LANDPRO

Make the most of your land

METADATA REPORT

Prepared for Regional Software Holdings Ltd

Northland & Waikato LiDAR (Block 1)

Project	Northland & Waikato LiDAR
Client	Regional Software Holdings Ltd
Contact	Mark Donnelly

Supplier	Landpro Ltd.
Address	13 Pinot Noir Drive Cromwell 9310 New Zealand
Phone	+64 3 445 9905
Supplier contact	Andy Burrell andy@landpro.co.nz
Landpro Reference	23553
Date of metadata creation	13 February 2024

Contents

1. Introduction

1.1 Background

Landpro Ltd was contracted by Regional Software Holdings Ltd to capture and supply LiDAR topographic data for the area of interest presented in Figure 1. The primary purpose for the contract was to provide a topographic LiDAR survey to support resource quantification & recovery after extreme weather events (Cyclone Gabrielle).

The purpose of this report is to provide detailed information regarding the acquisition, processing, and delivery of the requested LiDAR topographic survey and associated deliverables as provided to Regional Software Holdings Ltd.

1.2 Survey Coverage

The Northland & Waikato LiDAR project for Regional Software Holdings Ltd comprised of two areas of interest, as shown in Figure 1 and covered a total area of 17.3 km^2.

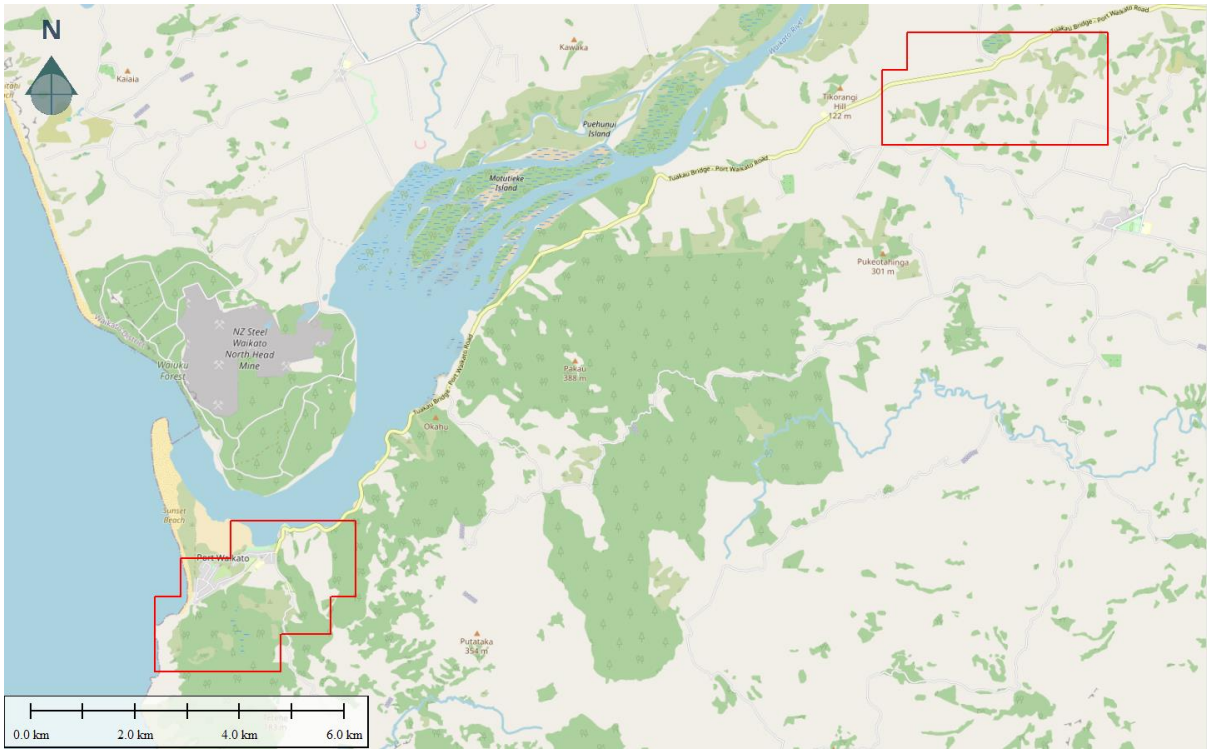

Figure 1. Areas of interest surveyed as part of the Northland & Waikato LiDAR project captured for Regional Software Holdings Ltd.

2. Data Acquisition

2.1 Data Capture

Imagery & LiDAR for this project was acquired on 21/21/2024 using the Leica Terrain Mapper system. The Leica Terrain Mapper includes the use of a 150 Hz LiDAR sensor, combined with a 80MP (RGBN) camera. The integrated system is fitted to a Leica PAV100 high performance, gyro-stabilised mount, for optimal capture.

A copy of the Leica Terrain Mapper calibration certificate can be made available upon request.

Figure 2: Leica Terrain Mapper showing the RCD30 camera head, and Terrain Mapper system respectively.

Sensor	Serial Number
Leica Terrain Mapper	6626
Leica PAV100 HP Mount	91014
Leica RCD30 80MP	82594

The supplied dataset includes the following items:

- LiDAR point cloud classified to ground, above ground, water vegetation, and building classes in LAZ format.
- 1 m DEM in RASTER (GeoTiff) format.
- 1 m DSM in RASTER (GeoTiff) format.
- Canopy Height Model in RASTER (Geotiff) format.
- All data has been supplied in NZTM NZGD2000 and NZVD16.

2.2 Flight Planning

Careful consideration was given during flight planning to geographic location, terrain, topographical characteristics of the area, acquisition efficiency, final output resolution. Table 1 provides a summary of the flight parameters during the capture of the Northland & Waikato (Block 1) LiDAR project.

Table 1: Summary of the flight planning parameters for the Northland & Waikato LiDAR project.

	Summary
No. of flight lines	10
Total length of flight lines (km)	60

2.3 Environmental capture requirements

All LiDAR was captured without the presence of cloud within the specified areas of interest.

2.4 Ground Control

Ground control was carried out by Landpro a month before the capture date.

2.5 Safety

No safety incidents were reported during the completion of this project.

3. Data Processing

3.1 GNSS Processing

Projection: NZTM NZGD2000
Vertical Datum: NZVD16
Reference Station: GSWI

GSWI: Mark details

MARK IDENTIFICATION

Code:	**GSWI**	Country:	**New Zealand**
Name:	**Waiuku Domain**	Land District:	**North Auckland**
Alternatives:		Topo50 sheet:	**BB31**
		NZTM:	**5875853.028 1753357.193**
		Scale factor	**0.9998897**
		Convergence	**+1° 02' 49"**

NZGD 2000 COORDINATES

Latitude:	**37° 15' 04.53171" S**	Order:	3	Previous coordinates
Longitude:	**174° 43' 45.17006" E**	Authorised:	**21-Dec-2018**	
Ellipsoidal height (m):	**50.126**	Reference:	**CORS Update (Constrained to PositioNZ stations DefMod v20180701 ITRF2008@2018-01-01)**	

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence	
Mount Eden Circuit 2000	**758770.840**	**396899.373**	**0.9999001**	**-0° 01' 16"**	Previous coordinates

ORTHOMETRIC HEIGHTS

Height datum	Height (m)	Order	Calculation Date	Reference
New Zealand Vertical Datum 2016	**17.524**	2V	**25-Feb-2020**	**2020CORS NZVD2016 Point Load**

MARK DETAILS

Last maintained:	**19-Feb-2021**
Maintenance level:	
Mark condition:	**Reliably Placed**
Description:	**N/A**
Mark type:	**Forced Centering**
Beacon type:	**Unknown**
Protection type:	**Not specified**

3.2 LiDAR Point Processing

Data processing has been in accordance with our standard policies and procedures surrounding acceptable tolerances, therefore ensuring optimal accuracy of deliverables.

GNSS/IMU data was processed using the GSWI Base Station and precise ephemeris data.

The GNSS and IMU were processed in a tightly coupled loop to give an optimum trajectory. This data was then applied to the LiDAR and image exterior orientations prior to LAS and ortho creation.

LiDAR data was generated via Leica HxMap.

3.3 LiDAR Calibration

Overlapping LiDAR points from adjacent aircraft trajectories were used to check the LiDAR calibration for heading, roll, pitch and scale.

These values were then used to make small flight-specific adjustments to the LiDAR data.

3.4 LiDAR Point Editing

A "1st run" automatic classification was carried out on the raw LiDAR points using *TerraSolid's TerraScan* software to separate the LiDAR points into ground hits and non-ground hits. This results in a greater than 90% correct classification. A manual classification was then used to edit points where gross classification errors occurred in the automatic classification process.

The DEM for the area of interest is presented in Figure 3.

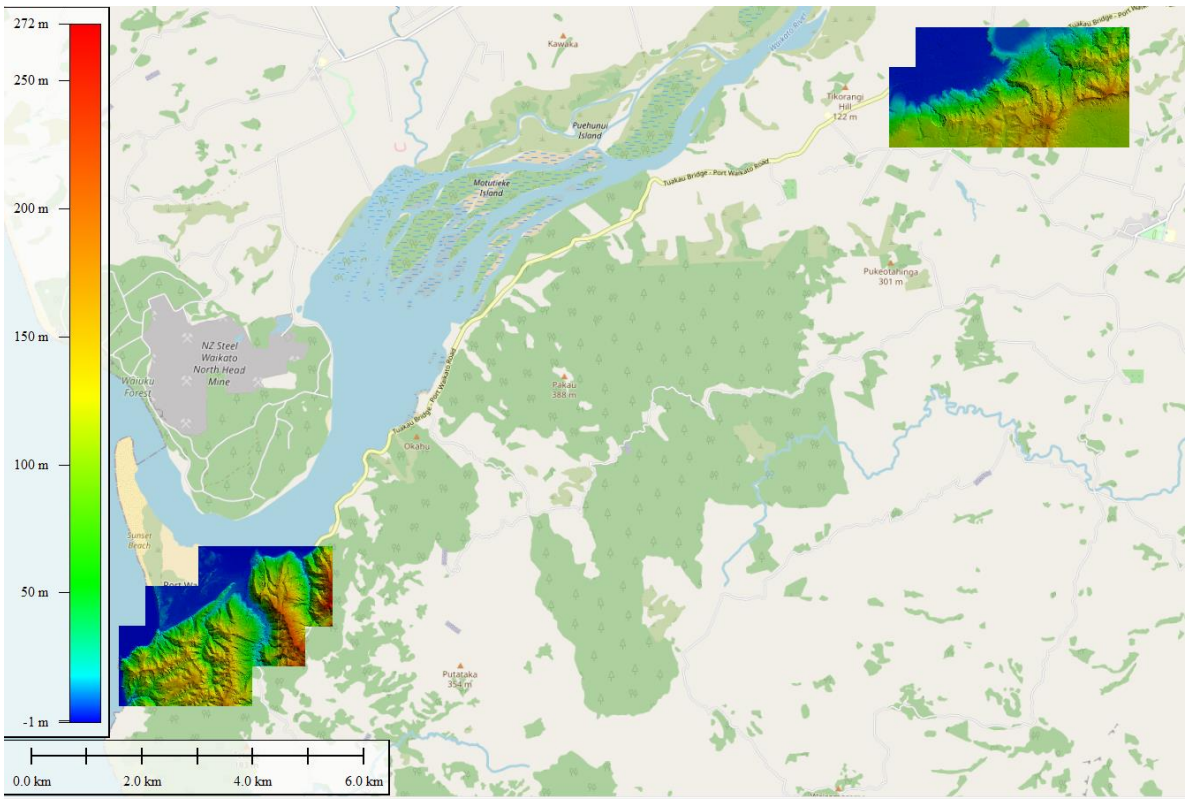

Figure 3: DEM for the Waikato LiDAR (Block 1) area of interest.

3.5 Vertical LiDAR Accuracy

Average dz	-0.00
Minimum dz	-0.056
Maximum dz	+0.048
Average magnitude	0.018
Root mean square	0.021
Std deviation	0.021

3.6 Horizontal Accuracy

The positional accuracy of the LiDAR data was checked by plotting Landpro Ltd. check points and displaying the LiDAR by intensity. The LiDAR was found to be in position.

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Northland & Waikato LiDAR

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Address	13 Pinot Noir Drive Cromwell 9310 New Zealand
Phone	+64 3 445 9905
Supplier contact	Andy Burrell andy@landpro.co.nz
Landpro Reference	23553
Date of metadata creation	28 June 2024

Contents

1. Introduction

1.1 Background

Landpro Ltd was contracted by Regional Software Holdings Ltd to capture and supply LiDAR topographic data for the area of interest presented in Figure 1. The primary purpose for the contract was to provide a topographic LiDAR survey to support resource quantification & recovery after extreme weather events (Cyclone Gabrielle).

The purpose of this report is to provide detailed information regarding the acquisition, processing, and delivery of the requested orthorectified imagery, LiDAR topographic survey and their associated deliverables as provided to Regional Software Holdings Ltd.

1.2 Survey Coverage

The Northland & Waikato LiDAR project for Regional Software Holdings Ltd comprised of one area of interest, as shown in Figure 1 and covered a total area of 5037.5 km^2.

Figure 1. Area of interest surveyed as part of the Northland & Waikato LiDAR project captured for Regional Software Holdings Ltd.

2. Data Acquisition

2.1 Data Capture

Imagery & LiDAR for this project was acquired between the following dates: 21/01/2024 – 17/05/2024 using the Leica Terrain Mapper system. The Leica Terrain Mapper includes the use of a 150 Hz LiDAR sensor, combined with a Leica RCD30 80MP (RGBN) camera. The integrated system is fitted to a Leica PAV100 high performance, gyro-stabilised mount, for optimal capture.

A copy of the Leica Terrain Mapper calibration certificate can be made available upon request.

Figure 2: Leica Terrain Mapper showing the RCD30 camera head, and Terrain Mapper system respectively.

Sensor	Serial Number
Leica Terrain Mapper	6626
Leica PAV100 HP Mount	91014
Leica RCD30 80MP	82594

The supplied dataset includes the following items:

- LiDAR point cloud classified to ground, above ground, water vegetation, and building classes in LAZ format
- 1 m DEM in RASTER (GeoTiff) format
- 1 m DSM in RASTER (GeoTiff) format
- Canopy Height Model in RASTER (GeoTiff) format
- All data has been supplied in NZTM NZGD2000 and NZVD16

2.2 Flight Planning

Careful consideration was given during flight planning to geographic location, terrain, topographical characteristics of the area and acquisition efficiency. Table 1 provides a summary of the flight parameters during the capture of the Northland & Waikato LiDAR project.

Table 1: Summary of the flight planning parameters for the Northland & Waikato LiDAR project.

	Summary
No. of flight lines	154
Total length of flight lines (km)	7250.3
Sidelap (%)	35

2.3 Ground Control

Ground control was carried out by Landpro within a week of the initial capture date..

2.4 Safety

No safety incidents were reported during the completion of this project.

2.5 Sensor hardware underperformance

Hardware underperformance was noticed during a portion of the Waikato region LiDAR capture. Affected flight dates were from 21/01/2024 until 21/02/2024. Near field backscatter affected a portion of the emitted pulses during flight, resulting in a higher than usual noise/signal ratio and a reduction in the resulting point density (not all emitted pulses registered valid returns) Point density of the point cloud is found to be above 8 points per square meter.

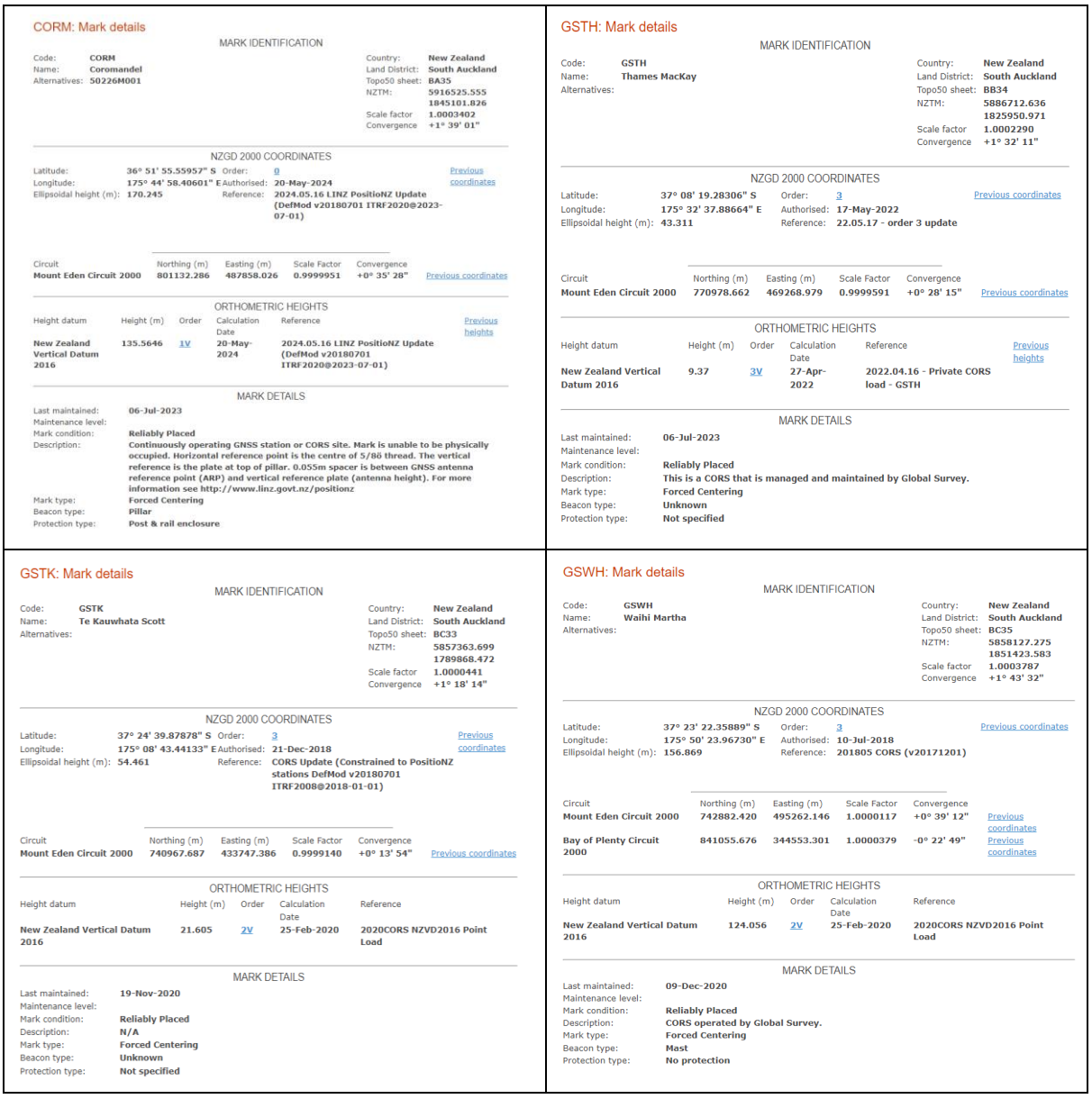
3. Data Processing

3.1 GNSS Processing

Projection: NZTM NZGD2000

Vertical Datum: NZVD16

Reference Station: CORM, GSTH, GSTK & GSWH



CORM: Mark details

MARK IDENTIFICATION

Code: CORM
Name: Coromandel
Alternatives: 50226M001

Country: New Zealand
Land District: South Auckland
Topo50 sheet: BA35
NZTM: 5916525.555 1845101.826
Scale factor 1.0003402
Convergence +1° 39' 01"

NZGD 2000 COORDINATES

Latitude: 36° 51' 55.55957" S
Longitude: 175° 44' 58.40601" E
Ellipsoidal height (m): 170.245
Order: 0
Authorised: 20-May-2024
Reference: 2024.05.16 LINZ PositioNZ Update (DefMod v20180701 ITRF2020@2023-07-01)
Previous coordinates

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence	
Mount Eden Circuit 2000	801132.286	487858.026	0.9999951	+0° 35' 28"	Previous coordinates

ORTHOMETRIC HEIGHTS

Height datum	Height (m)	Order	Calculation Date	Reference	
New Zealand Vertical Datum 2016	135.5646	1V	20-May-2024	2024.05.16 LINZ PositioNZ Update (DefMod v20180701 ITRF2020@2023-07-01)	Previous heights

MARK DETAILS

Last maintained: 06-Jul-2023
Maintenance level:
Mark condition: Reliably Placed
Description: Continuously operating GNSS station or CORS site. Mark is unable to be physically occupied. Horizontal reference point is the centre of 5/8ö thread. The vertical reference is the plate at top of pillar. 0.055m spacer is between GNSS antenna reference point (ARP) and vertical reference plate (antenna height). For more information see http://www.linz.govt.nz/positionz
Mark type: Forced Centering
Beacon type: Pillar
Protection type: Post & rail enclosure

GSTH: Mark details

MARK IDENTIFICATION

Code: GSTH
Name: Thames MacKay
Alternatives:

Country: New Zealand
Land District: South Auckland
Topo50 sheet: BB34
NZTM: 5886712.636 1825950.971
Scale factor 1.0002290
Convergence +1° 32' 11"

NZGD 2000 COORDINATES

Latitude: 37° 08' 19.28306" S
Longitude: 175° 32' 37.88664" E
Ellipsoidal height (m): 43.311
Order: 3
Authorised: 17-May-2022
Reference: 22.05.17 - order 3 update
Previous coordinates

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence	
Mount Eden Circuit 2000	770978.662	469268.979	0.9999591	+0° 28' 15"	Previous coordinates

ORTHOMETRIC HEIGHTS

Height datum	Height (m)	Order	Calculation Date	Reference	
New Zealand Vertical Datum 2016	9.37	3V	27-Apr-2022	2022.04.16 - Private CORS load - GSTH	Previous heights

MARK DETAILS

Last maintained: 06-Jul-2023
Maintenance level:
Mark condition: Reliably Placed
Description: This is a CORS that is managed and maintained by Global Survey.
Mark type: Forced Centering
Beacon type: Unknown
Protection type: Not specified

GSTK: Mark details

MARK IDENTIFICATION

Code: GSTK
Name: Te Kauwhata Scott
Alternatives:

Country: New Zealand
Land District: South Auckland
Topo50 sheet: BC33
NZTM: 5857363.699 1789868.472
Scale factor 1.0000441
Convergence +1° 18' 14"

NZGD 2000 COORDINATES

Latitude: 37° 24' 39.87878" S
Longitude: 175° 08' 43.44133" E
Ellipsoidal height (m): 54.461
Order: 3
Authorised: 21-Dec-2018
Reference: CORS Update (Constrained to PositioNZ stations DefMod v20180701 ITRF2008@2018-01-01)
Previous coordinates

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence	
Mount Eden Circuit 2000	740967.687	433747.386	0.9999140	+0° 13' 54"	Previous coordinates

ORTHOMETRIC HEIGHTS

Height datum	Height (m)	Order	Calculation Date	Reference
New Zealand Vertical Datum 2016	21.605	2V	25-Feb-2020	2020CORS NZVD2016 Point Load

MARK DETAILS

Last maintained: 19-Nov-2020
Maintenance level:
Mark condition: Reliably Placed
Description: N/A
Mark type: Forced Centering
Beacon type: Unknown
Protection type: Not specified

GSWH: Mark details

MARK IDENTIFICATION

Code: GSWH
Name: Waihi Martha
Alternatives:

Country: New Zealand
Land District: South Auckland
Topo50 sheet: BC35
NZTM: 5858127.275 1851423.583
Scale factor 1.0003787
Convergence +1° 43' 32"

NZGD 2000 COORDINATES

Latitude: 37° 23' 22.35889" S
Longitude: 175° 50' 23.96730" E
Ellipsoidal height (m): 156.869
Order: 3
Authorised: 10-Jul-2018
Reference: 201805 CORS (v20171201)
Previous coordinates

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence	
Mount Eden Circuit 2000	742882.420	495262.146	1.0000117	+0° 39' 12"	Previous coordinates
Bay of Plenty Circuit 2000	841055.676	344553.301	1.0000379	-0° 22' 49"	Previous coordinates

ORTHOMETRIC HEIGHTS

Height datum	Height (m)	Order	Calculation Date	Reference
New Zealand Vertical Datum 2016	124.056	2V	25-Feb-2020	2020CORS NZVD2016 Point Load

MARK DETAILS

Last maintained: 09-Dec-2020
Maintenance level:
Mark condition: Reliably Placed
Description: CORS operated by Global Survey.
Mark type: Forced Centering
Beacon type: Mast
Protection type: No protection

3.2 LiDAR Point Processing

Data processing has been in accordance with our standard policies and procedures surrounding acceptable tolerances, therefore ensuring optimal accuracy of deliverables.

GNSS/IMU data was processed using the CORM, GSTH, GSTK & GSWH Base Station and precise ephemeris data.

The GNSS and IMU were processed in a tightly coupled loop to give an optimum trajectory. This data was then applied to the LiDAR and image exterior orientations prior to LAS and ortho creation.

Image data was processed using Leica HxMap and any radiometric adjustment applied as required. LiDAR data was generated via Leica HxMap.

3.3 LiDAR Calibration

Overlapping LiDAR points from adjacent aircraft trajectories were used to check the LiDAR calibration for heading, roll, pitch and scale.

These values were then used to make small flight-specific adjustments to the LiDAR data.

3.4 LiDAR Point Editing

A "1st run" automatic classification was carried out on the raw LiDAR points using *TerraSolid's TerraScan* software to separate the LiDAR points into ground hits and non-ground hits. This results in a greater than 90 % correct classification. A manual classification was then used to edit points where gross classification errors occurred in the automatic classification process.

The DEM for the area of interest is presented in Figure 3.

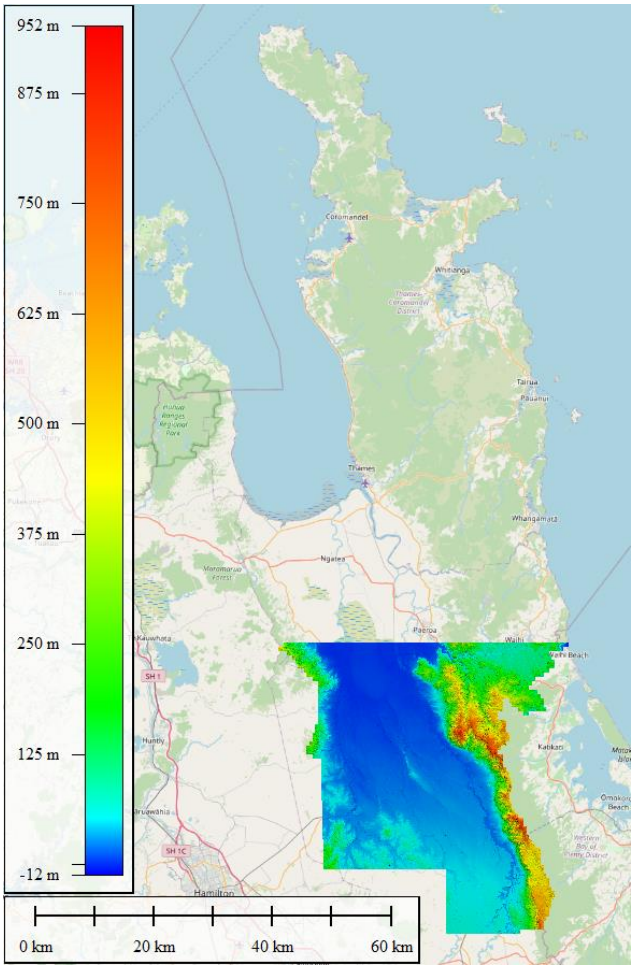


Figure 3: DEM for the Waikato area of interest.

3.5 Vertical LiDAR Accuracy

Average dz	-0.001
Minimum dz	-0.214
Maximum dz	0.165
Average magnitude	0.048
Root mean square	0.058
Std deviation	0.058

3.6 Horizontal Accuracy

The positional accuracy of the LiDAR data was checked by plotting Landpro Ltd. check points and displaying the LiDAR by intensity. The LiDAR was found to be in position.