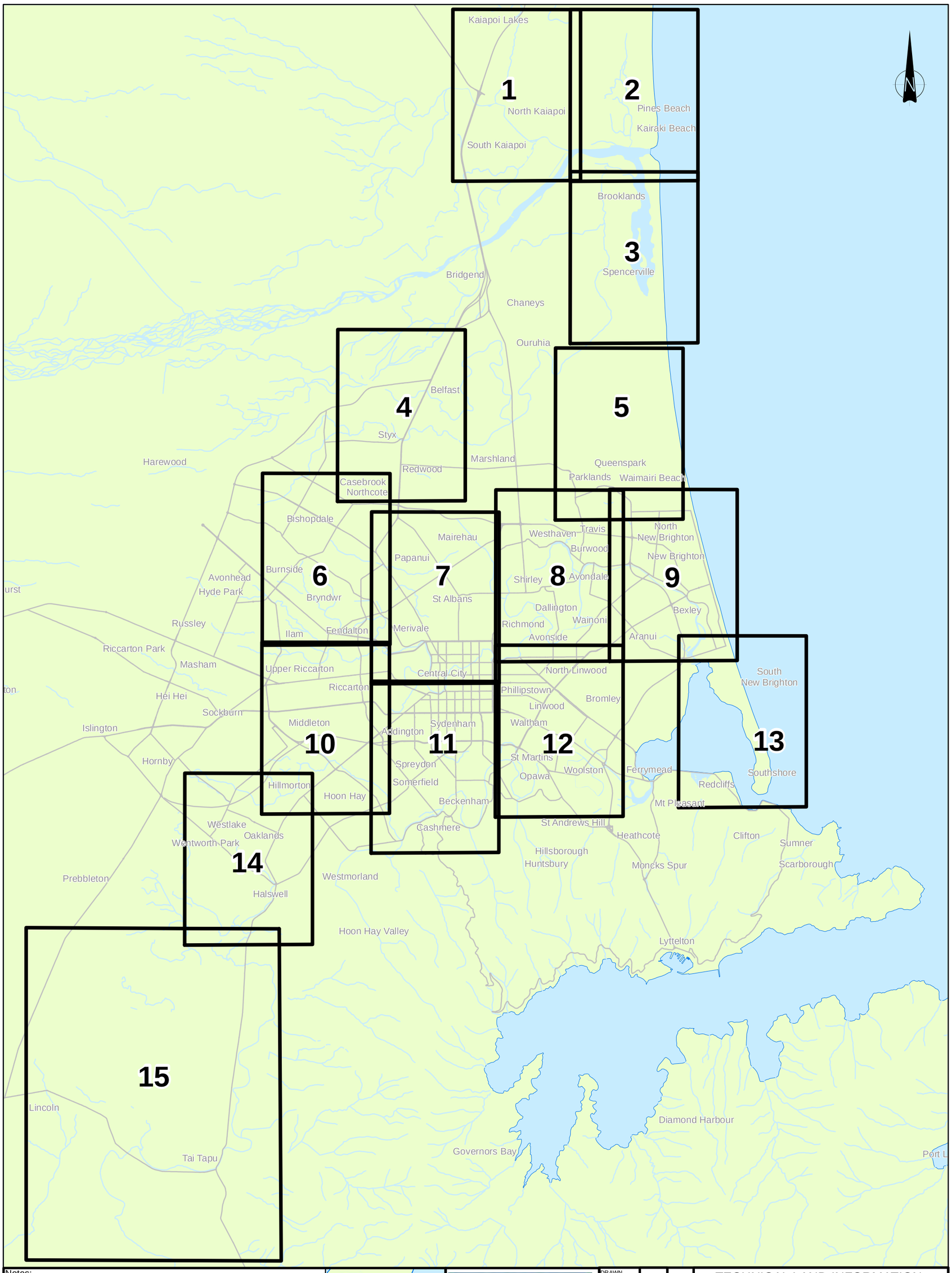
APPENDIX C

The Plains - area-wide suburb technical land information



Notes:
Road Database supplied by Terralink International Ltd.
Rivers, lagoons and coastline licensed under Creative Commons Attribution 3.0 New Zealand and sources from LINZ

A3 SCALE 1:100,000
0 1 2 3 4 5 (km)

Location Plan

EARTHQUAKE COMMISSION
KOMIHANA RŪWHENUA

DRAWN			
CHECKED			
APPROVED			

ARCFILE
SCALE (AT A3 SIZE) 1:100,000
PREPARED BY TONKIN & TAYLOR LTD
PROJECT No. 52020.0200

TECHNICAL LAND INFORMATION FACT SHEETS
Area-wide Suburbs

FIGURE No. Map Reference Sheet
REV No. 0

Factsheet 15 - Tai Tapu to Halswell

15.1 Ground conditions and groundwater

Regional geology maps show this area is generally underlain by river alluvium beneath plains or low level terraces of Holocene age.

Table C15.1 summarises the area-wide subsurface ground investigations undertaken by EQC in this area following the 4 September 2010 earthquake. These investigations indicate that the near-surface soil profile in the area generally comprises very loose to dense sands, gravels, silts and clays.

Table C15.2 summarises typical ground elevation and groundwater depths in the area (the values listed correspond to the 10th and 90th percentiles and the median). This was derived from LiDAR ground elevation survey commissioned by the Ministry of Civil Defence and Emergency Management in March 2011, and a groundwater surface developed from historic Environment Canterbury groundwater data. This area is generally elevated moderately well above sea level with a shallow to moderate depth to groundwater.

The ground conditions and groundwater in this area are generally similar to, or slightly more favourable than, most of the southern, central and northern suburbs of Christchurch

While ground surface disturbance has occurred in some areas (e.g. settlement, cracking and ejection of material), the underlying ground which liquefied appears to have now returned to its pre-earthquake strength.

15.2 Post-earthquake observations

Rapid mapping of liquefaction and lateral spreading observations was undertaken following the 4 September 2010 earthquake, first on a regional and street-by-street level in the days immediately after the earthquake, and then on a property-by-property level in urban areas over the following weeks. This mapping was supported by regional-level mapping for the subsequent main earthquakes. This additional mapping indicated that the pattern of liquefaction and lateral spreading for the subsequent earthquakes was generally similar to that observed in the first main earthquake, but less extensive and severe.

Figure C15.1 and Table C15.3 present a summary of the property-by-property rapid mapping of liquefaction and lateral spread observations undertaken by EQC in this area. The mapping undertaken by EQC was predominantly of the main urban areas of Lincoln and Tai Tapu, with less detail in the surrounding rural areas. For more extensive and detailed mapping of liquefaction observations in these rural areas, refer to the post-earthquake liquefaction report commissioned by the Selwyn District Council, available at http://www.selwyn.govt.nz/services/building/earthquake-building-recovery/liquefaction-report. These observed liquefaction and lateral spread mapping colours have completely different meaning to the colour codes used by the Canterbury Earthquake Recovery Authority (Cera) for residential land zoning and the Department of Building and Housing (DBH) for technical categories.

Table C15.4 summarises the change in ground elevation inferred from the LiDAR survey. The total change in ground elevation which has occurred is a combination of regional uplift or subsidence due to fault movements (tectonics) and local ground subsidence due to liquefaction and related effects. The LiDAR is of limited accuracy (about ±100mm). This means that the LiDAR is more suitable for measuring large changes in ground elevation (greater than about 100 to 200mm), and may not accurately represent areas where only minor changes in ground elevation have occurred.

Table C15.5 summarises the extent and severity of observed liquefaction and lateral spread.

Table C15.1 - Area-wide geotechnical investigations undertaken by EQC (December 2011)

Suburb	Number of cone penetration tests	Number of boreholes	Number of groundwater standpipes	Length of MASW geophysical testing (m)
Halswell River	-	-	-	-
Lincoln	-	-	-	-
Tai Tapu	7	-	-	-

Halswell River, Lincoln and Tai Tapu

Table C15.2 - Summary of ground elevation and groundwater depth (March 2011)

Suburb	Ground elevation above sea level	Groundwater depth
Halswell River	Typically 4.8m to 8.8m (Avg 6.5m)	Typically 0.7m to 1.3m (Avg 1.0m)
Lincoln	Typically 9.1m to 13.4m (Avg 11.3)	Typically 2.0m to 4.0m (Avg 3.0)
Tai Tapu	Typically 6.4m to 7.0m (Avg 6.7m)	Typically 0.7m to 1.3m (Avg 1.0m)

Table C15.3 - Summary of liquefaction and lateral spread observations for residential land, aggregated from mapping undertaken by EQC following earthquake of 4 September 2010

Suburb	Total residential property count	Not mapped	No observed ground cracking or ejected liquefied material	Minor ground cracking, but no observed ejected liquefied material	No lateral spreading, but minor to moderate quantities of ejected material	Moderate to major lateral spreading or large quantities of ejected material	Severe lateral spreading, ejected material often observed
Halswell River	391	61%	17%	0%	22%	0%	0%
Lincoln	1168	<1%	99%	0%	0%	0%	0%
Tai Tapu	174	3%	90%	0%	7%	0%	0%

Table C15.4 - Changes in ground elevation inferred from LiDAR survey

Suburb	Change in ground elevation from February 2008 to March 2011 (positive values are uplift, negative values are subsidence)
Halswell River	Typically -200mm to +50mm (Average -100mm)
Lincoln	No data (beyond extent of pre-earthquake LiDAR coverage)
Tai Tapu	Typically -200mm to +0mm (Average -150mm)

Factsheet 15 - Tai Tapu to Halswell

Table C15.5 - Liquefaction and lateral spread observations	
Suburb	**Observations**
Halswell River	Minor to moderate liquefaction in many rural areas alongside the Halswell River and other watercourses, causing sand ejection and settlement. Minor lateral spreading in some localised areas alongside the Halswell River. For the remainder of the area, no surface evidence of liquefaction or related land effects was observed.
Lincoln	No surface evidence of liquefaction or related land effects observed.
Tai Tapu	Minor to moderate liquefaction in several small areas, causing sand ejection and settlement. For the remainder of the urban area, no surface evidence of liquefaction or related land effects was observed.

For further area-wide geotechnical information, refer to the technical data reports on the EQC website, at http://canterbury.eqc.govt.nz/news/reports

Halswell River, Lincoln and Tai Tapu

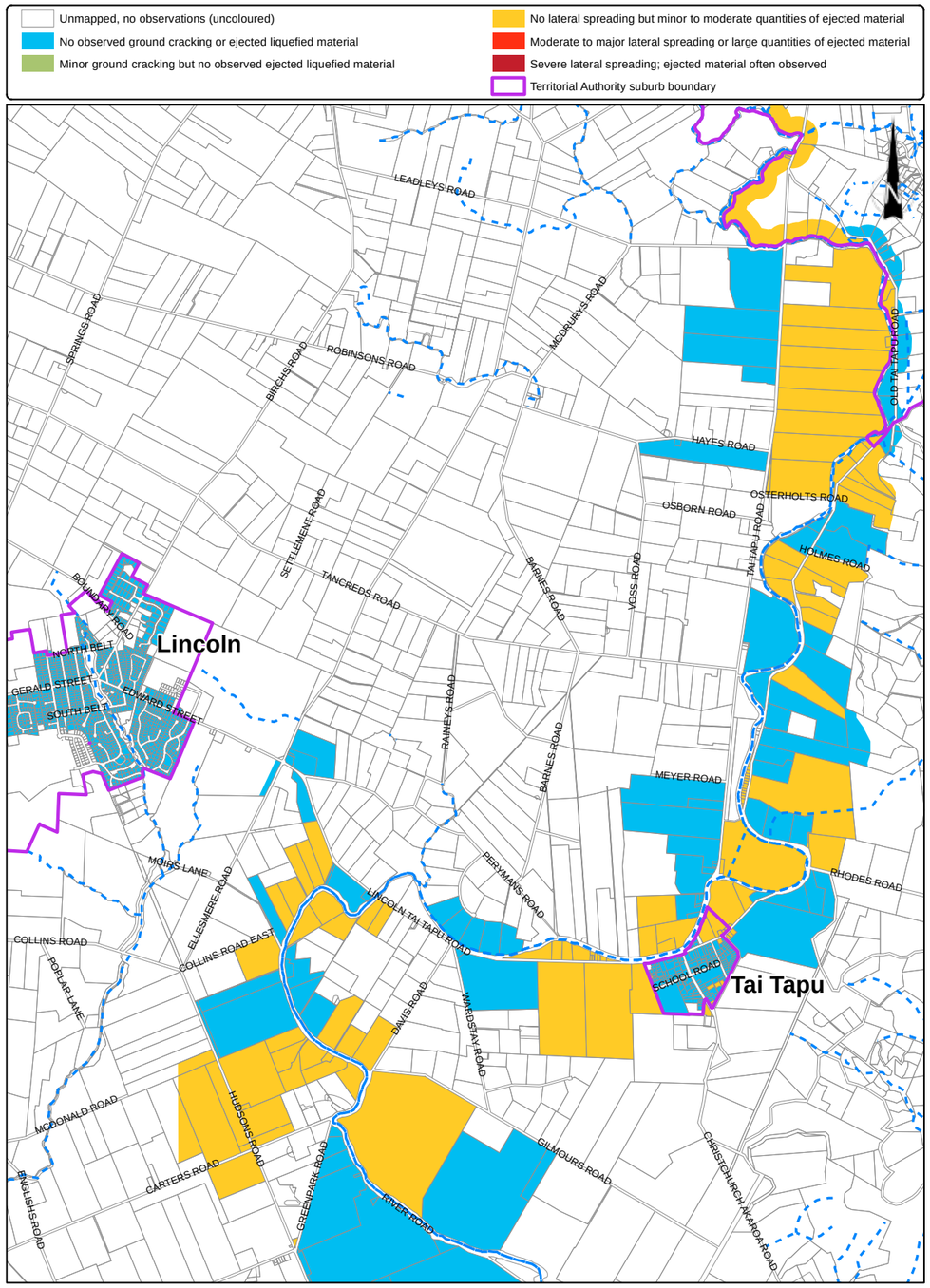


Figure C15.1 - Overview of liquefaction and lateral spreading observations, from mapping undertaken following the earthquake of 4 September 2010.