

Summer Edition 2024 #114

# SURVEYING + SPATIAL

*Magazine*

# *River,* LAND & Sea

WORLD HYDROGRAPHY  
DAY SEMINAR

GEOMETER DREAMS

2023 SPATIAL  
EXCELLENCE AWARDS





## Focus on River, Land and Sea

River, land and sea issues have increasingly gained prominence in New Zealand as severe weather events and climate change impacts are felt around the country.

Over the last few years, the devastating effects of flooding in Westport, Auckland and Hawkes Bay have certainly raised the issue of flood protection in our communities and central and local government authorities have recently had to escalate their response to meet changing conditions.

Flood resilience packages will be critical for our flood affected communities and those at risk to ensure greater flood resilience for the future. The Government allocated a \$203 million flood protection fund for Hawkes Bay and \$22.9 million fund for Westport last year, ensuring a good start for future infrastructure, but no doubt more will be needed to protect New Zealand communities over time.

In this summer edition of Surveying + Spatial we're focusing on the theme of River, Land and Sea, the impacts in the surveying and spatial sectors and projects and new developments that are helping our communities deal with changing environments.

In our feature story this edition, Mick Strack provides some insights and commentary from his own research into rivers, coastal ownership and boundaries and prompts for



further public discussion around the issues of environmental based land-use solutions for the future.

Reveal's John Parker presents a fascinating case study on the RiverLink subsurface risk management project in the Hutt Valley. The forthcoming RiverLink programme is a significant urban works project incorporating flood protection works, urban revitalisation and greater transport connectivity in Lower Hutt and Melling.

Jonathan Chuhaury, Sophie Clayton, Robbie Greene, Emily Tidey report on the 2023 World Hydrography Day Seminar at the School of Surveying in Dunedin.

And following on from the Auckland awards ceremony, we showcase the winners of the 2023 Spatial Excellence Awards. •



### **SURVEYING+SPATIAL ISSUE 114 SUMMER 2024**

A publication of Survey and Spatial  
New Zealand, Tātai Whenua.

ISSN 2382-1604

[www.surveyspatialnz.org](http://www.surveyspatialnz.org)

#### **EDITOR**

Rachel Harris

[surveyingspatial@gmail.com](mailto:surveyingspatial@gmail.com)

All rights reserved. Abstracts and brief quotations may be made, providing reference is credited to *Surveying+Spatial*. Complete papers or large extracts of text may not be printed or reproduced without the permission of the editor.

Correspondence relating to literary items in *Surveying+Spatial* may be addressed to the editor. Papers, articles and letters to the editor, suitable for publication, are welcome. Papers published in *Surveying+Spatial* are not refereed. All correspondence relating to business aspects, including subscriptions, should be addressed to:

The Chief Executive  
Survey and Spatial New Zealand  
PO Box 5304  
Lambton Quay  
Wellington 6140  
New Zealand  
Phone: 04 471 1774  
Fax: 04 471 1907  
Web address:  
[www.surveyspatialnz.org](http://www.surveyspatialnz.org)  
Email: [admin@surveyspatialnz.org](mailto:admin@surveyspatialnz.org)

Distributed free to members of S+SNZ.

Published in March, June, September  
and December by S+SNZ.

#### **DESIGN & PRINT MANAGEMENT**

GOODHERE – [www.goodhere.nz](http://www.goodhere.nz)

[hello@goodhere.nz](mailto:hello@goodhere.nz)

#### **TO ADVERTISE**

Email: [admin@surveyspatialnz.org](mailto:admin@surveyspatialnz.org)

or contact Tara Ranchhod

+64 4 471 1774



.....

# LAND RIVER AND SEA

*Mick Strack*

In response to the theme of this edition, it seems appropriate to contribute a few comments, reflections and summaries about my research into rivers and coastal ownership and boundaries. I hope many of the following issues will become major discussion points as we return to nature-based land use decisions.

## **River definition**

The legislated definition of a river leaves room for uncertainty. The RMA (s2) states: "a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not



include any artificial watercourse". However, it then adds that for the purpose of setting aside an esplanade reserve (s230(4)) adjoining a river, it is only when a river bed "has an average width of 3 metres or more where the river flows through or adjoins an allotment". For a surveyor, therefore, the bed width needs to be measured, whether there is flowing water there or not.

### River ownership

The ownership status of rivers is confused and often uncertain. In 1987, the Catchment Authorities recommended that it would be simple and appropriate to vest all rivers in the Crown. This recommendation was not followed, perhaps because it would be too complex to identify (and survey) all complying rivers, but also because such a tenure

conversion would apparently be confiscatory of recognised private property. Since then, even more variation of ownership has been implemented.

The fundamental common law presumption is that rivers are owned *ad medium filum* (to the centre line) by the adjoining owners. This is rebutted if the river is tidal (therefore an extension of the sea) or navigable (therefore being of prior public utility) when it is thus owned by the Crown. It may alternatively be open for Māori to assert that their customary title to a river has never been extinguished, in which case it may remain subject to unalienable Māori customary title. Or, as a result of a Treaty settlement, a river may be established as its own legal entity and under some jurisdictional control of an iwi.

### Making room for rivers

Past and current developments have squeezed river space to the extent that rivers, which have always been land-forming agents, no longer have the space to expand across flood plains, and adapt to changing environmental conditions. The priority given to fixed boundaries and productive land use have separated us from natural ecosystems. We have used rivers as free water sources (for energy and irrigation) and drains (for effluent disposal). It is time to consider rewilding all natural ecosystems.

### River boundaries

The cadastral question, however, remains: 'Where are the boundaries of a river?'

The bed is "a) in relation to any river— (i) for the purposes of



esplanade reserves, esplanade strips, and subdivision, the space of land which the waters of the river cover at its annual fullest flow without overtopping its banks; (ii) in all other cases, the space of land which the waters of the river cover at its fullest flow without overtopping its banks". It remains unclear to me how the introduction of the word 'annual' in the first definition makes any difference to any determination.

However, the challenge then is to define the banks. The Court of Appeal has determined in *Canterbury Regional Council v Dewhirst Land Co Ltd* [2019] NZCA 486 that the bank must be an observable feature on the ground marked by a slope or change of surface cover.

I therefore concluded that:

1. the responsibility to determine property boundaries, and including the identification of a riverbank as a boundary, rests with surveyors, subject only to judicial review;
2. River flows vary radically. The extent of a riverbed at low (or no) flow, or at flood flow does not indicate riverbank boundaries. Rivers intermittently overtop their banks; and
3. Because boundaries must be observed on the ground, a riverbank boundary can be recognised as a physical and observable feature. This conclusion, however, may not help the practical surveyor much in resolving disputes about where to show a river boundary.

## Riparian reserves

The idea that there should be a public reserve alongside all waterways has been a persistent myth. However, there has always been some sort of provision for such reserves to be set aside either

discretionarily or upon some land transactions such as the disposition of Crown land (Conservation Act) or the subdivision of general land (RMA). Ideally, such riparian and littoral reserves should be defined by the natural feature, move with that feature, and therefore retain the original purpose (conservation, access and recreation). When ambulatory water boundaries move away from fixed reserves, they lose their function. There seems to be no logical reason why the statutory provisions should not change to provide for all marginal reserves to be ambulatory. It would certainly assist public perceptions about them.

The other surveying issue is the problem of surveying and depicting such reserves in the cadastre.

From a database point of view, the certainty of defined and fixed boundaries is appealing, but from a practical real-world experience point of view, the surveying of spaces defined by an observable physical feature is redundant. I have argued elsewhere against the need for surveying such spaces.

## Foreshore and seabed

It has been recognised by various courts that Māori customary title existed over the whole of Aotearoa including the sea space, but the English common law position that the foreshore and seabed was vested in the Crown, dominated for much of our colonial history. When, in 2003, the Court of Appeal recognised that Māori customary title may not have







been extinguished, the government of the day passed the Foreshore and Seabed Act to explicitly extinguish Māori customary title and vested all the public foreshore and seabed in the Crown. Significantly private title in the foreshore and seabed was not extinguished, although the apparent purpose of the Act was to ensure uninterrupted public rights and access to the foreshore and seabed.

The idea of any sort of ownership of the marine space was eliminated with the Marine and Coastal Areas (Takutai Moana) Act, notwithstanding the continuing existence of private titles in the foreshore and seabed. This Act also provided a pathway for iwi to gain some statutory recognition of their rights by claiming Customary Marine Title

and Protected Customary Rights. This allowed the Crown to avoid any further recognition of the original Māori customary rights – another dishonouring of the Article 2 protections of Te Tiriti o Waitangi.

## Climate change

The vulnerability of our coastal land to the effects of climate change and sea level rise will be a significant challenge in the years ahead. Current and proposed legislation, the National Coastal Policy Statement and a plethora of reports about adaptation all point to the importance and the complexity of choices and responses.

Environmental conditions will have a serious impact on property rights but, ultimately, property must

give way to the sea. We need to stop further built development in the coastal zone and decide how we will respond to the loss of coastal property. Compensation will be a big contentious issue – including where compensation will come from (insurance, central or local government), how much will be paid and how it will be allocated. Buyouts and lease-back solutions may assist to soften the impact of retreat from the sea.

Other adaptation solutions must include development setbacks, exclusion zones, rolling easements (ambulatory marginal strips) and managed retreat. Engineering solutions like sea walls may provide some temporary relief, but are short-term solutions and are likely to exacerbate erosion problems along the coast. Further public discussion is needed to assess where the moral hazard lies for vulnerable coastal property.

## Conclusion

Human occupation and development on the land has been based, for too long, on the approach of human dominance over nature, and particularly over water. We have built in vulnerable locations, disrupted natural ecosystems, and tried to adapt the landscape to human needs. Finally, in the 21st century, we are seeing the massive impacts we have had on Earth's systems.

Climate change will affect us all in many ways. If we can adopt a Land Ethic, where we treat the land and water with love and respect, and we change our behaviours to match such an ethic, then there is hope that we can adapt to the new reality. We must live within our environmental limits. If we can do that, then property and boundaries of waterways will be managed more effectively. ●





# RiverLink

## A model of proactive subsurface risk management

*John Parker, Reveal*



Having outgrown its roots as a manufacturing hub and commuter suburb for Wellington, Lower Hutt is developing into a thriving business and residential centre defined by the winding rivers that flow down the Hutt Valley (Here-taunga).

The RiverLink project is a partnership between Greater Wellington, Waka Kotahi, Hutt City Council and iwi Taranaki Whānui ki Te Upoko o Te Ika and Ngāti Toa Rangatira to deliver crucial flood protection and river restoration work, improvements to public transport, walking and cycling routes, local roads and the State Highway 2 Melling Interchange, as well as urban revitalisation of the Lower Hutt city centre.

The project was planned and consented between 2019 and 2021,



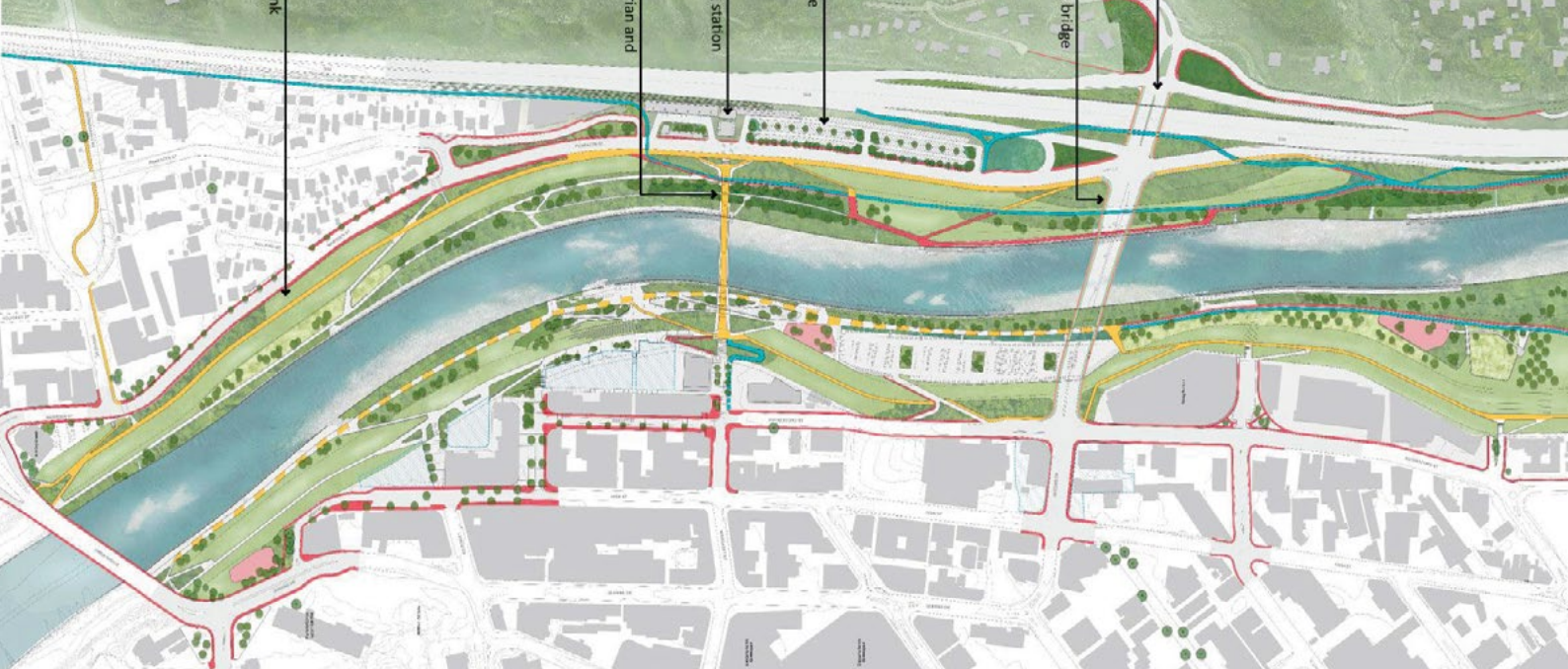
and the construction alliance Te Wai Takamori o Te Awa Kairangi engaged Reveal in December 2022 to create a comprehensive utility model within the planned project footprint in Lower Hutt.

### The Survey Phase

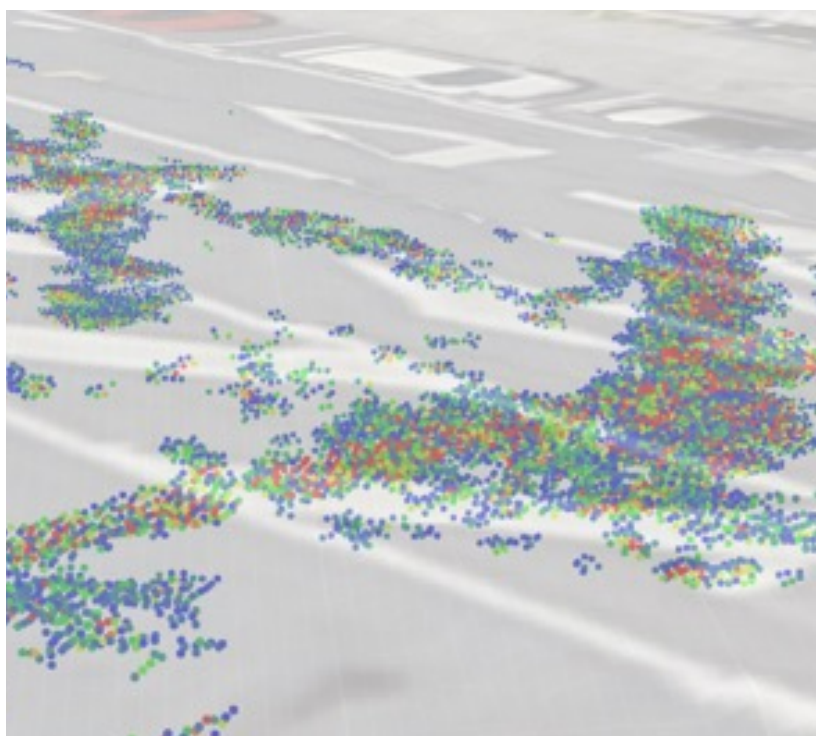
The work was completed in two stages, with the first stage involving a comprehensive 2D desktop study.

Reveal compiled information from various sources, including beforeUdig and worked with asset owners to obtain their existing utility plans, either from PDF or GIS sources. All resulting information was then mapped to a single data standard (Model for Underground Data Definition and Integration, or MUDDI), allowing a uniform display and comparison between datasets.





Following the desktop study, Reveal performed a ground-penetrating radar (GPR) survey with vehicle-mounted multichannel GPR in the road corridor. The GPR data was processed using Reveal's unique Underdots data processing service which produces an intuitive point-cloud visualisation of 3D radar data. Clusters of coloured dots indicate the depth and intensity of radar reflections, which can be quickly used to corroborate the location of existing utilities – or highlight the presence of previously unknown objects or anomalies.



Bringing together both existing records and utility detections data from geophysical investigations allowed Reveal to produce a Unified Utility Model for a large-scale infrastructure project – the first time such a model has been created for the Hutt Valley region.

### Creating the Unified Utility Model

The Unified Utility Model is a concept Reveal has developed to bring the best understanding of the subsurface to light in a data environment that is accurate, comprehensive, and open to

access and updates by all stakeholders in a project.

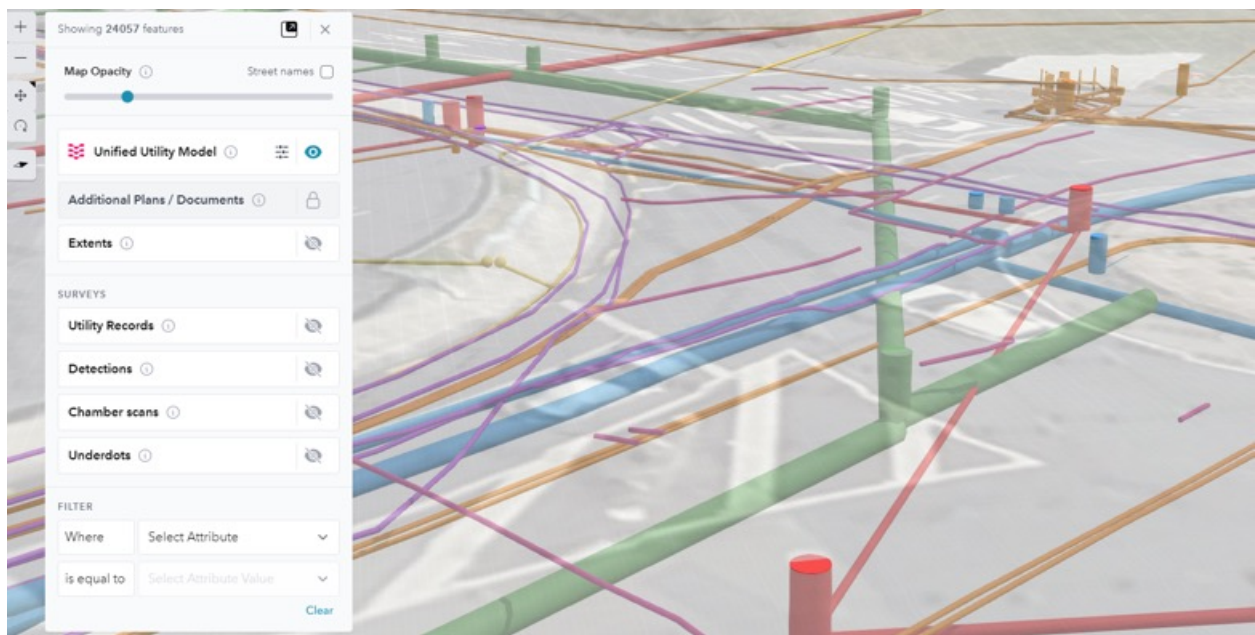
Existing utility plan information has traditionally been siloed by asset owners and provided (begrudgingly) on request to contractors for the purpose of immediate construction or repairs. In response, the field of utility locating has emerged to provide more accurate location data, but the output from these geophysical investigations is expensive to procure and requires high levels of expertise to interpret. Worse still, these valuable deliverables are typically shelved or lost on the completion of a project.

The impacts on the infrastructure industry are manifold: projects are routinely delayed and go over budget due to unknown utilities, and utilities are struck on a regular basis, causing injury, death, and disruption to critical services such as power and water.

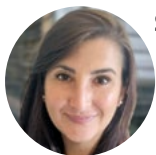
The Unified Utility Model aims to solve these issues through the application of established locating standards, standardized data exchange and easy mechanisms for feedback and updating data within the system.

By connecting all stakeholders in the underground to a single source of truth, the UUM can ensure better decision-making at the planning and design phases of a project and create a safer environment for workers in the field, ultimately reducing project costs and timeframes.





## Project Outcomes



### **Samantha Smith,**

Project Manager –  
Utilities for Te Wai  
Takamori o Te Awa  
Kairangi said,

*"One of the standout features of Reveal's model is its versatility. The model can be exported in various formats, making it compatible with our design software. This compatibility enabled seamless integration of the model into our planning and design processes, making it an invaluable tool. The visual presentation of the model is impressive, and the user interface is intuitive and easy to navigate."*

The Reveal team took only three-months from project inception to delivery of a fully-fledged Unified

Utility Model in a web-based platform for Riverlink's designers and engineers to work with.

### **Samantha Smith:**

*"One of the most significant benefits of using the Reveal model is its potential to reduce the need for invasive investigations. By highlighting unknowns and higher-risk areas, the model allows for targeted investigations and utility relocations planning. This approach minimizes disruptions and costs associated with more invasive methods."*

*"Reveal has proven to be innovative and forward-thinking in their field of subsurface utility investigations. Their diligent and thorough approach, coupled with the creation of a visually*

*appealing and user-friendly model, has enabled us to plan further investigations, and inform our relocations design with confidence."*

## **The future of subsurface utility engineering**

Reveal is working on more large-scale infrastructure developments across New Zealand, and partnering with international companies in Australia, Singapore and the United States to further the adoption of the Unified Utility Model method and technology. The company hopes to educate industry players on the value of proactive subsurface utility locating and mapping and drive better outcomes on infrastructure spending to create a safer, more sustainable built environment. ●



# 2023

# SPATIAL EXCELLENCE AWARDS

*Innovation and extremely  
high quality keeps the  
standard very high*

The winners of the 2023 Spatial Excellence Awards have carried on the tradition of producing innovative projects of an extremely high quality. The judges this year once again, had the difficult task of deciding which submissions should receive an award when all the entries are worthy of recognition!

The final winners were announced at a cocktail evening held at the Auckland Cordis Hotel on the 22 November. The awards are proudly brought to the sector by Survey and Spatial NZ to showcase and celebrate all things excellent in the spatial domain.

Congratulations goes to all the entrants and winners and thank you for your continued support of these awards.



S+SNZ's Andrew Perry, Kat Salm, Ashley Church, and Martine Fernandez



Sam Hackett, Wood and Partners Consultants and Andrew Perry, S+SNZ President



Karl Majorhazi and Andrew Perry



Geoff O'Mally of Toitū Te Whenua Land Information



The team from Wood and Partners Consultants Ltd



Drinks & Nibbles





---

## Award for Community Impact

---

The **Award for Community Impact** recognises unique contributions the spatial industry has had on people and communities.

### Finalists

This year the quality of entries was very high and, as a result, there were 2 finalists for the Award. These were Beca and a collaboration between Toitū Te Whenua Land Information New Zealand, Ngā Pou Taunaha o Aotearoa/NZ Geographic Board and Tātai Aho Rau/Core Education.

**The Winner of the Community Impact Award is Toitū Te Whenua Land Information New Zealand, Ngā Pou Taunaha o Aotearoa/NZ Geographic Board and Tātai Aho Rau/Core Education** for their 2023

Geospatial Virtual Field Trip for schools – Ngati Maniapoto stories.

The winner is a land development and geospatial consultancy with a desire to continually improve outcomes for its clients through technology use and innovation to improve efficiency, quality, and safety at scale. With this ethos, the Winner combined precise GNSS surveying with high-speed Mobile LiDAR and innovative workflows to achieve detailed settlement monitoring of road pavements. With an estimated 90% reduction of field survey time compared to conventional techniques and zero impact on traffic, this company delivered on safety as well as survey products.

### Judges' Comment:

The Judges felt this was a very successful program in the number of students involved and update across the student membership of the spatial program offerings. The project brings spatial into the lives of students, in a smart and engaging way, ensuring familiarity with the geo-professional landscape. The judges also commented that this was a great project that connects place to culture and communities in a way that children can learn with a great use of spatial technology.

Geoff O'Malley of Toitū Te Whenua Land Information accepted this award on the night.

---

## Award for Innovation in Medium to Large Business

---

The **Award for Innovation in Medium to Large Business** recognises a unique delivery of a project, product or service based on a new idea, method, technology, process or application resulting in significant social, environmental and/or economic benefits.

Now more than ever, we need better and more robust asset management processes that decision-makers understand and trust, to ensure funding goes to the right projects at the right time.

### Finalists

There were two finalists for this Award - Wood and Partners Consultants Limited for Innovative technique for Pavement Settlement Monitoring of the CNC Roding Project, and NZ Police for GeoSpatial Intelligence

Support to Major events.

**Winner of the Award for Innovation in Medium to Large Business is Wood and Partners Consultants Limited** for *Innovative technique for Pavement Settlement Monitoring of the CNC Roding Project*:

The company who submitted this project is a land development and geospatial consultancy with a desire to continually improve outcomes for its clients through the use of technology and innovation to improve efficiency, quality, and safety at scale. With this ethos, the company combined precise GNSS surveying with high-speed Mobile LiDAR and innovative workflows to achieve detailed settlement monitoring of road pavements. With an estimated 90% reduction of field survey time compared to conventional techniques

and zero impact on traffic, this company's innovative solution delivered on safety as well as survey products.

### Judges' Comments

"The winning project is a classic example of the application of rigorous surveying principles combined with innovative technology, in which accuracy standards were maintained and assessed whilst reducing costs. They also found the project particularly interesting because of the high speed at which the surveys were conducted - yet producing accurate results. It's essential to also acknowledge that achieving the high levels of accuracy required thorough preparatory work and innovative thinking."



---

## Award for GeoSpatial Enablement

---

The **Award for GeoSpatial Enablement** recognises products or projects in which the application of spatial information, methodology and/or tools has greatly improved the outcomes of a non-spatial project, process or product.

### Finalists

We had 2 Finalists for the Award this year – Stats NZ for their Population Grids for New Zealand and New Zealand Police for Enabling Frontline Police Officers in Fleeing Driver Incidents.

Winner of the Award for GeoSpatial Enablement is **Stats New Zealand**

The winner's first official population grids provide users the flexibility to analyse and visualise population data in new and innovative ways. The grids, first trialled this year, are a multi-resolution framework created using new data integration methods. The response to the trial was overwhelmingly positive and sets the platform for more gridded data products. We have already seen the benefit of the population grids being

used during Cyclone Gabrielle as the basis for highlighting the populations of isolated communities and this is a prime example of how the company's population grids can help put people back on the map.

### Judges' Comments

The Judges agreed that this kind of data can be beneficial for multiple disciplines and have vast application. It is a great concept and extremely valuable.

Karl Majorhazi accepted this Award on behalf of Stats New Zealand.

---

## Award for Technical Excellence

---

The **Award for Technical Excellence** recognises surveying and spatial projects that apply existing technology and methodologies to an exceptionally high technical standard, overcoming significant technical challenges, and delivering outstanding results for the client.

Winner of the Regional Award for Technical Excellence is **Wood and Partners**

**Consultants Ltd for Pavement Settlement Monitoring of the CNC Roading Project with high-speed mobile LIDAR.**

### Judges' Comments

The judges commented that this project was an innovative alternative solution to traditional methodologies requiring engagement with all stakeholders to deliver the required

outcome. Given the time frames involved to determine 'change over time' this project shows the value of traditional survey methodologies applied to new data acquisition systems and the need to visualise insights from the vast amounts of data created.

Sam Hackett of Wood and Partners accepted this Award on behalf of Wood and Partners.

---

## Postgraduate Student Award

---

Winner of the Individual Award Postgraduate Student Award is **Holly Still**

Holly is finding new ways to answer age-old questions in glaciology by applying high-precision positioning techniques that are not yet in the glaciology toolkit. Their work has demonstrated, for the first time, the effectiveness of

low-cost, low-power GNSS systems for detecting  $10^{-3}$  scale ice deformation patterns in challenging high-latitude sites. The work establishes low-cost solutions as comparable to traditional high-cost survey-grade GNSS systems. The high-precision observations are used to drive mathematical models that elucidate fundamental material

properties of the ice, in real-world settings that laboratory experiments cannot replace.

### Judges Comment

The Judges commented that this candidate had submitted a high-class project with great effort to improve the theory and application of GNSS field data collection.

---

## Diversity and Inclusion Award

---

The Winner of Diversity and Inclusion Award is **Shanon Henare Tait**.

The Winner of this Award created a StoryMap for education purposes to teach College students how geospatial can be used to complement their own studies. It was designed to show the impacts of relative isolation when

adverse weather events occur.

### Judges Comment

The Judges agreed that the winner had passion, energy and initiative for engaging with students to get more people in the Surveying profession. This person uses their knowledge and geospatial skills to create storymap for education

purposes and sets a good example of how geospatial impacts on the society with visible and simple method. This tool has been developed to breakdown digital barriers and encourage inclusion and it has been developed with a specific target audience in mind and will soon be tested on that audience.





# WORLD HYDROGRAPHY DAY SEMINAR

*Jonathan Chuhairy, Sophie Clayton, Robbie Greene, Emily Tidey*

**B**efore the S+SNZ conference in Dunedin this year, a day of workshops including a hydrography seminar were hosted at Te Kura Kairūri, the School of Surveying. The annual World Hydrography Day Seminar is supported by the New Zealand Region (NZR) of the Australasian Hydrographic Society (AHS) in conjunction with the S+SNZ Hydrography Professional Stream (HPS). This year we hosted more than 40 attendees including eight students, who were sponsored to attend, and present or to report back here with a summary of the day.





## **Four Years in Five Minutes – Jett Ganaway, Otago student**

Jett, a BSurv (Hons) finalist, shared his experience and perspective of the Bachelor of Surveying degree over the past four years. He described the characteristics that one would typically expect of a School of Surveying graduate. He painted the picture of someone who is hardworking and motivated, with solid theoretical knowledge and appropriate practical experience, and most importantly, someone who has had valuable life experience. These attributes set graduates up to succeed in their profession. Jett explained the constraints faced by aspiring hydrographic surveyors in the School of Surveying, with only two hydrographic papers available every second year. He suggested this lack of exposure could be a reason why the final hydrographic paper, SURV452, has a reasonably small class of 10. He also identified that one could be sure that the students who take up SURV452 are passionate and committed towards the subject.



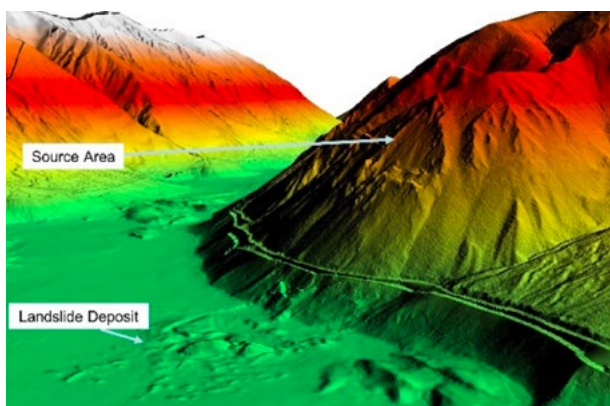
Jett's presentation. Photo: S. Clayton

## **The Role of Multibeam Sonar in Reconstructing Lake Tsunamis Across Te Waipounamu – Katie Hughes, Victoria University/Otago University student**

Katie presented her PhD research on lake tsunamis. These events can be particularly devastating due to the concentration and amplification of waves compared with ocean tsunamis. Notably, many of Te Waipounamu, the South Island's lakes are close to the Alpine Fault, potentially placing communities and infrastructure at high risk of tsunamis. Katie identifies past tsunamis using a combination of LiDAR and MBES (multibeam echosounder) to find steep areas within or near water bodies that show evidence of past landslips and deposits. Core samples are taken from these areas to date them, and models created to identify high-risk areas. There are very complex physics involved in modelling lake tsunamis, requiring high-resolution bathymetric data. To achieve this resolution, the project



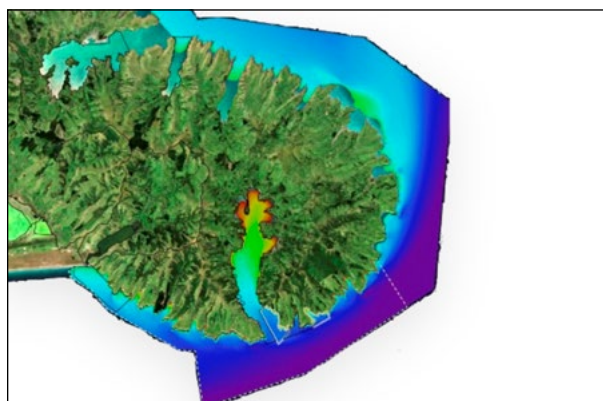
has been using MBES with compressed high-intensity radar pulse (CHIRP). Te Waipounamu's lakes are currently under-surveyed, making it more difficult to create models that correctly identify high-risk areas.



Katie showed some incredible data from her surveys of lake beds.  
Photo: S. Clayton, Image: K. Hughes

## MBES Bathymetry and Derivatives in Species Distribution Modelling – Ella Westenberg, Otago student

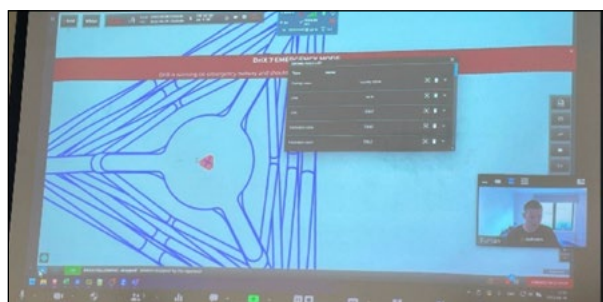
Ella is a fourth-year marine science honours student who has been using MBES bathymetry data to research the distribution of blue cod around the south-eastern parts of Banks Peninsula. Ella has been using LINZ MBES data gathered for the longi-airo project, which is a partnership between the Department of Conservation, ECan and the University of Otago to undertake backscatter analysis and habitat classification. Classifications were dictated based on things like depth, rugosity and slope, as well as the basic flora and fauna in the area. Fish density data was gathered by deploying baited video cameras for 30 minutes and counting the species observed. Poor visibility often made it challenging to identify fish species. Blue cod are an important species to New Zealanders in a customary, recreational and commercial context. Ella's research is providing important insights into what drives the abundance and distribution of the species in the area.



Banks Peninsula dataset that Ella is working with for the longi-airo project. Photo: S. Clayton, Image: LINZ/ECan

## Line Planning for the DriX USV – Duncan McRae, Sulmara

Duncan joined the session remotely to provide a live demonstration of his workflow for line planning for the DriX USV (uncrewed survey vessel). Once the client provides the necessary information about the survey area or targets, different software tools are used to determine the run lines before sending them out remotely to be executed by the DriX. Since USVs predominantly operate on latitude and longitude, it is often necessary to apply the appropriate coordinate conversion if it hasn't been done earlier in the workflow. The DriX software provides the final stage where line spacings and directions can be precisely specified for the DriX to follow during the survey. This spacing will be determined by factors such as water depth, required resolution and instrument frequency. During his presentation, Duncan demonstrated the remote capabilities of a DriX located in Taiwan, including showcasing live radar, camera and MBES data feeds.

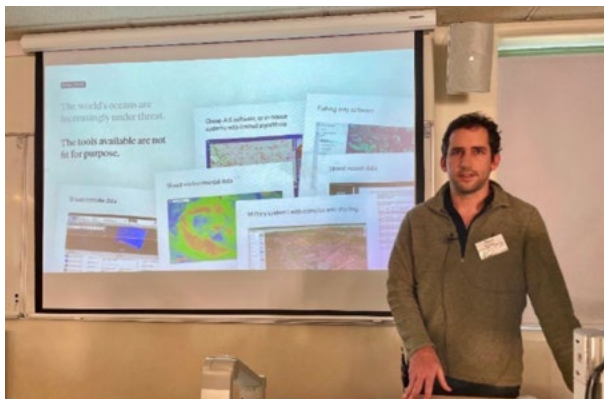


Duncan demonstrates issues with line planning around wind turbine generators using the DriX USV. Photo: S. Clayton



## Focus on the Vessels that Matter – Dr Dave Kelbe, Starboard Maritime Intelligence

Dave is a senior data scientist at Starboard Maritime Intelligence, a company dedicated to assisting nations in addressing complex maritime challenges through state-of-the-art surveillance solutions. The existing surveillance tools that have been in place are ineffective due to the scattered nature of the relevant information making it difficult to consolidate and analyse. Starboard aggregates data from many different sources, including satellite synthetic aperture radar (SAR) and photography, sea surface temperature (SST) data, bathymetric data, government regulations, and vessel lists and registries. This data is integrated with automatic identification system (AIS) data through intricate algorithms and machine learning, enabling a comprehensive analysis that paints a clear and intuitive picture of maritime activities within a given area. Starboard's product is allowing national authorities to filter through vast volumes of data and identify those exhibiting behavioural patterns indicative of harmful activities such as illegal fishing, drug trafficking or posing biosecurity concerns.



**Dave Kelbe presents on Starboard Maritime Intelligence.**  
Photo: S. Clayton

After the AHS AGM, there was an awards presentation to recognise a multitude of achievements. This year there were two recipients of the Australasian Hydrographic Society Annual Education Award, of A\$3500: Katie Hughes from Victoria University/University of Otago for her research on lake tsunamis and the use of hydrographic techniques for analysing these. The other recipient was Emily Harrex from the University of Otago for her research project, which addresses diversity within the hydrography field. There were two AHS Order of Merit awards received by Gary Chisholm (more than 20 years of work for the AHS) and Kevin Smith (previous past NZR Chair and AHS Awards Chair) for their service to the industry. Bevan Waller from DML was presented with his AHSCP Certified Professional Hydrographic Surveyor Level 1 certificate. DML also introduced its

inaugural Hydrographic Surveying Scholarship and awarded this to Ryan Slattery from the University of Otago. Ryan plans to undertake an honours project focusing on research around low-cost GNSS tide-buoys in 2024. It was great to see the range of award presentations – from career-long recognition to students starting out. Mīharo!



**Award recipients: Kevin Smith (AHS Service Award), Emily Harrex (AHS Education Award), Bevan Waller (AHSCP Level 1 certification), Gary Chisholm (AHS Service Award), Ryan Slattery (Inaugural DML Student Scholarship), Katie Hughes (AHS Education Award).** Photo: S. Clayton

## Benthic Terrain Modelling of the South-Western Hauraki Gulf: Habitat Identification and Human Impacts – Sam Davidson, NIWA

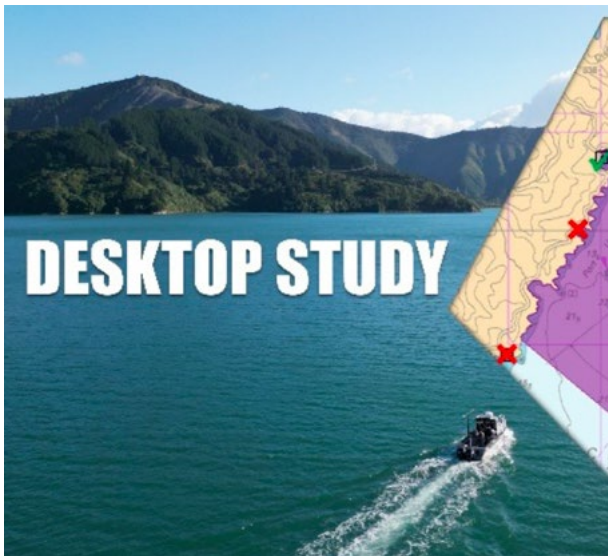
Sam 'Zoomed in' to discuss the drivers behind habitat mapping and how MBES allows us to quickly and affordably map benthic habitats. He walked us through the process of data collection, the survey outputs and geospatial derivatives focusing on DTM classification. An example area from Survey HS52 in the Hauraki Gulf was presented, highlighting features such as tilted parallel rock units, depressions and pockmarks, seafloor rugosity and substrate variability and how these present in data. The human impacts were also evident through linear scours and feathering marks from anchors as well as some exposed pipeline. Sam also spoke to us about how this geospatial data is presented through the use of public story maps which allow users to investigate various features.



**A cluster of rounded depressions which may be indicative of relict or active fluid seepage and may act as sites of sensitive ecosystems. A pipeline can also be seen immediately to the northwest of the pockmarks.** Image: NIWA

## Vertical Control Case Study (GNSS Tides): Port Underwood Survey – LTCDR Paul Trudgian, RNZN

Paul presented vertical control work carried out by the RNZN (Royal NZ Navy) for the Te Whanganui/Port Underwood Survey. The RNZN usually works on rapid data turnover projects but has the capability of completing surveys to support LINZ and national objectives too. This survey came with some challenges due to the area having complex geography, and as such, GNSS tide buoys and pressure sensors were used to collect water level measurements. The GNSS data was post-processed using a GeoNet CORS station and a Tidal Analysis Software Kit (TASK) was used to derive 26 harmonic constituents. The tidal model was used to determine the lowest astronomical tide referenced to the ellipsoid. Paul also discussed the need for a separation model to be developed as this area has a complex terrain and would likely require a third tide gauge to confirm.



Paul's slide indicating potential sites for tide gauges for the project.  
Image: P. Trudgian

## Unmanned Surface Vehicle: Interferometric SSS – LTCDR Robin Kuhn, RNZN

Robin's presentation focused on two pieces of equipment used by the RNZN: the unmanned surface vehicle MANTAS T12 and the side scan sonar PING DSP 3DSS-iDX-450 which is mounted on the MANTAS T12. The MANTAS T12 is a small USV (uncrewed surface vehicle) which has a maximum speed of 35 knots and a 30cm draught, giving it a very sleek appearance. It is predominantly used for experimentation work at this stage and one of the benefits is its ability to manoeuvre easily in shallow waters due to its shallow draught. The PING DSP 3DSS-iDX-450 side scan sonar mounted on the MANTAS T12 produces high-quality swath bathymetry and 3D side scan imagery. It allows for real-time corrections and outputs very clean data, making it a valuable piece of equipment for the RNZN's hydrographic survey operations.



A photo of the Maritime Tactical System MANTAS T12 in the water (foreground) and Robin presenting. Photos: R. Kuhn, S. Clayton.



## **HMNZS Manawanui Capabilities – LTCDR Matt Gajzago, RNZN**

Matt presented on the new naval vessel, HMNZS Manawanui. The 85-metre, 5741-tonne vessel has two RIBs for boarding operations and custom patrols, a dive team with compression chamber and a helicopter pad. It is able to provide support to advance force operations and has salvage capabilities of up to 1000m depth and 100t, with up to 450t cargo on board, which is new to the RNZN. It also has a remotely operated vehicle which operates to a depth of approximately 1000m and works alongside the onboard crane for salvage missions. The vessel uses dynamic positioning system and has hydrographic surveying capabilities. The HMNZS Manawanui provides fast turnaround on survey data to enable ports to reopen after disasters and operates predominantly around New Zealand, but also around the Southwest Pacific up to Hawaii.

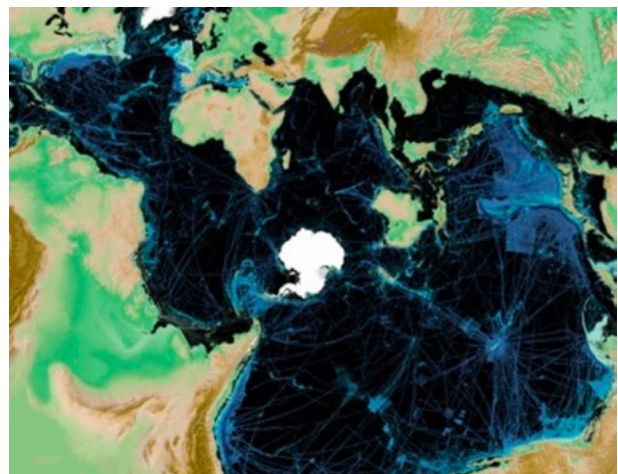


Matt presents the capabilities of the HMNZS Manawanui. Photo: S. Clayton, Image: RNZN)

## **Seabed 2030 and the Challenge to Map the World's Oceans. How Can You Make a Difference? – Belen Jimenez Baron, NIWA**

Initiated in 1903 by Prince Albert I of Monaco, the General Bathymetric Chart of the Ocean (GEBCO) has had several versions, released many decades apart. Fully mapping the sea floor is vital to understanding and sustainably managing our oceans. The mapping was initially run by volunteers, but in 2017 the Nippon Foundation partnered with GEBCO to launch the Seabed 2030 Project. Despite appearing to be fully mapped in many places, most of the sea floor uses modelled depth information. Seabed 2030 is now at 25% coverage. Collecting data for the remaining 75% requires the contribution of hydrographic authorities, corporations and

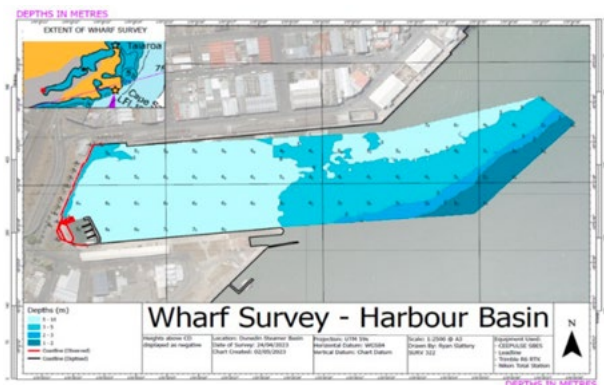
recreational mariners. Surveying companies such as Fugro have been involved in data collection while in transit. But anyone can take part: Belen showcased a device that allows any vessel with an echosounder – even recreational vessels – to gather depth soundings and the associated metadata to contribute to Seabed 2030.



Belen shows the audience the small sensor that can be installed on vessels to collect depth data for Seabed 2030 and an image showing how it's all just 'one ocean'. Photo: S. Clayton, Image: Seabed 2030

## **Technician to Undergraduate: A Professional Development Journey Within the Hydrographic Industry – Ryan Slattery, Otago student**

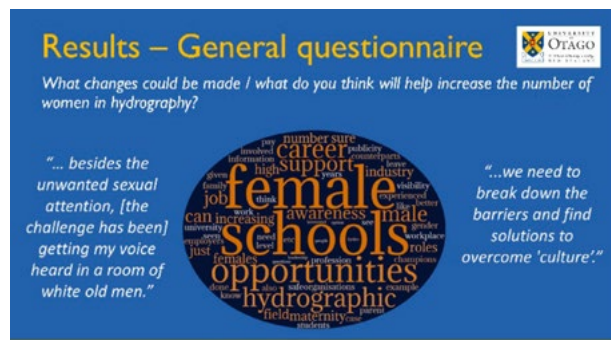
Ryan formerly served in the Royal New Zealand Navy as a hydro technician for seven years. Starting in 2013, he gained nautical charting experience and was involved in UXO (unexploded ordnance) searches as well as work with NZ Police. More recently, Ryan joined the School of Surveying | Te Kura Kairūri to complete a Bachelor of Surveying (BSurv) and is now in his third year of studies. The BSurv has supplemented Ryan's field experience with background theoretical knowledge giving him a more complete view of hydrographic surveying. Ryan is the inaugural winner of the DML Hydrographic Surveying Scholarship for 2024.



Ryan showed some of the work he has undertaken at university, including this chart of Harbour Basin. Image: R. Slattery

## Breaking Waves: Understanding the Barriers that Prevent Women from Pursuing a Career in Hydrography – Emily Harrex, Otago student

Emily, a final-year student in the BSurv programme, conducted research inspired by the IHO's Empowering Women in Hydrography project. Her study focused on investigating and understanding barriers preventing women from pursuing a career in hydrography in the Southwest Pacific region. Data collection methods included literature research and questionnaires. Findings from the questionnaire interestingly contradicted barriers cited in her background research, revealing that a lack of information regarding the profession in educational institutions as well as little to no public examples of women working on the job as the biggest barriers. Respondents suggested that increasing knowledge of the profession is vital to attract more women to a career in hydrography.



Emily in a 'standard-sized' immersion suit, and some of her findings. Photo: E. Tidey, Slide: E. Harrex

## Navigating New Horizons: Pushing Integrated Technology's Boundary – Alex Waugh, Fugro

Alex Waugh, Fugro New Zealand's country manager, talked about some of the jobs and technologies that Fugro has been involved with in New Zealand and Australia. The New Zealand team recently conducted positioning services to complete the decommissioning of an old offshore floating production storage and offloading (FPSO) station in the South Taranaki Bight. Multibeam surveys were conducted before and after the recovery of the 13mm anchor wires. He then described some multibeam systems being used in unconventional situations. Other technologies showcased included Fugro Adelaide's airborne LiDAR bathymetry system and Perth's Remote Operations Centre (PROC), as well as continual development of USVs in other Fugro offices.



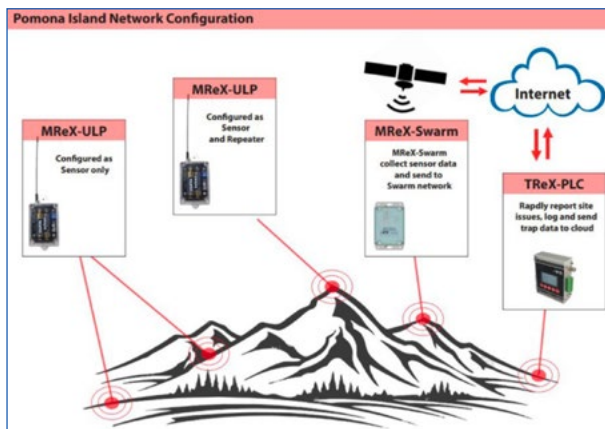
Alex's presentation. Photo: S. Clayton

## An Easier Way to Get MetOcean Tidal Data Back from Field Sensors Using IoT – Gary Chisholm

Gary Chisholm, a former university graduate who managed Trimble Marine for 35 years spoke about using the internet of things (IoT) in surveying applications. Recent technological developments have allowed the deployment and use of low-Earth orbit satellites manufactured by Swarm. A significant portion of the technology used is New Zealand-sourced, including Rocket Lab launches and the satellite tracking station in Bluff. The satellites allow



data streams to even the most remote places, however, the current network still results in two to three-hour data gaps due to their polar orbits resulting in fluctuating satellite availability. Gary presented a case study where the technology is used to monitor rat traps placed in Pomona Island, in the middle of Lake Manapouri. The technology has also been used in Australia to place river flow gauges in remote areas.



The Pomona Island Network Configuration set up by Gary.  
Slide: G. Chisholm, Photo: S. Clayton

After a busy and informative day, the hydrography team retired to Ombrellos restaurant and bar to continue discussions into the night. Thanks to the NZR AHS for its continuing generous sponsorship of student participation, the School of Surveying for hosting (congratulations on the 60th anniversary), sponsors DML, Fugro, NIWA, and Ocean Infinity, and the organisers of this excellent event. We look forward to meeting again next year.



Participants at the Hydrography Day Seminar. Photo: S. Clayton

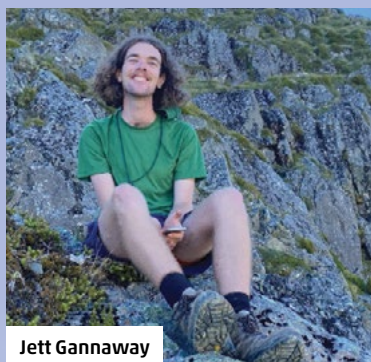
# BSurv Hons Dissertation Abstracts

University of Otago,  
School of Surveying

Three students undertook the Bachelor of Surveying (Hons) programme this year. This programme is open to all students with a B+ average, and requires more points (hours) than their BSurv counterparts in the final year. Most of this is in the form of a supervised project involving original research and the production of a dissertation.

Dissertation paper co-coordinator Emily Tidey says, "The students in this article have taken the opportunity to make the most of their time here at the School of Surveying: to focus on a theme of surveying and spatial, to develop specialisms in this field as well as in research and analysis, and to deliver their work in both written and oral presentations. They have put in sustained and individual efforts throughout the year, and we congratulate them on the excellent work they have produced."

## JETT GANNAWAY BSURV(HONS) PROJECT **Can't Stand the Strain\*. Temporal Strain Rate Variations on the Alpine Fault**



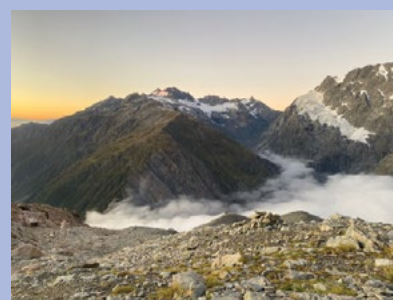
Jett Gannaway

Long-term (1990 to the present day) and post-major earthquake (2009 to the present day) geodetic strain rates are calculated for New Zealand's central Southern Alps, using velocities determined from GNSS observations. Velocities are determined from four GNSS datasets; three long-term and one post-earthquake. The area investigated is a transect of 30km by 10km across the Alpine Fault, which accommodates at least 75% of the

relative plate movement between the Pacific and Australian Plates, and has a high likelihood (75%) of causing a large (magnitude 8+) earthquake in the next 50 years.

Geodetic strain rates calculated from long-term velocities agree well with earlier work on the Alpine Fault, validating the methods used in this dissertation. A comparison is then made between long-term strain rates and strain rates following the 2009 magnitude 7.8 Dusky Sound earthquake. Eigenvalue parameterisation of strain rates ( $\epsilon_1, \epsilon_2$  and  $\theta$ ) and one engineering parameter ( $\bar{\epsilon}$ ) are compared.

Significant changes at the 95% confidence level are observed in 11 of 16 regions (polygons) considered. The changes, on average, represent an increase in the rates of both extensional and contractional strain accumulation, but the increased rate of extensional accumulation far exceeds the rate of contractional accumulation. The accumulation leads to area creations;



Sealy Range from Sefton Bivouac, central Southern Alps. Photo: Jett Gannaway, 2023.

or positive rates of areal dilation. For four polygons, the orientation of the principal axis of contractional strain rate has rotated counter-clockwise.

Future work is recommended to better weight observations in the least squares estimation process, expand the geographic area of research, and consider temporal changes over more than two epochs.

Jett was supervised by Dr Paul Denys, and is heading to Norway to begin working for Reach Subsea in 2024.

\**Can't Stand the Strain, Funkadelic (Edward Hazel, George Clinton, Jr.), 1973.*







MARTIE JOOSTE BSURV (HONS) PROJECT

## Aligning Home: Symbolism of Marae Meeting House Orientation

Marae are an important expression of Māori culture, providing safe spaces in times of change. Further research of these spaces allows for a greater understanding and support of Māori culture. This dissertation aims to explore the symbolism behind marae meeting house



Martie Jooste

Rotowhio Marae, Te Puia. Photo W. Bulach CC BY-SA 4.0.

orientation. It builds on the research done in David Goodwin's paper, *Aligning the Ancestors*, and expands on his work through the addition of different perspectives by incorporating qualitative-based methods.

The aim of this project is to determine if there is symbolism behind marae meeting house orientation. Three smaller tasks were determined to complete the research aim, first, analysing meeting houses across all of Aotearoa New Zealand before working towards identifying regional, and finally, individual patterns. A temporal analysis was then completed to determine if there has been a change in symbolism over time.

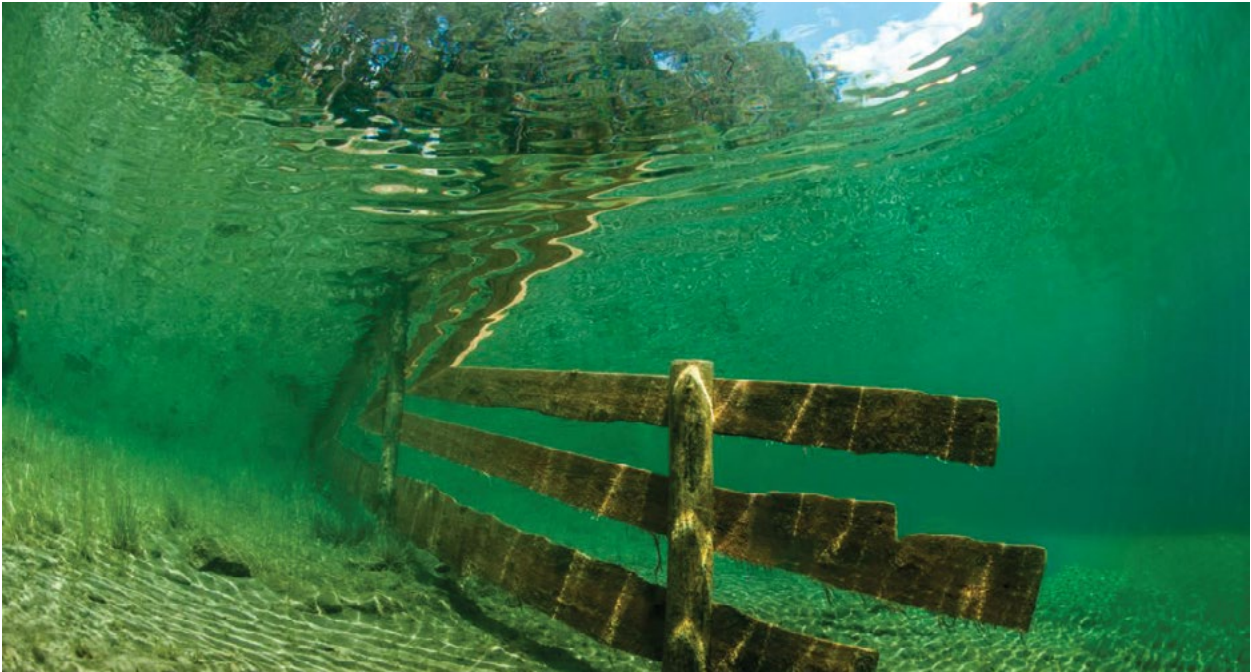
A variety of methods was chosen to accomplish the research: namely, a literature review to provide background information, a map analysis and interviews with a variety of key people. A combination of qualitative and quantitative analysis ensured all findings were supported.

Analysing the results showed a few patterns. The New Zealand-wide

analysis revealed there were general northern-facing patterns, but there was enough variability that the patterns were not due to a single reason. Going more in depth into the regions solidified the patterns found, but there was still variability within the region. Focusing on individual marae, especially in the South Island, showed that rather than a single pattern, each hapū has their own preferences. The temporal analysis showed clearer trends as there was a greater shift towards displaying cultural values over time.

Overall, each attribute of the meeting house is based on the values of the residing hapū. The symbolism behind the orientation of each marae is a strong indicator of the healing process each group is going through. By discussing these practices, Māori culture can be celebrated through an increased understanding of tikanga.

Martie was supervised by Dr Francesca Marzatico, and is going to work for Eliot Sinclair in Christchurch next year.



DAVID WATSON BSURV (HONS) PROJECT  
**‘In a Complicated Land’\*:  
 What will Happen to  
 Māori Land Affected by  
 Sea Level Rise?**

Māori land is disproportionately affected by sea level rise with many parcels located in low lying coastal locations. Sea level rise will have an enduring effect on the occupation and ownership of land holding a prodigious amount of cultural and spiritual importance for Māori. This dissertation discusses how the



David Watson

*\*Lyrics from Working Class Man,  
 Jonathan Cain, 1985*

Photo: Nies, 2018

ownership and rights to Māori land are challenged by sea level rise, examines Crown obligations under te Tiriti o Waitangi, and explores the extent of Māori participation in decision making about Māori land.

Current New Zealand legislation and policies are not adequate to deal with climate change adaptation. Future climate adaptation legislation will address managed retreat, but no bill has been presented to Parliament. The future of the Natural and Built Environment Act 2023 and the Spatial Planning Act 2023 are uncertain. If elected in October 2023, the New Zealand National Party could repeal the acts and reinstate the Resource Management Act 1991.

The Land Information New Zealand (LINZ) Guidance to support applications for recognition of customary interests under the Marine and Coastal Area (Takutai Moana) Act 2011 explains the movement of boundaries in response to sea level rise. As the line of mean high-water spring (MHWS) moves landward, inundated freehold land will become part of the marine and coastal area. The common marine and coastal

area is incapable of ownership, but a customary marine title can be claimed. Literature and key informants express the ideal of Māori retaining ownership of land inundated by the sea. Māori should be given the right to access and occupy their land to maintain a relationship and continue cultural practices, subject to safety conditions.

As defined by common law and the United Nations Declaration on the Rights of Indigenous Peoples, te Tiriti contains the principles of partnership, protection and participation. Experts and literature support Māori having the right to decide what happens to their land. Decisions involving Māori land and sea level rise should be made on a case-by-case basis while consulting with a panel of experts. According to experts, the Crown does not have an obligation under te Tiriti to protect Māori land against sea level rise, but has an obligation to protect the relationship that Māori have with their land.

David was supervised by Dr Francesca Marzatico and is now in Western Australia working for Category 5 Rail. ●



## Comprehensive eruption study highlights need for further work - NIWA

A new study has comprehensively mapped the immediate after effects of the January 2022 eruption of Hunga Tonga - Hunga Ha'apai, highlighting the risks of similar events.

The study, [published in Nature Communications](#), is part of the joint international project, the NIWA-Nippon Foundation Tonga Eruption Seabed Mapping Project (TESMaP), which includes 13 partners from Tonga, New Zealand, Australia, Germany, USA, and the UK.

The eruption was the biggest atmospheric explosion recorded on Earth in more than 100 years, displacing almost 10km<sup>3</sup> of seafloor, and generating a tsunami that sent shockwaves around the world.

Following the eruption, scientists from New Zealand's National Institute of Water and Atmospheric Research (NIWA) set sail on RV Tangaroa for a month-long voyage to collect geological data, video footage, seabed imagery and water column samples. Using this information, they were able to show the far-reaching ocean impacts of such a large eruption, including the widespread loss of seafloor life.

NIWA biogeochemist and lead author of the study Dr Sarah Seabrook says the initial voyage has led to discoveries never before seen, reshaping our understanding of the impacts of volcanic eruptions on ocean ecosystems.

"Just one example is the role of underwater mountains (seamounts) providing a sheltering effect from the powerful seafloor density currents that smothered much of the seafloor around the volcano, wiping out seafloor life in the area,

but left the seamounts relatively unscathed," Dr Seabrook says.

"Such refugia have been reported on land, where vegetation and

people have been sheltered, but not in the ocean. But survival after the initial event is only the first hurdle. The eruption causes dramatic



changes to nutrient and oxygen levels in the water which could have feedbacks that we are yet to understand.

"We do not know the timescale over which the seafloor communities in the Hunga Volcano may recover, but we think it may be aided by re-colonisation of the life which survived near these seamounts. The only way to see if it has survived, and to what extent, is to revisit the area."

She says that most eruptions of submarine volcanoes go undetected or underreported with little data before or after eruptions.

Dr Seabrook says that there is still much to be learned about the 22 mapped volcanoes in the Kingdom

of Tonga, along with hundreds more along the Tonga-Tofua-Kermadec Arc, and numerous others worldwide. "Future monitoring, of both the volcanic edifice itself and the surrounding seafloor and habitats, is necessary to robustly determine the resilience and recovery of both human and natural systems to major submarine eruptions. It will also help more broadly assess the risks posed by the many similar submerged volcanoes that exist worldwide."

Dr Isobel Yeo is a volcanologist, and lead scientist of the UK part of this international programme, based at the National Oceanography Centre (NOC).

"This work has highlighted the

potential of offshore volcanoes to produce immense eruptions that pose a serious threat to coastal communities and subsea infrastructure and highlights the urgent need for more research on and monitoring of these volcanic systems, not just in Tonga, but globally," she says.

Dr James Hunt of the UK's National Oceanography Centre says international partnerships were key to the success of the research. "This complex project required mobilisation of a vessel immediately after the eruption and brought together a truly multidisciplinary science team. This could only be achieved through international collaborations, underlining a need to work across borders to understand volcanic hazards." ●

---



## Completing New Landonline – Survey



**Nick Stillwell is the Lead Consultant Surveyor for Toitū Te Whenua Land Information New Zealand's Modernising Landonline programme.**

**A**s the result of customer feedback, the team behind New Landonline – Survey is focused on completing development of the new app as quickly as possible.

Toitū Te Whenua Land Information New Zealand (LINZ) consulting surveyor Nick Stillwell says the customer feedback aligns well with the requirement to decommission Legacy Landonline by April 2025.

"As a result, our focus is now on getting the remaining survey features out of the legacy system – prioritising this over making minor improvements to functionality already available in New Landonline – Survey."

The new focus comes hot on the heels of November's successful closure of survey capture in Legacy Landonline. This means surveyors must now perform survey capture activities in New Landonline, but continue to use the legacy system for spatial searching, plan generation, and submitting and signing cadastral survey datasets.

Nick says, though dates are yet to be confirmed, the next survey functionality to move completely to New Landonline will be:

- my messages
- sign and submit
- remaining spatial search functionality, including LandXML export
- plan generation.

### 2024 consultation on new digital viewer for cadastral survey datasets

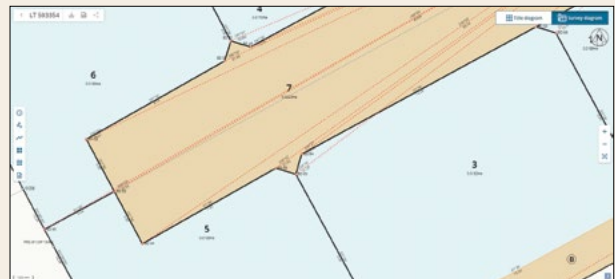
As part of the development of New Landonline, LINZ is preparing to consult with surveyors in 2024 on a new digital viewer for cadastral survey datasets (CSDs).

The new viewer will provide surveyors with a digitally interactive view of a CSD as an alternative to the static tiff images currently used.

A prototype of the interactive CSD viewer will support the consultation, enabling users to test its usability and see



**CSD viewer sneak peek – survey diagram zoomed out**



**CSD viewer sneak peek – survey diagram zoomed in**



**CSD viewer sneak peek – title diagram for a six-lot subdivision**

how it affects their workflow – including the sharing of information between professionals and clients.

The consultation will be broad and connect with all CSD user groups, particularly survey, legal and territorial authority professionals.

"Surveyors will be able to access the prototype from New Landonline – Survey. They can test this with colleagues and clients, then provide feedback on how user friendly the technology is," Nick says.

The transition of plan generation functionality into New Landonline will proceed in parallel with the consultation.

"If consultation proves that the CSD viewer prototype meets the needs of the tenure systems and customers, then we'll start transitioning from plan generation to the CSD viewer. This means it's important to not over-invest in plan generation in the short term. ●

### Where to go for help

For more information, please email

[engagement@linz.govt.nz](mailto:engagement@linz.govt.nz)





84.

## Overcoming Self-Doubt for Career Success a.k.a Imposter Syndrome

As the saying goes; just because you can't see something, it doesn't mean it isn't real. Imposter Syndrome is exactly that. If you've ever felt out of place or intimidated in your job, it might be the reason and its potential impact on your career is very real!

But don't worry, Imposter Syndrome isn't something you need to see your doctor about. In fact, many people experience it at some point, and when you take the right steps, it can be overcome.

Here at 84 Recruitment, we believe you shouldn't let imposter syndrome become an obstacle on your road

to career success. We sat down with Managing Consultant, Hannah Ealson to discuss the steps she suggests you can take to overcome this mindset.

### 1. Understanding Imposter Syndrome

While it doesn't take a rocket scientist to figure out that imposter syndrome means feeling like an imposter in your role or amongst colleagues, there are still a few things you should know.

Hannah explains that the root of imposter syndrome plays a big part in self-doubt. You question your skills and achievements – attributing them

to good luck or the help of colleagues rather than yourself.

As a woman in leadership at 84, Hannah had a few things to say around the gendered nature of imposter syndrome.

*"There is additional, gendered pressure on women to run a home, go to the gym and take care of their physical health, prepare a nutritious family meal, as well as go to work. That pressure can be overwhelming. Also, we haven't always seen models of female leadership to show us how it's done".*

Women are more likely to experience imposter syndrome because of gendered pressures they can't just leave behind at the office! Don't get me wrong, men also experience imposter syndrome, and should still be taken seriously. However, men are often slightly better at hiding their experiences.

### 2. How Imposter Syndrome Can Affect Your Career

Imposter syndrome is not only draining, but it can be hugely detrimental



to your career. The irony is that the more you feel like an imposter, the more of an imposter you become.

In Hannah's experience, putting on an act, a.k.a. the famous fake-it-till-you-make-it strategy, won't do you much good in the long run. Your colleagues are likely to notice disingenuous behaviour, which in turn, damages your credibility and trust!

### 3. Signs You're Experiencing Imposter Syndrome

Identifying the symptoms can be challenging but important for overcoming it. Ask yourself specific self-reflection questions to gauge if you're experiencing it.

Hannah helped curate some self-reflection questions, to identify whether you might be experiencing the symptoms of imposter syndrome:

- Are you consistently worried to pull the trigger when making professional decisions?
- Do you doubt your competence to do certain tasks?
- Do you attribute your successes to good luck or other external factors?
- Do you feel you've 'tricked' your way into certain roles, promotions, or assignments?
- Do you lack role models you can relate to in your industry or workplace?

### 4. Overcoming Imposter Syndrome

Telling yourself to 'just get over it', isn't likely to do the trick. Instead, reframe this as an opportunity to seek out mentors. Hannah suggests finding yourself a range of mentors, formal and informal to help guide you along your journey to career growth and success! The likelihood is your mentor has experienced self-doubt themselves. They can help validate your feelings of self-doubt, affirm your successes and belonging.

### 5. Stairs of Competency

When overcoming imposter syndrome, another tool in Hannah's toolbox is 'The Stairs of Competency'.

Use this tool to manage expectations of proficiency in your role, embracing each phase of your learning journey:

- The first stair is Unconsciously Unskilled – you don't know what you don't know. In other words, you are blissfully ignorant of how much learning is ahead of you.
- The second stair is Consciously Unskilled – you've been in your role long enough to notice what others are doing and can map out the skills you need to learn.
- The third stair is Consciously Skilled – you've been around the

block enough times to know what you're doing but you still need to focus while you're doing it.

- Finally, the fourth stair is Unconsciously Skilled – your role and your skills are second nature. Just like breathing, eating, and walking, you don't think too hard when applying your skillset.

This is a normal progression and should be expected! If you were at the final step and had achieved mastery from the start of your role - it's going to lack challenge and get boring pretty quick. Remember, you are not an imposter for lacking certain skills, you're just climbing the stairs and don't be afraid to take ownership of the skills you know and have mastered!

### It's time to own your success

Many people apply for roles without meeting 100% of the criteria, and in fact, employers might prefer a candidate who is hungry to learn and grow.

Don't let Imposter Syndrome hold you back in your career! Reframe your mindset, seek support, so you can thrive professionally.

If you need career advice, contact our team at 84 Recruitment, where our industry experts can guide you towards success and can help align you on your best career path! ●



# Rethinking the Use of Incorporated Societies in Land Development

*Anthea Coombes and Vicki Toan, Partners, Glaister Ennor*

The use of incorporated societies as a legal mechanism to own and/or manage shared property, assets and facilities in a land development context has been commonplace since the mid-2000s. While the use of an incorporated society as a land-owning entity was largely a response to the requirements of the Securities Act 1978 and the Securities Act (Real Property Developments) Exemption Notice 2007, it has proved a useful tool for greenfields subdivisions and other comprehensive multi-building residential and commercial developments. But the suitability and desirability of this may be about to change.

The new legislative regime for incorporated societies under the Incorporated Societies Act 2022 does not offer the same level of flexibility and scope for bespoke constitutional arrangements as was permitted under the Incorporated Societies Act 1908. And, since regulations to support the Incorporated Societies Act 2022 came into force on 5 October 2023, we are now seeing the impacts of the legislative changes on existing incorporated societies that are re-registering under the 2022 Act.

The Incorporated Societies Act 2022 introduces a more prescriptive and directive statutory framework (for a description of the key changes, see *Surveying+Spatial*, Issue 109, September 2022, p39). Changes that may

impact new and existing incorporated societies that were or are formed for the primary purpose of owning and managing land and/or other assets are:

- the requirement that all members consent to being members of the society. This requirement is potentially at odds with the typical existing arrangements where land-owners in a development with an incorporated society are legally obliged to become and remain a member of the society by virtue of an encumbrance or land covenant registered against the record of title to their property. The question that arises is whether a member is deemed to have consented when membership is mandatory.
- the prohibition of the distribution of the society's assets to members on dissolution of the society and the requirement that a society's constitution identify a not-for-profit entity (such as a registered incorporated society or charitable entity) that the society's assets will vest in on dissolution. These aspects of the Incorporated Societies Act 2022 raise a number of issues including:
  - what not-for-profit entity to choose – if an appropriate entity exists at all; and
  - whether any not-for-profit entity would want to take on real property and physical assets like roads, stormwater management devices, wastewater treatment systems, and native vegetation.
- the requirement that a society must have a minimum of 10 members at the time it applies for incorporation and at all times after incorporation. This will be an issue where the number of owners required to be members of the society is less than 10 because fail-



ure to have and maintain a minimum of 10 members is grounds for removal from the Register of Incorporated Societies.

It is not uncommon for a development proposal to be advanced on the basis (and resource consent to require) that certain assets be owned, maintained and managed by a 'homeowners' association' or other legal entity or mechanism. To date, compliance has been easily achieved by the creation of an incorporated society under the Incorporated Societies Act 1908. So, if an incorporated society is not the most desirable or appropriate legal mechanism, what other options are there?

We are aware of three practical alternatives:

- unit title developments under the Unit Titles Act 2010 including the use of layered developments
- land covenants; and
- landholding companies.

These alternatives have not historically been well utilised, but this may be the time for a shift.

As with every development, the unique circumstances of each development will dictate the best legal mechanism for dealing with shared ownership and management responsibilities. For more information, contact the team at Glaister Ennor. •

# Geometer Dreams

By Peter Byrne Hon Fellow SSSI  
Review by Gordon  
Andreassand, FNZIS

In *Geometer Dreams*, Peter Byrne, the 'Geometer', recalls people and events over 40 surveying years "when young, in brown and green lands, sweet moments, tribulations and travails". He writes of tribes within his tribe, strange happenings and a remarkable leader. There are more than 100 vignettes – great yarns – written in the third person.

In the preface, he explains his reason for eschewing 'surveyor' in favour of a variation of the French title, *geometre*. There is an abundance of different professionals today with the word 'surveyor' in their title, and this move to give the land surveyor a different name provides an indication to the reader that the book will not be a heavy read, but one seasoned with whimsy.

The message printed on the back cover of the book tells us that this is not a book about surveying but people – surveyors and many others – within its context. Yet it describes surveying

through stories of experiences, in the second half of the 20th century; and the advancements since... "when surveyors tread less on the object of their attention – the land".

In one story, the Geometer reflects on trig stations. "Now most trig stations will not be visited or used again, and having served their purpose have become redundant – as has the Geometer."

In the chapter, Too Long in the Bush, he reflects on long periods away from home and the challenges of re-entry. He observes that it is similar to reconnecting with the office. Deskbound colleagues were friendly and welcoming, and in reply to their query, "How was it?", he would start to respond, but become aware of their eyes glazing. The most interest was shown by those who had been there already. He would drift towards them; they recognised the symptoms – too long in the bush.

The author explains that *Geometer Dreams* would not have proceeded beyond a private paper to reach publication had he not read, then reviewed, the book, *SEMUT*. That book brought to light the extraordinary military careers of New Zealand surveyor Toby Carter and Australian surveyor Keith Barrie.

Stories in *Geometer Dreams* mention geometers of several nationalities, but most of Byrne's professional teams were Australians and New Zealanders. Kiwi readers with a lengthy surveying background will note the names of a number of geometers who qualified through the NZIS system. All good keen men.

Yes, a book mainly to be enjoyed by surveyors (or geometers in Byrne's terminology) – but I have spoken with several readers from other professions who have enjoyed the yarns in *Geometer Dreams* and considered the book a very good read. ●

## Available from:

Published in Australia, it is distributed by Rabble Books & Games, in Perth.

W: [www.rabblebooksandgames.com.au](http://www.rabblebooksandgames.com.au)

E: [rabblebooksandgames.com.au](mailto:rabblebooksandgames.com.au)

The book costs **A\$35**, total including post & packaging to New Zealand comes to **A\$53.50**. The e-book at **A\$14.99** is a bargain. Preferred payment is by PayPal.

## Geometer Dreams

ISBN: 978 064547 860 0

## Author's details:

Peter Byrne, Hon Fellow SSSI

Past President of the Institution of Surveyors Australia

Vice-President of FIG (1992-1995)

## BUY THE BEST OF BOGLE AT A SPECIAL PRICE FOR CHRISTMAS WHAT A MAN, WHAT A GIFT



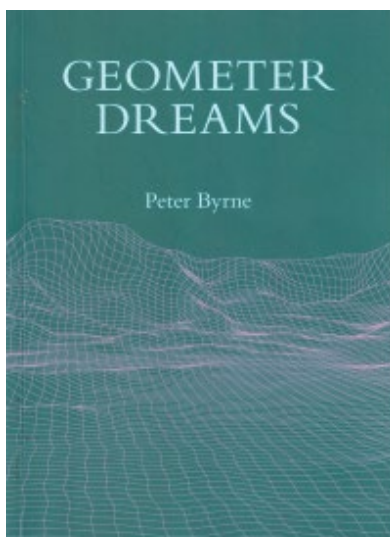
Order by emailing Andrew Blackman, [andyblackman17@gmail.com](mailto:andyblackman17@gmail.com) with your name and delivery address for a copy at the Christmas Special individual price of **\$42.00**, including GST and delivery, a **\$10.00** saving compared to the normal website price.

**Special Pricing Ends 22nd Dec 2023**, but order quickly for receipt by Christmas. Payment by subsequent emailed invoice.

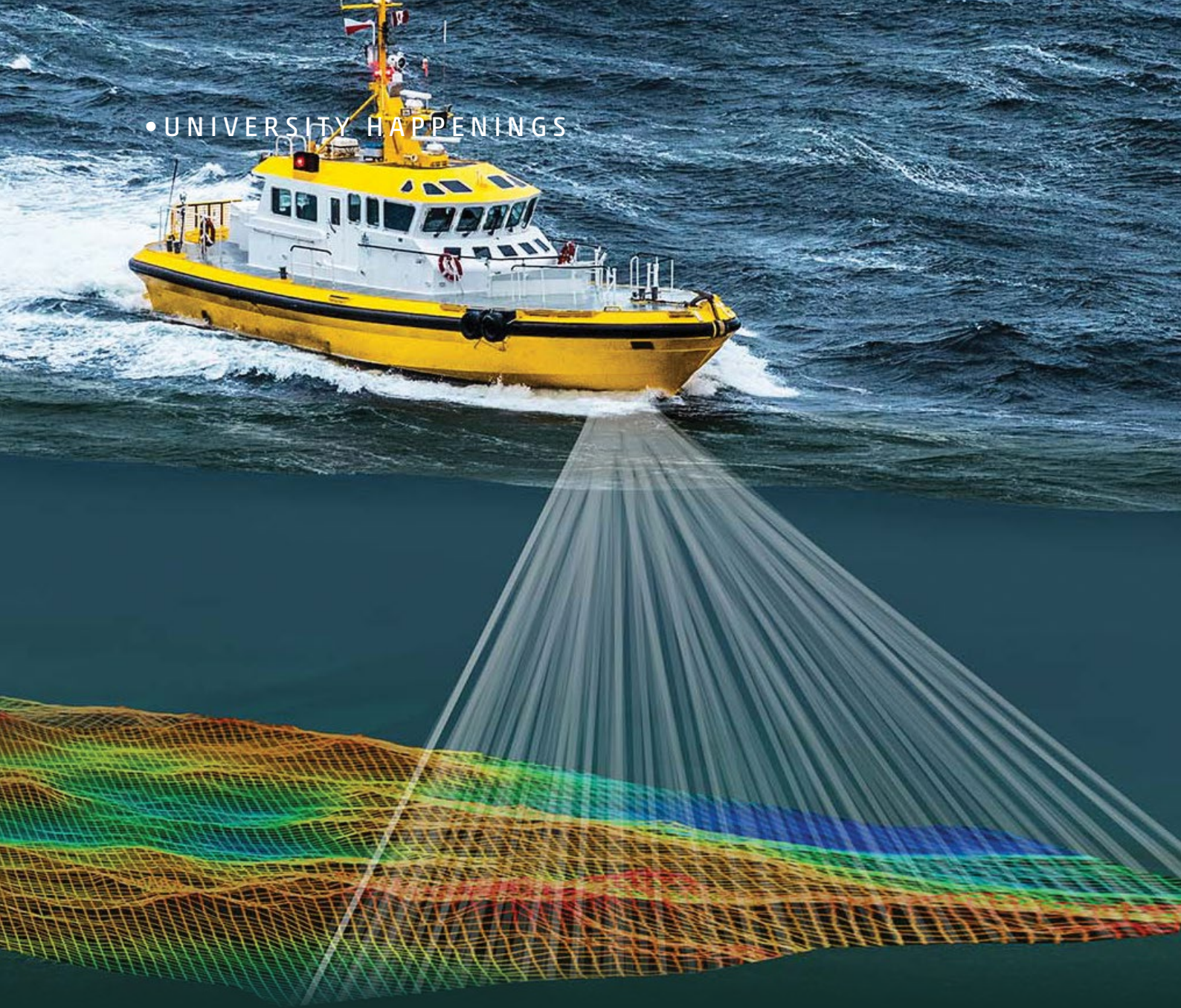
**Boxes of twelve books also available for \$400 plus GST, with free delivery in NZ.**

Archie Bogle was one of the last of the pioneering surveyors. He died 50 years ago, but in his last years he wrote an autobiography entitled *Links in the Chain*, which was published by the Institute in 1975. That autobiography tells the story of his early years, from about 1900 to the 1920s, working in the bush in the Whanganui River area. This has been republished as Part I of this three-part book, *The Measure of the Man*. Part II is a short biography of Archie, with the title *Surveyor Extraordinaire*. Part III, *The Best of Bogle*, is a series of short articles written by or about Archie. Collectively, the three parts illustrate his mastery of the pen, his humour, his erudite wisdom and his compassion.

Visit our website for more information – [www.surveyspatialnz.org](http://www.surveyspatialnz.org)







## (NOT) ALL AT SEA

*Emily Tidey – hydrographic surveying lecturer*

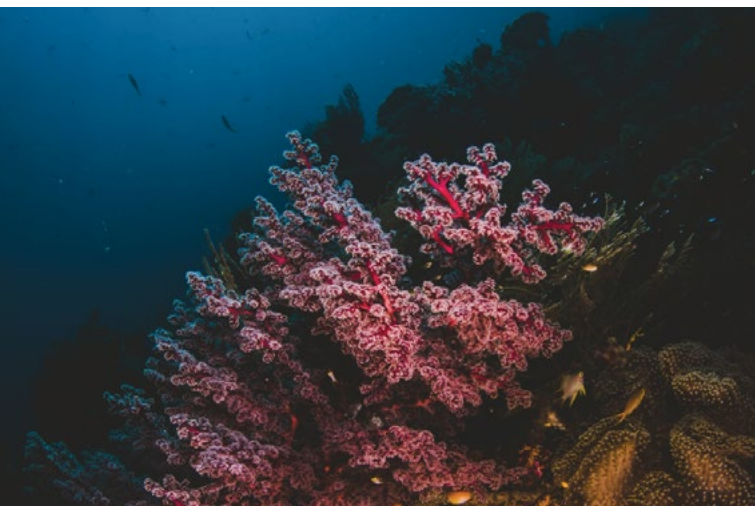
**M**ost study options for students at Te Kura Kairūri | the School of Surveying focus on land surveying, however there are a few options for those interested in surveying the remaining 70 per cent of our planet. At present, interested students can choose to take the optional hydrography papers SURV322 and SURV452, coordinated by myself over the past 10 years (I am a graduate of the school and have worked and studied as a hydrographic surveyor around the world). We

offer these papers every two years, to balance out the costs of hiring vessels with the number of students taking the subject.

A range of students choose the hydrographic surveying papers in their third or fourth years. There are usually a few who have recreational boating experience; perhaps through fishing or sailing experiences with their families. Occasionally we have had ex-Royal NZ Navy members who have chosen to do a degree after leaving the navy. Then there are those







“The job prospects are obviously fantastic in terms of travel (the ocean goes everywhere, and there are also lakes and rivers, of course) and the remuneration that accounts for long days away from home is not bad either.”

students who may have used a single beam echosounder during their summer holidays, or who have been made to wade into rivers, ponds and beaches with an RTK pole and wondered if ‘there might be a better way? And then there are students who are interested in the subject with no prior background – even occasionally a few who notify me that they cannot swim, so they are provided with a lifejacket for all activities near and on the water.

Each year when we present the paper options to our students, I am careful to point out that these are papers that require participation in all-day practical and lab sessions every Friday, and that the job market may not be great when students graduate. However, since 2022, I have been able to say there is a very high demand for hydrographic graduates. Recently, our students have been incredibly lucky to choose from several job options in New Zealand, Australia, Norway and Singapore. This year, every single final-year student who took the advanced hydrography paper has ended up working for a hydrographic surveying company – which is a new record since I’ve been taking the paper. The job prospects are obviously fantastic in terms of travel (the ocean goes everywhere, and there are also lakes and rivers, of course) and the remuneration that accounts for long days away from home is not bad either.

The papers are well received. Some of the best feedback I have received came from a student who didn’t end up pursuing a hydrography career, but enjoyed the freedom offered during practical sessions to develop their land surveying skills with different equipment. This is one of the things I like about hydrography; it stitches together land surveying skills with nautical ones. For my practical sessions, I often don’t prescribe an explicit method, as I prefer to let students investigate different options and learn to extend themselves in this way.

I’ve written most of this while ‘mowing the lawn’ (using a multibeam to get full coverage bathymetry of the

seabed) off Dunedin accompanying two past students who now work as hydrographers with New Zealand company DML who have hired the university multibeam for this work. It was an excellent opportunity to keep myself up to date, and also catch up on the wide range of experiences that our students can have. Both students, and several others I have taught, have now gained certification as Level 1 or 2 hydrographers – an established internationally recognised certification which considers education as well as experience. I’m really proud that our BSurv degree is recognised as providing such an excellent footing for this highest hydrography professional attainment.

What’s next? We’ve had our multibeam echosounder for close to seven years and it’s been used for some fascinating research with surveyors, marine scientists, geologists and geographers mapping parts of seabeds and lake-beds never mapped before. The university has talked of upgrading our large vessel over the past few years – it’ll be interesting to see how that goes, and it’s important that we’re involved in the process. Industry movement to uncrewed surface vessels (USV) and autonomous underwater vessels (AUV) certainly points to changes in the ‘traditional’ hydrographer’s role, but not their replacement, I think. Just like our land-based colleagues, we continue to adapt and use technology in novel ways, but as always, we bring our project management, measurement and analysis skills to the job.

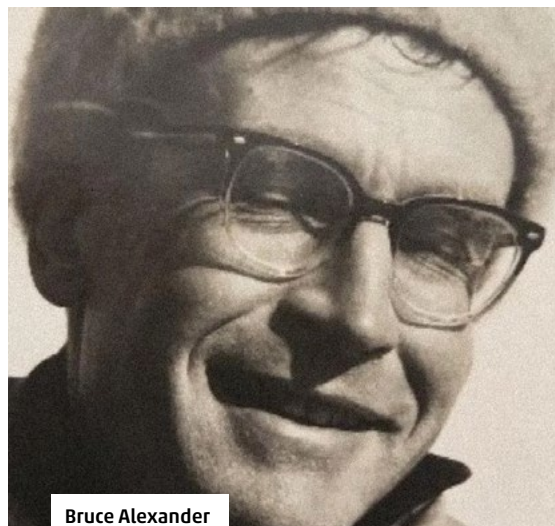
Most hydrographers I know are also always keen to share the exciting places we have mapped and explored (often for the first time), the cool new technology we are using and the interesting ways our data can benefit our communities and our world. It’s a privilege to be able to share this with students, personally, through amazingly generous guest lecturers, and with professional organisations who have supported us for many years.

Wishing you all calm seas over the summer. May your SVP connect, your patch test resolve and the bungs be in! ●



*Bruce Alexander / 1932 – 2023*

# LAND SURVEYOR AND PLANNER



The fortune of entering the 'closing years' of New Zealand's geographical exploration era, the 1950s, combined with his natural affinity with people and commitment to community, tempered by relentless curiosity and professionalism, set Bruce up for his multi-faceted life. His pioneering surveying work in the Pacific and Antarctica in the 1950s carried through to professional and civic life, mostly in Christchurch, reaching to the second decade of this century.

Two earlier callings reinforced his surveying baseline.

Seeds sown by his grandmother around Māori lore led to young Bruce's interest in biological and cultural artifacts. Completing a topographical map of the Claverley area at Pariwhakatau Pa in North Canterbury, where archaeologist Dr. Roger Duff was excavating Māori sites in the early 1950s, was a merging of Bruce's archaeological questing with survey professionalism.

The second was alpinism. Bruce was active with the Canterbury Winter Sports Club and the University Tramping Club during his cadetship years, and later, the NZ Alpine Club. The transalpine 'Three Pass' tramp led to alpine trips, working southwards to Western Otago. Bruce held explorer John (JT) Holloway in high regard, and in 1964, the NZ

Alpine Club published his revised map of the Olivine area together with a companion manuscript describing geographical place names, which built on Holloway's earlier work.

## **Survey professionalism**

### ***Tonga and Antarctica***

On graduating before the Survey Board in 1956, in their mid-20s, Bruce and co-graduate Larry Wordsworth, with retired Director of Surveys, Borneo, David Leach, established a headquarters for the fledgling 'Cadastral Survey of Tonga', in Nuku'alofa. It became base for surveying the islands into 'eight and a quarter acre' tax allotments and smaller housing settlements, within the 1882 Act to Regulate Hereditary Lands.

After fixing the astronomical position of the flagpole on the Nuku'alofa waterfront, during their 18-month assignment they surveyed the main island of Tongatapu into over 1000 lots and made a start on Eua. As Bruce wrote in *One Hundred Fathoms Square* (2013), a book written at the express request of the King of Tonga, they had "...created an organisation that had put Tonga on the map, and formed a well-trained and experienced team of survey staff, able to do the job in Tongan conditions."

Few Europeans other than missionaries and traders had lived in villages and experienced Tongan life as they had.

It was then a short if unusual step from Pacific to Polar. Bruce departed with the New Zealand Geological and Survey Expedition (1958/59) to Antarctica. He was surveyor in a party of four (with a geologist and two mountaineers) assigned to survey unmapped portions of the Victoria Land coast. Though at first no-one wanted this party of Kiwis – neither the Americans who had shipped them south, but could not land them at the chosen spot, nor the Kiwis who received them by surprise at Scott Base – improvisation triumphed.

With climbers Jim Wilson and Mike White, Bruce man-hauled a sledge the final 65km eastward along Ross Island to Cape Crozier, a modern, summer-season and shortened re-enactment of the mid-winter Terra Nova expedition 1910-13 journey, famously Apsley Cherry-Garrard's *The Worst Journey in the World*, and rounded-off by finding the stone shelter built in 1911.

At a recent reunion, Wilson and White recounted how their surveyor Bruce patiently stood, nearly motionless, on the summit of Mt Terror (3,200m) a sibling of Mt Erebus – a first ascent – in searing



Wally Romanes, Mountaineer, Bruce Alexander, Surveyor

Bruce Alexander (right) with mountaineer Wally Romanes, Antarctica, during the New Zealand Geological and Survey Expedition, 1958/59. (Alexander family collection)

cold for two hours as he manipulated the knobs of the phototheodolite to secure bearings on distant

landscape features. Sixty five years later, the three men sparked off each other as if it happened yesterday.<sup>1</sup>

### Survey practice, and town planning

On return from Antarctica, Bruce was enticed by a colleague to form a survey partnership, *Middleton and Alexander*. Ministry of Works was contracting out surveying for government housing projects, city subdivisions were on the go, and with luck for a mountaineer, a surge in skiing had built up demand for access road surveys.

By the mid-1960s, emerging controversial projects were adding spice to the surveyor's workload.

"With many arguments over subdivisions and the use of money

collected in lieu of setting aside reserve land, I thought some council decisions defied logic" Bruce wrote. "Grand properties in Fendalton were being ruthlessly subdivided into the smallest common denominator ...and no one was caring."

With the grand Mona Vale property at risk of sale to developers, Bruce jumped aboard the city Civic Trust as the Jaycees representative, the aim being for councils to purchase the property for the public.

In an attempt to boost fundraising, he encouraged those opposed to the subdivision to purchase dummy lots in the property that he had drawn up, taking care to underline that these were not legal transactions.

"Money drifted in slowly, but bitter differences of opinion arose between various local authorities", he recalled.

"Mona Vale was a long, bitter but ultimately successful fight."

Bruce showed leadership in other community causes including the purchase of land for the public reserve Mt Vernon Park, preservation of the Normal School, and restoration of the Peacock Fountain, and the Nurses' Chapel in Christchurch Hospital.

Fellow Civic Trust member Chris Kissling described Bruce's legacy as one of passion and determination, underpinned by qualities of a meticulous surveyor and planner. "Being involved from its inception in 1965 and leaving only when failing hearing frustrated his ability to contribute in his late 80s, made Bruce the longest-serving member of the Trust, serving over time as secretary, treasurer, chair, and appointee to other organisations, as well as his direct professional involvement with projects."

In 1999 Bruce received a Civic Award for services to the community.

<sup>1</sup> Bruce's work in Antarctica is described in greater detail in an obituary written by Richard McElrea, *Antarctic*, 41/2, November 2023, NZ Antarctic Society.





**Photo caption:** Bruce Alexander demonstrating a Wye theodolite in recent times. His other one, a Troughton and Simms that he bought ex-NZ Railways in 1955 was a life-long pride and joy as well as a tool of trade. Into his 90s he jumped at excuses to assemble it, and regale listeners how it could read to 10 seconds of an arc whereas some modern instruments could only manage 20 or 30.

When treading from survey into the discipline of town planning, Bruce was rebuked for being unqualified. He took the hint and graduated with a Post-Graduate Diploma in Town Planning in 1970.

Through secure times *Middleton and Alexander* employed up to 12 staff, but by the mid-late 70s there was bust among the boom in land development. After the partnership disintegrated about 1978, Bruce turned to a decade as a senior planner with the Christchurch City Council.

Back in private practice with David Ogilvie and Partners, he became right-hand man for engineer Peter Yeoman who was fronting the controversial Mt Cavendish Gondola, this time working on the development side of the fence.

"It was an ideal partnership" Bruce wrote, "...I helped manufacture the bullets, which Peter – as the front man – fired." Another long, hard battle, eventually won, in 1992.

## Home and family life

Bruce was born to Neill and Helen Alexander in Timaru. His great grandfather, Francis Hayter, was a resolute British seaman who sailed with Lord Elgin up Yangtse River during the opium wars in the 1850s, and with Captain Moresby on HMS *Basilisk* while surveying the New Guinea coastline, before marrying Eugenie Huddleston in Nelson in 1878 and settling in New Zealand. Bruce, who had a strong sense of family connectedness, proudly credited such lineage for much of his own enterprise.

He spent early years on farms in South Canterbury, then Sumner, Christchurch, before retreating to safe haven through the war years with family friends in Naseby, Otago. Formative years included a family split and new union, and secondary schooling at Christ's College in Christchurch.

Bruce married Ilena Druzianic, daughter of immigrants from Croatia, in 1960.

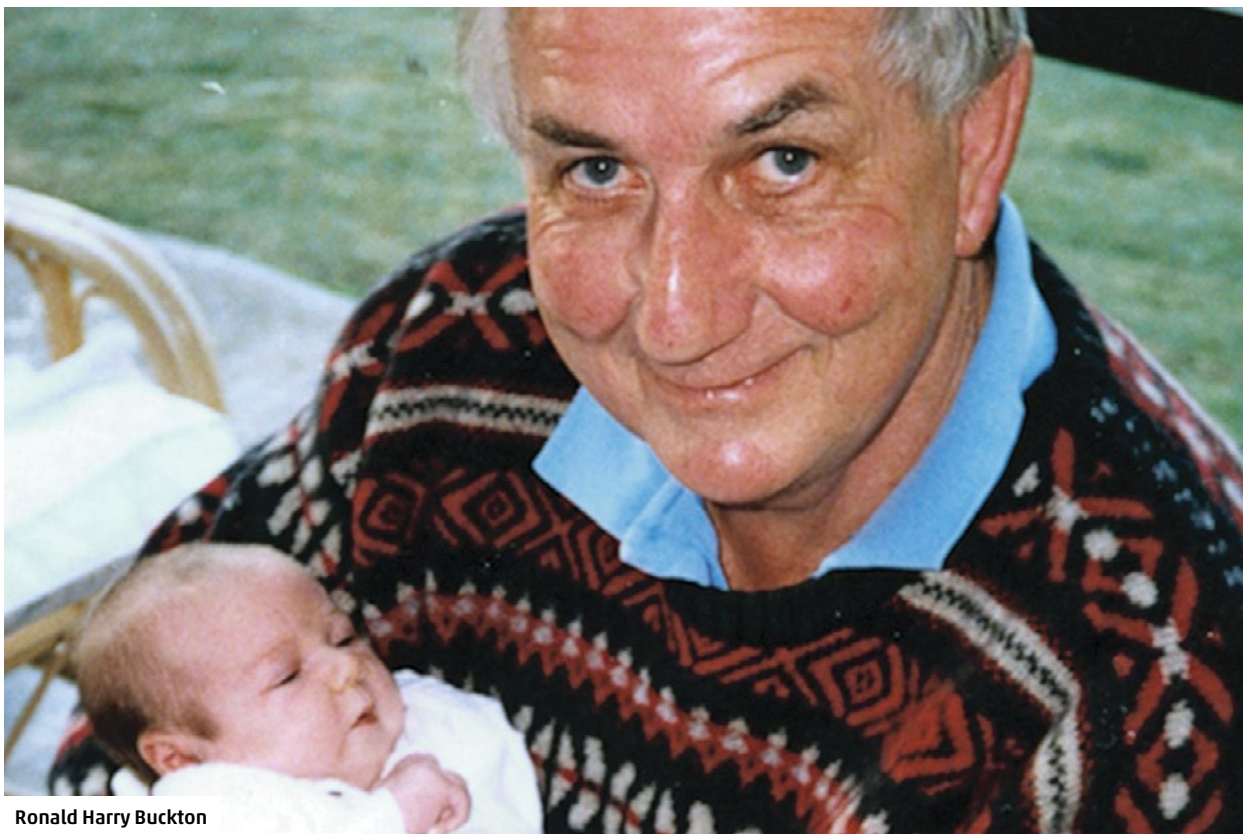
## Retirement years

With time eventually freed up by nominal retirement, Bruce switched part of his attention from the theodolite to equally exacting work making scale-model sailing ships. Pride-of-place HMS *Basilisk* that Francis Hayter had sailed in, then HMS *Bounty*, associated with Tonga, gave him steerage through a period of illness.

Bruce published his autobiography and family history, *For the Love of Hayters*, in 2023.

As his body slipped away, Bruce's mind never lost a beat and his intense interest in other people, and projects around him, never faltered. Last time I saw him, within his final month, his top question was about progress towards publication of an obituary he had recently written for Antarctic colleague and fellow surveyor, Brian Fitzgerald (NZ Antarctic Medal).

Bruce is survived by his wife Ilena and daughters Jane and Margot. ●



Ronald Harry Buckton

## **Ronald Harry Buckton**

**1938 – 2023  
aged 85 years**

**R**on, as he was known, was born in the Warkworth Maternity Hospital to parents Earnie and Eileen Buckton. He was the second of 5 children and grew up on the family farms at Tauhoa and then Woodcocks Road.

The Bucktons are descendants of Joseph Buckton, an Albertlander, and one of the settlers who arrived in Port Albert from England in 1862.

Ron was educated at Tauhoa School and his secondary schooling was at Warkworth District High School. Ron did well at school and in his final year, was Head Boy.

After leaving school, Ron worked for a short time in a bank and then as a trainee engineering draughtsman. When he turned 18, he was called up for compulsory military training, and it was during his time in the NZ

Army that he trained as an artillery surveyor in the Royal Regiment of New Zealand Artillery. As a Territorial Soldier he had regular weekend training camps and also some longer postings around New Zealand mostly at Papakura but also Waikouiri and Burnham. An interesting note is that Ron was at one point stationed at North Head in Devonport, where he was possibly one of the last soldiers stationed there as the North Head Battery was decommissioned in 1957.

It was from his time in the Army that Ron decided to make surveying his career. In 1958 he started work as a survey cadet under Peter Clifton who was a local surveyor in Warkworth at the time. Working during the day and studying by correspondence at night, Ron qualified as a Registered Surveyor in 1963. He then took over Peter Clifton's business in his own name (R H Buckton, Registered Surveyors) and practised till his retirement at the end of 2002. Buckton Consulting Surveyors continues today.

Ron was a very hardworking, diligent and accurate surveyor. The evidence of that is seen by the many, many survey plans in the Rodney and lower Kaipara Districts which bear his name. He was involved with and oversaw many successful developments. He was a great mentor to aspiring surveyors and set high standards.

Ron was a well-respected member of his community. His family and his Church were most important to him. His commitment to the Warkworth Anglican Parish was very evident and he was always an active member of that congregation. He had many pastimes such as holidaying on Kawau Island at the family bach, boating, fishing, Masonic Lodge, Rotary, tramping, brass band, gardening and after his retirement, travelling.

Ron is survived by his wife of nearly 55 years, Angela, two children, grandchildren, a great granddaughter and extended family. We offer the family our deepest condolences. He cannot be replaced. ●





