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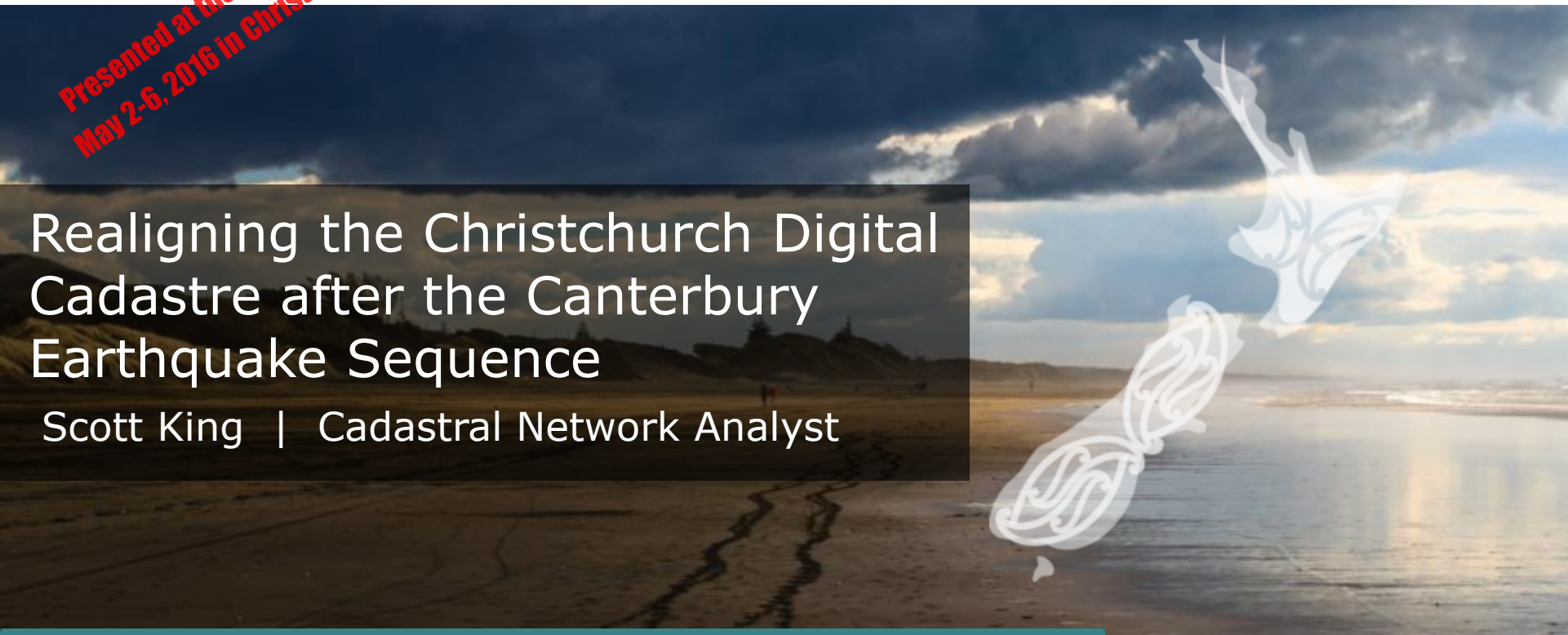
Presented at the FIG Working Week 2016,
May 2-6, 2016 in Christchurch, New Zealand

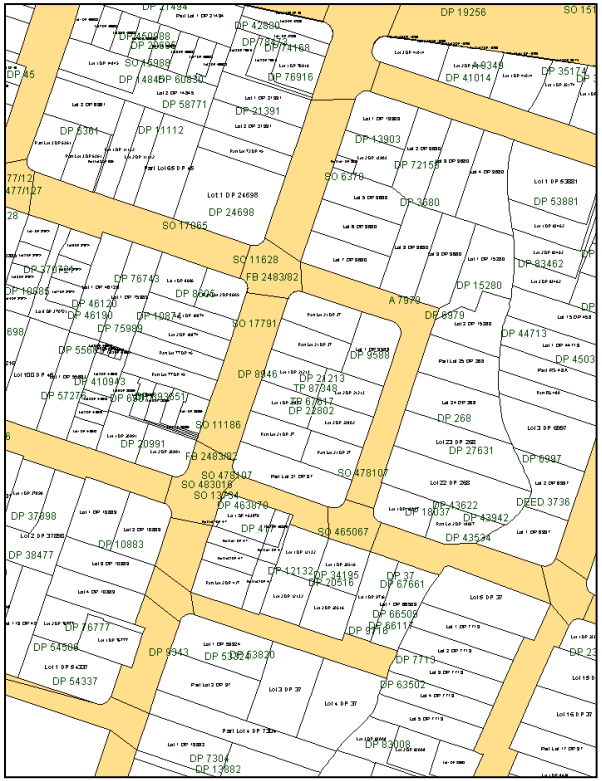


Realigning the Christchurch Digital Cadastre after the Canterbury Earthquake Sequence

Scott King | Cadastral Network Analyst

New Zealand's Digital Cadastre

- The Digital Cadastral Parcel Dataset is produced and maintained by Land Information New Zealand (LINZ)
- Is a fundamental base layer
- LINZ has a process for realigning the Digital Cadastre - WACA
- The Canterbury Earthquake Sequence had a significant impact on the Digital Cadastre in Christchurch

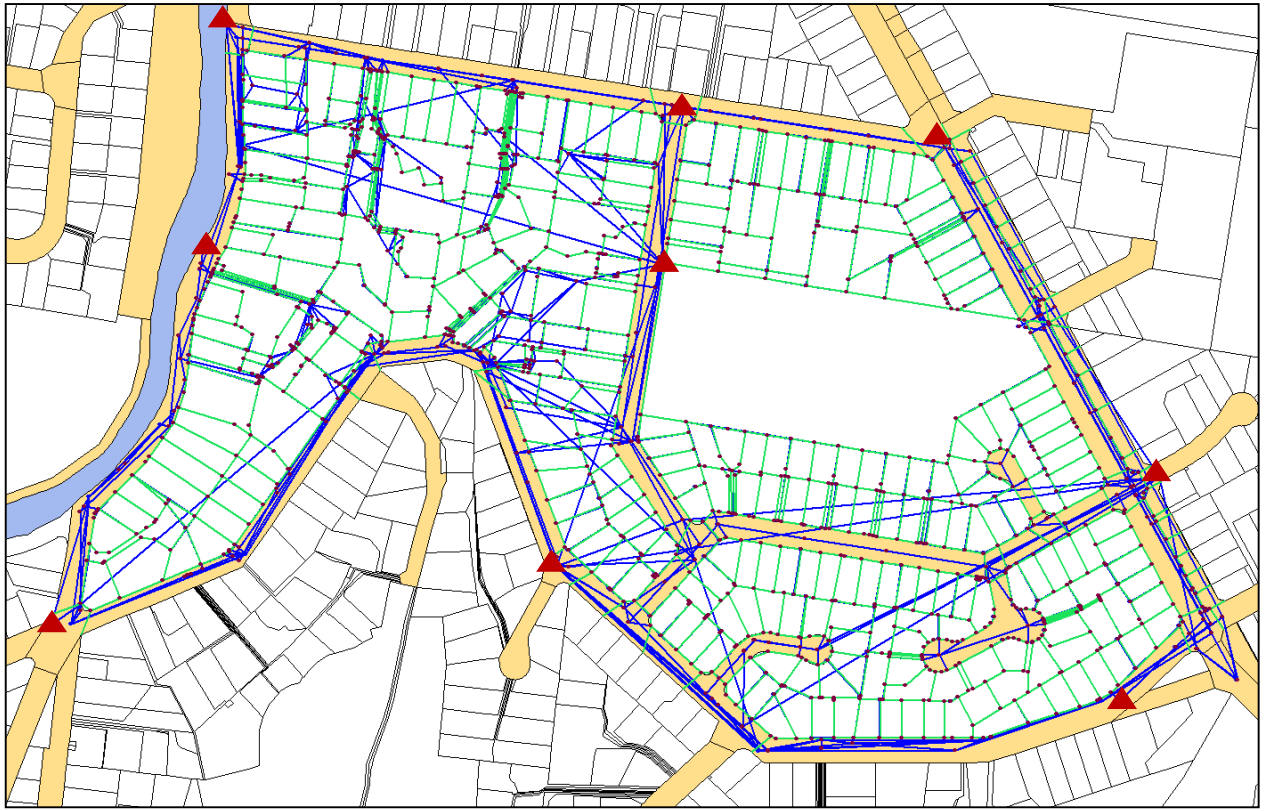


The standard Wide Area Cadastral Adjustment (WACA) process

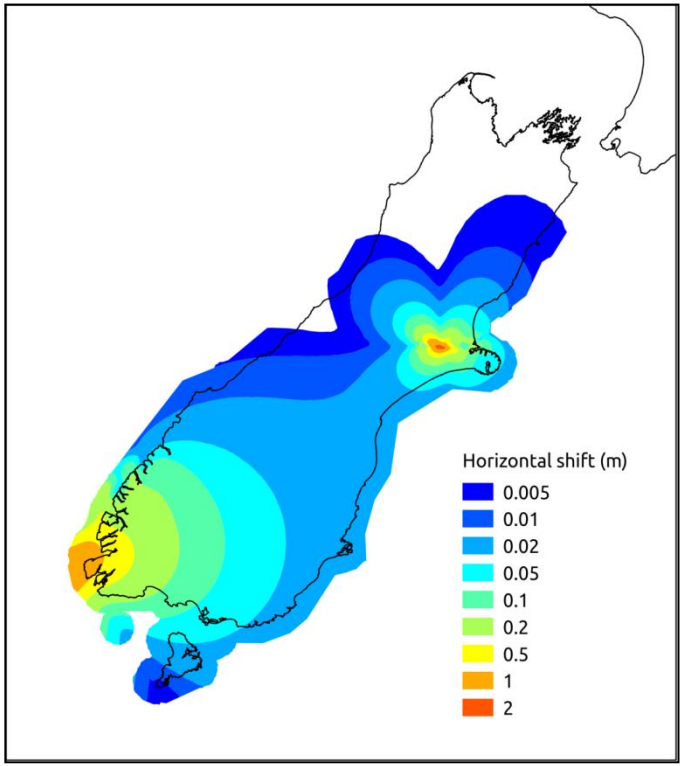
- WACA's maintain the alignment of the geodetic and cadastral nodes in Landonline
- WACA areas are called 'Parcel Blocks'
- All cadastral data is added to the adjustment
- Least Squares Estimate is the method used to generate coordinates
- Generate Order 7 boundary marks and Order 6 for non-boundary marks

Accuracy Standard	Land Use	95% Accuracy (m)	Landonline Accuracy Order
Survey Accurate (bearing and distance from survey plans)	Urban	0.15	6
		0.20	**7**
		0.50	8

Typical WACA Adjustment



The 2013 Landonline NZGD2000 Coordinate Update



- Coordinates updated using new deformation model
- After the deformation model was applied coordinates with GNSS data were updated
- Coordinates only updated where the change is greater than 5cm
- Deformation model only accounted for deep-seated movement

The Christchurch WACA Pilot
Why realign the digital cadastre?

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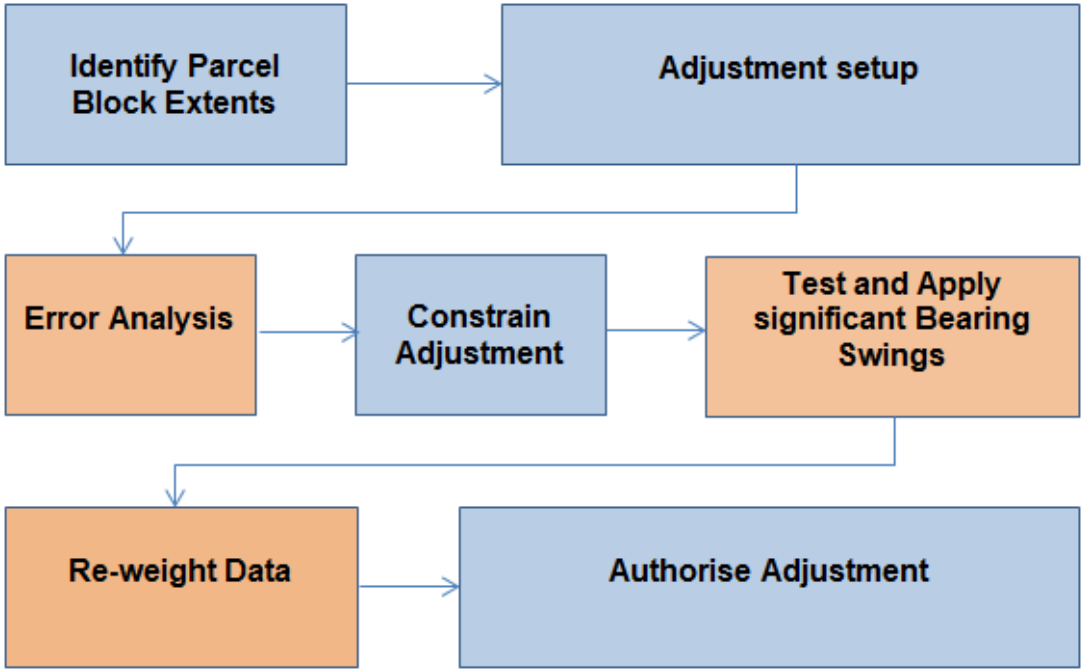
Realigning the digital cadastre in Christchurch means we can:

- Calculate coordinates that best reflect where survey marks and boundary positions are located after the earthquakes
- Ensure that the coordinate order is reliable and reflects the actual uncertainty in position
- Enable post-earthquake data conflicts to be identified

The Christchurch WACA Pilot
Refining the existing WACA process



- Existing WACA process did not work well
- Error analysis removed from the refined process
- Bearing Swings in Canterbury proved to be insignificant
- Pre-earthquake data re-weighted

The Christchurch WACA Pilot
Selecting high priority areas

- The pilot focused on areas of greatest shallow ground movement
- Model of shallow ground movement was calculated using cadastral and geodetic survey data
- Model is the difference between *total* and *deep seated* movement
- Model represented as contours

The Christchurch WACA Pilot
Selecting high priority areas

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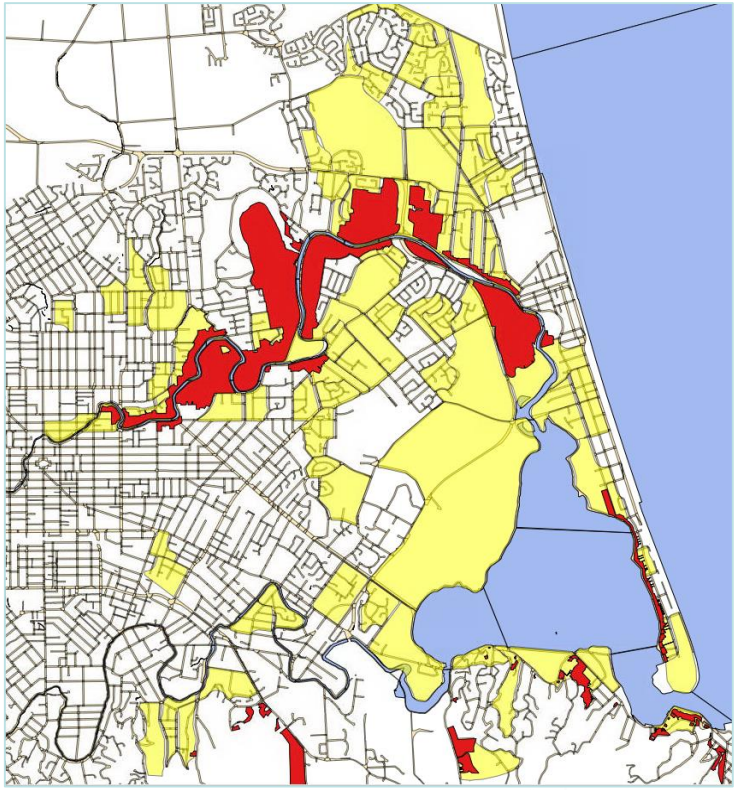
- Shallow ground movement Model was used to identify areas of movement greater than 0.20 metres

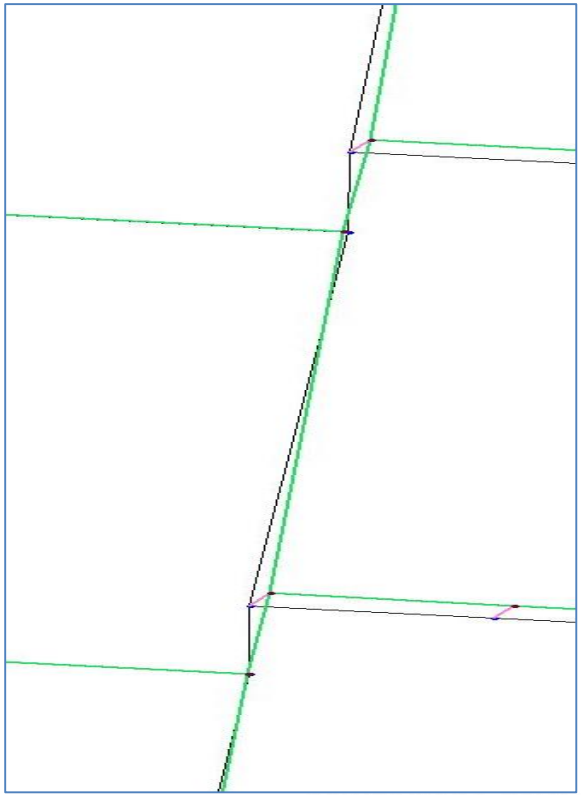
- 105 high priority parcel blocks identified with 24 selected for the pilot – mostly on the eastern side of Christchurch

- Some parcel blocks selected for the pilot were located in the ‘Red Zone’ areas



The Christchurch WACA Pilot Results

- Analysis compared coordinates from WACAs and pre-earthquake coordinates (with total EQ movement added)
- 95% of coordinates in areas of shallow ground movement, on average, are better than 21cm
- Boundary coordinates achieved appropriate accuracies. E.g order 7 or 8
- Adjustments corrected boundary distortions
- The Christchurch WACA process works well – Implement an operational process



The Christchurch WACA Pilot Summary

- The Canterbury Earthquake Sequence had a significant impact on the digital cadastre in Christchurch – pre and post earthquake data conflicts
- LINZ carried out a pilot to develop an alternative WACA process to realign the digital cadastre in Christchurch
- The focus of the pilot was on areas of greatest shallow ground movement
- Christchurch WACA process works well in areas of shallow ground movement where there is sufficient geodetic control and post earthquake survey data

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Questions?