Check Point Survey Report

"CA_FEMA R9 Lidar_2016_D17"
KEEFER-SLOUGH
USGS Contract: G10PC00013
Task Order Number: G17PD00044

Prepared for:
United States Geological Survey (USGS)

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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1. INTRODUCTION

1.1 *Project Summary*

Dewberry Consultants LLC is under contract to the United States Geological Survey to provide 8 Check Points in the State of California. Under the above referenced USGS 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 March 1 thru March 2, 2017.

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 CA State Plane, NAD83 in US Survey Feet. Final Vertical elevations are referenced to NAVD88 in US Survey Feet using Geoid model 2012B (Geoid12B).

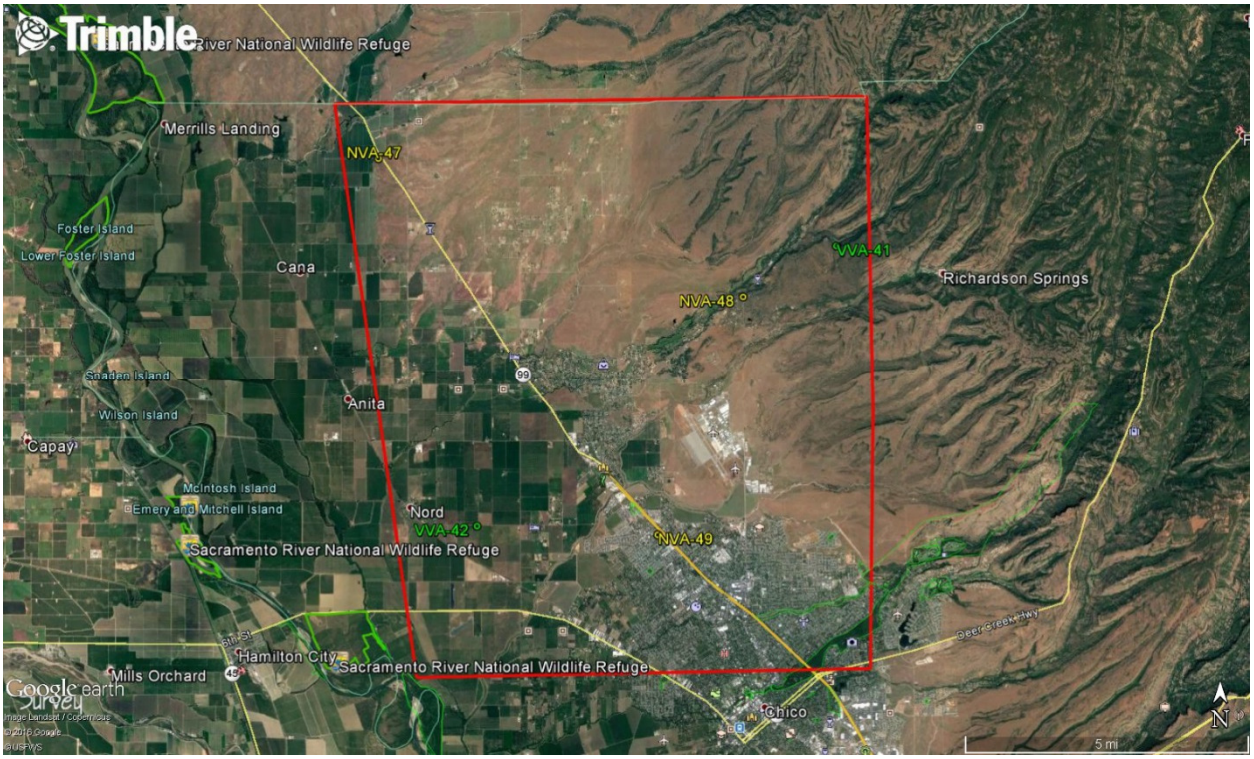
1.2 *Points of Contact*

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*



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 8 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 operated by CRTN. 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 20 and 30 minutes.

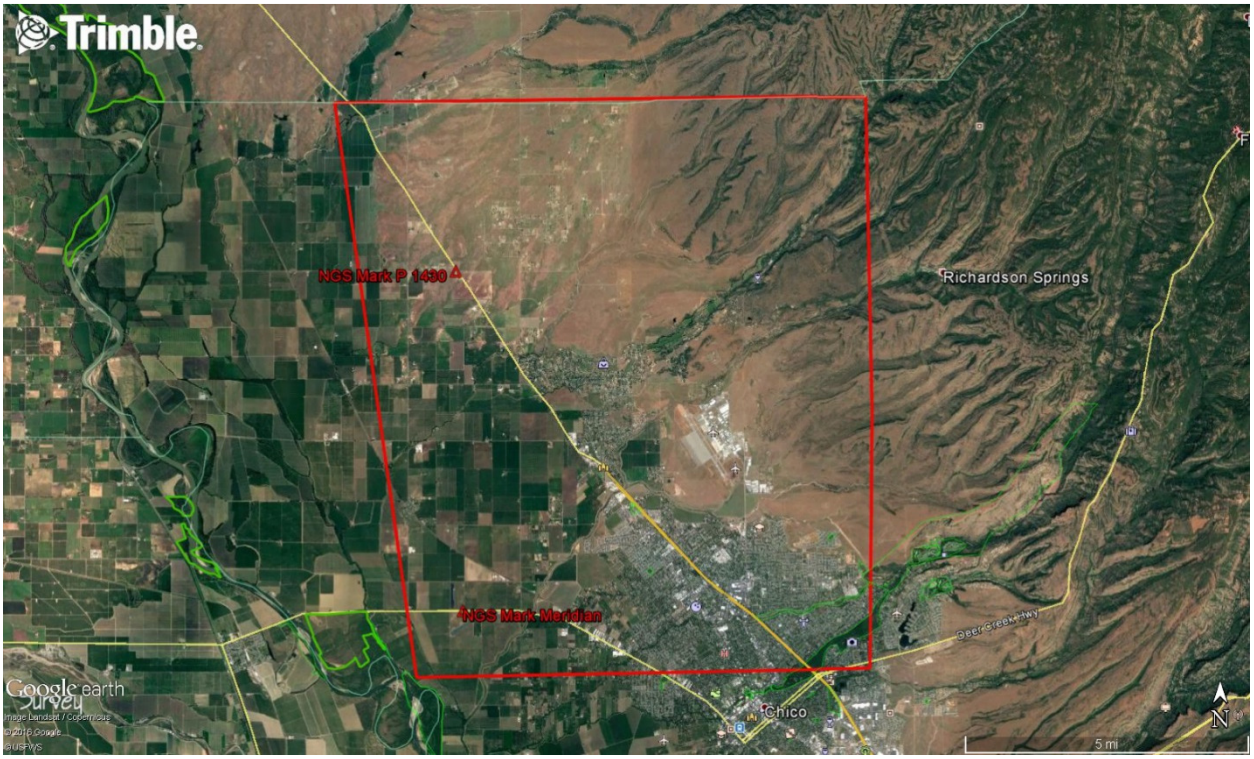
Field GPS observations are detailed on the "Check Point Documentation Reports" submitted as part of this report.

Two (2) existing NGS monument listed in the NSRS database were located as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as DH6532 and KS1922. The results are as follows:

	Observed Values			Data Sheet Values					
PT. #	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.	Δ X	Δ Y	Δ Z
MERIDIAN	2400345.6	6578969.988	140.385	2,400,345.61	6,578,969.98	140.4	-0.010	0.008	-0.015
P1430	2432077.773	6578283.161	192.552	2,432,077.73	6,578,283.18	192.53	0.043	-0.019	0.022

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 CRTN 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 2016) 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*

CA SPCS NAD83, NAVD88, Geoid 12B			
Point #	**Northing (ft)**	**Easting (ft)**	**Elevation (ft)**
NVA'S			
NVA-47	2442723.31	6571039.54	207.13
NVA-48	2429850.04	6605370.80	430.06
NVA-49	2407519.83	6597363.51	174.89
NVA-101	2395641.43	6595370.52	171.18
VVA'S			
VVA-41	2435032.06	6614406.35	660.63
VVA-42	2408288.43	6580355.72	152.27
VVA-79	2408759.61	6609248.87	216.90
VVA-81	2416312.16	6586371.79	173.35

4. *GPS OBSERVATIONS*

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA-47	3/1/2017	60	9:12	3/2/2017	9:37
NVA-48	3/1/2017	60	14:03	3/2/2017	10:22
NVA-49	3/1/2017	60	11:00	3/1/2017	17:16
NVA-101	3/1/2017	60	15:10	N/A	N/A
VVA'S					
VVA-41	3/1/2017	60	14:25	3/2/2017	10:31
VVA-42	3/1/2017	60	16:30	3/2/2017	11:33
VVA-79	3/1/2017	60	13:43	N/A	N/A
VVA-81	3/2/2017	60	11:21	N/A	N/A

5. *POINT COMPARISON*

Point ID	Point CK	Delta North (ft)	Delta East (ft)	Vertical Difference (ft)
NVA-47	NVA-47CK	0.02	0.06	0.06
NVA-48	NVA-48CK	0.05	0.04	0.04
NVA-49	NVA-49CK	-0.03	-0.02	0.04
VVA-41	*VVA-41CK*	*-0.02*	*0.00*	*0.03*
VVA-42	*VVA-42CK*	*-0.06*	*0.04*	*0.09*