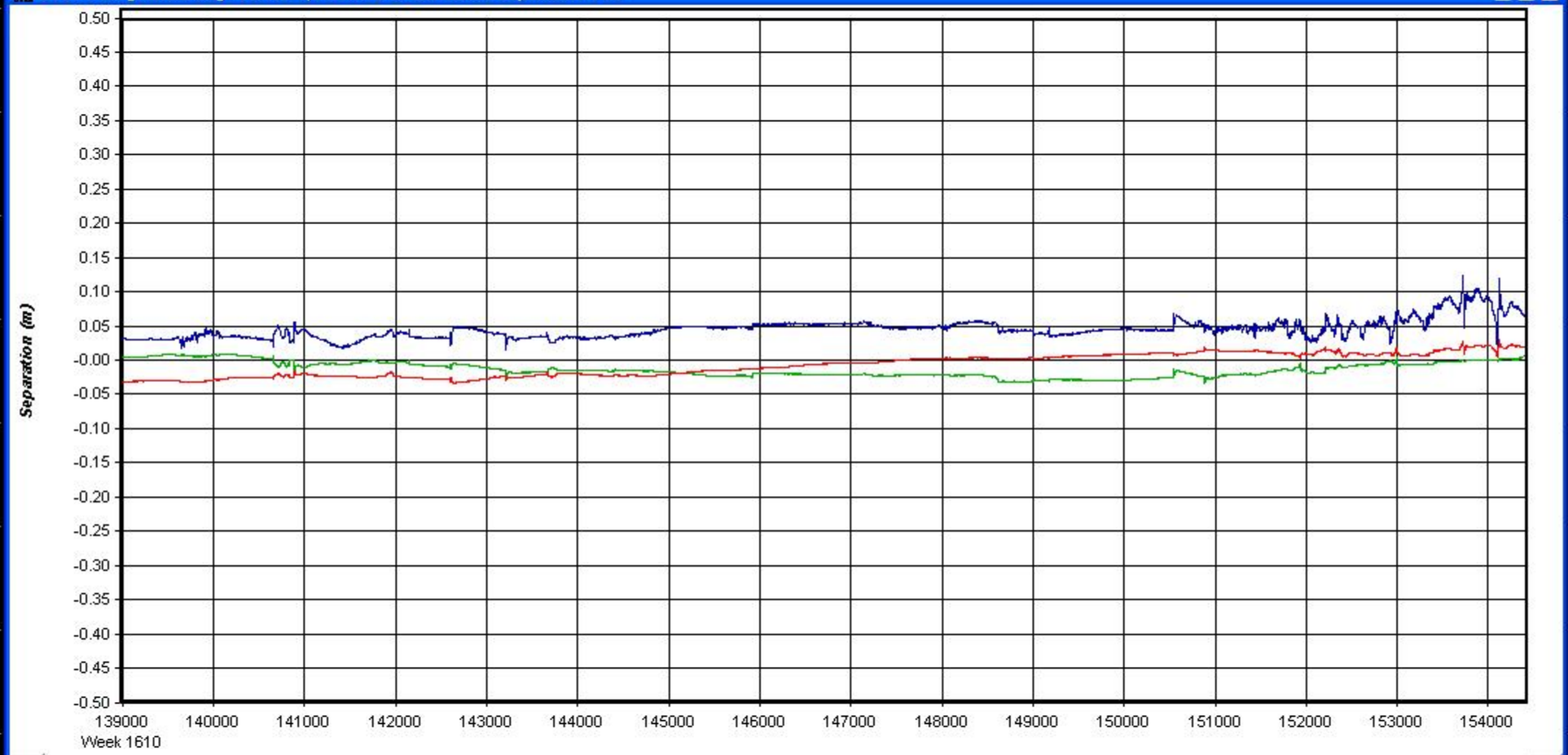
10 km

L111510A - POSGNSS 4.40

File View Process Settings Output Tools Window Help

Combined - Map Run (1)

L111510A [Combined] - Forward/Reverse or Combined Separation Plot




< Run (1) GPS Time (TOW, GMT zone) 12:15:08 on 11/17/2010 >

X: Y: East North Up Right click for more options

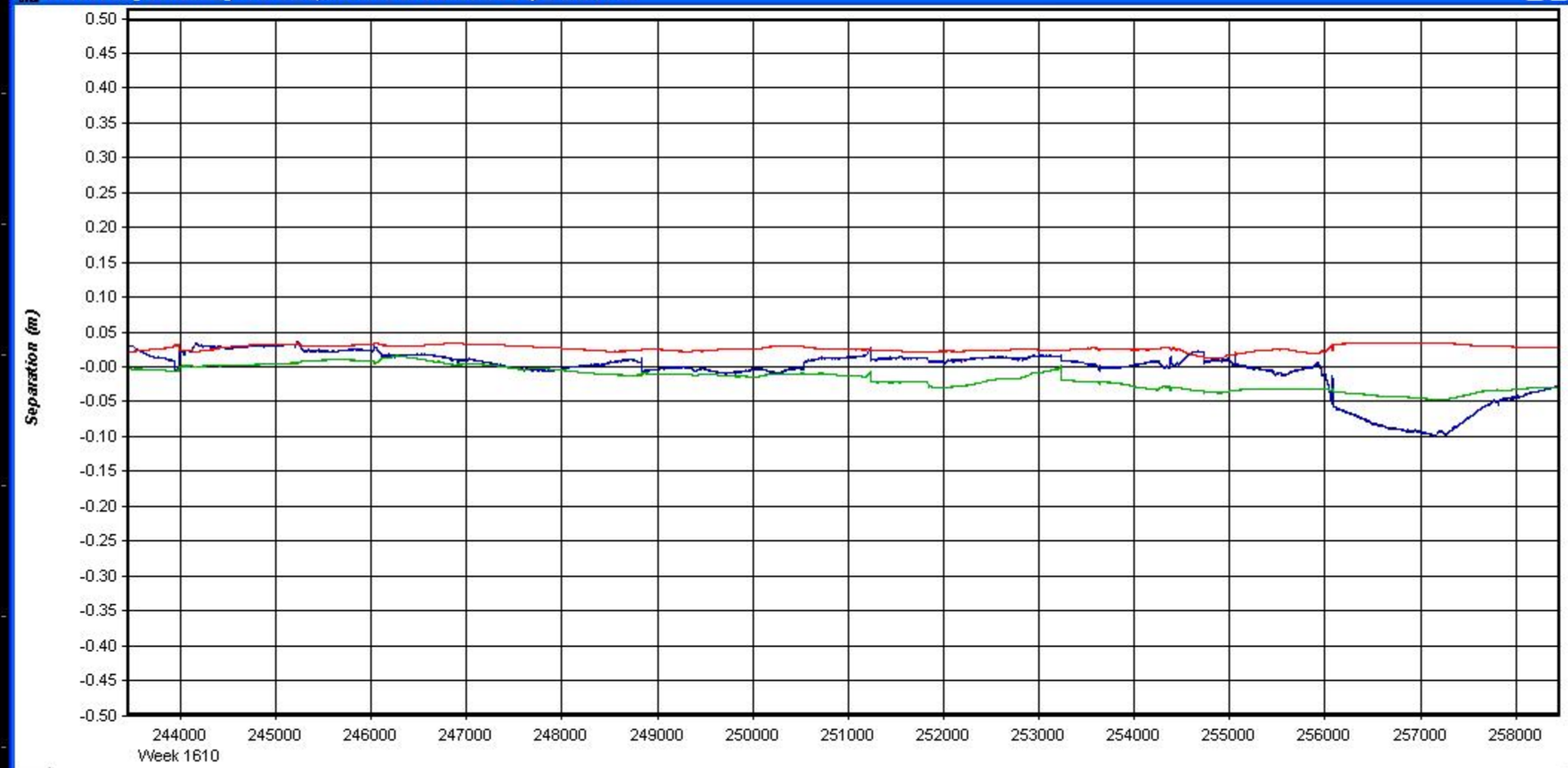
3 km

L1116108 - POSGNSS 4.40

File View Process Settings Output Tools Window Help

Combined - Map Run (4)

L1116108 [Combined] - Forward/Reverse or Combined Separation Plot



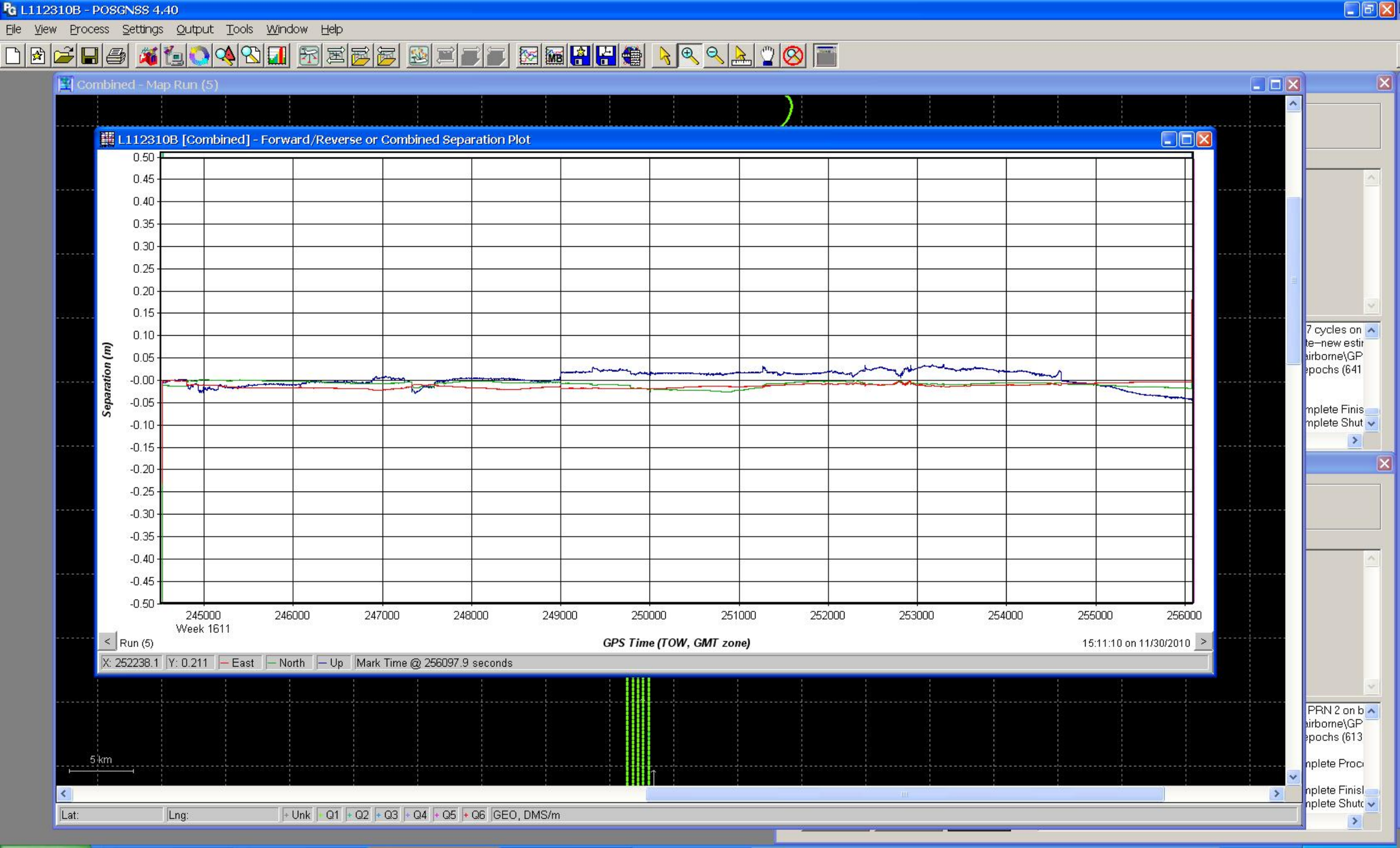

< Run (4)

GPS Time (TOW, GMT zone)

07:56:39 on 11/18/2010 >

X: 245943.5 | Y: 0.340 | East | North | Up | Right click for more options

1 km


L112310B - POSGNSS 4.40
File View Process Settings Output Tools Window Help
Combined - Map Run (5)
L112310B [Combined] - Forward/Reverse or Combined Separation Plot
Separation (m)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-0.50
245000
Week 1611
246000
247000
248000
249000
250000
251000
252000
253000
254000
255000
256000
Run (5)
GPS Time (TOW, GMT zone)
15:11:10 on 11/30/2010
X: 252238.1
Y: 0.211
East
North
Up
Mark Time @ 256097.9 seconds
5 km
Lat:
Lng:
Unk
Q1
Q2
Q3
Q4
Q5
Q6
GEO, DMS/m
7 cycles on
te–new esti
irborne\GP
epochs (641
mplete Finis
mplete Shut
PRN 2 on b
irborne\GP
epochs (613
mplete Proc
mplete Finis
mplete Shut

P:\1101025\Lidar\QAQC\Ozaukee County WI Control\Ozaukee.txt

| Number | Easting | Northing | Known Z | Laser Z | Dz |
|---|---|---|---|---|---|
| OZK101 | 417530.639 | 4819884.546 | 269.469 | 269.500 | +0.031 |
| OZK102 | 425583.963 | 4819958.402 | 253.539 | 253.490 | -0.049 |
| OZK103 | 434476.920 | 4819826.111 | 212.986 | 213.040 | +0.054 |
| OZK104 | 416648.260 | 4813416.014 | 257.208 | 257.240 | +0.032 |
| OZK105 | 425538.249 | 4813475.344 | 247.350 | 247.370 | +0.020 |
| OZK106 | 432013.161 | 4813392.026 | 222.892 | 222.820 | -0.072 |
| OZK107 | 417359.047 | 4807684.542 | 275.572 | 275.600 | +0.028 |
| OZK108 | 422882.816 | 4807480.688 | 252.728 | 252.670 | -0.058 |
| OZK109 | 429494.235 | 4807942.795 | 229.994 | 229.970 | -0.024 |
| OZK110 | 415738.901 | 4802132.862 | 263.830 | 263.840 | +0.010 |
| OZK111 | 422866.000 | 4801483.985 | 240.400 | 240.370 | -0.030 |
| OZK112 | 428353.833 | 4801643.202 | 212.741 | 212.890 | +0.149 |
| OZK113 | 415331.605 | 4795324.114 | 271.595 | 271.610 | +0.015 |
| OZK114 | 421007.412 | 4795618.862 | 249.777 | 249.780 | +0.003 |
| OZK115 | 427287.823 | 4795590.434 | 215.694 | 215.750 | +0.056 |
| OZK116 | 415314.967 | 4789954.860 | 257.222 | 257.290 | +0.068 |
| OZK117 | 420805.451 | 4790106.757 | 222.059 | 222.030 | -0.029 |
| OZK118 | 425804.585 | 4790264.391 | 212.326 | 212.330 | +0.004 |
| OZK119 | 414082.744 | 4784966.722 | 249.150 | 249.180 | +0.030 |
| OZK120 | 420062.639 | 4784534.500 | 206.629 | 206.700 | +0.071 |
| OZK121 | 426061.140 | 4784668.905 | 212.634 | 212.640 | +0.006 |

| | |
|---|---|
| Average dz | +0.015 |
| Minimum dz | -0.072 |
| Maximum dz | +0.149 |
| Average magnitude | 0.040 |
| Root mean square | 0.051 |
| Std deviation | 0.050 |