



Concept Paper

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1. Introduction

Following the wide-ranging review of information technology in the Queensland public sector the Information Technology Review Final Report was accepted by Cabinet on 17 September 1990. The Report noted that "*the information services developed to date have been largely agency-specific and aimed at automating administrative processes*" [Queensland Government 1990]. The preferred approach in future would be systems aimed at providing services to clients, and maximising the use of the information held in strategic databases.

This approach would demand integration, coordination and effective management of the State's information resource. Institutional mechanisms established during the 1980's were ineffective in performing these roles.

As a consequence, the Information Policy Board (IPB) was established with the mission of ensuring that the Government's information resource is managed and applied strategically for efficient, cost-effective and quality services to both public and private sectors.

Queensland had recognised the importance of land information systems as early as 1979 with the subsequent establishment of a Land Information Steering Committee in 1982. These initiatives matured in 1992 when the Queensland Department of Lands was appointed by the Information Policy Board as the Lead Agency for the coordination of the development of the Queensland Land Information System (QLIS).

The purpose of this QLIS Concept Paper is to document clearly the current vision held by the participants for the emerging Queensland Land Information System.

1.1 Land Information Environment

The Australia New Zealand Land Information Council (ANZLIC) defines land information as:

"... encompassing information about natural resources, the environment, land ownership, land use, transport, communications, mapping, demography and socio-economic factors where such land information can be related to geographic position."

[ALIC 1988]

This definition applies not only to the land surface of the earth but to the aquatic, atmospheric and sub-surface regions as well.

Commitments by all State and Territory Governments in Australia towards the creation of integrated land information systems has reached the stage where the products of some of these systems are becoming available to a wide range of increasingly sophisticated information users.

Development indicates that by the turn of the century the community will be served by comprehensive systems designed to provide information to assist in dealing with a range of complex operational and planning problems related to the land.

Queensland, through the **QLIS Initiative**, is now focussed on linking existing databases to land information networks, thus allowing application software and decision support tools to use available land information more effectively. This will result in a much broader information services industry.

The concept of a State-wide land information system has been reasonably consistent over the past decade. Significant progress towards its realisation has been made recently as:-

- databases are now coming on-line operationally;
- advances in database management and communications are making it technically more feasible;
- the demand by users for integrated data sets is growing rapidly.

There also currently exists an institutional environment where the policy of government is encouraging cooperation, systems coordination and the sharing of information, through initiatives such as the formation of the Information Policy Board (IPB) and the Queensland Land Information Council (QLIC) (see Section 5).

1.2 What is QLIS ?

QLIS is concerned with the integration of many systems, not the creation of a single independent database or system. As such it is best described as an overarching strategy encompassing technical resources, human resources and organisational procedures to ensure a coordinated approach to land information management. It has been defined as:

"... a grouping of component systems which interrelate and interact with one another to collect, record, process, store, retrieve, deliver and display land information to support strategic management and operational planning processes, including activities involving the use and control of land resources in Queensland."

[QLIC 1992a]

While the implementation of individual land information systems and databases is by no means complete, individual systems implementation issues are no longer the dominant concern. QLIS provides the framework such that these developments can be linked together to maximise their usefulness.

Simply stated the **QLIS Goal** is to improve mechanisms for community access to integrated land information [QLIC 1991]. This is achieved by the following **Objectives**:

- providing a framework (standards, procedures etc.) for the acceptance and development of QGIS;
- coordinating the integration of land information systems and thus enabling users to access and analyse land information;
- providing a directory of land information.

QLIS pursues a "**flight path**" (Figure 1) leading towards an environment which enables access, in a controlled manner, to all land information in Government throughout the State. This is a long term vision that will involve planning to incorporate the new technologies which can be expected to evolve.

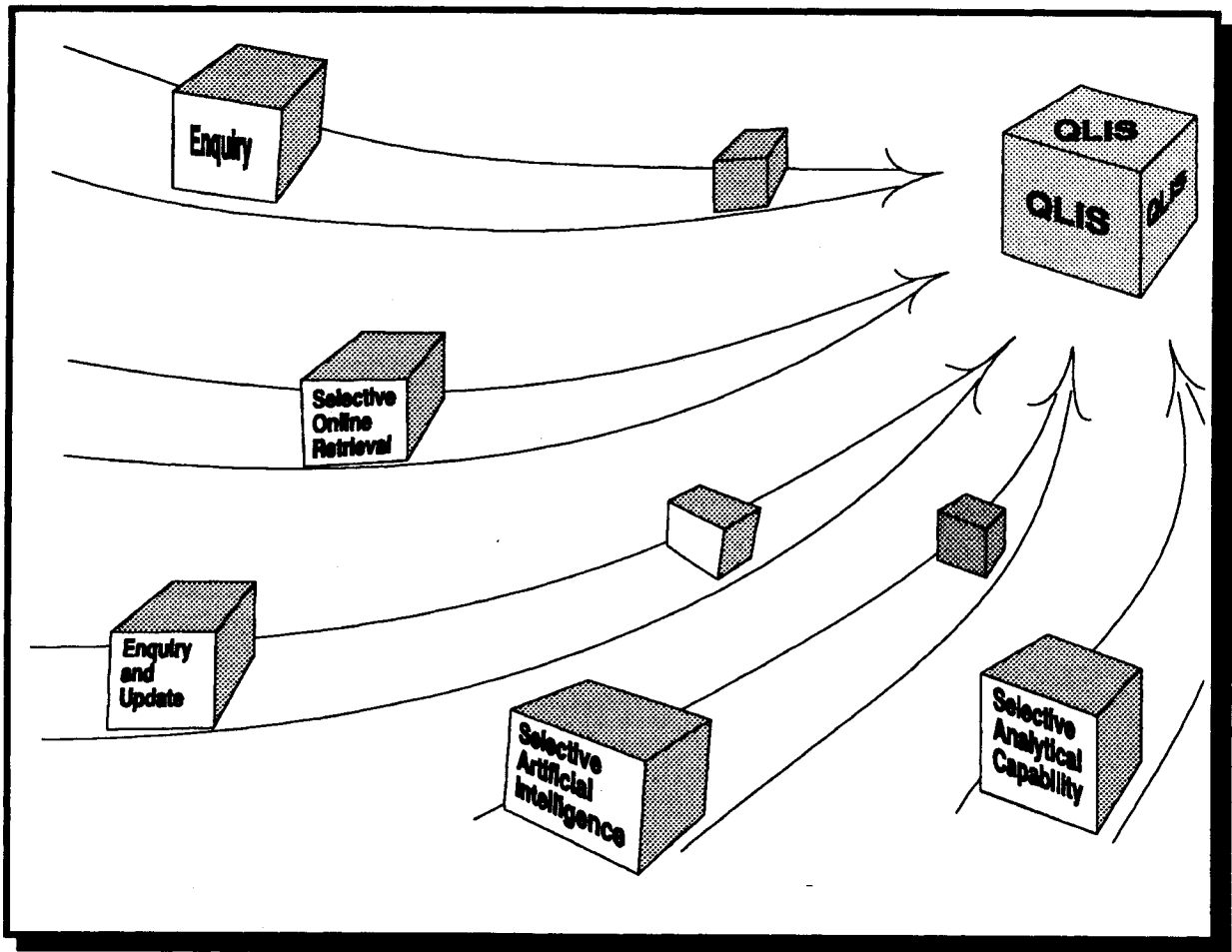


Figure 1: QGIS "Flight Path"

Many present information bases or initiatives are not within, or are only partially within this proposed "flight path". The direction must be indicated so that planned future developments can migrate towards, if not into, the preferred path.

Consistent with the "flight path" approach the following **Operating Philosophy** has been defined and endorsed to guide developments [QLIC 1991a]. These factors equate to broad development parameters.

1. A direction is prescribed which keeps options open.
2. Resource is allocated to development based on consideration of Demand, Cost, Return and Time-frame.
3. The level of sophistication (elegance) of application linkage is based on Demand, Cost, Return and Time-frame.
4. Development is incremental and builds on existing resources.
5. Custodianship of data accrues obligations to QLIS commitment, but custodians determine what restrictions are placed on data made available.
6. The widest possible means of access are pursued, taking into account information security requirements.
7. Short-term deliverables are pursued.
8. The user-interface is intuitive for entry level access but accommodates degrees of sophistication for more specialised users.
9. Continual review of systems design takes account of any changes with respect to policy, technology, data and demand.
10. Data policies and procedures are context sensitive and include data quality information.
11. A Directory of Queensland Land Information is maintained.
12. Utilisation of a Centralised Hub approach is to be minimised.
13. Access to information is not location dependent.
14. Standards facilitate linkage, access and delivery of information to ensure consistency but not necessarily uniformity.
15. Freedom of Information and Privacy considerations are recognised.
16. The Total Quality Management (TQM) approach applies.

QLIS must enable land information from a number of functional and administrative agencies to be integrated to produce composite information products to serve the needs of an open ended and largely unknown constituency of users.

1.3 QLIS As Infrastructure

The QLIS concept explicitly recognises the importance of three separate infrastructure components (see Figure 2).

The three infrastructure components are:-

- Land Information Infrastructure which consists of the data elements and associated nomenclature, standards and conventions.
- Technology Infrastructure which consists of a common resource of telecommunication services and computer hardware and software environments.
- Institutional Infrastructure is essential to the establishment of both the land information and technology infrastructures. It consists of the institutional arrangements and organisational procedures that guide the management of current and future land information.

Each of these infrastructure components are described in more detail in Sections 3, 4 and 5.

The concept of QLIS being a combination of infrastructures is based on the need to establish a system of operation that is as easy to use as the road network, telephone system or electric power grid. Information and technology resources must be widely available, easy to use and economical. They must also serve as a foundation for potentially large increases in use. For example, roads can be accessed and shared by a large number of users, for a multitude of uses. The reasons for using the road network have been limited only by market needs and the associated economic realities of those needs.

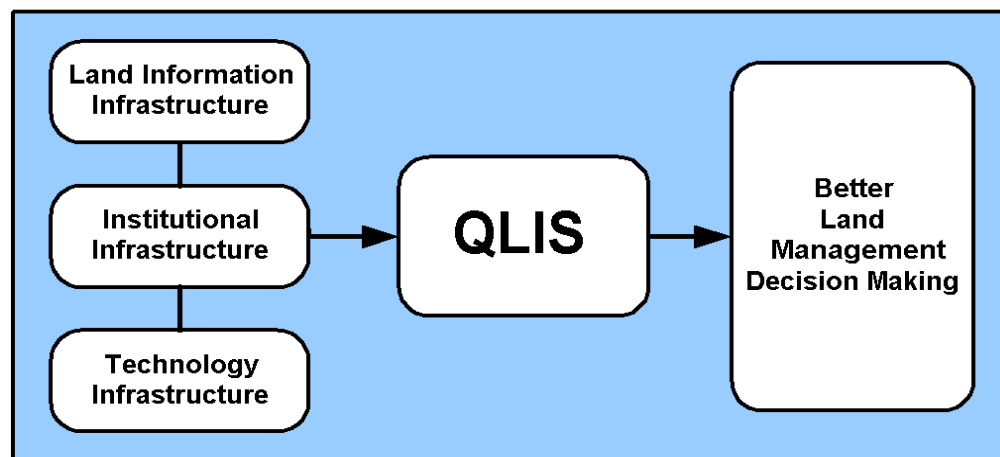


Figure 2: QLIS as Infrastructure

The current structure of land information databases in Queensland does not permit, let alone facilitate, integration. If it were now possible to enquire on any two databases simultaneously, the user would need to ascertain the reliability of the product of that enquiry. Causes of some data incompatibilities can be attributed to the following:

- cross database integrity problems;
- spatial reference differences; or
- inherent characteristics related to its origins (eg. accuracy or the purpose of collection).

The major challenge QLIS faces is to overcome integration incompatibility, by building on the need for a common information base, while recognising the need for continued independent management of land information by individual agencies.

2. QLIS Development Approach

The QLIS Lead Agency will be responsible for coordinating a QLIS Awareness Campaign. The awareness campaign involves the distribution of concept papers and issues papers, the organisation of workshops or forums and the establishment of multi-disciplined and cross-industry reference groups where necessary. Issue resolution will be achieved through a cycle of full consultation and review involving input from all sectors of the industry. However not all infrastructure design aspects necessitate development in this way (eg. if a relevant national policy exists QLIS may simply adopt it).

The sharing of land information is intrinsic to QLIS. This can only occur if there is a commitment to a cooperative approach by the contributing agencies and users. A prerequisite to this commitment is a full understanding. The land information community needs to be knowledgeable of the goals and objectives of QLIS, of the possible impact on their own operations, and of the role of the Department of Lands and other land information agencies. The time invested by participants in gaining and advancing this understanding ensures that QLIS reflects contributions from the whole-of-government and the private sector.

The development approach outlined below (Figure 3) is not a one-off pass, but an on-going process. The reference groups which are being established to assist in the design of QLIS will also be involved in the on-going maintenance and evolution of the QLIS environment.

Unlike traditional system design, the emphasis is not simply on a discrete system. The design process must be carried out differently from traditional methods because of the need to develop the information, institutional and technology infrastructures in a cohesive manner.

It is necessary to ensure that the development of QLIS addresses the needs of the various user groups, ranging from custodians of data to clients. It is vital that all groups share in the development of the direction, policies, standards and procedures associated with QLIS. It is intended that a consultative process will be adopted where critical issues will be documented and circulated to appropriate bodies for comment and input.

CONCEPT PAPERS	<p>The purpose of these documents is to communicate the vision and sustain a common, clear understanding of the concept.</p> <p>A Concept Paper will be prepared for each major QLIS initiative requiring development.</p>
STRATEGIC PLANS	identifies how the vision will be achieved by outlining the agreed strategies.
ISSUES PAPERS	<p>analysis of specific issues arising out of the Concept Papers or the Strategic Plans or from monitoring, reporting or evaluation activities.</p> <p>Issues Papers will conclude with recommendations to resolve the issues.</p>
QLIS POLICIES STANDARDS AND PROCEDURES	<p>the specifications and guidelines under which QLIS will operate.</p> <p>These will be determined as issues are resolved and operational decisions finalised.</p>

Figure 3: QLIS Documents.

2.1 QLIS Charter

The QLIS Charter comprises all published documentation produced for the development of QLIS, including Lead Agency Agreement, Theme Coordinator Agreements, Concept Papers, Strategic Plans, Issue Papers and Policies, Standards and Procedures. The Charter will continually evolve and will be upgraded or amended, in part or in whole, with the ongoing development of QLIS. It will provide a "Manual" for users (Figure 4 refers).

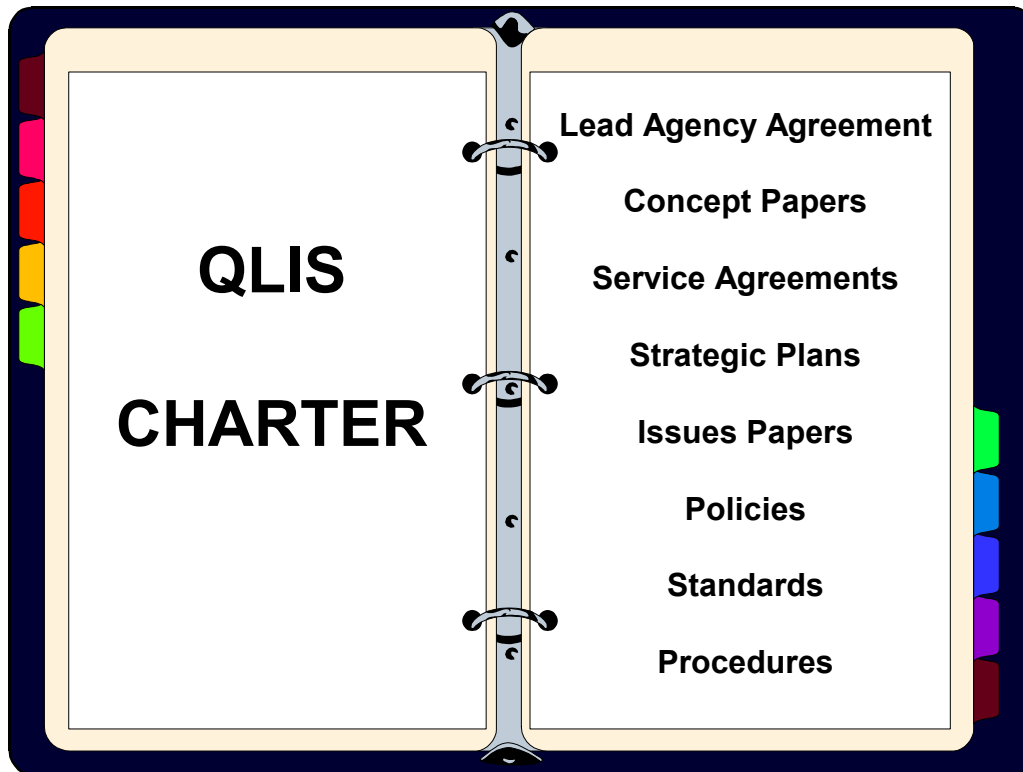


Figure 4: The QLIS Charter will provide a "Manual" approach to QLIS documentation.

2.2 Relationship With Agency Business Plans

QLIS will not have an individual Business Plan, nor will it become involved in individual agency developments from a detailed point of view. The QLIS Strategic Plans will only set out strategies. It is the responsibility of the appropriate agency to convert these strategies into action and to prepare system plans. The QLIS Lead Agency though, has the responsibility to monitor the development of QLIS across government, and occasionally will need to review all QLIS system plans in order to ascertain the current overall status of QLIS.

3. QLIS Land Information Infrastructure

The Land Information Infrastructure consists of the data elements and associated nomenclature, standards and conventions.

3.1 QLIS Themes and Classifications

All of society's activities and interests share a common element in that they are ultimately related to the land, which is taken to include the coastal environment. The primary classification is therefore according to the principal themes of land information. QLIS has been divided into five themes as shown in Figure 5:

- Natural resources information is primarily focussed on the physical and biological attributes of the environment, and their human use or interpretation.
- Transport information concentrates on transportation infrastructure such as roads, rail, harbours, and airports.
- Utility information is concerned with power, communications, water and associated services.
- Land administration information is concerned with rights, restraints and responsibilities associated with the land.
- Socio-economic information focuses on human and economic geography.

Natural Resources Information	Transportation Information	Utility Information	Land Administration Information	Socio-Economic Information
For example: Soils Geology Flora Fauna Climate	For example: Roads Rail Airports Harbours	For example: Gas Electricity Communications Water	For example: Tenure Valuations Land Use Land Control Ownership	For example: Health Welfare Population Public Order

Figure 5: QLIS Themes

The need for sharing of land information requires a common understanding and representation of data. This implies there must be common data identification, classifications and terminology. The following classification has been developed.

Data Themes: The primary ends to which the data is captured and applied;

Data Groups: The group of data that characterises a function, subject or topic;

Data Elements: A subclass of data within a Data Group. They may be at different levels, ie. a collection of data elements that together make up more useable information.

Figure 6 contains examples of this classification.

EXAMPLE DATA THEMES	EXAMPLE DATA GROUPS	EXAMPLE DATA ELEMENTS
Natural Resources	Climate	Rainfall Temperature Humidity Evaporation Winds
	Native Vegetation	Vegetation Type Density Height
Land Administration	Ownership	Name Address
	Sales	Sales Price Sales Date
	Valuation	Unimproved Value Improvements Effective Date

Figure 6: Examples of the Use of Themes, Groups & Elements

All data must contain a data quality statement defining its accuracy, reliability and integrity. To support the data management functions, it has been agreed that the development of a comprehensive data model and data dictionary is essential for each of the QLIS Themes.

3.2 QLIS Foundation Information

By definition land information must be related to a geographic position. Consequently certain data groups by their nature (or what they are used for) provide **Foundation Information** upon which all other information is related.

The principal data set in this category is the geographic or spatial positioning system (geodetic reference system), referred to as **Fundamental Information**. The geodetic reference system is monumented by survey marks whose locations are accurately measured and mathematically described relative to a common national datum, the Australian Geodetic Datum (AGD84). This reference system provides the spatial basis for all land-related data.

Certain other data groups provide a framework for the integration and analysis of a range of land-related data. These are referred to as **Framework Information** consisting of data upon which other data and systems will be constructed. Both fundamental and framework information support all QLIS themes. Figure 7 illustrates the relationships of these two categories and shows the theme that has the primary responsibility for generation of that particular information.

THEME INFORMATION	Land Administration	Natural Resources	Transport	Utilities	Socio-Economic
FRAMEWORK INFORMATION	Land Boundaries Place Names	Relief/ Drainage Coastline Remotely Sensed Imagery	Roads/ Railways		Census
FUNDAMENTAL INFORMATION	Geodetic				

Figure 7: QLIS Foundation Information

Each data group of foundation information will be acquired to a determined accuracy and content, ie. to a **base level**. The concept of a base level of data implies that there is a general need for the data at that level which extends beyond the specific and immediate needs of individual clients. Base level data will provide a common spatial reference within the foundation information. Acquisition of base level data is an integral component of a long term planning process which anticipates the need and demand for data. The process accepts the long term benefits which will flow to Queensland from the better management of the State's land resource when it is supported by the availability of a consistent standard of land information.

3.3 Land Information Directory

One of the three objectives of QLIS is the development of a Queensland Land Information Directory to provide basic knowledge on what data is available over any geographic area, who the custodians are and how it may be accessed.

In developing the concept of a Land Information Directory, the approach is towards a simple model which considers information in its broadest concept. This avoids embracing the complex issues associated with development of data profiles and ultimately data dictionaries for the database environment. These aspects will need to be considered though in the long term.

Figure 8 illustrates the breadth of information formats that are part of the Queensland Land Information Directory.

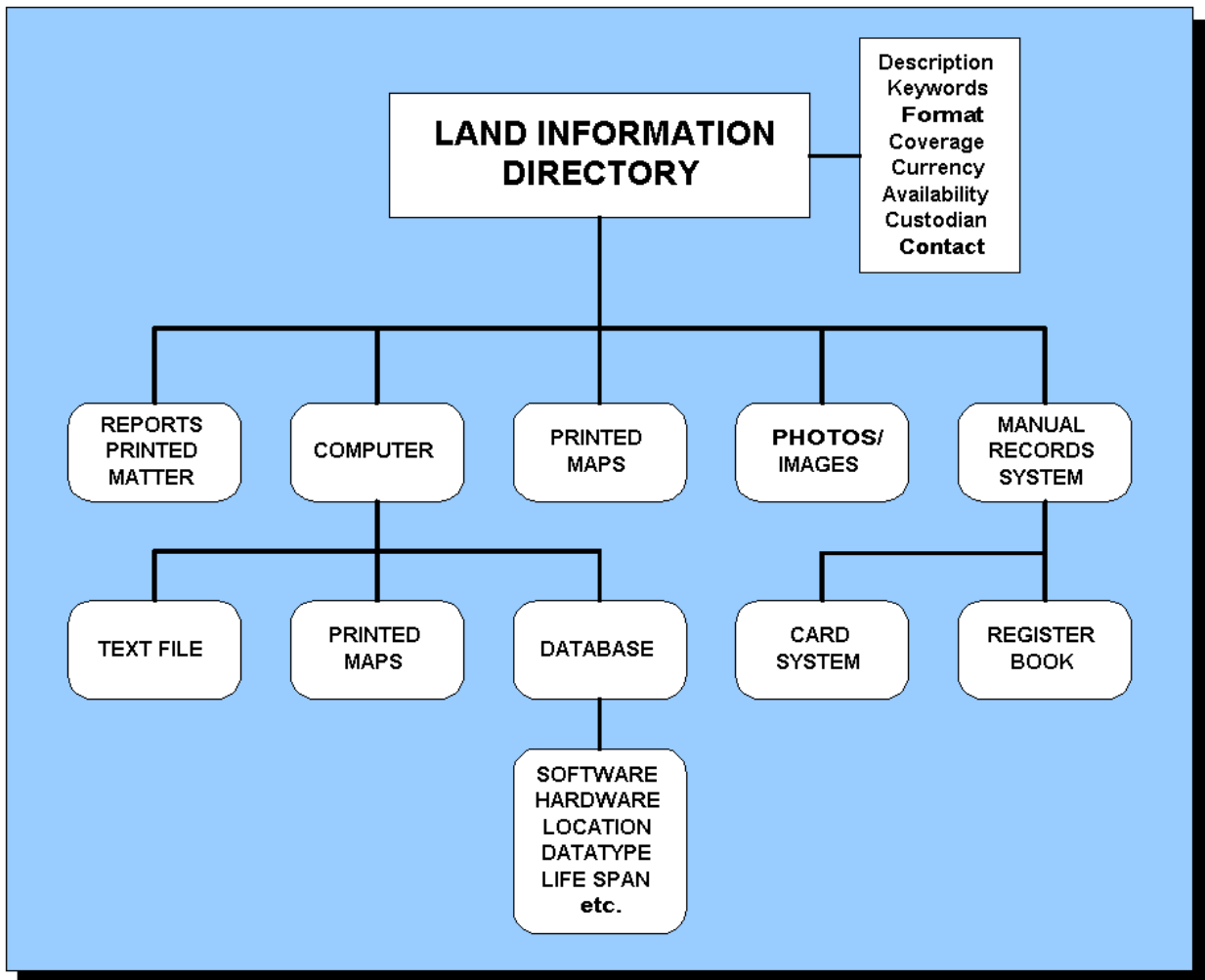


Figure 8: Land Information Directory Model

The Queensland Land Information Directory has the capability to be accessed by geographic location.

4. QLIS Technology Infrastructure

The QLIS Technology Infrastructure provides simultaneous access to land information for multiple applications at more than one site. The Technology Infrastructure must reflect the functional structure of land information agencies and be flexible to support future changes brought about by advances in technology or application development.

The QLIS Technology Infrastructure consists of a common resource of telecommunication services and information handlers that access, manipulate and output land information. The technology resources can be identified as:

- distributed networks (see Section 4.1);
- communications (see Section 4.2);
- standards, protocols and conventions (see Section 6)

To date, the uncoordinated approach to the introduction of information technology in Queensland has led to an increasing number of land information systems in the three levels of government. An Interim Land-Related Systems Inventory compiled in 1991, covering six of the major land-based departments, identified over 250 systems in those State Government departments.

To provide the required functionality to their systems, agencies have independently developed their own information systems. Consequently, inevitable duplication of the data itself and overlap of data collection have occurred. Similar information collected by agencies at the different levels of government has resulted in inconsistency and incompatibility.

This situation has impeded the sharing of information between land information agencies. The ability to integrate land information from a variety of sources is important and avoids unnecessary and costly duplication in data collection, policy formulation and land information management practices.

Systems integration is facilitated by creating an environment directed towards enabling differing systems and applications to function and cooperate together in a compatible manner. Mechanisms must be put in place which enable the transparent interchange of information and functionality between various hardware and software platforms.

The Queensland Government Information Policy Board (IPB) attaches great significance to the need to align strategic development towards an Open Systems Environment. Standards and procedures are being developed to guide the convergence of strategies by agencies, and to encourage the search for solutions from proprietary systems into a more open systems environment. Issues such as the costs and timing of moving away from an established proprietary base towards a new environment must be taken into account.

Conformance with the IPB's policies on the adoption of the Open Systems Environment (OSE) ensures that the design of the Technology Infrastructure is flexible to accommodate the rapidly changing sophistication and capabilities of technological development.

These policies include the adoption of Government Open Systems Interconnection Profile (GOSIP) standards which allow application software to:

- be ported across a wide range of systems
- interact with other applications
- interact with users in a style which facilitates user portability.

Integration through QLIS will provide an effective and efficient means to access, query and retrieve land information residing in several remote databases which use different proprietary software and hardware.

4.1 Distributed Land Information Networks

QLIS requires that its land information network combine the advantages of centralised and decentralised processing methodologies while minimising the disadvantages. There is general consensus among land information managers that the concept of distributed networks of land information databases is the most promising approach at this time.

In this design, land information is acquired and maintained by the agency which has custodian responsibilities, but the information is available to other agencies through the network as required.

Consistent with the Operating Philosophy described in Section 1.2, QLIS employs a distributed land information management approach. This can be technically described as a collection of land data that logically belongs to a single system, but is spread across physically dispersed computers interconnected by communication facilities.

4.2 Communication

The implementation of the QLIS concept requires an effective means of obtaining information from several remote databases which may be using different proprietary software and hardware.

Communications problems for spatial data handling result from the immense volume of data involved. The solution lies in either the compression of data or the creation of faster networks, or a different philosophy of data distribution (eg bulk distribution). Although there may be a limit on how much data can be compressed, spatial data handling is at the forefront of data compression development and further advances are expected. However, the upper limits of network speed are considered to be a long way off, and the data distribution philosophies are still in their infancy.

Factors such as the growth in data volumes, the need for data sharing, secure data transfer, and the increasing demand for real time systems, necessitate the provision of an efficient data communications facility for the Technology Infrastructure.

5. QLIS Institutional Infrastructure

The Institutional Infrastructure consists of established customs, laws, procedures and the organisational structure needed to support them. Figure 9 describes the environment comprising the Institutional Infrastructure.

Political	the political environment alludes to the way in which agencies implement QLIS management policies.
Legal	the legal environment refers to the body of rules by which the functions and operations of QLIS are regulated.
Administrative	the administrative environment entails making decisions in support of QLIS objectives and organising resources to implement those objectives.
Social	the social environment consists of the human resources available and the levels of technical and professional skills required for QLIS.
Economic	the economic environment requires that the tangible and intangible benefits of QLIS far outweigh the costs.

Figure 9: Environments comprising the Institutional Infrastructure

Essential characteristics of land information management are:

- data is identified, measured and costed at each stage in its life cycle (necessity determination, collection, processing, storage, use and distribution);
- the life cycle of the data is explicitly planned to ensure that requirements are realistic;
- costs are budgeted and properly balanced against other resource costs; and
- data and systems are quality audited to ensure that custodians remain accountable for the efficient and effective provision of land information.

At present land information management in Queensland is characterised by a complex set of institutional arrangements containing both a vertical structure according to the tiers of government and a horizontal organisation comprising departments, agencies and authorities with different areas of operation and overlapping responsibilities. The QLIS concept depends on the Institutional Infrastructure being defined with responsibilities allocated to specific agencies. This necessitates a broadening of institutional horizons through active participation by individual agencies in forums such as the Queensland Land Information Council, which is explained in more detail in Section 5.3.

To optimise the use of land information in Queensland, its management must be promoted above the agency level so that land information is seen as a Government wide asset. There have recently been some encouraging initiatives moving towards this view of Institutional Infrastructure.

5.1 Information Policy Board

The Queensland Government has recognised that information is a strategic resource. This is evidenced by the creation of the Information Policy Board (IPB). The Board has identified certain information systems which have Government-wide application. It has defined these systems as strategic systems because of their information content and relation to key activities and initiatives that have cross-agency implications. QLIS has been designated as a strategic system for land information. There are other strategic systems within Government being developed and coordinated by Lead Agencies with delegated responsibility on behalf of the IPB.

5.2 QLIS Lead Agency

A Lead Agency is an operational unit of Government which the IPB has designated as having defined managerial, and where appropriate, operational responsibilities for the performance and development of a specific strategic system. The Department of Lands is the IPB Lead Agency for QLIS. The Lead Agency has the responsibility for coordinating the development of QLIS, which includes the components of the Infrastructure.

The IPB Lead Agency Agreement for QLIS is substantially different from other agreements, such as the Queensland Government Financial Management System (QGFMS) or Human Resources Management System (HRMS) agreements, which are for single systems. Under the Lead Agency Agreement for QLIS the Department of Lands has responsibilities associated with land information system coordination and planning, standards, financial arrangements, user interests, interdepartmental consultation and establishment of agreements [Department of Lands, 1992].

5.3 Queensland Land Information Council

A Queensland Land Information Council (QLIC) was established to provide continually improving policy advice on land information matters. QLIC is a high level multi-agency body whose principal aim is to ensure an integrated and coordinated approach to the development of Land Information Systems in Queensland. QLIC provides the vital forum for effective liaison by the Department of Lands in its role as Lead Agency. QLIC also promotes the need for appropriate training and education in land information use and management.

5.4 QLIS Service Agreements

Coordination and operation is to be based upon signed agreements between participating QLIS agencies.

The Department of Lands, as the Lead Agency for QLIS, is responsible for three different types of Agreement.

1. Agreement for Public Access

To negotiate and maintain a service agreement with the Centre for Information Technology & Communications (CITEC), or with another similar provider, to provide and manage information processing and communications infrastructures facilities to support public access to QLIS;

2. Agreement with Theme Coordinators

To coordinate the organisation of information according to principal themes and delegate responsibility to Theme Coordinators where relevant. A separate Theme Coordinator Agreement will be developed between the Lead Agency and the Theme Coordinator specifying the responsibility of both parties.

3. Agreement with Custodians

To develop with each agency providing data to QLIS, a standard custodian agreement specifying the responsibilities of each party in relation to the operation and performance of QLIS. It is a requirement that custodian agencies accept responsibility for provision of information;

5.5 QLIS Reporting Arrangements

The reporting arrangements for QLIS are depicted in Figure 10. The key ingredient to this process is coordination on the part of the Lead Agency and cooperation on behalf of all government departments and other land information agencies, reference groups and the public.

One of the important functions of the Lead Agency is to ensure that roles and responsibilities defined for QLIS are effectively carried out in the short term. In the longer term, the institutional infrastructure will evolve in harmony with the development of QLIS.

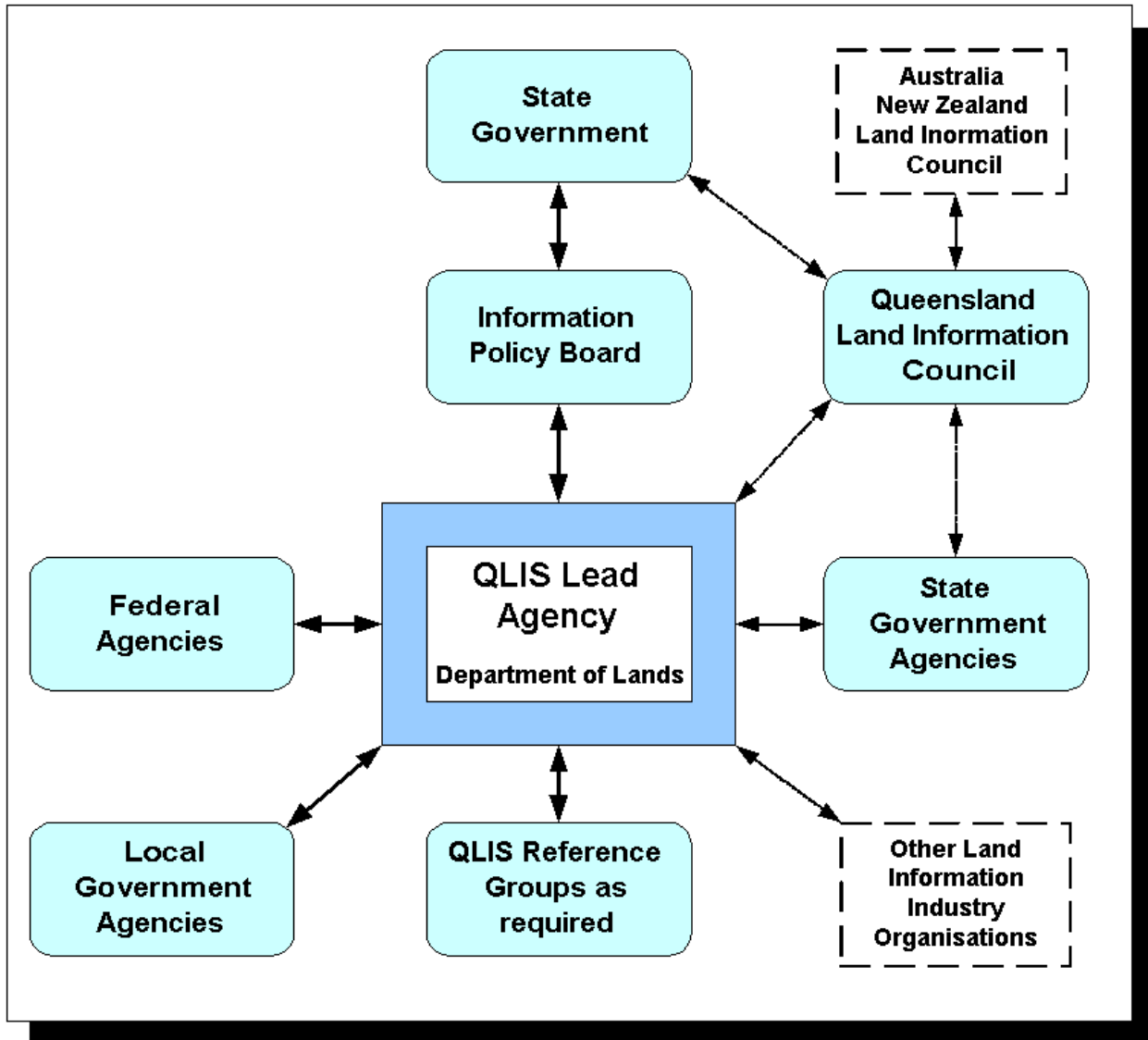


Figure 10: QLIS Administrative Reporting Arrangements

6. Information & Technology Infrastructure Standards

Agreement on standards relating to the management and use of spatial data and information technology is critical to the implementation of QLIS. At present there is a large number of vendor supported and agency specific standards in use across government and in the private sector. QLIS standards will facilitate an open systems environment that will allow users to gain more benefits from their own systems and from the systems of other land information agencies.

The standards which satisfy user expectations and support QLIS cover a wide field. The classification of standards can be viewed in a number of ways. Whichever classification is used there is some overlap as they are not seen as mutually exclusive, however for QLIS purposes they are consolidated into four classes.

Existing standards may be specific to particular government departments or they may be used for inter-agency applications, but they may still be used without consistency. However, for particular purposes they can be very effective and efficient. Standards are required which incorporate or replace the current standards. This will allow wider access to land information and less confusion and effort in the exchange of information between organisations. The integration of systems will be facilitated and this will result in transparent data exchange between multi-vendor systems, further reducing the training and user education effort.

The implementation of standards which cut across most land information applications will involve some compromise on the part of users. Although standards will change over time, they must always be upwardly compatible, provide users with a more stable operating environment and remove dependence on the capabilities of individual vendors.

6.1 Definitions

A uniform understanding of terms and definitions must be achieved within the land information management community. Generally, there is little understanding of key words outside the users own discipline or area of expertise, eg. terms that are used in relation to natural resources may have a different meaning when used in the context of the cadastral information. Synonyms and professional jargon must be catered for.

6.2 Software

Software standards can be categorised into a number of environments, eg. operating system, user interface, programming languages, data management, data interchange, graphic presentation, applications, plotting and network services. QLIS will address emerging software standards consistent with its agreed operating philosophy (see Section 1.2).

6.3 Data Specifications and Formats

Data is the most important component of QLIS. Building and maintaining spatial databases is the most expensive and time-consuming portion of land information systems development. To realise the maximum benefit from this investment, agencies and users must have certain specified standards to replace the myriad that now exist. Examples of these may cover spatial data transfer, data quality and feature classification. In general, these types of data standards are the least formalised with the pattern of their acceptance due to practical, professional or historical differences between users.

6.4 Communications and Hardware

The standards that need to be developed through QLIS cover spatial and textual data communications and systems operations. Hardware vendors and major clients have played a major role in the development of hardware standards which are to a large extent well established. Standards include storage media and data transfer.

7. Conclusion

Land Information is the most fundamental information resource and is vital to the community. Opportunities to improve access to this resource must be pursued. A coordinated approach to land information management and the development of land information systems is essential to ensure maximum benefit to the community.

Through this QLIS initiative, Queensland is now focussed on linking existing databases into land information networks, thus allowing application software and decision support tools to use available land information more effectively. This will result in a broad information services industry.

8. References

ALIC (1988), *National Strategy on Land Information Management*, publication by the Australian Land Information Council, 1988.

Department of Lands (1992), *Lead Agency Agreement for the Coordination of the Queensland Land Information System (QLIS)*. An agreement between the Information Policy Board and the Department of Lands, July 1992.

Eden R.J and Lennon P.J (1990), "*Towards a State Information Network*", Presented paper GIS International Symposium, Brisbane, 16-20th September 1990.

McLaughlin J.D. and D. Coleman. (1990). Land Information Management in the 1990's. *World Cartography*. Vol XX, pp. 136-148.

Palmer, D. (1984). *A Land Information Network for New Brunswick*. Fredericton: Technical Report, Department of Surveying Engineering, UNB.

Qld Gov't. *Information Technology Review* (1990). Final Report. September 1990.

QLIC (1991a). *QLIS Charter Development - Stage 1 Preliminary Planning*. Working Party Report, November.

QLIC (1991b). *Interim Land Related Systems Inventory*. Working Party Report.

QLIC (1992). Draft *QLIS Concept Paper*, QLIC Draft, April 1992.