

Check Point Survey Report
“TOPOGRAPHIC/BATHYMETRIC UPPER LAKE MICHIGAN”
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Prepared for:
National Oceanic & Atmospheric Administration (NOAA)



Prepared By:
Dewberry Consultants LLC
10003 Derekwood Lane, Suite 204
Lanham, Maryland, 20706
Phone (301)364-1855 Fax (301)731-0188

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	Including: a) Point Documentation Report & Photos of Survey Points	
	b) Final Coordinate List in Excel Format	
	c) NGS Data Sheets for Project Controls	

1. INTRODUCTION

1.1 *Project Summary*

Dewberry Consultants LLC is under contract to the National Oceanic & Atmospheric Administration (NOAA) to provide 33 Check Points in the State of Michigan. Under the above referenced NOAA Task Order, Dewberry is tasked to complete the quality assurance of LiDAR products. As part of this work Dewberry staff will complete Check Point surveys that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted December 9-10, 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 Check 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 16 North, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012B (Geoid12B).

1.2 *Points of Contact*

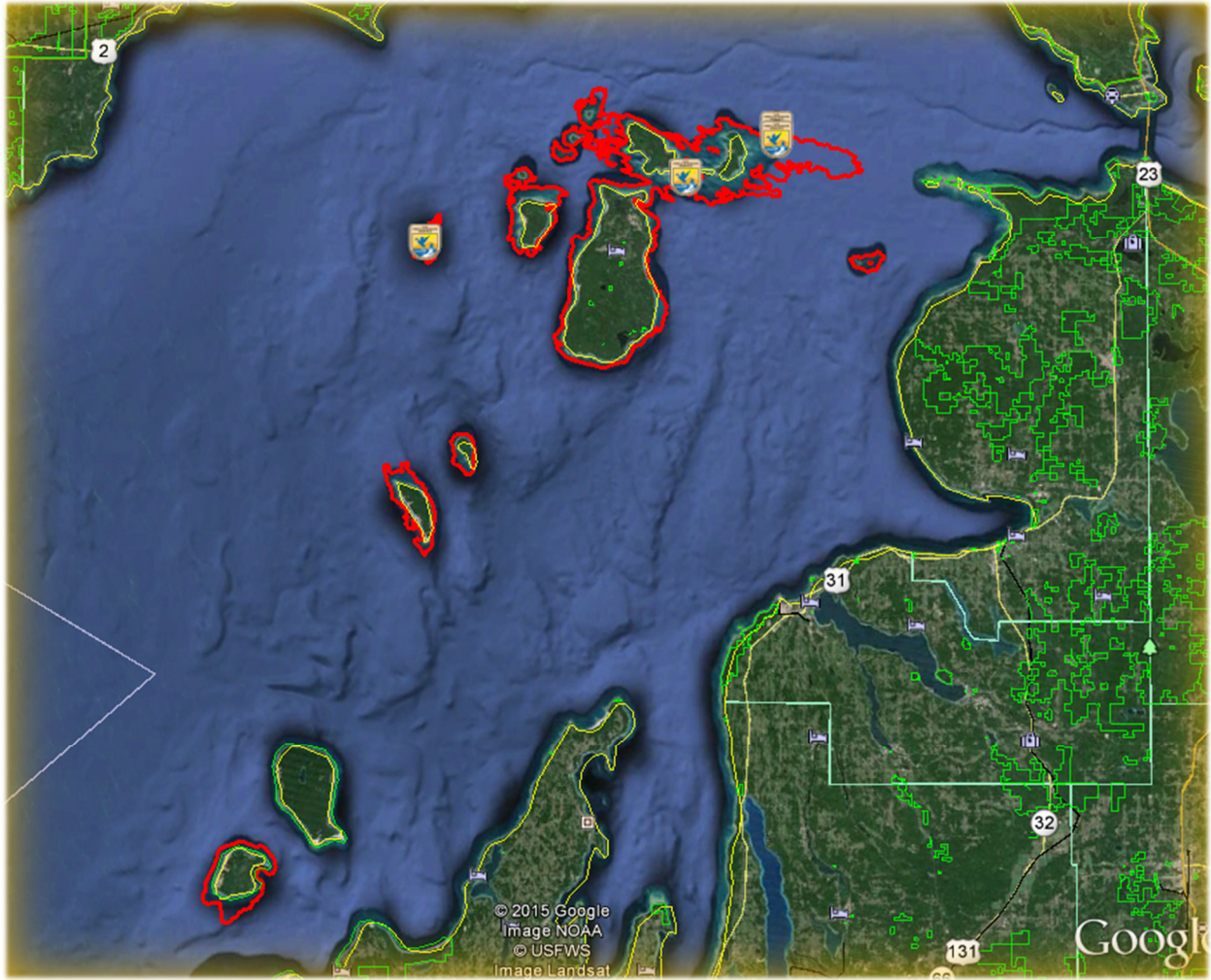
Questions regarding the technical aspects of this report should be addressed to:

Dewberry Consultants LLC

Gary D. Simpson, L.S.
Senior Associate
10003 Derekwood Lane
Suite 204
Lanham, Maryland 20706
(301) 364-1855 direct
(301) 731-0188 fax

1.3 Project Area





Upper Lake Michigan

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 33 LiDAR Check 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 Check Point locations are detailed on the “Check 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 the Michigan Department of Transportation. 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 ± 5 cm 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 20 and 30 minutes.

Field GPS observations are detailed on the “Check Point Documentation Reports” submitted as part of this report.

One (1) existing NGS monuments 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 QK0470. The results are as follows:

NGS PT. ID	As Surveyed (F)			Published (F)			Differences (F)		
	Northing(M)	Easting(M)	Elev.(M)	Northing(M)	Easting(M)	Elev. (M)	ΔN	ΔE	$\Delta Elev.$
NGS U 311	5017812.212	634707.274	206.608	5017812.210	634707.278	206.600	0.002	0.004	0.008

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



NGS Monuments

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 KEYNET 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

Upper Lake Michigan FY 2015 LiDAR POINTS			
POINT #	NORTHING (M)	EASTING (M)	ELEV. (M)
NVA			
NVA-12	5068299.06	611558.675	179.404
NVA-13	5066323.232	611894.895	179.551
NVA-14	5067060.729	614601.81	186.617
NVA-15	5066555.377	615974.903	178.461
NVA-16	5063885.211	615595.612	199.735
NVA-17	5061370.268	616725.858	184.272
NVA-18	5063816.788	611747.974	197.169
NVA-19	5060931.357	612077.82	203.157
NVA-20	5058899.246	614715.602	202.091
NVA-21	5057104.784	617236.586	178.768
NVA-22	5057245.665	612342.706	214.532
NVA-23	5052695.318	617754.581	180.694
NVA-24	5050899.322	615135.309	187.188
NVA-25	5047587.711	612308.74	181.487
NVA-26	5048283.956	609895.682	178.593
NVA-27	5049218.515	608973.424	216.985
NVA-28	5051930.267	609664.607	218.643
NVA-29	5054058.011	608516.355	182.731
NVA-30	5057074.848	608532.08	180.277
NVA-31	5059316.328	608964.332	181.925
NVA-32	5048995.251	613894.375	188.081
VVA			
VVA-1	5067501.616	612710.51	185.529
VVA-2	5067259.659	615369.253	179.215
VVA-3	5064055.494	612379.788	197.35
VVA-4	5060265.704	614691.382	202.035
VVA-5	5059886.821	609028.5	180.309
VVA-6	5057313.807	616110.587	187.314
VVA-7	5057287.647	615185.586	199.828
VVA-8	5052300.409	617665.646	180.189
VVA-9	5054499.276	609917.69	219.511
VVA-10	5048337.817	609725.684	179.69
VVA-11	5047718.108	612629.837	180.401
VVA-12	5064900.568	615019.155	196.935

4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA					
NVA-12	12/9/2015	343	15:10	12/9/2015	18:01
NVA-13	12/9/2015	343	15:20	12/9/2015	18:12
NVA-14	12/9/2015	343	14:40	12/9/2015	18:18
NVA-15	12/10/2015	344	5:30	12/10/2015	15:13
NVA-16	12/10/2015	344	14:50	N/A	N/A
NVA-17	12/10/2015	344	6:30	12/10/2015	13:48
NVA-18	12/9/2015	343	15:55	12/9/2015	18:28
NVA-19	12/9/2015	343	16:13	12/9/2015	18:47
NVA-20	12/10/2015	344	6:45	N/A	N/A
NVA-21	12/10/2015	344	12:25	12/10/2015	14:10
NVA-22	12/9/2015	343	16:30	12/9/2015	18:59
NVA-23	12/10/2015	344	12:05	N/A	N/A
NVA-24	12/10/2015	344	11:30	N/A	N/A
NVA-25	12/10/2015	344	10:15	N/A	N/A
NVA-26	12/10/2015	344	9:40	N/A	N/A
NVA-27	12/10/2015	344	9:30	N/A	N/A
NVA-28	12/9/2015	343	17:30	12/10/2015	14:36
NVA-29	12/9/2015	343	17:10	N/A	N/A
NVA-30	12/10/2015	344	7:48	N/A	N/A
NVA-31	12/10/2015	344	7:15	N/A	N/A
NVA-32	12/10/2015	344	11:05	N/A	N/A
VVA					
VVA-1	12/9/2015	343	14:55	12/9/2015	18:06
VVA-2	12/10/2015	344	6:15	N/A	N/A
VVA-3	12/9/2015	343	15:45	12/9/2015	18:35
VVA-4	12/10/2015	344	6:55	12/10/2015	13:55
VVA-5	12/10/2015	344	7:25	N/A	N/A
VVA-6	12/10/2015	344	12:35	12/10/2015	14:16
VVA-7	12/10/2015	344	13:15	12/10/2015	14:25
VVA-8	12/10/2015	344	11:50	N/A	N/A
VVA-9	12/9/2015	343	16:55	12/9/2015	19:22
VVA-10	12/10/2015	344	10:05	N/A	N/A
VVA-11	12/10/2015	344	10:49	N/A	N/A
VVA-12	12/10/2015	344	13:35	12/10/2015	15:03

5. POINT COMPARISON

LiDAR QA/QC				
POINT ID	POINT CK	DELTA NORTH (M)	DELTA EAST (M)	VERT. DIFF (M)
NVA QA				
NVA-12	NVA-12CK	0.020	0.003	0.010
NVA-13	NVA-13CK	0.016	0.010	0.001
NVA-14	NVA-14CK	0.004	0.000	0.017
NVA-15	NVA-15CK	0.000	0.004	0.000
NVA-17	NVA-17CK	0.016	0.000	0.002
NVA-18	NVA-18CK	0.008	0.001	0.001
NVA-19	NVA-19CK	0.004	0.004	0.015
NVA-21	NVA-21CK	0.000	0.001	0.001
NVA-22	NVA-22CK	0.003	0.005	0.007
NVA-28	NVA-28CK	0.002	0.004	0.003
VVA QA				
VVA-1	VVA-1CK	0.021	0.000	0.023
VVA-3	VVA-3CK	0.015	0.011	0.048
VVA-4	VVA-4CK	0.016	0.003	0.010
VVA-6	VVA-6CK	0.004	0.002	0.010
VVA-7	VVA-7CK	0.008	0.002	0.026
VVA-9	VVA-9CK	0.005	0.003	0.000
VVA-12	VVA-12CK	0.007	0.001	0.012