



SPATIAL DATA INFRASTRUCTURE for AUSTRALIA and NEW ZEALAND

INTRODUCTION

This paper has been produced to facilitate discussion of national spatial data infrastructure needs. It provides a focus and the catalyst for further consultation on data issues concerning the land and geographic information community.

It sets out the vision of the Australia New Zealand Land Information Council (ANZLIC) for fundamental spatial datasets, and the information derived from them, that are required to support activities undertaken in the national interests of Australia and New Zealand.

It proposes a model of spatial data infrastructure, describing the broad scope and characteristics of fundamental datasets which must be collected by government in the public interest.¹

DATA INFRASTRUCTURE

The concept of national infrastructures is not new in Australia and New Zealand. In both nations, the major road and telecommunications networks, and basic health and education facilities, have been funded by government to ensure that consistent infrastructure is developed in the national interest. The rationale is that a legitimate role of government, on behalf of the community, is to provide a common, consistent infrastructure upon which a variety of government, private sector and community activities can take place.

In recent times, national competition policies in Australia and New Zealand have reinforced the concept of a single, consistent, accessible, government funded infrastructure as a basis for developing competitive, private sector, value-adding services.

ANZLIC views land and geographic information as an infrastructure, with the same rationale and characteristics as roads, communications and other infrastructure. As the peak coordinating body for the management of land and geographic information, ANZLIC believes that Australia and New Zealand should have the spatial data infrastructure needed to support their economic growth, and their social and environmental interests, backed by national standards, guidelines, and policies on community access to that data.

The data required for a national spatial data infrastructure includes topography, transportation infrastructure, utility infrastructure, flora, fauna, hydrology, climate, land use, administrative boundaries, and much more. In the past, this data has generally been stored, managed and analysed in analogue map form but there is an increasing amount of data that is being collected in digital form. The flexibility of digital data has created new opportunities for the integration of separate jurisdiction datasets, in the national interest.

¹**Note:** The term 'public interest', as used by ANZLIC in this paper, does not preclude the use of commercial practices for data access and distribution.

WHY DO WE NEED A SPATIAL DATA INFRASTRUCTURE?

A significant proportion of our nations' economic development and social and environmental well being is heavily dependent upon land related activities. For example, mining, farming, forestry, transport, tourism, fisheries and the planning of services for the community to name a few.

Much of what we want to do in these areas can only be achieved with good, consistent land and geographic information being available and readily accessible to the private and public sectors as well as the community at large. Indeed this not only refers to present activities but it is especially important when we are planning for our future.

Land and geographic information or spatial information describes information that can be related to a position on the earth's surface whether that be on the land, sea or in the air. Vegetation, minerals, asset location, property ownership, soils, seagrass location, air quality and population distribution are all examples of spatial information. There are few areas of the economy which do not rely either directly or indirectly on this kind of information for planning, maintaining or rationalising activities.

Without spatial information we cannot address, let alone resolve national issues such as urban renewal, forest management, native title administration, coastal economic zone management, defence, drought relief and Landcare.

Similarly regional issues such as soil salinity, river water quality, catchment management, land development and transport planning as well as location of hospitals, police stations, fire stations and other community facilities all require good, consistent spatial information.

Local issues such as farm planning, coastal development, town and property planning, air quality, local transportation infrastructure are also heavily dependent upon spatial information.

Spatial information can be used for a variety of purposes. Soils information not only supports farmers in managing their farms and Landcare Districts but is useful to local authorities in identifying suitable areas of road construction material; Geological information not only supports the mining and petroleum exploration industries, but helps identify suitable underground water for our cities and towns: Census information assists in the development of Government policies on a whole range of issues as well as supporting the most appropriate positioning of community infrastructure such as infant health centres, fire stations and schools.

The list will expand in the years ahead, as data is adapted for use in new areas, such as real time monitoring of vehicle speed and location, monitoring of traffic density patterns, determining accident and crime locations and monitoring environmental and ecological trends.

The precision or scale of spatial information used for national applications will not be suitable for a regional or local applications. For instance a national vegetation study which produces a broad, generalised dataset will not provide much useful information for a regional Landcare group which needs site specific datasets with a lot of detail.

Everyone could collect the spatial information that they need at the national, regional and local level, but this leads to costly duplication of data and inconsistency. It also results in data that cannot be integrated with other data and used as a basis for spatial modelling and analysis to produce value added information. In other words, excessive costs, inefficiencies, confusion and decision making based on poor information.

ANZLIC believes that Australia and New Zealand do not have the resources to waste on such duplicated efforts. ANZLIC believes that the community should reach agreement on what fundamental datasets are required in the national interest, to what standards they should be collected and maintained, which agencies should have custodianship of those data, and what the national priorities are for collection of those data.

Using data that has been collected for one purpose (geology for minerals exploration) in another application (geology for water supplies) is cost efficient. However to take full advantage of this principle the information must be consistent, to acceptable standards, its existence widely known and it must be accessible.

ANZLIC believes, that New Zealand and Australia can benefit from better management of their spatial information by taking a perspective that starts from the national level and works down to the local level. The Price Waterhouse Benefit Study revealed a benefit:cost ratio for data usage over the last five years of approximately 4:1. This shows that for every dollar invested in producing spatial information, \$4 of benefit was generated within the economy. For the period 1989 - 1994 these benefits were in the order of \$4.5 billion. Benefits were distributed across the broad spectrum of economic activities ranging from the operation of electricity, gas, water utilities to projects involving agriculture, mining and environmental management.

By everyone adopting this national perspective we not only avoid wasting resources on data collection, storage and integration but we can gain some impressive advantages as well. We can provide users with consistent, repeatable data that can be used on issues such as reducing land use conflict, resolving environmental issues and improving our ability to locate mineral deposits. In doing so we also improve business competitiveness and hence the ability of our private sector to compete on the international market.

Better management of our spatial information means:

- Understanding the importance of having good, consistent information readily available.
- Understanding the need to manage our information in a consistent, known manner so that it can be used for a variety of purposes.
- Reducing the barriers to that information and sharing that information with many different organisations.
- Agreeing on what information is important, what standards are appropriate, who should be responsible for collection, to what precision and what are the priorities for that information.

Governments are increasingly calling on the private sector and the community to take up the delivery of services. It is imperative therefore that the information needed to support those activities must be identified and where it exists, be made widely available in a known consistent manner. We need to identify the information gaps and the associated priorities for addressing these. In other words, we need an information infrastructure.

The establishment of a Spatial Information Infrastructure with its associated specification of standards, responsibilities associated with information management will assist in maximising our investment in this vital resource.

The Price Waterhouse Benefit Study also showed that the existing infrastructure for supplying spatial data has provided information to users at a cost far lower than alternative methods. If the existing infrastructure had not been in place and users had been forced to meet their data requirements from other sources, their costs would have been approximately six times higher. Over the past five years alone, establishing infrastructure has saved users over \$5 billion.

In recent times, national competition policies in Australia and New Zealand have reinforced the concept of a single, consistent, accessible, government funded information infrastructure as a basis for developing a competitive private sector and facilitating value-adding services.

There are several examples of data infrastructure being developed in a national context in Australia and New Zealand by a number of different means. Programs conducted by the National government include statistics, oceanography and climate. Datasets developed by coordinated programs involving National/State/Territory/Regional governments include the National Geoscience Mapping Accord, National Topographic Database, Australian Collaborative Land Evaluation Program, National Forest Inventory.

INTERNATIONAL TRENDS IN THE AREA OF NATIONAL SPATIAL DATA INFRASTRUCTURE

Governments throughout the world are coming to recognise that information is one of the most critical elements underpinning decision making for economic and social development, and the need to assign resources to establishing an effective information infrastructure.

For example, in April 1994 the President United States of America issued an Executive Order which implemented a national spatial data infrastructure. The European Community has developed detailed policies and strategies for a European Geographic Information Infrastructure. Similar steps are being taken in South Korea, Japan, Indonesia and other countries in our region.

In October 1996, the Permanent Committee for GIS Infrastructure for Asia and the Pacific held its inaugural plenary meeting in Sydney to address the needs and strategies for a regional spatial data infrastructure.

APPLICATIONS OF A NATIONAL SPATIAL DATA INFRASTRUCTURE

There are certain emerging national user needs which require a consistent dataset across the nation, based on the integration of jurisdiction datasets. For example:

Population Census - The 5-yearly Australian national population census requires an up-to-date, consistent topographic/cadastral map base for delineating statistical collection units. The 1996 census will be based on such a base, produced by a consortium of Commonwealth, State and Territory public sector mapping agencies (PSMA) formed specifically for the project.

Defence - National defence agencies are looking increasingly to data routinely collected and maintained by State and Territory governments e.g. utilities, to build a consistent database to support national security purposes.

Native Title Administration - In 1993 the Australian States and Territories supplied basic land tenure data to the Commonwealth, to produce a national land tenure map to assist in the implementation of the native title legislation.

Vehicle Navigation - The emergence of vehicle navigation systems will require a nationally consistent, regularly maintained digital road network dataset, upon which system providers can base their value-added network. There are currently many different government data sources which are being considered for this purpose e.g. topographic mapping, road authorities.

Cross-jurisdiction users also require similar consistent datasets e.g. Murray Darling Basin in Australia.

In all of the above cases, considerable effort is required to integrate the separate jurisdiction datasets to produce a consistent dataset. This is because the datasets have been produced for the specific needs of each jurisdiction, with a lack of common standards. This narrow focus can also occur within jurisdictions, where different government agencies collect data in an uncoordinated manner to meet their specific needs. Such datasets are difficult to integrate with other similar datasets, leading to multiple datasets covering the same phenomena but to different criteria e.g. vegetation data.

ANZLIC's ROLE IN A NATIONAL SPATIAL DATA INFRASTRUCTURE

ANZLIC members, as representatives of all geographic information interests in their respective jurisdictions, are the means by which a national spatial infrastructure can be defined and implemented. ANZLIC provides the leadership necessary to secure adoption of the infrastructure concept and to convince political leaders of its importance.

ANZLIC does not propose to create the infrastructure itself. Generally, its component parts already exist. ANZLIC's intention is to help the community more clearly define and describe the infrastructure as a coherent national entity. ANZLIC wishes to lead the community in defining the components of the national spatial data infrastructure, the characteristics of those components, and provide a vehicle for the determination of national priorities and custodianship.

ANZLIC's MODEL FOR A NATIONAL SPATIAL DATA INFRASTRUCTURE

The primary objective of a national spatial data infrastructure is to ensure that users of land and geographic data who require a national coverage, will be able to acquire complete and consistent datasets meeting their requirements, even though the data is collected and maintained by different jurisdictions. The issue, therefore, is to determine what is required of jurisdictions and their datasets, to enable them to meet national needs.

ANZLIC envisages a distributed network of databases, linked by common standards and protocols to ensure compatibility, each managed by custodians with the expertise and incentive to maintain the database to the standards required by the community and committed to the principles of custodianship.

ANZLIC believes that a national data infrastructure will provide the institutional and technical framework to ensure the required national consistency, content and coverage to meet national needs. The infrastructure also ensures that all jurisdiction efforts are focussed in the national interest, thereby maximising investment in data collection and maintenance from a national perspective. Finally, such an infrastructure will help achieve better outcomes for the nation through better economic, social and environmental decision making.

ANZLIC has developed a national spatial data infrastructure model that comprises four core components - institutional framework, technical standards, fundamental datasets, and clearing house networks. These core components are linked as follows:

INSTITUTIONAL FRAMEWORK

defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets

TECHNICAL STANDARDS

define the technical characteristics of the fundamental datasets

FUNDAMENTAL DATASETS

are produced within the institutional framework and fully comply with the technical standards

CLEARING HOUSE NETWORK

is the means by which the fundamental datasets are made accessible to the community, in accordance with policy determined within the institutional framework, and to the technical standards agreed

These four components are further developed below to aid public discussion of ANZLIC's ideas.

INSTITUTIONAL FRAMEWORK

In ANZLIC's model for a national spatial data infrastructure, the Institutional Framework defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets. It comprises several key elements:

Leadership

It is essential that an institutional structure be identified to lead the development of a national spatial data infrastructure. In Australia and New Zealand, that structure is provided ANZLIC through its Advisory Committee, jurisdictional coordinating committees (such as the Commonwealth Spatial Data Committee) and various working parties and sub-committees established as required.

ANZLIC believes that its leadership responsibilities include:

- identifying fundamental land and geographic datasets
- identifying custodians for those datasets
- establishing operating policies for spatial data custodianship and distribution
- providing a coordination mechanism for the data production and maintenance programs of the custodians
- defining and supporting a national directory (system) for the fundamental datasets
- facilitating the development and implementation of technical standards
- sponsoring multi-agency GIS/LIS demonstration and pilot projects
- identifying education and training needs and facilitating the implementation of training programs
- assisting each sphere of government to define and coordinate their respective areas of responsibility for fundamental datasets, and to coordinate cross-jurisdiction policies, standards and programs.

ANZLIC has a Strategic Plan that addresses each of these responsibilities.

Sponsorship

To ensure that the development of the national spatial data infrastructure meets the needs of the community, ANZLIC has introduced the concept of national sponsors for the individual fundamental datasets. A national sponsor is defined as follows:

*A **national sponsor** of a fundamental dataset is a body having a special interest in ensuring that the dataset is widely available to the community as part of a national spatial data infrastructure and has a structure and resources to enable it to:*

- *liaise and cooperate with ANZLIC and other national sponsors in order to ensure that the national spatial data infrastructure is assembled, maintained and delivered in a nationally consistent way;*
- *consult with the community of users to determine specifications, standards and priorities for collection and maintenance of the data;*
- *consult with and coordinate the activities of the custodians of the individual datasets comprising the national dataset to the extent required to ensure that those datasets are collected, maintained and delivered in conformance with standards, specifications and priorities that enable a national dataset to be assembled from the component parts in accordance with the overall model for a national spatial data infrastructure.*

Custodianship

A key feature of the infrastructure model is the emphasis on the concept of custodianship. ANZLIC has developed the following definition of a custodian:

*A **custodian** of a fundamental dataset, or a component of that dataset, is an agency recognised by ANZLIC and having the responsibility to ensure that a fundamental dataset is collected and maintained according to specifications and priorities determined by consultation with the user community, and made available to the community under conditions and in a format that conform with standards and policies established for the national spatial data infrastructure.*

Responsibilities of custodian agencies may include some or all aspects of data acquisition, storage, maintenance, quality assurance, security, access, documentation and distribution. Custodians are also responsible for consulting with external users in the administration of their functions. These responsibilities must be well defined, particularly where a custodian chooses to delegate or contract a function to another agency, such as maintenance of a specific data item. Custodians may be identified for new datasets that have not yet been produced. Such custodians, or 'data set lead agencies', would then have the additional responsibilities of defining the initial data set specifications and production priorities, in consultation with users.

In return for these responsibilities, custodians also have certain clearly defined rights. These may include the right to charge a fee for data access, to market and distribute the data to certain classes of users, and to access and use the data administered by other custodians.

Criteria which may be considered in the allocation of data set custodianship include statutory responsibilities, operational needs, technical capability and availability of resources. Where many agencies have an interest, capability and capacity, the agency that requires the highest standards of quality may be the most appropriate custodian.

ANZLIC has explored the issues associated with custodianship in an earlier issues paper (ANZLIC Issues Paper No: 1 "Data Custodianship/Trusteeship", which is available from the ANZLIC Secretariat). Following the identification of the fundamental datasets, ANZLIC believes that national custodians should be identified for those key datasets and the rights and responsibilities of those custodians clearly determined.

ANZLIC does not intend to establish national custodians for every data set, although coordinating and consultation mechanisms need to be identified for developing national standards and priorities.

Data Distribution

Distribution involves institutional issues of establishing directories and policies to make the data affordable. A directory contains metadata for the land and geographic datasets comprising the national spatial data infrastructure. Metadata is "data about the data" and includes the key technical characteristics of the data, access conditions and procedures, and how to obtain further information. A national spatial data infrastructure should include such a directory, or directory system, through which all potential users can determine the availability and suitability of datasets for their purpose. The directory may include both the fundamental datasets that are part of the infrastructure, and other datasets that are available from the public and private sectors. The addition of a 'data forecasting' capability, that identifies datasets currently in planning or production, would increase the value of the directory.

ANZLIC supports the concept of a national directory of land and geographic data. It has identified the National Directory of Australian Resources (NDAR) as an appropriate vehicle for a directory of Commonwealth datasets. ANZLIC believes it is important that there is a free, two way transfer of metadata between jurisdictions and that it is not simply a transfer from the States and Territories to a national directory.

Custodians with data distribution responsibilities must administer pricing structures and licensing conditions for the access and use of data by external parties. Distribution policies are generally based on either a 'public interest' or a 'commercial' approach. While commercial data producers operating in

the private sector will clearly adopt a commercial approach, government agencies in the public sector may adopt any position on the continuum between public interest and commercial, depending on current government policies and the relevant laws regarding copyright and government information.

Key issues to be considered in establishing a government-wide data distribution policy therefore are:

- the basic pricing principles to be applied (public interest or commercial)
- whether or not prices should be varied according to the nature of the user or use
- what restrictions if any should be included in the licences.

ANZLIC has developed a draft National Agreement on the Transfer of Land-Related Data, and in that policy it supports the concept that data collected in the public interest should be made available to the community, for non-commercial purposes, at the average cost of transfer.

Education and Training

In designing and developing the infrastructure, it may be determined that there is a shortage of appropriately educated and trained people and that this is an impediment to successful implementation of the infrastructure.

ANZLIC is in an ideal position to address this issue with government, funding agencies and academic institutions. ANZLIC is developing a skills profile which will be matched against existing skills and thereby identify gaps where training and education are required.

Applications

Multi-agency projects that build on the data integration and analysis strengths of the technology would be particularly appropriate. Such projects help develop inter-agency cooperation, provide valuable experience on which infrastructure policies and priorities can be considered, develop technical skills, and provide cost/benefit data to support funding proposals for major GIS/LIS programs.

ANZLIC also has a key role in ensuring that the spatial data is effectively applied to real economic, social and environmental issues. This can be achieved through support for projects that demonstrate the application of GIS/LIS technology.

TECHNICAL STANDARDS

In the context of a national spatial data infrastructure, Technical Standards define the technical characteristics of the fundamental datasets.

Standardisation Processes

A national spatial data infrastructure requires standards in each of the following areas: reference systems, data models, data dictionaries, data quality, data transfer, and metadata.

The International Standards Organisation (ISO) has recently established a committee structure (ISO TC/211) for geographic information standardisation as a new field of technical activity. This ISO work will provide the framework for both international and national spatial data standardisation. Standards Australia and Standards New Zealand provide the institutional framework for development and support of technical standards for GIS/LIS data in their respective nations, and actively participate in the work of ISO TC/211.

Considerable work has already been done in Australia, New Zealand and overseas in the development of standards and that it may be neither necessary nor appropriate to develop completely new standards. Time and effort may be saved by adapting existing standards to national needs, with the added advantage of support by the major GIS/LIS vendors. The essential thing that must be done is to identify areas where standardisation is required, to identify or develop appropriate standards, and to encourage the adoption of those standards.

ANZLIC strongly supports the work of Standards Australia and Standards New Zealand because it believes that compliance with a single set of integrated national standards should be more efficient for industry than having to comply with the divergent standards of individual agencies. ANZLIC also believes that national spatial data standards should be independent of the system standards developed by GIS/LIS vendors. This is to ensure that land and geographic data can be utilised on any system, and that systems can be upgraded and replaced without loss of data.

Reference Systems

The geographic reference system, or geodetic datum, is a fundamental standard to enable integration of land and geographic data. The availability of Global Positioning System (GPS) technology has greatly improved geodetic knowledge at the national, regional and global levels, enabling computation of a precise geocentric datum. Within a national spatial data infrastructure, the two key requirements are for the fundamental datasets to be stored on a single accurate national reference system, and for the relationship between the national and geocentric reference systems to be well defined (if they are not the same).

The development and maintenance of a national geographic reference system, in the era of satellite positioning systems, requires a technological infrastructure of its own. The core of this geodetic infrastructure is a 'fiducial network' of GPS stations, linked to the national and preferably also the regional and global geodetic systems. In addition to the fundamental land and geographic data, this geodetic infrastructure also supports the geoscientific and navigational users of satellite positioning technology.

ANZLIC endorses the work of the Intergovernmental Committee on Surveying and Mapping in its efforts to adopt a geocentric datum for Australia and New Zealand by the year 2000.

Data Models

There are two levels to a data model standard - the conceptual data model and the logical data model (or data structure). A third level, the physical data model or file structure, is implemented in the data transfer standard. The conceptual model provides a schema for the representation of the real world in the form of spatial data. The schema provides a semantic structure for the spatial and attribute components of the fundamental datasets and for the relationships between the various datasets. The conceptual level is then mapped into one or more logical data models, which specify how the relationships are to be defined. This is the level at which, for example, a topological or raster data structure would be specified.

ANZLIC is identifying the requirements for standard data models in a variety of land and geographic areas.

Data Dictionaries

The data dictionary standard is built on the conceptual data model. It provides standard definitions for the spatial and attribute components of the fundamental datasets. For example, the feature 'road' may have a range of attributes such as 'class', 'surface' and 'width', and the attribute 'class' may have a range of values such as 'principal', 'secondary' and 'minor'. All these terms must be unambiguously defined in a data dictionary to enable accurate interpretation and efficient integration of data in GIS/LIS applications. Data dictionaries must be developed for each fundamental dataset, and cross-referenced to ensure consistency.

As more and more data is produced and the applications and communications technologies becomes more efficient, the lack of semantic standards such as data dictionaries has become a larger impediment to GIS/LIS success than the lack of technology-related standards such as data transfer.

Development of data dictionaries is being coordinated by Standards Australia and Standards New Zealand technical committee IT/4/4. There are currently groups working on data dictionaries for topography, cadastre, utilities, street addressing and geosciences.

ANZLIC's is identifying the requirements for data dictionaries in a variety of land and geographic areas.

Data Quality

Land and geographic data quality standards may be descriptive, prescriptive, or both. A descriptive standard is based on the concept of 'truth in labelling', requiring data producers to report what is known about the quality of the data. This enables data users to make an informed judgement about the 'fitness for purpose' of the data. A descriptive data quality standard may require producers to provide information on the following five key characteristics: lineage, positional accuracy, attribute accuracy, logical consistency, and completeness. A prescriptive standard would define quality parameters for each characteristic, for a particular application.

ANZLIC subscribes to the notion of descriptive quality standards. A quality statement is a key element in the metadata standard, because it enables potential users of data to assess whether the data held is fit for the purpose to which they intend to use it. However, for fundamental datasets, ANZLIC believes that prescriptive standards may be required and that wide community consultation is required to determine those standards. Quality standards will be addressed in the community consultation on fundamental datasets.

Data Transfer

Transfer standards provide an intermediate format for the transfer of data between different computing environments. They comprise a set of rules for encoding data into fields, records and files for transfer via a specified media. A data model is a prerequisite to development of the encoding rules. The intermediate nature of transfer standards is an important characteristic - they are not intended to be product or database structures. Transfer standards are optimised to achieve effective communication of all data and metadata, whereas product and database structures may be optimised for efficiency of storage, application or maintenance.

The transfer standard provides a GIS/LIS vendor-independent target for encoding data for output, and for decoding data for input. Vendor-independence enables production and application agencies to utilise whichever hardware and software systems are the most cost-effective for their needs, without compromising 'corporate government' principles.

It is hoped that the ISO activity will result in an international spatial data transfer standard which, with government agency and GIS/LIS vendor support, will facilitate effective data communications within and between nations. Australia and New Zealand are actively participating in the work of ISO TC/211 to try to ensure that any international standard adopted is compatible with AS/NZS 4270.

ANZLIC has supported the adoption of the US Spatial Data Transfer Standard (SDTS). It has been subjected to the usual Standards Australia/Standards New Zealand process of community consultation. Comments have been accommodated in the draft and the final standard has now been published as the joint Australian and New Zealand standard AS/NZS 4270. This standard will, in due course, replace AS 2482 but, recognising that the old standard has been implemented in many systems, it will remain a standard for another five years, after which it will be withdrawn.

Metadata

A metadata standard will specify how data is described in the national directory and in data transfers. Characteristics to be described may include the data set name, content, coverage, quality and structure, and information on access procedures and restrictions. The metadata standard can be viewed as a microcosm of the other data standards, requiring (meta)data model, dictionary, quality and transfer specifications of its own.

As previously indicated, ANZLIC supports the concept of a national directory of land and geographic data and has developed a metadata standard for which all jurisdictions have indicated support. The Council has adopted protocols aimed at encouraging all jurisdictions to consistently record their datasets on the national directory system and to freely share metadata.

FUNDAMENTAL DATASETS

The essential component of the national spatial data infrastructure is the Fundamental Datasets which are produced within the Institutional Framework and fully comply with the Technical Standards. They are the datasets which are collected as primary data sources, and from which other information is derived by integration or value-adding. ANZLIC defines a fundamental dataset as follows:

*A **fundamental dataset**, in the context of ANZLIC's vision for a national spatial data infrastructure, is a dataset for which more than one government agency requires consistent national coverage in order to achieve their objectives. This demand for a consistent national coverage implies that:*

- *there is a need for coordination between custodians to ensure that components of that dataset are collected to consistent standards;*
- *the community of users must be adequately consulted to determine specifications and priorities;*
- *access to the data is provided in accordance with policies determined for the national spatial data infrastructure; and*
- *it conforms with a set of standards that ensures that it can be combined with other components of the national spatial data infrastructure to create value-added products.*

There are two principal issues associated with the provision of Fundamental Datasets:

Identification and Priorities

A key activity in defining the national spatial data infrastructure is to identify the national land and geographic data priorities - what are the Fundamental Datasets that should be produced by governments and what are the funding priorities? Individual agencies will have very strong views on needs and priorities, based on their own programs.

Datasets that might be included in the infrastructure are aerial and satellite imagery, the cadastre, census results, land use and land cover, place names, administrative areas, transportation networks, utility networks, coastline, rivers and lakes, elevation, soils, vegetation, fauna, geology, climate, pollution, hazardous sites, and areas of environmental significance.

It is ANZLIC's objective to facilitate the determination of a national spatial data infrastructure that rises above the narrower sectional interests of individual agencies and jurisdictions. The Council aims to identify the Fundamental datasets comprising that infrastructure, to identify custodians of those data and to facilitate the development of national priorities and standards for those data.

ANZLIC anticipates that the technical characteristics of those datasets would include the spatial accuracy, associated attributes, attribute accuracy and currency. The level of government (national, state/province, local) responsible for production and maintenance, and any variations in characteristics according to geographic location, might also be specified.

To illustrate what the Council proposes, Annex A gives a draft list of fundamental datasets and tables of characteristics and locational classifications that might be applied to each fundamental dataset, followed by a mock example. These lists are provided as an aid to understanding ANZLIC's vision and to stimulate debate. They are not intended as a definitive model for the national spatial data infrastructure. ANZLIC is very keen to receive input from the whole geographic information community, both data providers and data users, in the definition of this model. An extensive process of consultation will be undertaken to refine the lists, but they give an indication of the type of information that ANZLIC believes should be defined.

Production and Integration

After the Fundamental Datasets have been identified and prioritised, the issues of data set custodians and funding of production and maintenance programs can be addressed. Cooperative arrangements will be needed to ensure that the Fundamental Datasets can be spatially integrated. That is, where a real world entity such as a road centreline is represented in two or more datasets, such as the transportation network and census boundaries, the spatial representations should be coincident.

Coordination and consultation mechanisms will be needed to ensure that standards and priorities are determined for the greatest benefit of the community as a whole. ANZLIC will offer its broadly based coordination structures to assist in this process but will look to custodians and special interest user groups to take a lead in developing standards and priorities.

CLEARING HOUSE NETWORK

The Clearing House Network is the final component of the national spatial data infrastructure and is the means by which the Fundamental Datasets are made accessible to the community, in accordance with policies determined within the Institutional Framework, and to the Technical Standards agreed. There are two issues to consider:

Technological Framework

The Clearing House Network is the technological framework established to give the community access to the Fundamental Datasets. The model does not propose a single central database. Rather, it model anticipates that datasets will be held on a number of independently maintained systems by the respective custodians, and that they will be linked by common standards and policies. Physical linkages between those systems will be through a range of mechanisms including dedicated telephone lines, local area networks, wide area networks and integrated-services networks.

Data Directory System

The national spatial data network will be a part of the developing, more general national infrastructure for information distribution and access. The key element of the network is the data directory system which should be freely accessible and contain highly accurate metadata for the Fundamental Datasets, including advice on gaining access to the data.

ANZLIC's aim in developing the Clearing House Network is to foster the integration of Fundamental Datasets into the network and to coordinate with other infrastructure coordinating bodies to develop a national consensus. The Clearing House Network is not something that ANZLIC can address on its own, as it is part of the broader information distribution problem. However, ANZLIC will encourage the adoption of standard data transfer protocols and national policies for access and pricing, and will ensure that the particular needs of the national spatial data infrastructure are taken into consideration when data distribution networks are being designed.

CONCLUSION

The preceding description of a national spatial data infrastructure has been prepared by ANZLIC to promote discussion on the topic in Australia and New Zealand.

ANZLIC welcomes comments on the document and encourages readers to contact the ANZLIC Advisory Committee members listed in Annex C.

Table 1: Fundamental Datasets

THEME	DESCRIPTION	SUGGESTED NATIONAL SPONSOR	
TOPIC/CLASS PRIMARY REFERENCE			
Geodetic Control Network National Geodetic Database Australian Height Datum National Geoid Model	Geodetic survey marks and benchmarks (NZ?) Definition of vertical datum surface (NZ?) Geoid-ellipsoid separations (N values) to convert from GPS observations to AHD heights	ICSM	
Aerial Photography	Available aerial photography	ICSM	Different custodians for archived and current photography may be needed
Satellite Imagery	Available satellite imagery	ICSM	Unless other more suitable alternative can be identified
TOPIC/CLASS ADMINISTRATION			
Land Parcels/Cadastrre	A consistent framework of land parcel boundaries defined for land tenure purposes, referenced to a common datum and including road casements	ICSM	
Land Tenure	Current, proposed and historical details of all tenures. eg Details of ownership, vesting.	Registrar General's Forum	
Street Address	Unique Street Address of parcels/properties	ICSM, PSMA, NMEC	
Mining and Petroleum Lease Boundaries and Tenure	Boundaries of mining and petroleum tenements (production or exploration, surveyed or unsurveyed) and conditions of ownership: eg Environmental & Statutory	Standing Committee of ANZMEC	Suggestion that M & P Boundaries be combined with M & P Tenure (see below)
Administrative Boundaries International, National and State Boundaries Suburb/Town/Locality and Local Government Electoral Boundaries	Jurisdictional Boundaries Boundaries of areas Boundaries of districts or Divisions	ICSM ICSM AEC	
Postcode	Boundaries of Postcode areas	Australia Post	
Constraining or major Interests in land	Heritage Sites - Polygon or point locations and details of significance Aboriginal Sites - Polygon or point locations and details of significance Restricted Sites - Boundaries of other restricted areas for example contaminated sites.	Registrar General's Forum	
Feature Names/Place Names	Official & local names of cultural & geographic features (including roads)	ICSM	National Gazetteer

THEME	DESCRIPTION	SUGGESTED NATIONAL SPONSOR	
TOPIC/CLASS NATURAL ENVIRONMENT			
Soils Classification	Boundaries and classifications of soil resources.	ACLEP	
Vegetation Classification (Plants/Flora)	Boundaries and areas of vegetation and associated entity description of dominant life form	ABARES/ABRS/ Heads of Australian Herbaria	
Biodiversity Regions	Interim biogeographic regionalisation of Australia and New Zealand	ERIN/NZ?	
Animals (Fauna)	Classification and location of native and introduced animals (fauna)	ANCA/ Museums	
Earth's land surface	Vertical distance from the earth's surface to a base defined by Australian Height Datum AHD	ICSM	Includes relief, contours and digital model
Bathymetry	Vertical distance of earth's surface from base defined by Lowest Astronomical Tide	HOMA/ICSM	
Coastline (or marine and coastal boundaries)	The limit of land features usually at mean high water level.	ICSM	To include islands and reefs
River Catchment/Drainage Areas	Boundaries of catchment/drainage areas.	ICSM	
Streamlines and Inland water bodies	Location of watercourses and all inland water bodies	ICSM	
Geology	Boundaries and classification of geological units	GGDPAC	
Mineral Resources	Boundaries and classification of areas of mineral occurrence	GGDPAC	
Hydrogeology	Boundaries and classifications of aquifers	GGDPAC/?	
Oceanography	Boundaries of physical and chemical characteristics of parts of the ocean	HOMA	
Climate	Macro climate for specific region	Bureau of Meteorology	Daily rainfall, max/min temperature, humidity, sunrise and sunset, wind direction, speed and cloud coverage at Registered Stations
Land Systems	Areas or groups of like topology, soils and vegetation throughout which can be recognised a recurring pattern	ACLEP	
Areas subject to natural hazard. eg inundation, cyclones	Spatial definition of such areas with attribute data on periodic level of probability.	NMEC	

THEME	DESCRIPTION	SUGGESTED NATIONAL SPONSOR	
TOPIC/CLASS SOCIO/ECONOMIC			
Census Collection Districts	Boundaries of areas defined for collection of demographic census information	ABS	
Demography	Population statistics linked to Census Collector Districts	ABS	
Planning Zones	Boundaries of areas of permitted land use defined by planning authorities		
Rural and Urban Land Use	Rural and urban actual land use activities	Indicative Planning Council	
TOPIC/CLASS BUILT ENVIRONMENT			
Cultural Features	Location of built environment, buildings, structures and other cultural features.	ICSM	
Aviation Features	Location of airports and navigation aids	Air Services Australia	
Marine Transport	Location of ports and navigation aids	AMSA	
Road Centrelines	Centreline of physical roads and carriageways with attribute data.	AUSTROADS	
Rail Centrelines	Location of trunk rail centrelines, with attribute data.	ANR	
Water Supply, Waste Water, Irrigation and Drainage Networks	Location of trunk networks and major assets with attributes of classification and ownership		
Electricity and Gas Networks	Location of trunk networks and major assets with attributes of classification and ownership	NMEC/Energy Ministers	
Telecommunication Network	Location of trunk networks and major assets with attributes of classification and ownership	Austel	

Table 2: Data Characteristics

ANZLIC suggests that the model of the national spatial data infrastructure should define the characteristics of the fundamental datasets of which it comprises. The characteristics that might be defined are as follows:

Characteristic	Description
Spatial Accuracy	Statistical measure of required accuracy in terms of the geodetic network (eg.x metres RMSE).
Attributes	Non-spatial data associated with each data item (eg. Owner Name, Title Identifier for freehold land).
Attribute Accuracy	Statistical measure of required confidence (eg. 95%)
Currency	Maximum age of spatial and attribute data; revision or maintenance cycle (eg. x days or y years).
Responsibility	Level of government responsible for acquisition and maintenance of spatial and attribute data (ie. Commonwealth, state/territory or local).

Table 3: Locational Classifications

ANZLIC suggests that the desirable characteristics of a fundamental dataset may not be uniform across the whole dataset but might vary according to the area covered. Therefore, areal classifications might be associated with the characteristics and those classifications might be:

Location	Description
All Australia	All locations.
All New Zealand	All locations.
Urban Areas	Cities, towns and settlements; built up areas; high population density
Rural Areas	Developed agricultural and grazing areas; medium population density
Remote Areas	Sparse grazing areas and wilderness; low population density
Special Areas	Sites or areas of special social, economic or environmental significance

Mock Example

The following example illustrates the level of detail proposed for the infrastructure model. The content has been arbitrarily selected for illustrative purposes only and is not intended to anticipate or influence the consultative process that ANZLIC intends to undertake in determining the characteristics of the national spatial data infrastructure.

Data Item: road centrelines

Location:	National		Urban Areas	
Rural Areas				
Spatial Acc'y:	100m RMSE		1m RMSE	10m RMSE
Attributes:				
Name	Name		Name	
Width	Width		Width	
	Surface		Surface	Surface
Authority			Authority	
Attribute Acc'y:	90%		Traffic 98%	95%
Currency:				
- spatial	10 years		1 year	4years
- attribute	10 years		6 months	
2years				
Responsibility:				
- spatial	Commonwealth	State/Terr		State/Terr
- attribute	Commonwealth	Local		State/Terr

Contact Addresses for ANZLIC Advisory Committee members and the Secretariat

[NOTE: While this list of contacts was appropriate at the time this paper was published, it is now out of date. Go to <http://www.anzlic.org.au/about/anzlicme.htm> for current information.]

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