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MOLYNEUX BAY ONSHORE TRANSECT SURVEY
Control and Lidar Co-ordination

Following the completion of the Molyneux Bay Onshore Transects in April 2013 by BTW South, it was raised by the Otago Regional Council that the data did not align vertically with the existing Lidar surface that was carried out in 2004.

We have reviewed all of the data that has subsequently been provided; including the Control Survey Report prepared by Connell Wagner in 2004. We have identified two issues that potentially contributed to the vertical mis-alignment. The first being the Connell Wagner control marks for the Lidar survey differed from those used by our transect survey.

On the 29th of August 2013 we carried out further survey work to identify any differences in the control marks. The origin of coordinates for the transect survey differs from the survey control used for the Lidar surveys in both 2004 and 2009. While both survey origins have agreement within themselves the two origins do not agree with each other. To counter this difference in origins, it was decided to recalculate the 2013 transect lines using the same origin as the Lidar data. It is noted in the Connell Wagner report that all future surveys should be based off their origin to avoid the differences such as found with the 2013 transect lines. The transect data has been amended to align with the Lidar control marks and is attached.

In addition to the difference in control marks, we have noted the original Lidar survey used a Connell Wagner vertical model to reduce the heights. This model was generated by Connell Wagner for the 2004 Lidar using know mean sea level and ellipsoidal heights on LINZ listed survey marks, due to the inaccuracies in the national geoid model at the time. In 2009 a new nationwide vertical model was released for use by LINZ for surveyors to use when undertaking GPS observations. This model was generated using years of gravity data and given the method used to generate the model and the sheer volume of data used to generate the model it is currently the best model available for determining the geoid separation in New Zealand. This model was used to determine the heights for the April transect survey.

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A review has been carried out to determine the difference between these vertical models and whether an adjustment is required to correct the 2004 Lidar data to bring it in terms of the 2009 model.

By processing the April observations relative to both models, a direct comparison is able to be made. For most transects (KAK 1-12, MB 1 – MB5) the difference was less than 180mm. As the transects progressed north east the difference increased to 550mm at MB 8. The following table shows the respective model heights for each transect and the difference.

Transect	2009 Geoid Model Height (m) (Otago Datum)	CW 2004 Model Height (m) (Otago Datum)	Difference (m)
KAK 12	112.827	112.887	0.060
KAK 11	102.594	102.701	0.107
KAK 10	102.918	103.040	0.122
KAK 9	103.024	103.141	0.117
KAK 8	103.540	103.649	0.109
KAK 7	103.668	103.780	0.112
KAK 6	107.896	108.017	0.121
KAK 5	103.992	104.120	0.128
KAK 4	103.576	103.713	0.137
KAK 3	104.363	104.519	0.156
KAK 2	108.434	108.605	0.171
KAK 1	104.550	104.720	0.170
MB 1	101.584	101.745	0.161
MB 2	100.313	100.424	0.111
MB 3	100.886	100.932	0.046
MB 4	127.381	127.370	-0.011
MB 5	126.474	126.421	-0.053
MB 6	114.909	114.678	-0.231
MB 7	104.755	104.399	-0.356
MB 8	104.628	104.078	-0.550

DIG 1.1 Geoid model comparison for each transect (at lowest chainage observation)

It was noted in the Connell Wagner report that there was very little control marks for the model to the north east and it is likely that the Connell Wagner model was distorted in this region.

To further evaluate the different models, a comparison has also been made between the Lidar heights (based on the Connell Wagner 2004 model) and the April transect heights (based on the 2009 model). Most of the transects crossed a formed road. It is the heights taken on the road surfaces that have been used for a comparison as this would provide the most accurate observations. It is noted that the Kaka Point transects crossed a sealed road that should not have changed in height, whereas the Molyneux Bay transects 4 – 8 crossed a metalled road that would fluctuate in height given the regular grading and maintenance.

For the transects at Kaka Point, the amended April data on the formed road compares well and appears consistent with the Lidar Data. For the Molyneux Bay transects there is less consistency between the Lidar and the transect road data with no constant difference found. The Lidar transect lines provided to BTW have been corrected to the 2009 NZ Vertical datum using the figures in Diagram 1.1. The differences between the Lidar transect lines and the 2013 surveyed transect lines can now only be attributed to the accuracy of the Lidar data, with both the survey origins and the geoid model used being the same for both sets of data.

It is therefore recommended that the attached amended transect data be used for comparison to the Geoid adjusted 2004 Lidar transect line data attached.

All future surveys need to be carried out in terms of the three benchmarks ADPA (W59), ADPJ (W71), B3ME (BAL FUNDAMENTAL). All future surveys need to also use the 2009 Geoid as the model to determine heights. This will ensure that all future surveys will align with the previous data and avoid any inconsistencies in data.

If we can be of any further assistance or if you have any questions, please do not hesitate to contact us at any time.

Yours sincerely

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