

Spatial Information Data Quality Guidelines

Part of Victoria's Spatial Information Management Framework
Second Edition

The Victorian Spatial Council was established under the Victorian Spatial Information Strategy 2004-2007 to support the advancement of Victoria's social, economic and environmental goals through the provision and application of spatial information. It does this by providing a coordinated approach to spatial information policy, development and management, and facilitating opportunities for greater partnership building, collaboration, cooperation and education.



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VSC CHAIRMAN'S FOREWORD

The Victorian Spatial Information Management Framework consolidates the policies, principles and guidelines for information management that were articulated by both the Victorian Geospatial Information Strategy 2000-03 and the Victorian Spatial Information Strategy 2004-07.

The Framework aims to support the effective use of spatial information to support Victoria's social, environmental and economic goals through the establishment of institutional arrangements for developing spatial information; creating and maintaining spatial information; making spatial information accessible and available; and strategic development of technology and applications.

The custodian of spatial information is at the heart of the Spatial Information Management Framework. Its policies set out the minimum requirements for custodians to manage their datasets, while a set of underlying principles provide the foundation for enabling them to maintain these datasets and ensure all Victorians are aware of and have ready access to them.

These principles address all elements of the Spatial Data Infrastructure of Victoria: *governance, custodianship, framework information, business information, quality, metadata, awareness, access, pricing and licensing, and privacy.*

The Framework is accompanied by ten Guideline documents to assist custodians in the implementation of these policies and principles. These *Data Quality Guidelines* provide an introduction to Victoria's approach to data quality: how it is defined, how it is managed, and how it may be implemented.

The Guideline documents are also intended to be accessible to the general reader by setting out fully the basis on which the Framework will be delivered.

The Victorian Spatial Council is Victoria's principal coordinating body for spatial information, with a mandate to develop policy and promote best practice for spatial information management. These *Data Quality Guidelines* are a key contributor to the Spatial Information Management Framework's objective to make spatial information accessible and useable. It is intended that they will be informed by practical experience, and contributions to future editions are welcome from practitioners and readers alike.



Olaf Hedberg

Chair, Victorian Spatial Council

INTRODUCTION

The Spatial Information Management Framework

The Spatial Information Management Framework is Victoria's best practice approach for establishing and retaining consistency in the management of spatial information across all organisations – whether public or private – with a role or interest in doing so.

Its objective is that spatial information be made as accessible as possible.

The Victorian Spatial Council has endorsed the development of the Framework because a coordinated approach to information management will provides the greatest opportunity to:

- reduce duplication of datasets, systems and processes, and increase consolidation, leading to more efficient spending on spatial information
- optimise investment and develop partnerships across the spatial information community (public, private and academic sectors)
- deliver higher quality datasets
- improve access to spatial information

Management of spatial information by participants in the Framework should facilitate its effective use, based on four key principles: that the spatial information will:

- represent the definitive and authoritative source of the data it contains
- be managed by designated custodians
- be accessible and available to all members of the community, except where confidentiality and commercially sensitive conditions apply
- be able to be combined with other spatial information products for the purposes of analysis and decision making

The Spatial Information Management Framework provides a holistic approach to managing spatial information in Victoria, encompassing the

1. **institutional arrangements for developing spatial information;**
2. requirements for **creating and maintaining spatial information;**
3. mechanisms for **making spatial information accessible** and available; and
4. **strategic development of technology and applications.**

Together, these components of the Framework create Victoria's Spatial Data Infrastructure (SDI).

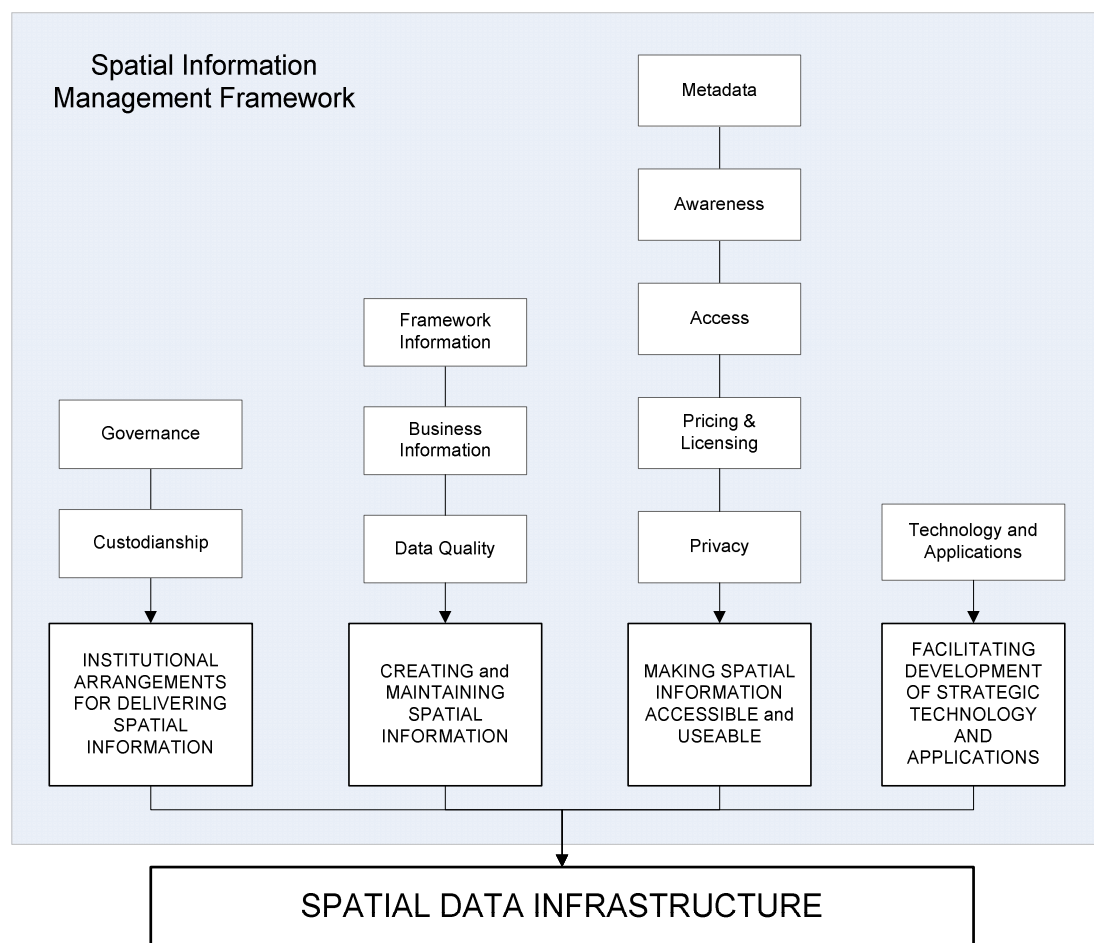
The SDI is an enabler – a mechanism for making data available and for sharing and exchanging it to enhance the achievement of social, environmental and economic goals. Behind it are the myriad of activities that create the conditions in which that sharing and exchange can take place, ie the development of the data, technology, policies, institutional arrangements and capacity building (ie equipping people to use the technology and information).

The Framework allows for the management of these elements in an integrated way to provide an environment for the effective use of spatial information.

This integrated approach is illustrated in Figure 1.

The Framework is supported by policies and guidelines that provide the formal requirements for implementing it, and tools and resources to support those responsible for that task.

Figure 1: The Victorian Spatial Information Management Framework



Separate Guidelines have been prepared for the following components of the Framework:

- Governance
- Custodianship
- Framework Information
- Business Information
- Data Quality
- Metadata
- Awareness
- Access
- Pricing and Licensing
- Privacy

The purpose of the Guidelines is to explain the policies and principles outlined in the relevant component of the Framework, and to describe activities that will support their application in implementing it.

It is envisioned that these Guidelines will vary over the life of the Framework as new information, policies, and procedures are developed, and as new issues arise.

This Document

It is intended that the Guidelines be read in conjunction with the document '*Victoria's Spatial Information Management Framework and Directory of resources*', also produced by the Victorian Spatial Council.

These Data Quality Guidelines have two parts.

- Part A provides an overview of the spatial information management principle of data quality.
- Part B outlines the role of the custodian and sets out key components for ensuring the quality of spatial data

PART A

“Adopt the new philosophy.

Quality management is a holistic philosophy that must be adopted in its entirety if it is to work.”

[Deming Element 13, Hands-on Guide to Continuous Improvement for the Victorian Public Service]

Background

Spatial data management systems have grown rapidly over recent years leading to a need for more structured data quality systems. To ensure data quality, quality assurance processes need to incorporate not only data creation and maintenance quality, but also data storage, access, transfer, and delivery. While many end users’ primary concern is data completeness, consistency and accuracy, organisations need to look at internal procedures to ensure that the data management procedures and services also meet the needs of users.

Under the Spatial Information Management Framework, the principles of custodianship and spatial information management apply to all categories of spatial data managed across all sectors of the spatial information community. The purpose is to ensure that a large range of authoritative datasets is maintained and managed under custodianship principles and available for use. These datasets need not be Framework Information, but they will be managed under the Spatial Information Management Framework principles to ensure users have confidence in the data they receive.

Ensuring that data is ‘fit for purpose’ and meets users’ needs will also further enhance this confidence. Under the Spatial Information Management Framework, the principle of data quality covers ‘spatial accuracy’, ‘completeness’, ‘consistency’, ‘temporal’ and ‘thematic’ accuracy, ‘lineage’, ‘purpose’, and ‘usage’.

Through the development of single authoritative datasets, the preconditions for reducing duplication of data, generating efficient maintenance and development expenditure, and increasing the detail and content of the datasets to create meaningful and information rich datasets are being put in place.

The purpose of this document is to:

- outline procedures for Quality Assurance of spatial data including Data Quality,
- clearly define Data Quality and the associated elements, including proposing the use of ISO standards for Data Quality Assessment and Maintenance, and
- bridge the gap between the ISO Standards and Spatial Information practice within Australia

Quality Assurance

“Quality is defined by the customer, so improvement in products and processes must be aimed at anticipating their future needs. Quality comes from improving the process, not from inspecting to remove the shoddy results of a poorly run process.”

[Deming Principle 1, Hands-on Guide to Continuous Improvement for the Victorian Public Service]

Organisations need to create a clear understanding of Quality Assurance, and how available resources may be coordinated and utilised for effective data quality reporting and improvements. This requires organisations to follow a data quality assurance policy that allows producers and users to clearly understand the data quality of the products, and the capacity for exchange, which meets Australian and International standards.

The objective of quality assurance activities should be to coordinate existing and proposed quality assurance systems and processes within a framework that focuses on quality being ‘fit for purpose’ and with the intention that all staff think about quality assurance from a common perspective. All staff benefit from a shared understanding of all quality assurance activities, and a common understanding of the objectives, to make spatial data ‘fit for purpose’. There are significant advantages in incorporating all quality assurance activities within a single quality assurance framework.

Data Quality

“The value of the information and the effectiveness of the decision-making and planning processes are closely linked to the quality and completeness of the information and the manner in which it is made available.”

[National Land and Water Resources Audit, *Natural Resources Information Management Toolkit*]

The purpose of describing the quality of spatial data is to enable data users to select the spatial data or dataset best suited to their needs. It allows data producers / custodians to validate how well a dataset meets the criteria set out in the product description / specification, and assists a data user in determining any specific product's ability to satisfy the requirements for their particular application.

To quantify data quality in a rigorous manner it is necessary to consider the ISO standards. They outline the five data quality elements for describing the data quality, and the associated data quality sub-elements, which are outlined in Appendix 2. The data quality elements, where applicable, shall be used to describe how well a dataset meets the criteria set out in its product specification.

The process of measuring (quantifying) Data Quality is important for all fields (spatial and aspatial) and in all stages of the datasets life cycle, from creation to maintenance and finally retirement. The data quality sub-elements describe aspects of the quantitative quality of a dataset. Data quality overview elements describe the non-quantitative quality of a dataset.

Data quality is quite difficult to define but so too is the delivery of data quality reports. This is usually achieved through both the metadata record and the product specification. It is necessary to be open, honest and transparent in data quality descriptions that are comprehensible by all members of the spatial community.

Data Quality Policy

A key measure of the quality of a dataset is 'fitness for purpose'. However, custodians and users of data may have different perceptions about what constitutes such 'quality'. It is therefore important that custodians provide adequate detail about the standards associated with their datasets in product specifications, and that results of any quality testing are reported in metadata or other documentation.

Therefore the aim of the Spatial Information Management Framework is to ensure that custodians are able to adopt consistent standards for data quality and provide data that is fit for purpose – ie that the data quality standard has been determined through consultation with users, is defensible, is published, and is understood by users.

This principle is expressed in the policy that has been set out in the Framework:

Custodians will develop data quality statements in consultation with users, and publish them in the product specifications and metadata for the respective datasets.
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PART B – GUIDELINES

Quality assurance is about process and tolerance to predetermined quality standards. A consistent process will facilitate an unambiguous explanation of the data quality standards. Limitations on available resources have tended to place quality assurance as a desirable rather than necessary aspect to data management. The object is to integrate data quality assurance into the procedures for acquiring and maintaining data rather than treating it as a separate activity.

Quality assurance of spatial data needs to be looked at from the perspective of:

- the role of the data custodian
- determination of data quality standards
- reporting of data quality
- creation of new data and improvement of existing data

The Role of the Data Custodian

Custodianship of spatial information is the act of ensuring appropriate care in the collection, storage and maintenance of the information, as well as ensuring the quality of the data and ongoing improvements. Whilst others within an organisation may contribute to the quality assurance process, including customer liaison, data maintenance, and data improvement, it is the role of the custodial officer to ensure a coordinated and documented approach to the quality assurance process of their dataset.

For detailed information on custodianship refer to the *Spatial Information Custodianship Guidelines*.

Maintaining data quality is an integral part of the role of the data custodian. All spatial data custodians are involved in quality assurance of some form, and undertake projects that address a component of the quality system. Many custodians think about data quality as part of their work, but not in an integrated or coordinated framework, within overall goals to be achieved. It is beneficial for all staff who work with spatial data to have an understanding of the many facets of data quality assurance.

It is the role of the custodian to consult external stakeholders and promulgate minimum and actual data quality standards for datasets, by:

- consulting the data users in relation to their specific data quality needs and issues
- identifying minimum quality standard requirements of data users in relation to datasets
- undertaking a ‘gap analysis’ between existing data quality standards and those of the key users
- assessing an organisation’s data quality program
- informing stakeholders and industry organisations of an organisation’s quality program

Determination of Data Quality Standards

The ISO International standards provide a framework for developing and applying quality to products / datasets. ISO Standards 19113 *Geographic Information – Quality Principles* and 19114 *Geographic Information – Quality Evaluation procedures* specifically address the issue of Data Quality. Other 19100 series ISO standards are relevant as they outline metadata standards, custodian standards, and product specification standards.

It is necessary to include both custodians and users in the determination of data quality standards to ensure that a viable standard is set. Actual quality thresholds are reliant on the purpose, lineage and use of the data; i.e. the quality should be based on “fitness for purpose”. No dataset need have the same quality standard as another unless it is deemed necessary by the stakeholders. The custodian will therefore need to:

- consider the purpose of the dataset
- understand the user needs
- understand the Data Quality required to meet these needs

- undertake a gap analysis of the difference between current and required quality
- ensure the process is transparent

Data Quality Testing

The custodian needs to prepare a program of data quality testing and validation, which incorporates both automated and non-automated procedures. Non automated testing includes on screen validation and field inspection and measurement. This program is best developed once custodians have identified and prioritised quality measures for each product.

Data Quality Statements

There are two aspects to the quality statement — actual quality standard and minimum quality standard.

The **actual quality standard** should reflect the current quality level of the information product and may be developed autonomously by the custodian. The quality statement checklist should be used in framing the quality standard assessment.

The **minimum quality standard** is the standard necessary to satisfy the requirements of the users of the information product.

It is understood that the data producer and custodian may view data quality from a different perspective from that of the data user. It is therefore important that documentation produced by the Custodian provide adequate detail about the data quality standards, and that results of quality assurance testing are reported in the metadata or other product documentation. DSE produces data quality documentation in the form of Product Descriptions and Metadata.

Data Quality Reporting

A quality description can be applied to a dataset series, a dataset or a smaller grouping of data located physically within the dataset sharing common characteristics so that its quality can be evaluated. The purpose of describing the quality of spatial data is to facilitate the selection of the spatial dataset best suited to application needs. Information on the quality of spatial data allows data producers / custodians to validate how well a dataset meets the criteria set out in the product description, and assists a data user in determining a product's ability to satisfy the requirements for their particular application. For the common benefit a standard provides the best option for documenting data quality information.

Data quality documentation needs to include data quality elements, data quality measures, tolerances, data testing / validation processes, sampling processes, and reporting formats. Prior to reporting, custodians should develop and prioritise quality performance measures for each product and incorporate these into a reporting framework that may be used to report information to management, data users, and other stakeholders.

The quality of a dataset should be described using two components:

- data quality overview elements
- data quality elements

Data quality overview elements provide general, non-quantitative information and are critical for assessing the quality of a dataset for a particular application.

Data quality elements describe how well a dataset meets the criteria set out in its product specification and provide quantitative quality information.

The content for each of these elements is outlined in Appendix 2.

A Data Quality Statement is reported in both the Metadata record and the Product Specification. It can be used to convey to the user the appropriateness and level of accuracy they may obtain through use of the dataset. Statements can quickly become complex with a long and varied history of the dataset and should be summarised in the metadata record and expanded in the product description/specification.

Metadata

Metadata is the key management mechanism for any spatial information environment. Metadata, defined as 'data about data' or 'information about information', provides fundamental information management tools at three levels:

- Discovery: enabling users to locate and evaluate information.
- Management: enabling custodians to better manage their spatial information.
- Utilisation: enabling users to access and manipulate information by means of automated / distributed systems.

Metadata is a structured summary that describes characteristics, such as content, quality, currency, access and availability, of the data or information. It aims to provide custodians and users with a common understanding of the data or information elements.

Metadata for spatial information is required for a range of purposes. It is used to provide, among other things:

- detailed information about data collection methods, integration and analysis techniques applied to various components of source data to support the preparation of scientific reports
- information about the accuracy of source datasets, processing history, and archival procedures to effectively manage and utilise data within custodian organisations
- information about projection specifications, scale, and a data dictionary to accompany data transfers to other organisations
- adequate descriptions of the content, quality and geographic extent of datasets so potential users of existing data can assess its suitability for their purposes
- summary descriptions of content and quality as well as contact information for inclusion in directory systems

Metadata provides the content for Spatial Data Directories and specifies the links and access conditions for distributed clearinghouses. Users can locate, evaluate and acquire information by using metadata.

For more detailed information on metadata refer to the *Spatial Information Metadata Guidelines*.

Product Descriptions

Fully describing the information product is important as it provides users with detailed information not contained in the metadata. However, the description need not be a 'Technical Specification'. Consequently, it does not require the level of detail needed to provide the means for rebuilding the dataset if it were lost. Instead, it should provide a clear picture to prospective users of how the product was put together, its content, sources, maintenance regimes, quality assurance processes and measures of accuracy and reliability. It should enable the potential user to answer the question '*Will this dataset suit my application?*'

The product description should be clear, concise and comprehensive. Not all of the elements of a product description will be relevant to a particular information product. However, all should be considered, and all should be answered explicitly. For example, if there is no data dictionary, the description should state that there is no data dictionary.

As product descriptions and metadata have a similar format, with the product description being an expansion of the metadata, it is recommended that custodians develop the product description and metadata concurrently.

Creation of New Data and Improvement of Existing Data

The common foundation of the Spatial Information Management Framework is Framework Information. Dataset developers should adopt the appropriate Framework Information dataset/s in combination with any applicable Business dataset/s as the foundation for the construction and ongoing maintenance of any new dataset. The

benefit of basing new datasets on Framework Information is the aligning of datasets created at different times, for different purposes, but on the same base.

For more detailed information on Framework Information refer to the *Spatial Information Framework Information Guidelines*.

Creation of New Data

Before developing a new dataset it is recommended that a 'Draft Statement of Purpose' be created. This document will outline the intended purpose, potential uses and the elements/fields within the dataset. The custodian in liaison with users sets the data quality standards. This is to ensure that the data is "fit for purpose" and the quality standards should reflect this. Once data quality standards have been set it is necessary to document them in the form of a data quality statement. This should appear in the Product Specification and the Metadata record for the dataset. The Product Specification should outline the acceptable data quality standards for this dataset and the Metadata should report the actual data quality standards. The custodian is to manage the difference between the data quality standards and the actual data quality.

Further, it is recommended that the developer of a dataset:

- Adopt industry standards – custodians should ensure that their data conforms to appropriate Australian and International Standards.
- Use nationally recognised Datums and suitably oriented projections – spatial data should be based on nationally recognised vertical (AHD) and horizontal (GDA or AGD) datums. Data should be stored, viewed and / or transferred in a suitable (Victoria oriented) format.
- Include Datum, Projection and Data Quality elements in metadata and include the Metadata in any data transfer.
- Maximise analytical capability through topological structuring – To maximise relativity and ensure the highest levels of spatial integrity, all data should be topologically structured.
- Establish a development plan that includes accuracy upgrades – establish a continuing development plan for the upgrade of the spatial accuracy of all dataset.

Improvement of Existing Data

The maintenance and upkeep of data quality is the responsibility of the Data Custodian. This includes consultation with stakeholders to define the quality confidence levels and reporting the data quality statement. This statement is reported in the metadata (which provides the actual data quality of the dataset) and the product specification (which addresses what the data quality should be).

On an annual basis (or as frequently as stakeholders agree necessary) the purpose, use and data quality standards should be reviewed by the custodian. This is to ensure that they change as the purpose and use of the dataset develops. This is a dynamic process and 'fitness for purpose' is defined by the current, future and past uses of the dataset, thus ongoing renewal is required. There also needs to be a review of data quality standards as required to align with documented quality requirements. If there are any changes to the dataset or its quality this should be reflected in the Product Specification and the Metadata.

If the dataset is not to be retired it is important that reviews are repeated throughout the life of the dataset. When the data is ready for retirement the final data quality statement should be included in the Metadata and Product Specification. The dataset should then be retired with these statements for historical and future records.

APPENDIX 1 – QUALITY MANAGEMENT SYSTEM

Quality management systems involve establishing processes to improve and maintain the quality of your product by helping you to:

- be consistent in the way tasks are performed
- reduce the chance of expensive mistakes
- use time and resources more efficiently
- monitor and improve customer satisfaction
- open up new business opportunities
- manage the growth of your business
- improve the public perception of your products

There are a number of steps to take when you begin to establish a quality management system that addresses the needs of your product and ways to improve its quality.

Analyse the entire process

Break the quality process down into key product areas (eg. sourcing and supply of materials, making the product, packaging design, customer service) and define what these areas require to ensure an overall quality product.

Plan an approach

Work out what kinds of resources are required to manage quality and analyse the effectiveness of any existing processes.

Decide if new processes are necessary

If you do need new or improved processes to maintain and improve quality, assess what sort of training and support is required for staff, including managers.

Make sure the new processes are working

Appoint a member of senior staff to monitor the new processes and procedures, ensuring that they are clearly understood by all staff and are being implemented correctly. Set targets and goals that, if achieved, will indicate that the processes are working effectively.

Revise the process

As with all aspects of business management, quality management systems need to be periodically reassessed and revised. This can be achieved through a periodic evaluation and by seeking feedback from all those involved in the quality process including staff, management, suppliers and customers.

Other steps to take

It is important for all senior managers to understand, support and commit to quality management. A 'top-down' approach is essential to bringing all staff on board with quality processes. Support from management helps to convince employees that there are well-considered reasons behind established processes and procedures and that every person's actions and inputs are acknowledged and encouraged.

[Source: http://www.business.vic.gov.au/BUSVIC/STANDARD/1001/PC_50453.html, accessed 21 September 2009]

APPENDIX 2 – ISO STANDARD 19113

ISO Standard 19113 outlines the components for measuring data quality. There are two categories: quantitative and non-quantitative data. Non-quantitative data is known as Data Quality Overview Elements, while quantitative data is known as Data Quality Elements. These are summarised below.

The ISO Standard also outlines when the data quality information should be reviewed and/or updated.

Data quality overview elements provide general, non-quantitative information and are critical for assessing the quality of a dataset for a particular application.

Purpose

This is the rationale for the creation of the dataset and contains information about its intended use.

Usage

This should describe the application(s) for which dataset has been used. Usage describes uses of the dataset by the data producer or by other, distinct, data users.

Lineage

This is the history of a dataset and, in as much as is known, recount the life cycle of a dataset from collection and acquisition through compilation and derivation to its current form. Lineage may contain two unique components:

- source information shall provide the parentage of the dataset;
- process step or history information shall describe a record of events or transformations in the life of a dataset, including the process used to maintain the dataset whether continuous or periodic, and the lead time.

ISO standard 19113 Clause 5.3

Data quality elements describe how well a dataset meets the criteria set out in its product specification and provide quantitative quality information.

The following elements are described:

Completeness

- Commission: excess data present in a dataset,
- Omission: data absent from a dataset.

Logical Consistency

- Conceptual consistency: adherence to rules of the conceptual schema,
- Domain consistency: adherence of values to the value domains,
- Format consistency: degree to which data is stored in accordance with the physical structure of the dataset,
- Topological consistency: correctness of the explicitly encoded topological characteristics of a dataset.

Positional Accuracy

- Absolute or external accuracy: closeness of reported coordinate values to values accepted as or being true,
- Relative or internal accuracy: closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true,
- Gridded data position accuracy: closeness of gridded data position values to values accepted as or being true.

Temporal Accuracy

- Accuracy of a time measurement: correctness of the temporal references of an item (reporting of error in time measurement),
- Temporal consistency: correctness of ordered events or sequences, if reported,
- Temporal validity: validity of data with respect to time.

Thematic Accuracy

- Classification correctness: comparison of the classes assigned to features or their attributes to a universe of discourse (eg ground truth or reference dataset),
- Non-quantitative attribute correctness: correctness of non-quantitative attributes,
- Quantitative attribute accuracy: accuracy of quantitative attributes.

ISO Standard 19113 Clause 5.2.2

Datasets are continually being created, updated and merged with the result that the quality or a component of the quality of a dataset may change. The quality information of a dataset can be affected by three conditions:

1. when any quantity of data is deleted from, modified or added to a dataset;
2. when a dataset product specification is modified;
3. when the real world has changed.

The first condition, a modification to a dataset, may occur quite frequently. Many datasets are not static. There is an increase in the interchange of information, the use of datasets for multiple purposes and an accompanying update and refinement of datasets to meet multiple purposes. If the reported quality of a dataset is likely to change with modifications to the dataset, the quality of a dataset should be reassessed and updated as required when changes occur.

The second condition, a modification to a dataset product specification, is most likely to occur before initial dataset construction and prior to the release of quality information. It is conceivable, however, that as a dataset is used its product specification is updated so that future modifications to the dataset will better meet the actual need. As the product specification changes, the quality of the current dataset also changes. The quality information for a dataset should always reflect the current dataset given its current product specification.

The third condition, a change of the real world, occurs continuously. Change may be caused by natural phenomena such as movements in the earth's crust or erosion, but it is most often a result of human activity. Changes are often very rapid and dramatic. For this reason, the date of data collection is important when judging the quality of a dataset. In some cases, when known, even the rate of change is of interest.

ISO standard 19113 Clause B 4.1

APPENDIX 3 – GLOSSARY

Access infrastructure	The way in which spatial information may be located and accessed. It broadly includes the policy framework, the physical network infrastructure and the spatial industry marketplace.
AS/ISO Standard on Metadata	ISO 19115:2003 (Geographic Information – Metadata) defines the schema required for describing geographic information and services.
Business information	Information considered valuable to the development and operation of Victoria's spatial information infrastructure, but is not framework information.
Custodian	The entity responsible for a data set. That is, the organisation formally responsible for ensuring accuracy, currency, storage, security, and distribution of the data. The custodian need not be directly involved in maintaining or supplying the data, but should be in a position to direct such activities.
Data	The base level of information stored in electronic or other databases. Data can exist in many formats including digital data, imagery such as aerial photos and satellite images, and hardcopy products such as maps or plans.
Data product	Dataset that conforms to a data product specification.
Data product specification	Detailed description of a dataset that will enable it to be created, supplied to and used by another party.
Dataset	Identifiable collection of data.
Framework information	Information considered fundamental to the development and operation of Victoria's spatial information infrastructure.
Information	The result of manipulating, analysing and interpreting data to produce a result which adds value or utility to the original data
Metadata	Data about data.
Spatial Accuracy	A broad concept referring to the level to which data sets may be integrated. In the context of this strategy, Spatial Accuracy refers to real-world features represented as digital data and the ability to accurately reflect their real-world spatial relativities, not only within a data set but also across data sets.
Spatial Data Infrastructure (SDI)	The technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data.
Spatial Information Infrastructure	The spatial information essential to the social, economic, and environmental development of Victoria.
Spatial Information Management Framework	Victoria's best practice approach for establishing and retaining consistency in the management of spatial information. It provides a holistic approach to managing spatial information, encompassing the institutional arrangements for developing spatial information; requirements for creating and maintaining spatial information; mechanisms for making spatial information accessible and available; and strategic development of technology and applications.
Victorian Spatial Data Directory (VSDD)	The directory of metadata that describes data sets that originates or may be of use in Victoria. It is a public resource available on the Internet. It includes both current and archived data.

APPENDIX 4 – FURTHER REFERENCE MATERIAL

National Land and Water Resources Audit, *Natural Resources Information Management Toolkit*,
http://www.nlwra.gov.au/toolkit/executive_summary.html

ISO Standards, <http://www.standards.org.au/>

In particular the following Standards provide the commonly accepted framework:

ISO 19113:2004, Geographic Information – Quality Principles

ISO 19114:2005, Geographic Information – Quality Evaluation Procedures

ISO 19138:2008, Geographic Information – Data Quality Measures

ISO 19139:2008, Geographic Information – Metadata – XML Schema Implementation

Victorian Government, 2006, *Continuous Improvement: A Hands on Guide for the Victorian Public Service*,
<http://www.vpsc.in.org/?p=569>

Business Victoria, <http://www.business.vic.gov.au>

ANZLIC – the Spatial Information Council, <http://www.anzlic.org.au/>

Guidelines:

Spatial Information Access Guidelines

Spatial Information Awareness Guidelines

Spatial Information Business Information Guidelines

Spatial Information Custodianship Guidelines

Spatial Information Framework Information Guidelines

Spatial Information Governance Guidelines

Spatial Information Metadata Guidelines

Spatial Information Pricing and Licensing Guidelines

Spatial Information Privacy Guidelines

All documents are available at <http://www.victorianspatialcouncil.org/>