3dQLD- Building the boundaries and positioning Queensland

Image courtesy of Brisbane City Council; Virtual Brisbane 20 April 2012

Discussion Paper

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Executive Summary

Imagine walking on to a multi-million dollar building site, GPS in hand, and being able to advise your contractor exactly where the existing utility services intersect with the building design (in 3 dimensions) and the boundary line. At the same time being able to pull up on screen where the 2011 flood reached in relation to your property boundary.

Imagine being in the field far west of Charleville and being able to advise your client of exactly how far inside their boundary that water bore is located, and where the petroleum exploration permit lease area intersects with their fence line.

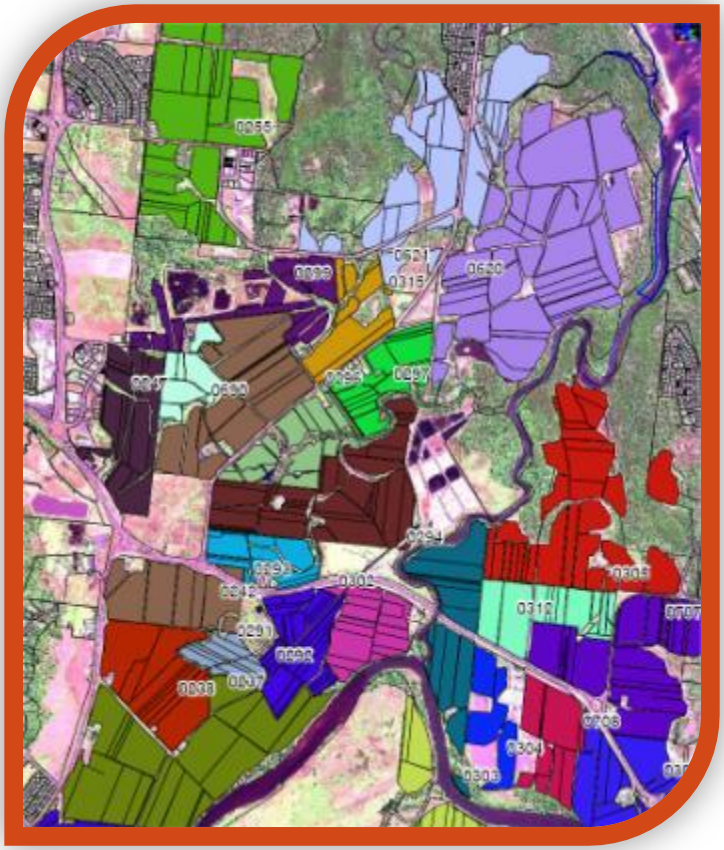

Image courtesy of True 3d, 8 Mar 2013

We can easily imagine the technology, so why are these scenarios so complex and time consuming to put into practice? Because we don't have all the elements in place that are needed to build a survey accurate spatial data infrastructure in Queensland.

With the technology readily available there is a growing expectation from the community and demand from industry that the state's property boundaries and associated data sets (the cadastre) are digitally available in a survey accurate state.

Farmers in Queensland are using machine guidance to farm to centimetre accuracy yet we can't provide them an accurate digital boundary framework that delivers investment confidence they are within their titled boundaries. The 3dQld initiative will enable significant efficiencies in infrastructure delivery, negating major cost overruns such as occurred in the Ipswich Motorway project due total lack of survey accurate position of mining infrastructure. 3dQld would incorporate statutory data sets of mine surveys and tenure.

Sophisticated handheld devices and Global Positioning Systems (GPS) are already widely used by the public, but what is needed to make the dream a reality is a survey accurate spatial data infrastructure for Queensland.

Right now, Queensland has the opportunity to take greater advantage of the currently under utilised state asset that is 'the cadastre', and re-envisage it as something more useful, more efficient and more productive to achieve a more prosperous Queensland.

The immediate streamlining and modernisation of land surveying practice in Queensland is essential to take full advantage of technology and enable the emergence over time of a positionally survey accurate cadastre and so realise wide ranging economic and social benefits for the community of Queensland.

The aim of the *3dQLD* (three dimensional Queensland) is to build on successful centuries old land surveying practice and law, transitioning to a modernised and efficient system suitable to meet the needs of the 21st century. *3dQLD* will be realised in part by land surveying professionals incorporating survey accurate, three dimensional measurements on the earth into their everyday practice and presenting this in a digital format. This will create a 21st century digital cadastre capable of supporting the changing needs of the community for generations to come.

This discussion paper aims to outline the vision for a *3dQLD*, the elements that are needed to make it happen, and the possible impacts of this reform. It will outline how utilising the power of an accurate digital cadastre can fuel economic growth, sustainable development and environmental and social harmony in Queensland into the future.

About the Authors

This discussion paper has been prepared by a *think tank* of senior spatial and survey professionals from both private and government sectors. It doesn't purport to represent the views of any professional or industry group, but presents for the consideration of fellow surveyor and spatial professionals the need to consider and support reform. The *Think Tank* consider it critical that we as professionals take a leading role in ensuring the cadastre will meet the needs of and deliver prosperity to the people of Queensland into the future. Members of the *think tank* are keen to see this become a key topic of discussion across the profession. Feedback is invited to Lee Hellen lee.hellen@landsolution.com.au or Peter Sippel peters@thg.com.au

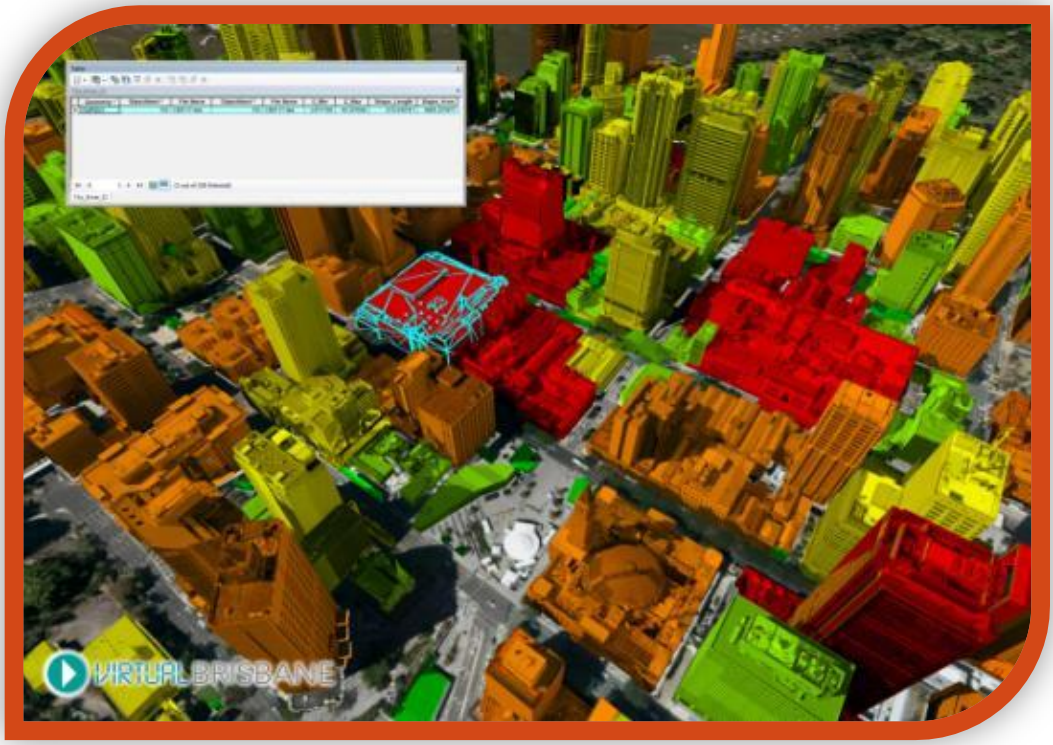

Image courtesy of Brisbane City Council; Virtual Brisbane 20 April 2012

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What will *3dQLD* mean to Queenslanders?

3dQLD is about the efficient capture, preservation and mainstream use of reliable spatial data. It is about 'Spatially Enabling Society'. 3dQLD will build upon current advances in technology and facilitate enhanced connectivity and data sharing of a wide range of spatial data sources. In doing so it will not only support current business but also provide new opportunities to the business community. 3dQLD will create a modern Spatial Data Infrastructure (SDI) for Queensland.

The commercialisation of positioning and information technology has meant an increasing number of people and businesses now rely on digital maps and global positioning to better understand the world they live in. Farmers, builders, miners, planners and designers rely and trust positioning and spatial information technology to visualize and manage activities that happen in the real world.

Computer simulated environments such as augmented and virtual reality that simulate a physical presence in the real world are fast becoming accepted management tools in the minds of the community.

Images courtesy of www.bdcnetwork.com ,2013

Certainty and a high level of trust in the use of spatial information is critical to realising the benefits of this technology and the positive effect it will have on our states economy.

Failure to embrace this potential and utilise the technology readily available reduces the accuracy, reliability and productivity of our spatial data resources.

For the community *3dQLD means:*

- ✓ *Providing three dimensional certainty or point of truth at a local level for all forms of spatial data.*
- ✓ *Accelerated improvement in the accuracy and usefulness of the current Digital Cadastral Data Base (DCDB).*
- ✓ *Efficiency for the consumer by reducing duplication with current survey processes.*
- ✓ *An accurate infrastructure for simulation of the real world through spatial information technology.*
- ✓ *A more open and transparent system that consumers can visualise and understand, and that interacts with technology they are familiar with such as Google earth and global navigation systems.*
- ✓ *Retaining the integrity and security of the current land boundary system.*

For land surveying and spatial professionals *3dQLD means:*

- ✓ *Facilitating a refinement of current practice and thinking in survey methodology.*
- ✓ *Creating a new sense of purpose to enhance our state's cadastre in the 21st century.*
- ✓ *Modernising our approach to how land surveying professionals acquire and present information.*
- ✓ *Enabling spatial professionals to become the custodians of a modern cadastral database.*
- ✓ *Playing a leading role in assisting the community in the digital simulation of the land and the built environment.*
- ✓ *Facilitating improvements in data management and the mainstream use of spatial information in the modern digital world.*

What will underpin the successful transition to a *3dQLD* vision?

*The Department of Natural Resources and Mines, th*e Land Titles Registry and Registered Land Surveyors are linked by state legislation to operate and maintain the cadastre. Through healthy government and private industry collaboration we have the ability to create a highly accurate multi-dimensional cadastral information dataset (*3dQLD*) for Queensland. With better integration and an improved regulatory process it is well within our reach to deliver real world survey precision to the desktop or portable device of anyone in our community.

The *3dQLD* revolution fundamentally consists of moving from a definition of the extent of ownership that is based on two dimensional physical monuments in the ground with little positional accuracy (for example pegs and fence posts) to a definition of property boundaries based on highly accurate geographic measurement capturing a third dimension (height). Pegs and fence posts will simply be the temporary markers or physical identifiers of the extent of land ownership. This change in thinking and process will facilitate with time a transition of the functioning century old land cadastre system into a more modern efficient and dynamic digital dataset that will better serve the future needs of the community.

Systems for two-way transfer or sharing of spatial digital data will also need to replace the current paper systems. Steps are currently underway to facilitate this change though the state government ePlan.

The ePlan digital plan lodgment process currently being developed by DNRM will underpin the migration from paper to digital. Further investment in this system will provide the opportunity to eliminate duplication within the current survey process and facilitate greater two way communication of spatial information for land surveyors and other property professionals.

What will be the future targeted activities of *3dQLD* reform?

The four economic pillars of the Queensland economy will experience significant benefit from *3dQLD* reform.

Construction

- integration with machine construction systems, planning, design, impact assessment, reduction in building approvals and assessment.

Agriculture

- integration with automated farming, land use planning, Land tenure, **management of** water rights, more sustainable farming management and preservation of critical cropping lands.

Mining

- planning, health and safety, tenure, investment, exploration, reduce regulatory process
- certainty in position with respect to property ownership and overlapping tenures

Tourism

- better managing effects of flooding and rising sea level, planning and approval processes.

The current uptake of spatial information in these sectors of the economy is high. New opportunities will emerge in these areas of the economy as trusted sources of spatial data are shared through the 3dQLD vision. Spatial information will become more readily available and far more useful than it is currently for those who invest in spatial information technology.

Empowerment of business and the community in the use of spatial information will see enhanced productivity and the greatest return on investment. Collectively, practicing land surveyors and the Department of Natural Resources and Mines (DNRM) will seek the input of various stakeholders in the Queensland economy to accommodate the future need of these sectors in the reform process.

The benefits of *3dQLD* will span all state and local government departments through platforms such as Google™ Globe. It is possible to envisage a future where the enhanced 3d cadastre will be able to be accessed by anyone in the community with access to a desktop computer or portable mobile device.

What are drivers to implement *3dQLD*?

All legal cadastres evolve and change on a daily basis. They are dynamic assets unique in their age, geographic area and complexity. *3dQLD* will utilise leading research from Australia and overseas to implement an industry leading data infrastructure to an open standard that will enhance and support the current legal cadastre.

The Queensland cadastre is an under utilised community asset due to its current limitations in positional accuracy. The opportunity the 3dQLD reform presents is to give far greater meaning of these records to business and government. Reduced approval times and greater certainty in decision making will have extensive benefits to productivity of the Queensland economy.

The threat is that if the integrity of the current land cadastre system is compromised or not brought into a modern context, it may undermine its original purpose of giving certainty and efficiency in transactions of land and land use. A range of different organisations may create their own systems, potentially without the expertise of surveyors, potentially without any inter-operability or consistency, limiting mainstream use and increasing cost for all. This will significantly limit the potential for the state's growth in vital sectors of our economy.

The Queensland economy is currently experiencing signs of these of problems with delays in development approvals, confused mining tenure boundaries and perceived high costs to perform land surveys. Reform is currently needed to restore public confidence in the cadastral system, to eliminate 'red tape' and to reduce the cost of doing business to the community and the Queensland economy.

Image courtesy of www.bakerimpliment.com, 2013.

How will *3dQLD* work?

3dQLD will be a progressive change, and build upon the current land cadastre system. Most who do not have an intimate understanding of the surveying and mapping process may not even notice a change.

As *3dQLD* builds and the volume of accurate three dimensional spatial data increases it will be possible to use *3dQLD* data to correct or improve the limitations of the current Digital Cadastral Data Base (DCDB). This will coincide with increased public use of mapping and hence a greater reliance on the data produced by this reform. *3dQLD* will become critical in adapting the current system to meet the future needs of the community.

For those who administer land, the effects of change will be incremental but significant to their everyday process. A greater utilisation of positional technology and digital data over traditional methodology will inevitably occur over time.

A digital conveyance platform for registration of interests in land will be supported by 3dQLD reforms.

3dQLD will not mean there will be any change in licensing or registration of land surveyors. Steps will be taken to assess competency amongst Registered Land Surveyors to meet the changes in technology and survey process.

3dQLD will aim to limit the reliance on government and encourage a collaborative private - public sector partnership in the future function and maintenance of the cadastral system.

Image courtesy of DNRM, 2013

Who will be critical to implementing the reform?

As certainty in extent of ownership is critical to a functioning cadastre, the task of performing legal surveys must still remain with competent persons. Otherwise there is a risk that the integrity of the system will be compromised.

Registered Land Surveyors are currently the most qualified persons to align or capture the monument based cadastre to bring it into a geographic *3dQLD*environment. Empowering the existing workforce with the skill to maintain the system will be the responsibility of the Land surveying profession working in partnership with government, universities and training providers.

There are opportunities for the community to also add to our Geographic Information Systems (GIS) with the use of Volunteered Geographic Information (VGI). An example may be photographs of flooding events that may alter an ambulatory watercourse. The *3dQLD* vision is about supporting and encouraging community mapping as an additional resource in managing the future of the state.

What will be the costs of the reform?

This is not a money hungry reform that is seeking private or government funding for some large scale project. Initially, it is about using existing resources and expertise in the public and private sectors to our best advantage. Financing for these reforms will be a shared responsibility of registering government authorities and practicing land surveyors.

Over time the land surveying professional may have to invest time and money in new equipment and changes to operation and process. This is inevitable as Surveyors throughout history have adapted to changes in technology and process to be more efficient in the way they deliver their products and services. Besides most land surveyors already have modern geodetic capable equipment or have access to it and the cost of this technology will continue to fall in coming years as this technology continues to be utilised in common practice

Similarly, Investment will be required to develop a system capable of managing and delivering high quality data in a 3d Model. The system will need to be sufficiently flexible to enable integration with other 3d data – for example building models, mine layouts or road networks.

The net result for most land surveying professionals will be a more diverse and efficient service base which can be used for value adding of services with advancement in technology. New business opportunities will arise in a more diverse marketplace.

The Department of Natural Resources and Mines (DNRM) has already completed work that sets the framework for the accurate geographic location of land boundaries. Investment in the systems for data storage and transfer, such as ePlan will need to be further developed and

refined. DNRM has shown a commitment to enabling the *3dQLD* vision through the development of the state control network facilitating a network of Continuously Operating Reference Stations (CORS). Further commitment to the streamlining and modernization of systems and processes to enable use of modern technology has already demonstrated a greater level of accuracy and efficiency in pilot projects such as Flagstone City. Additional projects such as this will be used in developing and refining a process to enable the realisation of the *3dQLD* vision.

Ultimately there will be an on-going cost to state government to maintain the central repository for survey records and to adapt the current survey regulations and systems to accept the spatial data produced by *3dQLD*. These costs could be structured in a way to build on existing reforms which realise increased efficiency across the whole of the public service. Investment in *3dQLD* by government will see greater productivity within DNRM and other government departments yielding significant cost savings in the short to medium term. Governments must be committed beyond their political agendas to these reforms in order to maximise the potential that lies in this digital infrastructure for Queensland.

For the community the individual cost for land surveys is unlikely to change significantly, or over time may in fact be reduced. This is due to the fact that, once established, duplication in survey practice will be significantly reduced and greater efficiencies realised, meaning less time to perform a land property survey. However the alternative if *3dQLD's* vision is not put into practice, survey cost is ultimately likely to increase over time.

Hence there is an overwhelming public need to reform the survey process before the costs of survey becomes out of reach for the average consumer and the integrity of the cadastre suffers as a result.

Image courtesy of Land Solution Australia, 2013

Cost benefits to business and the community will also be realised through more cost effective survey accurate spatial data and considerably less 'red tape'. The ability for the public to access and more accurately assess the quality of spatial information produced by the *3dQLD* reform is envisaged to improve development assessment and reduce planning approval time frames for business and the development sector.

Put into context, for a minimal additional outlay by stakeholders in the public and private sectors a net return on investment can be realised that will have a positive effect on all four pillars of Queensland's economy, ensuring sustainable growth and prosperity into the future.

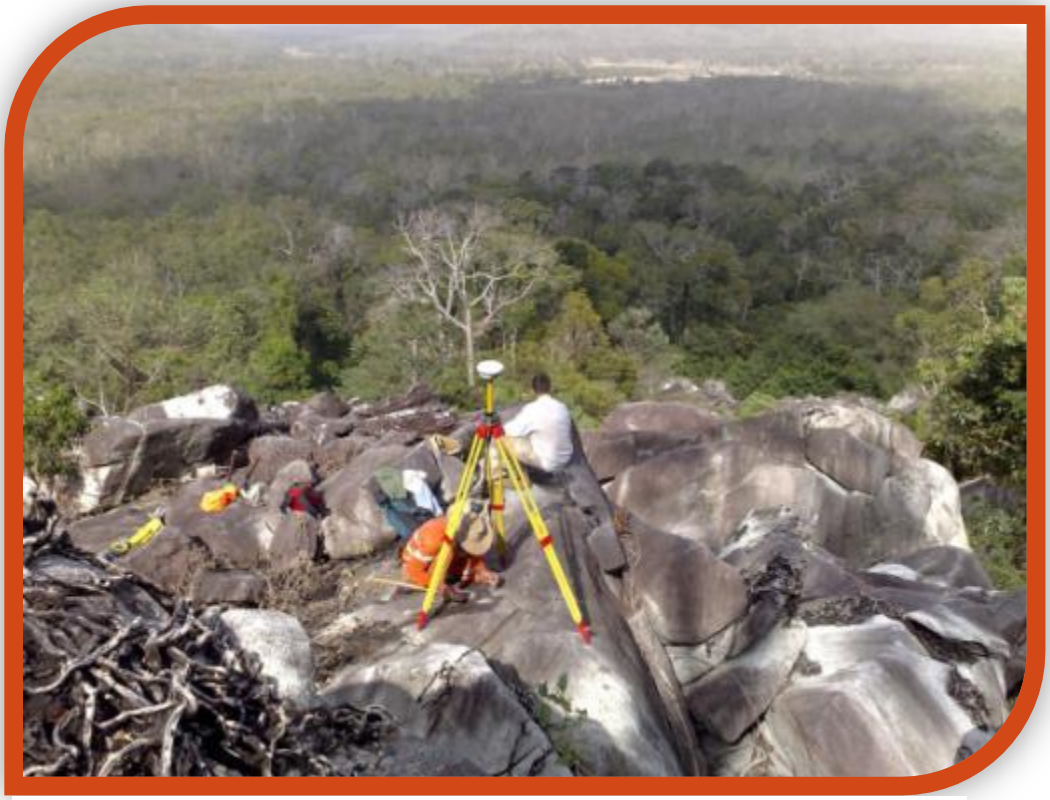

Image courtesy of Terramodus Surveying 2013

The plan for action

As previously mentioned all sectors – private, government and academia - have a role in progressing the 3dQLD reform. For the transition to be successful and the benefits realised a proactive collaboration between all stakeholders and a well managed staged process will be need to be implemented

The action plan for the 3dQLD reform is proposed to consist of the following stages:

- ✓ Build support for a *3dQLD* vision across business, academia, the regulatory body and practicing surveying and spatial professionals in Queensland.
- ✓ Facilitate support of allied stakeholders in *3dQLD* across the four economic pillars of the Queensland economy; development, mining, construction and tourism.
- ✓ Support from the Government to commence reform of the regulations and laws that will support enhancing and modernising the cadastre.
- ✓ Commencement of training programs within the land surveying profession so they can maintain the proposed system with integrity.
- ✓ Testing and implementation of digital plan and data lodgment platforms.
- ✓ Commencement of Surveys to 3d Cadastre in specialist areas - e.g. larger scale master planned development sites.
- ✓ Industry funded research into database systems and methods of distribution and access to *3dQLD*.
- ✓ Drafting of amendments to Surveying practice directions, laws and regulations in consultation with industry and review in partnership with industry.
- ✓ Progression to the *3dQLD* model.
- ✓ Private and Public sector spatial information to be progressively lodged in digital form.
- ✓ Government to continue building 3d cadastre (*3dQLD*) database as private sector lodge digital spatial data.
- ✓ Mining lease and Grazing lease surveys are also added to the digital 3d cadastre - both existing and new tenements.

More information

For more information or to provide feedback discussion or get involved visit the *3dQLD* website:

http://www.3dQLD.org

or contribute to the discussion via the Queensland Surveying and Mapping blog:

http://qldsurveying.blogspot.com.au/

References and recommended further reading

Joint publication of FIG-Task Force on 'Spatially Enabled Society' in cooperation with the Global Spatial Infrastructure Association (GSDI) and with the support of Working Group 3 of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP), *Spatially Enabled Society*, FIG Publication No.58, edited by Daniel Steudler and Abbas Rajabifard, Copenhagen, Denmark: International Federation of Surveyors (FIG), April 2012, accessible online at URL http://fig.net/pub/figpub/pub58/figpub58.pdf

Kaufmann, Jürg and Daniel Steudler, *Cadastre 2014 – a vision for a future cadastral system*, a report for FIG Commission 7 (Cadastre and Land Management) with a foreword by Ian Williamson (Chair), Copenhagen, Denmark: International Federation of Surveyors (FIG), July 1998, accessible online at URL http://www.fig.net/cadastre2014/translation/c2014-english.pdf

Kaufmann, Jürg; Cadastre 2014 - *A Vision on Future Cadastral Systems*, Slide presentation given at the 1st Congress on Cadastre in the European Union, held at Granada, Spain, May 2002, accessible online at URL : http://www.fig.net/cadastre2014/presentation/2002-05-kaufmann-granada-cad2014-slides.pdf

Onyeka, Eugene Chukwunwike, 'Multipurpose cadastre: an under-utilized NGDI dataset, paper TS1.5 as part of Plenary Session TS1- *From Pharaohs to Geoinformatics,* delivered at FIG Working Week 2005 and GSDI-8 Conference, held at Cairo, Egypt from 16-21 April 2005. Programme and Technical Sessions for Plenary Session TS1 accessible in PDF online at URL http://www.fig.net/pub/cairo/tech_programme.pdf. Paper TS1.5 accessible in PDF online at URLhttps://fig.net/pub/cairo/papers/ts_01/ts01_05_onyeka.pdf

Jones, Brent; and Nick Land, Innovative Cadastre and Land Rights Management, paper TSo4A as part of Cadastre 2.0 – A technology vision for the cadastre of the future, delivered at FIG Working Week 2012 - Knowing to manage the territory, protect the environment, evaluate

the cultural heritage, held at Rome, Italy from 6-10 May 2012.Programme and Technical Sessions for Plenary Session TS04A Innovative Cadastre and land Rights Management, Tuesday 8 May 2012 from 09:00 to 10:30, accessible online in PDF at URL http://www.fig.net/fig2012/downloads/tech_prog.pdf. Paper TS04A accessible online in PDF at URL http://www.fig.net/pub/fig2012/papers/ts04a/TS04A_jones_land_5601.pdf

UN Committee of Experts on Global Geospatial Information Management (GGIM), Future trends in geospatial information management: the five to ten year vision, documented summary of thoughts expressed at the inaugural meeting of the Committee of Experts on Global Geospatial Information Management (GGIM), held in Korea in October 2011, accessible online at URL http://ggim.un.org/docs/meetings/Netherlands/Future%20trends%20in%20geospatial%20information%20management%20summary_12April.pdf

Cheung, Paul: (Director, GGIM Secretariat and Statistics Division), United Nations, Department of Economic and Social Affairs, Statistics Division, Statement to UNRCC-PCGIAP International Symposium on *Spatially Enabled Government and Society*, Kuala Lumpur, Malaysia, 15 - 16 February 2012, accessible online at URL http://unstats.un.org/unsd/newsletter/speeches/Feb2012_PC_Statement_UNRCC%20PCGIAP%20symposium_KualaLumpur.pdf