Towards a Single Cadastre in NSW: The Why and How

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ABSTRACT

Availability of cheap and effective Geographic Information Systems (GIS) has resulted in a wide range of government and non-government organisations utilising these systems. The range of spatial datasets held by these organisations has increased dramatically as has the desire to access this data by an increasing array of consumers. The cadastre is the basis of a wide variety of spatial datasets without which they become almost meaningless. In New South Wales the cadastral base for these systems has been purloined from its original centralised origin and is now managed separately by a range of authorities and organisations. Additionally the quality of the cadastre has been found to be lacking, leading to individual GIS managers within these bodies implementing uncoordinated changes to the original. The end result is a plethora of detached cadastral databases that respond to individual needs and cannot be utilised to provide a single point of reference in order to allow access to spatial data beyond the bounds of the specific cadastres to which they relate. The benefit of a single cadastre to which the full range of spatial datasets relate is difficult to estimate, not because it is limited but rather it is limitless. A system that integrates all functioning cadastres into an apparent single entity needs to be agreed on and implemented. This paper outlines the aspirational goal for a single state-wide spatial information system that will provide an increasing array of 'aligned' spatial data viewable by a range of customers at no cost through multiple entry points. It explains in lay terms what such a system would look like and how it would be an improvement on the current situation. It also provides examples demonstrating the value of such a system and explores a range of initiatives that might be implemented to develop it.

KEYWORDS: *Cadastre, spatial information, GIS, standardisation.*

1 INTRODUCTION

This paper provides a 'plain English' discussion relating to the need for an agreed state-wide common electronic cadastre. Its purpose is to stimulate discussion and challenge those organisations currently using individualised cadastres to accept the obvious benefit that a common dynamic (constantly updated) cadastre would provide. This paper discusses the how's and why's and outlines the considerable benefits and opportunities that would flow from the availability of an up-to-date, common, state-wide cadastre for all levels of users. It examines commercial opportunity and 'opening the door' to private enterprise to use the common cadastre as a base layer for commercial application.

While not providing all the answers and certainly being likely to raise differences of opinion, its primary aim is to open up the topic for discussion and promote action. This paper does not enter into the technological processes needed to achieve a common cadastre, which (while complex) are certainly available, because so often such discussion becomes incomprehensible

to non-technocrats and mitigates against action.

2 THE CADASTRE

2.1 Who Owns the Cadastre?

Answer: Surveyors? This is a simplistic answer, but worth examining. All cadastral boundaries in NSW have been created or defined by surveyors, both government and private. Although many have left this earth, many remain, or at least the companies they established or worked for remain. In city areas, almost all boundaries have been defined by private surveyors.

If and when any commercial value is placed on cadastral information obtainable through Geographic Information Systems (GIS), should the surveyors who invested their intellectual property into providing this information receive a return? This is a particularly interesting question for those talking about a survey accurate cadastre, as one presumes this accuracy will (at least in part) be established from coordinate data and measurements included on Deposited Plans produced by surveyors for other purposes.

2.2 Who Should Manage the Cadastre?

Surveyors are the people who understand the complexity of the cadastre and have the ability to manage it as a state-wide dataset, particularly if it is to become a dynamic dataset, rather than a static representation of property boundaries at a point in time (more on this later). Certainly the profession to manage the cadastre is the surveying profession. Have you ever tried to explain ‘projections’ to other professions?

2.3 The Cadastre is Dynamic

This fact is the nub of the problem, many users and administrators in various government authorities do not realise or acknowledge that an accurate representation of the cadastre is dynamic and changes virtually minute by minute.

Spatial changes to the cadastre stem from:

- Boundary changes, e.g. subdivision, consolidation and boundary amendment (daily changes).
- Local adjustments to improve accuracy (the timing of changes can be managed).
- Overall adjustments, e.g. projection and geodetic driven changes (the timing of changes can be managed).

Informational changes relating to land parcels that are part of the cadastre change even more frequently:

- Ownership.
- Encumbrance on title.
- Valuation information.

Static cadastres are therefore a potential disaster as they provide out-of-date data, causing confusion and potentially financial loss. For example, a recent visit to the cadastre-based planning information system available through a major NSW government department

revealed incorrect out-of-date property and planning information resulting from a recent subdivision not being recognised. As councils with GIS that is based on the cadastre and used to provide property and planning information know, the cadastral information and related data must be maintained or there is a real risk of legal action.

2.4 Who Uses the Cadastre?

Users of the cadastre fall into two basic categories, information generators and information users.

Information generators are those who use the cadastre to present spatial information, including councils (e.g. zoning maps), government authorities (e.g. Rural Fire Service, bushfire-prone land maps), instrumentalities (e.g. telecommunication companies, service location diagrams) and private enterprise (likely to increase).

Information users are those who examine information sources based on the cadastre to find out land related information, e.g. builders, planners, public enquiry, valuers, surveyors, engineers, marketing people and just about everybody else.

2.5 What Type of Information is Defined by the Cadastre?

Just about every set of spatial data is defined, or is locatable, by reference to cadastral boundaries. In addition to the spatial definition of information, textural attributes relating to land parcels form part of the cadastre.

2.6 How Accurate Does the Cadastre Have to Be?

The current cadastres in use have widely varying accuracies, and in many areas are not fit for purpose. Country towns with 10- to 20-metre shifts are not uncommon, and rural area boundaries that vary widely from on-ground boundaries are the norm (as can be seen from virtually any overlay of cadastres onto now fairly accurate pixel-adjusted air photography). Within city areas accuracy varies but is mostly fit for purpose at the 1-metre level.

While survey accuracy is desirable and actually achieved in some local cadastres (e.g. Sutherland Shire), it is a long way off on a state or city wide basis and an impractical goal in the short and medium term. It would be nice to achieve sub-metre accuracy across the state but even this is a big ask in the short to medium term. However, it is certain that delaying a common cadastre to wait for acceptable accuracy attainment is unrealistic. Instead, the 90% rule should be applied, i.e. introduce and utilise the available cadastre and improve it over time.

If an agreed dynamic common cadastre is achieved, accuracy improvements can be introduced as information becomes available. This will allow improvement in accuracy on a local ‘as needed’ basis as well as facilitating programs for overall or more widespread improvement. A program to achieve optimal accuracy, perhaps on a variable basis (e.g. 0.1 m in cities, 0.5 m in suburbs and towns, 2 m in closely settled rural areas, and 5 m in remote areas), could be easily developed.

2.7 Spatial vs. Textural

One of the most significant changes in information management stemming from the GIS

revolution was the ability to store and manage information spatially rather than in textural databases. Management and quality control of large textural data bases is (was) certainly a nightmare in local government where up to 100 and sometimes more attributes had to be recorded against land parcels in order to meet statutory obligations (planning and rating information). Imagine checking 25,000 land parcels in a textural database to see if they were bushfire-affected or not (i.e. comparing a field of numbers on a screen with a paper map). Obviously, errors are (were) frequent.

Compare this with simply asking which land parcels in the cadastral layer of the GIS system are intersected by the bushfire-affected land polygon. Or simply asking that question on a land parcel by land parcel basis as an enquiry is made. Better still, allow the user to view the 'map layers' directly and obtain an enquiry report.

Additionally, textural information relating to the land parcel can be 'attached' to the relevant polygon and delivered by enquiry through the GIS (e.g. owner and address information). While textural databases with land-related information continue to exist, this seems to be a legacy of textural information databases woven into organisational operating systems. The fact is maintenance and quality control of land parcel relevant textural information is now achievable through the GIS.

The current duplication of information (both spatial and textural) in GIS and textural databases is inefficient and leads to increased data management costs and errors. Where information can be spatially represented or directly attached to a land parcel in a GIS, this GIS information should be used as the single source.

3 A SINGLE DYNAMIC CADASTRE

3.1 Why Have a Single Cadastre?

The need for a single cadastre is obvious, recognising that the cadastre is dynamic and it is therefore essential to update the spatial information and textural data as it changes. Many of the cadastres in use are fairly static and differentially updated (if at all). Multiple cadastres prevent single-source access to *all* available information. Many cadastres and their respective information datasets are not directly available to users.

A single agreed cadastre, available to all *information generators*, that is current in terms of its graphic representation of land parcels would form a consistent base for all spatial information datasets. It will reduce duplication and maintenance, resulting in overall cost savings.

3.2 What Information Systems Utilise the Single Cadastre?

This list of information systems utilising a single cadastre is endless. Some examples are given below.

Systems providing access to cadastral data:

- Lot and DP details.
- Location of property boundaries.
- Dimensions, size and shape of properties.

Systems providing access to subsidiary spatial datasets:

- Zoning.
- Hazards.
- Planning information.
- Vegetation mapping.
- Soil mapping.
- Land form (e.g. LiDAR and contours).
- Transport systems.

Interactive systems allow interrogation of spatial and related textural systems relating to land parcels. These are already in use by a range of authorities but can be better managed and provide better service through a common cadastre based system. Current examples include ePlanning systems, issuing planning certificates online, SCIMS (Kinlyside, 2013) and service location.

A significant single feature of a state-wide cadastral database linking planning, hazard, service and environmental information (all of which is currently available in disparate systems) would be the ability to spatially integrate layers of information on a state-wide (or regional) basis. A simple planning example would be to find the number of properties with an area greater than 800 m^2 within land zones R2 (low density residential) not affected by flooding or bushfire hazard with a slope of less than 15%.

Currently queries such as this just cannot be dealt with at the state or regional level, significantly limiting planning at that level. Future users (both public and private) should be able to access the common cadastre to provide interactive systems in accordance with agreed (and where appropriate contracted) protocols. Fee for service is an obvious factor.

3.3 What Should a Common Dynamic Cadastre Allow Users to Do?

Information generators should be provided with access to an up-to-date state-wide NSW (and aspirationally Australian) dynamic cadastre (or the section of the cadastre to which their use relates) as well as an agreed procedure and mechanism for adjusting cadastre-related information as changes occur. This protocol and mechanism is the essential management element if a single cadastre is to be developed and implemented.

Information users should have multiple entry points available, but no matter where you enter a spatial information system based on the common cadastre, you should reach all available datasets:

- All data available once you enter a system.
- Seamless access (you do not know where the cadastre comes from; you just know it is up to date and can determine the accuracy metadata).
- No passwords required.

3.4 How to Build and Maintain a Single Dynamic Cadastre?

Take the best available sections of the cadastre and ‘stitch it together’ from the individual sources to form a composite cadastre. Each source body should be responsible for maintenance (which they do now anyway). Currently it seems that the only authorities using and maintaining a cadastre are a number of local councils. These would act as sources for

sections of the dynamic cadastre.

The State would be the de-facto manager of the single dynamic cadastre, supporting it where other authorities do not have the capacity to do so. Maintenance would be carried out on an agreed basis and the updated sections projected into the composite cadastre. Initially this update could be on a weekly basis, but as systems evolve it would head towards real time.

3.5 How Can Subsidiary Layers Be Maintained?

As previously stated, many information layers 'hang off' the cadastre, i.e. spatial information is defined by polygons that are based on the boundary locations within the cadastre. This means that any change in location of boundaries in an agreed common cadastre need to be reflected in the subsidiary layers of spatial information. This is why many authorities (mainly councils) have been loath to change the base cadastre other than updating for individual lot creation and consolidations. Councils with a comprehensive GIS based on the cadastre already maintain these subsidiary information layers and related textural information as changes to their respective cadastres occur. This process is not cheap but is essentially the same or less than previous manual systems of information recovery and leads to huge performance improvement, e.g. planning certificates available online in real time, ePlanning systems and improved land management (rating) systems.

The cost to maintain these datasets is approximately $5-10 per parcel per annum for councils using comprehensive GIS with multiple subsidiary layers. Some authorities/bodies can manage their respective subsidiary layer information, others cannot (opportunity for service provision at cost for a central government authority or private enterprise). What is certain is that there should be only one 'layer' of like subsidiary information available and its maintenance should be in accordance with an agreed protocol.

Classic examples of multiple layers of essentially the same information are land zoning maps in NSW, some maintained and some not. A single dynamic cadastre and agreed management and maintenance protocols between information providers would eliminate duplication (save costs) and provide users with updated and correct information. Where this information is statutorily based (e.g. zoning maps and bushfire-prone land maps), legislative changes will be required.

3.6 Legislation Required

Legislative change is needed on several fronts. Legislation is required to allow formal reliance on computer (GIS) generated spatial data. The classic examples are zoning maps and bushfire-prone land maps. Both are primarily used in their GIS form but statutorily required in hard paper (or like) format. Legislation should also require statutory information that can be expressed spatially to be so expressed rather than as a written specification. In the planning sphere alone this would cut red tape dramatically, e.g.

- A single map layer showing where complying development is permissible rather than a bundle of written restrictions most of which can be spatially expressed.
- State Environmental Planning policies being expressed spatially (as a map layer).

3.7 When?

A 10-year timeframe has been talked about. However, in the author's opinion, 10 years is 8

years to long. Project times greater than 2 years are simply unrealistic politically, financially and technologically. Delivery of outcomes must commence within 2 years or 'it's a dead duck'. Initial delivery might be limited to a number of significant datasets and services (i.e. low-hanging fruit) with a clear program to deliver increasing functionality and accuracy over time. The target should be one year to plan and one year to commence delivery.

3.8 How?

A project plan needs to be developed. The following tasks might be included but not necessarily in this order:

- Identify information providers that manage their own cadastres.
- Identify information providers that rely on others to maintain the cadastre.
- Identify information providers that rely on an unmaintained cadastre.
- Develop a protocol for a dynamic composite cadastre.
- Develop a protocol for maintaining the composite cadastre.
- Develop a protocol for maintaining subsidiary layers.
- Specify the procedure and requirements to produce and maintain a composite dynamic cadastre.
- Specify the procedure and requirements to maintain subsidiary layers relating to the composite dynamic cadastre.
- Prepare a stakeholder agreement.
- Get buy-in from users.
- Identify required legislative changes.
- Prepare a cost-benefit analysis.
- Prepare an implementation plan.
- Establish a timetable.

This needs to be followed by implementing the plan.

4 COMMERCIAL OPPORTUNITY

Commercial opportunity abounds on several fronts. Certainly if action is not forthcoming and immediate private enterprise is likely to recognise the opportunity and enter the market place on a selective customer-focused basis, i.e. setting up systems serving high-use areas and ignoring areas where costs outweigh income (rural NSW).

Where authorities do not have the capacity to manage and maintain a section of the dynamic cadastre or subsidiary layers, a de-facto manager should be established. Given current roles and skill sets, the only public authority with capacity is LPI. However, it should be recognised that private enterprise is looking over the shoulder.

Given the considerable benefits such a system will realise in reduced duplication and improved service levels, this service must be funded either directly from those obtaining the service (in lots of cases this will be 'poor' country councils) or State Government (at least initially until other commercial opportunities can be developed and exploited). Public sector and private enterprise interactive systems based on the common cadastre will provide a range of commercial opportunities.

4.1 Layer-Related Advertising

Every time a layer is accessed, opportunity is available for related services to be advertised on a spatial basis. For example, the zoning layer is viewed in in a specific Local Government Area (LGA). This enables a 'pop up' advertisement *Find a Planner*, and when the user clicks (at their discretion), ads for town planners servicing this area are provided. The planners pay for this service. Similarly, this would work for bushfire consultants, engineers, builders, certifiers. More sophisticated systems can obviously be developed relating to associated textural information.

4.2 Sale of Information

Sale of information can include:

- Sale of title and land-related documents (e.g. Deposited Plans, Certificates of Title, dealings).
- Planning certificates.
- Service diagrams.

4.3 Applications with Associated Fees and Charges

These applications can include:

- Application lodgement facilities (including private enterprise).
- Obtaining quotations for services.

5 CONCLUDING REMARKS

The cadastre is a valuable item, however ownership is unclear. A common dynamic cadastre is the logical next step. It would provide the base layer for a range of spatial and related information systems that will improve productivity and reduce costs. Commercial opportunities utilising the cadastre abound. The technology is available. Legislation is needed. Gesta non verba (deeds, not words).

This will involve the following:

- Establish ownership of the cadastre.
- Achieve agreement between stakeholders as to the need for a common cadastre and define roles and responsibilities.
- Develop a staged plan to make it available.
- Develop systems and procedures to ensure subsidiary information layers are consistent with the cadastre.
- Identify and develop commercial opportunities.

REFERENCES

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