

December 2018  
Issue 96

## Urban Planning

**NZ's urbanisation pressures: why collaborative and design-led spatial planning is crucial**

**LiDAR mapping the Auckland region - a flood modelling project**

**Highlights of the Indigenous Mapping Waananga 2018**



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## • EDITORIAL



# Addressing gender balance

*Rachel Harris*

This year has marked 125 years of women's suffrage in New Zealand.

As a result of the efforts of 24,000 suffrage petitioners and the 1893 Electoral Act that followed, our country holds the venerated position of becoming the first self-governing country in the world to grant women the vote in parliamentary elections.

Whilst I am proud to be the great-granddaughter of a petition signatory, and we have much to celebrate in terms of our historical emancipation, there are still many issues surrounding gender equality that needs improvement, from addressing the gender pay gap to supporting opportunities for women in leadership roles and career development.

Survey and Spatial New Zealand are actively taking these issues to task joining the industry-led Diversity Agenda campaign, a collaboration between Engineering New Zealand, the New Zealand Institute of Architects (NZIA) and the Association of Consulting Engineers (ACENZ), which endeavours to get organisations to commit to 20 per cent more women in roles by 2021 as well as aiming to achieve balanced gender representation at council and board level.

This final edition for 2018 features a wide range of topics from project case studies to industry updates and workshop outcomes.

From the Land Development and Urban Design Professional Stream, University of Otago Urban Design lecturer Dr Crystal Filep examines the need for collaborative and design-led professional spatial planning to assist with the challenges of increased urbanisation trends in this country.

Supporting and inspiring women across the survey and spatial industries is the theme of two articles this edition. Toni Hill of Birch Surveyors reports on the positive and engaging discussions from this year's Second Women in Infrastructure, Construction and Engineering Leadership Summit, and Spatial Stream Chair Dr Kat Salm discusses the Diversity Agenda which aims to engage a greater presence of women in roles across the industry.

Nicola Trott, Katie Anson, and Dr Mick Strack report on experiences, aid opportunities and developments from September's Volunteering Toolkit Workshop for survey and spatial professionals.

And from the Positioning and Measurement Stream this edition, Sam Hackett takes a look at Auckland's 2016 LiDAR mapping project for updated flood modelling.

Finally, thank you to all our valued contributors and readers this year, a happy Christmas to everyone and best wishes for 2019.



# December Update

As I write this article, we are in the midst of preparing for the AGM, stakeholders and communications forums and Council meeting in mid-November. This is always an intensely busy time of year for anyone, let alone those contributing to the activities of an organisation outside of their day-to-day roles, so I would like to once again thank all of our volunteers at branch, Council, Board and committee level for the time you devote to Survey and Spatial NZ.

I attended the Survey and Spatial NZ Board meeting held in Wellington on 17 October. Below is a report on matters of interest to the membership.

## Pacific Advisory Group

Planning is now under way for a Pacific surveyors workshop at the Survey and Spatial NZ 2019 conference. Following the success of the first 'volunteer toolkit' workshop in Dunedin in September, a second volunteer workshop is looking likely and will be held in Auckland around the time of the conference.

## LINZ – ASaTS

James Mowat and Nick Stillwell provided an update on the Advanced Survey and Titles Services (ASaTS) business case. The business case was presented to the Minister for Land Information and the Cabinet has since approved the business case – refer to the [public announcement on LINZ's website](#).

## Consulting Surveyors NZ division strategy

CSNZ committee members Paul Newton and Carl Fox attended the Board meeting to provide an update on their division's strategy. The CSNZ strategy is intended to be aligned with the Survey and Spatial NZ strategy with a vision to support members achieve business excellence. The board and CSNZ agree there is scope for increased CSNZ involvement in matters such as advocacy at local government level (promotion of RPSurv etc), helping to increase YP governance and business skills, Diversity Agenda and supporting the MOU with ACENZ. The next CSNZ workshop is to be held in Wanaka next March.

## Spatial Stream strategy

The Spatial Stream is planning to run a workshop early in 2019, which will involve representatives from a variety of groups within the wider spatial sector. The aim of the

workshop is to understand what the different groups want and need from a professional organisation. The results of this workshop will feed into plans for marketing the new name of our organisation.

## Certification

The certification paper has now been issued to branches in advance of the stakeholders workshop in November. At the stakeholders workshop, the aim will be to provide delegates with more background on conclusions reached by stream committees and on how the transition to the new certification model should work.

## Diversity Agenda plan

Survey and Spatial NZ is now a founding partner of the Diversity Agenda: [https://www.surveyspatialnz.org/news\\_and\\_events/Story?Action=View&Story\\_id=186](https://www.surveyspatialnz.org/news_and_events/Story?Action=View&Story_id=186).

National Office is working on an action plan, which will include developing case studies that demonstrate how, through inclusive practices, our members are actively working to increase the number of women in our sector.

## NZVD2016 pilot seminar

Survey and Spatial NZ provided administrative and member support for a half-day LINZ presentation to councils in the Hawke's Bay region on 2 October. The purpose of the seminars was to advocate for widespread adoption of the NZ Vertical Datum 2016. A half-day workshop for survey and spatial industry professionals was held the following day. Further updates from LINZ about a national implementation plan will be provided at the stakeholders forum.

## Conference

Organising is well and truly under way for the 2019 conference. The National Technical Committee (NTC) has been developing a list of potential speakers and the local organising committee is providing input on possible local activities. If any members have suggestions for speakers, please contact the NTC via National Office.

*Rebecca Strang, President, Survey and Spatial New Zealand*



## Cadastral Stream

Since the last S+S publication you no doubt will have seen that the Environment Court decision has been received on Don McKay's application supported by S+SNZ for a declaration that a conversion of a cross lease title to free simple is not a subdivision within the meaning of Section 218 of the Resource Management Act 1991. Unfortunately, Judge D.A Kirkpatrick declined the application but did make some interesting comments on "subsidiary issues". If you would like to read the decision and also commentary on the case prepared by S+SNZ Board member Thomas Gibbons, this is available on the S+SNZ website: [https://www.surveyspatialnz.org/Story?Action=View&Story\\_id=187](https://www.surveyspatialnz.org/Story?Action=View&Story_id=187).

By the time you are reading this, the Cadastral Stream seminar/webinar on Good Survey Practice will have been held. A big thank you to all who presented, helped organise and made the event run smoothly. We are currently working with a number of groups on Good Survey Practice and anticipate that in the New Year we will be asking members to be involved with a working group on this topic. Keep an eye on your inbox if this is of interest and you would like to be involved.

Members of the Stream Executive are working closely with LINZ on both the ASaTS and Rules review projects and are calling for feedback from members where appropriate. We understand that some members are not receiving emails from us, so please check both your [www.surveyspatialnz.org](http://www.surveyspatialnz.org) dashboard setting and your spam filters to ensure that you receive these.

The Cadastral Stream welcomes ideas for future seminar topics and feedback on any Cadastral related matters that may be of interest to our members via email: [cadastral@surveyspatialnz.org](mailto:cadastral@surveyspatialnz.org).

*Matt Ryder, Cadastral Stream*

## Engineering Surveying Stream

We have had an eventful period with the Engineering Stream continuously looking to provide value to its members.

On 26 October, after the success of our first event in May 2017, we held the Engineering Surveying and Positioning and Measurement Stream Seminar at the Novotel at Auckland Airport. Again it was a success, with about 130 attendees all up, and some inspiring and very interesting speakers and exhibitors. The challenge now for the next one is to keep it fresh, and we are considering whether the next one should be in Christchurch. Any suggestions for improvements are greatly appreciated.

Max Will, from National Office, and Mike Cutfield also held a stall at the Auckland Build expo on 8-9 November.

The purpose was to promote the membership to the general public. There was a lot of interest in how members of Survey and Spatial New Zealand can provide a higher quality of service over non-members.

The Engineering Surveying Stream is also providing feedback on the revised RPSurv certification and we are encouraging the rollout of the process as soon as it is ready.

*Michael Cutfield, Engineering Surveying Stream*

## Hydrographic Professional Stream

Many members of the HPS enjoyed participating in a successful HYDRO18 conference in Sydney in November. The theme, *The Climate for Change*, provided a wide range of workshops and presentations, ensuring a busy three days for all. Also in November other members attended the UNB/CCOM 76th Multibeam Sonar Training Course in Townsville, Queensland, and the New Zealand Coastal Society Conference in Gisborne. In October, members of the HPS attended the Shallow Survey 2018 conference in St John's, Newfoundland, Canada, where it was pitched that the next Shallow Survey conference should be held in New Zealand in 2021. Updates on this will follow as we hear more...

Congratulations to Eliot Sinclair and surveyor, Jono Renwick, who won the Trimble geospatial software application competition for Jono's video showcasing the company's innovative surveying in a post-earthquake project in Kaikoura. Part of this required supplying survey data in the gap between where a conventional hydrographic survey had been undertaken and the low-tide mark. This gap ranged from 50m to 500m. The novel solution was an UAV dipping survey which combined modern aerial positioning with leadline depth measuring and a mechanical tension sensor. See the winning video at <https://www.youtube.com/watch?v=irHflpmxfbw&feature=youtu.be>.

Working with the Ministry of Foreign Affairs and Trade, LINZ has established a coordinator role to liaise with [marine science researchers](#) undertaking work in New Zealand's territorial sea, the EEZ and continental shelf. The role of LINZ is to ensure researchers comply with their obligations to provide voyage and scientific reports, data and samples to New Zealand.

*Emily Tidey and Stuart Caie, HPS leadership team*

## Land Development and Urban Design professional stream

It continues to be an extremely busy time for land development. Although there are possible signs of change on the horizon, there is still confidence in sustained demand for new housing developments.



Planning for the 2019 conference is now well under way. Next year's conference will be held in Auckland in May, with a theme of 'Shaping Tomorrow's Communities'. As part of the National Technical Committee, the stream has been contributing to the line-up of conference speakers. Having the conference in Auckland lends itself to a strong urban design and land development focus, and it will be one not to miss.

Also, after a request earlier this year to stream members for assistance, we are fortunate to have David Gibson, a senior planner at Spencer Holmes Ltd, representing Survey and Spatial New Zealand on the Quality Planning Content Subcommittee. Thanks to David for taking on this challenge.

*Julia Glass,  
Land Development and Urban Design Stream*

## Positioning and Measurement Stream

A lot has been happening in the P&M Stream and there's lots more coming up.

Thanks to everyone who attended the P&M and Engineering Surveying seminar in Auckland. It was great to see an audience even bigger than last year. For those who didn't attend, there is some great news:

- Most of the sessions were recorded and will be available via the S+SNZ portal
- We will be looking to work with the Engineering Surveying Stream to hold a similar event in 2019.

The stream is looking forward to the 130th conference in May 2019. We are working with the organising committee to have a stream workshop with cases studies from NZVD2016. Look out for more details about this and the stream conference dinner.

Finally, we wish to welcome our new stream Chair, Bruce Robinson, and thank our outgoing Chair, Rachelle Winefield. Bruce was officially appointed at the 2019 AGM and is looking forward to steering the committee over the next two years.

*Rachelle Winefield,  
Positioning & Measurement Stream*

## Spatial Professional Stream

The Spatial Professional Stream committee has developed our draft stream strategy which aims to develop and expand the offerings and appeal for new spatial members, and cater to members' needs more effectively. This was presented to the Board for discussion and has support for action in the priority areas. These include running a value proposition workshop with existing members and individ-

uals from the wider spatial industry early in 2019; working to engage spatial partners such as SIBA to leverage joint opportunities (such as events and advocacy); and the ongoing development of the RPSpatial certification concept.

The name change to Survey and Spatial New Zealand has been a positive development in terms of more clearly and openly demonstrating a more inclusive institute for spatial members. We see this name change as an opportunity to raise awareness more broadly of S+SNZ's purpose and value for a wider range of members.

The RPSpatial working paper was circulated and feedback collected. There was a mixed response as to whether the introduction of this certification would be successful and supported. The existing GISP-AP certification has been available since 2007, and only 14 people in New Zealand have attained it. As a relatively new profession, spatial may not be in a mature enough position yet for certification. There are three potential areas of benefit for certification that we see – one around the individual, one around employers, and one around the industry as a whole.

In general, individuals are interested in spatial certification if it provides an opportunity for a career progression milestone, ongoing professional development and an indication of professional standing. For employers, the value currently appears less clear as there are costs involved, but there is the notion that it may provide a way to 'pathway' employees in terms of personal development activities. Employers see a clear benefit, though, if certification provides a competitive advantage in securing new work, but this is currently not the case. For the industry, the creation of a certified professional framework is valuable in creating a cohort that can drive and progress key advocacy issues such as ethics, industry standards, policy, etc. Next steps for RPSpatial certification will be decided following a full review by the committee of the feedback.

The NZSEA awards event was a highlight of the year, with individuals and projects being celebrated in an event at Te Papa on 17 October and a number of our members won awards. The SPS Committee is proud that S+SNZ is a key organiser of this event and extend congratulations to

*(continued page 6)*



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# Rebuilding Landonline, Consulting Surveyor update, and summary of member feedback



Nick Stillwell, ASaTS Consulting Surveyor



## WHAT HAS HAPPENED SINCE MY LAST UPDATE? BIG NEWS...

Cabinet has approved the programme business case to rebuild Landonline. LINZ will progressively rebuild Landonline in four stages (known as tranches) over five years. The programme will use Scaled Agile development and will be delivered using NZ ICT resources.

By the end of the first stage/tranche (mid 2020), the following new services will be in place:

- Web-based search – this will give New Zealanders the real-time ability to search for and purchase products such as Certificate of Titles and Survey plans, directly from our website
- Search API (Application Programming Interface) – this will enable others to connect their websites and software directly to Landonline to search and purchase products
- Notice of sale – this gives conveyancing professionals the ability to automatically notify territorial authorities that a sale has occurred when they have transferred a title in Landonline
- Notice to mortgagee – this is the ability for banks/lenders to receive automated system notification

when mortgages are registered

At this stage, the intent of the subsequent stages/tranches (subject to on-going refinement) is:

- Stage/Tranche 2 will continue to make improvements for surveyors and conveyancing professionals. It will replace surveyors' and conveyancing professionals' access to Landonline with new web-based tools, improving the workflow and removing constraints on the way we work. Landonline will look completely different at this stage.
- Stage/Tranche 3 is all about improvements for LINZ. LINZ access to Landonline will be replaced by new web-based tools, improving workflow and removing constraints on internal processing.
- Stage/Tranche 4 will introduce 3D and a validation API to enable third parties to access LINZ's pre-validation service.

The programme to progressively rebuild Landonline will be complete in 2024.

## What have I been doing since my last update?

Since my last update in *Surveying + Spatial* quite a lot has happened:

*(Professional Stream News continued from page 5)*

all the entrants and finalists for continuing to progress the eminence of our industry.

Planning is well under way for the 2019 S+SNZ conference in Auckland in May, with a spatial representative on the National Technical Committee (NTC) discussing options to improve the appeal of the conference to spatial professionals. Watch for more information coming soon!

We are also pleased about the recent alignment with the Diversity Agenda. A representative from the Diversity Agenda programme was invited to speak at a WIS lunchtime meeting, which also included a short workshop to identify some key issues for women in our industry and how we can start to address them. WIS also recently ran a survey of members, and the

results should be available in a report early in the new year. The group continues to run regular, well-attended events for spatial and survey professionals – with all welcome.

The SPS stream has continued to support spatial events across the country as well, including GeoSocial meetups in Christchurch and the Emerging Spatial Professionals (ESP) Career Symposium in Auckland. We are also pleased that S+SNZ has supported events of interest to spatial members including GeoCart '18 and the 2018 BIM conference, to name a couple.

The current Spatial Professional Stream Committee members are: Kat Salm (Chair), Elaine McAlister, Ben Dash, Jasmine Callosa-Tarr, and Callum Smith.

*Kat Salm, Spatial Stream*



- The approval to rebuild Landonline from cabinet (as above)
- I have attended 15 of the 16 Survey + Spatial NZ Regional Branches and have met a lot of you in the process
- I have compiled an enormous amount of feedback from you about your major issues and opportunities with the system and am feeding these back into the programme

### ***What is going to be done about fixing the issues working between third party tools and Landonline***

In my previous update, I highlighted the five most common themes of feedback. Here is a little more detail on one of them and what LINZ is looking to do about it.

A common complaint is the amount of effort wasted by having a version of your data within third party software and another version in Landonline, and having to manually keep them in sync with each other. It is common to have to make changes in both places, to lose work on re-import, and to build complex QA processes to ensure they are both in sync with each other. In the worst cases, this can result in the re-drafting of entire survey plans, and in the most minor cases it is still frustrating.

Surveyors have suggested a range of solutions to these issues, from only being able to capture work in third par-

ty tools, to partial upload of LandXML files, to automatic syncing between third party tools and Landonline. Based on the feedback received, it is clear that the frustration is coming from the re-work associated with being stuck between two systems.

By the end of the programme, LINZ aims to make it possible for a surveyor to prepare and upload an entire CSD (data and supporting documents) from third party tools to LINZ for submission. This would include decommissioning the current survey capture tools from within Landonline.

The majority of surveyors I have spoken with support the ability to upload completed CSDs from their third party tools to LINZ because it removes the constraints from Landonline on our workflow. Some surveyors have also highlighted the risk of ending up with a monopoly provider of CSD preparation software. When I have raised this risk with LINZ they have acknowledged that there is a risk of this, but at this stage, based on their engagement with a number of software suppliers there is the potential for competing products and they are keen to proceed with the concept.

### ***Request for feedback***

I want to hear your views so I can raise the profile of them with LINZ. Please get in touch via my Survey and Spatial New Zealand contact details, which should have been made available to you by your branch.

## **Farewell to Hadyn Smith CEO**

In November we said farewell to Hadyn Smith, Survey and Spatial NZ's CEO of six years. Hadyn joined the then-named NZIS on the cusp of implementing the hugely challenging new governance model developed in 2011-2012 titled *'The Way Forward 2013'*. The new organisational constitution and rules were successfully implemented under Hadyn's watch.

Hadyn came to us from Land Search and Rescue New Zealand, bringing with him strong financial management, leadership and relationship building skills which he put to excellent use in building up the very successful commercial partnership programme. He was also instrumental in bringing together the NZ Spatial Excellence Awards (NZSEA) that have now been recognising and celebrating the very best of geospatial community for five years.

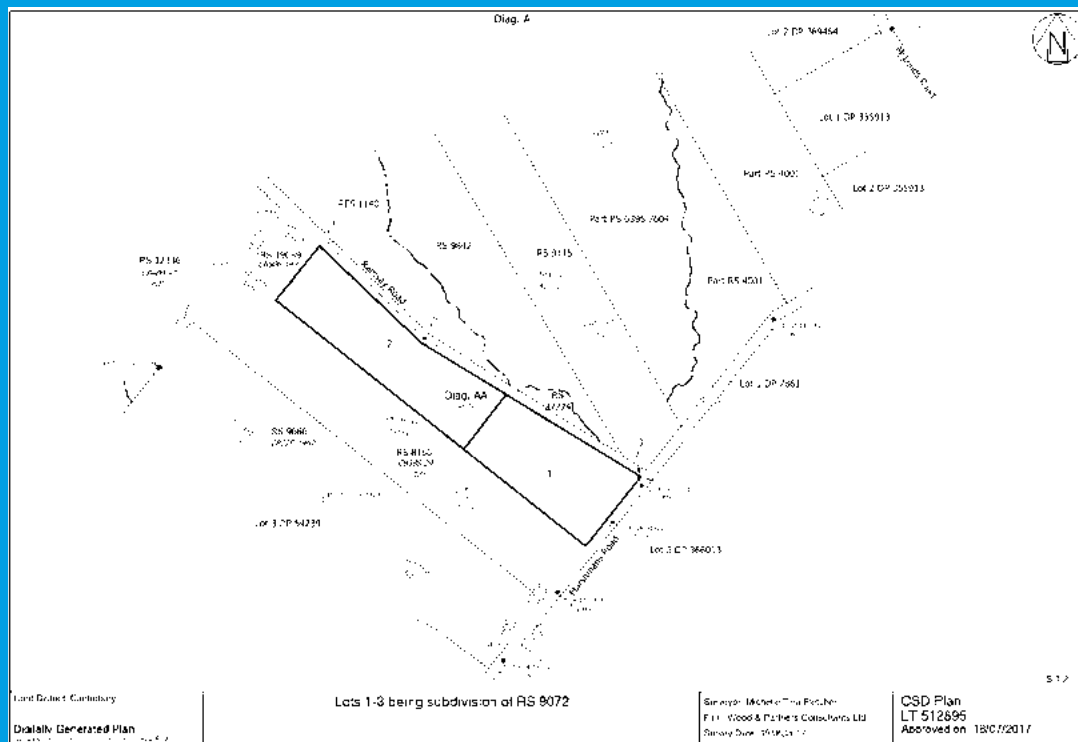
During his tenure, Hadyn showed a strong interest in not-for-profit community projects and was the Chair

of the Alex Moore Park "Sportville" Development in Johnsonville, Wellington. This interest also came to the fore with launch of the Kairūri Community Trust – set up to help the next generation of surveying and spatial

professionals where Hadyn was a key player in the Trust's development and implementation. As an avid sports fan, particularly in rugby and softball, Hadyn has been deeply involved in developing New Zealand's young softball talent.

S+SNZ wishes Hadyn all the best in his new role at *Crimestoppers NZ* where he will be able to put his early career experience with NZ Police to good use.





# An elegant solution to a complex plan

A CASE STUDY OF  
RAMSAYS & MARSHMANS ROADS, CANTERBURY

by Michelle Fletcher



## Introduction

The elegance and simplicity of this plan belies the complexity of the data considered to reach this solution.

Many survey plans in the final iteration look very simple and do not reflect the amount of time and reflection undertaken to reach that point.

This Canterbury plan was surveyed by Woods surveyors in mid-2017. The various solutions and each of the merits were discussed vigorously and rigorously to attempt to find the best outcome for both the cadastral network and our client. The age of the underlying data—1884 was the date of the neighbouring plan—meant field work would need to be thorough. The basic principle of searching and searching well would be paramount.

Cadastral surveyors are generally accepting of being critiqued by LINZ staff but most consider they are simply doing their job, putting a plan together in a logical and systematic way that complies with the various rules. Exceptional plans are unusual; this plan methodology is not the exception, but simply interesting and a good example of the process and complication involved in calculating the definition of a subdivision.

The following will outline the process of collating the data and discuss the decisions made by the surveyors involved in this project. The complications considered include 'limited as to parcels' titles, lack of survey monuments, and the age of underlying survey information, title shortages and excesses.

This is not a step by step or a 'how to', in preparing a complicated data set, but an example of how this particular data set was prepared. It was more of a learning exercise for me reviewing our processes than expected, more often a job once completed is never referred to again.

## The site

The land to be defined had not been surveyed for more than 100 years resulting in a complex survey definition with several solutions to be investigated before isolating the optimum solution. The land is rural, the area occupied by lifestyle blocks and farms.

## The parcel

The parcel of land is on Ramsay Road, Rural Section 9072, with the title first issued in 1893 and only shown on old Black Map 9. The parcel of land is on two sides legal road, Ramsay to the northeast and Marshmans Road to the southeast. To the northwest the land is another Rural Section, RS 19089, defined by SO 4308, a very early survey plan prepared in 1884. The parcel

adjoining the southwest is RS 8166 and also only shown on BM 9.

Black maps were very early surveys of the area, the information is generally difficult to access and often in poor condition usually requiring an appointment at Archives New Zealand to arrange a viewing and in most cases does not provide any more information than can be sourced from the title diagrams. Black Map 9, as expected, is rather light on useful information and reflects the more easily available title data. Archives together with the regional council and Nga Tahu have recently filed digital images of Black Map 9 making this information readily available.

The opposite side of Ramsay Road was surveyed by SO 6771 in 1935 and defined part of Ramsay Road.

The opposite side of Marshmans Road was defined by DP 41491 in 1978. And, as mentioned, SO 4308 defined the parcel to the north of RS 9072. The land is held in a guaranteed title CB12F/526. The title of RS 19089 is held in title CB506/149 and accurately reflects the details shown on SO 4308. The title for the remaining adjoining parcel RS 8166, CB388/29 is limited as to parcels.

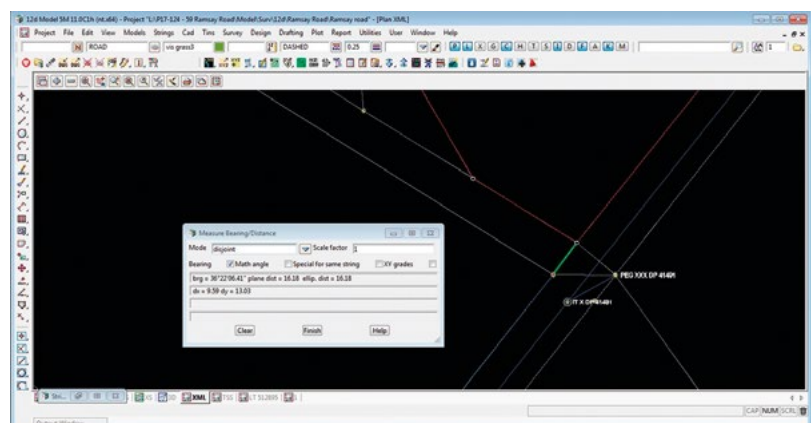
There are no significant encumbrances on the title.

## Pre field survey calculations

At this point a more detailed analysis is useful, the data was entered into 12D but the preparation of a calculation sheet clearly illustrates the present cadastral situation.

The shared boundary between RS 19089 and RS 9072 is in conflict. The RS 19089 measured 125.67 and the title distance on RS 9072 is 120.7, a significant difference of 4.97. The title area is recorded as 8.0937 hectares but using the CT dimensions calculates as 8.6650ha, a significant 0.57ha difference. The shared boundary between RS 9072 and RS 8166 is in conflict. The distance shown in CB388/29 is 804.67 with RS 19089 89.60 resulting in 715.07 a 0.97 difference to the 714.10 shown on CB12F/526. RS 8166 is limited as to parcels. RS 12336 is also limited as to parcels and shares a boundary with RS 19089.

A continuing complication to all Canterbury surveys is the impact of the Canterbury earthquakes on the survey



network. This variable is difficult to predict; some areas are not really affected but some have significant measurable differences. Of value to Canterbury surveyors is the survey of all the level 0-5 marks in the Canterbury survey network post-quake by LINZ and its agents; this provides a starting point for cadastral calculations.

The data is very old, and the xml data extracted from the Landonline database is not very reliable or accurate. In this case it is quite distorted due to the considerable conflicts with the title information. The database is not complete due to the age of the underlying survey data. Ramsay Road is shown as being 16 metres wide, the legal width is 100 links – 20.12m, the parcel RS 9072 is shown as 168.05m along the Marshmans Road boundary, title is 154.90m.

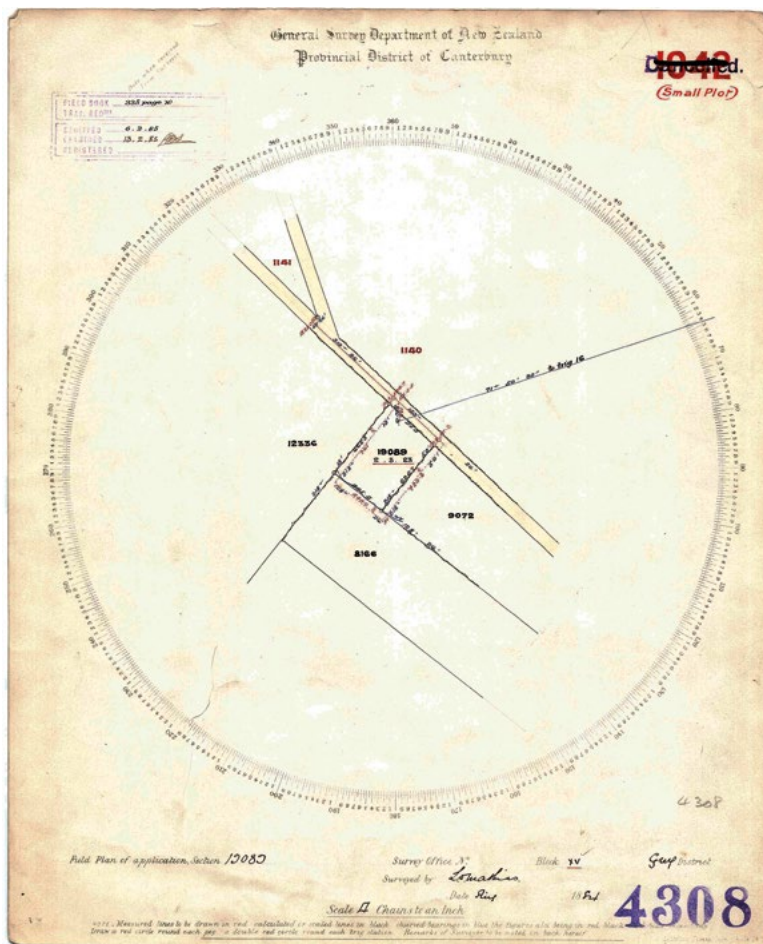
The most recent survey nearby is DP 54239 to the southwest. The information from this plan was used to define

DP 7861 defines the alignment of Marshmans Road with a parallel traverse with offsets to both sides of the road.

SO 6771 connects directly to DP 7861 and defines the alignment of Ramsay Road from the intersection of Marshmans Road to the first bend. It is likely that SO 6771 ranged this based on the occupation. The half angle and offsets calculate the corner of RS 9072 at the intersection of Marshmans and Ramsay roads.

The half angle as defined by the bearing on SO 4308 and SO 6771 defines the bend and the alignment of Ramsay Road.

SO 4308 defines the extents of RS 19089 and therefore the northwestern boundary of RS 9072 but there is no simple connection to the survey network on this plan. The plan shows an observed bearing to Trig 16 but no calculated distance, and the observation is from an unmarked position.



The peg at the corner of Ramsay Road and RS 1141 is shown on SO 2677.

This peg can be connected to by observations from Trig 16 most recently observed by DP 57544 to survey data from DP 33111. Using this data to calculate the position of the pegs on this plan and closing the traverse on Trig 16 using the observed bearing shown on the plan results in a misclose of about 0.70m. The size of the misclose is significant and finding any evidence of marks from this plan could affect the definition of RS 9072.

Using this data, but without knowing if or where the traverse marks will be found calculations defining the parcel can be approximated. At first glance this results in differences to the title information with more than a 6m excess between the Unmk DP 54239 and the corner of Marshmans and Ramsay roads compared with title distances for the three parcels. The half angle point defined by SO 6771 also results in difference to title distances. A shortage compared with title is between the western corner of RS 19089 and the Post DP 54239. The southwestern boundary calculates close to title distance for RS 9072.

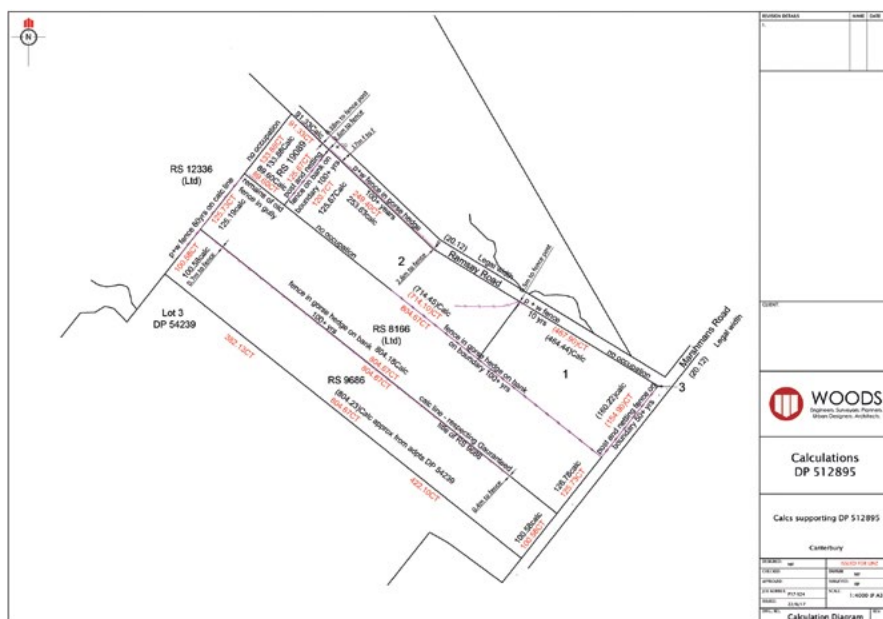
the southwestern boundary of RS 9686, that adjoins the limited parcel RS 8166 and needs to be considered in the definition of RS 9072. The survey information from DP 54239 is entered into the calculation software, 12d. This data is built upon with information from DP 41491 that establishes a traverse along Marshmans Road and provides adoptions to DP 7861 and connection to Trig 16.

## Important definition issues

At this point several different issues become important to consider:

1. RS 19089 is a guaranteed title, boundary distances must be respected.
2. RS 9072 is a guaranteed title – but has conflicts in terms of area and dimensions.





- RS 8166 and RS 12336 are limited as to parcel. (Why the other parcels in this area are not limited is something to puzzle on another day?)
- Road alignments must be respected.
- The differences with the title information are significant and require more consideration and field investigation, should the excess or shortages be simply pro-rata-ed out, how does the occupation on site fall in relation to the first iteration of calculated boundaries?
- The survey and title information is very old and it will not be easy to search for or find any of the old survey monuments.
- Have the earthquakes had any impact on this site to further complicate the survey?

## Field work

The field work would require multiple site visits.

The first visit would be to observe existing traverse and boundary marks and occupation over the site. The adjoining occupation for RS 19089, RS 8166, RS 9686 of fences, gorse hedges and boundary mounds were measured using GPS observations. The traverse marks on Marshmans Road were all found stable and in good condition. The post at the end of RS 9686 from DP 54239 was also found in good condition. The IT VI SO 6771 found on Ramsay Road was found in good condition about 0.30m away from the calculated position. This mark is located on a gravel road on a hill and this difference is considered simply a more accurate measurement of this mark.

The pegs shown on SO 4308 were of uncertain location and required holes to be dug of quite a large size and depth. None of the marks from SO 4308 could be

found, all seven pegs shown were searched for but had been likely destroyed due to age and decay.

Finding any evidence of marks from SO 4308 would have defined the northwestern boundary of RS 9072 but despite comprehensive searching, none could be found. The only evidence of original occupation on site shown on SO 4308 is the southeastern boundary mound of RS 19089.

## Field observations – analysis

Traverse marks found were stable and in good condition. The boundary mark Post (1) DP 54239 is stable and in good condition. The occupation is very old and longstanding over the site. The original mound established by digging a sod along the boundary and planting a gorse hedge along the top of the mound is in evidence on the southwest and northwest boundaries of RS 9072. The only fence remaining from the time SO 4308 was surveyed is the bank on the shared boundary of RS 19089 and RS 9072; the northern fence adjoining RS 12336 has been destroyed and there is only a short fence on the boundary between RS 8166 and RS 19089. The occupation of a fence and gorse hedge on the northern boundaries of RS 9686 and RS 8166 is very old and good evidence to support boundary definition.

The field work has provided confirmation on the location of the traverse marks and therefore the Marshmans Road definition. Ramsays Road can also be defined based on the observation of the supporting traverse mark.

The complicating factor is where is the definition carried out by SO 4308 located? Without the confirmation of finding the survey pegs, there is no firm position for this plan. There is no convenient relationship to nearby surveys, there is no significant earthquake damage, there is no clear solution.

## Decision time

There are various solutions to be considered and each to be weighed on its merits – is it the best solution? What is the impact on the cadastral system? What is the impact on the occupiers and owners of the site and neighbouring properties? How does it relate to the occupation on site? Where do the occupiers think the boundary is, what is the longstanding use of the site?

## Title distance

The existing title distances based on the title dimensions using the alignments of the road was calculated and overlaid with the existing occupation. These dimensions do not fit any of the occupation on site. The guaranteed titles must at least be respected at a minimum, and limited titles, if there is no supporting mathematical solution, should reflect the occupation.

## Occupation

Previous survey plan DP 54239 has also observed fences and given an indication of the position and age using them as evidence for definition of that survey. Our information confirmed the age and position of some of these fences.

## Occupiers

The field party had various conversations with the owners and occupiers on the site confirming that the fences and other occupation had been stable over the site for as long as they could remember and that the fences represented the boundaries of their allotments. There was no mention of any conflict or historical disagreements between neighbours about the location of the occupation.

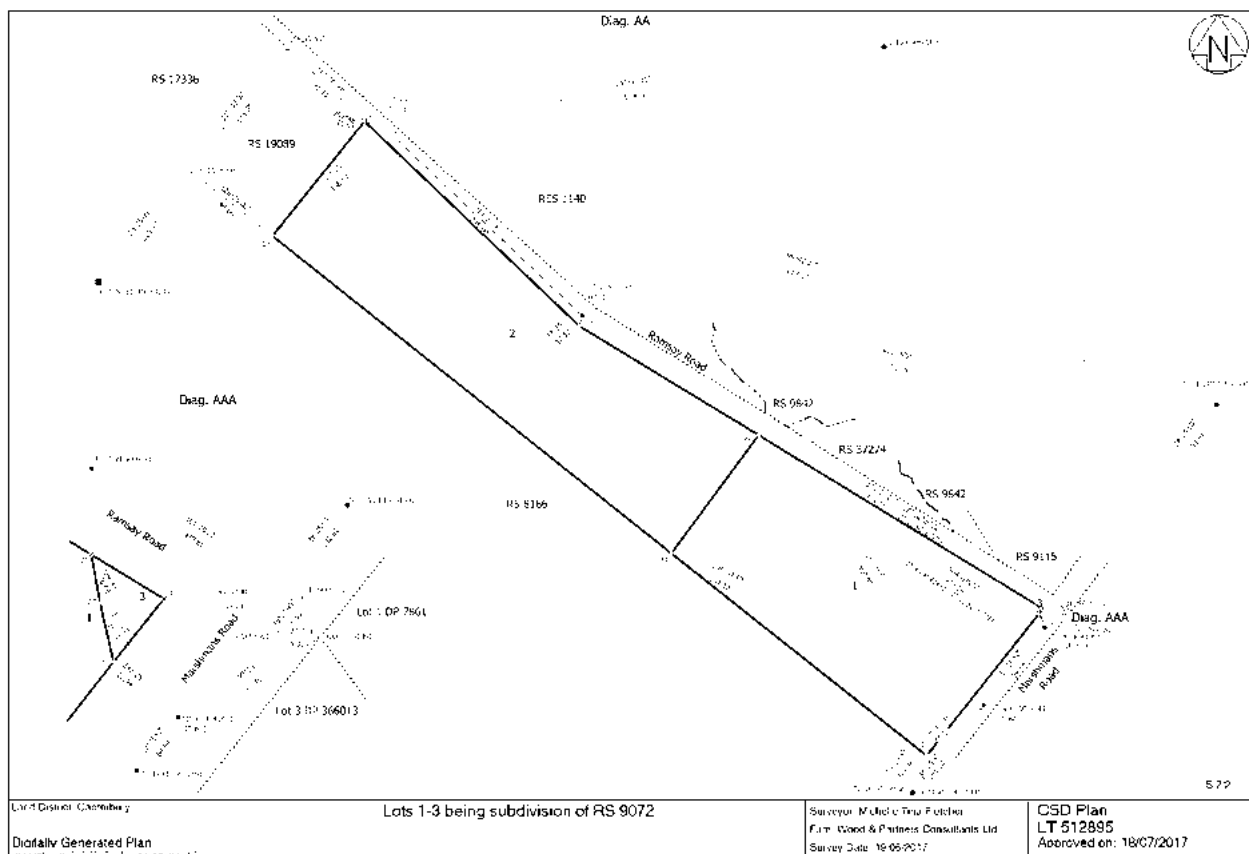
## Debate and definition

At this time a rigorous debate occurred – what was the stronger evidence, should the information from the most recent survey in the area DP 54239, establishing the alignment of the northwestern boundary of RS 19089, which now has no supporting occupation and does not fit with the occupation of the southeastern boundary, be used or should the occupation itself be considered the best evidence for the alignment of the boundary?

If the occupation is used as the boundary, will RS 19089 still have enough land for a guaranteed title and how will RS 9072 be affected?

Although it could be argued either way in this example – the mathematical versus the occupational evidence – it was decided the best solution was the very old mound fence-line. But also to be considered was how this fitted with the southwest boundary of RS 9072. The mathematical solution was not as good a solution as the occupational evidence. This was discussed within the team and altered the outcome a few times before reaching a final conclusion.

Also, clearly there is a significant conflict between the title distances on this boundary. Mathias, the surveyor of SO 4308, would have had good reason to make such a distance the title distance of RS 19089, and it would be interesting to know what it was but that information is lost in time. A possibility is that it is likely that the definition was based on the occupation and use of the site.





While the location of the southwest boundaries of RS 9686, RS 8166 and RS 9072 could be defined by mathematical means, title or pro rata, or the evidence of the existing occupation, title must be respected for RS 9072 and RS 9686. The occupation was compared with the title distances between RS 9686 and RS 8166 and was found to be close enough to use the title distance as a calculated boundary. The occupation was also compared with the title distances between RS 8166 and RS 9072 and did not fall close, it was about 6m different. The pro-rata calculations were compared and also did not fit with the very old occupation. RS 8166 is limited so the fence became the alignment of the boundary resulting in a small shortage. The result of the fence as the alignment is that the boundary is 5.32m different from the title. The line of the fence fits well with the alignment of Ramsay Road and the definition of RS 19089.

The 5m difference is consistent with the 5m difference in the same direction as measured by SO 4308.

The definition of RS 19089 also has an effect on the definition of the northwestern boundaries of RS 9686 and RS 8166. The Post (1) DP 54239 falls on a fenceline and the fence along the northwestern boundary of RS 9686 and RS 8166; using the occupation-based definition of RS 19089 fits close to the title distances of these parcels, with only a small shortage. The guaranteed titles must be respected even though they are not defined in this survey. The next surveyor will have an easier job thanks to the work undertaken in this definition.

The second field trip placed new boundary marks at the extents of the allotment and confirmed the position of the existing traverse marks.

RS 9072, as mentioned previously, has many conflicts in terms of the parcel dimensions that it seems obvious that the title areas will also have differences. The area on the title is 8.0937ha. Using the title dimensions, the area calculates at 8.6550ha, a significant half-hectare difference. Recalculating the area in this survey resulted in 8.9580ha – nearly a hectare difference to the original title.

## Survey report

The survey report submitted with the plan is considerably more succinct than this description, but details the final decision and not the

process to reach this point. This report is very outcome focused and the biggest challenge is anticipating the potential questions an approving surveyor at LINZ may have, or any other surveyor that may happen upon this job. This is perhaps one of the most difficult parts of the process as the data is so familiar that identifying particular issues is challenging and has to be carefully considered. Distilling the complex information into a simple description that will clarify the decisions made for surveyors in the future is important especially with the nearby parcels still remaining 'limited as to parcels'.

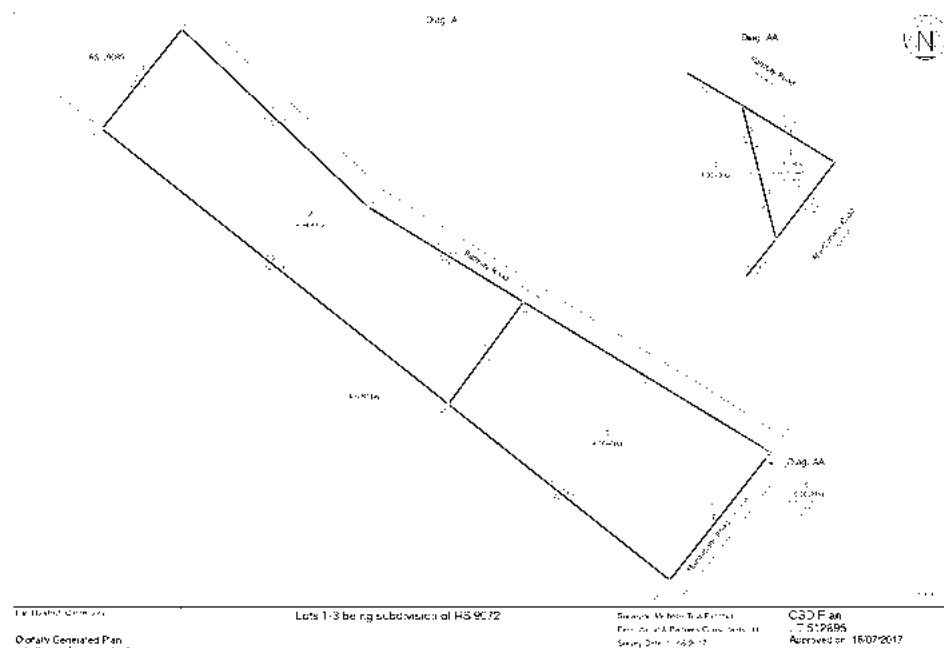
## Requisition

The elephant in the room for any survey plan is: was it requisitioned by LINZ? It was, despite our best intentions. The items requisitioned were for careless issues, the plan name did not take into account Lot 3, a genuine mistake overlooked due to the more complicated parts of plan preparation, some drafting was hidden, and further clarification was required on the differences with the recalculated title area. Reassuringly, there was no requisition for the definition.

## Conclusion

The final outcome of all these decisions was a very simple, uncomplicated plan – LT 512895. Upon review of the dataset in the preparation of this plan, it is in my opinion an elegant solution to a complex situation.

*Michelle Fletcher (née Reid) is a licensed cadastral surveyor at Woods in Christchurch. She is experienced largely in cadastral surveying, with 17 years at Christchurch City Council followed by several years in the private sector with Woods. She prepared the first approved e-survey in New Zealand.*



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*Katie Anson, Nicola Trott  
and Dr Mick Strack*

## Volunteering Toolkit Workshop

### Introduction

The Volunteering Toolkit Workshop was developed in response to an initiative suggested at the FIG Congress in Christchurch in 2016 when the Young Professionals Group decided it should become more involved in social and environmental development volunteering, looking at how doctors and engineers have established similar responses (Medecins sans Frontieres, <https://www.msf.org/>, and Engineers without Borders, <http://www.ewb.org.nz/>).

A Volunteer Community Surveyor Program (VCSP, [http://fig.net/news/news\\_2017/07\\_YS\\_vcsp.asp](http://fig.net/news/news_2017/07_YS_vcsp.asp)) has been established with the support of FIG, UN-Habitat, and the GLTN (Global Land Tool Network). On behalf of the Young Professionals Group, Claire Buxton signed up and organised this workshop to bring together experienced professionals (those having worked extensively in aid overseas) with young professionals, students, and some older professionals interested in learning about aid-type opportunities.

The workshop was a great opportunity to bring together youth with overseas aid and volunteering experience and surveyors and spatial professionals keen to expand their horizons and look beyond their New Zealand surveying practices. There was much animated and excited discussion, questions and engagement, and a will to make progress.

### The workshop

The workshop was opened by Clare Curran, MP for Dunedin South. The opening session included an introduction to Volunteer Service Abroad (VSA) by Claire McClintock, and a live video call from Eva-Maria Unger, the director of VCSP.

Peter Ollivier, from Calibre, discussed some of the development needs around the Pacific (many of which are

commercial contracts, but may incorporate collaboration with volunteer surveyors and engineers), and Malcolm Archbold provided an overview of MapAction, a UK-based surveying and GIS volunteer organisation which responds to disaster relief. This session provided essential background to organisations that may be contacted for volunteering opportunities.

The second session introduced Jordan Friis who volunteered for VCSP in Nepal, and Aaron Hicks who volunteered with VSA in Kiribati. These inspirational young professionals discussed the ups and downs of working in a different environment and with very different cultures. In both cases, their work provided a strong sense of confidence in being able to be self-motivated and self-reliant in novel environments, but also emphasised the powerful personal growth gained with their experiences. Bill Robertson and Neil Pullar then briefly described some of the overseas work opportunities they have both had. The main lessons here were that the overseas experience provides evidence of particular skills in adaptability, and the contacts made are useful for later career opportunities.

For the third session, David Goodwin had produced three recorded short lectures on some of the theoretical background to the continuum of tenure – from customary informal tenure to formalised registered tenure. These prompted small group discussion sessions where the theory was compared with both the realities we had just heard about from previous speakers, and other issues. Some very interesting discussions arose, many coming back to the clash of cultures and concerns about imposing Western values and systems on other cultures.

The afternoon sessions included explanations about fit-for-purpose solutions and community mapping as well as some hands-on use of tools such as Open Tenure, led by Neil Pullar; and STDM (Social Tenure Domain Model), led by Kelly Gragg, Jordan Friis and Claire Buxton. There is likely to be an expectation that anyone volunteering



in survey and spatial can use these tools proficiently. This is especially relevant if it is associated with disaster relief mapping and the restoration of boundaries and property. Therefore, the exposure provided at the workshop was immensely valuable to all in attendance.

The final session was led by Malcolm Archbold with a focus on the importance on geodetic networks. He pointed out that only a very small proportion of the Pacific is covered by a modern geodetic network, which limits the ability to use GPS-type position fixing and GIS development with any confidence. Finally, Malcolm led a group discussion and panel on the future of the volunteering initiative. He revealed he had bought the domain name 'surveyorswithoutborders.org' pre-empting what may one day become a reality. Although the name is still undecided, the direction and passion is clear.

## Discussion points

At present, it seems existing aid and volunteer organisations (such as VSA) are the best route into developing the contributions of surveyors and spatial professionals. It is to be hoped that similar workshops are developed around the country and that the Young Professionals Group of Survey and Spatial New Zealand further develops these opportunities.

To make this initiative a reality, the group believes it is best to become involved in current projects funded by government and aid agencies to make the necessary connections and demonstrate what we can offer as a profession.

It is not the lack of equipment in Pacific nations that is limiting their survey development but the lack of knowledge and training. Equipment is lying idle and deteriorating due to the current knowledge gap. Therefore, it is not donations of equipment that is required but people with a willingness to teach and leave behind knowledge that will provide ongoing growth and development.

**"Give a person a total station and they will try use it for a day, teach a person to use it and they can survey for a lifetime."**

We are very fortunate in New Zealand to have a functioning cadastral system. What developing nations or



Claire Buxton quizzes the experienced volunteers using questions submitted by the attendees

communities require in their cadastral system may not be what we would typically expect for a developed nation. Ownership of land and resources, whether it be individual or communal, is not universal and we must respect the rights of people and communities. Furthermore, if we were to enforce a cadastral system comparable to ours in a developing nation not only do we risk removal of rights but a potential collapse of the system due to the ongoing costs and upkeep required. If we establish cadastral systems that are not fit for purpose, they are unlikely to continue in operation.

There are numerous international examples of how indigenous rights in land have been removed by Western intervention. We should strive to learn from the mistakes of those before us and establish systems that are fit for the needs of the locals. When entering these nations, we are aiming to secure and protect their rights, especially in times of disaster, rather than imposing our standards on them.

## Summary

The workshop was highly inclusive with individuals with no volunteering experience and those with vast experience discussing where we go from here. The ideas that were pitched ranged from opportunities in New Zealand, such as holding mapathons, to what we can offer as professionals overseas. It was exciting to hear that all survey and spatial professionals can be involved, regardless of experience and location, if they desire.

Claire Buxton was the driving force behind this workshop and she gathered together a wonderful collection of expertise and enthusiasm. She deserves high praise for her efforts; thank you, Claire.

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Caitlin Tuagalu presenting her proposal for a prototype development in Dunedin

# Design-led, Collaborative Spatial Planning for Urbanisation

Dr Crystal Filep (Lecturer in Urban Design), University of Otago – [crystal.filep@otago.ac.nz](mailto:crystal.filep@otago.ac.nz)

## Introduction

Pressures of urbanisation are upon New Zealand, whether we like it or not. The world's urban population is set to nearly double in 40 years, and most rapid urbanisation is occurring in cities of fewer than 1 million inhabitants, which the United Nations refers to as 'secondary cities'. With the exception of Auckland (1.6 million inhabitants), New Zealand is a nation of these 'secondary cities'. Internationally, professional collaborations are under way to tackle challenges associated with increased urbanisation trends. One significant collaboration between the Prince's Foundation for Building Community (PFBC), the Commonwealth Association of Planners (CAP) and the Commonwealth Local Government Forum – referred to as Planning for Rapid Urbanisation 2030 – places a particular

emphasis on the capacity of 'secondary cities' to absorb some of the growth otherwise destined for already gorged metropolises.

Research by CAP has confirmed that within the Commonwealth the problem [of rapid urbanisation] is compounded by there being far too few property and planning professionals [including surveyors] working in the built environment, and of those that do exist, most are invariably working in the capital cities. However, much of the projected growth is likely to be in secondary and smaller cities where the capacity to develop and enforce urban framework plans is often extremely limited. (*Smart Cities World*, 2016, n.p.)



A critical discussion about proposals for a prototype development in Dunedin

Without design-led, collaborative spatial planning for urbanisation – and recognition that ‘urban’ can and does often refer to cities of fewer than 1 million inhabitants – much of New Zealand’s urban population will suffer negative environmental, social and economic implications. Such spatial planning efforts not only identify, but importantly also *design* new growth areas. In other words, such efforts acknowledge the importance of regulatory planning, but rely equally on the creative problem-solving capacity of urban design.

Together with planners, urban designers, landscape architects, architects, engineers, ecologists, archaeologists, project managers and other relevant professionals, surveyors collaborate on many key aspects of spatial planning processes, including site assessment, feasibility studies, design layout, topographical and site investigations, engineering design, resource consenting, construction supervision and management, completion certification, and land transfer and as-built surveys. The perspective and skills that a surveyor brings to such processes are critical.

Furthermore and due to recent population trends, there is a unique opportunity at present for the surveying profession to play an essential role in the opening up of new, responsive and meaningful approaches to how New Zealand copes with growing urbanisation pressures. How can surveyors collaborate with other professionals to improve urban design processes and outcomes that better address the environmental, social and economic challenges of New Zealand cities? Is it possible for the surveying profession to help lead urbanisation efforts that model and contextually adapt international ‘best practice’ (design that is sustainable, accessible, robust and people-oriented)? How the next generation of surveyors conceptualise, normalise, challenge and collaborate on the spatial planning of human settlement patterns is a key challenge of this century.

## Urbanisation challenges in Dunedin

According to Dunedin Mayor Cull and backed up by recent trends, the demand for housing in New Zealand’s seventh

largest city (as of 2018, according to Statistics New Zealand) is set ‘to increase dramatically in the next 10 years’ (Miller, *Otago Daily Times*, 2018, n.p.). Putting immediate pressure on this demand is the expectation that hundreds of people will ‘move to Dunedin to work on the hospital rebuild’ (ibid.), with construction expected to begin as soon as 2020.

In response to this pressure on a key ‘secondary city’ of New Zealand,

Mayor Cull has established a housing taskforce, which met for the first time in April 2018. The taskforce is ‘made up of [Dunedin City Council] staff and will make suggestions to the Council addressing long-term social, affordable and healthy housing issues’ (Miller, *ODT*, 2018). The taskforce is an ‘advisory group’ without ‘decision-making authority’ (ibid.). Nevertheless, it has the stated aim of playing a key role in ensuring Dunedin is prepared for an increased housing demand.

## Fuelling a more collaborative, design-led approach

While Dunedin’s establishment of a housing taskforce is commendable, there is the danger of this taskforce becoming a cursory internal exercise of the council that defaults to the mere regulatory (Dunedin has recently released decisions on its Second Generation District Plan). To help fuel a more public, collaborative and design-led approach, an educational outreach project was undertaken as part of the National School of Surveying’s undergraduate programme. This past semester, fourth-year surveying students had a unique opportunity to explore and present urban design ideas to help address Dunedin’s increased housing needs.

Through the school’s elective paper *SURV453 (Urban Design 2)*, students were asked to design a prototypical development for consideration by Dunedin City Council’s housing taskforce. The students’ brief was to propose a development that could house 50 to 100 hospital rebuild workers and their families (assuming that 50 per cent of these workers relocate to Dunedin alone, and the other 50 per cent relocate with families). Students were tasked not only with this immediate project goal, but also with factoring in long-term viability and sustainability of the development.

A core assumption was that any new cadastral patterns, urban spaces and buildings established in the immediate future for hospital rebuild workers would likely remain in place (and, ideally, in use) long after the rebuild was

complete (and thereby contribute to Dunedin's overarching spatial planning tactics).

Assigned a project site on the southern tip of Dunedin's designated 'central city', students undertook site and precedent analyses to inform their designs. Each student was asked to draw together lessons learnt from his/her analyses through design thinking to create an original, well-defended proposal that addressed the site's strengths and weaknesses and met the project goals while also improving urban amenity and vibrancy in the area. Key learning objectives for the students included knowledge, practice and communication of urban design processes, challenges, ideas and outcomes: skills increasingly essential to a 21st century surveyor's professional 'toolkit'. Students' urban design proposals addressed a range of scales and included land uses, architectural style(s), building types and massing, signage, visual permeability, setbacks, vegetation, materials, etc. Within a limited timeframe and from

the perspective of soon-to-be professional surveyors, different design ideas were explored and tested through various analytical and visualisation methods, then through a 'real world' verbal exchange of these ideas.

On Tuesday, 9 October 2018, 24 fourth-year surveying students presented their urban design proposals to a panel of relevant professionals, including the chair of Dunedin City Council's housing taskforce Cr Aaron Hawkins and other elected officials. Each student had two minutes to introduce and 'sell' his/her design to the panel, after which audience members circled around the displays and queried students further about their proposals.

Each person in attendance – students, industry professionals, local government workers, politicians and academics – brought a different perspective and set of skills. The result was an afternoon of critical debate, creative exchange and two-way learning. On the one hand, students had the opportunity to learn from 'real world'

## Embracing Universal Accessibility

*Dr Crystal Filep (Lecturer in Urban Design), University of Otago – [crystal.filep@otago.ac.nz](mailto:crystal.filep@otago.ac.nz)*

It is all too easy to default to catering for the perceived 'norm'. We all do it – marketers, chefs, writers, electricians, you name it. When it comes to the design and layout of cities, however, a significant amount is at stake. The streets and spaces of the city in which you live help to shape your life – your commuting habits, where you spend time relaxing with friends, where you go shopping, how often you walk, drive, etc. And what about those people among us who cannot walk or drive, or go shopping without assistance? A city is for everyone, and should be accessible for all, for it helps to shape us all... whether we like it or not.

During an *Access for All* forum in Dunedin on 26 October 2018, more than 40 people convened at the Dunedin Public Library to discuss and debate accessibility issues. As an urban designer and representative of the National School of Surveying, I joined the Dunedin City Council and Otago Regional Council to collaborate on possible ways forward in designing cities for universal accessibility. During this forum, it struck me just how motivated and positive the people gathered were. Most in attendance have bigger struggles than you or I in getting around and accessing essential functions; the streets and spaces of their city shape – sometimes enable, but unfortunately more often inhibit – their daily movements, their habits, if and how they spend time in public spaces. Yet such struggles seem not to discourage, but to motivate and empower most of the individuals I talked with at the forum. Their commitment and drive to

positive change is inspiring, and, potentially infectious.

Surveyors – together with planners, urban designers, landscape architects, architects, engineers, ecologists, archaeologists, project managers and other relevant professionals – collaborate on many key aspects of urban design processes and outcomes, including those that determine how accessible (or not) a particular site or development is. It is all too easy in such collaborations to default to catering for the perceived 'norm' – to design roads and detail curbs as they have 'always been done', to idealise the 'quarter acre dream', to interrupt the footpath with private driveways, to specify traffic lane widths wide enough to enable (and sometimes encourage) unsafe vehicular speeds. Yet I would challenge the surveying profession – as an integral collaborator in urban design – to embrace the challenge of overcoming limitations that might have been 'handed down' in the profession.

Take inspiration from those living with disabilities, from those who remain optimistic and solution-oriented despite very real daily obstacles. The obstacle of critically evaluating – and, when needed, taking a stance to overcome – professional 'norms' is one that should be embraced, not shied away from. The perspective, skills and problem-solving willingness that a surveyor brings to urban design processes and outcomes are critical if we are to ensure our cities are accessible to all, not just an elite few.

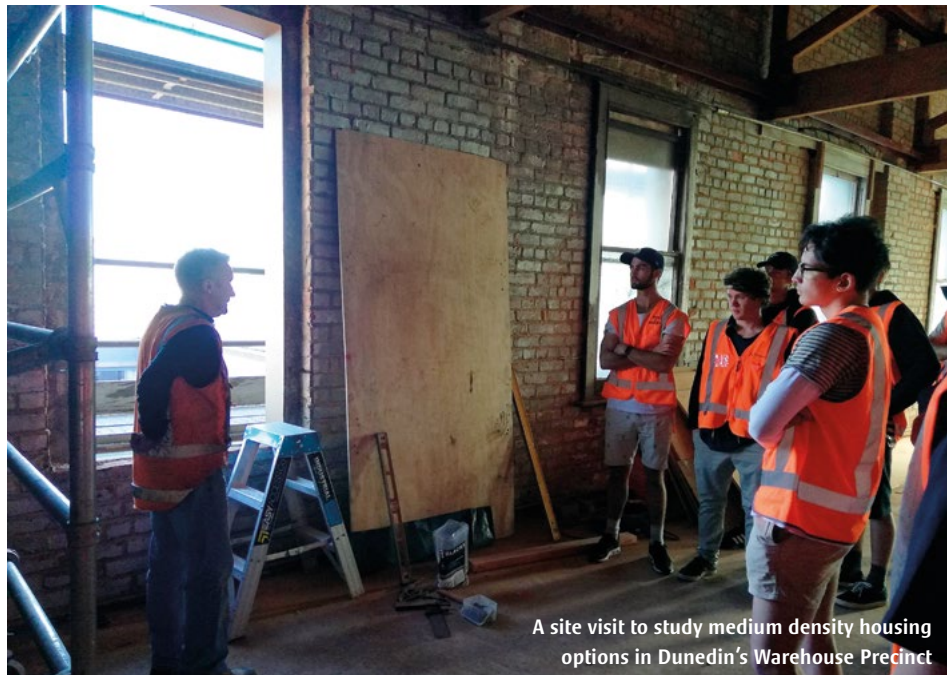


urbanisation challenges and a range of professional perspectives involved in the multidisciplinary field of urban design, helping to prepare them for the evolving professional landscape of surveying. Professional feedback on student design proposals included praise for their creative ideas and inclusion of green space, but also challenged them to prioritise solar orientation of housing, to ensure universal access and safety, to engage with and dignify historic features of the site, to prioritise the public realm, and – perhaps most importantly – to take a clear professional stance on density versus the ‘quarter acre dream’.

This last point is one that the surveying profession must increasingly challenge itself on if real, sustainable change is to occur in the way that new housing developments are laid out in New Zealand. Simultaneous to student learning, relevant professionals had the opportunity to consider and learn from the ideas of New Zealand’s next generation of surveyors. Many attendees chose to stay long after student presentations had concluded, and impromptu discussions ensued into the evening. Further expanding this exchange into the public realm was local media coverage of the event (Loughrey, *ODT*, 2018):

The students were given a hypothetical site on Market Reserve and the northern tip of the Oval to design their housing development. They came up with ideas from pedestrianising Princes St to including community gardens, laneways and plazas in their designs. Their work was the culmination of a semester-long project. Dr Filep said the ‘politically sensitive’ site was chosen as a learning tool to develop an understanding of the trade-offs required in dealing with limited space. (Loughrey, *ODT*, 2018, n.p.)

The hope is that – prompted by the school’s efforts and willingness of relevant professionals to engage with these efforts – further design ideas will be explored through an open, critical exchange prioritised by Dunedin City Council’s housing taskforce.



A site visit to study medium density housing options in Dunedin’s Warehouse Precinct

## Why it matters in the bigger sense

As a ‘secondary city’ beginning to bear some of the brunt of New Zealand’s urbanisation pressures, Dunedin is uniquely situated to set a certain collaborative, design-led standard that challenges planning efforts being made elsewhere in the country and, importantly, showcases the capacity for growth outside of Auckland. As home to the University of Otago and National School of Surveying, it also offers an opportunity to involve students – including the country’s next generation of surveyors – in such efforts, thereby bolstering their urban design learning and simultaneously bringing fresh young perspectives and skill sets to the table. While surveyors are not urban designers, they have and will continue to play essential roles in spatial design processes and outcomes, including those of both regulatory planning and urban design.

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*Sam Hackett*

LIDAR CAN BE LOOSELY DESCRIBED AS THE ART OF SHOOTING MILLIONS OF LASER BEAMS AT THINGS TO FIGURE OUT WHERE THEY ARE. AIRBORNE LIDAR HAS THE DISTINCTION OF GETTING AIRSICK WHILE DOING IT.

## Project background

The Auckland region has 233 stormwater catchments and is the most intensely developed region of New Zealand. Modelling of and planning for water quality and water quantity outcomes is the task of the Healthy Waters department of Auckland Council. Flood modelling has been undertaken extensively within the region. The accuracy of flood modelling depends on many factors, and knowing the terrain is fundamental to this.

Auckland Council has previously contracted aerial LiDAR surveys for terrain modelling since 2006, with additional captures in 2008-2010 culminating in region-wide coverage from the combined surveys. The data was captured with varying specifications for point density ranging from 1 point per 25m<sup>2</sup> (0.04pts/m<sup>2</sup>) to 2pts/m<sup>2</sup>.

In 2013 the council recaptured the urban areas which make up about one-third of the region. The recapture had an increased point density and had the advantage of using the 2009 geoid model. Many rural flood plains were not within the updated coverage.

## Introduction

In 2016 the council started a new project to recapture LiDAR over the entire region to update the flood modelling based on a region-wide standardised dataset.

Two aerial contractors were engaged, and aerial capture was undertaken separately by AAM NZ Ltd and Aerial Surveys Ltd. The capture started during 2016, with the last capture of the outer island areas completed in September 2018. The efforts captured 90 billion points covering an area of 6,500 km<sup>2</sup> which was divided and delivered as 18,796 rectangular tiles, as shown in *Figure 1*.

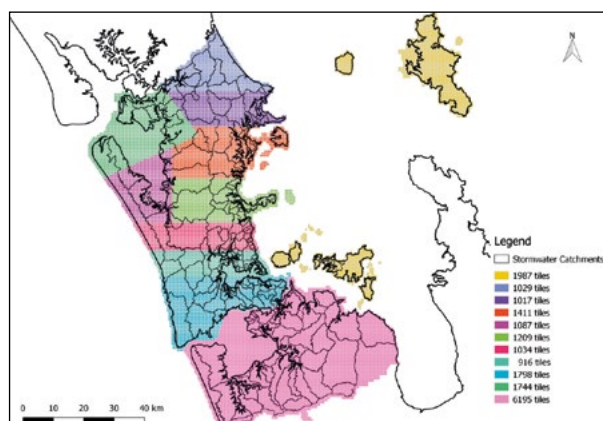


Figure 1 – 2016 LiDAR project tile layout – 18,796 tiles.

## Specification

During 2016 LINZ released a LiDAR base specification and guide for a minimum standard for public sector LiDAR projects to be suitable for inclusion in the National



Elevation Model. <https://www.linz.govt.nz/data/linz-data/elevation-data>.

The Auckland 2016 LiDAR project specification satisfied the base accuracy requirements of  $\pm 0.20\text{m}$  (95%) vertical and with a nominal density of  $4\text{pts/m}^2$ , it exceeded the point density requirement by twice the minimum. The project also required classification of not just ground points (class 2), but also vegetation (classes 3-5) and buildings (class 6) to enable greater value for other potential users.

### Auckland Vertical Datum 1946 (NZGeoid2016) vs Auckland Vertical Datum 1946 (NZGeoid09)

The release of the NZGeoid2016 model and New Zealand Vertical Datum 2016 in 2016 was timed perfectly for the project. While small area topographical surveys can usually make do with lower accuracy geoid models by using a local survey origin and relatively small survey area, the accuracy of a region-wide survey is dependent on the accuracy of the geoid model. We mapped the height difference between AUK46 (NZGeoid09) and AUK46 (NZGeoid2016) of the project area, shown in Figure 2. For most of the project, the two versions of the datum matched within  $0.05\text{m}$ , however in a few areas we see up to  $0.15\text{m}$  between the two surfaces which demonstrates the value of the higher accuracy geoid model for a project of this scale.

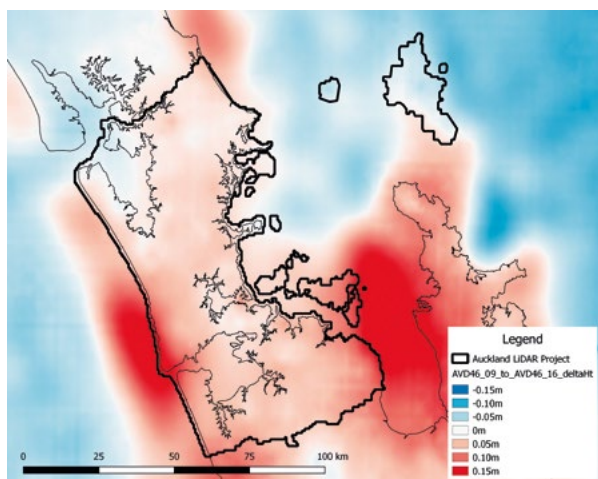


Figure 2 – Auckland Vertical Datum 1946 (NZGeoid2016) minus Auckland Vertical Datum 1946 (NZGeoid09).

### One survey, two datums?

Project deliverables were produced in Auckland Vertical Datum 1946 to be consistent with the council's existing spatial and flood modelling records. The Raw Point Cloud (RPC) is also produced in the national datum NZVD2016 to allow seamless integration into the National Elevation Model.

<https://www.linz.govt.nz/data/geodetic-system/datums-projections-and-heights/vertical-datums/new-zealand-vertical-datum-2016-nzvd2016>

### How precise is each point?

The accuracy of a single swath of LiDAR is a combination of the GPS/Inertial Measurement Unit (IMU) trajectory of the aircraft and the accuracy of the LiDAR system. With the use of ground control points (GCP) these error sources are significantly minimised. The main error contributors are the IMU precision for roll/pitch/yaw which significantly affects the horizontal accuracy of the LiDAR points  $1.8\text{km}$  below the aircraft. Post Processing Kinematic (PPK) GPS is fundamental to maintaining a consistent trajectory, and the LiDAR sensor precision contributes to the point noise which can be observed on smooth surface. Both contractors used high-grade systems achieving low noise on clear surfaces.

Inter-swath vertical consistency becomes an issue only when you don't have it. Inconsistent adjacent swaths of point cloud can result in excessive noise in overlap areas and affect classifications from automated classification routines. Swath edge management techniques include the use of overlap/overage classification which can minimise noise caused by overlap by excluding extremities of swaths to create a clean join. If a significant mismatch was present this could show as a step in the ground surface at the join location.

Dilution of accuracy along the trajectory is largely dependent on the PPK GPS. The least manageable error of GPS is tropospheric delay, and while the pilot can see obvious weather such as cloud, the troposphere above the base receiver is just as important and could be a considerable distance from the aircraft. Clear weather and shorter length flight lines can minimise this error of dilution over time.

Swath matching during the post-processing routine will likely achieve the most robust results as well as allow maximum use of overlapping swath areas. The swath matching will minimise the propagation of surface noise in areas of overlap. This is a technique Woods uses with mobile laser scanning where completely overlapping multiple pass swaths are surface matched to produce a single averaged solution. Aerial surveys have the added benefit of being able to cross-tie flights perpendicular to the primary flight direction.

### How accurate?

The vertical accuracy of the raw point cloud was assessed with ground control surveying in the form of 229 separate survey site locations. Ground control surveys were controlled from nearby geodetic control marks of 5th order or

better accuracy. Each survey site was reduced to a single average height difference of all valid ground points at the site. An example ground control site is shown in *Figure 3*.

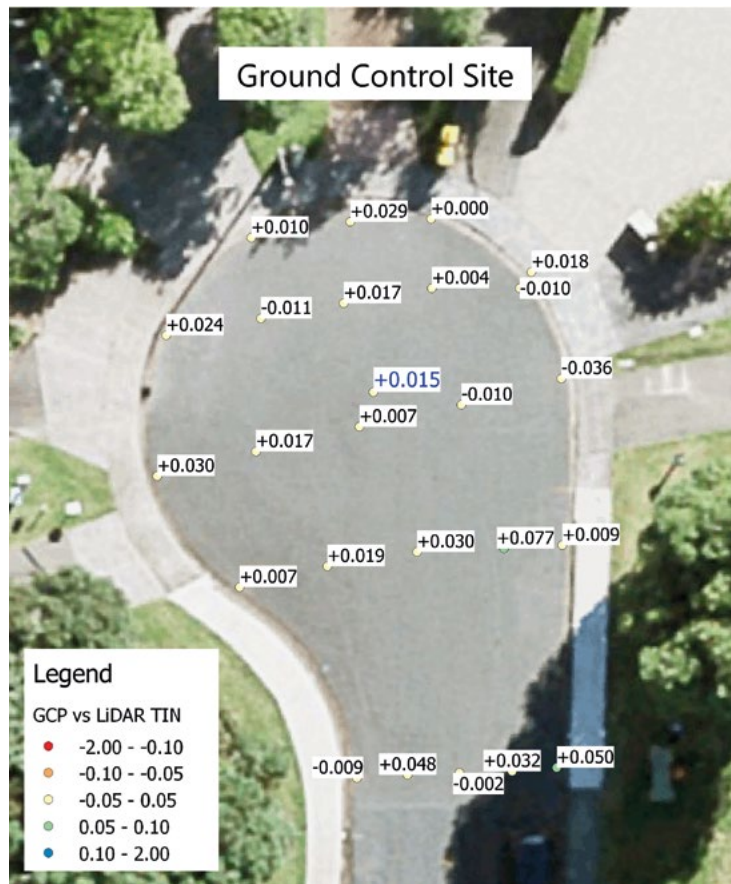


Figure 3 – Ground control site location showing noise of points. The site average of +0.015m is shown in blue.

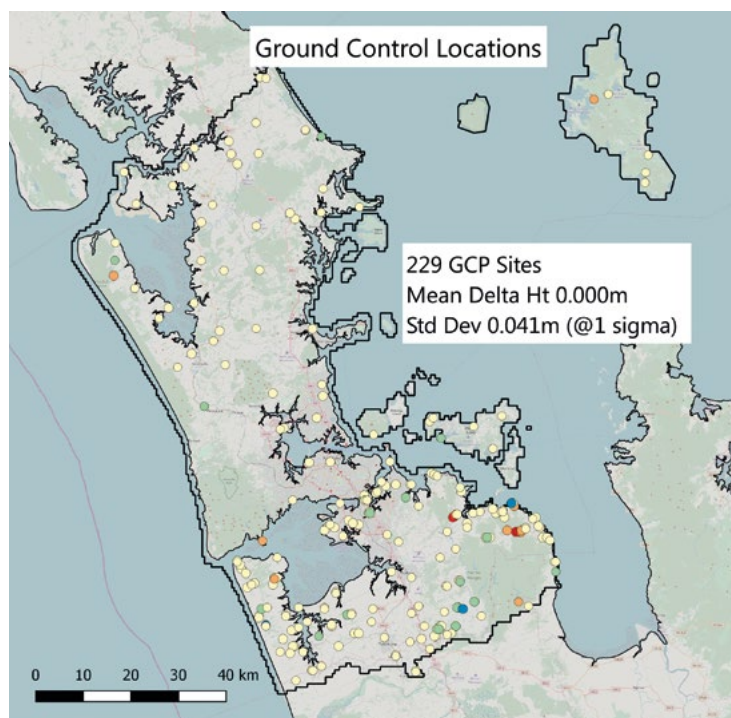


Figure 4 – Ground control site locations showing GCP sites and independent check sites.

The standard deviation of the site averages for all sites was 0.041m at one confidence interval with a mean of 0.000m showing the data matched to datum. The location of ground control sites is shown in *Figure 4*.

## Classification of the Raw Point Cloud

All points in the RPC are in one class before classification begins. The first task is to isolate low noise points. These are points which are below the ground and would likely cause incorrect ground classification. The low noise could be the result of atmospheric interference, water or other causes. Once these are isolated into class 7 (noise), the ground classification begins. Algorithms analyse tile zones of point data in an iterative process to classify all points on the ground into class 2. Terrain type, buildings, other structures and vegetation can all affect the quality of ground classification and are managed with pre-defined parameters for things such as maximum triangle length, rate of change of a grade and limits on spike points.

Water bodies are classified into class 9. This is often a manually guided process with delineated polygons along water boundaries, however it can be semi-automated by leveraging point cloud properties such as height, planarity, intensity and density.

Vegetation is classified into three separate classes, low vegetation (class 3) medium vegetation (class 4) and you guessed it, high vegetation (class 5). Low vegetation and medium vegetation are a result of height-above-ground classifiers, where low vegetation is from ground up to 0.3m above ground, and medium is from 0.3m to 2.0m above ground. High vegetation is above 2.0m above ground, however this also has the distinction of being the default classification for above ground data that fails the building classification routine which marks building points as class 6.

Elements that fail to be classed as building default to be in class 5 vegetation, however further classification can achieve separation of non-vegetation elements such as overhead lines, street lamps and vehicles.

Bridges have been classified as class 10 for this project. This aids the development of transport surface models where the bridge surface may be the desirable information rather than the ground underneath.





Figure 5 – Difference between DEM and DSM surfaces with aerial imager for visual reference.

## Digital Elevation Model (DEM) and Digital Surface Model (DSM)

The DEM has been sampled from last return ground points at 1.0m resolution to give a healthy balance between level of detail and volume of data. Hydro-flattening is included for DEM production to give smooth surfaces over water areas of significant size.

The DSM is sampled from first returns only. On open ground this matches the DEM surface, however where above ground features exist, the DSM shows the highest surface above ground. The DEM can be subtracted from the DSM to produce a height above ground derivative useful for tasks such as vegetation growth analysis.

## So we have a ground surface model, is it as good as the raw data?

The DEM has a distinct advantage of being a continuous surface, however surveyors should keep in mind that this also means information has been interpolated in order to fill voids within the ground TIN. Often these filled voids are obvious when we view with appropriate rendering as they show as unnaturally smooth surfaces when the void was caused by obstructions such as buildings.

Dense vegetation can also reduce ground coverage. High tree canopies can cause significantly reduced ground point density which will not be evident in a DEM raster. Dense low vegetation has the potential to completely prevent laser returns from the ground. The risk with dense low vegetation preventing ground coverage is the possibility of a ground classification routine following the top of the vegetation.

Only when we review the RPC with all point classes can we ascertain the reliability of the ground products. Metrics such as density of ground point returns can be produced to understand the characteristics of the dataset and of the LiDAR system used.

Many survey software applications have the ability to

work with LAS data giving surveyors the ability to develop DTMs utilising the full detail of the RPC. This can prove useful to better define rapidly changing features such as stream beds or built environments.

## Other products

What else can you do with the data? What does the RPC look like? Woods has produced a coloured flythrough showing the characteristics of the RPC: <https://vimeo.com/290828332>.

A few uses include:

- Forestry applications including canopy height model (CHM) for vegetation growth mapping and canopy density metrics
- Clearance mapping of overhead utility corridors
- Land use mapping can make use of building and vegetation classifications which can be aided with reflectance mapping.
- Building outlines, roof planes and solar potential analysis.

## How to access the data

The products include:

- Raw Point Cloud (all classes) (LAS)
- Class 2 Raw Point Cloud (LAS)
- Above Ground Point Cloud which includes classes 1, 3, 4, 5, 6, 9, 10 (LAS)
- DEM (ASC)
- DSM (ASC)
- Contours 0.25m (SHP).

For data requests or for the RPC, the GIS team can be contacted at [GISData@aucklandcouncil.govt.nz](mailto:GISData@aucklandcouncil.govt.nz).

DEM and DSM data is also available via the LINZ data service and contours are viewable on Auckland Council Geomaps: <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.



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- GLONASS: L1C/A, L1P, L2C/A, L2P, L3
- Galileo: E1, E5A, E5B
- BeiDou: B1, B2
- SBAS: L1C/A, L5, QZSS, WAAS, EGNOS, GAGAN, MSAS

#### Built rugged

The Horizon Kronos C3+ has a water resistance rating of IP67 for protection from water immersion up to 1 meter, for 30 minutes. The Horizon Kronos C3+ also boasts a staggering IK08 impact rating, to help resist up to a 3 metre drop on to a concrete surface.

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Along with a great new format and new style, congratulations go to all the winners of this year's NZ Spatial Excellence Awards. We are particularly proud of the Survey and Spatial NZ members who are well represented in this group with Kat Salm, Elaine McAlister, Claire Buxton, Geoff O'Malley, Dr Robert Odolinski and Julian Thom all being award recipients.

A new format was introduced this year – instead of a sit-down dinner, a late-afternoon cocktail format involving 8 video stations for viewing was employed. Over two hundred guests enjoyed the spectacle including Wellington Mayor, Justin Lester and The Hon. Eugenie Sage, Minister of land Information. Check out the award project videos at [www.nzsea.org](http://www.nzsea.org)

## Supreme Award AND Environment & Sustainability Award

### Ethos Environmental

*Ethos Environmental invented a GIS-powered Internet of Things system that records when a trap is sprung, with the data accessible from anywhere in the world. Not only is this system saving the unique and precious species of Glenfern Sanctuary on Great Barrier Island, Ethos Environmental are working with other groups and agencies throughout New Zealand to progress the use of GIS in pursuit of conservation.*



Scott Samball, Ethos Environmental receiving the Supreme Award for from Rebecca Strang, S+SNZ President



Minister of Land Information Hon. Eugenie Sage with Scott Samball of Ethos Environmental





New format project viewing station



New event format



Minister of Land Information, Hon. Eugenie Sage

## People's Choice Award

**Claire Buxton**

## Export & Innovation Award

**Orbica**

*Orbica produced a product called GeoBI with Environment Canterbury that combines business intelligence information with spatial data layers. The product has become a powerful storytelling tool for ratepayers, providing greater transparency and interactivity around how the council spends rates money.*

## People & Community Award

**The University of Auckland**

*The University of Auckland developed an index to better measure area-level deprivation through employment, income, crime, housing, health, education and access to services. All of this has helped people to better understand communities, and is informing research, policies and practices designed to reduce inequalities in society.*

## Spatial Enablement Award

**Christchurch City Council**

*The Christchurch City Council transformed its approach to using spatial information, to enable teams to create and share their own spatial applications. Now people who aren't spatial experts can innovate with spatial data and this has increased its use to help make good decisions and target Council services appropriately.*



Claire Buxton with her  
Young Professional of the Year Award



Geoff O'Malley,  
Outstanding Contribution to Spatial



Elaine McAlister, Professional of the Year with  
Steve Critchlow, Fellow S+SNZ



## Technical Excellence Award

### Orbica

*Orbica created a system called GeoAI that uses artificial intelligence to automatically extract and classify features of the Earth's surface. By classifying features in earth observation imagery captured from satellites, planes and drones; GeoAI provides rapid and valuable insights in real-time without needing onerous, expensive and time-consuming human intervention, which frees up people to focus on more valuable uses of their time.*

## New Zealand Cartographic Society Award

### Andrew Douglas-Clifford, Geospatial Analyst at Tonkin + Taylor, former Student at University of Canterbury

*Andrew is truly passionate about his maps. He calls himself the "Map Kiwi" and has a website devoted to his work. The website and two of his maps form part of his NZSEA submission in the Student of the Year category. The New Zealand Cartographic Society felt that these examples demonstrated Andrew's ability to clearly communicate through his maps. They showed a sound appreciation and awareness of, not only the principles of map design, but the importance and value of good map design.*

## Education & Professional Development Award

### Dr. Robert Odolinski, Senior Lecturer in GNSS/Geodesy at University of Otago

*Robert has achieved through his research, teaching and publications; and has proven his leadership in empowering his students; in fact, the 2018 Student of the Year – Julian Thom – is one of Robert's students. Robert's long-term dedication to not only the advancement of education but the overall industry is admirable.*

## Professional of the Year Award

### Elaine McAlister, Technical Geospatial Business Analyst at Department of Conservation

*In addition to Elaine's impressive work history and raving reviews from her peers, what really stands out is her commitment to encouraging and supporting women in the surveying and geospatial industries through the Women in Spatial group she established. This group has helped many women's careers to succeed in the spatial industry.*



Kat Salm with her Women's Leadership Award



Student of the year, Julian Thom

## Student of the Year Award

**Julian Thom, University of Otago**

*Julian has a strong academic record which has culminated in a piece of research on property rights which has strong application to the spatial sector. This work and further independent research was subsequently published in two academic journals demonstrating its quality and technical expertise.*

## Women's Leadership Award

**Kat Salm, NCTIR Visualisation Lead at Aurecon**

*Kat leads by example in her contribution to the spatial profession as a whole and has held many diverse and senior roles across the geospatial sector. These roles have inspired and continue to contribute to the profession, and the way that women look to their careers within this sector.*

## Young Professional of the Year Award

**Claire Buxton, Senior Licensed Cadastral Surveyor at Calibre**

*Claire's passion and enthusiasm are obvious from the significant impact she has already made on the geospatial industry. Her high involvement in numerous successful groups and committees shows that she acts as a role model for others in the industry and is an emerging young leader in her field.*

## Outstanding Contribution to Spatial Award

**Geoff O'Malley, Principal Analyst – Geospatial Capability Building  
at Land Information New Zealand**

*Geoff has long been involved with both spatial and survey in New Zealand, from when he graduated Otago School of Surveying he joined what went on to become Land Information New Zealand today. In recent years Geoff has worked with schools to encourage kiwi participation in the Barbara Petchenik Children's World Map Drawing Competition. He is one of handful of Geospatial Professionals in NZ who have the professional qualification of GISP-AP. In addition, Geoff has helped to organise the Geocart conference in 2016 and 2018. He was also a key driver behind getting Geospatial on the skills shortage list in New Zealand.*



Wellington Mayor Justin Lester



Guest speaker, Deanna Hutchinson, SIBA Australia

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**- Kevin Birch, Director of Birch Surveyors**



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Shaping New Dimensions

# Cross lease conversions as subdivisions

Mick Strack – [mick.strack@otago.ac.nz](mailto:mick.strack@otago.ac.nz)

## ***Application by Donald Fleming McKay*** **[2018] NZEnvC 180**

Cross leases have been a common form of land development since the middle of the 20th century – usually arrangements to allow for multiple dwelling units within one building or separately on one parcel of land. Cross leases have been a convenient form of development because they were not defined as subdivisions of land; surveys were simply required to illustrate buildings that were subject to a lease, and some exclusive occupation or shared spaces. Infrastructure servicing could be combined and was therefore cheaper, and planning consent was not required.

On the other hand, the property rights acquired were often misunderstood and caused some conflict among owners and perhaps also devalued the property (see Matt Ryder's commentary in *S+S*, December 2017). In the RMA 1991 cross leases were incorporated into the definition of a subdivision, which meant that subdivision consent was required to create cross lease titles. The word 'subdivision' has an obvious and common definition, but it also has a statutory definition in the Resource Management Act 1991 – specifically section 218. In 1999 the Law Commission recommended the phasing out of cross leases and conversion of their titles to separate fee simple titles or to unit titles.

Progress through the conversion process has been slow, partly because of apathy by cross lease proprietors, but partly because of the barrier of requiring a subdivision consent to acquire new fee simple titles. In the past, territorial authorities have allowed cross leases as a way to increase urban density and to allow shared services, so arguably, the conversion process is just a tenure issue rather than a resource management issue where the sustainable management of natural and physical resources and the effects of activities needs to be considered.

Don McKay, a Fellow of Survey and Spatial NZ (S+SNZ), therefore sought a declaration from the Environment Court that "the conversion of cross lease titles to fee simple titles **do not** constitute a subdivision within the meaning of section 218 Resource Management Act 1991". In receiving this application the Environment Court was concerned that due to the effect its decision would have on so many cross lease proprietors that the hearing should

be, if not adversarial, at least independent and widely discussed. It is interesting to observe that the court invited participation of MfE, LINZ, LGNZ and S+SNZ, and then the Auckland Council (given that a large proportion of cross leases are in the Auckland region). To the surprise of the court, only S+SNZ accepted the invitation. The court therefore found it necessary to appoint an *amicus curiae* (Dr K Palmer) to assist the court with legal issues and additional submissions.

The court described the issue as "deceptively simple in its terms" but "not as straightforward as it might appear". The arguments brought to the court seemed quite compelling: no additional environmental effects were introduced in the conversion process, and as a cross lease was already a subdivision (providing for separate composite titles to be issued defining exclusive interests over separate parcels), the further title conversion was not an additional subdivision.

The court stated: "While the plan of the cross leases may show separate areas of the allotment, those divisions are for the purposes of the lease and are not of the fee simple of the allotment."

I would suggest that those divisions are for the purposes of the issue of a separate composite title providing for separated interests in the land and that therefore the parcel is already divided. However, the court focused on the division of the underlying fee simple title (which is shared as tenants in common), rather than the spatially separated encumbering interests.

The court examined the statutory regime in detail, particularly RMA section 218. The court acknowledged that there is some circularity in the RMA definitions that link subdivision, allotment and survey plan such that they each define each other. This required the court to sometimes treat the word subdivision to just mean division of land. It is worth noting that several other recent cases have required definition of the term 'subdivision' (commentaries about which I will be writing more in a forthcoming *NZ Surveyor* journal). The court also clarified "the five methods listed in s 218 (1)(a) are not equivalent with each other except as being [different] types of subdivision".

The court summarised these provisions as: "No person may divide a parcel of land of continuous area and whose boundaries are shown separately on a survey plan by ap-

(continued page 36)

# DIVERSITY on the agenda

Kathryn Salm (Spatial Stream Chair) and Elaine McAlister (WIS Chair)

Diversity has been a theme in a number of forums this year, with a milestone celebrated of 125 years since women in New Zealand won the right to vote. It was a strong thread through the S+SNZ conference earlier this year in Nelson, a women's leadership award was awarded for the first time in the NZSEA awards and, in October, S+SNZ joined the Diversity Agenda New Zealand as a foundation member. (<https://diversityagenda.org/>).

The backbone of the Diversity Agenda is a clear industry target – 20% more. That could be 20% more women in management, or simply hiring 20% more women. It could be a 20% more diverse workforce (as diversity is not just about gender). Basically, the vision is to be 20% better at being diverse by 2021.

Diversity comes in many forms: gender, race, religion, sexual orientation, age, culture, background, etc. These are all important, as bringing people together from diverse backgrounds in an inclusive environment has been shown to increase innovation and generate ideas and perspectives that may not have been considered before. The Diversity Agenda acknowledges diversity in all forms, but

its first focus is on women, as women make up 50% of the population and yet the current statistics on gender diversity in the industry are dire.

To help raise awareness of the Diversity Agenda and some of the specific issues in our industry, WIS hosted Bridgit Sissons, GM for marketing and communications from Engineering NZ, for a lunchtime session to speak about the background, vision, and goals of the Diversity Agenda. This was followed by a short workshop to start to identify some of the key focus areas to improve the inclusiveness of the culture in our survey and spatial industry.

Bridgit provided an introduction and background to the Diversity Agenda by describing the recent changes that Engineering NZ has gone through in its transition from IPENZ, and the more inclusive, diverse and representative culture and membership that it is aiming for.

Currently, in engineering and architecture, the statistics are not rosy: the engineering industry is made up of about 14% women, and architecture about 22%. As well, about 30% of women leave the profession in the first five years. The issue is not just attracting women but retaining them,

(continued from page 35)

plying for a separate certificate of title for part of that parcel unless allowed by a district rule or a resource consent and is shown on a survey plan suitable for deposit under the Land Transfer Act 1952."

The court recognised that the issue being brought before it was both a strict legal issue and that it had wider practical issues relating to cross leases. It is therefore, worth noting that the composite cross lease titles are supported by a cross lease survey plan, which clearly identifies the spatial extent of the lease, the exclusive covenant area, the common area and the area of the fee simple title held as tenants in common. These boundaries can be used for the fee simple boundaries, so no new parcels or boundaries need be created (although they would need to be shown on a new survey plan as allotments). However, the court returned to statutory definitions: "it thus constitutes the division of a parcel of land shown separately on a survey plan and therefore is the subdivision of land within the meaning of s 218(1)(a)".

The court refused the application for the declaration as applied for, and confirmed that the conversion of a cross lease to fee simple title was a subdivision that required a resource consent.

However, the court proceeded to comment on the practical issues raised, to suggest that the existing use of a cross lease development and the fact that no practical effects were involved might be a way to encourage consent for a conversion. It stated that planning consent conditions must: a) be imposed for the purposes of the RMA and not for any ulterior purpose; b) fairly and reasonably relate to the development; and c) not be unreasonable. Furthermore, "the consent authority should generally approach such an application in a way that is mindful of the possibility that there may be few, if any, material environmental implications warranting a full-scale assessment".

The next step might be to try to get territorial authorities to record cross lease conversions as permitted activities and therefore exempt from the consenting conditions.

Don McKay and S+SNZ must be congratulated for bringing this application to the courts. Unfortunately it was declined, but it has clarified the legislation and provided implicit guidance to councils to facilitate cross lease conversions. The judge's statements in the previous paragraphs should be attached to, and for the support of, any subdivision consent application for a cross lease conversion. Good luck with that.



and supporting women into leadership positions. The stats become worse in higher positions – only 9% of engineering technical leads are female and only 3% of Engineering NZ Fellows are women. In our own industry, based on current S+SNZ membership, about 10% are women with no female S+SNZ Fellows at the time of writing this article!

This is what the Diversity Agenda aims to address. They are signing up organisations (76 to date) to commit to drive changes in workplace cultures and environments – which are key in encouraging and retaining women. They have a six tikanga (principles) within the Agenda:

- Creating a culture of respect
- Appointing women to senior roles
- Offering flexible working
- Working towards pay equity
- Building career paths not glass ceilings
- Championing diversity and inclusion.

All of these rely on participants championing change and action at an organisational level.

The Agenda has an approach of 'What gets measured is what gets done.' They have met with CEOs who can reel off numbers on their health and safety statistics, revenue and other key metrics off the top of their heads, but have no idea how many women there are in their organisation, in leadership roles, or even on their boards. By creating a measurable target, the Diversity Agenda aims to provide a benchmark for change.

WIS also ran a short workshop which posed the question around what the specific challenges are for our industry in particular, and how we might start to address them. There were some key themes that emerged, which were summarised in the diagram below.

These included raising awareness of – and addressing – unconscious bias; implementing supportive policies around diversity (which are often lacking especially in



Mind map by Dionne Hansen, WIS committee member

smaller organisations); instilling more inclusive values; not just having flexible working but making it OK to work that way without the stigma which is often attached (supporting 'leaving loudly'); and supporting and raising the profile of female role models – not just for our current professionals but also for future generations looking at the industry as an option.

WIS has also recently completed a survey of women in the industry alongside the University of Wellington, and we expect the outcomes of that shortly which should provide additional, valuable insight into the current state of our industry diversity.

Simply – diversity equals creativity. This is not just a 'women's issue' or an issue for other under-represented groups, but is a human issue and a business imperative. For example, aside from the ability to generate new ideas and approaches, supporting diversity also opens you up to a bigger talent pool and supports retention. It also supports a more vibrant company culture. It's worth thinking about...

(Note: The Diversity Agenda offers some great outreach and awareness initiatives, and resources through its website to support change. For more information, go to: <https://diversityagenda.org/>.)





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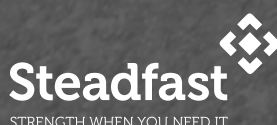
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Christina Hulbe

*"I heard you this morning peddling the usual PC lies. Why are you a professor of surveying? Do you even know which end of the theodolite to look through?"* These are the first few lines of an email I received a few hours after an interview on the morning television news about a research article on Greenland, Antarctica and sea level rise that had just been published in the journal *Nature Climate Change*. I don't think what I had to say was "politically correct", at least it was not my intent to spare the feelings of climate change deniers, who are clearly the social out-group in this situation. The other two questions, while apparently meant as insults, are perhaps worth addressing.

*Why surveying?* I am interested in making new measurements, developing new approaches to the analysis and visualisation of geospatial data, *and* grounding people in the midst of the changing environment, all of which makes the National School of Surveying the right place to be. Surveyors and spatial professionals are helping communities all across Aotearoa New Zealand continue to grow in ways that are responsive and resilient in the face of future change.

*Which end of the theodolite?* My correspondent should try harder. Paul Denys is using precise GNSS to detect 3D motion all across Te Waipounamu/South Island landscapes, including the inexorably rising sea. It's the patient, methodical approach of a geodesist that makes Paul's work valuable to coastal managers. PhD student Todd Redpath is using repeat drone-based photogrammetry to measure snowpack in central Otago and his supervisor Pascal Sirguey is developing new algorithms that together with very high-resolution satellite imagery are being used to detect change in rugged alpine environments. Todd and Pascal are driven to characterise the errors and improve their algorithms but water and land managers care just as much about the results of this work. Emily Tidey is using multifrequency echo sounding to map marine habitats.

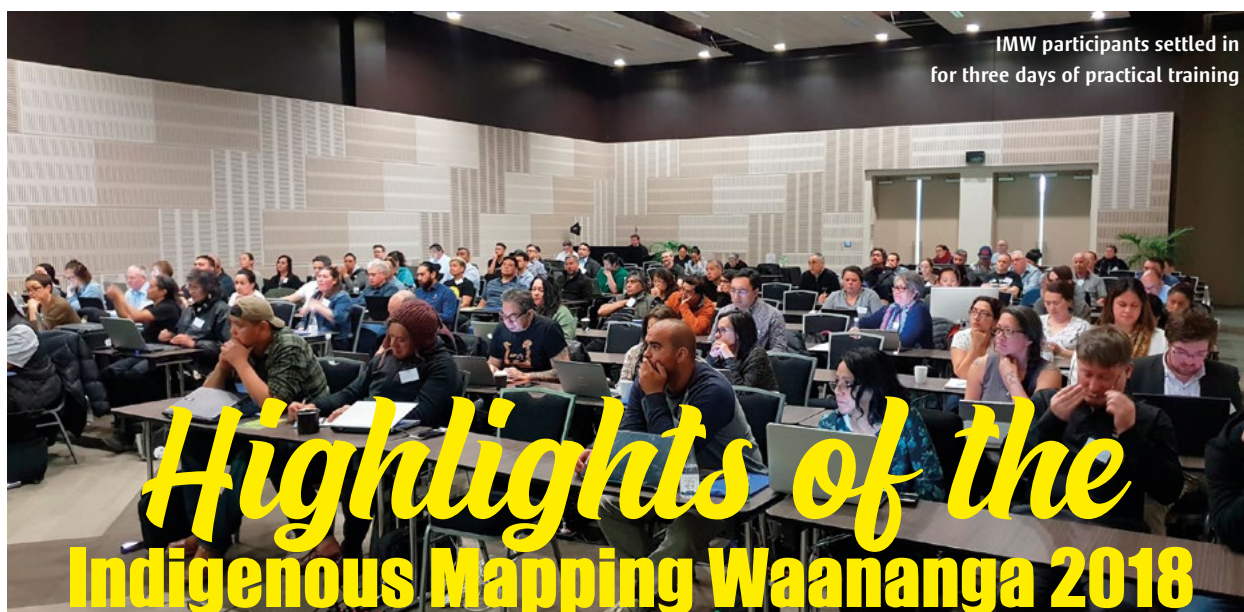
Emily is driven to understand the acoustics but marine scientists and coastal communities care just as much about the new map and how it can be integrated into customary resource management. Meanwhile, David Goodwin and Mick Strack are reflecting on the importance of figurative language (*figurative!*) in understanding what people really mean when they forge agreements about the land. And me, I'm writing code that simulates glacier physics and helping colleagues in Antarctica make sure their land surveying goes to plan. The examples could go on and on but you probably take my point. We are diverse, we link surveying and spatial theory with applications that matter in the real world, and we all know the right end of the telescope. More importantly, we know why we are using our chosen tools for our chosen work, and we care about the results and the people who will use them.

I'm confident that the authors of the research article I was asked to comment on feel the same way. The article, a new synthesis of work conducted at several universities (including Victoria University of Wellington), aimed at answering this question: What happens to the polar ice sheets if governments do manage to meet the Paris Agreement global average warming target? The team came to two main conclusions: one about sea level rise at 2100 if the Paris targets are met and a second about "tipping points", thresholds in the physical processes that if crossed lead irreversibly to large changes in the ice sheets.

The good news: If we can keep the average warming between 1.5 and 2°C then the models suggest the net sea level rise from Greenland and Antarctica will be up to about 18cm by 2100. The bad news: Warming to that level probably does pass the threshold for more change in Greenland even after climate stabilises. The less clear news: The threshold is probably not crossed for Antarctica but we need a much better understanding of some key

(continued page 43)





*Duane Wilkins, Geospatial Advocacy, Capability & Outreach, Land Information New Zealand*  
 Email: [dwilkins@linz.govt.nz](mailto:dwilkins@linz.govt.nz)

E ngā mana, e ngā reo, e ngā karangaranga maha o te ao, tena koutou katoa.

Indigenous peoples and local communities have a strong role to play as kaitiaki, maintaining a long-term balance of environmental protection and natural resource management, and often see themselves as looking after the land for the next generation.

In early 2018, LINZ provided logistical support for the fifth Indigenous Mapping Waananga (IMW), a training event at Claudelands Event Centre, in Hamilton, which was hosted by Waikato Tainui and attracted 150 participants.

IMW 2018 provided hands-on training in using and accessing geospatial information to support and advance iwi, hapu and whanau aspirations by increasing indigenous digital mapping capabilities from the ground up. In addition to using the tools, the training including the application of geospatial technology to asset management, land-use decision making, and the visualisation of tribal histories.

Geospatial tools can assist the kaitiaki role of indigenous people by providing a means to develop, store and share traditional knowledge handed down through generations and preserving it for generations to come.

## Rangatahi Day

On the first day of the event we were joined by 75 senior student representatives from te kura kaupapa Māori schools that have invested in building capability to use geospatial technology in the classroom. Students learnt about drones from DJI, coding from Google developers,

capturing 360 Streetview imagery and creating virtual reality (VR) tours with international guests from the United States, Canada, Australia and India as well as local experts.



Erana Kihī, a teacher at Te Wharekura o Rākaumangamanga, described the value of geospatial mapping to students

Activities focused on a final presentation by each group, ending in total chaos as the last of the chocolate rewards and treats were used to encourage voluntary demonstrations. The students were very productive, demonstrating ancestral stories using maps, recorded waiata, and a variety of games developed in the coding sessions.

A focus for many Māori communities is succession planning, involving the next generation to take on knowledge, leadership and associated responsibilities. Working with Google developers and hearing speakers from LINZ, Digital Navigators, Stanford University, DJI and others, the students found this a memorable and career-inspiring event.



Raleigh Seamster, Google Earth Outreach programme manager, talked about the ways other indigenous groups use Google Earth for mapping their projects

## Highlights

When you're sharing historical, oral and traditional stories, communicating with others based on landscape features, you can't beat 3D visualisations. Iwi groups immediately see and understand the value that 3D mapping provides for creating visualisations and flythroughs to communicate oral and traditional stories, journeys, and sites of significance, all of which helped navigation and verbal maps of the landscape. Most used the tools to visualise their own story or their mihi, describing the maunga, awa, or moana they associate with their whakapapa.

Raleigh Seamster, from Google Earth Outreach, led the Tourbuilder sessions. Tourbuilder enables users to create online stories that can be shared based on featured locations. Media and descriptive text provide a guided step by step storyline – a similar structure to a PowerPoint slide outline view. These can also be downloaded for use in Google Earth, providing a well-formatted pop-up that is quite difficult to produce in native KML. Google Earth Desktop was one of the most well-attended software tutorials. Of particular interest to Māori is the ease at which

you can overlay and georegister a historical ML plan or aerial photo, which inherits the 3D properties of the layer underneath.

Using the 'snapshot' view function for each place, the default 3D view can be updated to any custom angle, and played as a flythrough tour. Tourbuilder files can also be opened in [earth.google.com](http://earth.google.com) for online 3D viewing. Check it out at [tourbuilder.withgoogle.com](http://tourbuilder.withgoogle.com).

OK, now that you're familiar with Tourbuilder, and just to confuse you, there's an even more exciting tool – Google Tour Creator [vr.google.com/tourcreator](http://vr.google.com/tourcreator). It also enables storytelling, but uses 360 images from Google Streetview



Wiremu Ruru, on behalf of Te Runanga o Turanganui a Kiwa, presented a 3D visualisation work developed since the IMW 2017 event

as the basis for content, and allows you to include narration, ambient audio and popup imagery, inside a VR experience. Anyone can access these stories on a desktop, without a headset, or you can buy a cardboard one on [Trademe.co.nz](http://Trademe.co.nz) for about \$5 that uses your smartphone as the screen.



A VR tour created with [vr.google.com/tourcreator](http://vr.google.com/tourcreator) which tells the story of Paikea



## QGIS.org

This year we had a large turnout for QGIS training. Pano Skrivanos, from Inlailawatash, Canada, with support from Emory Beck, from Kenex, took participants through the basics of creating maps, editing and managing data. QGIS is an open source free desktop software app that is one of the few GIS applications available for OSX and Linux. Using plugins can provide all the GIS desktop functionality you would expect to perform desktop geospatial processing.

## Esri ArcGIS.com

Leading up to IMW, awareness and demand for 'Storytelling with Maps' was generated using webinars on the Māori GIS Facebook group and this approach generated a huge turnout for the storytelling and related sessions. As iwi authorities develop capability and asset management, they have a strong need to build a spatial view of their asset base and develop mobile apps to support management and environmental monitoring. A key part of communicating this work is sharing this information in formats that can be consumed by a variety of audiences and trust beneficiaries. Storymaps and 3D maps are a great way to do this.

IMW encouraged field data capture using the Esri suite this year, as, while there are many free tools, their online tool provides good ease of use, administration, integration and has long-term data security built in. Professional Esri trainers joined us from Eagle Technology. Participants



who completed most of the Esri-based sessions were able to apply for a year's home user licence to help maintain their momentum.

But the star of the sessions at IMW 2018 were the Esri ArcGIS Online StoryMap sessions. You can view the growing collection of these in the gallery at <https://storymaps.arcgis.com>.

One of the most inspiring applications we have seen so far has been the use of a storymap to provide an update and report, *He Tangi na te Ruru, Report on Phase 1: Poukai-based research 2016 – 2017*. You can view this at [tinyurl.com/teRuru](https://tinyurl.com/teRuru).

## The main event: Free data

The most popular session was 'geospatial data for iwi Māori projects', which had to move to a much larger room. We thought it might be useful to share a few thoughts about the key open datasets sought for iwi Māori projects.

### LINZ Data Service | [Data.linz.govt.nz](https://data.linz.govt.nz)

LDS is the first stop for property data. Here you can find parcel boundaries, survey plans, titles and owner details,

as well as being a great source of imagery and elevation data. One dataset of interest for iwi Māori mapping projects are the spot heights – which can make it easier to identify the peak of a maunga, as well as the historical points from the topographical data – 1:50k and 1:250k. Water features like river and lake lines and polygons are also a primary dataset as these have historical significance as highways and food sources. Modern tracks from the topographical maps are also useful in identifying historical trails.



Pano Skrivanos is a drone expert, but at this moment – holding a crashed \$20,000 LiDAR drone – he was not feeling that great!



## Stats NZ |

[datafinder.stats.govt.nz](https://datafinder.stats.govt.nz)

People who want authoritative regional, district, city and unitary council boundaries should start by looking at this site. Generally most census data for Māori communities is difficult to use as the populations are often in sparsely populated rural areas, but this information is still useful to calculate drive times. These can be used to determine service areas, for example, how many people live more than one hour's drive from a medical centre, and what is the demographic makeup of those communities.

## Ministry for the Environment | [data.mfe.govt.nz](https://data.mfe.govt.nz)

A huge number of environmental data layers are available but the most sought-after layer from MFE is the river environment classification, including the linework and the polygon catchments. For Māori groups, being able to collect the significant catchments and being able to identify the river hierarchy can assist discussion and decision making for environmental projects, as well as project-based monitoring and evaluation reporting.

## Māori Land Court | [hae.re/mlc](https://hae.re/mlc)

The Māori Land Spatial Dataset was published on the site in May 2017 in addition to management data. One of the most useful fields in this data is the URL field that points a user to the same block on the Māori Land Online site.

## Manaaki Whenua Landcare Research |

[iris.scinfo.org.nz](https://iris.scinfo.org.nz)

Two stand-out datasets for iwi Māori projects are the NZLRI Land Use Capability Assessment and the Land Cover Database (LCDB) 4.1.

Often when people ask for a 'soil map', generally they are not wanting FSL NZ soil classification, which takes a fair effort to understand. The Land Use Capability Assessment (LUCA) will usually better meet their needs, including the main limitations and extent of that limit. This data describes the ability of each area to sustain agricultural production based on an inventory of factors including rock, soil, slope, erosion, and vegetation within a scale of 1-8. LUCA 1 represents land with no limitations, and LUCA 8 is land with very severe limitations, making it unsuitable for cropping, pasture or forestry.



Tania Wolfgramm on YouTube – © Youtube.com  
([youtube.com/watch?v=nHtyuFZF2bg](https://youtube.com/watch?v=nHtyuFZF2bg))

The other primary dataset is the Land Cover Database 4.1. This dataset comes into its own when you overlay data from the Māori Land Court with class 68 manuka/kanuka and other native cover to identify suitable areas for manuka honey production. The other dataset you'll need to complete the analysis for a given area, are the approximate locations of existing hives, to ensure good coverage and distributed pollen harvesting and avoiding surprisingly violent battles and all-out war – and you thought honey bees were peaceful creatures!

## Tonga is now on Google Maps Streetview | [hae.re/tonga](https://hae.re/tonga)

And we saved the best till last. The most memorable part was a presentation by Wikuki Kingi and Tania Wolfgramm, who presented the results of their work over the past year to put Tonga on Google Maps Streetview. They connected with the Streetview programme manager at IMW 2017, and it was amazing to see what they've collected over the past year. Google prepared an excellent video about their work which you can find at [hae.re/tonga](https://hae.re/tonga) or just search YouTube for 'Tonga Streetview'.

So there are a few thoughts, tools and data we thought could be interesting to share. We're not sure yet if there will be an Indigenous Mapping Waananga 2019, or if it could be a series of regional sessions. Join the community on Facebook, join us at MaoriGISNZ and like IMWNZ for future updates.

(continued from page 39)

physics in order to be more confident about this result.

It's easy to choose the pessimistic view and assume the worst, that either we won't get our collective act together and slow down before the worst scenarios are locked in or that it's too late to do anything about it.

That's not my experience of surveying and spatial professionals. I think you all are optimists. You take the measure of every new situation and know how to pay attention to the details without losing sight of the big picture. *Why surveying?* That's why.



Toni Hill

SEPTEMBER 19, 2018 WAS A SPECIAL DAY CELEBRATING 125 YEARS SINCE WOMEN WERE GIVEN THE CHANCE TO VOTE IN NEW ZEALAND. OVER FOUR DAYS, AT THE WOMEN IN INFRASTRUCTURE, CONSTRUCTION AND ENGINEERING SUMMIT, 97 PEOPLE ATTENDED THE DAYS OR THE WORKSHOPS EITHER SIDE OF THE SUMMIT. ATTENDEES CAME TO AUCKLAND FROM A RANGE OF BACKGROUNDS AND ROLES, AND FROM ALL ACROSS THE COUNTRY. I WAS DELIGHTED BIRCH SURVEYORS GAVE ME THE OPPORTUNITY TO ATTEND THIS INSPIRING SUMMIT FOCUSING ON LEADERSHIP FOR WOMEN IN OUR WIDER INDUSTRY.

### What was it all about?

Day 1 for me consisted of a pre-summit workshop on crafting a strengths-based approach to leadership. There was a small group of us attending and this created a focused environment to develop self-awareness to comprehend and minimise weaknesses. The workshop empowered us to build effective strategies to improve unique leadership talents and equip us with the knowledge to shape our team's capabilities based on its strength. The aim was to inspire supportive leadership.

The summit itself was held over two days and included a number of case studies, panel discussions and sharing of personal experiences in the industry. Topics included moving forward in your role; managing multidisciplinary teams; driving positive change; successfully managing career breaks; champions for change; establishing yourself as a confident leader; inspiring authentic leadership; building resilience to lead and empower; setting the foundation for effective delegation; achieving fearless leadership; leading through uncertainty; emphasising accountability as a leader; creating the world our hearts

know is possible; and paving pathways for confident leadership.

The event concluded with another small group attending the post-summit workshop on channelling assertiveness through effective communication. This was focussed on communicating in a confident and firm manner without being perceived as aggressive and allowing for the proactive resolution of challenges through cooperation, feedback and incorporating ideas and opinions.

### Some of the facts

Internationally, according to Grant Thornton International's annual *Women in Business Report*, 75% of businesses have at least one woman on their senior management teams (up from 66% in 2017) but the proportion of women in senior management roles has slipped from 25% to 24%. New Zealand, however, has gone from 63% down to 44% of businesses with at least one woman on their senior management team and an all-time low of 18% of women in senior management roles, down from 20% in 2017, and down from 31% when the report began in 2004.



New Zealand previously ranked in the top 10 countries surveyed, but is now ranked 33rd out of 35 countries.

Within our own industry group, 11% of S+SNZ members are women and the Board has 64% female representation, Council 33%, Branch chairs 12%, CSNZ 3.5% and the latest information on the Cadastral Surveyors Licensing Board website shows a 40% representation. It's really great for the young women coming through to see this representation although it would be great to have more women join our amazing industry, and have female ownership of companies increase also.

Overseas statistics suggest more than half of women who enter STEM fields leave within a decade – 56% of women leave organisations at mid-level points in their career, usually due to workplace experiences rather than family-related concerns.

### Why women-only training?

So when we are fighting for equality and to be treated equally, why then do we hold these sorts of events for women only to attend? Is this gender discrimination against males? Many of the topics covered are specifically designed for a female audience. While some men would possibly benefit from hearing the discussions around some of these topics, being in a female-dominated space creates a friendly vibe where more people are willing to contribute to discussion and ask questions. Events like this also give valuable opportunities for networking with like-minded individuals to share stories, inspire and network with each other. Traditional networking events like

rugby games, golf days and after-work drinks are not necessarily events that support many women or those with families. For me personally, I really enjoy hearing the story behind how people got to where they are and some of the issues and challenges leaders have faced to get there. Putting myself in the speaker's shoes and thinking how I would deal with the same issue if I was faced with this not only makes me more prepared should I be faced with that particular issue but it has also enabled me to better support other colleagues or friends in similar situations. Hearing some of the stories of situations that some have had to deal with certainly makes me grateful for the opportunities and experiences I have had. The sharing of resources is also hugely important.

### Unconscious bias

While I believe there is great value in these sorts of events, it is important for us to realise attracting greater diversity into our industry is not achieved by the diverse group alone. It needs the industry overall to contribute. The summit included a panel of men who were described as 'champions for change' as well as presenters talking about constructively dealing with conflict and emphasising accountability as a leader. Their presentations generated a lot of discussions afterwards and it is important men are at the table to hear about the issues that women face. Even those who are well meaning may have an unconscious bias that may have a detrimental effect on retaining women in the industry; women need to be able to bring this unconscious bias to people's consciousness.







are given the opportunities for personal development.

There are a number of providers out there that create training opportunities for professional development. The seminar I attended was run by Liquid Learning and was very enjoyable, it emphasised a lot of the knowledge I already had in my leadership journey but it gave me a few more resources I could turn to. It was a great networking opportunity to connect with amazing women in the wider industry who are so resilient and doing wonderful things.

I am very grateful to Birch Surveyors for allowing and supporting me to attend this

## Career breaks

One of the topics discussed at this summit was focused around career breaks which many would assume would focus around motherhood. Policies and support for people wishing to have career breaks is not solely for mothers but is equally relevant to fathers. It also includes those wishing to take time off for travel, sporting commitments, for health reasons, caring for others or undertaking further studies. These opportunities seem to be attractive to the young professionals coming through where work-life balance is more of a focus in their lives.

## Investing in your staff

It's been said that: 'The only thing worse than training your employees and having them leave is not training them at all and having them stay'. Employees are a company's most important asset and should be heavily invested in. Employees feel valued and appreciated when they

training and the other recent training opportunities that myself and colleagues have attended. Feeding back this knowledge, experience and learnings to other colleagues has reinforced our learnings, and has been a lot of fun and good for all concerned.

I would encourage every employee to look for something that appeals to them and employers to invest in their future and: "Live as if you were to die tomorrow. Learn as if you were to live forever" – Mahatma Gandhi.

Survey + Spatial runs workshops through specific streams (for example, the Engineering Workshop and Good Survey Practice Workshop), as well as holding a conference each year. The 130th Annual Conference will be held in Auckland in May 2019 with the theme 'Shaping Tomorrows Communities'. These are very good value for money and I would recommend that as many people as possible support these events.



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Fellow

## S+SNZ 2018 FELLOWS

THIS YEAR WE ARE CONGRATULATING FOUR MEMBERS WHO HAVE GAINED THE HONOUR AND DISTINCTION OF BEING VOTED FELLOWS OF SURVEY AND SPATIAL NZ BY THEIR PEERS. VICKI NALDER (OUR FIRST FEMALE FELLOW), MARK ALLAN, MIKE MOORE AND BRUCE MCFADGEN WERE ALL ACKNOWLEDGED AT A FUNCTION FOLLOWING THE S+SNZ AGM IN NOVEMBER 2018.

### Viki Nalder, Blenheim



Viki receiving her certificate from Rebecca Strang, S+SNZ President

The Fellow Award is for eminent service to Survey and Spatial New Zealand and the members who nominated Viki for the fellowship believe she encapsulates this with her engaged attitude to S+SNZ matters and her past and current achievements. Viki is seen as an inspiration to many and is worthy of the award of Fellow.

Currently Viki's work in the survey profession includes Chair of the Licenced Cadastral Surveyors Board (CSLB) and an active voting member of the Nelson Marlborough Branch. Recently she was in Dunedin visiting the University of Otago Te Kura Kairūri, as Chair of CSLB.

### Mark Allan, Christchurch



Mark has 42 years of experience in the survey profession as a Registered Professional Surveyor and a Licensed Cadastral Surveyor. During his career he has given many hours of service to S+SNZ and the survey profession, culminating in serving terms as both Chairman of Consulting Surveyors New Zealand (CSNZ) and President of S+SNZ in 2016 and 2017.

His service includes serving as Canterbury Branch Secretary and serving on the Membership Committee of S+SNZ Council in the early days of his registration, as well as serving on the Management Committee of Consulting Surveyors New Zealand (CSNZ) from 2004-2013, including a term as Chairman from 2009-2011. He was an S+SNZ Board member from 2013-2015 and a member of the Council from 2009-2017, including a term as President from 2015-2017.



## Mike Morris, Wellington

Mike's most recent service to S+SNZ has been as a member of the Ethics Committee to which he was invited to join in 2007 and is still active in.

He has dedicated a huge amount of time to S+SNZ since becoming a member in 1983, using his extensive legisla-



tive expertise. This has included the Wellington Branch executive committee in the 1980s; the Legislation Committee in 1992 (led by Stuart Kinnear) in which he played a significant part in the submission leading to the first major amendment of the Act in 1993, and a Council member from 1994-1996.

In his role on the Legislation Committee, Mike was actively involved in preparing submissions on bills and making submissions before various select committees. These bills included the Resource Management Amendment, Conservation Amendment (including submissions on the fallacy of the Queens Chain), amendments to the Building Act, Cadastral Survey and Local Government, and arguably his most significant role related to the review of the Unit Titles Act 1972. During this time, he was the S+SNZ representative from 2005 to 2010 on the Department of Building and Housing's External Reference Group.

Mike also represented the Institute on the Quality Planning Steering Group from 2000-2004, which led to the establishment of the Quality Planning website, the primary tool for delivering robust information on RMA processes and environmental policy to resource management practitioners.

## Bruce McFadgen, Wellington

Bruce is a Registered Surveyor and has been a member for 50 years. He has a Dip. Surv, MA(Hons) Anthropology, and a PhD (Geology).

During his career, which has included surveying with the Department of Lands and Survey, staff archaeologist with NZ Historic Places Trust, and scientist with the Department of Conservation, he has written several books and published over 60 refereed journal papers. Upon retiring from the Department of Conservation in 2003, Bruce became the J.D. Stout Fellow at Victoria University of Wellington. He is currently an Honorary Research Associate with the School of Maori Studies at Victoria University where his research makes use of old survey plans and field book

records and where possible, recognises their value as an important historic record.

Bruce was editor of the *New Zealand Surveyor* from 2007-2014 and has represented S+SNZ on the Royal Society of NZ Constituent Organisations Committee for many years. He is also a regular presenter at conferences and a great supporter of the history of our profession.



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The key to accuracy in any mapping or 3D modelling project is control. This can be either GCPs (ground control points) visible in the photos, or camera locations, the precise point where each photo was taken.

Enabling your mapping data acquisition with accurate camera locations and lens calibration will reduce or eliminate the need for GCPs, saving on ground survey crew time and cost while increasing accuracy and reliability.

One of Position Partners most popular RPAS Surveying configurations is the DJI Inspire 2 with X4S camera and Klau PPK system. This camera has all the right features for photogrammetry and is modified and calibrated by Klau Geomatics. Precise event timing for the PPK module and X4s lens calibration creates sensational photogrammetric data and ensures that you are providing the highest levels of absolute accuracy available for your clients.



\* Note that the Klau PPK module can be customised for almost any RPAS system. Contact us about your product today!

**Get in touch today:**

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