The Technology behind the Integrated Cadastre/Land Registry Solutions in the Canadian Provinces of New Brunswick and Nova Scotia

Greg MULHOLLAND, and Luis PONTES

Key words: Cadastre, Land Registration, Technology, Geospatial.

SUMMARY

CARIS has been involved in providing geomatics solutions for a variety of markets for over 26 years. During that time the firm has been fortunate to work with some of the world's leading organizations in there respective fields. Service Nova Scotia and Municipal Relations (SNSMR) and Service New Brunswick (SNB), the provincial authorities responsible for the land recording processes in the Canadian provinces of Nova Scotia and New Brunswick respectively, are not exceptions to this statement. CARIS has benefited from close working relationship with both organizations by capturing their expert knowledge in the development of cadastral and land registration solutions currently being marketed by the firm worldwide. The advanced thinking of these and other CARIS client organizations coupled with the ability of CARIS to respond with geomatics solutions based on the latest technological advances have enabled client organizations to realize the benefits of this technology at a very early stage. New software components developed through these partnerships and contracts are incorporated into CARIS's capabilities for new projects and when deemed advantageous to the markets CARIS serves, new products are born. This paper will discuss the CARIS development cycle with particular focus on how client expert knowledge has been leveraged to strengthen the firm's cadastral/land registration system software offerings.

The Technology behind the Integrated Cadastre/Land Registry Solutions in the Canadian Provinces of New Brunswick and Nova Scotia

Greg MULHOLLAND, and Luis PONTES, Canada

1. Introduction

The Canadian Provinces of New Brunswick and Nova Scotia have undergone dramatic shifts in the manner in which they manage and disseminate land information. Institutional change, the conversion of land information into digital form, private/public partnerships and guiding visions were all critical precursors to these successes. The advent of complete digital coverage of property mapping and land registry information coupled with progressive technology solutions have led to real time land information delivery of modernized cadastre/land registration systems. The technology behind the software solution built by CARIS (CARIS LIN), a company headquartered in the provinces capital, affirmed that online information service delivery could meet all provincial security and data integrity concerns.The CARIS LIN based online registry service automated the legislative rules and business processes involved with the registration of deeds initially and then developed the functionality to convert to and support a system of land titles.

The development of the software engine (CARIS LIN) behind both SNB and SNSMR's (the provincial authorities responsible for the land administration in the Canadian provinces of New Brunswick and Nova Scotia) land registration systems was designed and built through a very close working relationship between SNB and CARIS. Initial development of SNB's system was awarded to the firm through a series of contracts, each a logical modular component of SNB's target implementation plan. The approach enabled SNB officials to be actively involved throughout each component of the development process while incrementally attaining full system benefits with each module's deployment. CARIS has found that close working relationships with our clients are critical to understanding their needs and respective markets. This approach has led to the development of the CARIS product development process a proven methodology the firm continues to employ to provide the most stable, secure and advanced technology to our current and prospective clients.

This paper will provide a generic discussion of the CARIS product development process and will continue by focusing on our working relationships and delivery of complete cadastre and land registration solutions with/for SNB and SNSMR. The paper will discuss the core CARIS LIN software, some of its value added extensions, and the recent launch of a new product for maintaining digital cadastral maps (CARIS CPD).

2. CARIS Development Process for Products

Most of CARIS' products are developed in direct response to market needs and customer demand. CARIS works very closely with client agencies, responding to their vision, goals and needs. The firm has been very lucky to be closely associated with forward thinking clients who strive to have only the best technology solutions. Responding to both present and anticipated market needs has resulted in CARIS developing and offering only proven world

class products. Great care is put into developing these solutions to be open, flexible and customizable to the markets we serve.

The development of a product within CARIS is affected by contributions from many people with different backgrounds and perspectives on the same product. The illustration below represents this scenario showing the Product Development process being affected with contributions from Sales, Development, and Customer Support. Members from the Sales team influence the product while developing businesses with customers requiring some level of construction in the product. Members from the development team strategize architectural improvements dictated by a growing demand of processing power, interoperability and uniformity between CARIS products. Finally, members from the Customer Support team influence the product by dealing with feedback from the user community.

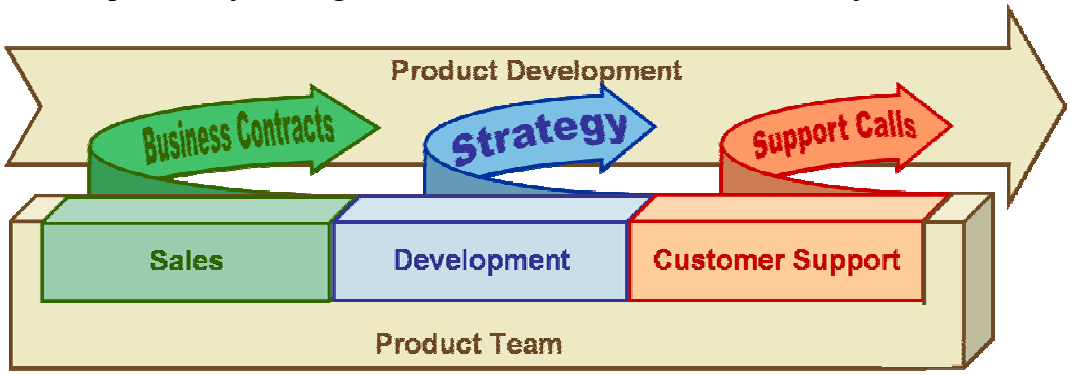

Figure 1 - CARIS Product Development Process

While a business is being developed the whole team navigates the product closer to the course of the market needs. In turn, the product leverages the development of new project contracts, by providing a solid framework subject to a continuous maintenance process.
The activities required for these types of interactions can be grouped under the flowing three major categories, are suggested in the next illustration.

- Maintenance Development
  The set of activities needed to resolve technical support issues detected on released versions of the product.
- Contract Development
  The set of activities related to a paying development contract with a defined objective.
- Strategic Development
  The set of activities related to the product evolution strategy.

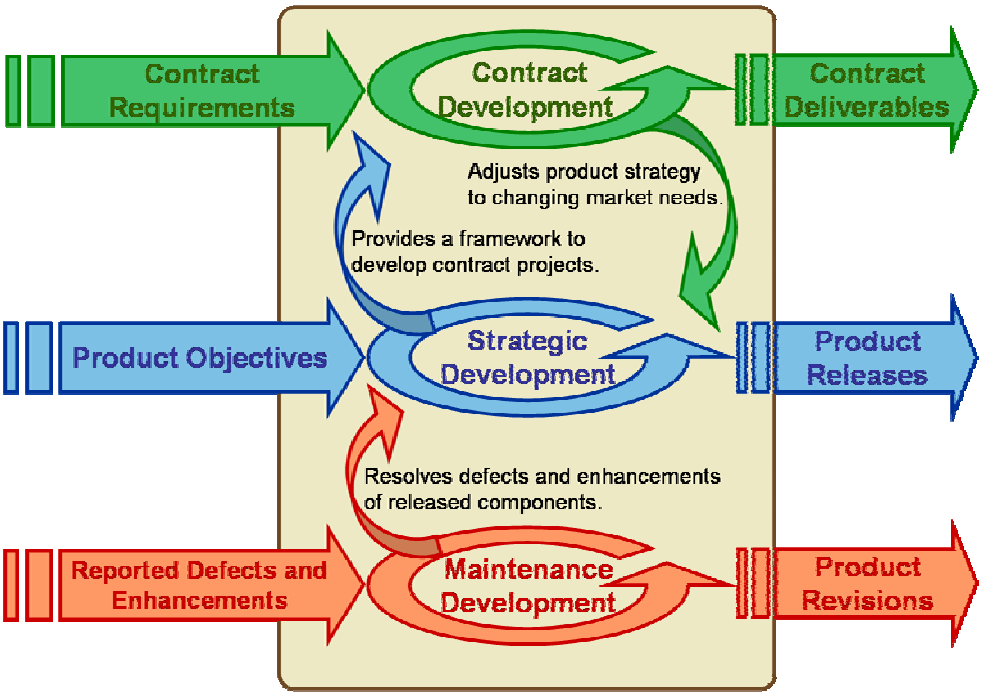

Figure 2 - CARIS Product Development Activities

Each of the categories above constitutes a process that exists within the context of a greater objective: the actual life-cycle of the product itself. This life-cycle is what constitutes the Product Development Process (PDP).

Strategic Development is the governing sub-process of the PDP as it maintains the product within the scope of its role in a given products suite (such as the CARIS Real Property Suite). There is only one instance of this process running within the PDP. In contrast, at any given time there can be several Contract and Maintenance processes running simultaneously. The following illustration summarizes these concepts.

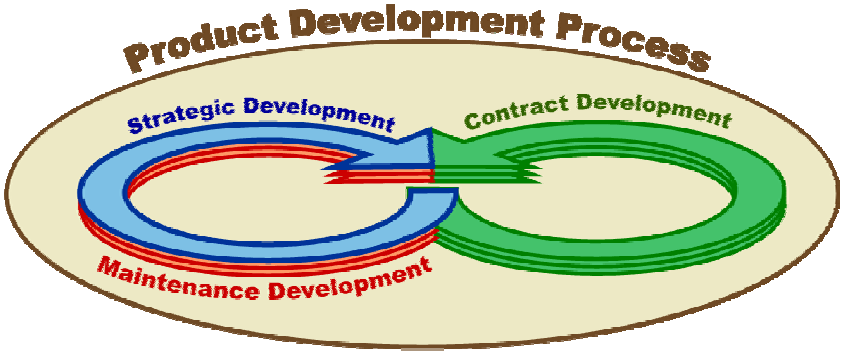

Figure 3 - CARIS Product Development Process

The remaining portions of this paper will discuss how CARIS has responded to the Cadastral/Land Registration market by leveraging and integrating the firms knowledge of technology with the expert knowledge and requirements of two client organizations, SNB and SNSMR. Particular focus will be placed on CARIS' relationship with it's public sector partner, SNB, the site of initial development of CARIS LIN.

3. Real Property Information Internet Service (RPIIS)-1996.

Prior to 1996 individuals interested in real property information in New Brunswick had to visit country registry offices distributed throughout the province to gain access to land information and complete land transactions.

Recognizing the inefficiencies, costs and an opportunity to serve stakeholders better the New Brunswick Geographic Information Corporation (NBGIC) embarked on a project to distribute property information online. In a close working relationship, CARIS and NBGIC (which later evolve into SNB) worked together to leverage the latest developments in internet and geomatics technologies to increase the efficiencies associated with accessing land-related information.

The resulting application included an internet mapping engine that was beta tested in 1995 by SNB. The system, the Real Property Internet Service (RPIIS) was "one of the first commercially available on-line registry systems providing access to integrated data sets" (Finley, 2000) and has been referred to as "the first commercial Internet Mapping/GIS program" (Plewe, 1997).The RPIIS service provided access to static land ownership, value and location information for every parcel of land in the province (Henderson, 2000).

3.1 Administrative Functions

The application offered many value added functionalities that still remain an integral part of the RPIIS system upgrade (described below) that expanded the application beyond a spatial information portal. System administrators were provided with:

1. Complete administrative control.
2. Functions to create accounts for clients (organizations with multiple users) and individual users..
3. Transaction management functionalities that were:
    a. coupled with cost models providing revenue generating capabilities and;
    b. used to audit all aspects of system use by individual user accounts.

With these front end functionalities the administrator was given complete control over system access, could audit system use and charge users for access to the system on a transaction or subscription basis. This gave SNB the ability to charge external users for access to this value added service which helped generate the revenue necessary to achieve and maintain its mandate to become a completely self sufficient public sector corporation.

4. Developing a Modernized Land Registration System with Service New Brunswick

Early modernization of the land registration system at SNB (1998-2000) included the automation of the business processes and workflows associated with the registration of deeds.

It also conglomerated the province's distributed real property information into one central database which could (can) be accessed from any geographic location through a provincial intranet. Documents were indexed against parcel identifiers so this historical index of land transactions could be easily tied to the cadastre and the RPIIS system. This provided the external user community with access to real time information stored within the systems database.

Having tied the deeds based land registration system to cadastral maps facilitated the province of New Brunswick's (and a couple years later, Nova Scotia) 35 year objective of converting their property system to a modified Torrens system of land title. The province deployed a sporadic approach to conversion triggered by land transactions and mortgaging processes. CARIS again worked closely with SNB to build the functionality and additional components of the data model to support the new processes involved in the conversion to and registration of title.

Throughout the development cycle with SNB, CARIS took great care in the system's development to ensure that the its architecture, data model, and interfaces were flexible and easily customizable so that the system could be easily implemented in other jurisdictions. The Service New Brunswick system evolved from a single project to an adaptable land registration software product following proof of its portability with the successful customization and deployment within the province of Nova Scotia. The resulting product was branded CARIS LIN.

Some features of the core CARIS LIN system are as follows:

Complete administrative control, inclusive of archiving and auditing mechanisms. Administrator(s) can easily: set up user accounts, assign various levels of system access based on the user type (role). Essentially the system administrator has complete control over system access. In addition permanent log files are kept recording all searches and changes to the database which gives the system administrator a means to monitor system usage and change.

Front Counter Cashiering Providing an automated solution for front counter payment acceptance, receipting, and recording daily transactions.

Storage of document indexes in one centralized location. A secure centralized authoritative database becomes the sole storage location for indexing documents and other related land information.

Exceptional Land Information Management. All land related information stored within CARIS LIN is centred on the land parcel. This critical data management principal is realized by assigning each parcel a unique identifier on which all land related information is referenced. This is the key to the advanced data storage, modification and retrieval capabilities found in all CARIS LIN systems.

Dramatically improved data integrity- All changes to the central database occur through digital standardized forms reflecting the organization's business rules and workflows and become subject to mandatory edit checks ensuring data integrity.

Dramatic increased internal efficiencies and productivity The automation of business processes and workflows through standardized forms reflecting 100% of the adopting agencies workflows expedites the routine processing of land related documents.

Transparent system access from any location.

> **Workflows -** Automated, standardized forms are accessible from any location within the adopting agencies intranet. Therefore the business processes and workflows necessary towards final document acceptance can be distributed amongst several geographic locations.
>
> **Access-** Internal staff are provided with real time access to all of the information stored within CARIS LIN through the jurisdiction's internet/intranet. The extent of access for any user can be completely controlled by the system administrator.

External access mechanisms A Spatial Internet Browser (described below) gives real property professionals and the public access to real time digital information stored within CARIS LIN. This function has many advantages including the facilitation of legal processes involved with transferring rights to land. The cost models and accounting functions of this component can be used to provide the adopting agency with a means to charge external users for this service.

Integration to other Information Systems- CARIS LIN has been developed as a group of modules, each module has been developed in such a way that it can be completely integrated with other databases, information systems and 3rd party business applications.

Land Titles- The system can be delivered as a deeds or land titles based registration system or both.

The remaining sections of this paper will describe the development and features of other software products and extension that have been implemented as part of SNB and/or SNSMR's land registration systems. The software is presented in chronological order as developed to described the phased approach and evolving nature of both land registration systems in further taking advantage of today's newest technologies.

4. Further Progress towards a Virtual Office for Land Registration Processes

Progress towards a complete virtual office for Land Registration processes continues within both SNB and SNSMR. Both departments have a continued goal to further maximize the efficiencies and simplify processes involved with all aspects of land registration. An early impediment to this goal involved the registration and storage of land records in paper format. Paper submission involves massive storage requirements and was recognized as an impediment to increasing efficiencies in further modernizing business processes. The approach to accomplish the reduction (or elimination) of paper within the land registration system included the deployment of two new types of technology: an imaging solution and; software enabling the direct electronic submission of land instruments by notaries over the internet.

4.1. Imaging- 2002

SNB and CARIS worked closely to design and implement an imaging solution to compliment existing business processes involved with registering land records. The imaging solution that resulted from this process is seamlessly integrated within the land registration workflow and CARIS LIN's data model. Easily customizable business processes involved with image scanning, quality control, backups, archiving and storage of final images in CARIS LIN's central database are delivered with this module. Within SNB once a document or survey plan is registered any paper submitted has been scanned, stored, indexed, and is immediately available through CARIS LIN's external internet portal

CARIS LIN's imaging module was part of the first deliverable of SNSMR's CARIS LIN land registration system. This technology has provided both organizations with a solution with the means to greatly reduce and eventually remove all paper storage requirements. It also has the ability to serve stakeholders of land information better by providing land records that can be disseminated over the internet.

4.2 Electronic Submission of Documents- (2004)

Although all internal processes are semi-automated within the CARIS LIN system, SNB and SNSMR continue to define new ways to move to a completely virtual land registration environment. Beginning in the year 2000 CARIS technology has been providing the electronic means for notaries to submit the necessary instruments over the internet for the conversion from the deeds based registration system to one of land titles. This Land Titles conversion process within CARIS LIN provides an early example of how new legislation, well defined public/private partnerships and business processes complimenting today's latest technological advances can provide new innovative ways to increase both internal (the land registration authority) and external (to the private sector entity- lawyer, land surveyor) efficiencies involved with land registration processes.

The successes in integrating the business processes involved with title conversion was later expanded within the CARIS LIN deployment in Nova Scotia to allow land records to be submitted by notaries electronically. Notaries can now submit documents electronically over the internet without having to leave their offices. This has further expanded the system's workflow to include the semi-automation of the private sector component of the land registration process. The electronic submission of documents extension to CARIS LIN is integrated directly into the system's workflow, and once validated the structured data is stored directly into CARIS LIN's central database. The implementation process of this CARIS LIN module was slow as the business processes involved with document submission required reform to traditional registration practices that have been in place for over 200 years. However, SNSMR has overcome this institutional barrier with new legislation and policy and is realizing increased efficiencies through a more complete electronic registration workflow. SNB has plans to follow in the very near future.

5. CARIS LIN's Land Gazette Extension- 2004

CARIS LIN's newest module, the Land Gazette, was carefully designed to meet the vision and needs of SNB. The Land Gazette provides an application and repository of permanent and temporary third party land related notices and other critical information. As the Land

Gazette is deployed as an extension to CARIS LIN, submitted data is maintained directly within its data model.

Today the Land Gazette enables any New Brunswick provincial department to register their interest in real property online, whether it be a right, restriction, or hazard. The Land Gazette extension as implemented within SNB:

- can only be accessed by an authorized entity, who is;
- completely responsible to maintain registered interests (notices), who has;
- multiple options for methods of data upload, and can;
- charge a fee for dissemination of those notices when accessed through the external web portal.

The multiple options available have been designed to be flexible and adaptable to accommodate a variety of departmental policies involved with data dissemination. Web linkages can also be associated with Land Gazette notices to bring the user to the interest holder's website, or to stored images of a formal notice of interest or property hazard.

System users in turn, have increased confidence they have a complete record of all interests or hazards associated with any unit of land when accessing information through CARIS LIN's Spatial Internet Browser. Land Gazette searches can be either parcel or area based providing the additional land information functionalities to meet the needs of diverse communities of interest.

6. CARIS LIN's Spatial Internet Browser- An Upgrade to the RPIIS technology-2004

Three years following the deployment of the RPIIS system CARIS developed a more powerful internet mapping engine which was branded in 1999 as CARIS Spatial Fusion. Spatial Fusion server technology serves both geospatial data and the web clients needed to access that data. The server can publish virtually any geospatial data format, can be integrated with most databases and business applications and conforms to the standards of interoperability defined by the Open Geospatial Consortium (OGC).

CARIS has developed, delivered and supported many web mapping client applications for a diversity of organizations since the product's initial development. Many of the new functionalities developed for these client applications were included in the deployment of CARIS LIN's Spatial Internet Browser. The browser was first deployed as part of SNSMR's CARIS LIN system in 2003. SNB replaced the RPIIS technology with this new CARIS LIN module in 1994.

CARIS LIN's new browser technology has provided SNB with many advantages over the RPIIS technology such as:

1. A more modern interface for accessing the system's administrative functions
2. Access of orthophotography and topographic data as backdrops to the cadastral maps for visual analysis.
3. Functionality enabling users to download formatted reports and maps.
4. Enhanced and more comprehensive property search capabilities.

5. Spatial analysis tools (neighbor searches, distance and area measurements, buffering, etc.)

SNB envisions the availability of new markets and business opportunities with the integration of new thematic layers of information with this new technology. The integration of new information sources and web services between SNB and other departments is anticipated to reduce the need to duplicate large data sources from multiple agencies while maximizing the utility of government information and lead to new business opportunities. The adoption of CARIS's Spatial Fusion Web Mapping platform ensures that spatial and non-spatial data from any number of sources can be easily integrated with the CARIS LIN system.

Given the added value of the new browser technology over its predecessor (RPIIS) the application has become a more useful tool for non-traditional users resulting in faster rates of revenue generation than with the RPIIS system.

7. A Database Driven Model for Cadastre Maintenance CARIS CPD- 2005

A cadastre is defined for the purpose of this discussion as a record of the spatial location and extent of all the parcels in a defined unit of land. This unit of land would normally represent the complete area of responsibility of a governing department or organization. For example, the New Brunswick cadastre includes all the survey plans, legal parcel descriptions, and the digital map for all parcels of land in the province.

CARIS has leveraged technology from the firm's core framework to create a database driven application for managing the cadastral mapping (the cadastral fabric) component of the cadastre. The products deployed as part of this solution include: the CARIS Cadastral Production Database (CARIS CPD) which provides the storage space for the digital cadastral data using Oracle spatial database technology; CPD's Source Editor for building, updating, validating data stored within the Production Database; CPD's Map Editor for producing cartographic cadastral maps and; CPD's Publisher for publishing data to web.

CARIS has recently deployed CARIS CPD and CPD's Source Editor within SNSMR as an upgrade to existing GIS technology for maintaining the provinces cadastral fabric. The technology tracks all changes to the database, provides increased security, maintains all metadata, allows users to view historical versions of any area of interest, provides multi-user access (currently 15 distributed users), and standardizes all processes involved with the maintenance of the cadastral fabric.

An integrated solution comprised of CARIS LIN (which stores and maintains the remaining components of the cadastre) and CPD provide our current and prospective clients with proven database driven business solutions for modernizing both their cadastre and land registration systems.

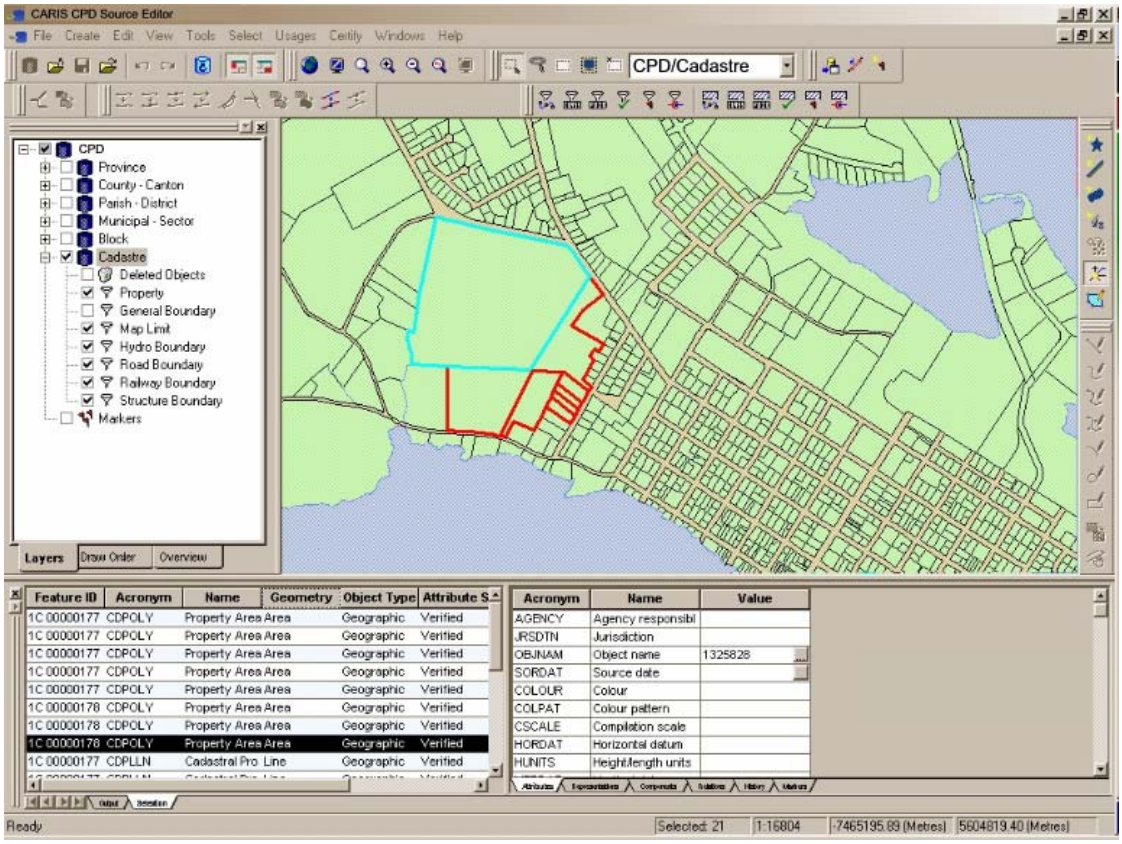

Figure 4 – CPD's Source Editor Application Interface (Nova Scotia Implementation)

8. Discussion

The CARIS development cycle has resulted in many exciting and leading edge software solutions coupled with success stories that the firm takes pride in bringing to market. Careful strategies have been developed to leverage expert knowledge and compliment that knowledge with the firm's technical resource base, to ultimately meet client needs with new innovative technical solutions. The CARIS suite of products for the cadastral/land registration market continues to evolve as the firm reacts to, or anticipates the needs of our current and prospective clients.

CARIS looks forward to working and supporting their client organizations in the continual advancement and modernization of their land records solutions. Software deployments are anticipated for the near future that will:

- give land surveyors the capability to electronically submit survey plans;
- integrate CARIS LIN with enhanced provincial assessment systems;
- support a program to accelerate the conversion process to land titles;
- provide a solution supporting the guarantee of boundaries under for Parcels under land titles.

Anticipating these upcoming projects CARIS has developed CARIS CPD and a new CARIS LIN module supporting the electronic submission of survey plans to provide. CARIS

anticipates that these new products/CARIS LIN modules will provide the functionalities necessary for SNB and SNSMR to move to a title system which includes guaranteed boundaries in the near future.

What began as a relationship based on a series of contracts has become a formalized partnership between SNB and CARIS in bringing CARIS LIN to market. New Brunswick and Nova Scotia's evolution from their humble beginnings in land information management and land administration throughout the last 40 years, supported by the deployment of CARIS LIN provide interesting case studies for developing and developed countries alike. The state owned corporation (SNB) and private partner (CARIS) have developed a product and defined a business relationship that is a working example for other jurisdictions eager to replicate their success.

REFERENCES

Finley D. (2000). "Service New Brunswick: the modernization of a land information service". In Geospatial Data Infrastructure. Concepts, Cases and Good Practice. Ed. Groot, R. and McLaughlin, J. (2000). Oxford University Press. pp245-251.

Plewe, B. (1997). "GIS Online: Information Retrieval, Mapping and the Internet". Santa Fe. USA. OnWorld Press. pp 114.

BIOGRAPHICAL NOTES

Greg Mulholland was born in 1974 in Canada. He holds a Bachelors of Science in Forestry and Environmental Management degree, and has also completed a Masters in Engineering degree from the department of Geodesy and Geomatics Engineering at the University of New Brunswick. Greg specializes in GIS, cadastral and land registration systems, and natural resource management. As a CARIS technical solutions provider Mr. Mulholland works closely with domestic and international clients to deliver cadastral, land registry and enterprise geospatial products and services.

CONTACTS

Greg Mulholland
CARIS
115 Waggoners Lane
Fredericton, New Brunwick
CANADA
Tel. +1-506-458-8533
Fax: +1-506-459-3849
Email: greg.mulholland@caris.com
Web site: www.caris.com