FEEDBACK DOCUMENT

7 AUGUST 2018

- **GEOSPATIAL FORM AND FUNCTION REVIEW**
- **STANDARDS AND INTEROPERABILITY REVIEW**

Feedback on Geospatial role and function reviews – Overview

1. Background and Context

Geospatial data is critical to NZ's prosperity and resilience. It is key to a modern digital economy- and to effective public services.

LINZ is the Government leader in geospatial. In 2007, we launched the Geospatial Strategy to improve coordination, sharing and use of geospatial data across government. The Strategy had four goals – good governance across the system; creating and maintaining key geospatial datasets; accessible and useable Government geospatial data; and interoperability.

In the 10 years since we launched the Geospatial Strategy, LINZ has:

- Adopted a "data first" and "digital by default" business strategy.
- Developed the LINZ Data Service, establishing data as a stand alone product and working with customers to develop new, high value datasets. LINZ has recently established a syndicated contract that allows other agencies to establish the same data publishing capability at a much lower cost.
- Been involved nationally and internationally in creating data standards – across hydrography, addressing, imagery and elevation
- Collected and maintained key geospatial datasets (such as aerial photography and elevation data) to improve NZ's economy, resilience, environment and infrastructure development through the Mapping 2025 project
- Worked on the property system to ensure quality, accessible, linked property data – IPS, Addressing, MLS, ASaTS
- Been involved in research, capability building and awareness raising across Government

While the goals and principles of the Geospatial Strategy still hold true, a lot has changed since it was first introduced:

- LINZ's Outcomes Framework has set clear priorities for LINZ to achieve in the next five years to ensure that high-value geographic and property data are used effectively to deliver value for New Zealand. This sets a clear direction for LINZ's work in geospatial and encompasses the aims of the Geospatial Strategy.
- In 2017, the New Zealand Geospatial Office was disestablished and its functions distributed across LI; and the principles of the Geospatial Strategy were integrated into the LI strategy.
- There is now stronger data and ICT leadership across government. The Stats NZ CE has taken on the role of Chief Data Steward; and the Chief Executive at the Department of Internal Affairs (DIA) is the Chief Digital Officer, responsible for delivering the Government ICT strategy.
- Both Statistics NZ and DIA are working to ensure that data and information held by Government can be used to inform policy and add public and private value, with a focus on standards to enable sharing of data; building capability; and working across Government to ensure key data sets are accessible.
- This includes Stats NZ setting up a cross-Government Approvals Board to review data collection standards and recommend whether they should be published for use across Government; and

proposals to strengthen the Government Chief Data Steward's leadership role to set mandatory standards and direct the adoption of common data capabilities to enable a common approach to the collective management and use of data.

Given these changes – and changing (and increasing) customer demands, advancing technologies and our limited capacity – it is even more critical that we focus on how we can have the most impact. To achieve LINZ's outcomes, we need a more focused, collective LI work programme and stronger leadership and engagement across the geospatial system.

To understand how LI can best respond to these challenges, work was commissioned to inform LILT's thinking about the current roles, responsibilities and functions in LI – and what will be required in future to support LINZ's strategic direction:

- A review of LINZ's Geospatial role and function to ensure alignment with the Outcomes Framework
- A review of our Geospatial Standards and Interoperability work

Teams and individuals across LI, as well as external stakeholders, were consulted widely in completing this work.

We are now seeking your feedback on the findings and recommendations of these reports before making decisions about next steps.

2. Providing Feedback

Feedback should be provided in writing to feedback@linz.govt.nz.

Both individual and group feedback is welcome. Feedback closes at **5pm on Friday 17 August**. If you have any questions about the process or the review documents, please talk to your manager.

In your feedback on these reports, we'd like you to answer the following questions:

Geographic role and function review

- Do you think that the approaches to system leadership, stakeholder engagement and capability building recommended in this report will help LI to:
    - Increase LINZ's impact and influence?
    - Achieve LINZ Outcomes?

Geospatial Standards and Interoperability review

- Do you think the changes to the S&I function outlined in this document will help LI to:
    - Achieve LINZ Outcomes?
    - Develop and promote geospatial standards and interoperability within LINZ and across the system?

3. Next steps

Your feedback will be collated and considered by LILT and the key themes will be shared with staff.

Once your feedback has been considered, LILT will release a proposal for changes to the current S&I functions for consultation.

LILT is also reviewing stakeholder engagement, awareness raising and capability building activities across LI, starting with LILT's strategic engagement activities. Your feedback on the attached reviews will also help to inform this work.

Review of LINZ's geographic data role and functions

Prepared by Deidre Hill

March 2018

1. Introduction

This document outlines the findings of a review of LINZ's geographic role and function. The review covers the work of the Location Information Group (LI), including the capability transferred in from the New Zealand Geospatial Office (NZGO).

This document makes recommendation on LINZ's geospatial functions but does not cover LI's operating model or organisational structure.

The report is divided into two sections:

- General findings from the review
- Answers to some specific questions posed by the Location Information Leadership Team to inform their thinking

2. Background

In 2007 LINZ published the New Zealand Geospatial Strategy. The New Zealand Geospatial Office (NZGO) was responsible for the Geospatial Strategy, working with participating organisations to:

- Develop agreed work plans to progress their contribution to the Strategy
- Help them measure the benefits of their participation
- Capture their stories and case studies.

Since 2007, a significant amount of work has been done to progress the Geospatial Strategy. However, LINZ's context has changed significantly:

- In December 2016, NZGO moved to Location Information.
- In early 2017, Location Information (LI) reviewed its functions. As a result, NZGO was disestablished, its functions distributed across LI and the Geospatial Strategy principles were integrated into the LI Strategy
- In December 2017, LINZ launched its Outcomes Framework
- Statistics NZ has taken a data leadership role across government
- Department of Internal Affairs (DIA) has taken up the role as Lead Digital Officer
- LINZ's role in the wider environment has changed

As a result of these changes, LINZ needs to review its geographic role and functions and ensure these align to organisational outcomes.

3. Methodology

The methodology for this review included:

- Interviews with key internal stakeholders
- Interviews with selected key stakeholders from the Department of Internal Affairs and Statistics NZ

- A review of key documents:
    - LINZ's corporate strategic documents, including the Outcomes Framework

- The external stakeholder interviews undertaken to inform the development of the Outcomes Framework
- The review of the geospatial work programme and National Spatial Data Infrastructure completed by ConsultingWhere in April 2017
- LI's strategy, business plans and documents from the review of LI undertaken in June 2017
- The Geospatial Strategy and a range of material prepared by NZGO staff to execute the strategy

4. Key Observations

4.1 Context has changed fundamentally since the Geospatial Strategy was launched

Both inside and outside LINZ, things have moved on significantly since the Geospatial Strategy was developed in 2007. These changes are largely positive and create the opportunity for LINZ to clarify its role in geographic data.

Stronger strategic focus for LINZ and LI

Over the ten years since the Geospatial Strategy was written, LINZ's focus has shifted significantly from products to data; to being "digital by default"; and to working with the wider system to achieve an ambitious goal of growing by tenfold the value created for NZ through the use of geographic data by 2025.

The LI review last year signalled a stronger strategic and system wide focus for LI and LILT as well as effecting structural change:

- The Data Services remit has expanded to focus on a wider delivery of data across the system and spatial industry. The GM Data Services has principal responsibility for the geospatial strategy principles
- LILT is making a step change to system leader, influencing and connecting across the sector; and leveraging the expertise and knowledge of others to achieve LI's wider goals
- Prioritisation at both a strategic and operational level; and leveraging expertise to cope with rapidly changing technology and customer demands and limited resources are cited as important.

Outcomes framework sets a clear direction for geographic information

On-going work to clarify LINZ's strategy, purpose and direction have emphasised the importance of geographic information.

The LINZ Outcomes Framework developed last year encompasses many of the aims of the Geospatial Strategy and outlines expected outcomes in 1-2 and 3-5 year periods. These include:

- **Data and use** – identifying key datasets, opening these up for public access and building capability
- **Connecting data** – linking, integrating and aggregating
- **Reporting** –on nationally important geographic and property information

These outcomes (particularly the data-related ones) are a significant change for LI and will require a focused work programme to achieve.

Stronger data and ICT Government leadership

New positions and functions have been created across Government to optimise the use of data and information. The Statistics New Zealand CE has taken on the role of Chief Data Steward; and the DIA CE is the Chief Digital Officer, responsible for delivering the Government ICT strategy.

Both these functions (like LINZ) are taking a leadership role in ensuring that data and information held by Government can be used to inform policy and add public and private value, with a focus on standards to enable sharing of data; building capability; and working across Government to ensure key data sets are accessible.

Statistics NZ in particular is engaging widely across Government to find out what other agencies are doing and identify opportunities for co-designing and implementing data standards.

4.2 LINZ's geographic role and function is operating well in some areas, but it's fragmented and lacks direction and focus in others

LI teams are delivering a lot of work to advance the accessibility and usability of geographic data, particularly with its critical few - IPS, Mapping 2025 and Resilience.

This work is not only instrumental in achieving the LINZ outcomes but is also delivering components of an SDI for New Zealand, although this is not always actively recognised.

In the areas of stakeholder engagement and awareness raising, capability building and technical leadership there is some good work happening – but the work lacks direction and focus in some areas.

There are gaps in external engagement – and engagement work is not aligned across LI

Operational and functional engagement across LI is relatively strong, but there are gaps in awareness raising and strategic engagement/thought leadership:

- LI Staff are engaging regularly and positively with operational stakeholders and have developed good working relationships across the sectors they work with.
- General awareness raising about geographic data is less focused and tends to be opportunistic
- There is a lack of strategic engagement and thought leadership – including identifying opportunities to raise awareness and build capability more purposefully; thinking more widely about how engagement can support the achievement of LINZ outcomes; and leveraging senior contacts to influence and advocate across the system.
- LI has strong international networks and an on-going international engagement programme. A review of how, for what purpose and to what extent LI engages internationally would be useful to manage competing priorities and limited resources.
- Engagement work across LI is not always aligned. This can be confusing for stakeholders, gives the impression that the LI work programme is not coherent and means that opportunities are being missed to coordinate and strengthen engagement across all areas.

4.3 There's an opportunity to lead in geographic data – and stakeholders want LINZ to lead

Stakeholders see a clear leadership role for LINZ in geographic data – but don't see this happening now. They are aware of the Geospatial Strategy, but they don't see it as relevant – and while they agree that the principles still hold true, stakeholders are unsure of what's happening with it now, or what's been achieved.

Issues raised consistently by both internal and external stakeholders include:

- A lot of the work around the Geospatial Strategy is theoretical and conceptual and therefore hard for others to engage or see the benefits
- A sense that LINZ is trying to "boil the ocean" with the Geospatial Strategy. Picking some key areas where tangible benefits can be delivered would help to build credibility – and a leadership mandate

Key stakeholders in senior roles in other organisations don't always feel well-informed about what LI is doing in geospatial – but do think that there are issues in common and would welcome regular discussion. They have quite consistent views about what LINZ needs to do to step up into the leadership space:

Sell the vision - Clarify LINZ's role and value proposition

- Stakeholders want LINZ to clarify its role, value proposition and contribution to the wider system – "Don't ask me what I want – tell me what you can do"
- Positioning LINZ as being part of NZ's **critical economic and social infrastructure** was seen as good way to get buy-in from other agencies
- Determining the role LINZ wants to play as a geographic data leader. It's important to have a clear set of priorities - or LINZ will be hijacked by others' agendas.

Establish common ground – engage and communicate

- **Communicate change and be transparent** – some stakeholders are confused about LINZ's role as geographic data leader, the previous positioning of the Geospatial Strategy and NZGO (was it part of LINZ or not?) and what the next steps are.
- **Work collaboratively and engage with others** to understand their perspectives, identify opportunities to work together, and to build the vision, strategy and work programme across government.

Demonstrate thought leadership - be influential

- LINZ needs to be **a more influential advocate** for geographic data – engagement, facilitation and advocacy needs to be at a different level to influence the system
- **Understand what others are doing and how to apply LINZ expertise** - focus on and understand the key problems/issues for NZ that could benefit from LINZ's expertise (eg: water, climate change, housing and urban development)
- **Thought leadership** - link customer/stakeholder needs with data, identify opportunities and risks, provide thought leadership around technology and geographic data

Deliver tangible benefits

- **Execution and delivery** is the key to credibility
- Provide **pragmatic solutions** to real world problems
- **Identify key data** that can inform decisions about NZ's key problems
- **Standards, interoperability and a common understanding about data quality** across Government is key
- **Resilience planning –** Play a greater role in planning and coordinating geographic data needed for the National Disaster Resilience Strategy.
- **Combining and linking data** – a combined data picture to help community/people-centric problems – for example, joining up data between local and central Government agencies to allow better decision making
- **Interoperability** – Common data standards and platforms nationally to reduce duplication and improve exchange of data.

4.4 Stronger leadership is critical

While LI is doing a lot of work (across all teams) that contributes to the achievement of the Geospatial Strategy principles, an integrated approach and focused work programme is needed to achieve the goals outlined in the Outcomes Framework and take a more active leadership role across the system.

Stronger internal leadership is required to:

- Set the direction for an agreed, overarching geographic data work programme
- Prioritise, agrees milestones and monitor progress
- Align the work already being done across LI to advance the cause of geographic data – and identify gaps or low value work that should be stopped
- Align the different streams of engagement activity

Externally, purposeful strategic engagement at senior levels across the system will be important to clarify LINZ's role, to be influential and to advocate for the use and value of geographic data.

5. Key Questions

5.1 How does the Outcomes Framework influence and change our role and functions?

The Outcomes Framework encompasses many of the aims of the original Geospatial Strategy. These are now publicly stated, time-bound priorities for LINZ to achieve in the next five years. They also signal some significant changes for LI (for example the focus on key datasets) and will require a focused work programme – and collective leadership - to achieve.

The Outcomes Framework also provides the basis for a new conversation with stakeholders about LINZ's leadership role in geographic data.

5.2 What is LINZ's role in geographic data leadership in government? What does taking a lead in geographic data mean and look like across government?

There is a clear geographic data leadership role for LINZ in government.

Stakeholders clearly want LINZ to take a leadership role that they don't see happening now; and geographic data is a key enabler for other agencies working on big issues for New Zealand.

The focus of other agencies on data (Statistics NZ) and information technology (DIA) is complementary and creates potential for LINZ to lead geographic data in partnership with these agencies.

The recommended approach is to:

Set and sell the vision

Refresh the LI Strategy and work programme and use this and the Outcomes Framework as a basis for engaging with senior people in other agencies to clarify LINZ's role, approach and goals for geographic data; and provide a coherent view of the current work programme, including the LI "critical few"

Engagement – establishing common ground

Engage and consult with key Government agencies on the refreshed LI Strategy and work programme to:

- Seek input to refine the work programme
- Tell others what LINZ is already doing and why it's important
- Understand others' work programmes and identify opportunities to work together

This should initially be done at senior level.

Deliver tangible benefits

Once a common understanding is established, work with other lead agencies to identify a "critical few" joint projects to co-design and deliver. These should be small enough to deliver relatively quickly; deliver tangible benefits that can be used to "sell" the benefits of geographic data more widely; and be consistent with the aims of LINZ's wider work programme and the Outcomes Framework.

There are some specific areas where LI can build on what it's currently delivering to build its leadership role:

- Playing a leadership role in standards and interoperability work for geographic data
- Identifying key datasets
- The resilience work programme
- Capability building across Government

- Providing consultancy and advisory services
- More focused engagement and awareness raising

5.3 How does LINZ fit with the data leadership role of Statistics NZ? And how do we influence it?

Statistics NZ sees geographic enabled data as critical to its strategy and is keen to collaborate more closely with LINZ – and LINZ is in a strong position to influence Statistics NZ, build a complementary leadership role and work with Statistics NZ on projects that benefit both organisations.

Statistics NZ's goals are similar to LINZ's geographic data goals – partnering with agencies to

- increase their capability to manage and use data
- identify and remove roadblocks to accessing data
- implement data standards
- use new methodologies.

Because of its experience leading the Geospatial Strategy over the last ten years, LINZ is arguably more advanced than Statistics (who are relatively new to their role) in their thinking about what's needed across the system to improve data sharing and accessibility.

LINZ has experience dealing with a lot of the issues that Statistics NZ is grappling with as it seeks to build a leadership role in data. LINZ has strong technical and operational expertise; and well-established national and international networks.

There are a number of areas where LINZ could work more closely with Statistics NZ, including:

- Supporting the development of Statistics NZ's Integrated Data Infrastructure
- Identifying key datasets
- Collaborating to lead standards and interoperability work across Government
- Joint capability building and awareness raising

5.4 What is LINZ's role in geographic data standards and interoperability?

Standards and interoperability is viewed internally and externally as the key to delivering a workable infrastructure for geographic data. There is also strong potential for LINZ to take a leadership role in partnership with Statistics NZ – particularly given that LI's critical few are all delivering core data infrastructure.

In the past, LINZ's work on an SDI has suffered from a "boil the ocean" approach. This has meant that while some good work has been done, it's often not visible or relevant to decision makers and has had limited impact and usefulness.

Finding areas where LI can collaborate with others on smaller, high priority projects that deliver tangible benefits quickly would be an advantage. This will allow LI to build a cross-Government work programme for standards and interoperability over time – with the flexibility to change direction or try new things when necessary.

This will require:

- Leadership and advocacy - to sell the value of standards and interoperability
- Data and technology – and the capability and capacity to focus on excellent operational delivery

5.5 How far down the geographic information value chain does LINZ go?

At the moment, LI's work spans the value chain, with engagement, capability building and awareness-raising currently focused at the lower end of the value chain.

A more balanced and deliberate approach across the value chain would help to match priorities with resources and decide what LI's overall approach should be.

There is definitely a place for work lower down the value chain – general awareness-raising is valuable. However it needs to be balanced against (and informed by) work further up the value chain, particularly in the leadership space. A refresh of the LI Strategy and work programme will help LILT to make more deliberate decisions around work at different levels on the value chain.

5.6 What is LINZ's role in building geographic data capability across government?

As discussed above, LINZ has the technical expertise and experience to play a leadership role in building capability across Government – and this is an effective way to build LINZ's credibility and networks and increase the use of geographic data.

Key ways that LINZ can do this include:

- Looking at a leadership role across Government in developing standards and interoperability in conjunction with Statistics NZ
- Expanding on existing consultancy/advisory services
- Expanding on existing capability-building work

Again, deciding LINZ's role will require a purposeful approach and balancing priorities with resources.

Review of Geospatial Standards and Interoperability

Prepared by Jeremy Palmer

May 2018

Executive Summary

The objective of this document is to review LINZ's standards and interoperability work delivered so far, and to outline the roles and functions that will support LINZ's new strategic direction.

Findings

The key findings are as follows:

- There is high value in properly implementing standards and interoperability functions within LINZ to enable better reuse of NZ data and support the LINZ outcome focus areas.
- The National Spatial Data Infrastructure (NSDI), which outlines the standards and interoperability characteristics, was a good initiative in theory but struggled to align to real-world practice after its first version.
- There is still a need to promote the value of geospatial standards and interoperability with customers, agencies and vendors.
- Good geospatial metadata standards are still required by users, but a new iteration of standards, and aligned tools are required to meet operational workflows.
- The LINZ Data Service (LDS) is a world class data publishing service and provides users with excellent access to LINZ data.
- ISO standards are not open and do not have development processes that are collaborative with users and industry, which potentially results in barriers for national uptake and goes against NZ open principles.
- Open Geospatial Consortium (OGC) APIs are an effective way for NZ to share geospatial data for plug and play access. However some effort is still required to fully implement the standards, or to create new standards to meet real-world customer use cases.
- Standards development across Location Information teams has varying level of support resulting in inconsistent implementation or certain issues not being addressed.
- There have been standards implementation successes within the hydrographic, addressing, imagery and elevation functions of LINZ
- geodata.govt.nz usage has low usage, is not well maintained, can create confusion in the overall NZ data catalogue government landscape, and should be reviewed.

Recommendations

The key recommendations of the report are as follows:

1. LINZ retains the Geospatial Strategy 2007 keys principles that apply to standards. In addition, LINZ adopts a needs based, expert led, pragmatic, open, internationally aligned set of standards development principles.
2. LINZ promotes the value of geospatial standardisation with other government and crown agencies. This should focus on convincing agencies to use geospatial standards when

publishing data, and best practices for using spatial data types, coordinates systems and transformations.

3. LINZ should work with Stats NZ on how LINZ with its Geographic Information expertise can best support the government data and information function.
4. LINZ should work with DIA (data.govt.nz) and StatsNZ to gain all of government alignment and positioning for spatial data publishing/accessibility services and standards.
5. Promote the syndicated data service subscription as a blueprint for successfully publishing geospatial data.
6. LINZ should work with Stats NZ to leverage the data standard development process for standards going forward.
7. Provide standards development foundations for the wider LINZ data management teams to use - including templates, collaboration methods, review and maintenance processes.
8. LINZ should continue to work with OGC groups or with OGC and ISO joint groups for standards development where applicable.
9. In the medium-term LINZ should continue to manage NZ's engagement with ISO/TC211's, with focus on effort to LINZ outcomes.
10. Ensure that all LINZ data management teams implement the LINZ Data and Information Management policies. This includes assigning formal roles.
11. The function to develop the standard for data products should sit within the LINZ product teams.
12. Ensure that all LINZ data management processes are evolved to include the definition of open standards, policies, and procedures to support customer requirements.
13. LINZ participates in the development of new OGC API standards to ensure NZ services have fit for purpose, adopted, and modern data access mechanisms.
14. LINZ works with technology communities and vendors to ensure OGC technology standards are robustly implemented.
15. Ensure tools are available to support the creation and maintenance of geospatial metadata.
16. LINZ Establishes operational governance that provides leadership alignment, sponsorship, oversight and monitoring over data management activities.

NOTE: It is proposed that further work is required to determine how the functions would operate within the organisation given the wider remit of the geospatial function review.

Introduction

This document outlines the findings and recommendations of a review of LINZ geospatial standards and Interoperability role and function. The scope of the review is:

- Review what has been delivered so far by LINZ
- Describe the new LINZ function and role
- Define the requirement for the standards and interoperability function aligned against the LI strategy, LINZ outcomes framework and other current LINZ core business
- Assess the value of leveraging and participating in international standard's work, e.g. OGC, ISO

Note these recommendations should be used in conjunction with the concurrent geographic data role and function review.

Background

LINZ's "Power of Where" vision is to 'grow by tenfold over the next decade the value created for New Zealand' by: Increasing the use of geographic information; Unlocking the value of property; and Improving resilience to natural events.

The Location Information group is supporting the delivery of this vision by a digital first, data first strategy with a focus on 3 areas: Mapping 2025, Property System and Resilience and Climate Change. Each one of these areas relies on data that is fit for purpose and re-usable for a broad set of customer needs. Location Information and LINZ also have core business activities that require the management of data and information for existing products and services. e.g. Hydro Charts, Topo maps, Landonline, OIO and Crown Property.

In 2007, LINZ published the New Zealand Geospatial Strategy, and in 2008 the New Zealand Geospatial Office (NZGO) was established. Within the NZ Geospatial Strategy, the need for the standard and interoperability function was outlined as part of the National Spatial Data Infrastructure (NSDI) implementation.

In 2017, the NZGO was disestablished after a review of LINZ and LI functions. The NZGO functions were distributed across LI, and the Geospatial Strategy principles were integrated into the LI Strategy. The Standard and Interoperability function was transferred into the LI Data Services Group. The consultation document outlined that Data Services was widening its remit across the property and location systems to ensure alignment of work, so it was a logical fit for the Interoperability and Standards function to transfer from the Sector Data Programmes Group.

Methodology

The review involved the following approach:

- Interview with key LINZ stakeholders
- Interview with select key external stakeholders (to limit past over-interviewing)
- The review of the following documents:
    - NZ Geospatial Strategy 2008
    - LINZ Strategic Plan 2015
    - LI Strategy Critical Few A3 pages
    - LINZ Data and Information Policy
    - LINZ Outcomes Framework Workshop Summaries 2017
    - Crown Property Future Focus documentation
    - Hydro Passage Plan
    - Topo Strategy and Group Structure consultation document
    - IPS Group Structure consultation document
    - The Value of Standards - A Delphi Study Open standards, open source, and open innovation
    - Economic benefits of standardization
    - OGC Website (http://www.opengeospatial.org/)
- Analysis and report writing

What is Standards and Interoperability?

Standards and interoperability are often confused or loaded terms. In summary geospatial standards provide plug and play frameworks for end users and software developers to easily understand, integrate, and use data. Interoperability is the outcome of successfully implemented standards that are used for a set of real-world use cases.

Note: For the purpose of this paper a standard can be referred to in title as either a standard or specification document. This document defined as a formal document that establishes uniform criteria, methods, processes and practices.

The key components are:

- Content data standards - documented agreements on structure/meanings and management lifecycle (e.g. creation/capture, update, delete, store, access, and use) of domain data. Including consideration of integration other reference datasets, metadata, and specification and classification of data items to be captured.
- Technology standards/specifications - documented agreements on transmission and/or format, i.e. the pipes that carry the content/data from point ‘a’ to ‘b’ and enable automation and machine to machine processes. This would include things like open APIs (Application Programming Interfacing), formats for data transmission (e.g. GML, JSON, Shapefile), and formats for describing the management lifecycle (e.g. metadata).
- Delivery approach - Centralised vs federated vs mixed delivery of government data (e.g. National vs Local). Centralised will distribute and publish national datasets which are either national captured or aggregated from multiple local sources. Federated will distribute the dataset directly from the organisation that captures and maintained the source data.

Value of Standards and Interoperability

Standards and interoperability is viewed internally and externally as the key to delivering a modern digital economy, both for operational efficiency, and for enabling better decision making. Data and data standards are the core foundation that support this. Having Standards and Interoperability specifically enables:

- High quality data for better trusted and robust decisions
- Efficiency gains in access and use of data
- Re-use of datasets to new customers

National Spatial Data Infrastructure (NSDI)

One of the key focus areas of the National Geospatial Office (NGO) was the development of a NSDI. A NSDI is a comprehensive system of interrelated elements involving governance, policy, standards, data, hardware, software, and people across all levels of their organisations, designed to enable the re-use of data to support better decision making, innovation or operational efficiencies for existing services. To provide the blueprint for the NSDI the NGO, with input from other central government agencies, local authorities, academia, and the private sector created and published an SDI cookbook for NZ in 2011. The cookbook provides general guidance and characteristics for the following:

- Data stewardship and custodianship
- SDI standards (Technology Access and Metadata) and Concepts
- Making Data Accessible
- Making Data Discoverable
- Using Data

The theory of the cookbook was generally sound, however feedback from those using it suggest it still required to advance to a level of maturity to gain better value from material delivered.

As part of the NSDI, the NGO carried out leadership, promotion and establishment of standards. This role primarily focused on development using international organisations such as ISO/OGC, and leveraged common knowledge or output from other international national geospatial or mapping agencies. Some good work was done on specific domain standards (e.g. Addressing), but in general stakeholder feedback suggests there has not been enough promotion or facilitation of standards based on identified New Zealand needs.

At an operational leadership level, LINZ successfully created the LINZ Data Service (LDS). This service was very well received and tried its best to initially implement the NSDI features where possible. As time went on the LDS developed its own features based on customer feedback which were not always aligned to or part of the cookbook.

Standards Development

LINZ NGO roles have focused on developing standards using international organisations. This has leveraged standards development processes from these organisations as well as a knowledge base from the international members that are involved. The key bodies include the Open Geospatial Consortium (OGC) and the International Organization for Standardisation (ISO).

Past members of the NGO have given feedback on the standards development role as:

- More promotion is necessary for the value of standards and the process that creates them.
- The development and involvement has been too international focused and being involved in standards work that is in train that is not directly linked to NZ problems.
- Current direction is too focused on the theory, without the focus in parallel of how it would be applied to the New Zealand context.
- Local government needs more support in the development and implementation of standards as it cannot justify resources to complete the work on its own.

Open Geospatial Consortium (OGC)

The OGC was founded in 1994 and has over 500 members. Its main mission is to advance the development and use of international standards and supporting services that provide geospatial interoperability. It is the primary international organisation for the development of standards for geospatial data types, geospatial references systems for applied software implementation.

LINZ is currently an associate member. This means we can participate in the creation of standards or experiments, but we cannot vote on standards. The OGC primarily is an application focused organisation and creates applied standards for data or technology. Most of the OGC current technologies are very old by today's standards, which does not attract new young developers.

In the past, LINZ has attended OGC meetings and contributed to the development of standards such as Spatial Data on the Web (via W3C relationship) and been part of engineering test beds.

OGC over recent years has updated its strategy to ensure the development of new OGC standards are better aligned with mainstream IT standards and leverages many modern IT frameworks. In addition, the new OGC standards development process is more open and collaborative with the general IT community. OGC has strategic partnerships with many of the core standards bodies including ISO and W3C. OGC is currently re-designing multiple API using this new approach.

OGC has a good applied research and development fund which allows for real world testing of ideas before standards are created and implemented by software vendors or developers.

International Organization for Standardisation (ISO)

The ISO is an international standard-setting body composed of representatives from various national standards organizations. ISO/TC 211 is a standard technical committee formed within ISO, tasked with covering the areas of digital geographic information and geomatics.

Like OGC, ISO provide value in the standards agreement process, global market adoption, and building standards that link to each other. Also, ISO standards are of a better level to reference in rules, regulations, or procurement documents.

LINZ has been involved in ISO for various groups, including addressing and Geodetic coordinates systems and reference frames. LINZ's observation is ISO is not always good at finding ways to operationalise IT services (e.g. vocab services or coordinates system registry) or putting together implementation plans to get buy-in from other related international committees.

Standards NZ

Standards NZ is New Zealand's representative for the ISO and publishes and sells all of the standards. One of the issues with ISO standards is you have to pay for them (unlike OGC standards), which potentially means it becomes a barrier for national uptake and goes against NZ open principles.

LINZ has an active role in the Standards NZ frameworks which is tied to ISO processes and protocols. This broadly involves:

- Managing NZ's engagement with ISO/TC211's work programme on geographic information/geomatics standards
- Engagement with Joint Committee IT-004, Standards Australia/Standards New Zealand regional efforts with formal geographic information standards

Within these frameworks LINZ has two specific responsibility areas:

- Convenor of the NZ IRG (International Review Group); a technical committee of sector representatives to monitor/manage NZ's technical participation in ISO/TC211's work programme
- Designated ISO/TC211 Ballotter; engagement in every obligatory ballot; complying with all protocols for participation.

Feedback has been that LINZ's role in leading NZ's engagement for the ISO/TC211's work programme has been good and should continue, and LINZ is the best organisation to do this.

Promotion

LINZ has carried some work for the promotion of geospatial standards. This includes outreach via LINZ web pages, LINZ YouTube channel, and targeted programmes of work.

Some specific work is still in progress to integrate geographic information standards into the NZ Government Enterprise Architecture framework (GEA-NZ). GEA-NZ is managed by the Government Chief Digital Officer (GCDO). This work will potentially enable wider awareness of the data and IT standards that can be used by other government departments, and aid procurement processes.

General Standards and Interoperability Work

Below is a summary of key geospatial standards and interoperability that LINZ has been involved in that cover the general geospatial domain.

Geospatial Metadata

LINZ worked with ANZLIC and local experts to define a geospatial metadata standard for use by New Zealand government agencies. This standard was an evolution from a previous NZ standard that failed to get adoption. The main goal was to align with the international metadata standard ISO 19115:2003 and get better uptake. LINZ was not involved in the development of the ISO standard.

The ANZLIC standard has had some success within government agencies. Many agencies created and published metadata for geospatial data that was stored and published using this standard. This included LINZ which in 2011 published over 1500 layers of ANZLIC metadata compliant data. However, many users within agencies failed to see the full benefits of the metadata and saw the metadata as a compliance exercise. Users found the following specific issues:

- Hard to create attribute metadata
- Difficult to record valuable capture or processing workflow information
- Dataset categories and keywords were not fit for purpose

Many developers and users of the metadata standard stated the use cases should have been clearly defined before the standard was created.

General tools were developed by both ANZLIC and Eagle for the creation and maintenance of the metadata files. These tools were only partially successful as they were not maintained or enhanced to meet user needs beyond their first major version. This is still an issue for agencies that are still maintaining ANZLIC metadata, as no replacement tool has been created.

ISO 19115:2003 has now been superseded by ISO 19115:2015. LINZ however has not fully considered how this new standard can be implemented.

Data Access

The NZSDI Cookbook provided the framework for an agency to release its data and users to consume this data. This cookbook was initially taken by LINZ and used to develop the requirements for the LDS. In 2011, LINZ established the LDS and quickly published the majority of the data it owned.

The LDS led the way by implementing a world-class, award winning data publishing service. The LDS took a pragmatic approach to the way it made data discoverable and accessible by:

- Focusing on Search Engine Optimisation (SEO) for good Google searching
- Providing file download services to broaden the potential customer base - including semi-automated bulk data distribution by courier service
- Integrating the catalogue and data access together into a shopping cart application

- Creating automatic workflows for the creation and maintenance of datasets
- Implementing robust OGC APIs for customers to access LINZ data
- Providing changeset services to provide customers to enable fast incremental updated between LINZ data releases

LINZ also created new internal processes for the release, updating and publishing of data, and developed strategies to provide new high value datasets to customers.

More recently LINZ has taken this original success and established a syndicated contract that allows other NZ government agencies to establish the same data publishing capability at a much lower cost.

Of particular of interest with the LDS implementation is the file download access function which is not using the standard based OGC APIs. Analytics report that ~60% of user interactions are from file downloads, where the OGC API services make up ~40% of the interactions.

During the development of OGC APIs on the LDS, LINZ came across many of the shortcomings when implementing the standards. The key issues were:

- Standards not being fully implemented by software developers for both server and client
- Ambiguity in standards documentation, which was inconsistently applied in software implementation, causing many user bugs
- Standards not being developed with end-users in mind, creating functionality or performance limitations

LINZ over the last seven years has worked with OGC, open source projects and commercial vendors such as FME and Esri to improve the situation within the current set of aging standards. This has been mostly successful; however the following specific issues still exist:

- [s 9(2)(g)(i)] [redacted] Because Esri has a large part of the NZ GIS market (~55%) that means users are required to use the file downloads service (that go stale) to get data into their workflows.
- The LDS does not provide an OGC API to access raster data due to poor software implementations.
- LINZ does not provide APIs for the online bulk download of datasets that are over 4GB in size.
- There is not a lot of documentation on how to use the LDS changeset API or table cropping by spatial relationship features. This possibly contributes to the current low uptake of these APIs.

In 2015/16, the NGO ran workshops to create a comprehensive set of features and descriptions for a NSDI compliant data provider. The LDS and Canterbury maps services were chosen as case studies to create a blueprint for wider reuse. The intention was to further socialise this work and create a DIA ICT (Information and Communications Technology) standard for other organisations to adopt. This work was never finished.

Significant data services now providing data for NZ are:

- https://data.linz.govt.nz (LINZ Data Service)
- https://data.mfe.govt.nz (MfE Data Service)
- https://datafinder.stats.govt.nz (StatsNZ Geospatial Data Service)
- https://lris.scinfo.org.nz (Landcare Data Service)
- http://opendata.canterburymaps.govt.nz/ (Canterbury Region Consortium Open Data)
- http://aucklandopendata-aucklandcouncil.opendata.arcgis.com (Auckland City Open Data)

The majority of these services are using the same technology platform that also drives the LINZ Data Service. Many Councils and some central agencies are serving data through the Esri Open Data Portal platform. While these Esri sites provide some level of access to data, some of the data is harder to access (such as raster files or large vector data) and does not have the same level of OGC API support.

Data Discovery

LINZ has worked on creating an environment for making data accessible by promoting the creation of metadata for data and then publishing the metadata in centralised catalogues for searching. The purpose of the central catalogue is to create an authoritative easy to use website for users to go to find data for all NZ agencies. There are two main central catalogues in NZ

- geodata.govt.nz: National Geospatial catalogue for government and private sector offline and online geospatial datasets - administered by LINZ
- data.govt.nz: National catalogue for government online datasets - administered by DIA

Most, but not all geospatial datasets from the major NZ data services websites are registered in geodata.govt.nz. However, geodata.govt.nz suffers from low investment and low usage. data.govt.nz receives a much better coverage of datasets (including non-geospatial) but doesn't have the richness of metadata that geodata.govt.nz contains. Discussions are in progress to investigate data.govt.nz to harvest more geospatial attributes to make the service more functional for geospatial users.

Analytics from the LDS have shown that much of the first-time user discovery of data originates from organic search requests, which indicates it is more important to get your basic metadata correct in the website data pages to support good SEO in search engines like Google.

Content Domain Standards and Interoperability Work

Below is a summary of standards and interoperability work that LINZ has lead or been involved in that relate domain areas.

Data Management (Across all groups)

LINZ has been on a seven-year journey to drive 'data first' and 'digital by default' business strategies. A key part of this journey has included:

- Embedding data management functions within multiple LINZ teams
- Releasing what we have "as is", to gain immediate value and feedback
- Collecting managing, and releasing data in a continuous cycle
- Establishing data as a core stand-alone product, rather than a by-product of an existing process or product.

During this period LINZ has released data to varying levels: e.g. in some cases data releases contained data dictionaries, in others cases not; or the dataset development process re-used parts of international standards or involved customer input into design, in other cases not.

In 2016 LINZ developed an organisation Data and Information Management Policy to ensure that data and information is managed as an asset to meet business goals. This policy defines a set of roles and processes that guide good data management. LINZ to date has not fully operationalised this policy.

Addressing

LINZ has been supporting the development of National Addressing Standards. This involved the successful development of:

- AS/NZS 4819 - New Zealand & Australian addressing allocation standard
- ISO 19160 - International addressing conceptual model standard
- New Zealand profile for ISO 19160 to create logical model that aligns with AS/NZS 4819.

LINZ was primarily involved in the development of the AS/NZS 4819 standard through the Office of the Surveyor General (OSG) in 2002/3. LINZ was later part of the review and enhancement of ISO 19160 in 2011/12 involving a cross government working group including NZPost, StatsNZ, and eSpatial. The NZ profile was produced by the working group and was done in parallel with the ISO standards revision process. The standard development and profile created the following benefits:

- Interoperability Technology, and basis for AIMS implementation.
- Forced councils to standardise the allocation of road names and addresses for improved data quality and consumption.
- Leverage of international knowledge for the development of the standards.

In general, the development of the addressing standards has been a success. However, the Addressing and Information Management System (AIMS) implementation of the NZ profile suffered in part from the LINZ addressing team not been fully involved in the creation and review of the standards.

3-Waters Metadata

LINZ, with support of MBIE, gained Better Public Services seed funding from Treasury to develop national metadata standards for the 3-waters (potable, waste and storm) network. This piece of work laid the content standards for capturing, describing and storing data for vital local authority infrastructure. These standards were released on 1 September 2017, but are not openly accessible. The following feedback on the development process and future of the standards has been provided:

- The standards shouldn't have been called "metadata" standards. They are actually content standards for capturing, describing and storing data. This creates user confusion.
- LINZ did well in bringing together the community to create the standards.
- The standards seem to be of high value, but this couldn't be validated due to project ending without an implementation or evaluation stage.
- NZ users can't easily find or use the standards. This is because the licence and access are not open and controlled by A-Spec.
- The standards maintenance process is not clear.
- These set of standards are not LINZ's core business, and the geospatial part of the standard is only a very small element. The best future approach would be for Local government to take ownership and control of thiese standards. LINZ can support with expertise on geospatial matters where required.

Environmental Integrated Data Infrastructure (eIDI) Pilot

The e-IDI Pilot aim was to make environmental data more discoverable, shareable, accessible and able to be aggregated. The pilot created a data infrastructure that users could query and access online, and it used real-time water quantity data to test the concept. The pilot was lead by MfE with support from LINZ, NIWA and Regional Councils.

The successful parts of the pilot were:

- The PoC showed that a working system can be developed.
- Use of a dedicated IT Architect.

The pilot also recommended the need to:

- establish and govern national registries for authoritative common terms, dataset and vocabulary access and descriptions.
- Use an expert for the development of any future standards.

Views from members of the pilot group were more guidance and support were needed in the facilitation of the development of standards, and ensuring the right experts are sent to appropriate international standard forums.

Hydrography

The focus for the LINZ Hydrographic Authority team is releasing datasets that it collects as part of the hydrographic charting programme. The hydrographic charting products are created to internationally agreed standards set by the International Hydrographic Organization (IHO). As part of these standards LINZ publishes data from the Electronic Navigation Charts (ENC) product data model to the LDS (in a slightly modified format for better GIS use) and on the LINZ website in official IHO formats.

At present the team is not fully aware of all the standards and sees that standardisation will be required for many marine datasets.

The team is starting to explore and recruit capability to develop a Marine SDI for NZ. The initial focus is to create a Marine domain working group to determine the requirements and high values needs of the Marine SDI. This focus will require expertise in domain data models, business processes, classifications, and transfer formats, as well as a standards development process.

Topography

The LINZ National Topographic Office maintains capture and data publishing standards for its independent datasets and mapping products. Capture specifications have been created for some of the Topo50 classes, but due to a lack of resources, has not been completed. The topographic team is not currently referencing or using international standards for the capture or publishing of its data. Good work has been done to establish capture specifications for Imagery, Elevation, roads, and tracks.

The topographic team has indicated that it needs more resource to better consider the wider customer needs of the data.

Positioning

The majority of the geodetic GNSS data formats are based on international specifications or standards. The Positioning team have also been involved in the ISO/TC 211 work groups for general geodetic parameter and coordinate systems, as well as the ANZLIC working group for the eGeodesy data exchange format. Both of these initiatives have been under-resourced and it's uncertain if they will succeed.

A key function of the Positioning team is the development, maintenance and advocacy of standards for NZ reference frames and coordinate systems. Many of these standards have been produced by LINZ in the past, but in recent times the focus and resourcing in these areas has been low. Two important areas that have been under resourced are:

- Deformation modelling standard for the accurate management of NZ datum coordinates. This standard once completed needs to be integrated into GIS and survey software and would need a significant level of customer support to implement.
- Implementation of NZ datums and coordinate systems. This involves working with vendors, software packages, and registries (e.g. ESPG) to ensure NZ datums and coordinate systems are well implemented.

Resilience

The Positioning and Resilience team are developing programmes to improve resilience to natural events in NZ. The primary outcome of this work is to support the Ministry of Civil Defence and Emergency Management (MCDEM) in the establishment of their National Disaster Resilience Strategy. This involves better understanding the needs of the geospatial datasets that can directly support processes for the prevention, response and recovery from disaster situations.

LINZ's role still is not clear and work is ongoing within the team with to align with MCDEM. Regardless work has begun to scope out potential key datasets and geospatial infrastructure (e.g. web mapping or data publishing) that is likely required in a response to a natural disaster.

LINZ has also started conversations with the OGC Emergency & Disaster Management Domain working group. It's hope that being involved in future work with this group will provide reusable knowledge or standards that can be directly use for emergency and disaster activities in NZ.

Proposed Standards Functions

Key Principles

To support the implementation of the LINZ outcomes framework, in particular the High-value Geographic and Property Information outcome, principles are required to provide structure and guidance for the way we operate.

The key principles of the Geospatial Strategy 2007 still apply to the development of the standards functions required at LINZ. Those principles are:

- Geospatial information is collected once to agreed standards to enable use by many.
- Discovery and access of geospatial information is easy.
- Within the appropriate context, geospatial information is easy to understand, integrate, interpret, and use.
- Geospatial information that government needs is readily available, and its use is not unduly restricted.
- Geospatial content is appropriately preserved and protected.

To provide a focus for LINZ standards implementation the follow principles also apply:

Needs based - The development of standards are based on a solid identified need from NZ customers which are aligned to LINZ outcome focus areas.

Expert Led - The standards development process is led by the domain experts for which the standard applies. This is to ensure the standard is aligned with the identified need and desired outcomes.

Pragmatic - The development of standards are done in realistic and practically applied way aligned to customer needs, and wider industry best practice, rather than focusing on theoretical considerations.

Open Standards - To enable widespread adoption, standards are developed and maintained in a collaborative and consensus driven way involving the public. The full standard document is made available to the public in an open and easily accessible way.

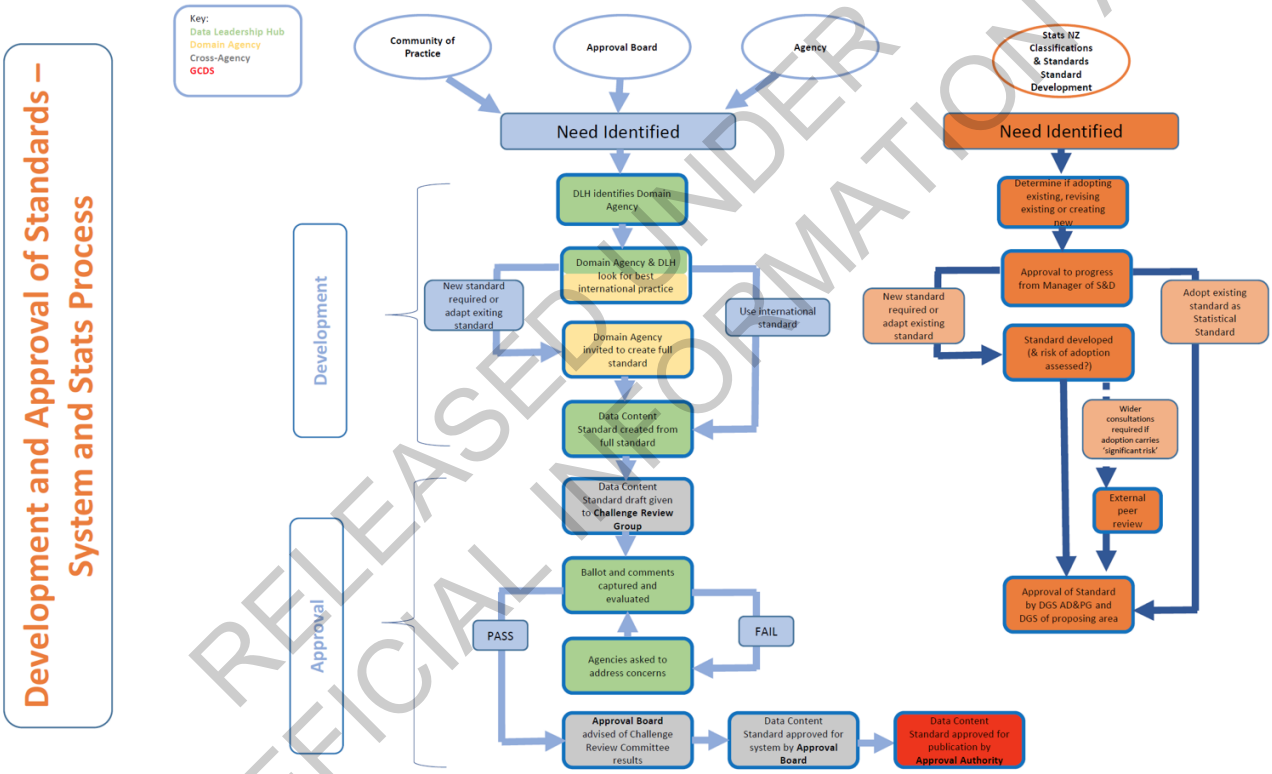
International Alignment – Where possible standards development should leverage international work already done (unless it encumbers the open principle). If at a later date new international work starts where NZ already has a standard, work should be done to align the NZ standard where practically possible.

Maintained - The standard must be under effective change control and maintained to align with customer needs.

Standards Development Process

To create effective agreed standards that provide interoperability, the standards need to be created in a robust way that aligned with the key principles. This requires a standards development process or guideline.

As part of its data leadership function, Statistics NZ has been developing a data standard development and approval process which leverages its existing statistics classification experience. This process is pragmatic and takes a project management approach to delivery which includes up-front needs identification and resourcing requirements. It also includes leveraging international standards work where applicable.



Statistics NZ Draft proposed standards development process

ISO and OGC have well established standards development processes for geospatial standards. When LINZ identifies a need that aligns with ISO or OGC, LINZ experts should participate. Because ISO standards are not openly available, but OGC standards are, LINZ should strategically push for all new standard work to be solely done by OGC working groups or with OGC and ISO joint working groups.

Again, because ISO isn't providing open standards LINZ should review its long-term future managing NZ's engagement with ISO/TC211's work programme and the Joint Standards Australia/Standards NZ Committee involvement.

Recommendation: LINZ should work with Stats NZ to leverage the data standard development process for standards going forward.

Recommendation: Provide standards development foundations for the wider LINZ data management teams to use - including templates, collaboration methods, review and maintenance processes.

Recommendation: LINZ should continue to work with OGC groups or with OGC and ISO joint groups for standards development where applicable.

Recommendation: LINZ for the medium term should continue to managing NZ's engagement with ISO/TC211's, with focus on effort to LINZ outcomes.

Geospatial Functional Leader

While the Geospatial Office's vision of a National SDI has not been fully effective, there are elements that are still important to carry out to achieve LINZ's desired outcomes. These elements include standardisation, linking, publishing, use and discovery of geospatial data. This leadership will be critical to successful delivery of High-value Geographic key datasets which require collaboration with many other agencies.

To make LINZ effective in Geographic information we need to take a pragmatic approach for the development and implementation of standards. We have the focus areas correct, we only need to change the approach and better resource the limited resources to make real impact. Focus should first be placed on getting our current functions and processes working well, then LINZ can promote and further development the reusable of what we have achieved.

Recent government changes have occurred in the data and information domain with Stats NZ taking the Data and Information functional leadership role. This role is heavily connected with the refocused DIA GCDO roles that focuses on digital and information technology. Stats NZ leadership role is still very new and will take some time to mature. DIA and StatsNZ have jointly been making recent strategic changes to the data.govt.nz service to support new Data Catalog Vocabulary (DCAT) standards for making government data accessible as well as publishing small to medium size datasets on behalf of other agencies.

Recommendation: LINZ promotes the value of geospatial standardisation with other government and crown agencies. This should focus on convincing agencies to use geospatial standards when publishing data, and best practices for using spatial data types, coordinates systems and transformations.

Recommendation: LINZ should work with Stats NZ on how LINZ with its Geographic Information expertise can best support the government data and information function.

Recommendation: LINZ should work with DIA & Stats NZ (data.govt.nz) to gain all of government alignment and positioning for spatial data publishing/accessibility services and standards.

Recommendation: Promote the syndicated data service subscription as a blueprint for successfully publishing data.

Data Management

To continue the evolution to a data centric organisation, provide consistency, and deliver higher quality products LINZ needs to create improved data development functions and processes for the data it manages. The key functions should be:

- Customer requirements
- Standards, policies, and procedures
- Metadata
- Storage
- Publishing
- Maintenance

The functions that define the data product itself, such as requirements, standards, and storage should sit within the LINZ data product teams to ensure the correct customer knowledge and domain expertise is applied during development. This will ensure pragmatic results are delivered. The team should be constantly engaging with key customers to determine and prioritise product requirements. Defined open standards, policies, and procedures will provide the team foundations for delivery of a consistent and high-quality product. Where applicable, the team should leverage the organisational policies and standard development processes and lead the standards development at the national and international level.

Recommendation: Ensure that all LINZ data management teams implement the LINZ Data and Information Management policies. This includes assigning formal roles.

Recommendation: The function to develop the standard for data products should sit within the LINZ product teams.

Recommendation: Ensure that all LINZ data management processes are evolved to include the definition of open standards, policies, and procedures to support customer requirements.

Geospatial Technology

LINZ has successfully implemented and promoted OGC/ISO metadata and technology standards. However current standards are lagging behind mainstream IT, or in some cases do not meet customer requirements. With LINZ's knowledge of operating the LDS and how customers use our data, LINZ can play a large role in operationalising OGC standards in conjunction with other international experts, open source software developers and commercial vendors. This role directly supports LINZ outcome areas for making data accessible and integrated for customers. It also provides a capability to drive further reuse from existing data and attract new customer types.

Recommendation: LINZ participates in the development of new OGC API standards to ensure NZ services have fit for purpose, adopted, and modern data access mechanisms.

Recommendation: LINZ works with technology communities and vendors to ensure OGC technology standards are robustly implemented.

Recommendation: Ensure tools are available to support the creation and maintenance of geospatial metadata.

Governance

The data management within LINZ should be governed across the business to ensure that organisational policies are implemented and initiatives are sufficiently aligned and resourced for business goals. The Geographic Information key datasets should be the focus within this group. The main functions that the governance should provide oversight of are:

- Leadership alignment to ensure data aspects of the LINZ outcomes are delivered.
- Case/value for new data investment, taking different lens/use cases into considering (e.g specific areas of water, Resilience and climate change, and urban development)
- Considering Business integrations
- Setting and monitoring implementation of policies, high level processes and frameworks for data management

Recommendation: LINZ Establishes operational governance that provides leadership alignment, sponsorship, oversight and monitoring over data management activities.

Appendix A - People Interviewed

Name	Role	Organisation
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	Horizons Regional Council
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	ISO
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	OGC
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	OGC
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	NIWA
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	Esri Redlands USA
[s 9(2)(ba)(i)]	Senior Business Architect	LINZ
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	Landcare
[s 9(2)(ba)(i)]	Manager Geodetic Infrastructure	LINZ
[s 9(2)(ba)(i)]	SDI Technical Leader	LINZ
[s 9(2)(ba)(i)]	SDI Technical Leader	LINZ
[s 9(2)(ba)(i)]	Programme Lead IPS	LINZ
[s 9(2)(ba)(i)]	Hydro Leadership Team	LINZ
[s 9(2)(ba)(i)]	LINZ Data Service Manager	LINZ
[s 9(2)(ba)(i)]	Senior Spatial Analyst	LINZ

[s 9(2)(ba)(i)]	Manager Resilience	LINZ
[s 9(2)(ba)(i)]	Manager Topographic Data	LINZ
[s 9(2)(ba)(i)]	Technical Leader Data	LINZ
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	Koordinates Limited
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	Statistics New Zealand
[s 9(2)(ba)(i)]	[s 9(2)(ba)(i)]	Statistics New Zealand