PROGRAM REPORT

WHITEHORSE 2024 GROUND GRAVITY SURVEY

Whitehorse, Yukon

Report Prepared for:

Yukon

Yukon Geological Survey

Report Prepared by:

AURORA GEOSCIENCES

PROGRAM REPORT
WHITEHORSE 2024 GROUND GRAVITY SURVEY
Whitehorse, Yukon

Survey Centre:
60° 40' N, 135° 6' W
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1 INTRODUCTION

This report details the ground gravity survey that Aurora Geosciences Ltd. (Aurora) conducted for the Yukon Geological Survey (YGS). The goal of the program is to assess the geothermal potential in the area by locating large faults and structures in Whitehorse, Yukon. The 4 km by 7 km survey area was covered by the collection of 136 gravity stations. While the data collection was completed from April 22 – June 19, 2024, there were only 12 data acquisition days.

This work was completed by Aurora personnel whose base of operations was in the city of Whitehorse. The survey points were all accessed by light-duty truck.

The content of this report describes the survey specifications, data acquisition, and data processing. Digital copies of raw instrument data files, processed databases, raster images and maps in Oasis format are included with this report as Appendix I.

Interpretation and modelling of the data were not within the scope of this project but can be completed upon request.

2 CREW AND EQUIPMENT

2.1 CREW

The Aurora personnel who conducted the survey are shown in Table 1. Further details describing the daily operations is found in the supplied Crew Log in Appendix II.

Table 1. Personnel List and Deployment Dates

Name	Position	Deployments
Andre Lebel	Geophysicist (Gravity Operator)	April 22 – May 3 and June 5 2024
Dzmitri Spasau	Geophysical Technician (GPS Operator)	April 22 – May 3 2024
Will Buckland	Geophysical Technician (GPS Operator)	June 5, 2024
Anna Pernu	Geophysical Technician (GPS Operator)	June 5, 19, 2024
Robert Chee	Geophysical Technician (Gravity Operator)	June 5, 2024
Heather Neufeld	Geophysicist (Gravity Operator)	June 19, 2024

2.2 EQUIPMENT

The Aurora crew used the following instruments and equipment to complete the survey accurately, efficiently and safely.

Table 2. List of Instruments and Equipment Used

Item	Description
Gravity	Scintrex CG-6 Gravimeter (s/n: 18060099) Scintrex CG-6 Gravimeter (s/n: 20010232) Scintrex CG-6 Gravimeter (s/n: 22110487)
Global Navigation Satellite System (GNSS)	2 Leica GS15 GNSS Rover Antennae 2 Leica GS15 GNSS Base Antennae 2 Leica GS14 GNSS Antennae 3 Leica CS15 Controller Pac-Crest radios and repeater
Other	Spare parts 4 – Handheld non-differential Garmin GPS 4 – Bear spray and bear bangers 2 – Light duty trucks

Further details of the gravimeter instruments are found in Appendix III.

3 SURVEY LOCATION

The survey area is 4 km by 7 km covering the southern part of the city of Whitehorse (Figure 1). For planned locations that coincided with private land, those stations were either moved to public land or permission was received from the landowners.

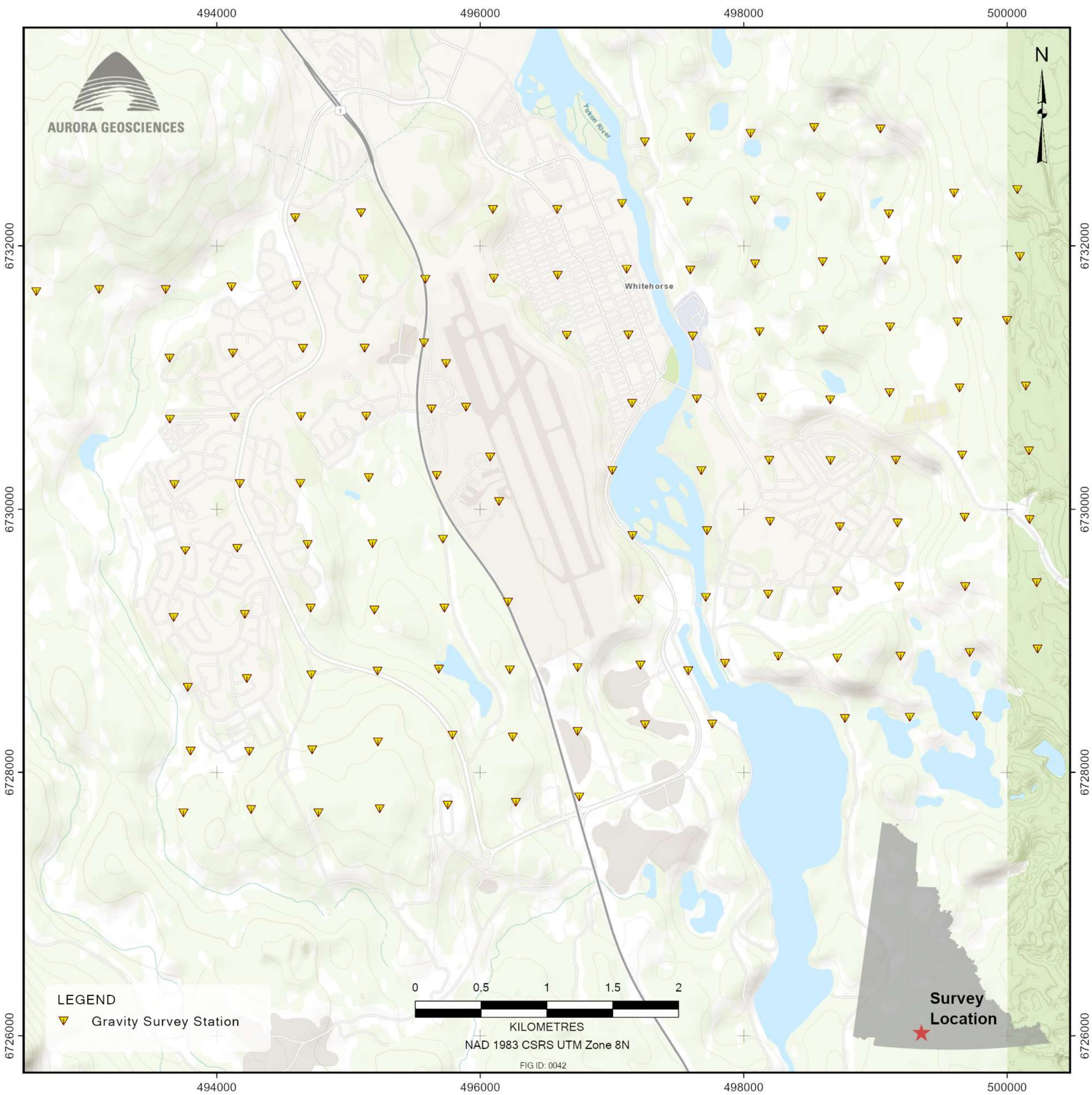

Figure 1. Plan map showing the ground gravity survey area and the measured station locations.

4 SURVEY SPECIFICATIONS

The survey was conducted according to the following specifications.

Table 3. Survey Specifications

Line Orientation	Azimuth of 178°
Line Spacing	500 m
Station Spacing	500 m
GPS Location	NAD 83 (CSRS) Zone 8N UTM coordinates
Elevation	Orthometric Heights (CGVD2013 datum)
Seismic Filter for Gravity Collection	Yes
Minimum Stack Time for Gravity Collection	Readings are stacked for a minimum of 60 s (2 readings x 30 s)
Noise Threshold for Gravity Collection (Survey Stations)	Maximum standard deviation of individual 10 Hz readings within the stack of 0.050 mGal
Noise Threshold for Gravity Collection (Control Stations)	Maximum standard deviation of individual 10 Hz readings within the stack of 0.020 mGal
GNSS quality	Maximum CQ3D of 0.025 m

5 DATA COLLECTION

From April 22 to June 17, 2024, 136 stations of ground gravity were collected over the survey grid. The data acquisition was completed in 12 workdays during that span of time.

Detailed survey logs that describe daily survey activities are provided in Appendix II.

5.1 PRE-SURVEY GRAVIMETER CHECKS

5.1.1 Gravimeter Drift Test

Prior to mobilization, the gravimeter is warmed up for a minimum of 48 hours on a level cement floor. The instrument is then cycled for at least 16 hours taking 60 seconds readings continuously to determine the remnant instrument drift and to adjust the drift constant, if required.

Gravimeter drift tests were completed prior to the initial mobilization, and again on June 4 - 5, 2024 prior to completing the survey. The results of the drift tests of each gravimeter show that the gravimeters are in optimal working ability. Only one gravimeter (CG6 099) had a drift correction applied which was adjusted from -0.003557 mGal/day to 0.005657 mGal/day. As shown in Figure 2, a 0.005 mGal remnant tidal effect is still observed in the result – however, such minor remnant tidal amount is a testament to the sensitivity of the instrument.

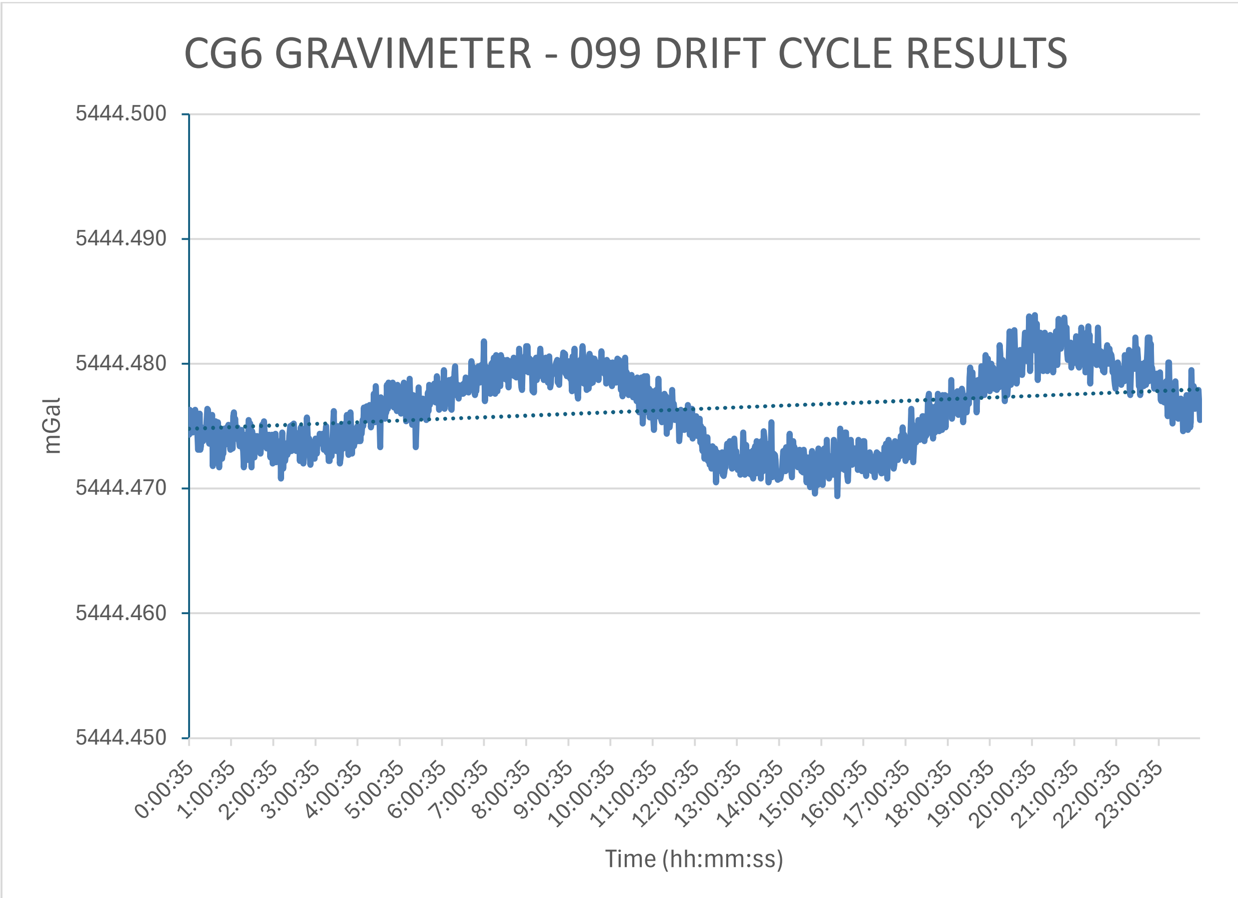

Figure 2. Drift test results from April 21, 2024 for CG6 1860099 showing slight drift which was corrected.

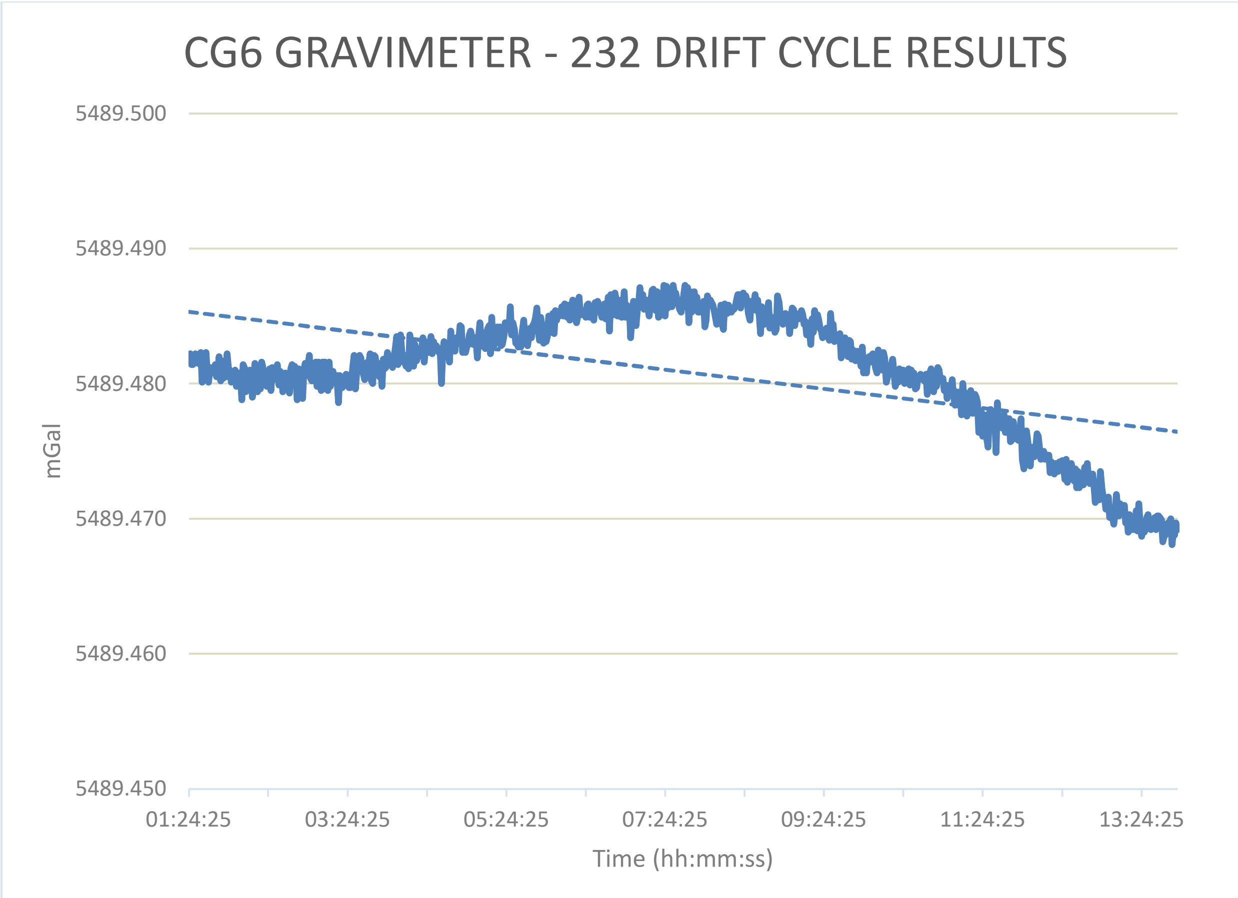

Figure 3. Drift test results from July 4, 2024 for CG6 20010232 showing negligible drift.

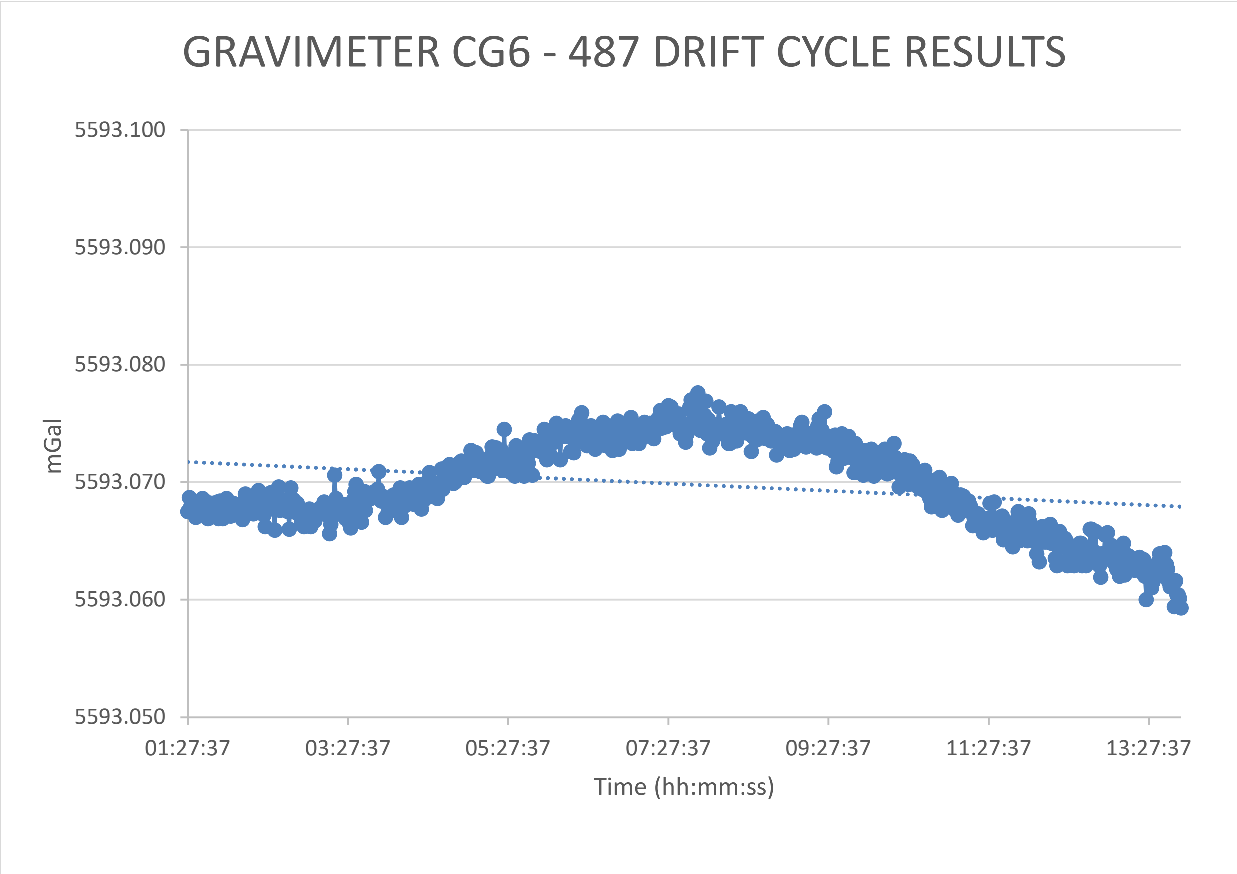

Figure 4. Drift test results from July 5, 2024 for CG6 22110487 showing negligible drift.

5.1.2 Gravimeter Walk Test

Gravimeter walk tests were completed prior to the initial mobilization on April 22, 2024, and again on June 5, 2024. In each occurrence, 10 readings were taken at the same location following a period of walking in between each reading and subsequent 10 second settling time. The range of the readings for the gravimeters was less than 0.020 mGal indicating the gravimeters were functioning well.

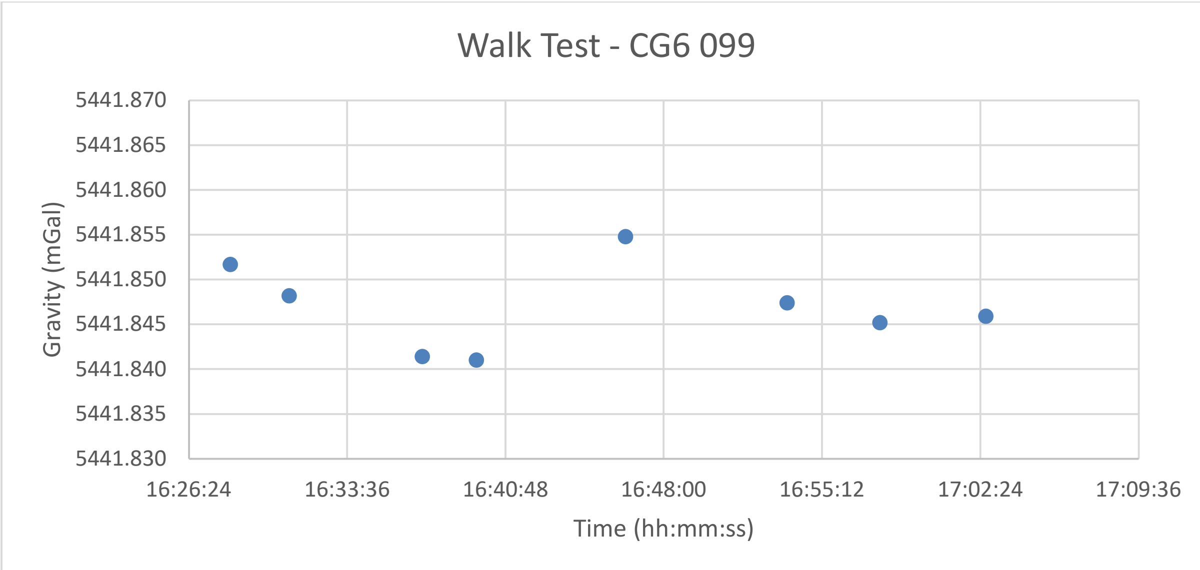

Figure 5: Gravity reading results of the walk test for CG6 1860099.

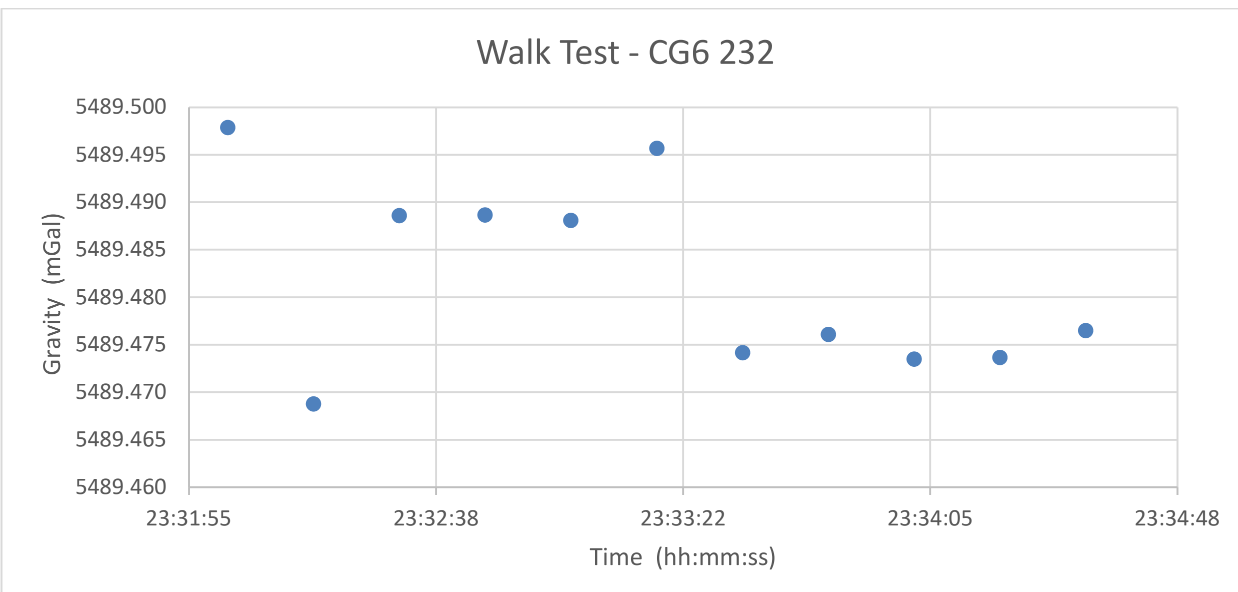

Figure 6: Gravity reading results of the walk test prior for CG6 20010232.

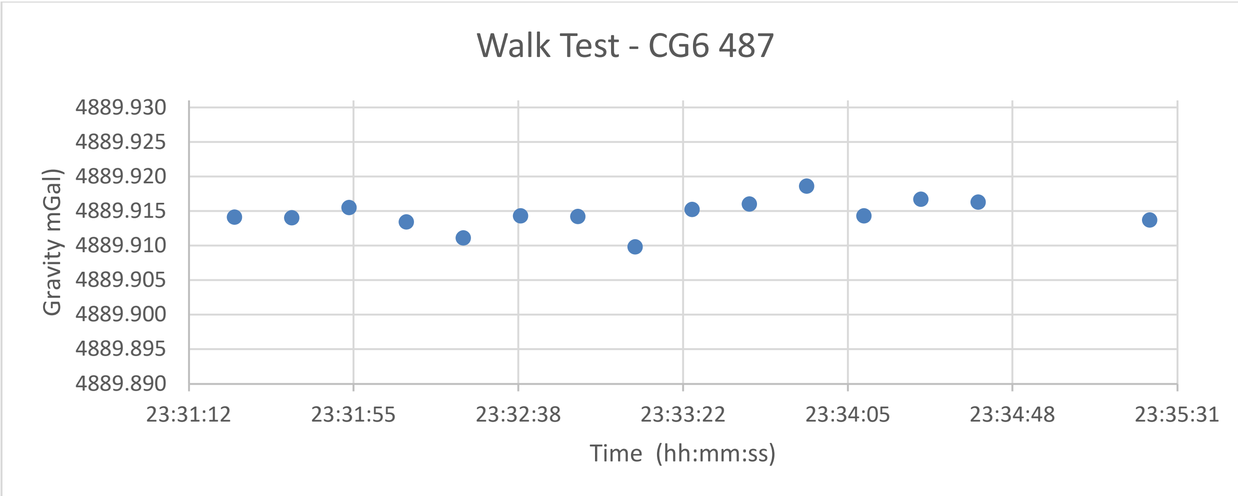

Figure 7: Gravity reading results of the walk test for CG6 22110487.

5.2 SURVEY ACQUISITION PROCEDURES

5.2.1 Gravity Data

Prior to and post daily surveying, readings are taken at a control station. This station is established at a specific location that is stable and easily accessible for the crew. Control station readings require a minimum of three readings with a maximum range of 0.020 mGal. For this survey, the control station was established at the Aurora office in Whitehorse, YT.

Each gravity station on the survey grid is located using a handheld non-differential GPS. The station location is cleared of (during winter) snow, (in summer) soft moss and organics, or preferentially, located on a low available boulder. The exact location of station is at the discretion of the operator as it must be a suitable site for both good quality gravity and positional measurements. The gravimeter is then levelled prior to initiating a reading.

As indicated in the Survey Specifications section, the readings are stacked for a minimum of 60 seconds. If the standard deviation of the individual 10 Hz readings (after seismic filtering) exceeds 0.050 mGal, repeat readings are taken. Repeat readings are also taken periodically at the discretion of the operator to ensure quality control of the results.

Throughout the survey, a minimum of two readings were taken at each station, however, three readings were often recorded. In addition to these repeat readings, several gravity stations were remeasured to assess the quality of the overall methodology. Remeasured readings were surveyed on different days with a remeasured positional location. These remeasurements are assigned a unique line-station identifier by incrementing by “1” the station or line number.

Out of 516 total readings, 15 were flagged for a standard deviation exceeding the 0.050 mGal threshold and a lack of repeatability for two stations in the resultant bouguer anomaly calculation. These readings were not included in the final products.

5.2.2 Positional Data

Accompanying the gravity survey is a triple-frequency Global Navigation Satellite System (GNSS) survey. This survey provides vertical control for the gravity reductions described in Section 6.2 using the GPS, Glonass and Galileo constellations. Control stations are established from the base station measurements that are broadcasted via radio to the GNSS rover for real-time kinematics (RTK) corrections. These locations are logged for post-processing after the survey. The position for a GNSS control station is only estimated once, when first established, and the same position is used for each subsequent day that the GNSS control station is occupied. The actual position of the control stations is later determined by using the Canadian Spatial Reference System Precise Point Positioning (CSRS-PPP). The CSRS-PPP is an online application maintained by the Government of Canada which provides accurate user positions by using precise satellite orbit, clock and bias corrections derived from a global network of receivers (Table 4). All three levels of solutions from CSRS-PPP are used (ultra-rapid, rapid and final). Where possible, several days of control station data are submitted and the results are averaged. Once the final position information has been determined, an adjustment is made to the GNSS data to correct the difference between the estimated position of the control station and the averaged final position as determined by CRSR-PPP. These adjustments are shown in Table 5.

Table 4. GNSS Control Stations from Averaged CSRS-PPP Solutions

Control Station	Dates In Use	Easting (m)	Northing (m)	Orthometric Elevation (m)
FALCON DRIVE B	2024-04-22	493693.953	6729092.355	788.479
N STAR BASE 0423	2024-04-23	494439.136	6728887.480	791.260
HALMITON B BASE	2024-04-26, 2024-06-05	494828.411	6731178.150	723.997
HOSPITAL RD BASE	2024-04-25, 2024-04-26, 2024-06-05	497802.948	6731142.709	662.000
N STARBASE 0430	2024-04-29, 2024-06-05	494439.027	6728887.560	791.238
GREY M BASE	2024-04-30, 2024-05-01	500140.832	6730126.397	752.669
SQUAKA LAKE BASE	2024-05-03	498689.269	6728739.969	720.345

Table 5. GNSS Control Station Adjustments to CSRS-PPP Determined Position

Control Station	Easting Adjustment (m)	Northing Adjustment (m)	Orthometric Elevation Adjustment (m)
FALCON DRIVE B	0.398	3.208	-6.428
N STAR BASE 0423	0.121	1.151	-9.668
HALMITON B BASE	0.208	-0.035	-4.991

Control Station	Easting Adjustment (m)	Northing Adjustment (m)	Orthometric Elevation Adjustment (m)
HOSPITAL RD BASE	0.081	2.290	-6.034
N STARBASE 0430	-0.195	0.515	-4.828
GREY M BASE	0.072	0.412	-3.141
SQUAKA LAKE BASE	-0.679	1.700	-5.230

GNSS readings are taken at the same locations as the gravity readings on the survey grid. A radio link between the base antenna at a GNSS control station and the rover allows for RTK phase-fixed positional solutions. Specification for the 3D Coordinate Quality (CQ3D) is 2.5 cm. If the 2.5 cm threshold is not met, up to 30 minutes of GNSS rover data are recorded for post-processing. Note that the CQ3D, although proportionally related to the quality of the GNSS solution, is not a proxy for an estimate of error as the relationship between the CQ3D and error is non-linear. A CQ3D of 2.5 cm does not imply a positional accuracy of 2.5 cm.

The rover measurements are not always made on the exact gravity station. When the GNSS measurement is initiated simultaneously with the gravimeter reading, the gravimeter is on the point requiring the GNSS measurement to be made approximately 25 cm away. Every effort is made to ensure the GNSS measurement point is at the same elevation as the gravity measurement point. This is acceptable because while an accurate vertical survey is critical for gravity reductions as described in the Gravity Corrections section, the same accuracy for the horizontal survey is not required.

The GNSS solutions for the ground gravity survey were, in general, good with most positions achieving a phase fixed solution through the RTK radio link. There were six positions that did not achieve an acceptable solution by RTK but were successfully post-processed to phase-fixed solutions.

5.2.3 Bathymetry Data

When gravity readings are completed over water bodies (i.e. during the wintertime), water depths and ice thickness measurements are collected to record the bathymetry data which are used in the gravity reductions. For this survey, no gravity stations were read over frozen waterbodies, therefore no bathymetry measurements were collected.

6 DATA PROCESSING

The suite of gravity corrections to process gravity data requires Digital Elevation Model (DEM) and precise positional data. The processing steps for these corrections are described below following an explanation of the generation of the DEM and the GNSS processing.

6.1 DIGITAL ELEVATION MODEL

A DEM is required for the terrain corrections (see Near and Far Terrain in Gravity Corrections section). The model incorporates 3 zones of DEMs (inner, intermediate, and outer) to balance high resolution close to the gravity station and consider reasonable file size and computing time. Terrain corrections are completed using each of these DEM zones (see Figure 8).

Near-station corrections proximal to the survey area use a dense inner DEM covering the survey area and 200 m to 500 m beyond with a 5 m cell size. Intermediate far station corrections use a middle DEM that starts at the perimeter of the inner DEM and extends out 10 km beyond the inner DEM using a 20 m cell size. Distal far-station corrections use a coarse outer DEM that starts at the perimeter of the intermediate DEM and extends to 100 km beyond the intermediate DEM using a 100 m cell size.
The primary product for the inner DEM is LiDAR data provided by the Yukon Government. It is constructed from approximately 0.5 m data and is generally available as a 2 m grid. The LiDAR data have a higher resolution than 2 m and is down sampled for the inner DEM. While this data adequately covers the survey grid, the northeast corner does not extend more than 200m beyond the survey grid.

The LiDAR data is trimmed to NAD83(CSRS) UTM zone 8N coordinates 492000, 501000, 6727000, 6733000 (xmin, xmax, ymin, ymax) to produce the inner DEM.

The intermediate DEM is constructed using Arctic DEM[1] mosaic tiles 40_08_2_1, 40_08_2_2, 41_08_1_1, and 41_08_1_2. They are transformed from height above ellipsoid to the CGVD2013 vertical datum using the CGG2013a geoid (2023 CSRS reference) using the NRCAN GPS-H tool on an 80 m grid. The resultant DEM is trimmed to NAD83(CSRS) UTM zone 8N coordinates 478218, 510338, 6720916, 6751180 (xmin, xmax, ymin, ymax) and the area of the inner DEM is removed to prevent double terrain corrections.

The outer DEM uses the Canadian Digital Elevation Model (CDEM) trimmed to NAD83(CSRS) UTM zone 8N coordinates 378218, 610338, 6620916, 6851180 (xmin, xmax, ymin, ymax). Despite these data being in the CGVD28 vertical datum, a transformation to the CGVD2013 is not performed. The outer DEM is distal to the survey area and therefore has less effect on the gravity reductions, and the difference between CGVD28 and CGVD2013 are small at less than a metre.

The southcentral extreme of the outer DEM is proximal to Skagway, Alaska and these elevation data are not available from the CDEM. The area of the intermediate DEM is removed to prevent double terrain corrections.

[1] Porter, Claire, et al., 2023, *"ArcticDEM, Version 4.1"*, https://doi.org/10.7910/DVN/3VDC4W, Harvard Dataverse, V1, [2023-12-11]

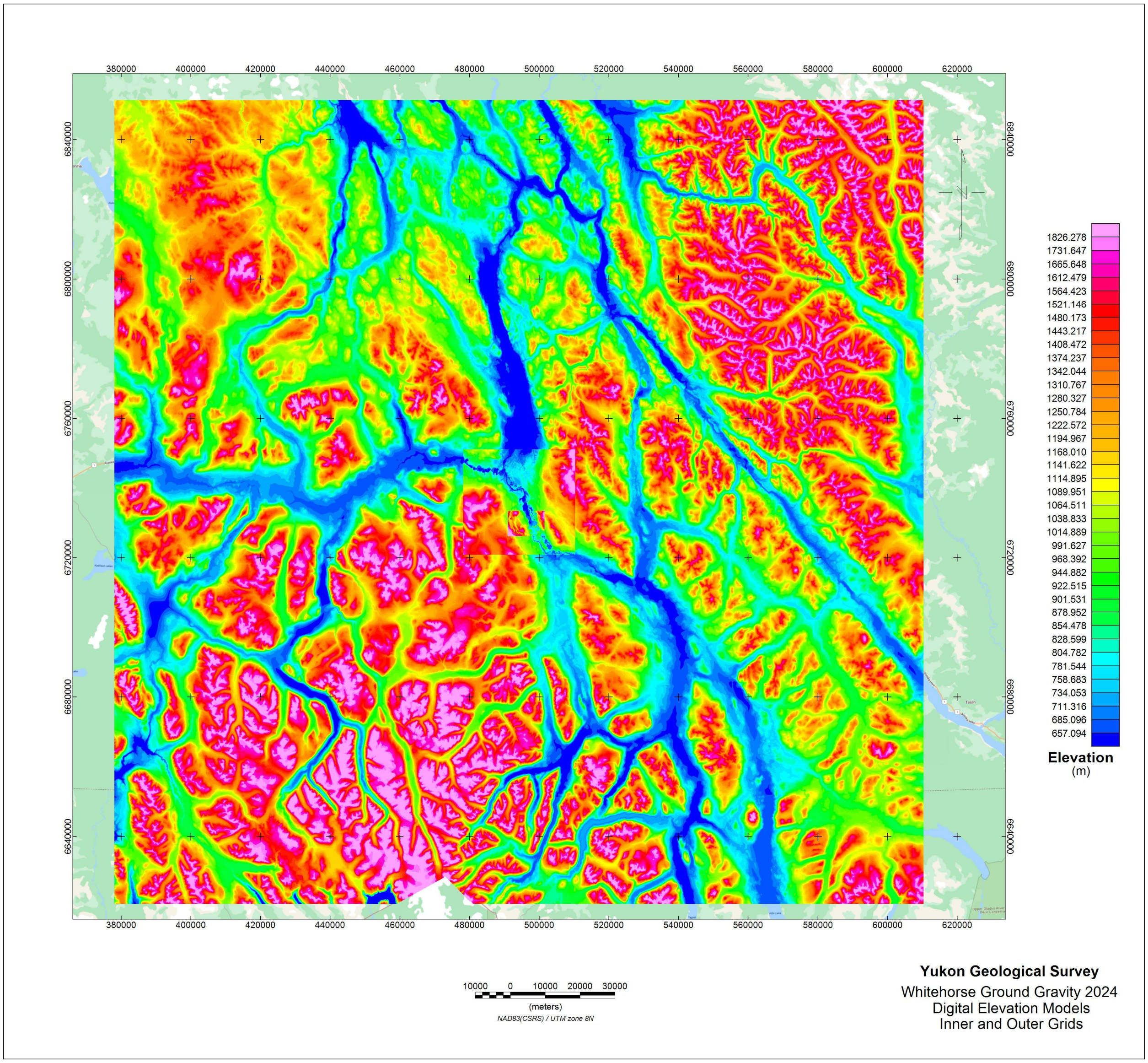

Figure 8. Plan map showing the outer, intermediate, and inner DEMs used for terrain corrections.

6.2 GNSS PROCESSING

During the GNSS processing, the first check completed is typically to ensure there are no labelling errors of the GNSS points. Each station point is confirmed against the expected position to verify the proper label. The next step involves examining the survey location data to identify any points that did not achieve a full phase-fixed solution. Any points that are labelled with an RTK phase-fixed position but have 3D Coordinate Quality (CQ3D) values greater than 0.025 m are flagged. The identified points are post-processed using Leica Infinity software based on the estimated location of the base as broadcast via radio link to the rover during data collection.

Six points in the dataset were identified with these criteria and were successfully corrected by post-processing:

- April 29 (three points)
- April 30 (two points)
- May 2 (one points)

Additionally, three points were flagged and were not able to be successfully post-processed. While these points are included in the database, they have been flagged as not meeting the GNSS criteria and are therefore not included in the final calculations. Remeasurements of these stations were performed on subsequent days and are included in the database but not the table of remeasurements.

All positions are then adjusted to account for the difference between the initial estimated position of the GNSS base station(s) and the final CSRS-PPP determined position.

Finally, the GNSS elevation readings and LiDAR and Arctic DEMs are compared. There is good agreement between the GNSS measured elevations and available LiDAR elevations. Almost all the LiDAR elevations were within 0.35 m of the measured GNSS readings (mean = 0.34m, standard deviation = 0.61 m). The largest differences were points L60 -500, L65 -500 and L95 -1000 which have differences of -3.750 m, 1.921m and 2.457m respectively. Two points, L 65 -500 and L65 0, were along a road where road work may have occurred since the LiDAR. For station L60 -500 there may have been earth moved around as it was on loose gravel, and L95 -1000 was on a steep slope. While it is possible this measurement may have been taken on a boulder, larger than average differences between GNSS measured and LiDAR elevations is common on steep slopes.

Together, these agreements between the measured GNSS elevations and the different DEM products supply confidence to the terrain correction that rely on these data.

6.3 BATHYMETRIC PROCESSING

No bathymetric processing was required for this survey as no gravity data was collected over a waterbody. All gravity station locations were located on land.

6.4 GRAVITY CORRECTIONS

A suite of corrections is applied to the raw gravity to produce the Bouguer Anomaly (BA). Drift, tilt and temperature corrections are performed on-board the CG-6 gravimeter. Tidal corrections are also part of the on-board suite of corrections but are removed and replaced with externally calculated tide corrections to ensure proper implementation. Latitude and free-air corrections are then applied resulting in the free-air anomaly.

The BA is calculated by adding the Bouguer, Bullard-B, near-station terrain and far-station terrain and bathymetric corrections (not applicable for this survey) to the free-air anomaly. As these corrections are all directly proportional to density, a suite of densities (2.40 g/cm^3, 2.50 g/cm^3, 2.60 g/cm^3, 2.67 g/cm^3, 2.70 g/cm^{3}and 2.80 g/cm^3) are used to create an individual BA for each density.

6.4.1 Adjustment to Absolute Gravity

As described in Appendix IV, the gravity reference station 9904-1990 on McIntyre Creek Rd. was surveyed on October 10, 2023. This was required to establish a difference of 15.344 mGal between that reference station and the Aurora Whitehorse office control station. The absolute gravity at McIntyre Creek Rd. is adjusted to ground through the reported gradient, giving an absolute gravity value of the Aurora Whitehorse office control point of =Ti mGal.

6.4.2 Drift

In addition to the internal drift correction, residual drift is removed by applying the linear interpolation of gravity readings at the control station prior and post every survey day. The datum is originally set arbitrarily and then later adjusted to reflect absolute gravity.

The measurements taken at this control point are shown in Figure 10.

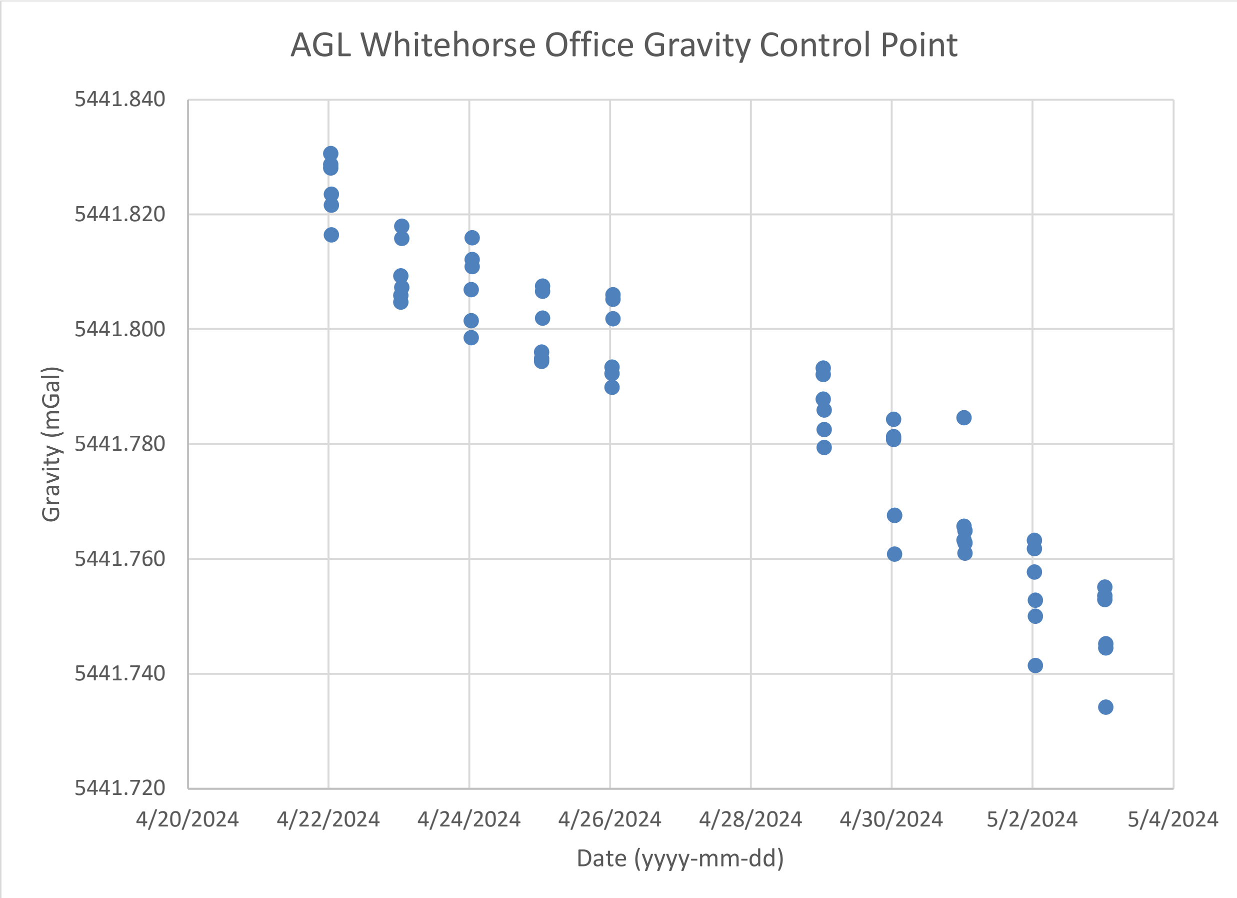

Figure 9. Pre- and post-survey measurements at Aurora Whitehorse office gravity control point.

6.4.3 Latitude

Due to the centrifugal force and equatorial distension of the terrestrial spheroid, Earth's gravitational field varies with latitude. Gravitational acceleration consequently increases from the equator towards the poles. Somigliana's equation is used to determine the expected strength of the gravitational field at the latitude of every gravity station through:

$$G_{\phi} = G_e \frac{1 + \mathrm{k} \sin^2 \phi}{\sqrt{1 - e^2 \sin^2 \phi}}$$

Where G_{ϕ} is the expected gravitational field at latitude ϕ, $G_e$is the normal gravity at the equator (978032.67715 mGal), e is the eccentricity of the Earth (6.6943799013 X 10^{-3}) and k is an ellipsoidal parameter (1.931851386 X 10^{-3}).

6.4.4 Free-Air

The free-air correction corrects for the change in distance from the centre of the Earth through:

$$\Delta g_{FA} = H(2\frac{G_{\phi}(1 + f + m - 2f \sin^2 \phi)}{a} - 3H\frac{G_{\phi}}{a^2})$$

where Δg_{FA} is the free-air correction, H is the geoid elevation of the point, G_{ϕ} is the expected gravitational field at latitude ϕ, a is the semi-major axis of Earth (637817 m), f is the flattening of Earth (3.35281068118 X 10^{-3}) and m is 3.44978600308 X 10^{-3}.

The free-air anomaly is calculated by subtracting G_{ϕ} from the observed gravity (which incorporates the on-board tilt and temperature corrections, external calculated tidal, drift and local datum corrections) and then adding Δg_{FA}.

6.4.5 Bouguer Slab and Bullard-B

The Bouguer slab correction compensates for the attraction of an infinite slab of material of density *ρ* located between mean sea level and the elevation *H* of the gravity station. The Bouguer slab correction (Δg_B) is:

$$\Delta g_B = -0.0419 * \rho * H$$

The Bullard-B correction accounts for the curvature of Earth and is applied to account for the finite nature of the crustal slab used in the Bouguer correction.

6.4.6 Near Terrain

The near-station terrain correction compensates for the effect of local differences in topography within 20 m from a gravity station. Usually, the DEM are neither fine nor precise enough for this correction and instead gravity operators must measure the average slope within six 60˚ sectors in a 20 m radius around the reading site. However, the LiDAR data used for this survey is in excellent agreement with the measured phase-fixed GNSS solutions and covers the survey area. As discussed in Section 6.2, the Arctic DEM is in good agreement with the both the LiDAR and the measured GNSS elevations. Given the quality of the DEM over the survey area, elevation differences are better extracted from the inner DEM and then used in the following sector equation for the gravitational effect of a sector from a vertical cylinder:

$$\delta g_T = \gamma\rho\theta \left\{ (r_o - r_i) + \sqrt{r_i^2 + \Delta z^2} - \sqrt{r_o^2 + \Delta z^2} \right\}$$

where δg_T is the terrain correction required for a sector of angle θ with inner and outer radii equal to r_i and r_o , γ is the gravitational constant (6.67430 X 10^{-11} Nm^2/kg^2), terrain density equals ρ, and $\Delta z = |z_s - z_a|$ where z_s is the station elevation and z_a is the average terrain elevation in the sector. The 2 m DEM is interpolated to make a calculation for a suite of cylindrical sectors with $r_o - r_i = 0.1$.

The final near terrain correction (Δg_{NT}) is the sum of the contributions from all individual sectors as:

$$\Delta g_{NT} = \sum_r \sum_\theta \delta g_T(r, \theta)$$

The elevation used at the station for the near-station terrain correction is the sampled elevation from the DEM instead of the actual measured GNSS elevation. This prevents artifacts from any mismatch between the measured elevation and the DEM.

6.4.7 Far Terrain

The far-station terrain correction compensates for terrain effects from 20 m to over 100 km outside the survey area.
Three zones of DEMs, as previously described in the DEM section, are used with the following formula to evaluate the vertical component of the gravitational attraction of a flat top prism.

$$\delta g_{FT}(x, y, z) = -\gamma\rho \int_{x-u_1}^{x-u_2} \int_{y-v_1}^{y-v_2} \int_{z-w_1}^{z-w_2} \frac{w}{\sqrt{(u^2 + v^2 + w^2)^2}} du\, dv\, dw$$

Each DEM node becomes the centre of a prism reaching halfway to the adjacent nodes and is combined with each gravity station location. For every gravity station, the sum of the contribution of all individual DEM nodes yields the far terrain correction (Δg_{FT}).

The elevation used at the station for the far-station terrain correction is the sampled elevation from the DEM.

6.5 TREND REMOVAL

Trend removal is a common practice in gravity surveys to highlight features of interest that can be masked by large scale gravity trends. The data are gridded using a minimum curvature algorithm with a 100 m cell size and then several methods of trend removal can be used.

- For the first-order trend removal (FOTR), all points of the gridded data are used to calculate a best-fit plane which is then subtracted from the original grid.
- For the second-order trend removal (SOTR), all points of the gridded data are used to calculate a best-fit second order polynomial which is then subtracted from the original grid.
- The original gridded data are upward continued by 1000 m and the upward continued grid is subtracted from the BA grid. The resultant grid then has the long wavelengths removed and are labelled up1000TR.

For this survey, all three methods of trend removal were used to produce a residual BA product for a suite of densities.

7 RESULTS AND DISCUSSION

Details of the remeasurements are shown in Table 6. The *Distance* column reflects the separation between the remeasurements; if the distance was greater than 20 m, the stations were treated as separate measurements. It should be noted that if some stations were not within the above noted parameters, the *Accepted Range* and *Accepted Mean* columns are left blank and the original values for BA_267_Avg (where repeat readings are averaged) were left in the database. If the distance of the remeasurements was less than 20 m, the values were averaged, and this mean was used in the database. Of the accepted values, the mean difference of the remeasurements is 0.024 mGal with a maximum difference of 0.049 mGal. These values give an indication of the overall error associated with the survey.

Several of the stations were remeasured because a phase-fixed solution was not achieved at the first site, however they are included in this analysis as the first GNSS solution was successfully post-processed.

The BA for ρ = 2.67 g/cm³ is shown in Figure 5, and the BA for ρ = 2.67 g/cm³ with the 1000 m upward continued trend removed is shown in Figure 6.

Table 6. Gravity Station Remeasurement Results

Line	Station	Easting (m)	Northing (m)	Distance (m)	BA_267 (mGal)	Range (mGal)	Mean (mGal)	Accepted Range (mGal)	Accepted Mean (mGal)
L45	0	493611.750	6731663.035	0.468	-111.768	0.015	-111.761	0.015	-111.761
L45	2	493611.754	6731662.568		-111.751				
L50	0	494111.704	6731682.342	17.275	-112.674	0.022	-112.695	0.022	-112.695
L50	2	494128.894	6731684.055		-112.702				
L70	-502	495741.106	6731099.853	0.867	-115.226	0.132	-115.172	0.132	-115.172
L70	-500	495740.298	6731100.168		-115.118				
L80	-3501	497251.270	6728353.910	0.922	-115.563	0.134	-115.529	0.134	-115.529
L80	-3500	497250.358	6728354.045		-115.418				
L85	-3500	497761.090	6728359.510	0.597	-115.909	0.056	-115.879	0.056	-115.879
L85	-3501	497761.361	6728358.978		-115.856				
L85	-501	497613.141	6731308.759	0.011	-114.044	0.015	-114.034	0.015	-114.034
L85	-500	497613.132	6731308.752		-114.025				
					Mean	0.062			
					Maximum	0.134			

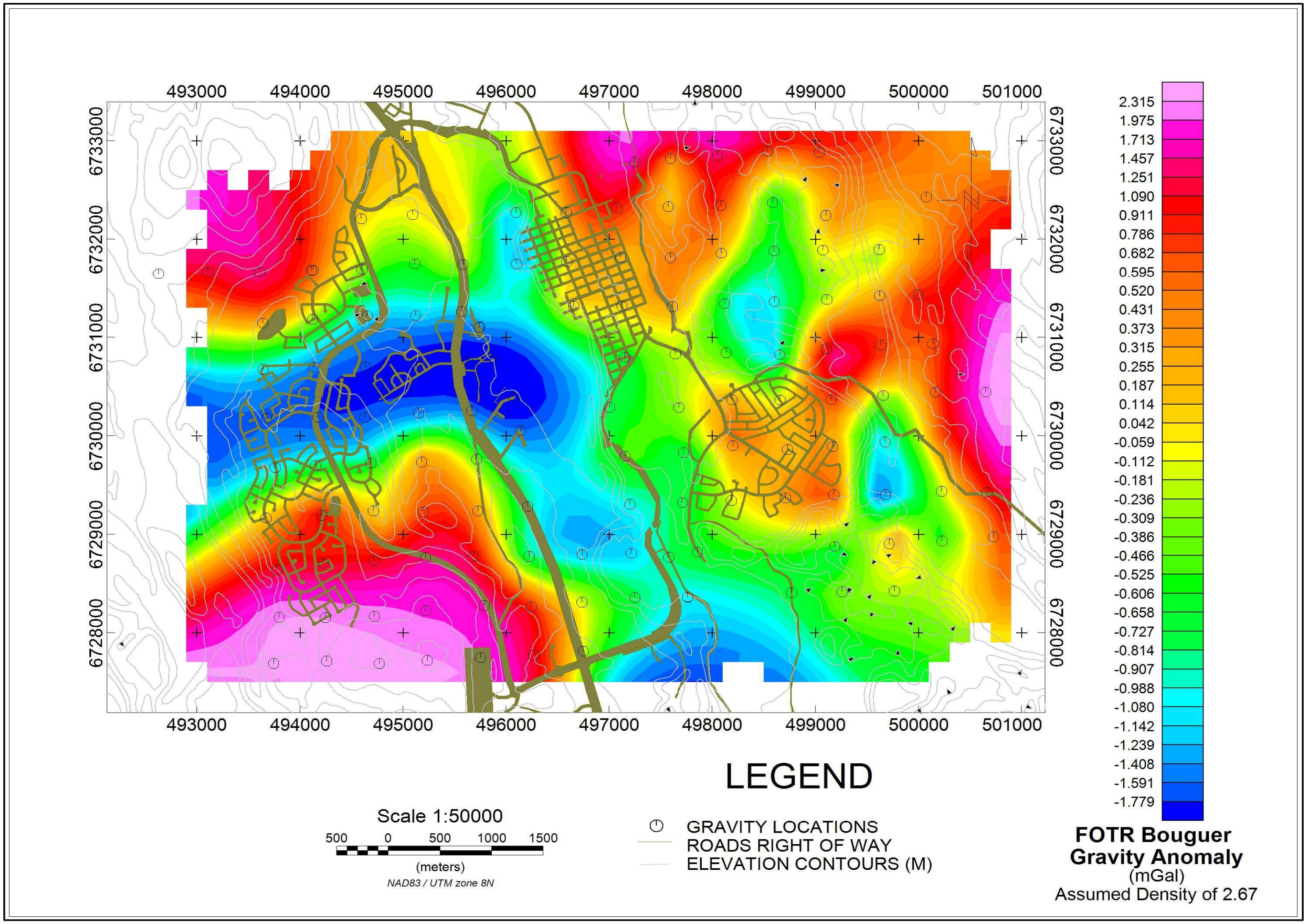

Figure 10. Gridded FOTR bouguer anomaly for an assumed density of 2.67 g/cm³.

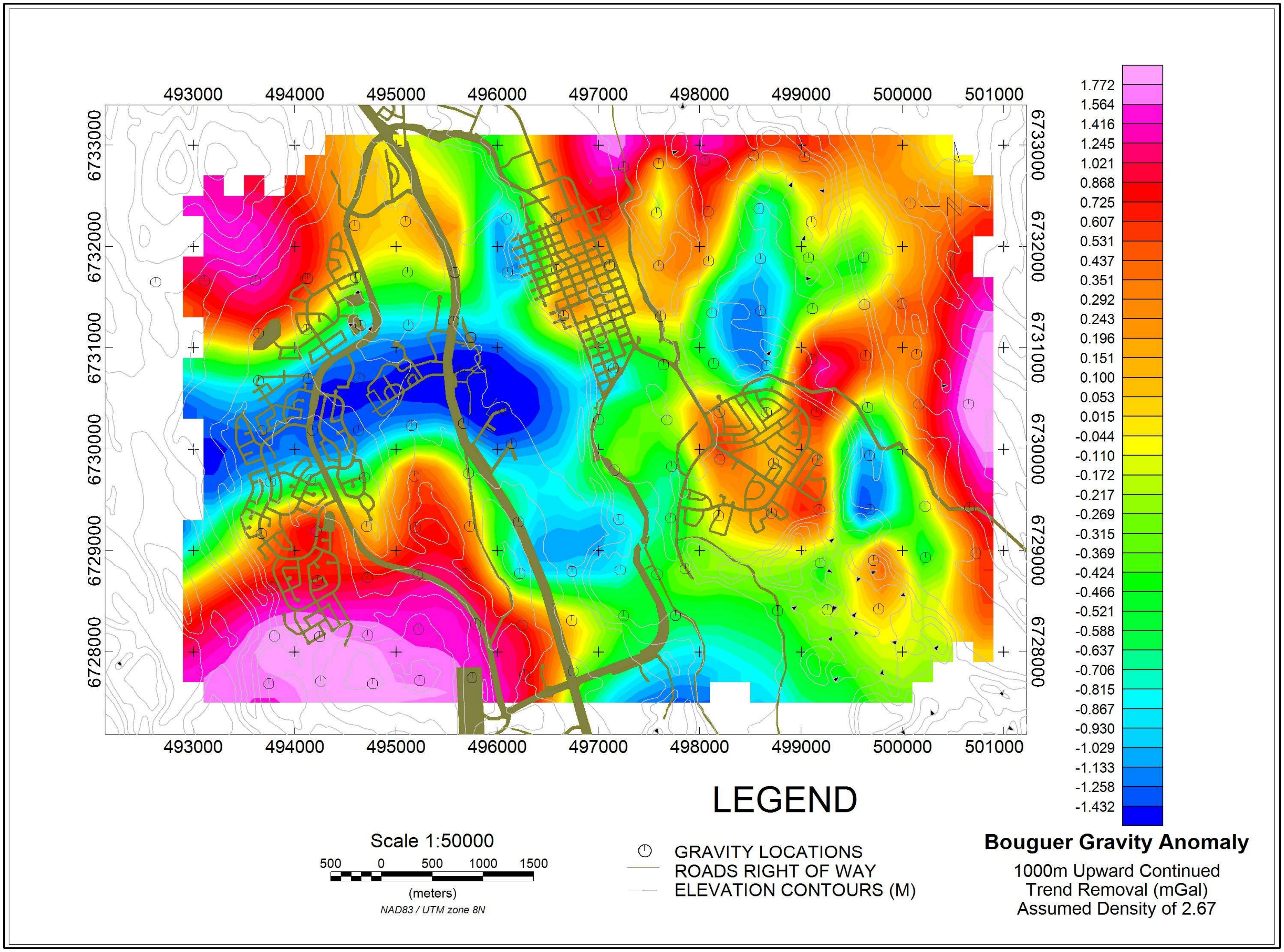

Figure 11. Gridded upward continued trend removed bouguer anomaly for an assumed density of 2.67 g/cm³.

8 PRODUCTS

The channels in the provided gravity database are described in Table 7.

Table 7. Ground Gravity Database Channel Descriptions

Channel	Description	Units
Line	Local X coordinate.	m
Station	Local Y coordinate.	m
Time_UTC	HHMMSS of data collection in Coordinated Universal Time.	HHMMSS
Date_UTC	Date of data collection in Coordinated Universal Time.	YYYY-MM-DD
Xnad83z8	Corrected easting in NAD83 (CSRS) UTM Zone 8.	m
Ynad83z8	Corrected northing in NAD83 (CSRS) UTM Zone 8.	m
Zhae	Corrected elevation relative to the WGS84 ellipsoid.	m
Zcgvd2013_cgg2013a_2023	Corrected orthometric elevation relative to the CGG2013 Geoid using the 2023 epoch.	m
Grav_Cor_0	Gravimeter measurement with internal corrections (long-term instrument drift, instrument tilt, sensor temperature).	mGal
SD	Standard deviation of individual 10 Hz gravity measurement. The average of these is the basis for Grav_Cor_0.	mGal
Tide_Cor	Value of the tidal correction from Longman formulas, calculated using Python's *tidegravity* library.	mGal
Instrument_Drift_Cor	Drift of the instrument since the first occupation of a gravity Aurora Whitehorse Office control point on that shift.	mGal
Tie_Drift_Cor	Levelling to the gravity Aurora Whitehorse Office control point datum of 0.000 mGal.	mGal
To_Abs_Gravity	Offset for gravity Aurora Whitehorse Office control point to absolute gravity.	mGal
Latitude_Cor	Latitude correction.	mGal
FreeAir_Cor	Free air correction.	mGal
Bouguer_267_Cor	Bouguer slab correction for ρ = 2.67 g/cm^3.	mGal
BullB_267 Cor	Bullard-B correction for ρ = 2.67 g/cm^3.	mGal
NT_267_Cor	Near station terrain correction for ρ = 2.67 g/cm^3.	mGal
FT_A_267_Cor	Far station terrain correction for ρ = 2.67 g/cm^3 using the inner DEM.	mGal
FT_B_267_Cor	Far station terrain correction for ρ = 2.67 g/cm^3 using the intermediate DEM.	mGal
FT_C_267_Cor	Far station terrain correction for ρ = 2.67 g/cm^3 using the outer DEM.	mGal
Bathy_A_167_Cor	Bathymetric correction for ρ = 1.00 g/cm^3. Not used in this survey.	mGal

Channel	Description	Units
Lat	NAD83 (CSRS) latitude.	DD.dddddd
Long	NAD83 (CSRS) longitude.	DD.dddddd
CQ3D	A measure of quality for the GNSS solution.	m
Duration	Duration of gravity measurement.	s
Serial	Short version of gravimeter serial number.	string
Model	Model of gravimeter (string).	string
Tilt_X	X-axis tilt of gravity measurement.	arcsec
Tilt_Y	Y-axis tilt of gravity measurement.	arcsec
Sensor_Temp	Sensor temperature compared to its reference value.	mK
Grid	Name of survey grid.	string
Operator	Initials of gravity operator.	string
IH	Instrument height. Assumed to be constant and not used in this survey.	cm
IH_Cor	Instrument height correction. Not used in this survey.	mGal
Scaling_Adj	Adjustment for elevation scaling differences between gravimeters. Not used in this survey.	mGal
Abs_Grav	Absolute gravity established from the gravity measurement.	mGal
Flag	Note on gravity or GNSS measurement.	string
QAQC_GNSS	Quality control for GNSS readings, a "1" indicates acceptance.	Boolean
QAQC_Grav	Quality control for gravity readings, a "1" indicates acceptance.	Boolean
FreeAir_Anomaly	Grav_Cor_0 + Tide_Cor + Instrument_Drift_Cor + Tie_Drift_Cor + Latitude_Cor + FreeAir_Cor + To_Abs_Grav.	mGal
BA_267	FreeAir_Anomaly + Bouguer_267_Cor + BullB_267_Cor + NT_267_Cor + FT_A_267_Cor + FT_B_267_Cor + FT_C_267_Cor + Bathy_A_167_Cor.	mGal
BA_267_avg	Averaged repeats for BA_267.	mGal
BA_267_RepAvg	Remeasured points averaged for BA_267.	mGal
BA_240_Avg	Bouguer Anomaly points averaged for ρ = 2.40 g/cm^3 .	mGal
BA_250_Avg	Bouguer Anomaly points averaged for ρ = 2.50 g/cm^3 .	mGal
BA_260_Avg	Bouguer Anomaly points averaged for ρ = 2.60 g/cm^3.	mGal
BA_270_Avg	Bouguer Anomaly points averaged for ρ = 2.70 g/cm^3 .	mGal
BA_280_Avg	Bouguer Anomaly points averaged for ρ = 2.80 g/cm^3 .	mGal
LiDAR	Orthometric height, sampled from the 1m cell size raster derived from the 2019 LiDAR survey, obtained from Yukon Government.	(m)
LiDAR2RTK	Offset of LiDAR elevations to the measured GNSS elevations.	(m)

Table 8 describes the digital products found in Appendix I of this report.

Table 8. Ground Gravity Digital Products

Folder \ *File*	**Description of Contents**
Final Products\PDF,PNG,TIF*.pdf,*.png,*.tif	Figures in pdf, png and tiff format.
Processed Data\ASCII*.xyz	Processed gravity and GNSS data in ASCII format.
Processed Data\Databases*.gdb	Processed gravity data in .gdb format.
Processed Data\Grids*.grd	Full suite of Bouguer Anomaly grids in Oasis *.grd format at 100 m cell size. Suite of densities = 2.40 g/cm³, 2.50 g/cm³, 2.60 g/cm³, 2.67 g/cm³, 2.70 g/cm³ and 2.80 g/cm³. Trend removal using FOTR, SOTR and up1000TR for density of 2.67 g/cm³ only.
Processed Data\Oasis Packed Maps*.map	Figures in Oasis packed map format.
Raw Data\	Daily archive of instrument dump files organized by date.

Respectfully submitted,
Aurora Geosciences Ltd.

(signed)
Andre Lebel, B.Sc.
Geophysicist

Reviewed by

(signed)
Eileen Lyon, P.Geo.
Senior Project Manager

APPENDIX I

Digital Archives of the Ground Gravity Survey Data

Submitted electronically.

APPENDIX II

Program Crew Log

Submitted electronically.

APPENDIX III

Ground Gravity Survey Instrument Specifications

Submitted electronically.

APPENDIX IV

CGSN Whitehorse McIntyre Creek (9904-1990) Gravity Reference Station Report

Submitted electronically.