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# The Geospatial Skills Shortage in New Zealand

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## Executive Summary

This report was commissioned by the New Zealand Geospatial Office (NZGO) and Spatial Industries Business Association, New Zealand (SIBA NZ). The report addresses three main questions:

1. What evidence is there of a shortage in the workforce for people with geospatial skills internationally?
2. What is the extent, if any, of a geospatial skills shortage in New Zealand?
3. If a skills shortage exists, what facilities are in place to address this shortage?

### International Shortage

There is broad agreement that the geospatial industry is a growth industry. Additionally, a current shortage of geospatial professionals has been identified in the U.S. and Australia. In Australia alone, this figure has been estimated at between 3,000-4,000 currently unfilled positions. It is also estimated that this shortage will grow.

### A New Zealand Geospatial Skills Shortage

A similar geospatial skills shortage in New Zealand was identified through an online survey of 157 organisations in the geospatial industry. The number of current geospatial professionals in the industry was estimated by this report as 1,600 - 2,500. Over the last two years, 97 new positions were created in the surveyed organisations over and above staff turnover and net of any disestablished positions.

In addition to difficulties in filling vacant positions, there are various dimensions to this shortage. Demand is highest for applicants with greater than five years' experience, however geospatial qualifications are also highly sought. New Zealand competes internationally for the retention of geospatial professionals. Opportunities for graduates to gain initial experience through internships and apprenticeships are limited and some organisations raised concerns about graduate employment prospects. Other organisations, however, found difficulties in recruiting graduates. Shortages across a number of geospatial areas were identified with the greatest shortages associated with database, programming and spatial reasoning and problem-solving skills. The geospatial sector is primarily urban based and rural recruitment difficulties may be amplified. A subsequent effect of the difficulty in recruiting geospatial professionals is that

inexperienced and under-skilled staff may be appointed. Related to this is a lack of awareness outside of geospatial professionals of the potential benefits in using geospatial techniques within an organisation.

## Filling the Shortage from Within: Capacity Building through Training, Education and Up-skilling

Geospatial qualifications offered by tertiary institutions in New Zealand have grown over the last five years. Professional certification is also gaining traction. While most organisations believe that there are sufficient education opportunities, graduates alone are unlikely to meet current industry demand. Attracting students into these qualifications is difficult as most postgraduate qualifications require potential students to have already completed a relevant undergraduate degree. Education pathways are not obvious for secondary school students wishing to specialise in this area. Furthermore, few organisations particularly target positions at geospatial graduates through internships and apprenticeship streams. Once in a role, most geospatial professionals are supported by their organisation to pursue a number of different up-skilling options, primarily through conference and training courses rather than academic qualifications.

## Recommendations

This report makes five recommendations.

1. The addition of 'Other Spatial Scientist' to the New Zealand long term skills shortage list in order to attract qualified and experienced geospatial professionals.

The remaining four recommendations are key areas identified for consideration in the report.

2. The development of clear graduate pathways for new graduates wishing to gain initial industry experience.
3. Supporting current staff in the attainment of skills, especially recognised academic qualifications.
4. Raising awareness of geospatial careers with secondary school students.
5. Raising awareness amongst managers and other key stakeholders of the possible benefits of applying a geospatial approach.

## 1. Introduction

The geospatial industry is a growth area in New Zealand but anecdotally, there is a shortage of geospatial skills. This shortage has been cited as one of the main barriers to the realization of the economic value of geospatial information and services in the country (Forne 2010). ACIL Tasman (2009) estimate that the geospatial industry added $1.2 billion to the New Zealand GDP in 2008. For the same year, ACIL Tasman estimate that a further $481 million was lost due to the skills shortage and other barriers. This loss carries associated tax revenue of $100 million. ACIL Tasman also suggest that the negative economic effects of these barriers are likely to grow unless notable issues, including the skills shortage, are addressed.

The three aims of this report are: first, to review the evidence for any shortage in the workforce for people with geospatial skills internationally, second, to establish the extent, if any, of a geospatial skills shortage in New Zealand and third, if a skills shortage exists, to ascertain what facilities are in place to address this shortage.

We begin this report by describing the geospatial sector and defining key concepts, such as what constitutes geospatial skills (Section 2). We then review international literature, including published employment projections, to ascertain the international demand for geospatial skills (Section 3). We focus our attention on three case studies; the U.S., the U.K. and Australia. In Section 4, we report on the findings of a national survey of the geospatial sector in New Zealand. This survey confirms the anecdotal evidence of a geospatial skills shortage and sheds light on the dimensions and implications of this shortage. In the following section (Section 5), we explore the current capacity building efforts to fill the shortage and particularly examine current educational pathways. We conclude in Section 6 with how New Zealand fits into the global need for augmentation of a skilled geospatial workforce, and finally offer some recommendations in Section 7.

## 2. Defining 'Geospatial'

The geospatial industry in New Zealand revolves around the use, collection, management, analysis, presentation, and dissemination of data referenced to a spatial location on the Earth's surface. Information with a spatial location, such as addresses or census areas, can be combined and transformed to work with

numerous available datasets to better manage current resources or to reveal new information or patterns, for example, to explore new areas for business expansion.

The geospatial industry spans both the private and public sectors and comprises both users and producers of geospatial skills, services, data, software and hardware. As a user, geospatial techniques can be an approach or set of tools used to support an organisation's core business or elements of their business. For example, industry may use geospatial software and data to streamline logistics or to analyse their customer base. As a producer, geospatial techniques or datasets are marketable products and are sold to support geospatial use in other organisations. While consultancy companies play a large role in this area, data provision is also a key aspect, e.g. aerial or satellite photography, house prices or elevation data.

In comparison to other sectors in the economy, government is a key user of geospatial skills and products as well as a significant stakeholder in the sector from regulatory and policy viewpoints. Government is also, in some cases, a supplier of datasets, e.g. census information, topographic maps or aerial photographs. Government geospatial use extends across all scales of local, regional and central government.

While geospatial occupations can include surveyors and cartographers, we use a more constrained definition for this report, except where explicitly stated. Specifically, we use the ANZSCO (Pink & Bascand 2009) definition for 'Other Spatial Scientist' below to refer to geospatial professionals.

> Acquires, integrates, analyses, interprets, presents, manages and distributes information about locations in space and time, and develops related equipment, software and services.

This definition encompasses varied uses of geospatial technology and the skills required for these occupations fall under the broader terminology for geographic information science (GISc). Geospatial professionals utilize numerous geo-technological approaches, some of which have a long history in science, while others employ the most current and innovative satellite and computer based technologies (Estaville 2010). The umbrella term of 'geospatial technology' incorporates skills in spatial modelling, surveying, global positioning systems

(GPS), geographic information systems (GIS) and traditional cartography techniques (Estaville 2010).

## 3. International Shortage

In 2004, the geospatial workforce was heralded as one of the fastest growing areas of employment globally (Gerwin 2004). The potential uses of geospatial technologies are vast and span applied governmental, academic and private commercial sectors (Gerwin 2004). According to the National Aeronautics and Space Administration (NASA), advancements in geospatial technologies, such as satellites for global mapping, will have as profound an impact on daily life as the computer has during the last half century (Gaudet & Annulis 2008).

TechNavio, a market analysis firm, estimate that the GIS technology market will grow at an annual growth rate of 9.2% to 2015 (TechNavio 2012a) with growth in the U.S. and Europe to outstrip this (TechNavio 2012b & 2011). Predicted growth in the Asia Pacific region is a still strong, but more restrained at 7.8% (Technavio 2012c). Growth in GIS use has also increased in Asia and Africa (Research and Markets 2010).

These growth figures reflect buoyancy in the sales and development of software but are also indicative of increasing demand for the software tools to undertake geospatial processes. However, taking advantage of these technologies across such a broad spectrum of industries and governmental agencies requires a large pool of highly trained employees from which to draw.

### Case study 1: The United States

Recent advancements in geospatial technologies have had an enormous impact on the U.S. economy. In 2004, NASA estimated that the geospatial market would increase from $5 billion to $30 billion by 2005 (Gerwin 2004) and the U.S. Department of Labour projected that the growth in the geospatial workforce would continue at a rate of 35% per annum (U.S. DOLETA 2005). Today, the geospatial industry is still classified as a 'high growth industry' (U.S. DOLETA 2010). It is clear, therefore, that Gerwin's estimates in 2004 of a projected boom in employment for trained geospatial scientists in the workforce were correct. Furthermore, Estaville (2010) predicted that employment will grow across all sectors of the geospatial industry to 2016 with an estimated increase of 14-20% for geoscientists, mapping technicians, cartographers and photogrammetrists.

While the growth of the industry and the opportunities for geospatial employment were met with enthusiasm (Gerwin 2004), there is concern within the industry that employment needs are not being met (DiBiase *et al.* 2006; Solem *et al.* 2008). Indeed, the advancements in GIS and satellite technologies are worryingly out of step with the level of training in the current workforce, with several studies highlighting a geospatial skills shortage in both private and governmental sectors (Estaville 2010). The National Intelligence Agency projected the need for 7,000 new employees in the U.S. trained specifically in remote sensing by 2014. Solem *et al.* (2008) identified GIS and cartography as the most sought after geospatial skills among some 447 U.S. governmental and business organizations. Reports from the U.S. Department of Labour also highlighted that 87% of geospatial technology providers stated difficulties in filling positions requiring geospatial skills (DiBiase *et al.* 2006). The advancements in global satellite technology certainly require a highly skilled workforce, however, there is also a shortage of GIS technicians with base-line proficiencies in using the 'off the shelf' GIS programmes (Marble 1998; Marble 2006). Of yet further concern is the imminent retirement of many of NASA's and the Renewable Natural Resources Foundation's senior and most skilled employees (Estaville 2010), which will leave some of the highest positions in the governmental geospatial workforce vacant.

The solution for filling the growing requirement for geospatial skills in the workforce is two-fold. First, the next generation of young employees needs to be trained to the high standards demanded by the industry. Second, to achieve this standard there is a need to attract new students and trainees into geospatial programmes. In the past five years, there has been some success across University campuses in this regard. An analysis of U.S. geography programmes from 2007-2008 revealed that 188 of the 209 Universities and 8 of the 13 listed Community Colleges had specialized programmes in GIS (Estaville 2010). GIS certificate programmes were established across 120 U.S. universities in response to the growing needs of the geospatial industry (DiBiase *et al.* 2006), particularly those jobs identified by Marble (2006) for basic training in GIS. Further, higher education institutes developed 80 GIS certificate programmes directly in response to the geospatial industry (AAG, 2008; Estaville, 2010). Other organizations, such as the Urban and Regional Information Systems Association, developed GIS certificate programmes that have since become national programmes. These programmes have graduated some 4,500 spatial scientists and the steps are clearly positive. However, when viewed in parallel to growing demands of the

industry, they are likely to only meet some of the demand of the U.S. geospatial workforce.

## Case study 2: The United Kingdom

The UK geospatial industry is well developed and professionalised (Broeders, 2011) with professional associations, such as the Association for Geographic Information (AGI[1]). The entrenchment of the industry is reflected in the education sector, with substantial educational and training options available. The geospatial website, GoGeo, lists 31 higher education institutions offering GIS programmes of study; many of which offer several separate GIS programmes at both undergraduate and postgraduate levels. Additionally, 15 private providers are listed, plus 7 providers of short courses (GoGeo, 2012).

Given the number of courses and qualifications available and a lack of literature, it seems that current demand for geospatial professionals is being met. However, it is predicted that geospatial skills will be increasingly in demand, aiding and aided by economic revitalisation (Donert, 2012). For the UK, this increased demand for geospatial skills is likely to be predominantly in non-geospatial professional roles (Haklay, 2010). These are roles where geospatial skills complement the main workload of the staff member, e.g. hydrology and planning. In particular, the UK has seen a surge in free geographic data, but for the value of that data to be realised, a broad range of professionals need the fundamental geospatial skills to understand, manipulate and use that data (Donert, 2012).

## Case study 3: Australia

High demand for geospatial technologies has also occurred in Australia. The geospatial industry is currently estimated to contribute $10 billion to the annual Australian GDP (ACIL Tasman 2008). However, SIBA Australia estimated a shortage of 3,000-4,000 geospatial professionals to meet the demands of the geospatial industry (CRCSI 2011)[2]. Given that the Department of Sustainability and Environment estimated in 2010 that there were some 51,000 full-time geospatial professionals in Australia, this deficit is significant (Allen Consulting Group 2010). SIBA Australia also projected that Queensland alone requires the re-training of a minimum of 300 mid-career workers due to technological advancements (CRCSI 2011). As in the U.S., the Australian workforces are aging and there is a need for young highly trained individuals to move into the

[1] http://www.agi.org.uk/
[2] This is a wider definition of geospatial and includes cartographers and surveyors.

imminent vacant positions. SEAC (2007) raised this concern and cited, based on data collected in 2001, that one quarter of the male workforce employed in geospatial positions were aged over 50 years. Only 20% of the total workforce is between the ages 20-29 whereas 43% are between 60-64 years (SEAC 2007).

There is a growing discrepancy between the demand for geospatial skills and the number of available trained geospatial workers across sectors in Australia. This discrepancy may be due, in part, to a lack of university level education programmes for spatial scientists. Many Australian universities amalgamated their spatial sciences departments or closed them altogether (SEAC 2007; SSSI 2011). University programmes from nine institutions in 2007 had 1,400 undergraduate students enrolled in spatial sciences programmes, with an estimated 220-250 graduates per year (SEAC 2007). This number is not high enough to fill the internal shortage. It has been suggested that difficulties in attracting students to geospatial programmes is a large factor in the low enrolment rates (SSSI 2011; SEAC 2007).

## 4. The New Zealand Case

In this report, a disparity between the growth in the geospatial industry and the availability of geospatial employees has been identified in the U.S. and Australia. Anecdotally, evidence exists for a similar geospatial skills shortage in New Zealand, however, information on the extent of this shortage and its dimensions are lacking.

This section of the report provides an overview of the geospatial sector in New Zealand and explores whether and to what extent a geospatial skills shortage in New Zealand exists. This section draws upon the results of an online survey conducted in May-June 2012. The development of the survey, and participation rates are detailed in Appendix A. The survey itself is included as Appendix B. The results of this survey were rich and as such, the information presented in this section is a summary of the information collected. The survey was anonymous and while an individual participant reflects the view of a particular organisation, individual's names, contact details or organisation identifiers were not captured or stored with their responses. While voluntary, most organisations who participated in the survey were willing to supply their organisation name. The participating organisations are listed in Appendix C. The remainder of this section is divided into three: a description of the geospatial sector in New Zealand, the

recruitment experiences of the different organisations and a discussion on the dimensions and existence of a geospatial shortage for New Zealand.

## The Geospatial Sector in New Zealand

Organisations employing geospatial professionals span a multitude of sectors[3]. The ACIL Tasman (2009) report on Spatial Information in the New Zealand Economy explores the current use of geospatial skills and technologies across a number of different sectors. These are government (e.g. LINZ, local government, New Zealand Transport Agency and NIWA), services (e.g. consulting and mapping services), manufacturing, trade and retail services, construction, agriculture, food, fishing, forestry, transport, communication and utilities, minerals and mining, and tourism. The value of geospatial techniques and technologies to these organisations differs. Organisations may provide or consume geospatial skills and services and the division between the demand for and supply of geospatial skills and services is not absolute. For example, organisations may create datasets for internal use but also sell these externally. 45% of the organisations surveyed did not supply geospatial skills and services. The supply of geospatial skills and services by the remaining organisation varied across a range; for 12% of organisations this was a primary role, 10% were major suppliers and 32% were minor suppliers. Inversely, most organisations were minor geospatial consumers (53%), yet geospatial techniques were seen as providing significant support for the core business of the organisation (61%).

On average, organisations had 5 full time geospatial staff working in the 157 organisations, another 1 geospatial position where geospatial was the main but not the only workload (50-75% of workload), and 0.4 part time geospatial staff. For the organisations surveyed, these figures total a geospatial workforce of 926. In addition to these primary geospatial positions, a further 8 staff on average had geospatial roles which formed a significant but not the main part of their workload.

As geospatial professionals can be employed in a range of sectors and in supporting an organisation in a range of roles, there are difficulties in estimating the true numbers of skilled employees within the workforce; a fact consistent with studies elsewhere (DiBiase *et al.* 2006; Marble 1998; Estaville 2010). Estimates of the size of the sector are further complicated by a lack of clear professional identity which means individuals working in the sector will be assigned to other professions in a national census. However, from the figures gathered in this

[3] See Appendix C for the sectors represented by the participating organisations.

survey an estimate of the size of the geospatial sector in New Zealand is possible. These estimates rely on a number of assumptions. First, the responding participants in the survey are representative of the organisations included in the mailing list but who did not respond. The survey had a 69% response rate. Second, since the mailing list compiled is not complete, we must estimate the total population of geospatial organisations. In particular, the government sector was well represented as the use of geospatial technologies or otherwise in their operations is not commercially sensitive information. However, the private sector is harder to identify and a database of geospatial organisations is not available. Additionally, there was a focus in the compiled mailing list on ESRI software users due to ease of access to this data. Consequently, the authors estimate that this study contacted approximately a third to a half of private geospatial organisations[4]. In light of these assumptions, it is estimated that the geospatial workforce in New Zealand (as defined by ANZSCO) comprises of 1,600 – 2,500 workers. Conservatively, the lower end of this range is less than twice the number of geospatial professionals captured by this survey reflecting the survey's response rate. In contrast, the 2006 New Zealand census recorded 1,779 surveyors and cartographers which are outside this definition.

## A Geospatial Shortage?

The geospatial sector in New Zealand is a strong growth sector, in contrast to much of the New Zealand economy. Over the last two years, 97 additional roles were filled in the organisations surveyed over and above the replacement of staff (94) and the disestablishing of 55 roles. Of the 246 filled positions across 50% of surveyed organisations, 62% were new roles, 77% were filled by New Zealand applicants, and 23% were filled by recent New Zealand graduates.

Despite strong growth in the sector, 55.5 positions remain unfilled and are current vacancies. This equates to 6% of the current workforce and affects 19% of organisations. Of these, only 40% are currently advertised. In 30 advertised positions, the vacancies could not be filled as applicants did not have appropriate experience (57%), suitable qualifications (20%), or were unable to work in New Zealand (7%). These figures highlight recruitment difficulties for geospatial organisations.

[4] This takes into account that not all ESRI users were contacted as well as users of other software, e.g. MapInfo, Manifold and open source alternatives.

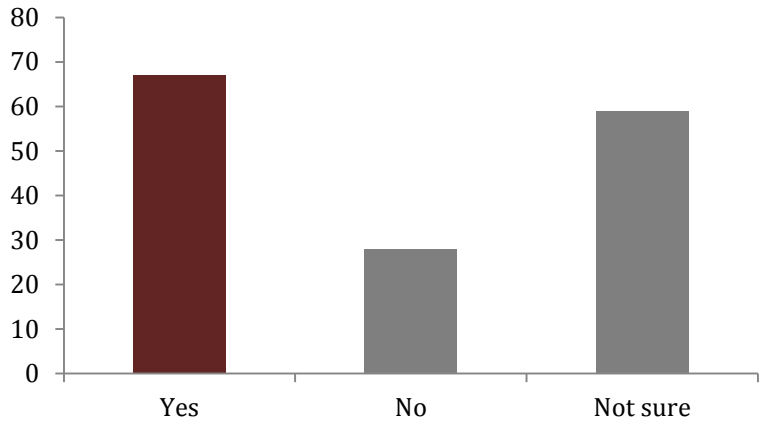


**Figure 1: Does a skills shortage exist? Perception of organisations surveyed**

Furthermore as illustrated in Figure 1, most organisations (44%) believe that there is a current geospatial skills shortage in New Zealand and a further 38% were unsure. Respondents' experience of recruitment and their perception of whether a shortage exists provides strong evidence of a geospatial skills shortage in New Zealand.

## Exploring the Skills Shortage

In this section, we explore the skills in most demand in the sector and delve into the more hidden elements of the geospatial skills shortage.

In recently advertised roles, both geospatial qualifications and prior experience are rated as important to extremely important (see Figure 2). However, of these prior experience within the industry is more highly prized with high demand for applicants with over five years' experience (see Table 1). Demand is lowest for applicants with no prior experience and no relevant qualifications and rises in keeping with improving credentials.

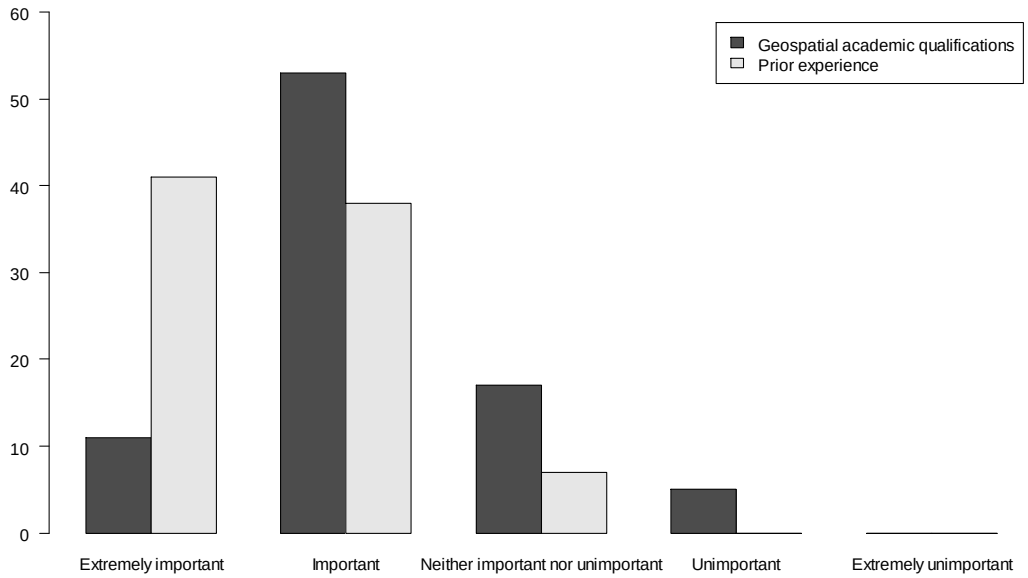


**Figure 2: Importance of geospatial academic qualifications and prior experience for most recently advertised position**

**Table 1: Ranking of applicant qualifications and experience based on the most common responses (mode)**

| Ranking | Academic Qualifications | Prior Experience |
|---|---|---|
| 1 | A specific geospatial certificate, diploma or degree | Five year's prior experience |
| 2 | A related geospatial certificate, diploma or degree | Between 2-5 years |
| 3 | Tertiary geospatial course | Less than 2 |
| 4 | No geospatial qualifications | No prior |

While in Table 1, tertiary geospatial courses and a related geospatial qualification were ranked differently, the average ranking was the same (2.4). This is perhaps due to the lack of GIS/GISc focused components in these certificates, diplomas and degrees (e.g. Geography or Surveying). In New Zealand, no institution offers a full geospatial bachelor degree and most qualifications in this area comprise of a number of courses at undergraduate or a specialised postgraduate qualification. The current education sector is more explicitly examined later in this report in Section 5.

As demand is lower for new graduates compared with those with greater work experience, concerns about the ease of gaining a position as a recent graduate were raised.

> "There seems to be … reduced opportunity for grads to get the important first two years of experience in "production" environments"

However other respondents felt graduates were also scarce.

> "There does not appear to be enough NZ born graduates available. Doing OE???"

Few organisations (15%) offer a graduate apprenticeship programme or an internship scheme with internships more commonly offered than apprenticeships. Expectations surrounding initial geospatial roles may also be a deterrent and qualified applicants will not expect to take on more traditional entry roles in a buoyant market.

> "I was extremely lucky to get the GIS job straight out of my postgraduate degree. Others on my course were not so lucky and have had to move on to a different field of study in order to find work, without having to resort to data-entry positions."

Developing local graduates and providing clear entry pathways into industry to gain hands-on experience through apprenticeships and internships is important but, as yet, limited in New Zealand.

Respondents were also asked to rank the importance of specified geospatial skills for their most recent roles. Of the 8 skills, 6 were deemed important (both mean and median values less than 3) (Table 2) with geospatial software familiarity with at least one software as extremely important. Both application development programming and remote sensing were seen as less relevant.

**Table 2: Importance of different geospatial skills for the most recent vacancy**

| Geospatial Skill | Median | Mean | Importance |
|---|---|---|---|
| Geospatial software familiarity with at least one software | 1 | 1.55 | Extremely Important |
| Spatial reasoning and spatial problem solving | 2 | 1.87 | Important |
| Geospatial database familiarity | 2 | 2.05 | |
| Cartographic skills | 2 | 2.42 | |
| Familiarity with servers | 2.5 | 2.56 | |
| End user programming (e.g. coding to automate own work processes) | 2.5 | 2.7 | |
| Application development programming | 3 | 2.85 | Neither Important nor Unimportant |
| Remote sensing | 3 | 3.27 | |

Shortages across all 8 geospatial skills were identified, with the strongest shortage acknowledged for geospatial database familiarity, application development programming, spatial reasoning and problem-solving and end user programming (Table 3).

**Table 3: Skill shortages identified by the number and proportion of organisations surveyed**

| Geospatial Skill | Frequency | % |
|---|---|---|
| Application development programming | 45 | 67% |
| Spatial reasoning and spatial problem solving | 45 | 67% |
| Geospatial database familiarity | 45 | 67% |
| End user programming (e.g. coding to automate own work processes) | 38 | 57% |
| Geospatial software familiarity with at least one software | 31 | 46% |
| Remote sensing | 29 | 43% |
| Cartographic skills | 29 | 43% |
| Familiarity with servers | 24 | 36% |

The lack of emphasis on remote sensing and application development skills in terms of importance for recent roles and their identification as a shortage area is not as contradictory as it first appears. These are specialised skills and consequently will not be demanded for each geospatial role. However, remote sensing in New Zealand is not well developed and there is a lower awareness of the value of this skill set.

> "Photogrammetry and remote sensing training is very specialised and often not undertaken in New Zealand."

Other dimensions of the shortage are also worth noting as they may have policy implications. Most geospatial positions are located in the three main population centres and some respondents raised questions over whether the shortage was prevalent in rural areas.

> "There had been little or no response to the job advertisement in that time [couple of years] - possibly partly to do with location (rural NZ town rather than city)."

New Zealand is also competing against strong markets internationally and with Australia in particular for geospatial professionals (e.g. "Our GIS staff are moving off shore to Australia"). This has resulted in the loss of valued staff to higher paying opportunities.

A further less visible dimension of the shortage concerns the qualifications, skills and experience of current staff.

> "Very few of our staff have more advanced geospatial skills. Most have basic knowledge from using webmaps etc. to browse data but very few have experience using more advanced tools and analysis."

While there is a high number of unfilled positions and many respondents found it difficult to hire staff, a further consequence is that inexperienced and under-skilled staff may be appointed, e.g. "Many small local authorities struggle to employ graduates in GIS and therefore rely on non-qualified, but experienced GIS staff". These under-skilled staff may not be aware of more efficient alternatives to their current work practices and, as one respondent wrote, "… do not demonstrate sufficient skills to grow their roles." Staff who are experienced but under-qualified may also experience difficulties in gaining employment elsewhere in the industry if their positions are disestablished.

A related element is a lack of awareness of the potential of a geospatial approach in an organisation beyond the geospatial staff (e.g. "There is a huge lack of geospatial capability awareness across government and commercial organisations, so demand is suppressed"). This issue was identified for New Zealand (ACIL Tasman 2009) but is also a factor internationally. Following from this, other barriers identified by ACIL Tasman (2009) for New Zealand, such as data interoperability, are more difficult to surmount if awareness of the issues and the

required skills to overcome the obstacles are lacking. However, certain sectors are recognising the potential of a geospatial approach and in particular, GIS use within Iwi is growing.

## 5. Filling the Shortage from Within: Capacity Building through Training, Education and Up-skilling

Filling the identified geospatial skills shortage in New Zealand requires the building of national capacity. Geospatial education in New Zealand has grown over the last five years with a number of institutions offering new qualifications and courses. Most respondents (55%) believe that there are sufficient geospatial training, education and up-skilling options currently available in New Zealand, however 25% are unsure and 21% do not agree. Nonetheless, a number of issues remain. First, what qualifications are available for potential geospatial professionals? Second, are these qualifications producing enough graduates to fill industry demand? Third, are the pathways to work clear and achievable for these graduates? And finally, given the skills shortage and under-skilling in the industry, to what extent is industry supporting the up-skilling, further training and re-skilling of their staff? Each of these questions are dealt with in this section of the report.

Following is an overview of the different geospatial qualifications currently available in New Zealand. The overview is primarily based on a review of the tertiary institution websites and as such, may be out of date. At the tertiary undergraduate level, degree, certificate and diploma courses in GIS are generally unavailable to students. Exceptions to this include the Bachelor of Applied Science majoring in GIS at the University of Otago, a short course certificate in GIS and GPS at Waiariki Institute of Technology, and certificate of proficiency options at other tertiary institutes where students can take individual or multiple GIS courses. GIS courses are generally housed within the Geography programmes, exceptions include the Surveying and Information Management programmes at the University of Otago and Forestry in Waiariki IT.

At postgraduate level, the choice of geospatial qualification is wider. Recently, the University of Canterbury and Victoria University of Wellington launched a joint Masters and Postgraduate Diplomas in Geographic Information Science (MGIS/PGDipGIS). Massey University offer a long standing Postgraduate Diploma in Arts (Geographic Information Systems) and a Master of Philosophy (GIS). The

University of Auckland offer a Postgraduate Diploma of Science in GIS since 2010. The University of Waikato offer a graduate specialisation in GIS as part of their honours, Postgraduate Certificate and Postgraduate Diploma programmes in Geography. The University of Otago offer Postgraduate Diplomas in Science and Applied Science in Geographic Information Systems, a Masters of Applied Science in GIS and a major in GIS for an Applied Science Honours programme. Of these, Massey University provides a distance option for students while the other courses are delivered in situ.

Not all GIS courses are delivered in tertiary institutions and vendor courses in ESRI ArcGIS and MapInfo are also frequently available covering basic to more advanced applications, such as server installation and content delivery. These are usually short block courses targeted towards particular software functions and most expect attendance rather than requiring the students to achieve a particular standard.

The advantage of academic geospatial courses, where the attainment of skills is assessed, over vendor specific courses is that the teaching of concepts and exposure to multiple software products is possible. In practice, however, most academic institutions use a single software provider for much, if not all, of their teaching.

A third means of gaining recognition of geospatial skills is a professional certification. The SSSI provide a number of relevant certifications; GISP-AP for Spatial Information Professionals, RSP for Remote Sensing Professionals and General Certification for Spatial Professionals (SSSI n.d.). These certifications require a "formal tertiary education in a particular spatial science discipline", professional experience, and involvement in the wider profession, e.g. mentoring and conference contributions. They encourage continued professional development through attendance of conferences and workshops.

To answer the second of our capacity building questions, are these qualifications producing enough graduates to fill industry demand? Many students enrolled in postgraduate geospatial programmes are completing the programme part time and are currently employed in the industry. Additionally, the absolute numbers of students taking each tertiary qualification is relatively small (approx. 10-15). Given these restrictions and the attraction of more highly paid overseas markets

for graduates, the current shortage is unlikely to be filled by current numbers of graduates.

As in Australia, attracting students onto geospatial education pathways is difficult. The interdisciplinary and dynamic nature of the sector can make informing students and their teachers about geospatial pathways challenging. Added to this, many geospatial qualifications are gained at a postgraduate level and few undergraduate courses are provided, so interested secondary school students do not have a clear pathway to employment in this sector. The increasing professionalization of the industry through named academic qualifications and professional certification may help define this area more clearly. But current steps are taken on an ad hoc basis and lessons may be learnt from similar professionalization journeys in other industries, e.g. architecture and accountancy.

In New Zealand, spatial analysis has been recently added to the secondary geography curriculum. The curriculum now offers two spatial analysis achievement standards at levels 1 and 2 (approx. 15 and 16 year old students). But these standards are not required for all geography students and are studied at the discretion of their schools. This initiative was supported by the Board of Geography Teachers and subsequently one of the geospatial software vendors (Eagle Technology) developed modules to reduce the barriers to the selection of these standards. The effectiveness of the initiative in attracting students to this industry will take a number of years to measure and is dependent on awareness-raising among schools and geography teachers.

The third capacity building question concerns whether current graduates have established methods to gain initial experience. Of those organisations surveyed, only 15% offered internships or graduate apprenticeships. These intern and apprenticeships were provided by larger organisations and with larger number of geospatial staff. However, not all organisations of this size followed this method of graduate recruitment and these methods are not standard practice in the industry.

Given the skills shortage and the capability building issues identified above, are industry supporting the up-skilling, further training and re-skilling of their staff? There is recognition of the need for continued professional development in a dynamic industry with changing skill requirements and a skills shortage. Most organisations offer at least one type of in-house training (83%) and support

attendance of vendor courses (74%) and conferences (88%). However, few organisations provide support to gain tertiary qualifications or attend individual tertiary courses (39%). Industry focus is on non-assessed methods of up-skilling which cannot provide a yardstick for current or prospective employers as to the level of that skill.

## 6. Conclusions

This report had three aims; to review the evidence of shortages in the workforce for people with geospatial skills internationally, to ascertain the extent of any such shortage in New Zealand and, if a national skills shortage exists, establish what facilities are in place to address this shortage. Each of these three aims was addressed in turn in Sections 3, 4 and 5 respectively of this report. Here we summarise the findings of these sections.

The geospatial industry is growing internationally as reflected by the positive market outlooks for geospatial software and other sources. We focused on three case studies, the United States, the United Kingdom and Australia to determine whether a skills shortage exists in these three countries. Strong growth potential was present in all three case studies and for Australia and the United States, an acute skills shortage was identified.

Within New Zealand, the geospatial industry is a growth area and a skills shortage also exists. This shortage was reflected in both the perception of organisations in the industry and the number of new and unfilled vacancies reported. In addition to the number of vacancies, a number of dimensions of the shortage were exposed; the high demand for professionals with qualifications and experience, potential issues regarding careers paths for recent graduates, the need to compete against strong international competition for professionals, greater difficulties in hiring rural geospatial staff, under-skilled current staff and a lack of awareness in the wider organisation of the potential of geospatial techniques.

New Zealand is unlikely to fill this shortage internally in the short term. The number of graduates produced from geospatial qualifications does not meet current demand. Geospatial courses and qualifications have increased but the number of students graduating from these is still low. What can be done to attract students into these courses requires further examination. Few industry

professionals have certification and while this number will grow, it is still dependent on a base tertiary qualification. Any initiatives for internal capacity building will lag behind demand as they will take some time to filter through to increasing the number of graduates. However, these approaches are long-term investments and require establishing a framework to build upon.

Thus, a second approach would be to attract skilled immigrants into New Zealand governmental, academic and industry positions. However, this requires easing barriers for geospatial professionals in gaining employment in New Zealand and in particular may necessitate creating a new category for 'geospatial professional' or 'Other Spatial Scientist' in the skills migrant protocol for immigration into New Zealand. This approach and internal capacity building, if combined in a long-term strategy, could not only keep New Zealand in line with global requirements for a trained geospatial workforce but also represent an opportunity to put New Zealand at the forefront of one of the largest growing global industries.

## 7. Recommendations

In the short term, more vacancies are being created in New Zealand than the number of students graduating from geospatial qualifications. Additionally, demand is greatest for professionals with more than 5 years' experience.

1. Easing entry to the New Zealand workforce for skilled overseas geospatial professionals by adding 'Other Spatial Scientist' to the long term skills shortage list will remove some of the potential barriers for geospatial professionals wishing to relocate to New Zealand.

Other options are also needed to fill the skills gap within New Zealand in the longer term. This report identifies four further key areas for consideration by government and industry.

2. Graduate pathways. Experience combined with educational qualifications is highly sought by the geospatial industry. Currently, few organisations offer internships and graduate apprenticeships which allow qualified but inexperienced graduates to gain valuable industry experience. The potential to expand these opportunities should be investigated.
3. Up-skilling of current staff. Concern about the skills level of current staff was raised. While many organisations support up-skilling through

attendance of conferences and vendor courses and internal training, few provide opportunities to gain academic qualifications which provide assessment of the skill level attained. In particular, there is a need for the education sector to provide short introductory block courses as well as more advanced block courses, e.g. spatial analysis and remote sensing, to improve the knowledge of more specialised aspects of the industry. Industry support for up-skilling is also likely to lead to a greater professionalization of the industry.

4. Awareness of the geospatial industry as a potential career path for secondary students. Attracting students to the geospatial industry is difficult. Some work has been done in this area in New Zealand but a wider framework for targeting potential students is required.
5. Raising awareness of the potential for a geospatial approach to current business models. Geospatial professionals are often a component of the organisation's core business rather than a primary focus. As such, wider organisational awareness of the potential of geospatial techniques is limited. There is a need for awareness-raising programmes, such as a series of workshops or presentations on introductory geospatial concepts, data and software as well as the capabilities of spatial analysis targeted towards managers and other influential individuals within the wider organisation.

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## Appendix A: Development of the Survey and Participation Rates

Responses to an online survey by 157 geospatial organisations in New Zealand were collected for this study. An anonymous survey link was sent to 227 organisations giving a response rate of 69%.

The survey mailing list was created from a number of different sources; local government, central government geospatial users known to the New Zealand Geospatial office, by soliciting contacts via the ESRI GIS users list, by contacting a subset of Eagle Technology customers, personal contacts of the author and through contacting the corporate members of the ESRI GIS user group and SIBA (Spatial Industries Business Association). For each organisation a single contact was sought to answer on behalf of the organisation. In most cases, the appropriate contact was sought by phoning that organisation. This method of contact serves a key purpose by mimicking Dillman *et al.*'s (2008) "Tailored Design Method" by providing an alternative form of contact alerting potential participants to the future launch of the survey.

The survey was delivered via Qualtrics, an online survey tool supplied by Victoria University of Wellington. The survey was tested on a number of students within the School of Geography, Environment and Earth Sciences and a number of external staff in the geospatial workforce. Using this feedback, the survey was amended.

The survey was broken into 5 areas. The first four sections were anonymous to encourage organisations to participate and share their views. Responses to the final section were collected in a separate database. The questions in each of the 5 areas are summarised below.

1. Current Staff: the number of staff in the organisation, the number of geospatial staff, and the location of the geospatial staff.
2. Recruitment: the number of unfilled geospatial positions, the number of currently advertised positions, the number of staff successfully employed over the last 2 years, the major cause of any unfilled positions, the number of new and disestablished roles, the number of roles filled by New Zealand applicants and recent New Zealand graduates, the importance of an applicant's academic qualifications and experience and the important of different geospatial and general skills.

3. Training: the training opportunities offered to current staff, whether adequate training, education and up-skilling options are currently available in New Zealand, the number of internship and graduate apprenticeship schemes offered, and whether there is a geospatial skills shortage in New Zealand.
4. Your organisation: the organisation's core business, the role geospatial skills and services play in the organisation, whether the organisation is a supplier or consumer of these skills and services, and which skills and services were offered. Participants were also offered the option of commenting on the survey in this section.
5. More information: email address if the respondent would like to receive the final report, and the name of the organisation. Responses to this section were not linked to responses to sections 1-4 and were collected in a separate database.

The survey was launched on May 30th, 2012 and the participants were asked to provide an alternative contact if they were unable to fill in the survey on behalf of their organisation. Further emails were sent to updated contacts as needed. A reminder email was sent on June 13th and a final email reminder was sent on June 25th. While the survey was anonymous, email addresses and organisation names were collected in a separate database and participants on these lists were removed before reminders were sent. This multiple contact method, as advocated by Dillman *et al.* (2008), increased response rates.

Mostly incomplete responses were deleted as a second participant from that organisation may have been asked to fill in the survey and leaving these responses in the database would bias the results.

This study selected organisations as the entity of interest. While there are significant advantages to this approach in terms of the collection of data of interest, it does bring some limitations. Chief amongst these is the requirement placed on a sole participant from each organisation to represent the geospatial skills requirements, the open vacancies and any issues encountered in filling positions for that organisation. This approach favours the collection of data in smaller geospatial companies as Human Resources (HR), geospatial management and strategic planning may be the purview of one person or a small number of people. In larger organisations, such as LINZ, knowledge of the skills needed and other recruitment requirements across the whole organisation is harder to gather. However, as this approach favours smaller organisations, it is likely to

underestimate the needs of larger employers and in this way, is likely to understate any shortage.

Additionally, the methods used to generate a contact list favoured government users. Government, and in particular local government, were expressly targeted. Due to the wider availability of these contact details, it was possible to survey the majority of the sector. Moreover, these organisations are numerous but many have a small number of geospatial staff serving the needs of the local authority. However, local and central government are important components of the geospatial sector. Geospatial use in government is well documented (e.g. Campbell & Masser 1992, ESRI 2012, & Gerwin 2004) and indeed, the first GIS software was developed by and for government (Longley *et al.* 2011). The greater capture of government users was also expressly taken into account in the derivation of sector estimates.

# Appendix B: The Survey

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

**About the Survey**

The purpose of this survey is to collect information from organisations around New Zealand on the current and future access to geospatial professionals. The survey comprises of 5 short sections; current staff, recruitment, training, your organisation and more information. These questions relate to geospatial roles in your organisation based on the ANZSCO definition for **other spatial scientist** given below.

> **Geospatial role (other spatial scientist)** - "Acquires, integrates, analyses, interprets, presents, manages and distributes information about locations in space and time, and develops related equipment, software and services". Geospatial roles may include a Geographic Information Systems (GIS) manager, remote sensing technician or geographic information specialist.

This survey is voluntary, anonymous and you are free to withdraw at any point during data collection. This survey is likely to take between 10-15 minutes to complete.

The results of this research will be documented in at least one academic paper and a report for government. The research is sponsored by SIBA NZ (Spatial Industries Business Association) and the New Zealand Geospatial Office (NZGO). To carry out this research, Victoria University requires ethical approval to be obtained.

**Data Usage**
Data collected will be strictly anonymous. No person will be identifiable, with exception of email addresses which are sought at the end of the survey. Email addresses are only used to provide feedback to participants and are not linked in any way to your responses.

**Consent Form**
Please read this section carefully as it includes information about the data privacy for this survey.

- I have been provided with adequate information relating to the nature and objectives of this research project, I have understood that information and have been given the opportunity to seek further clarification or explanations.
- I understand that I may withdraw from this study at any time before the final submission of data without providing reasons. If I withdraw from the study, any data I have provided will be destroyed.
- I understand that any information or opinions I provide will be anonymous and reported only in an aggregated/non-attributable form.
- I understand that when this research is completed the information obtained will be retained.

We greatly appreciate the time you take to answer these questions.

**Contact Details**
Dr Mairéad de Róiste
School of Geography, Environment and Earth Sciences,
Victoria University of Wellington, PO Box 600, Wellington
Office: 04 463 6431 Email: mairead.deroiste@vuw.ac.nz

If you are **happy to participate** in the survey, **please click on the "Take part in the Survey" button** below and answer the questions to the best of your knowledge. Otherwise, please close this webpage.

## Section 1: Current Staff

1. How many **staff** does your organisation currently employ?
[Please select **one** answer by clicking on the appropriate circle]

- 0-4
- 5-9
- 10-24
- 25-49
- 50-249
- 250-499
- 500-999
- 1,000+

2. How many **geospatial staff** does your organisation currently employ?
[Please enter the **number** in the boxes below]

0 Full time positions where geospatial is over **75%** of workload

0 Full time positions where geospatial is between **50%** and 75% of workload

0 Full time positions that require geospatial skills but where geospatial is **not the main workload**

0 **Part time** positions where geospatial is over 75% of workload

3. **Where** in New Zealand are your organisation's **geospatial** staff located?
[Please select **all** options that apply by clicking on the appropriate squares. These areas are based on regional council areas and main cities.]

- Northland
- Auckland
- Waikato [excluding Hamilton]
- Hamilton [city]
- Bay of Plenty [excluding Taranga]
- Tauranga [city]
- Gisborne
- Hawke's Bay
- Taranaki
- Manawatu-Wanganui [excluding Palmerston North]
- Palmerston North [city]
- Wellington Region [excluding Wellington City]
- Wellington [city]
- Tasman
- Nelson
- Marlborough
- West Coast
- Canterbury [excluding Christchurch]
- Christchurch [city]
- Otago [excluding Dunedin]
- Dunedin [city]
- Southland
- Other, Please specify

**Section 2: Recruitment**

## Section 2: Recruitment

1. In addition to your current staff, are there any **further unfilled** geospatial positions?
[Please select **one** answer by clicking on the appropriate circle]

- Yes
- No
- Don't know

1a. **How many** geospatial positions are currently unfilled at your organisation?
[Please enter the **number** in the box below]

Unfilled positions: 0

1b. How many of these unfilled positions are **currently advertised**?
[Please enter the **number** in the box below]

Advertised positions: 0

2. Has your organisation either **recruited** or attempted to recruit geospatial staff in the last 2 years (24 months)?
[Please select **one** answer by clicking on the appropriate circle]

- Yes
- No
- Don't know

3. In the past 2 years, how many new geospatial staff were **successfully employed** by your organisation?
[Please enter the **number** in the box below]

New geospatial staff: 0

4. If any of the positions were **unfilled**, what was the major **cause**?
[Please select **one** answer by clicking on the appropriate circle]

- Not applicable
- No one applied
- Applicants were not suitably qualified
- Applicants did not have suitable experience
- Applicants were unable to work in New Zealand
- Other, please specify:

5. How many of these positions were **new roles**?
[Please enter the **number** in the box below]

New positions: 0

6. How many of these roles were filled by **New Zealand** applicants (either citizens or permanent residents)?
[Please enter the **number** in the box below]

New Zealand applicants: 0

7. How many of these roles were filled by recent **New Zealand university graduates**?
[Please enter the **number** in the box below]

New Zealand graduates: 0

8. In your most recently advertised geospatial role, how **important** were the applicant's academic **qualifications**?
[Please select **one** answer by clicking on the appropriate circle]

| | Extremely important | Important | Neither important nor unimportant | Unimportant | Extremely unimportant |
|---|---|---|---|---|---|
| Geospatial academic qualifications | ○ | ○ | ○ | ○ | ○ |

9. Please **rank** the following **qualifications** in order of importance for your most recently advertised geospatial role.
[To **rank** the different qualifications below, please **drag** each qualification into the correct order]

No geospatial academic qualifications

Tertiary geospatial course(s), e.g. an introductory GIS course

A related geospatial certificate, diploma or degree, e.g. surveying

A specific geospatial certificate, diploma or degree, e.g. a postgraduate diploma in GIS

Other, please specify

10. In your most recently advertised geospatial role, how **important** was the applicant's **prior experience**?
[Please select **one** answer by clicking on the appropriate circle]

| | Extremely important | Important | Neither important nor unimportant | Unimportant | Extremely unimportant |
|---|---|---|---|---|---|
| Prior experience | ○ | ○ | ○ | ○ | ○ |

11. In your most recently advertised geospatial role, please **rank** the following years of **experience** in order of importance.
[To **rank** the different years of experience below, please **drag** each option into the correct order]

No prior experience

Less than 2 years' prior experience

Between 2 to 5 years' prior experience

Over 5 years' prior experience

Other, please specify:

12. In addition to prior experience and qualifications, please specify any **other factors** that were also important for your most recently advertised geospatial role?

13. In this most recently advertised geospatial position, how **important** were the following (core geospatial) **skills**?
[Please select **one** answer for each skill by clicking on the appropriate circle for each skill]

| | Extremely important | Important | Neither important nor unimportant | Unimportant | Extremely unimportant |
|---|---|---|---|---|---|
| Application development programming | ○ | ○ | ○ | ○ | ○ |
| End user programming (e.g. coding to automate own work processes) | ○ | ○ | ○ | ○ | ○ |
| Spatial reasoning and spatial problem solving | ○ | ○ | ○ | ○ | ○ |
| Remote sensing | ○ | ○ | ○ | ○ | ○ |
| Geospatial software familiarity with at least one software | ○ | ○ | ○ | ○ | ○ |
| Familiarity with servers | ○ | ○ | ○ | ○ | ○ |
| Geospatial database familiarity | ○ | ○ | ○ | ○ | ○ |
| Cartographic skills | ○ | ○ | ○ | ○ | ○ |
| Other geospatial skills, please specify: | ○ | ○ | ○ | ○ | ○ |

14. In this most recently advertised geospatial position, how **important** were the following (general) **skills**?
[Please select **one** answer for each skill by clicking on the appropriate circle]

| | Extremely important | Important | Neither important nor unimportant | Unimportant | Extremely unimportant |
|---|---|---|---|---|---|
| Oral communication (including presentations) | ○ | ○ | ○ | ○ | ○ |
| Written communication | ○ | ○ | ○ | ○ | ○ |
| Team work | ○ | ○ | ○ | ○ | ○ |
| Ability to work independently | ○ | ○ | ○ | ○ | ○ |
| Problem solving | ○ | ○ | ○ | ○ | ○ |
| Project management | ○ | ○ | ○ | ○ | ○ |
| Other general skills, please specify: | ○ | ○ | ○ | ○ | ○ |

15. How many **geospatial** roles have been **disestablished** within your organisation within the last 2 years?
[Please enter the **number** in the box below]

Disestablished roles: 0

16. Are there any additional comments you would like to make about your organisation's recruitment practices?

**Section 3: Training**

**Section 3: Training**

1. In the last 2 years, did your organisation offer any of the following geospatial **training** for **current** staff?
[Please select **all** options that apply by clicking on the appropriate squares]

Provide in-house training

- ☐ Bring in vendors, e.g. for tailored training
- ☐ Used internally created resources
- ☐ Used externally created resources
- ☐ Other, please specify:

Support staff attendance on tertiary courses (e.g. university GIS courses)

- ☐ Through financial scholarships
- ☐ Provide time in lieu for study
- ☐ Other, please specify

Support staff attendance on vendor courses (e.g. ESRI's ArcGIS Desktop)

- ☐ Fully funded attendance
- ☐ Partially funded attendance (e.g. fees or travel only)
- ☐ Provide time in lieu for attendance
- ☐ Other, please specify

Support staff attendance at conferences

- ☐ Fully funded attendance
- ☐ Partially funded attendance (e.g. conference fees or travel only)
- ☐ Provide time in lieu for attendance
- ☐ Other, please specify

2. In your view, are there **sufficient** geospatial **training**, education and up-skilling options currently available in New Zealand?
[Please select **one** answer by clicking on the appropriate circle]

- ○ Yes
- ○ No
- ○ Not sure

2a. Please comment briefly on your answer

3. Does your organisation have a geospatial summer **internship** or graduate **apprenticeship** programme?
[Please select **one** answer by clicking on the appropriate circle]

- ○ Yes
- ○ No

3a. **How many** geospatial summer internships and/or graduate apprenticeships did your organisation offer in the last 2 years?
[Please enter the **number** in the box below] (If you hover your mouse over the blue text, you will be provided with explanations of the terms)

- 0 Graduate apprenticeships
- 0 Summer internships
- 0 Other, please specify:

4. Are there any **additional comments** you would like to make about your organisation's training practices?

5. Do you think there is a current **shortage** of geospatial skills in New Zealand?
[Please select **one** answer by clicking on the appropriate circle]

- Yes
- No
- Not sure

5a. Please comment on your answer

**Section 4: Your organisation**

## Section 4: Your Organisation

1. Which of the following sectors best describes your organisation's **core business**?
[Please select **all** options that apply by clicking on the appropriate squares] (If you hover your mouse over the blue text, you will be provided with explanations of the term)

- Agriculture or Horticulture
- Asset or Facilities Management
- Banking and Finance
- Business Services
- Central Government
- Construction
- Culture, Arts or Heritage
- Defence or Homeland Security
- Education
- Emergency Services
- Energy, Mining or Resources
- Engineering
- Environmental
- Health
- Information Technology
- Insurance
- Land Development
- Land Titling or Land Administration
- Legal and Accounting
- Local Government
- Logistics
- Manufacturing
- Maori
- Maritime
- Marketing, Market Research or Media
- Printing and Publishing
- Property Professionals
- Real Estate
- Retail
- Social or Community Services
- Sport and Recreation
- Surveying
- Telecommunications
- Tourism
- Transport
- Utilities: Electricity, Gas or Water
- Valuers
- Other, please specify

2. What **role** does **geospatial** play in your organisation?
[Please select **all** options that apply by clicking on the appropriate squares]

- Geospatial is our core business
- Geospatial is an important component of the skills and services we offer to clients (e.g. distinctive business unit)
- Geospatial provides significant support for our core business
- Geospatial provides minor support for our core business
- Geospatial is used to help run the organisation
- Other, please specify

3. Is your organisation a **supplier** of geospatial skills and services?
[Please select **one** answer by clicking on the appropriate circle]

- Yes, primarily
- Yes, to a large extent
- Yes, to a minor extent
- No
- Not sure

4. Which of the following **skills or services** does your organisation **offer**?
[Please select **all** options that apply by clicking on the appropriate squares] (If you hover your mouse over the blue text, you will be provided with explanations of the term)

- 3D visualisation
- Aerial imagery collection
- Civil infrastructure design
- Data analysis
- Data brokering or reselling
- Data compilation
- Data fusion
- Data integration
- Data publisher or distributor
- Digital or terrain modelling
- Education or training
- Equipment or hardware supply
- Expert witness, e.g. court appearances
- Field data collection
- GIS development through architecture, programming, etc.
- Internet deployment or web hosting
- Map preparation
- Mobile location services
- Mobile mapping technology
- Office based data capture
- Precision measurement or monitoring
- Project management
- Radar or Photogrammetry
- Software development
- Software supply
- Space imagery collection or distribution
- Spatial data consultancy
- Spatially enabled data mining
- Standards
- Strategic or business planning
- Systems analysis or integration
- Terrestial LiDAR
- Titling plans and documents
- Town planning
- Other, please specify:

4. Is your organisation a **consumer** of geospatial skills and services?
[Please select **one** answer by clicking on the appropriate circle]

- Yes, primarily
- Yes, to a large extent
- Yes, to a minor extent
- No
- Not sure

6. Are there any additional comments you would like to make about your organisation?

7. Do you have any further comments on this survey?

## Section 5: Further information

**Thank you for your responses so far. The information collected on this page is not linked in any way with the information you have already provided. Your email address and the organisation you work for will be stored separately and cannot be linked to your responses.**

1. If you would like to receive information regarding the results of this survey please provide an email address below. [This information is not linked in any way with the responses you have just provided]

2. What is the name of your organisation? [This information is not linked in any way with the responses you have just provided]

## Appendix C: Participating Organisations

**Table 4: List of participating organisations. Not all organisations provided this information.**

AECOM
Aerial Surveys Ltd
Airways Corporation of New Zealand
Array Solutions Ltd
Ashburton District Council
Aurecon
AUT University
Ballance Agri-Nutrients
Bay of Plenty Polytechnic
Bay of Plenty Regional Council
BERL
Bill Robertson and Associates
Bruce Churchouse Cartography & CAD Services Ltd
BTW Company
Canterbury University
Capacity Infrastructure Services Ltd
Capital and Coast District Health Board
Central Hawkes Bay District Council
Chorus
Christchurch City Council
Clutha District Council
CODC
Contact Energy Ltd
Critchlow Limited
Department of Conservation
Downer
Eagle Technology
Electoral Commission
Electra Ltd
Environment Canterbury
Environment Southland
Ernslaw One Ltd
e-Spatial Limited
GasNet Limited
Geo & Spatial Information Systems Ltd
Geographic Business Solutions Ltd
Geographx
GeoRamic Ltd
GeoSmart
Gisborne District Council
Golder Associates (NZ) Ltd
Gore District Council

Greater Wellington Regional Council
Grey District Council
Hastings District Council
Hawkes Bay Regional Council
Hikurangi Forest Farms Limited
Horowhenua District Council
Hurunui District Council
Inland Revenue Department
Institute of Environmental Science and Research
Intergraph Corporation of NZ (Ltd)
Landcorp Farming Ltd
Lat 37 Ltd
Lincoln University
M&P Consulting Limited
Mackenzie District Council
Manawatu District Council
Maori Trustee
Massey University
Meteorological Service of New Zealand
Ministry for the Environment
MPDC (Matamata-Piako District Council)
Napier City Council
National Library of New Zealand
Nelson City Council
New Plymouth District Council
New Zealand Defence Force, Geospatial Intelligence Organisation
New Zealand Petroleum and Minerals, a branch of the Ministry of Economic Development
New Zealand Police
NewTopo NZ Ltd
Nextspace Ltd
Ngati Kahungunu Iwi Incorporated
Northland Regional Council
NorthSouth GIS NZ Ltd
NZ Aerial Mapping Ltd
NZ Fire Service
NZ Forest Managers Ltd
NZ Geospatial Office
NZ Transport Agency
Ollivier & Company
Otago Regional Council
Otorohanga District Council
Palmerston North City Council
Porirua City Council
Powerco Ltd
Rangitikei District Council

Ravensdown Fertiliser Cooperative
Roger Ackers
Rotorua District Council
Scion
Selwyn District Council
Sinclair Knight Merz (SKM)
Solid Energy NZ Ltd
South Taranaki District Council
South Waikato District Council
Southern District Health Board
Splice Group Ltd
Statistics NZ
Taranaki Regional Council
Tararua District Council
Tauranga City Council
Timaru District Council
Timberlands Limited
Tonkin & Taylor Ltd
Transport Accident Investigation Commission
Transpower NZ Ltd
Unitec Institute of Technology
University of Auckland
University of Otago
Upper Hutt City Council
Vicinity Solutions
Victoria University of Wellington
Waikato District Council
Waikato District Health Board
Waikato Regional Council
Waimakariri District Council
Waimate District Council
Waipa District Council
Wairoa District Council
Waitangi Tribunal Unit
Walking Access Commission
Wanganui District Council
Watercare Services Ltd
Waterfront Auckland
Wellington City Council
Wenita Forest Products
West Coast Regional Council
Western Bay of Plenty District Council
Westland District Council
Whakatane District Council
Whangarei District Council

**Table 5: Sectors represented by participating organisations**

| Sector | Response |
|---|---|
| Agriculture or Horticulture | 15 |
| Asset or Facilities Management | 23 |
| Banking and Finance | 3 |
| Business Services | 11 |
| Central Government | 21 |
| Construction | 5 |
| Culture, Arts or Heritage | 6 |
| Defence or Homeland Security | 6 |
| Education | 15 |
| Emergency Services | 17 |
| Energy, Mining or Resources | 10 |
| Engineering | 17 |
| Environmental | 28 |
| Health | 5 |
| Information Technology | 25 |
| Insurance | 1 |
| Land Development | 14 |
| Land Titling or Land Administration | 10 |
| Legal and Accounting | 2 |
| Local Government | 66 |
| Logistics | 2 |
| Manufacturing | 1 |
| Maori | 10 |
| Maritime | 6 |
| Marketing, Market Research or Media | 3 |
| Printing and Publishing | 2 |
| Property Professionals | 2 |
| Real Estate | 1 |
| Retail | 1 |
| Social or Community Services | 8 |
| Sport and Recreation | 6 |
| Surveying | 9 |
| Telecommunications | 3 |
| Tourism | 6 |
| Transport | 17 |
| Utilities: Electricity, Gas or Water | 20 |
| Valuers | 2 |
| Other, please specify | 18 |

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