# Ground Control Point Survey Report

# "FEMA Region 2 Great Lakes Area QL2 LiDAR"

## USGS Contract: G10PC00013

## Task Order Number: GP13PD00043

## Prepared for:

***United States Geological Survey (USGS)***



Prepared By:

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# 1. INTRODUCTION

## 1.1 *Project Summary*

Dewberry Consultants LLC is under contract to the United States Geological Survey to provide 21 Ground Control Points in the State of New York. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of Aerial Photography & Digital Orthophotography products. As part of this work Dewberry staff will complete Ground Control Point surveys that will be used to evaluate horizontal accuracy. The ground survey was conducted April 20 to April 23, 2015.

Existing NGS Control Points were located and surveyed to check the accuracy of the RTK/GPS survey equipment with the results shown in Section 2.4 of this Report.

As an internal QA/QC procedure and to verify that the Ground Control Points meet the 95% confidence level approximately 50% of the points were re-observed and are shown in Section 5 of this report.

Final horizontal coordinates are referenced to UTM Zone 18, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012A (Geoid12A).

## 1.2 *Points of Contact*

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

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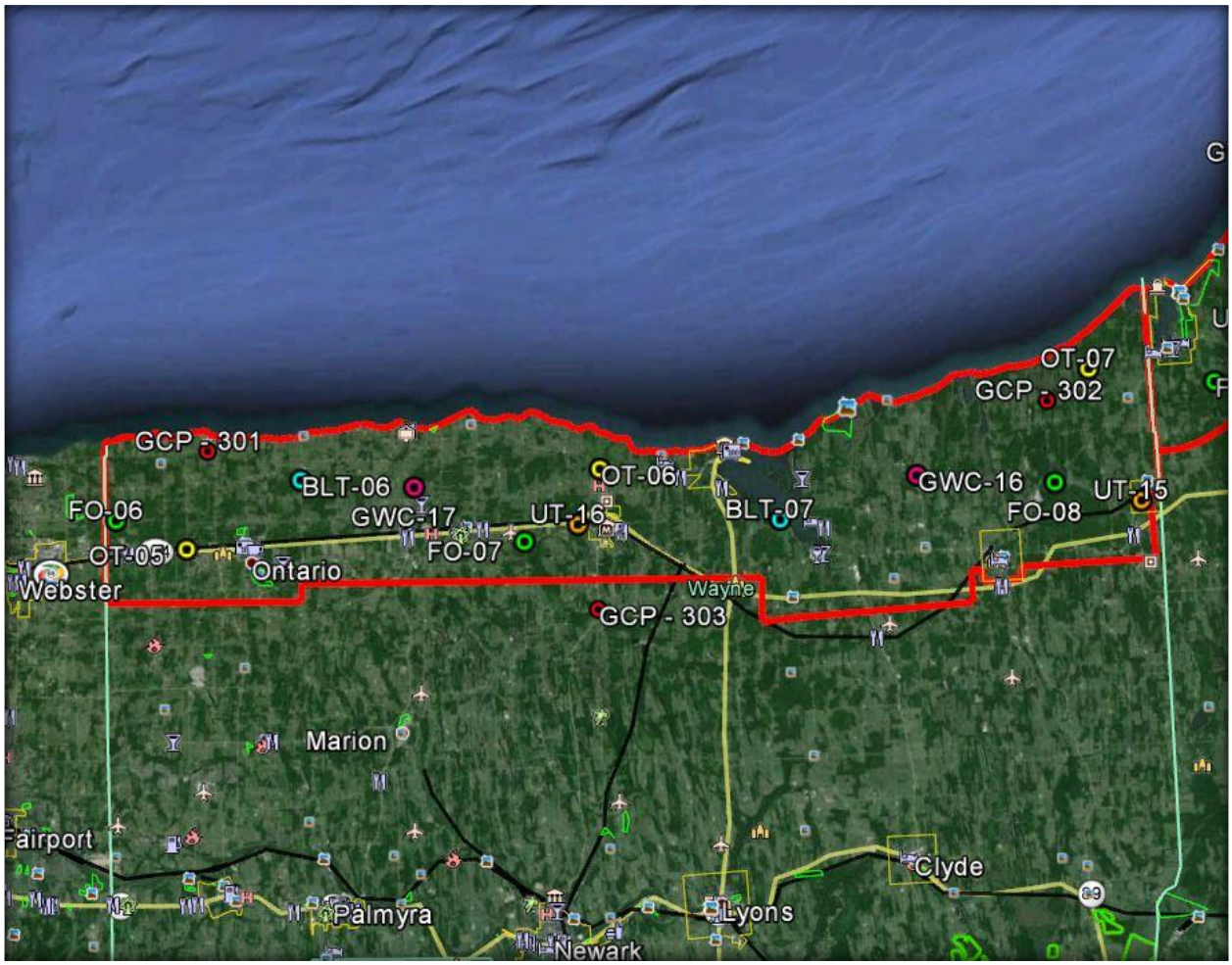
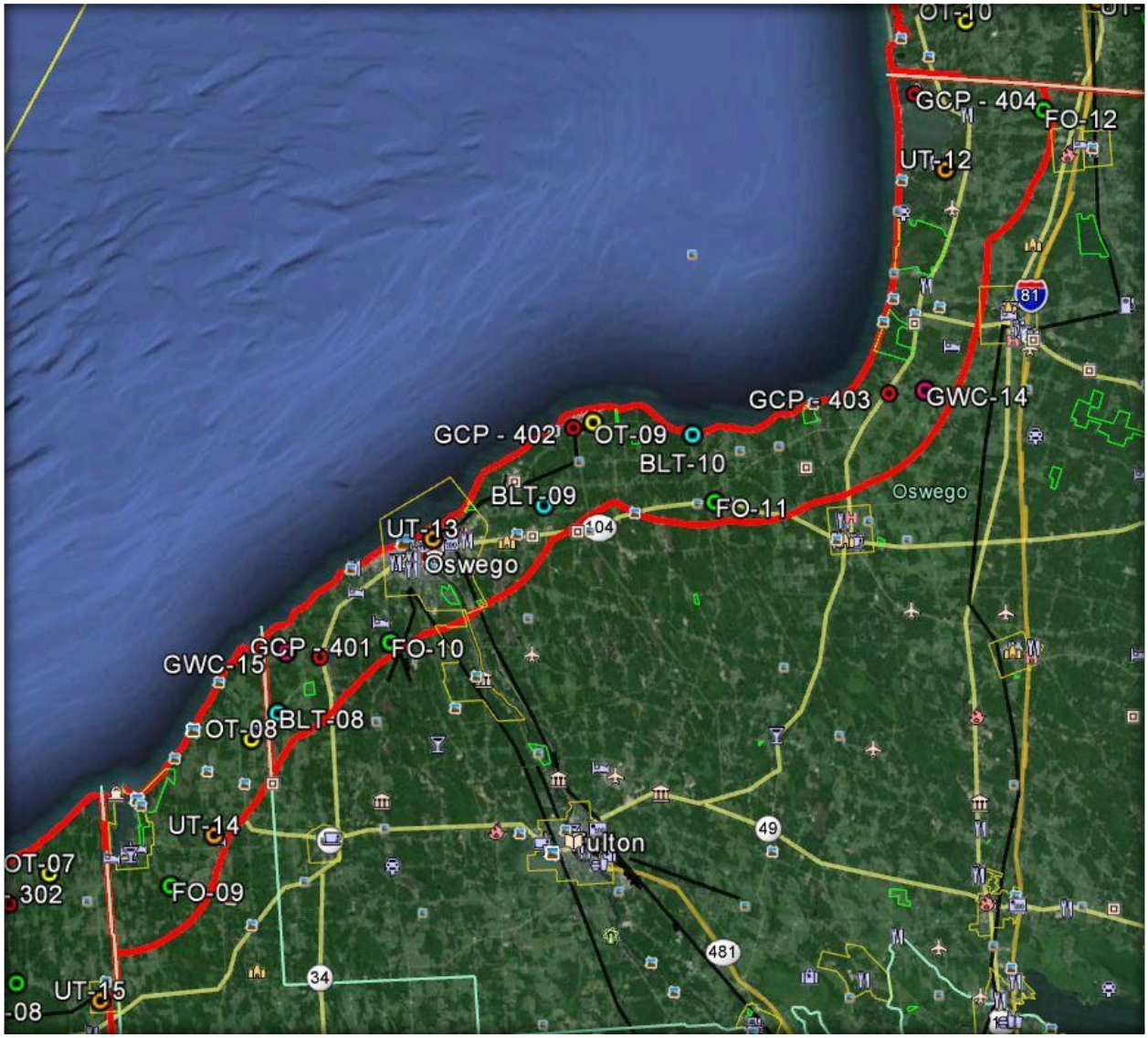
## 1.3 *Project Area*

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GWC-14
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UT-13
104
Oswego
GWC-15
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UT-15
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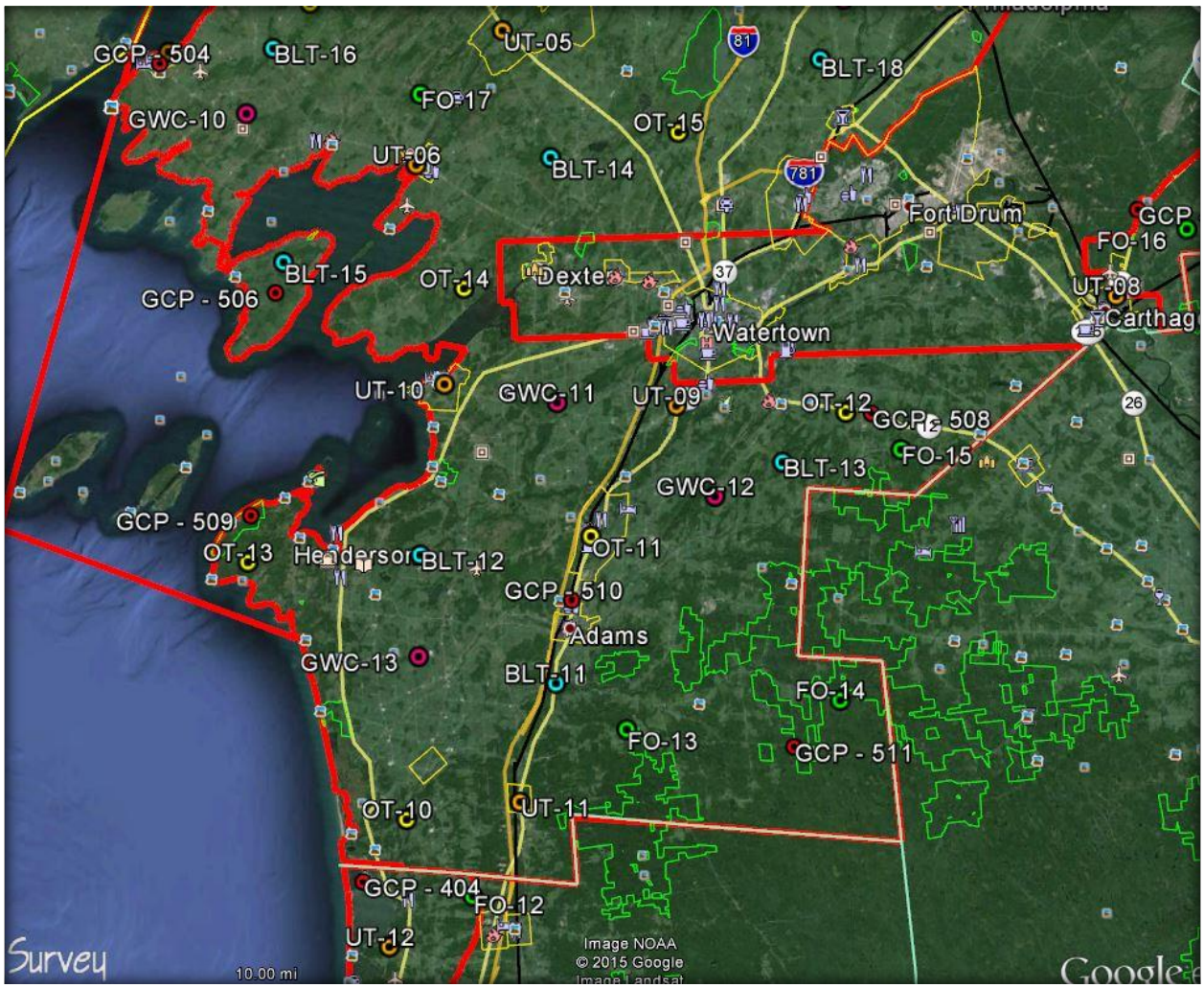
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BLT-14
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FO-16
BLT-15
OT-14
Dexter
UT-08
GCP - 506
Watertown
Carthag
UT-10
GWC-11
UT-09
OT-12
GCP - 508
FO-15
BLT-13
GWC-12
GCP - 509
OT-13
Henderson
BLT-12
OT-11
GCP - 510
Adams
GWC-13
BLT-11
FO-14
FO-13
GCP - 511
OT-10
UT-11
GCP - 404
FO-12
UT-12
Survey
10.00 mi
Image NOAA
© 2015 Google
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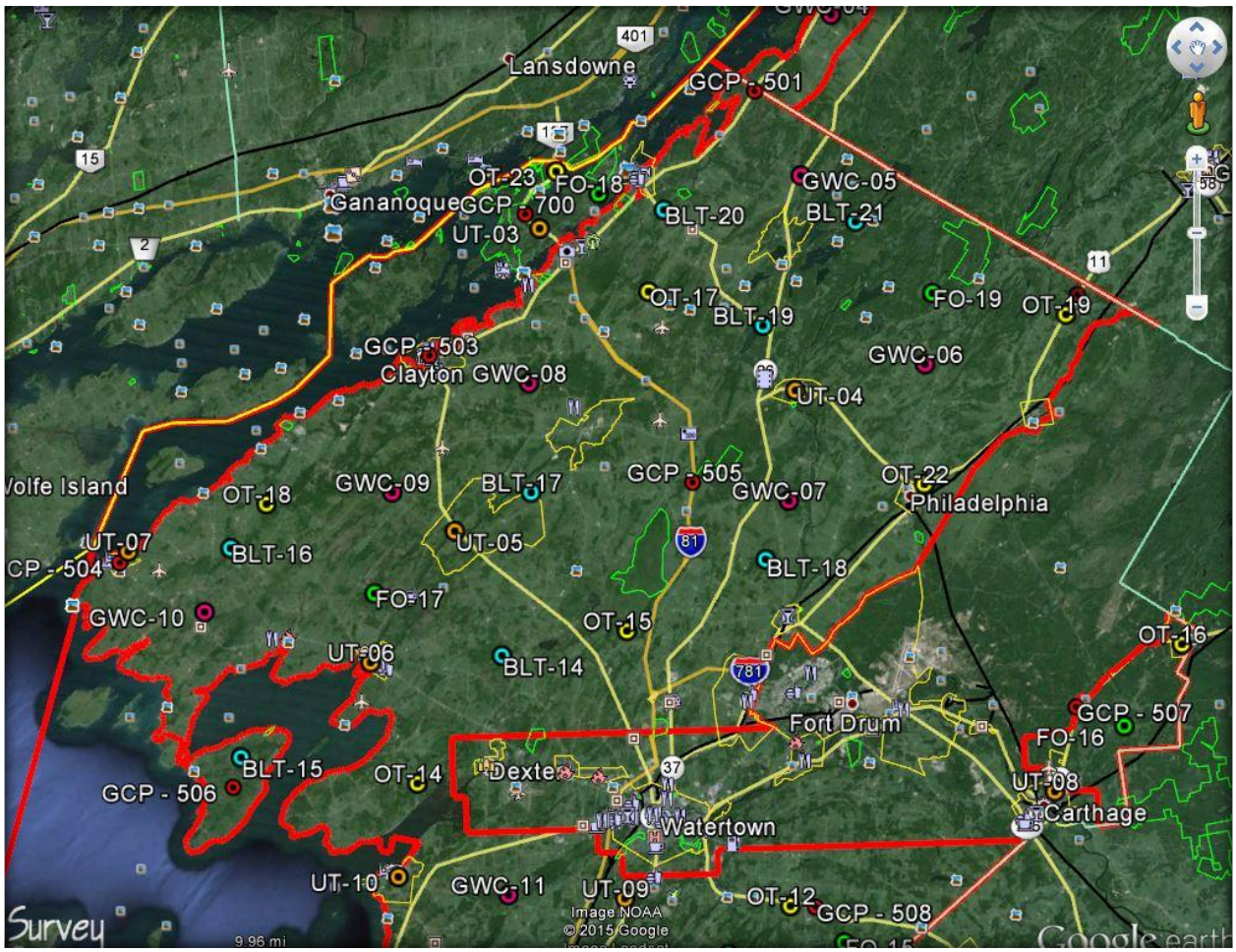
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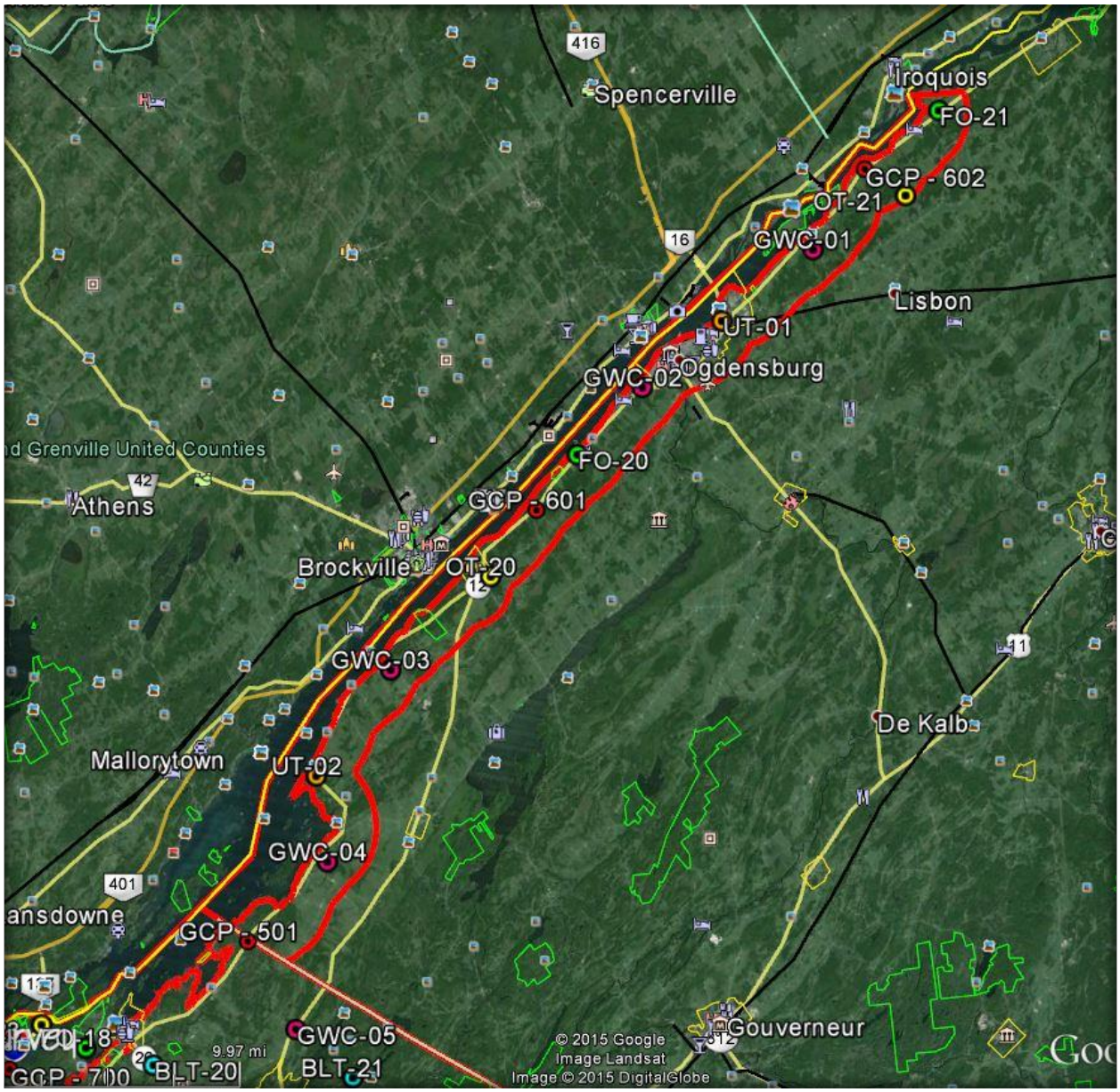


***USGS FEMA Region 2 – Great Lakes LiDAR***

# PROJECT DETAILS

## 2.1 *Survey Equipment*

In performing the GPS observations Trimble R-10 GNSS receiver/antenna attached to a two meter fixed height pole with a Trimble TSC3 Data Collector to collect GPS raw data were used to perform the field surveys.

## 2.2 *Survey Point Detail*

The 21 Ground Control Points were well distributed throughout the project area.

A sketch was made for each location and a nail was set at the point where possible or at an identifiable point. The Ground Control Point locations are detailed on the "Ground Control Point Documentation Report" sheets attached to this report.

## 2.3 *Network Design*

The GPS survey performed by Dewberry Consultants LLC office located in Lanham, MD was tied to a Real Time Network (RTN) managed by New York DOT. The network is a series of "real-time" continuously operating, high precision GPS reference stations. All of the reference stations have been linked together using Trimble GPSNet software, creating a Virtual Reference Station System (VRS).

The Trimble NetR5 Reference Station is a multi-channel, multi-frequency GNSS (Global Navigation Satellite System) receiver designed for use as a stand-alone reference station or as part of a GNSS infrastructure solution. Trimble R-Track technology in the NetR5 receiver supports the modernized GPS L2C and L5 signals as well as GLONASS L1/L2 signals.

## 2.4 *Field Survey Procedures and Analysis*

Dewberry field surveyors used Trimble R-10 GNSS receivers, which is a geodetic quality dual frequency GPS receiver, to collect data at each surveyed location.

All locations were occupied once with approximately 50% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerance of ± 5cm or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for approximately three (3) minutes in duration and measured to 180 epochs.

Each occupation which utilized OPUS (if used) was occupied between 18 and 20 minutes.

Field GPS observations are detailed on the "Ground Control Point Documentation Reports" submitted as part of this report.

Two (2) existing NGS monument listed in the NSRS database were located as an additional QA/QC method to check the accuracy of the VRS network as well as being the primary project control monuments designated as Y 198, and, SODUSPORT. The results are as follows:

| NGS PT. ID | As Surveyed (M) | | | Published (M) | | | Differences (M) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Northing(M) | Easting(M) | Elev.(M) | Northing(M) | Easting(M) | Elev.(M) | Δ N | Δ E | Δ Elev. |
| Y 198 | 4852035.595 | 434278.316 | 426.685 | 4,852,035.598 | 434,278.302 | 426.660 | 0.003 | 0.014 | 0.025 |
| SODUSPORT | 4789105.217 | 327850.061 | 127.171 | 4789105.23 | 327850.01 | 127.159 | 0.010 | 0.050 | 0.012 |

The above results indicate that the VRS network is providing positional values within the 5cm parameters for this survey.

## 2.5 *Adjustment*

The survey data was collected using Virtual Reference Stations (VRS) methodology within a Virtual Reference System (VRS).

The system is designed to provide a true Network RTK performance, the RTKNet software enables high-accuracy positioning in real time across a geographic region. The RTKNet software package uses real-time data streams from the GPSNet system user and generates correction models for high-accuracy RTK GPS corrections throughout the network. Therefore, corrections were applied to the points as they were being collected, thus negating the need for a post process adjustment.

## 2.6 *Data Processing Procedures*

After field data is collected the information is downloaded from the data collectors into the office software. The Software program used is called TBC or Trimble Business Center.

Downloaded data is run through the TBC program to obtain the following reports; points report, point comparison report and a point detail report. The reports are reviewed for point accuracy and precision.

After review of the point data an “ASCII” or “txt” file which is the industry standard is created. Point files are loaded into our CADD program (Carlson Survey 2014) to make a visual check of the point data (Pt. #, Coordinates, Elev. and Description). The data can now be imported into the final product.

## 3. *FINAL COORDINATES*

| POINT # | NORTHING | EASTING | ELEV. |
|---|---|---|---|
| **GROUND CONTROL POINTS (GCP'S)** | | | |
| GCP-301 | 4793664.038 | 312527.952 | 83.829 |
| GCP-302 | 4794944.190 | 355367.794 | 85.783 |
| GCP-303 | 4785047.041 | 332176.700 | 130.637 |
| GCP-401 | 4807439.699 | 372177.527 | 109.823 |
| GCP-402 | 4819245.003 | 386903.075 | 82.375 |
| GCP-403 | 4820370.785 | 402614.441 | 86.415 |
| GCP-404 | 4836077.757 | 404458.546 | 75.784 |
| GCP-501 | 4915016.356 | 434381.252 | 77.681 |
| GCP-502 | 4901647.120 | 454313.967 | 153.073 |
| GCP-503 | 4899048.332 | 413396.716 | 84.682 |
| GCP-504 | 4886696.761 | 393446.197 | 85.571 |
| GCP-505 | 4890608.251 | 429721.915 | 106.968 |
| GCP-506 | 4872355.383 | 400185.620 | 82.933 |
| GCP-507 | 4875817.475 | 453393.470 | 231.222 |
| GCP-508 | 4863833.664 | 436618.439 | 331.374 |
| GCP-509 | 4858723.796 | 398232.999 | 101.099 |
| GCP-510 | 4852972.406 | 417857.819 | 192.927 |
| GCP-511 | 4843651.058 | 431212.691 | 446.982 |
| GCP-601 | 4940424.192 | 452630.894 | 94.838 |
| GCP-602 | 4960310.168 | 473072.822 | 83.710 |
| GCP-700 | 4907742.223 | 419699.300 | 94.087 |

## 4. *GPS OBSERVATIONS*

| Great Lake Ortho QA | | | | | |
|---|---|---|---|---|---|
| POINT ID | OBSERV. DATE | JULIAN DATE | TIME OF DAY (PST) | RE-OBSERV. DATE | RE-OBSERV. TIME |
| GROUND CONTROL POINTS | | | | | |
| GCP-301 | 4/21/2015 | 111 | 10:37 | 4/21/2015 | 18:21 |
| GCP-302 | 4/21/2015 | 111 | 15:05 | N/A | N/A |
| GCP-303 | 4/21/2015 | 111 | 13:17 | N/A | N/A |
| GCP-401 | 4/21/2015 | 111 | 16:10 | 4/21/2015 | 20:18 |
| GCP-402 | 4/21/2015 | 111 | 17:30 | 4/21/2015 | 21:16 |
| GCP-403 | 4/22/2015 | 112 | 9:30 | 4/22/2015 | 21:33 |
| GCP-404 | 4/22/2015 | 112 | 8:15 | 4/22/2015 | 21:40 |
| GCP-501 | 4/22/2015 | 112 | 15:08 | 4/23/2015 | 15:59 |
| GCP-502 | 4/23/2015 | 113 | 8:37 | N/A | N/A |
| GCP-503 | 4/22/2015 | 112 | 16:45 | 4/26/2015 | 14:58 |
| GCP-504 | 4/22/2015 | 112 | 13:20 | 4/23/2015 | 13:16 |
| GCP-505 | 4/22/2015 | 112 | 20:00 | N/A | N/A |
| GCP-506 | 4/22/2015 | 112 | 14:40 | N/A | N/A |
| GCP-507 | 4/23/2015 | 113 | 10:15 | N/A | N/A |
| GCP-508 | 4/23/2015 | 113 | 9:23 | N/A | N/A |
| GCP-509 | 4/22/2015 | 112 | 6:50 | N/A | N/A |
| GCP-510 | 4/22/2015 | 112 | 12:00 | 4/23/2015 | 11:26 |
| GCP-511 | 4/22/2015 | 112 | 10:45 | N/A | N/A |
| GCP-601 | 4/22/2015 | 112 | 12:24 | 4/23/2015 | 16:56 |
| GCP-602 | 4/22/2015 | 112 | 9:37 | N/A | N/A |
| GCP-700 | 4/22/2015 | 112 | 17:30 | 4/23/2015 | 15:41 |

## 5. *POINT COMPARISON*

| Ortho QA | | | | |
|---|---|---|---|---|
| **POINT ID** | **POINT CK** | **DELTA NORTH (m)** | **DELTA EAST (m)** | **VERT. DIFF (m)** |
| GCP-301 | GCP-301CK | 0.010 | 0.042 | 0.019 |
| GCP-401 | GCP-401CK | 0.010 | 0.002 | 0.009 |
| GCP-402 | GCP-402CK | 0.001 | 0.001 | 0.003 |
| GCP-403 | GCP-403CK | 0.002 | 0.003 | 0.002 |
| GCP-404 | GCP-404CK | 0.002 | 0.003 | 0.004 |
| GCP-501 | GCP-501CK | 0.002 | 0.002 | 0.006 |
| GCP-503 | GCP-503CK | 0.004 | 0.006 | 0.005 |
| GCP-504 | GCP-504CK | 0.009 | 0.002 | 0.004 |
| GCP-510 | GCP-510CK | 0.000 | 0.002 | 0.004 |
| GCP-601 | GCP-601CK | 0.006 | 0.007 | 0.012 |
| GCP-700 | GCP-700CK | 0.004 | 0.006 | 0.007 |