



# Spatial Services

A unit of the Department of Finance, Services and Innovation

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## NSW Spatial Data Infrastructure (SDI) Roadmap SDI Future State & Roadmap Report



# About this report

The purpose of this report is to bring clarity to the scope and objectives of a Spatial Data Infrastructure (SDI) for NSW and provide a roadmap of activities that will raise the level of SDI maturity across government and industry to the benefit of the economy, community and the environment.

To set the scene in providing some context for a SDI discussion, the reader should consider the following:

Take for example, the infrastructure that underpins our time and date systems which facilitates the use of calendars, diaries, timetables, schedules etc., that has developed over centuries and is now taken for granted. Basic elements include, datum established as Greenwich Mean Time (GMT); Julian (solar) calendar established by the Romans; the International Dateline; time zones organised around each 15° of latitude representing 1 hour; synchronisation with an atomic clock; etc., all which make it easy to communicate, compete and trade reliably in a global society.

Similarly, SDI refers to the fundamental infrastructure that underpins our spatial information capabilities to find, locate, navigate and map the real world with precision and reliability that is as ubiquitous and predictable as time and date. The basic elements of a SDI include, datum in 3D (x, y, z) based on the geoid; Global Navigation Satellite Systems (GNSS); survey control; map projection systems; data standards, governance arrangements etc., all of which are necessary for achieving more effective and efficient social, economic and environmental outcomes in an increasingly technological world.

At the core of a SDI are a critical few data sets that act as the coordinating and alignment foundation for all spatial data. This foundation infrastructure is as important as our date and time system and our financial system for organising society.

Commitment to the NSW Spatial Data Infrastructure Roadmap is a fundamental step in preparing for transformational change, increasing the value of our data and information assets and encouraging innovation and industry development in a digital economy.

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# Glossary

Term	Definition
ASDI	Australian Spatial Data Infrastructure
BOSSI	Board of Surveying and Spatial Information
CRCSI	Cooperative Research Centre for Spatial Information
DFSI	NSW Department of Finance, Services and Innovation
FSDI	Foundation Spatial Data Indexing
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
LIAC	Location Intelligence Industry Advisory Council
LLG	Location Leadership Group
OGC	Open Geospatial Consortium
SCCU	SDI Capability Coordination Unit
SDI	Spatial Data Infrastructure

# 1. Executive Summary

Spatial information is now an essential input to all business activity across government, industry, academia and the community. Complete, reliable and accurate spatial (or location) information is as essential to our economy, environment and society as time, numerical and language systems, and finance systems. Spatial Data Infrastructure (SDI) provides a framework for communities'/organisation's information systems to facilitate and coordinate access, exchange and use of spatial data effectively and as efficiently as possible.

With the proliferation of spatially enabled “portals” and “globes” facilitating industry and community engagement and Open Data policies, it is important to recognise that these portals and globes are components of a SDI but not in themselves a SDI. However, a mature SDI provides the foundation upon which these functions can be delivered effectively and efficiently.

A SDI is not a direct public value in its own right. It delivers public value through improved decision-making; more efficient transactions and operations; better use of data and information assets; and reduced operational costs. This value accrues in both the public and private sectors as a SDI is an enabling infrastructure applicable in all areas. In fact, the more broadly and consistently a SDI is adopted the greater the value it delivers.

Three things need to be established to allow an effective SDI to be delivered:

- **Public value - what public value the SDI will provide;**
- **Auspices the mandate or directive that a SDI is a public value that should be provided; and**
- **Capability - the resources necessary to achieve the public value.**

The NSW SDI Roadmap is intended to establish these three requirements, and to provide the performance framework to allow the value achieved to be quantified and recognised.

In addressing these high level requirements there are specific success factors:

1. **Establishing vision, purpose and strategy**
2. **Establishing effective and representative governance**
3. **Alignment of investment and of capability improvements**
4. **Delineating demand and supply side capabilities, roles and responsibilities**
5. **Developing a benefits realisation framework**
6. **Removal of duplication, promotion of re-use and sharing**
7. **A single authoritative cadastre**
8. **A single authoritative spatial data-indexing framework**
9. **A single authoritative and comprehensive data and services discovery platform**
10. **A federated, high performance delivery network backing the discovery service**

## 1.1 Motivation

Spatial services now offer the opportunity to move autonomous devices and robotics out into the real world, radically increasing their application and the benefits our economy and society can obtain from them. Put simply, spatial services will unbolt the robotics from the factory floor, and allow them to function anywhere in the external environment.

This transformation will affect every aspect of every sector of our economy and society, commencing in the next five years and spatial services are the fundamental enabler of this transformation.

The most critical influencing factors and industry trends driving the need for investing in SDI Development are:

- Intelligent machine guidance systems and autonomous vehicle navigation in transport, mining and agriculture that will rely on precise positioning infrastructure;
- Digital transformation to create virtual real world execution in an information management paradigm for design, construct, maintenance and operation of our natural environment and built assets;
- Ubiquitous Internet – a massive network of sensors, processors and autonomous devices and the ‘sense, think, act’ paradigm that underpins it - the Internet of Things, which is driving innovative solutions for business improvement, environmental management and society in general.

NSW SDI needs to be a complete, accurate and reliable location and positioning framework for NSW, as part of an overarching national (and global) framework. NSW SDI will:

Optimise spatial data and services to support delivery of broad-based economic, environmental and social benefits; and

Do so in a way that makes data and services available to all (public, private, academic and community sectors) in the most cost-efficient manner.

The following vision for NSW Spatial Data Infrastructure requires endorsement:

***NSW will create a spatial services platform capable of transforming the way industry, government and academia makes decisions which comprehensively benefits our economy, society and the nation.***

## 1.2. Priorities

A SDI Roadmap has six fundamental components that provide a framework for identifying improvements necessary to achieve the objectives in realising this vision for NSW Spatial Data Infrastructure.

SDI Component	SDI Objectives
Strategy	To demonstrate commitment to a common vision and mission that delivers defined collaboration strategies and a roadmap of SDI projects supporting agency priorities for social, economic and environmental outcomes.
Governance (policies, standards and guidelines)	To enable formal governance participation across agencies that ensures alignment to and achievement of government and agency priorities and outcomes with policy and standards development coordinated through participation in national and international committees.
People	To establish effective collaboration between government and industry sectors to clearly delineate core spatial science roles from business engagement roles in guiding academic and skills training programs that encourage information sharing, development of a competencies framework to evolve and centres of excellence to emerge.
Data	To develop a cohesive spatial data management framework to address whole-of-Government geocoding capabilities for all relevant enterprise information systems, interoperability between external reference data and master data repositories that leverages the value and benefit of spatial data.
Technology	To rationalise unnecessary duplicate and redundant systems and architectures to achieve efficiencies and savings through platform consolidation, process improvement and optimisation of licensing management to help fund investments in precise real-time positioning and location services delivered through high performance, scalable network connectivity for key clients.
Discovery and Access	To consolidate spatial metadata catalogues within a federated corporate knowledge management framework, which are accessible through various delivery channels configured and optimised to meet user demands and industry trends with an appropriate 'set and forget' licensing regime.

### 1.3. Recommended SDI Roadmap activities

Activities for SDI Roadmap development strategies can be arranged into two groups.

**Group A: SDI Operating Model** activities that address the strategy, governance and people components;

An operating model focuses on the delivery element of the business model. It describes the way an organisation does business and how it delivers value to its customers or constituents.

Strategy	Production of a NSW Government policy Briefing paper based on the SDI Roadmap developed in conjunction with CRCSI Economic study and supported by the Secretaries Board.
Governance (Policies and Standards)	A review of the current governance arrangements including formal and informal forums representing spatial information interests across government, industry, academia and professional associations including LLG, LIAC and BOSSI.
People	Explore the need for a Spatial Capability and Coordination Unit (SCCU) with the legislative support for consolidation of geospatial data capabilities and resources to optimise recruitment, training and utilisation across government agencies.

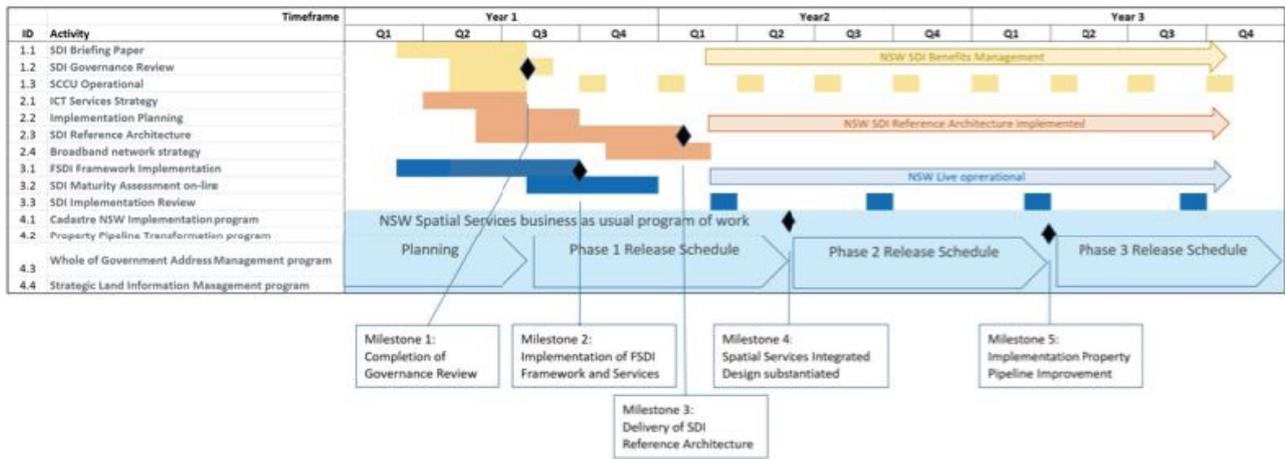
**Group B: SDI Reference Architecture** activities that address the data, technology, discovery and access components.

A Reference Architecture provides a template that documents what is considered to be best practices for a specific domain and provides a common vocabulary in discussing solutions and implementation planning.

Data	SDI Reference Architecture includes associated data and information management frameworks to support NSW Foundation Datasets development, access and use.
Technology	SDI Reference Architecture includes associated business process, applications, systems and security frameworks to support NSW ICT Strategic planning and development for SDI.
Discovery and Access	SDI Reference Architecture includes associated knowledge management and a Foundation Spatial Data Indexing (FSDI) framework to support government, industry and academic access and utilisation of NSW spatial data assets.

## 1.4. Roadmap Timeline

The following timeline is indicative of the key SDI Improvement activities and the business-as-usual work program that NSW Spatial Services need to resource and deliver through until 2020.



## 2. Introduction

This document builds on the excellent work undertaken by Land & Property Information (LPI) - now Spatial Services, over the past decade or more in providing leadership in establishing a basic spatial data infrastructure for NSW government, industry and academia. Evidence of this is reflected in the NSW Government Foundation Spatial Data Framework published in 2013.

### 2.1. Project Background

The NSW Location Leadership Group (LLG) aims to establish a NSW Spatial Data Infrastructure (SDI), serving government, industry, the non-profit sector, academia and citizens in general.

The NSW SDI will comprise:

- Policies and Institutional Arrangements
- People
- Spatial Data
- Technology
- Access and Discovery

### 2.2. Approach

The intended approach is to commence with the broadly accepted model for a SDI and:

1. Develop a 'best practice' model as a refinement of the base model:
  1. Identify and document learnings and improvements from four current SDI implementations;
  2. Identify and document learnings and improvements from relevant CRC-SI SDI research; and
  3. Identify and document strategic drivers, trends and disruptors likely to impact (positively and adversely) the NSW SDI implementation.
2. Assess capabilities and requirements of participants (principally NSW Government agencies) to establish both existing and target SDI maturity models and a gap analysis.
3. Develop appropriate strategies in consultation with industry and the community for implementing the NSW SDI Vision and Roadmap.

## 2.3. Scope

The scope for this phase covers stages 3 and 4 listed above. Figure 1 shows the scope as Phase 2 of the overall project as endorsed by the Project Board on 28/04/2016. This stage will deliver an ‘end state’ SDI model and the basis for the Roadmap developed in Stage 4.

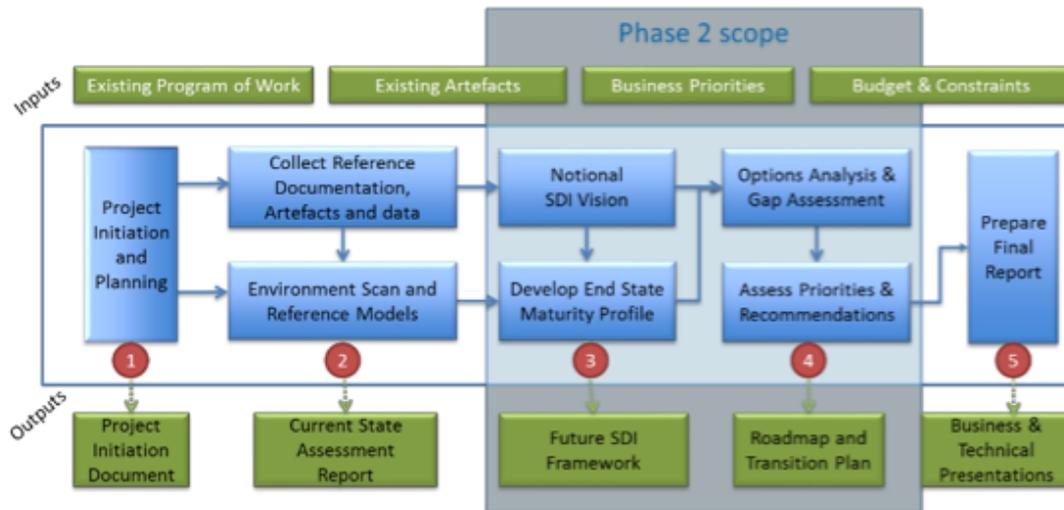


Figure 1 - Scope of Stage 3 in overall scope

## 2.4. Objectives

Based on an accepted definition of a SDI, a baseline of SDI capabilities and requirements for improvements will be identified that will lift the overall SDI maturity across NSW to meet the demands of government, industry and the community. The principal objective is to develop a roadmap of initiatives and activities that will constitute the business case(s) for investment in resources to achieve the desired outcome over a 5-year planning horizon.

## 2.5. SDI Principles

The following principles, assembled from the principles identified in the course of scanning various SDI initiatives globally, are proposed as a guide to framing a vision for NSW Spatial Data Infrastructure development towards a fully mature SDI. As the capability assessment progresses these principles will be refined and simplified to provide the key design principles.

SDI Component	Principles
Strategy	<ul style="list-style-type: none"> <li>Vision: Commitment to a SDI vision giving clarity of purpose for government, industry and academic sectors.</li> <li>Collaboration: Effective consultation process to ensure government policy settings achieve strategic objectives.</li> <li>Leadership: leadership of a SDI must be clearly visible, pragmatic and collaborative in order to bring together the federated elements and direct them down a common path that achieves the benefits of a contemporary SDI.</li> </ul>

SDI Component	Principles
Governance	<ul style="list-style-type: none"> <li>• NSW SDI should provide access to spatial data and services necessary for economic, environmental and social outcomes.</li> <li>• Identify and quantify benefits, to improve participation and support, backed by performance monitoring.</li> <li>• Implement through progressive coordination, collaboration and consolidation of existing capabilities and resources, NOT a 'greenfield' monolithic build.</li> <li>• Inclusive: SDIs must be inclusive. If a foundation dataset is the means by which disparate datasets can be quality assured and/or shared and value-added, then by definition it should be available to and used by all.</li> <li>• Users – government, industry, academia, community – have a role in governance and strategic direction.</li> <li>• User requirements should drive strategic direction and investment.</li> <li>• Communications and engagement should be planned to leverage the current increased appetite for collaboration, sharing and re-use.</li> </ul>
Policies and standards	<ul style="list-style-type: none"> <li>• Efficiency through removal of duplication, standardisation, re-use and sharing is fundamental.</li> <li>• Re-use and sharing can mean federation and/or centralisation.</li> <li>• Open standards and guidelines to promote interoperability.</li> <li>• Mainstream ICT technical and finance/budget processes: Policy settings for SDIs need to include integrating SDI into frameworks.</li> <li>• Technology and standards: Leveraging and keeping up with technology and standards is essential. There is a need to address the many demand side users, which tend to have lower capabilities and capacity in this respect, rather than the few supply side providers.</li> </ul>

SDI Component	Principles
Data	<ul style="list-style-type: none"> <li>• A 'real world' spatial reference framework supporting location, positioning and operational activities is the core function of a SDI.</li> <li>• Coordinating and alignment foundation: The core of a SDI is the critical few datasets that act as the coordinating and alignment foundation for all spatial data. This foundation is the spatial equivalent of our alphabet, our number system, our date and time system and our financial system – without agreed and enforced standards and compliance in these basic elements our society and economy cannot function effectively.</li> <li>• Single authoritative sources: Data should be maintained and collected once.</li> <li>• Competing datasets mean increased costs not only in production and maintenance but also in application (single authoritative source does not necessarily mean a single centralised entity).</li> <li>• Operational datasets are the most sustainable datasets: Datasets developed and maintained for a specific transactional purpose are most likely to have robust, long-term development plans, stable format and structure.</li> <li>• Framework datasets are the foundation on which operational datasets can be derived and may need re-engineering and enhancement.: There is an inherent tension between the business-specific objectives of the owner of an operational dataset and those who wish to use it as a framework dataset, building a framework dataset that meets all needs is unlikely to be viable.</li> </ul>
People	<ul style="list-style-type: none"> <li>• Awareness and literacy through clear leadership in respect of delivering spatial services that prove the benefits by performance that inspires engagement and take-up the services of the SDI.</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Effective provision and efficient delivery channels are fundamental to commercially viable business use, whether by government, industry or community. Connectivity remains a key issue for SDI success.</li> <li>• Compliance and leverage of mainstream ICT disciplines, environments and processes.</li> <li>• Non-proprietary, 'plug and play' services architecture and components.</li> <li>• Discovery and access, including the capacity for assessing fitness for purpose is essential.</li> </ul>

***Core of a SDI are the critical few datasets that act as the coordinating and alignment foundation for all spatial data. This foundation is the spatial equivalent of our alphabet, our number system, our date and time system and our financial system.***

## 2.6. NSW SDI Vision Statement

NSW will create a spatial services platform capable of transforming the way industry, government and academia makes decisions which comprehensively benefits our economy, society and the nation.

This will be achieved through:

- i. Setting priorities. SDI objectives and actions will remain aligned to Whole-of-Government priorities and outcomes. Progress and alignment will be monitored as part of formal review processes.
- ii. Supporting strategy. The SDI governance model will support the delivery of strategic government outcomes; provide direction to and contribute toward public services delivery; support industry and academic forums for the purpose of developing digital policies, standards and skills development.
- iii. Connecting demand and supply. An effective market place will connect “demand” and “supply” side participants at data, services and resource levels,(specialist and generalist capabilities) facilitated by close engagement with business and research sectors.
- iv. Reliable data services. Spatial datasets and repositories will be optimised to maximise delivery performance, data security and service reliability, within a unified data and information management framework. This will underpin the spatial data market place by allowing it to operate seamlessly across government, business and the academic communities.
- v. Ubiquitous access to location information. ICT service architectures will sustain flexible technologies that makes the best use of technology integration opportunities, via interoperability standards and computing scalability; to enable ‘plug and play’ provisioning of ubiquitous high-precision, real time, reliable positioning that allows the assemblage of multiple data sources ‘on the fly’.
- vi. Linkages to federated providers. Consolidated spatial data publishing and discovery services will deliver a comprehensive range of data channels that satisfy user demands for spatial content and location services; via commercial service delivery levels, machine-to-machine (M2M) interoperability, and workflow.

## 3. A SDI Framework for NSW

**Infrastructure** is ‘the basic physical and organisational structures and facilities (e.g. buildings, roads, power supplies, etc.) needed for the operation of a society or enterprise.’<sup>1</sup>

Infrastructure is not an end in itself, but an enabler for achieving societal or enterprise value. It is critical to acknowledge the organisational structures and facilities as well as the physical.

Spatial Data Infrastructure (SDI) is defined by the NSW Location Leadership Group (LLG), giving context for this study as: “a federated infrastructure and collection of technologies, policies and institutional arrangements linking online spatial data and allowing it to be discovered, accessed and used.”<sup>2</sup>

SDI has also been described as: “the basic physical and organisational structures and facilities that allow us to measure, locate and position objects and to understand the spatial relationships (proximity, context) between objects”. These are fundamental capabilities for everything we do, whether in planning or in operations.

More simply: “SDI provides a framework for community and organisational information systems to facilitate and coordinate access, exchange and use of spatial data effectively and as efficiently as possible.”

This SDI concept has developed for the past 20 years to the extent that most organisations have some exposure to collecting, managing and using spatial information in some form or another. The challenge/opportunity however, is to leverage the economic, social and environmental benefits of spatial information by developing mature and reliable SDI frameworks across local, regional and global jurisdictions.

With the proliferation of spatially enabled “portals” and “globes” facilitating industry and community engagement and Open Data policies, it is important to recognise that these portals and globes are components of a SDI but not in themselves a SDI. However, a mature SDI provides the foundation upon which these functions can be delivered effectively and efficiently.

### 3.1. A National SDI context

The Australian Spatial Data Infrastructure (ASDI) is a national framework for linking users with providers of spatial information and is similar in concept to a national highway or railway network. The ASDI comprises the people, policies and technologies necessary to enable the use of spatially referenced data through all levels of government, the private sector, non-profit organisations and academia.

1. <http://www.oxforddictionaries.com/definition/english/infrastructure>

2. GSDI 2009. The SDI Cookbook. Accessed 29 May 2015, via: <http://www.gsdi.org/gsdicookbook/index>

3. <http://www.icsm.gov.au/hdmi/index.html>

4. GSDI: <http://gsdiassociation.org/index.php>

Some elements of the ASDI are already developed, including policies, guidelines, the Australian Spatial Data Directory (ASDD), national data models such as ICSM's Harmonised Data Model<sup>3</sup>, metadata records and institutional arrangements.

The ASDI is aligned with a Global SDI (GSDI) framework being advanced through the GSDI Association<sup>4</sup> whose purpose is:

*“to promote international cooperation and collaboration in support of local, national and international Spatial Data Infrastructure research, education, capacity building and implementation challenges, issues and good practice from around the globe that will allow nations to better address social, economic, and environmental issues of pressing importance”.*

### **3.2. Why a SDI Framework?**

Spatial information is now an essential input to all business activity, across government, industry, academia and the community. Consistent, reliable and accurate spatial (or location) information is as essential to our economy, environment and society as time, numerical and language systems, and finance systems.

However, spatial information is incomplete, of variable quality levels, of limited availability, and inconsistently and inaccurately applied. These challenges reduce the benefits that can be achieved, and increase the costs. A SDI is the instrument necessary to create and sustain spatial information and resources at levels that maximise the value and use of data and information assets.

A SDI is not a direct public value in its own right. It delivers public value through:

- Improved decision-making;
- More efficient transactions and operations; and
- Reduced operational costs.

This value accrues in both the public and private sectors, as SDI is an enabling infrastructure applicable in all areas. In fact, the more broadly and consistently a SDI is adopted the greater the value it delivers.

The NSW SDI needs to align with the ASDI Framework such that cross-jurisdictional collaboration and spatial information interoperability is achievable at federal, state and local government levels.

### **3.3. What will SDI deliver?**

Spatial measurement, like any measurement (time, money) needs to be universally agreed, adopted and applied to be effective. NSW SDI will be a complete, accurate and reliable location and positioning framework for NSW, as part of an overarching national (and global) framework.

NSW SDI will:

- Optimise spatial data and services to support delivery of broad-based economic, environmental and social benefits; and
- Do so in a way that makes data and services available to all (public, private, academic and community sectors) in the most cost-efficient manner.

### 3.4. Success factors

Three things need to be established to allow an effective SDI to be delivered:

- **Public value** – what public value the SDI will provide;
- **Auspices** – the mandate or directive that a SDI is a public value that should be provided; and
- **Capability** – the resources necessary to achieve the public value.

The NSW SDI Roadmap is intended to establish these three requirements, and to provide the performance framework to allow the value achieved to be quantified and recognised. Whilst a roadmap outlines a series of objectives and activities aimed at achieving a target state, it is critical that various measures of success and milestones are identified to monitor progress and make appropriate adjustments where necessary along the way.

Falling below these three above mentioned high-level requirements there are specific success factors:

1. Establishing vision, purpose and strategy.  
Successful SDI implementation requires top down commitment, if not legislative support, for a SDI Charter for NSW and associated framework of goals, purpose and outputs for monitoring success at the highest level.
2. Establishing effective and representative governance.  
Working groups established to progress SDI initiatives will need to operate within an effective governance model with clearly defined accountabilities, responsibilities and performance measures.
3. Alignment of investment, and of capability improvements.  
A portfolio investment approach to funding SDI initiatives will improve the ability to balance priorities between capital and recurrent expenditure leveraging whole of government resources.
4. Delineating demand and supply side capabilities, roles and responsibilities.  
An effective SDI must have a reliable supply side contributing to quality datasets as well as the demand side awareness to create a sustainable spatial market place.
5. Developing a benefits realisation framework.  
A mechanism is required that allows benefits accruing to end user organisations to be factored into the business case for SDI improvements and to establish the value of spatial data and services.

6. Removal of duplication, promotion of re-use and sharing.  
Articulation of a conceptual value chain model describing the spatial data workflows and interactions with suppliers and customers is fundamental to supply chain optimisation and encouraging continuous process improvement practices.
7. A single authoritative cadastre.  
A SDI cannot succeed without a single authoritative NSW cadastre, representation of property rights and entitlements that reflects the NSW Land Titles system records.
8. A single authoritative spatial reference framework.  
A SDI cannot succeed without a single authoritative spatial data indexing framework in establishing a common index into all foundation spatial data sets for geocoding and location based services for business and community.
9. A single authoritative and comprehensive data and services discovery platform. A SDI must provide a mechanism for spatial data custodians to publish authoritative datasets and services for consumers to access and bind to seamlessly in meeting their business requirements regardless of end-point technology being used. While operating as a single authoritative platform it may be underpinned by a number of federated platforms.
10. A federated, high performance, secure delivery network backing the discovery service. A successful SDI needs to rely on a high performance delivery network to support demand for real time access to large spatial datasets.

### 3.5. SDI Reference Architecture

Two integral components of any SDI are Position Infrastructure and Location Infrastructure, which are separate but interrelated. Position is a definitive concept that defines the real world coordinates of an object. Whereas Location is a relative concept, that expresses the whereabouts of an object relative to the positioning framework and/or other objects.

**Positioning Infrastructure** includes the Global Navigation Satellite Systems (GNSS), processes and associated technologies for communicating, receiving and processing global position signals and provision of correction data for determining local datum in three dimensions (x, y, z) based on the shape of the earth.

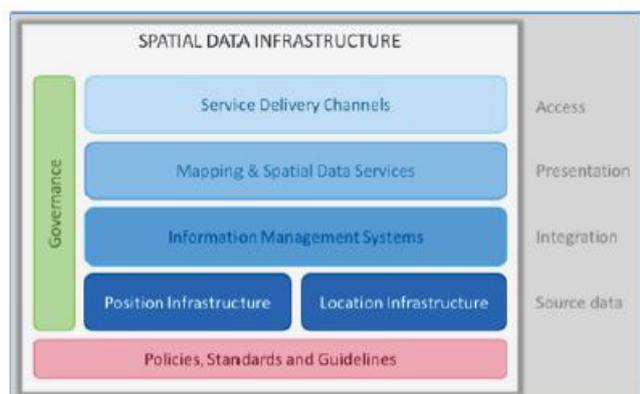


Figure 2 - Spatial data Infrastructure reference model

**Location Infrastructure** includes the supply chain processes and technologies associated with capture, manage, maintain, integrate, extract and supply the various types of geocoded data that are fit-for-purpose and referenced to relevant datum.

Spatial Data Infrastructure, as described in the SDI reference model (Figure 2) integrates position and location infrastructure in producing mapping and spatial data services for access through service delivery channels. Each of the position and location infrastructures have separate but complementary ICT environments and requires a coordinated approach to design and implementation of business processes, information, applications and security.

*A Spatial Data Infrastructure (SDI) reference architecture will provide NSW with an enterprise architecture perspective for both position and location infrastructure that address these requirements.*

### 3.6. SDI Terminology

The following terms require definition to remove potential ambiguity relating to their use in the context of a SDI Roadmap:

#### Data and Services

Spatial Data is the fundamental commodity of a SDI. Data is captured, ingested, maintained, managed, integrated with other data, exported and consumed. This is a supply-side perspective. Data products can be delivered through a variety of service channels to the consumer including physical media, file transfer or via a web service. References to spatial data services is the demand-side or consumer perspective. A SDI therefore refers to spatial data as the **Data** component and data services as part of the **Discovery and Access** component.

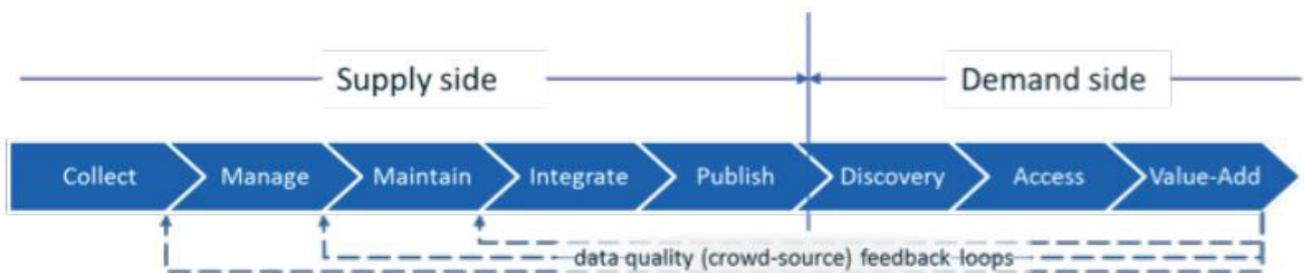


Figure 3 - Data and services supply chain

## Strategy, architecture and frameworks

Strategy is the implementation of policy, whereas an architecture can provide the “big picture” that conveys a concept and is preliminary to the design process. Frameworks are an implementation of an architecture and essentially describe the logical structure of interrelated concepts that define the scope and context for a specific topic such as; corporate policy frameworks, business operating models and enterprise information systems. Frameworks are generally devoid of any data and describe policies, guidelines, standards and business rules that govern the design, build and implementation of a solution.

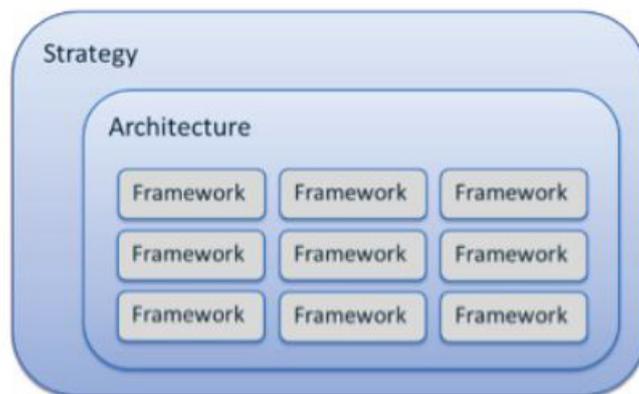


Figure 4 - Strategy, architecture and frameworks

*A SDI framework therefore should relate to and align with an overarching SDI strategy and architecture.*

## Foundation Spatial Data Indexing (FSDI) framework

Spatially enabling business data means applying (preferably standard) location indexes, with the core being parcel identifier, property identifier, address, spatial coordinates (x, y, z). These core spatial indexes underpin a range of authoritative administrative boundary indexes – localities, local government areas, electorates and the Australian Statistical Geographical Classification (ASGC).

A range of business specific geocoding indexes (Travel Zones, Post Codes, etc.) also enabled from the core indexes, as shown below in Figure 5 - FSDI framework, are aligned or linked to these location indexes, enabling geocoding and location based services for business and community applications.

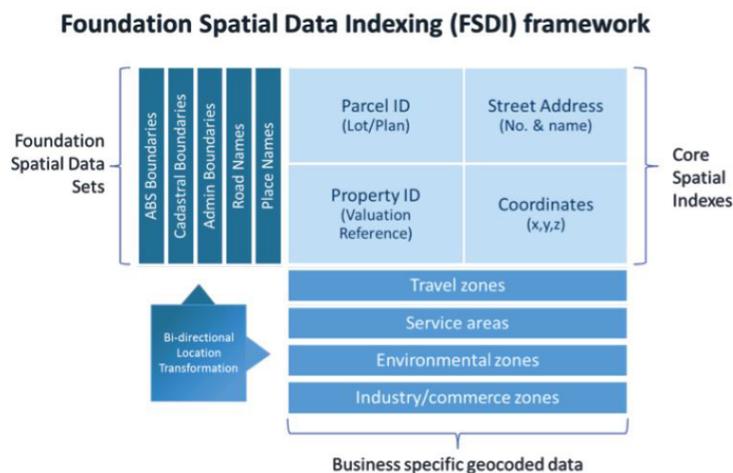


Figure 5 - FSDI Framework

A well-structured and validated index framework means there are proven, reliable, consistent and repeatable methods for linking and integrating disparate datasets. All agencies and users benefit from this consistency and repeatable processes. The value achieved and the confidence level obtained, when data with different location indexes are integrated can often be significantly compromised by inconsistent application; e.g. the use of a geocoded address for design of national broadband network connection design process.

### Authoritative or Fit-for-Purpose?

When location data is correlated with position data through a regulatory framework governing the capture, processing and quality assurance methods, spatial data can be authenticated and considered authoritative. In many cases data can be fit-for-purpose without necessarily being authoritative. For a SDI to deliver reliable authoritative foundation data sets there needs to be a recognised accountable authority with appropriate resources to maintain the data and provide appropriate access and delivery services.

# 4. Requirements overview

This requirements overview is a summary of findings identified in the previously documented Research Review, Environmental Scan and Current State Assessment reports based on extensive market investigations and engagement with key NSW government agencies.

## 4.1. Common needs

The commonality shown in capabilities and capacity across most government agencies reflects common underlying spatial requirements and processes, particularly for:

- Asset and property management
- Infrastructure and services planning and delivery
- Mobile workforce.

Within these broad requirements there is a need for common basic spatial services such that all agencies and users benefit from this consistency and repeatability.

- Address management and geo-coding service, which provides additional consistency and interoperability benefits, as well as savings through capital and operating costs reductions.
- Routing service, as part of the broader scheduling activity for services, with emergency dispatch one of the most critical.
- Foundation Spatial Data indexing service, providing a spatial index framework of proven, reliable, consistent and repeatable methods for linking and integrating disparate data sets.

## 4.2. Influencing factors

In scanning the SDI environment locally and internationally, a number of technology, economic and social trends are highlighted that will drive and shape an effective SDI implementation. The most critical of these are:

- Intelligent machine guidance systems and autonomous vehicle navigation in transport, mining and agriculture that will rely on precise positioning infrastructure;
- Digital transformation to create virtual 3 dimensional real world execution in an information management paradigm for design, construct, maintenance and operation of built assets;
- Ubiquitous Internet – a massive network of sensors, processors and autonomous devices and the ‘sense, think, act’ paradigm that underpins it - the Internet of Things, which is driving innovative solutions for business improvement, environmental management and society in general.

5. Business Insider Australia, Harry Tucker article - January 8th 201

Driverless cars are inevitable. Companies such as Google and Apple are investing heavily in the driverless car market, estimated by Lux Research to be worth as much as \$87 billion worldwide by 2035. Companies such as Toyota and Nissan expects that all of their vehicles sold in Australia from 2018 will be equipped with GPS capable of 2cm positioning and LiDAR sensors with real-time crash avoidance capabilities. While this technology poses a significant challenge for the Australian government to amend legislation there will be an increasing demand for a SDI to support the need for reliable, real-time precise positioning and location services.

On-line systems (e.g. Google Earth) bring a form of the SDI to everyone. There has been a proliferation of autonomous devices that know, think and communicate (sensor networks) enabling our communities to interact more intimately with business and the environment. Web services are improving the ability of applications to access the SDI and progressive institutions such as Open Geospatial Consortium (OGC) are established to provide standards enabling interoperability. The concept of Virtual Australia has emerged and has been adopted as a key initiative by the CRC SI together with projects to support the development of the Australia New Zealand Spatial Market Place (ANZSM).

Developments such as these are influencing spatial innovations. Spatial Services now offer the opportunity to move autonomous devices and robotics out into the real world, radically increasing their application and the benefits our economy and society can obtain from them. Put simply Spatial Services will unbolt the robotics from the factory floor, and allow them to function anywhere in the external environment.

This transformation will affect every aspect of every sector of our economy and society, commencing in the next five years and Spatial Services are the fundamental enabler of this transformation.

Regardless of other requirements, the key role for a future SDI is the provision of a 3 dimensional 'real world' spatial reference framework that allows location, positioning and actual operational processes to be undertaken by autonomous devices, in the real world.

### **4.3. Specific requirements**

The following critical requirements have been identified across agencies, grouped under broad headings:

1. SDI strategy development
  - a) Spanning demand and supply sides
  - b) Spanning the public, private and academic sectors
  - c) Aligned to NSW Government outcomes and priorities
  - d) Informed and refreshed by ongoing performance review and measurement.
  
2. SDI governance, policies, standards and guidelines
  - a) Resourced to provide strategic direction, measure performance
  - b) Representative of demand and supply

- c) Representative of public, private and academic sectors
- d) Serve the individual and collective interests of SDI participant organisations
- e) Policies and standards current and implemented, including Next Generation Australian Datum.

### 3. People

- a) Spatial data and services commoditised to minimise/remove the need for specialist spatial skills in business uses/end uses
- b) Small core group of spatial scientists delivering spatial data and services for independent consumption by end users
- c) Small core group of spatial business analysts brokering spatial capabilities and business requirements.

### 4. Data

- a) Spatial reference architecture as part of the broader NSW Government ICT architecture and Data Management Framework
- b) Foundation data and services delivered as a single authoritative source and part of a master data framework. Duplication minimised, sharing and re-use maximised. This includes, as a priority, single authoritative 'real world' spatial reference framework and cadastre
- c) Foundation data delivered at fit-for-purpose quality levels agreed and supported by all, through the governance process. Quality levels documented and maintained
- d) Spatial data and services development plans jointly developed, endorsed and reviewed through the governance process.

### 5. Technology

- a) Enterprise level open, agnostic ICT service delivery architecture. Plug and play component architecture
- b) Performance monitoring and license management optimise procurement and investment
- c) Ubiquitous high-precision, real time, high reliability positioning and location services supporting business outcomes
- d) High capacity, high performance infrastructure to process and integrate high volume sensor outputs (imagery, LiDAR, sensor nets, etc...)
- e) High capacity, scalable network connectivity to allow access, remove the need for duplicated data and services.

### 6. Discovery and Access

- a) Single consolidated enterprise discovery for all spatial data and services, linking to federated providers
- b) Enterprise level range of delivery channels (direct access, web services, and physical media) that meet user demands at commercial/operational service levels

- c) Consistent, standardised delivery methods and channels integrated at enterprise level, change management supports commercial/critical business service levels
- d) Complete as 'set and forget' enterprise level common access and licensing policy and framework.

#### 4.4. SDI Maturity Assessment

The following maturity levels of Spatial Data Infrastructure development for any jurisdiction represent, in general terms, the evolution of continuous improvement in reliability, availability and affordability of spatial data services to benefit economic, social and environmental outcomes.

**Level 1: Ad-hoc (independent and opportunistic deployment)**

**Level 2: Repeatable (market segmentation stimulating vertical applications)**

**Level 3: Managed (integrated infrastructure coordination happening on a large scale)**

**Level 4: Optimised (ubiquitous reliability providing foundation for new industries)**

**Level 5: Adaptive (innovation and alternative technologies and services emerge)**



Figure 6 - Indicative NSW SDI Maturity Profile

Assessment criteria and a comprehensive set of SDI maturity indicators have been developed in consultation with NSW LLG representatives. Preliminary assessment of the overall SDI maturity of NSW government agencies based on these indicators suggests a current level of maturity between Level 2 and Level 3, in general, with some agencies more advanced than others. The following maturity profile is indicative of the current state of NSW SDI maturity.

Validation of the SDI maturity model and assessment criteria is recommended. Each government agency and local council in NSW should be given access to an on-line self-assessment survey tool (provided in Appendix A) that will enable individual profiles to be developed and provide baseline metrics for continuous improvement initiatives.

# 5. SDI improvements

NSW is well placed in terms of capacity and understanding of requirements to deliver a SDI. The most critical capacities to be developed are at governance and strategic levels, to pull the SDI together. Strategy is required to establish purpose and direction. Governance capacity, particularly on the demand side, is required to deliver on strategy, and to provide the performance monitoring and measurement to demonstrate value and achievement.

Key stakeholder agencies' requirements and other influencing factors are now consolidated into the accepted SDI components to establish a framework and methodology for roadmap development. The following areas of improvement (see Table 1 below) have been identified to lift the current spatial data infrastructure maturity across NSW and leverage greater benefits from the substantial investment in spatial information across government and industry. These improvements are further developed into roadmap activities.

**Table 1 - Areas of SDI improvement**

SDI Component	Areas of Improvement
Strategy	<ul style="list-style-type: none"> <li>Economic benefit of SDI recognised and reflected in Government policies</li> <li>Alignment with government priorities with performance measures identified</li> <li>Commitment to common vision endorsed by Location Leadership forum</li> <li>Introduction of spatial data considerations into Treasury business case development stage for ICT projects linking spatial data investment to data analytics benefits.</li> </ul>
Governance (Policies and Standards)	<ul style="list-style-type: none"> <li>Commitment from senior executives to provide direction</li> <li>Open data development through engagement with international standards bodies</li> <li>Legislative support to incentivise compliance and recognition for improvement Review cross agency and industry engagement forums (LLG, LIIAC, BOSSI) charter and structure</li> <li>Incorporating spatial data considerations into Gateway Review process for ICT projects.</li> </ul>
People	<ul style="list-style-type: none"> <li>Community of expertise to leverage skilled spatial practitioners, industry, government and academia</li> <li>Development of spatial data education facilities and resources available to all agencies</li> <li>Knowledge coordination through dedicated spatial services support resource</li> <li>Collaboration and partnering arrangements to limit competing/conflicting SDI.</li> </ul>

<p><b>Data</b></p>	<ul style="list-style-type: none"> <li>• Data management principles and practices to increase data integrity and business confidence</li> <li>• Spatial Reference architecture developed, endorsed and adopted by NSW Government agencies</li> <li>• Authoritative foundation spatial data maintained and managed at appropriate levels of service (LoS) to compliment ASDI requirements</li> <li>• Spatial data repositories designed to accommodate OGC compliant Web Map Services (WMS), Web Feature Services (WFS) and Web Tile Services (WTS) requirements for discovery and access</li> <li>• Criteria for certification and administration of authoritative spatial datasets and compliance obligations</li> <li>• Compliance with ICT Information</li> <li>• Management framework to support the exchange of information between agencies.</li> </ul>
<p><b>Technology</b></p>	<ul style="list-style-type: none"> <li>• Platform consolidation to remove duplication, rationalise licencing and reduce maintenance costs</li> <li>• Enterprise level open, agnostic ICT delivery services architecture supporting plug and play components</li> <li>• Positioning infrastructure development to support dynamic datum services</li> <li>• Location Services infrastructure development to enable B2B and B2C applications</li> <li>• High capacity, secure and scalable network connectivity enabling real-time access to federated spatial data services.</li> </ul>
<p><b>Discovery and Access</b></p>	<ul style="list-style-type: none"> <li>• Access to market research, literature reviews and case studies to increase awareness technologies, applications and available data sources to support investment decisions</li> <li>• Single consolidated enterprise discovery for all spatial data and services, linking to federated providers, including: <ul style="list-style-type: none"> <li>• Cadastre As-a-Service accessible to local councils, government agencies, utilities and value added suppliers of land and property information services;</li> <li>• Address validation and geocoding As-a-Service implemented across Government;</li> <li>• Routable road network As-a-Service accessible to commercial routing applications.</li> </ul> </li> <li>• Foundation Spatial Data Indexing (FSDI) framework for common spatial indexing and geocoding translation applications</li> <li>• Enterprise level range of delivery channels and change management support that meet user demands for commercial service levels.</li> </ul>

SDI improvement strategies have been developed to address these required improvements in taking the NSW SDI to the next level of maturity.

## 5.1. Strategy

Strategy development is an organisation's process of defining its vision, or mission, and setting a direction and framework for making decisions on allocating its resources to achieve a set of objectives. Best practice strategic planning for NSW SDI requires alignment of government strategies for SDI at the local, state and federal level and provides the necessary guidance and support to achieve common objectives.

### 5.1.1. Purpose

To demonstrate commitment to a common vision and mission that delivers defined collaboration strategies and a roadmap of SDI projects supporting agency priorities for social, economic and environmental outcomes.

### 5.1.2. Success measures

Government policy announcement in support of SDI Vision and Roadmap recommendations with appropriate budget funding.

### 5.1.3. Accountabilities

As principal sponsor and chair of the NSW Location Leadership Group (LLG), the Executive Director of DFSI Spatial Services should be accountable for achieving this SDI Strategy objective.

### 5.1.4. Outputs

Production of a NSW Government Briefing paper based on the SDI Roadmap developed in conjunction with CRCSI Economic study.

### 5.1.5. Activities

The following outcomes and implementation activities have been identified.

**Table 2 - Strategy roadmap activities**

Outcomes	Implementation activities
a) Economic benefit of SDI recognised and reflected in Government policies	Consideration of the CRCSI Economic study to support the SDI roadmap and recommendations.
b) Alignment with government priorities with performance measures identified	Establish a SDI benefits management framework to monitor SDI implementation and regularly reporting to the Secretary's Board.

c) Commitment to common vision endorsed by Location Leadership Group and Secretary's Board	Endorsed SDI Vision and Roadmap and proposed Briefing paper accepted by NSW Secretary's Board and presented to Minister with recommendations.
d) Introduction of spatial data considerations into Treasury business case development stage for ICT projects linking spatial data	Briefing paper presented to NSW GCIDO with 3 - 5 year roadmap of activities with Benefits Management Plan with support from DAC.

## 5.2. Governance (policies, standards, guidelines)

Good governance is all about ensuring those who have responsibility for delivering outcomes do so in the best interest of those who are accountable for the outcomes. Best practice governance for NSW SDI requires appropriate forums to be established with senior executive and political level support to develop the policy settings and enforce compliance with the industry standards and guidelines necessary for a fully functioning spatial marketplace.

### 5.2.1. Purpose

To enable formal governance participation across agencies that ensures alignment to and achievement of government and agency priorities and outcomes with policy and standards development coordinated through participation in national and international committees.

### 5.2.2. Success measures

Acceptance of the SDI Briefing paper and recommendations by the Secretary's by June 2017.

### 5.2.3. Accountabilities

As principal sponsor and chair of the NSW Location Leadership Group (LLG), the Executive Director of NSW Spatial Services should be accountable for achieving this SDI Governance objective.

### 5.2.4. Outputs

A review of the current governance arrangements including formal and informal forums representing spatial information interests across government, industry, academia and professional associations including NSW Location Leadership Group (LLG), NSW Location Intelligence Industry Advisory Council (LIIAC) and NSW Board of Surveying and Spatial Information (BOSSI).

## 5.2.5. Activities

The following outcomes and implementation activities have been identified.

Outcomes	Implementation activities
a) Commitment from senior executives to provide direction	Allocation of time and resources from agencies to participate in the Location.
b) Data and Services standards development through engagement with international standards bodies	Appropriate representation of NSW SDI interests on national and international forums, such as Open Geospatial Consortium (OGC) and Global Spatial Data Infrastructure (GSDI) Association, through active participation in contributing and communicating standards requirements and implementation.
c) Legislative support to incentivise compliance and recognition for improvement	Development of legislation and guidelines that align spatial data and information management practices with whole-of-government government ICT principals, policies and procedures.
d) Revised charter and structure cross agency spatial information	Review effectiveness and relevance of charter and structure of LLG, LIAC and BOSSI as appropriate in meeting future SDI requirements.
e) Incorporating spatial data considerations into Gateway Review process for ICT projects	Provide input to review of current governance arrangements to ensure SDI projects are subjected to the government Gateway Review procedures.

## 5.3. People

Capacity and capability planning, to ensure the appropriate skills and expertise are being developed in industry, government and academic institutions, is an essential element in contributing to the development and implementation of a sustainable SDI. Best practice capability planning for NSW SDI requires a concerted approach to fostering innovative talent and leadership skills to exploit the wave of digital technologies that are increasingly reliant on spatial information.

### 5.3.1. Purpose

To establish effective collaboration between government and industry sectors to clearly delineate core spatial science roles from business engagement roles in guiding academic and skills training programs that encourage information sharing and development of a competencies framework to evolve and centres of excellence to emerge.

### 5.3.2. Success measures

An established Spatial Capability and Coordination Unit (SCCU) with endorsed charter and governance model for consolidation of spatial data capabilities and resources to optimise recruitment, training and utilisation across government agencies, operating by June 2017.

### 5.3.3. Accountabilities

As principal sponsor and chair of the NSW Location Leadership Group (LLG), the Executive Director of NSW Spatial Services should be accountable for achieving this SDI People objective.

### 5.3.4. Outputs

Creation of a proposed SCCU with the legislative support to develop a cross-agency community of expertise and the business case to support operations by June 2017.

### 5.3.5. Activities

The following outcomes and implementation activities have been identified.

**Table 4 - People roadmap activities**

Outcome	Implementation activities
a) Community of expertise to leverage skilled spatial practitioners industry, government and academia.	Geospatial capability and capacity review of NSW government agencies to be included in a proposed ICT Services Strategy. Define terms of reference and establish a work plan with cross agency representation.
b) Development of spatial data education facilities and resources available to all agencies	Engagement with CRCSI and the Academic College to identify and develop appropriate SDI education material and resources to meet market demand.
c) Knowledge coordination through dedicated spatial services support resource	Organisational design of the proposed SCCU to include Knowledge Coordination - servicing whole-of-government needs.
d) Collaboration and partnering arrangements to limit competing/conflicting SDI agendas and duplicate programs	Provide mechanisms to intervene in government agencies budgeting and procurement planning processes to identify opportunities to collaborate and leverage SDI related investments.
e) Provision of spatial data subject matter experts to participate in Gateway Review process	SDI Technical Reference Group to participate in Gateway Review process.

## 5.4. Data

Data management is the development, execution and supervision of plans, policies, programs and practices that control, protect, deliver and enhance the value of data and information assets. Best practice spatial data management for NSW SDI requires a comprehensive approach to practices and procedures to address the following data management functions:

1. Data Governance
2. Data Architecture, Analysis and Design
3. Database Management
4. Data Security Management
5. Data Quality Management
6. Reference and Master Data Management
7. Data Warehousing and Business Intelligence Management
8. Document, Record and Content Management
9. Meta Data Management
10. Content Data Management.

### 5.4.1. Purpose

To develop a cohesive spatial data management framework to address whole-of-Government geocoding capabilities for all relevant enterprise information systems, interoperability between external reference data and master data repositories that leverages the value and benefit of spatial data.

### 5.4.2. Success measures

SDI Reference Architecture for NSW endorsed by DFSI ICT Review board in conjunction with the SDI Policy briefing paper, and endorsed by Secretary's Board.

### 5.4.3. Accountabilities

As principal sponsor and chair of the NSW Location Leadership Group (LLG), the Executive Director of NSW Spatial Services should be accountable for achieving this SDI Data objective.

### 5.4.4. Outputs

SDI Reference Architecture that includes associated data and information management frameworks to support NSW Foundation Datasets development, access and use.

### 5.4.5. Activities

The following outcomes and implementation activities have been identified.

**Table 5 - Data roadmap activities**

Required Outcomes	Implementation activities
a) Data management principles and practices that increase data integrity and business confidence	The proposed SCCU to provide leadership and support services across agencies to promote data management practices and principles.
b) Spatial Reference architecture developed and endorsed by SDI community	Engagement with CRCSI and appropriately qualified Enterprise Architect professional(s) to develop the NSW Spatial Reference Architecture.
c) Foundation Spatial Data Indexing (FSDI) framework for common address validation and geocoding translation applications	FSDI design and development to be included in the NSW Spatial Reference Architecture.
d) Criteria for certification and administration of authoritative spatial datasets	Organisational design of the proposed SCCU to include a SDI Data Quality Unit that has the skills and resources to act as the SDI compliance regulator to focus specifically on monitoring and improving spatial data quality.
e) Compliance with ICT Information Management framework to support the exchange of information between agencies	Ensure that the proposed review of NSW SDI governance arrangements provides a forum for SDI data and information standards and practices are consistent and integrated with whole-of-government ICT guidelines.

## 5.5. Technology

Technology is an enabler of business initiatives and is fundamental to society in developing the economy, improving living standards and managing the environment. Information technology enables modernisation and provides the agility to react/adapt to new opportunities. Best practice information technology for NSW SDI requires an open systems approach to the way SDI is designed, implemented and integrated in the context of a spatial reference architecture that supports interactions between all parties along the spatial data value chains.

### 5.5.1. Purpose

To rationalise unnecessary duplicate and redundant systems and architectures to achieve efficiencies and savings through platform consolidation, process improvement and optimisation of licensing management to fund investments in precise real-time positioning and location services delivered through high performance, scalable network connectivity for key clients.

### 5.5.2. Success measures

SDI Reference Architecture for NSW endorsed by DFSI ICT Review board in conjunction with the SDI Policy briefing paper, and endorsed by Secretary's Board.

### 5.5.3. Accountabilities

As principal sponsor and chair of the NSW Location Leadership Group (LLG), the Executive Director of NSW Spatial Services should be accountable for achieving this SDI Technology objective.

### 5.5.4. Outputs

SDI Reference Architecture that includes associated business process, applications, systems and security frameworks to support NSW ICT Strategic planning and development for SDI.

### 5.5.5. Activities

The following outcomes and implementation activities have been identified.

**Table 6 - Technology roadmap activities**

Required Outcomes	Implementation activities
a) Platform consolidation to remove duplication, rationalise licencing and reduce maintenance costs	Conduct an audit and economic analysis of SDI related technologies across government agencies.
b) Enterprise level open, agnostic ICT delivery services architecture supporting plug and play components.	Develop SDI Service Delivery framework to support the Discovery and Access functions to conform with NSW data.nsw.gov.au infrastructure requirements.
c) Positioning infrastructure development to support dynamic datum services	Develop SDI Reference Architecture to include separate and complementary positioning technology framework.

d) Location Services infrastructure development to enable B2B and B2C applications	Develop SDI Reference Architecture to include separate and complimentary Location technology framework.
e) High capacity, secure and scalable network connectivity enabling real-time access to federated spatial data services	Develop SDI Reference Architecture to include a comprehensive network and communications framework that addresses the specific needs of SDI for high bandwidth, low latency, secure and reliable services to encourage innovation and support the needs of science, commercial and community spatial applications.

## 5.6. Discovery and access

Data must be able to be discovered and accessed before it can be reused. The value in data resources is in the discovery and knowledge that are built from them, not necessarily in the data themselves. Not all data that is discoverable is open or free. Best practice for NSW SDI data discovery and access arrangements depends on provisioning quality data and services that are readily and reliably available and easily consumable by industry, government and academia.

### 5.6.1. Purpose

To consolidate spatial metadata catalogues within a federated corporate knowledge management framework, which are accessible through various delivery channels configured and optimised to meet user demands and industry trends with an appropriate 'set and forget' licensing regime.

### 5.6.2. Success measures

SDI Reference Architecture for NSW endorsed by DFSI ICT Review board in conjunction with the SDI Policy briefing paper, and endorsed by Secretary's Board.

### 5.6.3. Accountabilities

As principal sponsor and chair of the NSW Location Leadership Group (LLG), the Executive Director of NSW Spatial Services should be accountable for achieving this SDI Discovery and Access objective.

### 5.6.4. Outputs

SDI Reference Architecture that includes associated knowledge management framework to support government, industry and academic access and utilisation of NSW spatial data assets.

### 5.6.5. Activities

The following outcomes and implementation activities have been identified.

**Table 7 - Discovery and access roadmap activities**

Required Outcomes	Implementation activities
a) Single consolidated enterprise discovery for all spatial data and services, linking to federated providers.	Provide support for government agencies to apply NSW Open Data policy to publish data that can meet market/user demands for discovering and accessing data able to be consumed as web services.
b) Enterprise level range of delivery channels and change management support that meet user demands for commercial service levels.	Develop metrics for inclusion of spatial data utilisation as part of the NSW Open Data scorecard framework.
c) Enterprise level common access and licensing policy and framework accepted by industry as 'set and forget'.	SDI Reference Architecture to include associated data access and licencing framework that applies NSW Data Sharing Legislation to sharing agency data. [Data sharing (government sector) act 2015 No. 60].

# 6. SDI Roadmap for NSW

The SDI Roadmap activities are based on the six fundamental components that provide a framework for identifying development strategies to achieve the objectives set to realise the vision for NSW Spatial Data Infrastructure, which is:

**NSW will create a spatial services platform capable of transforming the way industry, government and academia makes decision which comprehensively benefits our economy, society and the nation.**

## 6.1. SDI development strategies

Activities for SDI Roadmap development can be arranged into two groups.

**Group A: SDI Operating Model** activities that address the strategy, governance and people components;

An operating model focuses on the delivery element of the business model. It describes the way an organisation does business and how it delivers value to its customers or constituents.

SDI Component	Operating Model implementation activities
Strategy	Endorsed SDI Vision and Roadmap and proposed Briefing paper accepted by NSW Secretary's Board and presented to Minister with recommendations.
Governance (Policies and Standards)	A review of the current governance arrangements including formal and informal forums representing spatial information interests across government, industry, academia and professional associations including LLG, LIAC and BOSSI.
People	Establishment of a Spatial Capability Coordination Unit (SCCU) with the legislative support for consolidation of geospatial data capabilities and resources to optimise recruitment, training and utilisation across government agencies.

**Group B: SDI Reference Architecture** activities that address the data, technology, discovery and access components.

Reference Architecture provides a template that documents what is considered to be best practices for a specific domain and provides a common vocabulary in discussing solutions and implementation planning.

SDI Component	Reference Architecture Implementation activities
Data	SDI Reference Architecture that includes associated data and information management frameworks to support NSW Foundation Datasets development.
Technology	SDI Reference Architecture that includes associated business process, applications, systems and security frameworks to support NSW ICT Strategic planning and development for SDI.
Discovery and Access	SDI Reference Architecture that includes associated knowledge management and a Foundation Spatial Data Indexing (FSDI) framework to support government, industry and academic access and utilisation of NSW spatial data assets.

## 6.2. Risk Management

The three things identified in section 3 above that need to be established to allow an effective SDI to be delivered are:

- **Public value** - what public value the SDI will provide;
- **Auspices** - the mandate or directive that a SDI is a public value that should be provided; and
- **Capability** - the resources necessary to achieve the public value.

Below these three high level requirements the SDI Roadmap development for NSW is dependent on the several success key factors outlined in the table below with risks and associated mitigation strategies proposed.

**Table 8 - Risk Assessment**

Key Success Factor	Risk	Likelihood	Impact	Mitigation Strategies
1. Establishing vision, purpose and strategy	Lack of political support. NSW SDI is a Whole-of-Government commitment and the NSW government has ultimate accountability for implementation.	Low	High	Lead agency responsibilities for NSW SDI implementation and development being assigned to Spatial Services
2. Establishing effective and governance	Existing governance arrangements may be inappropriate	Medium	High	Review cross agency and industry engagement forums (LLG, LIAC, BOSSI) charter structure
3. Alignment of investment, and of capability improvements	Investment in projects that fail to advance the SDI maturity	Medium	High	A portfolio investment approach to funding SDI initiatives linking project funding and SDI benefits realisation
4. Delineating demand and supply side capabilities, roles and responsibilities	Disconnection between services provided and industry needs	Medium	Medium	Develop spatial data value chains and process models for SDI foundation data sets
5. Developing a benefits realisation framework	Inability to monitor and report on progress toward SDI maturity improvement.	Medium	High	Develop metrics for key performance indicators and reporting procedures and publish through a SDI dashboard
6. Removal of duplication, promotion of re-use and sharing	SDI fails to achieve expected efficiency gains and maturity improvement	Medium	High	Promote the monitoring of SDI maturity improvement through participation in the Capability Maturity Assessment process
7. A single authoritative cadastre	SDI fails to achieve expected efficiency gains and maturity improvement	High	High	Establish the business case to support funding requirements for a coordinated program of work to re-engineer the end-to-end cadastre management process
8. A Foundation Spatial data Indexing reference framework	SDI fails to achieve expected efficiency gains and maturity improvement	High	High	Develop and publish the SDI Reference Architecture and Foundation Spatial Data Index (FSDI) with support from ICT Review Board.
9. A single authoritative and comprehensive data and services discovery platform	Limited take up of SDI services and benefits not realised across agencies, industry and academia.	Medium	High	Ensure agency data catalogues can be federated and linked to "Data.NSW" with geocoding mandatory For all government key data sets.
10. A federated, high performance delivery network backing the discovery service	Limited take up of SDI services and benefits not realised across agencies, industry and academia.	Medium	High	Establish the business case to support funding requirements for a broadband network strategy to service government, industry and academic requirements for spatial data and applications.

### 6.3. Priorities and timeframe

The following list of activities are drawn from the SD Improvement measures identified in Section 5 and the risk mitigation strategies in managing the key success factors. Most activities are considered to be included as business-as-usual (BAU) for the SDI Lead Agency (NSW Spatial Services) however, Phase 1 Direction activities are critical to the NSW SDI Roadmap development and require endorsement by the Location Leadership Group.

**Table 9 - SDI improvement activities & priorities**

Phase	Activity	Milestone
1. Direction	1.1 - SDI Briefing Paper 1.2 - SDI Governance Review 1.3 - SDI Reference Architecture	Dec 2016 - Apr 2017 Feb 2017 - May 2017 Mar 2017 - Oct 2017
2. SDI Development	2.1 - ICT Services Strategy	Jan 2017 - May 2017
	2.2 - Implementation Planning 2.3 - SCCU Operational 2.4 - Broadband network strategy	Mar 2017 - Jul 2017 Feb 2017 - Jul 2017 May 2017 - Dec 2017
3. Implementation	3.1 - Foundation Spatial Data Index service development 3.2 - SDI Maturity Assessment on-line 3.3 - SDI Implementation Review	Dec 2016 - Jul 2017 May 2017 - Oct 2017 Dec 2017 then every Quarter
4. Program of Work Progress Reporting (in parallel with Phase 2 and 3)	4.1 - Cadastre NSW Implementation program 4.2 - Property Pipeline Transformation program 4.3 - Whole of Government Address Management program 4.4 - Strategic Land Information Management program	Jan 2017 - Jun 2019 Jan 2017 - Jul 2018 Jan 2017 - Jun 2019 Jan 2017 - Dec 2017

The following timeline is indicative of the key SDI Improvement activities (activity groups 1, 2 and 3) and the business-as-usual work program (activity group 4) listed above that NSW Spatial Services need to resource and deliver through until 2020.

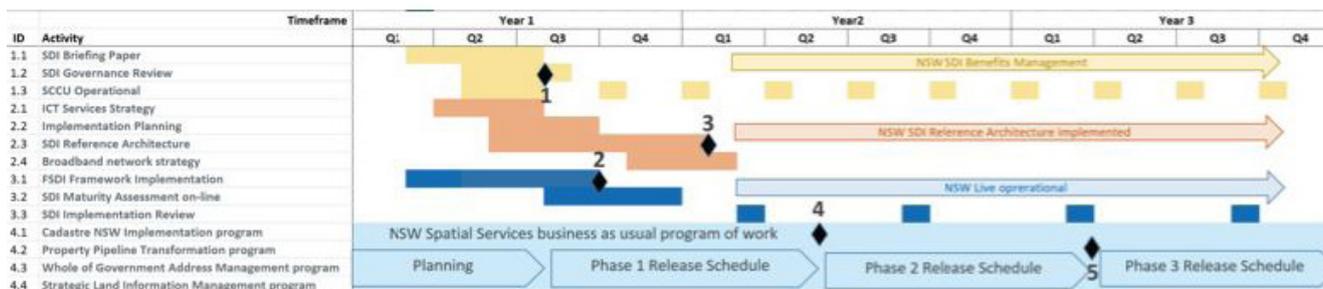


Figure 7 - NSW SDI Timeline

The following milestones are identified in the above timeline where specific key deliverables and benefits could be achieved.

**Table 10 - Milestone deliverables and benefits**

Milestone	Key deliverable benefits	
1. Completion of SDI Governance Review	<ul style="list-style-type: none"> <li>Establishing effective and representative governance is an essential element for successful SDI implementation.</li> </ul>	Q2 2017
2. Implementation of FSDI Framework and Services	<ul style="list-style-type: none"> <li>The FSDI will deliver a well-structured &amp; validated index framework enabling proven, reliable, consistent and repeatable methods for linking and integrating disparate data sets.</li> </ul>	Q3 2017
3. Delivery of SDI Reference Architecture	<ul style="list-style-type: none"> <li>An SDI architecture and associated frameworks that provide a blueprint to deliver SDI outcomes and benefits realisation.</li> </ul>	Q4 2017
4. Spatial Services Integrated Design substantiated	<ul style="list-style-type: none"> <li>Commitment to an integrated program of work for implementing priority foundation spatial data infrastructure and whole of government change management plans.</li> </ul>	Q2 2018
5. Implementation Property Pipeline Improvement	<ul style="list-style-type: none"> <li>Completion of the Property Pipeline Improvement work-stream to minimise delays in the land development approval and registration process.</li> </ul>	Q1 2018

# Appendix A. SDI Maturity Model Assessment Tool

## Organisational Spatial Data Infrastructure Maturity Assessment

### Introduction

This survey is conducted by Business Aspect on behalf of NSW Spatial Services. The objective of the survey is to validate a potential framework for a Spatial Data Infrastructure (SDI) Maturity Model and development of a SDI Roadmap for NSW.

The purpose of establishing a SDI Maturity Model is to provide a benchmark for agencies to assess their current capabilities and capacity to meet the demands of business and community to fully leverage the benefits of spatial data to innovate and create opportunities that improve economic, social and environmental outcomes.

The questions in this survey are designed to assess the extent of Spatial Data Infrastructure development in any jurisdiction based on the following six SDI domains and the associated maturity level descriptions.

<b>STRATEGY</b>	Business drivers and benefits that support a vision for social, economic and environmental outcomes of a SDI
<b>GOVERNANCE</b>	Spatial data governance, policies and standards, underpinned by an Information Management Framework
<b>PEOPLE</b>	Capacity and capability to contribute to the development and implementation of a sustainable SDI.
<b>DATA</b>	Accessible, discoverable and in a readily usable and interoperable digital format, including spatial data in the form of digital base maps, thematic layers as well as statistical and foundation spatial data
<b>TECHNOLOGY</b>	The integration and federation of hardware, software, networks and databases using secure and robust technologies
<b>ACCESS &amp; DISCOVERY</b>	Spatial data that need to be discoverable and accessible by government agencies, the commercial and non-profit sectors, academia and the community

## Organisational Spatial Data Infrastructure Maturity Assessment

### Introduction (continued)

In responses to the following questionnaire select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.

Maturity Level	Characteristics
A-hoc	Jurisdiction is isolated with little or no government policy development and standards to guide the management of shareable data. Market forces alone are driving the coverage, industries and applications for spatial data services.
Repeatable	Coordination of basic spatial data service and interaction with other suppliers and consumers of spatial data. Data sharing arrangements are informal and relationship based. Policies and standards are being influenced by national bodies.
Managed	Jurisdiction wide coordination, collaboration of government, industry and academia to integrate fundamental spatial datasets. Policies and standards are well developed to accommodate a variety of technologies. Basic business model for spatial data services value chain
Optimal	All sectors have access to ubiquitous spatial data services that can be relied upon to operate critical business functions, improve productivity and safety. Standards, delivery channels and pricing support commercially sustainable location based services.
Adaptive	Higher order spatial services transform industry, government and academia. The built environment can be accurately and completely measured and modelled in 3D to achieve transformational change across economy, society and environment

## Organisational Spatial Data Infrastructure Maturity Assessment

### Part 1 - Strategy

**Strategy development is an organisation's process of defining its vision, or mission, and setting a direction and framework for making decisions on allocating its resources to achieve a set of objectives. Best practice strategic planning for NSW SDI requires alignment of government strategies for SDI at the local, state and federal level and provide the necessary guidance and support to achieve common objectives.**

**Select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.**

\* 1. In my organisation, a Spatial Data Infrastructure (SDI) vision and mission is:

- 1. Not recognised or agreed at any level.
- 2. Recognised by operational business areas to be of value.
- 3. Established collaboratively by all participants.
- 4. Delivers defined collaboration strategies and approaches supporting organisational priorities and outcomes.
- 5. Established at enterprise level, enabling organisation and jurisdictional priorities and outcomes, kept current relevant and aligned.

Can you better describe the maturity level you have selected?

\* 2. My organisation's SDI Strategy development and review process is:

- 1. Unknown, no review process.
- 2. Ad hoc feedback and drivers trigger reactive changes.
- 3. Periodic review and refresh at operational level.
- 4. Regularly measured and reported as part of an enterprise level process.
- 5. Kept current, relevant and aligned to enterprise priorities and outcomes.

Can you better describe the maturity level you have selected?

\* 3. My organisation's SDI Roadmap development and review process is:

- 1. Non-existent
- 2. Ad-hoc and reactive to individual program / project needs.
- 3. Documented as a current state baseline with strategies and objectives aligned with the SDI vision and mission.
- 4. Driving a comprehensive program of work to improve SDI maturity in governance, data, people, technology and discovery and access capabilities.
- 5. Aligned with enterprise SDI strategies and roadmap that is reviewed and updated annually.

Can you better describe the maturity level you have selected?

## Organisational Spatial Data Infrastructure Maturity Assessment

### Part 2: Policies and standards (Governance)

**Good governance is all about ensuring that those who have responsibility for delivering outcomes do so in the best interest of those who are accountable for the outcomes. Best practice governance for NSW SDI requires appropriate forums to be established with senior executive and political level support to develop the policy settings and enforce compliance with the standards and guidelines necessary for a fully functioning spatial marketplace.**

**Select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.**

\* 4. In my organisation SDI governance is:

- 1. Not adequately acknowledged or resourced.
- 2. An identified need but not formalised.
- 3. Committed to, with appropriate level of representation and resourcing.
- 4. Progressing alignment to and support of organisation's priorities and outcomes.
- 5. Sustainable, delivering strategic direction, and contributing to organisation's outcomes.

Can you better describe the maturity level you have selected?

\* 5. In my organisation foundation spatial data, services and interactions are:

- 1. Uncoordinated, inconsistent and mostly bilateral.
- 2. Identified as opportunities for efficiencies and savings through integration and rationalisation.
- 3. Beginning to be integrated and rationalised based on organisational business requirements.
- 4. Supported by an enterprise information policy framework as single points of truth, delivering demonstrated benefits.
- 5. Integrated and aligned to whole of government priorities and outcomes, delivering demonstrated benefits.

Can you better describe the maturity level you have selected?

\* 6. In my organisation demand for spatial data and services is:

- 1. Not understood or quantified.
- 2. Beginning to be identified and addressed.
- 3. Beginning to be consolidated to inform organisational frameworks.
- 4. Integrated and aligned with enterprise demands to inform overall requirements.
- 5. A driver of organisational and whole of government strategy, and effectively satisfied.

Can you better describe the maturity level you have selected?

\* 7. In my organisation spatial data policies and standards:

- 1. Have not been adopted or developed, or are specific to our organisation.
- 2. Are being developed, within a broader enterprise framework.
- 3. Have been established, adopting or aligned to an enterprise framework, and are delivering business benefits.
- 4. Drive performance within and across organisational workflows and external supplier/customer interactions.
- 5. Are an integral part of a current and relevant enterprise framework with monitoring and improvement processes closing the loop on policy and standards development.

Can you better describe the maturity level you have selected?

## Organisational Spatial Data Infrastructure Maturity Assessment

### Part 3: People (Human Capital)

**Capacity and capability planning to ensure the appropriate skills and expertise are being developed in industry, government and academic institutions is an essential element in contributing to the development and implementation of a sustainable SDI. Best practice Human Capital planning for NSW SDI requires a concerted approach to fostering innovative talent and leadership skills to exploit the wave of digital technologies that are increasing reliant on spatial information in shaping the future.**

**Select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.**

\* 8. My agency's spatial resources, skills and expertise are:

- 1. Sourced entirely and directly from specialists.
- 2. Developing, as specialists better understand organisational requirements, and the organisation better understands spatial capabilities.
- 3. Improving and increasing in business units, providing better business capability, supported by a small more focused spatial science core.
- 4. Pervasive across business teams, providing more business driven applications and benefits, with a small spatial science core as an enabler.
- 5. An integral part of staff competencies, specified and certified as part of an enterprise skills framework.

Can you better describe the maturity level you have selected?

\* 9. My agency's spatial resources, skills and expertise are:

- 1. Mostly vendor and/or application specific, not able to be more broadly utilised.
- 2. Developing into common approaches and capabilities, reduced reliance on proprietary systems.
- 3. Driven by formal mechanisms for sharing, and training and development, based on open standards.
- 4. Evolving to an open standards framework for sharing, training and development, common services and platforms.
- 5. Responding to business needs. Competencies framework operating, utilising open standards and resources.

Can you better describe the maturity level you have selected?

\* 10. In my agency quality of service levels for spatial data maintenance and support are:

- 1. Variable, undocumented and in many cases not fit for purpose.
- 2. Beginning to be documented, in most cases not fit-for-purpose.
- 3. Documented at fit-for-purpose levels with targets identified and development plans established.
- 4. Documented and maintained at fit-for-purpose levels, as part of an organisational Information Management framework.
- 5. Have achieved optimal fit-for-purpose levels and routinely subjected to continuous improvement audits and procedures.

Can you better describe the maturity level you have selected?

11. In my agency spatial experts have:

\*

- 1. Limited understanding of organisational business requirements.
- 2. Begun to shape services and performance by better understanding organisational requirements.
- 3. Through improved understanding, aligned service, deliverables to organisational requirements, leading to more use and broader application.
- 4. Understood organisational requirements so that foundation data and services are optimised.
- 5. Standardised/ commoditised foundation data and services as part of enterprise capabilities.

Can you better describe the maturity level you have selected?

\* 12. In my agency spatial suppliers and users:

- 1. Have no effective communication mechanisms to link supply and demand objectives and requirements.
- 2. See the need for effective communication, as gains are achieved through clearer understanding.
- 3. Have a broad-based, representative demand and supply engagement mechanism to establish common and improved understanding.
- 4. Have advanced to a 'marketplace' level of understanding and cooperation to achieve government priorities and outcomes.
- 5. Have an effective marketplace at enterprise level connecting demand and supply.

Can you better describe the maturity level you have selected?

## Organisational Spatial Data Infrastructure Maturity Assessment

### Part 4: Data

Data management is the development, execution and supervision of plans, policies, programs and practices that control, protect, deliver and enhance the value of data and information assets. Best practice spatial data management for NSW SDI requires a comprehensive approach to practices and procedures to address the following data management functions:

- |   |  |
|---|--|
| 1) Data Governance                        | 6) Reference and Master Data Management                  |
| 2) Data Architecture, Analysis and Design | 7) Data Warehousing and Business Intelligence Management |
| 3) Database Management                    | 8) Document, Record and Content Management               |
| 4) Data Security Management               | 9) Meta Data Management                                  |
| 5) Data Quality Management                | 10) Contact Data Management                              |

Select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.

13. My agency's spatial data are:

\*

- 1. Duplicated (internally/ externally), cannot be reconciled with other versions due to currency, format, structure and other inconsistencies.
- 2. Acknowledged as a candidate for consolidation and removal of duplication, to deliver savings and efficiencies.
- 3. In the process of consolidation through removal of duplicate and redundant elements. Benefits are being realised through decommissioning.
- 4. Optimised at organisational level through removal of all unnecessary duplicate and redundant data sets and stores.
- 5. Fully optimised and supported by sound data curation methods to maintain SDI fit-for-purpose quality standards.

Can you better describe the maturity level you have selected?

\* 14. My agency's spatial data structures and formats are:

- 1. Vendor/application specific, restricting interoperability and broader use, and increasing in costs.
- 2. Beginning to be rationalised and standardised along and across workflows and systems.
- 3. Rationalised and standardised along and across workflows and systems, allowing ad hoc and standard uses.
- 4. Aligned with a developing Information Management framework, as part of an enterprise approach.
- 5. Supporting business critical applications and spatially enabling the enterprise.

Can you better describe the maturity level you have selected?

15. In my agency spatial data management practices and procedures are:

\*

- 1. Not driven by or aligned to business requirements.
- 2. Specified and developed to isolated business requirements.
- 3. Specified and developed to support multiple business requirements.
- 4. Specified and developed to support multiple business requirements across organisational boundaries.
- 5. Optimised to fully support highly automated machine-to-machine and data linkage applications.

Can you better describe the maturity level you have selected?

\* 16. In my agency critical spatial data management functions are:

- 1. Not provided and operational areas are unsupported.
- 2. Provided by an Information Systems support service.
- 3. Coordinated under an Enterprise Architecture framework with appropriate communications support.
- 4. Incorporated into a comprehensive Enterprise Information Management framework subject to review and change control.
- 5. Consistent with whole of government policies and procedures meeting systems interoperability, business continuity and quality of service requirements.

Can you better describe the maturity level you have selected?

17. In my agency spatial data legal status, privacy and security impacts are: \*

- 1. Not resolved.
- 2. Acknowledged as key issues to be addressed.
- 3. Developing into an overall data management framework.
- 4. Set as an organisational framework integrated with metadata, channels and delivery processes.
- 5. Integrated in enterprise framework and given the same priority and consideration as financial or personnel data.

Can you better describe the maturity level you have selected?

## Organisational Spatial Data Infrastructure Maturity Assessment

### Part 5: Technology

**Technology is an enabler of business initiatives and is fundamental to society in developing the economy, improving living standards and managing the environment. Information technology enables modernisation and provides the agility to react/adapt to new opportunities. Best practice information technology for NSW SDI requires an open systems approach to the way SDI is designed, implemented and integrated in the context of a spatial reference architecture that supports interactions between all parties along the spatial data value chains.**

**Select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.**

\* 18. My agency's spatial software and systems are:

- 1. Proprietary and bespoke, application specific.
- 2. Identified as an opportunity for consolidation and standardisation.
- 3. Part of roadmap for consolidation and standardisation, with stated savings/efficiencies targets.
- 4. Managed through removal of all unnecessary duplicate and redundant systems decommissioned. Savings target achieved.
- 5. Enterprise level open, agnostic ICT services architecture. Plug and play component architecture.

Can you better describe the maturity level you have selected?

19. My agency's spatial technology procurement is:

\*

- 1. Uncoordinated, allowing duplicated hardware/software procurement and unmanaged use.
- 2. Along with license management, identified as savings opportunity.
- 3. Savings and efficiencies documented through license management and procurement consolidation.
- 4. Hardware procurement and software licensing management optimised to demand.
- 5. Hardware procurement and software licensing management optimised to demand at *enterprise* level

Can you better describe the maturity level you have selected?

\* 20. My agency's spatial technology is:

- 1. Not, or poorly, integrated, with access geared around applications or institutional boundaries.
- 2. Identified as savings opportunity through cross-organisational integration and access improvement.
- 3. Delivering savings and efficiencies through cross-organisational integration and access.
- 4. Optimised to provide complementary data and services delivering organisational capabilities.
- 5. Expanded to whole of government level network access and utilisation.

Can you better describe the maturity level you have selected?

\* 21. My agency's positioning technology is:

- 1. Incomplete/incompatible and driven by independent commercial demand.
- 2. Coordinated under a positioning infrastructure framework based on industry standards.
- 3. Under development delivering reliable positioning and locations services.
- 4. Delivering precise positioning and locations services.
- 5. Ubiquitous high-precision, real time, high reliability positioning and location service supporting business outcomes.

Can you better describe the maturity level you have selected?

\* 22. My agency's network connectivity is:

- 1. Limited, necessitating redundant data storage and duplicated services.
- 2. Identified as an impediment to access to single authoritative sources and consolidated infrastructure and services.
- 3. Subject to business case development for fit-for-purpose network connectivity, infrastructure consolidation.
- 4. A high performance, scalable network connectivity delivering key services and business processes.
- 5. An enterprise level high performance, scalable network connectivity means data location is immaterial. Multiple data sources can be integrated 'on the fly'

Can you better describe the maturity level you have selected?

## Organisational Spatial Data Infrastructure Maturity Assessment

### Part 6: Discovery and access

**Data must be able to be discovered and accessed before it can be reused. The value in data resources is in the discovery and knowledge that are built from them, not necessarily in the data themselves. Not all data that is discoverable can be freely accessed. Best practice for NSW SDI data discovery and access arrangements depends on provisioning quality data and services that are readily and reliably available and easily consumable by industry, government and academia.**

**Select the level (1 to 5) that most accurately describes your organisation. If you feel the description can be amended to better describe your organisation, please provide the appropriate wording.**

\* 23. In my agency data discovery and access is:

- 1. By word of mouth and bilateral agreements. Few, if any, have a clear understanding of overall data and services holdings.
- 2. Ineffective to the point that the value of a single comprehensive inventory is understood.
- 3. Specified and initiated as a single consolidated point of discovery, with engagement and support of data suppliers and users.
- 4. Available through a single consolidated point of discovery for all spatial data and services, linking to federated providers.
- 5. Part of single consolidated discovery for all spatial data and services across all levels of government.

Can you better describe the maturity level you have selected?

\* 24. My agency's spatial data delivery channels are:

- 1. Limited and inadequate, distribution by physical media – web services not at fit-for-purpose service levels.
- 2. Acknowledged as an impediment to effective adoption and utilisation of key data and services
- 3. Acknowledged as an impediment to effective adoption and utilisation of key data and services
- 4. Configured and optimised to meet organisational demands in a comprehensive channel strategy.
- 5. Part of whole of government comprehensive range of delivery channels that meet user demands at commercial/operational service levels.

Can you better describe the maturity level you have selected?

\* 25. My agency's spatial data delivery methods are:

- 1. Inconsistent, integrating multiple data sources requires pre-processing and/or reformatting, restructuring.
- 2. Acknowledged as a disincentive to utilisation, through imposition of process cost and delays.
- 3. Based on standard data and service formats, structures and methods and channels meeting user demands.
- 4. Configured and optimised to progressively minimise processing, delays and quality degradation.
- 5. Consistent, standardised delivery methods and channels integrated at whole of government level

Can you better describe the maturity level you have selected?

\* 26. My agency's pricing, licensing and access conditions are:

- 1. Restrictive and negotiated upon request relying on informal arrangements.
- 2. Identified as contributing to increasing transaction costs and time delays and an impediment to utilisation.
- 3. Developing towards a single common access and licensing policy and distribution model.
- 4. Complete within a single common access and licensing policy and framework supported by suppliers and users.
- 5. Complete as 'set and forget' enterprise level common access and licensing policy and open data framework.

Can you better describe the maturity level you have selected?

\* 27. My agency's spatial data delivery process is:

- 1. Ad hoc, non-repeatable.
- 2. Recognised as an impediment to use and imposing unnecessary costs.
- 3. Progressively being standardised and adopted, based on single common access and licensing framework
- 4. Standardised, repeatable processes, under strong change management and quality of service obligations.
- 5. Standardised, secure, reliable processes supporting semantic web concepts delivering critical business services.

Can you better describe the maturity level you have selected?

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