



Spatial Data
Warehouse Ltd.

INITIATIVE 1: CADASTRAL MAPPING

AltaLIS

P3

The SDW/AltaLIS Model

Spatial Data Warehouse (SDW) is a “Part 9”, not-for-profit corporation that oversees a P3 (Public Private Partnership) with AltaLIS Ltd. The SDW Board includes members from government, industry (utilities, energy, forestry) and municipalities including:



SDW is modeled as an information utility, where SDW acts as the “regulator” over the “operator”, AltaLIS. SDW has a unique relationship with the government. Through a data licensing agreement, SDW has the sole responsibility for reengineering, updating and distributing a series of indispensable data sets in Alberta including the cadastral (parcel) data, titles mapping and Crown land disposition surveys. AltaLIS is responsible for undertaking the physical tasks on behalf of SDW (i.e. loading, storing and marketing the provincial data sets). Work is conducted under the auspices of the SDW/AltaLIS Joint Venture (JV) with all SDW and AltaLIS costs covered by JV operations. Profits are reinvested into data and systems improvements.

BACKGROUND

The Government of Alberta started a mapping program, the Municipal Integrated Surveying and Mapping Program, in the 1960s. This cost sharing program between the province and some 70 participating municipalities included the establishment of a survey control (spatial referencing) network and production of 1:1,000 scale cadastral maps, with digital map production beginning in 1978.

Negotiations between the Government of Alberta and utility companies in the province were initiated in the late 1980s to collaborate on the extension of the digital cadastral mapping into rural areas. The program evolved, so that by 1995 cadastral data was being maintained and managed internally by the Government of Alberta and by a series of contracts with numerous survey firms. By 1996, Alberta's major utility companies had contributed in excess of \$5 million dollars towards the initial compilation of rural cadastral mapping (Source: Spatial Data Warehouse Ltd., 1998. White Paper – Alberta Spatial Data Infrastructure Initiative: An Overview).

THE PROBLEM

In 1995 there were significant demands by users to improve the quality, timeliness and accuracy of the cadastral data and to reduce the cost of the various map products in Alberta. Existing cadastral data was:

- Inaccurate and inconsistent
- Poorly maintained
- Stored in multiple CAD drawing formats and files
- Not GIS ready (difficult to work with in an integrated CAD file or intelligent, data layered GIS environment)
- Time consuming and costly to obtain – either in hardcopy or electronic format

A filing fee model was implemented using SDW as the custodian of the data to ensure that maintenance of the data is sustainable and independent of government budget constraints or limitations.

ESSENTIAL TECHNICAL ISSUES



What's missing:

- Georeferencing (size, placement, alignment)
- Integration with surrounding cadastral features



What is Cadastral Mapping?

Cadastral or parcel mapping data depicts the location of survey plans registered with Alberta Land Titles and shows the boundaries of surveyed parcels including additional data, such as right of ways. Urban and rural cadastral data defines the location of all plans of survey registered with Alberta Land Titles, including subdivisions, descriptive plans (metes and bounds), roads, rights-of-way, condominiums, railways, etc. This mapping portrays block lines, lot lines, lot numbers, road limits, right of way limits, metes and bounds, plan numbers, dimensions and other information about property parcels found on plans of survey. Cadastral data is used for building applications, regulatory permitting and planning.

SDW is the custodian of the “authoritative” cadastral/parcel data for Alberta.



SDW is Unique to Alberta

The cadastral system developed by SDW/AltaLIS is the most advanced system of its kind in Canada (and possibly the world) with a unique ability to continuously improve the quality and accuracy of the entire mapping fabric and database as new plans are added (source: E.A. Kennedy, 2011 Ontario Digital Cadastral Feasibility study). It's estimated that the reengineering project alone could have cost the Government of Alberta between \$6 to \$16 Million if it had decided to procure and develop this capacity internally.

The core components of the updating system include the extraction of data from layered drawing/CAD files provided directly from surveyors and interactively integrating the data into mapping base at a substantially lower cost but with improved relative and absolute accuracy.

The cadastral maintenance process was onerous, and consisted of an inefficient digital-to-paper-to-digital conversion:

- Surveyors performed the field survey, used coordinate geometry and survey adjustment techniques to compute coordinates, then prepared a plan of survey in CAD
- A mylar copy was submitted to Land Titles Office (LTO) for registration
- After registration, a paper copy was provided to SDW
- Contractors re-entered the plan's information, created an AutoCAD or MicroStation file, then adjusted the plan to fit existing base using coordinate geometry and survey adjustment techniques
- AutoCAD files were converted to MicroStation
- The province reviewed and quality controlled the contractors' work
- The registered plan was replicated in the legal base data

Users in the private sector and many government departments were frustrated that updates to the map representation and base dataset could take from 3 to 8 months from the time changes were registered at the Land Titles Office and there was no way of tracking what or when changes had been made or were available. To make matters worse, the data was expensive to purchase and would take from 2 to 6 weeks from

“The Alberta system is still the envy of other provincial jurisdictions – 14 years after it was first implemented – thanks in part to the continued improvement undertaken by SDW/AltaLIS”

- Bill Elliot

*Director Business Support Services and Land Information Services
Land Titles Office, Service Alberta*

the point of ordering map sheet data to having it delivered (by mail). As a result, other than the major utility companies, few users bothered to use the “official” government data and instead found other ways of making do - including creating their own versions of the base data - resulting in duplication of effort and cost.

The cost to the government of maintaining, updating and distributing the data was pegged at between \$2.5 and \$3 million per year (in 1996 dollars). Using a traditional governmental procurement approach to modernizing the systems (collection, updating, maintenance, order and access) and creating a “smart” digital dataset from the old “unintelligent” graphics mapping would have cost between \$6 and \$16 million by most estimates. The government was not inclined to take this route given that it was in a period of fiscal restraint and was struggling to find ways to better control operating costs (let alone investing in new technology upgrading projects). The province needed a better, cheaper and more innovative way to manage, update and distribute cadastral data.

CHALLENGES

A number of challenges were encountered in the process of loading and updating the cadastral data:

- **State of the original information:** Paper hardcopy originals were inaccurate, poorly maintained and difficult to access



Faster Turnaround

Updates are now available within 1 to 5 days from the time a plan is registered at the Land Titles Office (down from 3 to 8 months). The underlying data and database was reengineered to be “smart”, allowing users to track all previous changes which significantly improves accessibility and confidence in the quality of the information.

“From the perspective of the Land Titles Office , working with SDW/AltaLIS is an example of the best practices of how partner or contractor relationships, even between departments, should work.”

- Bill Elliot
Alberta Land Titles Office



Affordable, Accessible and Accurate

The pricing and access model allows all users to afford and access the data. Accuracy and quality have been improved by the system's unique ability to continuously enhance the entire mapping fabric and database as new plans are added.

SDW is self-funded. The SDW/AltaLIS Joint Venture (JV) earns income through data processing (filing fees received for cadastral plan integration and DIDs processing) and data sales activities (subscriptions, one-time sales, etc.). SDW is paid a Management Fee from the JV. This money can then be used to pay any expenses including GM salary, legal fees or annual audits. AltaLIS Ltd also provides all office facilities to SDW at no charge.. Net earnings, after expenses, are split between SDW and AltaLIS and reinvested in data and system improvements.

- **Magnitude:** Provincial-scale issues associated with complexity and volume
- **Data formats:** Multiple sources and formats
- **Costs:** Lack of a sustainable funding model

APPROACH

The reengineering process was undertaken by AltaLIS, at its sole cost and risk, with the support of staff at Sustainable Resource Development and the Land Titles Office of the Government of Alberta. The provincial cadastral data was originally converted from paper by a number of contractors into two file format standards in three projections and maintained in non-integrated tiled files. While a high degree of spatial accuracy was maintained, the files essentially contained only line drawings. The first step for AltaLIS was to clean and restructure all of the data, and create an accurate, seamless and integrated digital land-base in a single projection across the 650,000 square kilometers of provincial territory. An Oracle database was created to contain the historical and current information on each cadastral station and on each plan of survey.

Fundamental to this re-engineering process was the development of a sustainable funding model which would be independent of government budgets. SDW/AltaLIS consulted with numerous stakeholder groups and government departments and achieved agreement to proceed with its proposal to:



- Implement a digital filing requirement
- Institute a filing fee of \$100 per plan

An amendment to legislation was required and quickly passed. This shifted the burden of data maintenance from the taxpayer to the person or entity that was causing the change and thus benefiting from the plan registration. The model also ensured that ongoing maintenance costs were always covered, regardless of the government's fiscal situation.

THE SOLUTION

AltaLIS, under the direction of SDW, undertook the following:

- Funded and built new processes for data loading, maintenance, storage and distribution
- Developed new software for plan integration and quality control
- Converted and updated the datasets
- Designed and implemented a state-of-the-art IT infrastructure for loading, storage, security and distribution of cadastral data
- Provided training to end users
- Provided support services to allow surveyors to submit plans digitally as part of the normal filings at the Land Titles Office (LTO)

Great effort was expended in the development of the integration engine and related processes to:

- Improve accuracy
- Eliminate issues of benching and breaks
- Maintain the relative accuracy and integrity of the survey

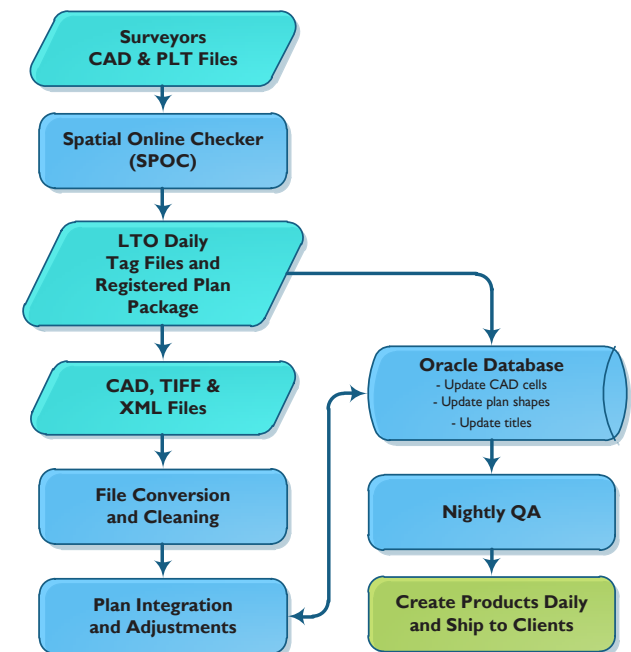
Integration of the process with the Land Titles Office was critical as the government was using this initiative to:

- Move to an entirely digital filing process
- Provide enhanced online access to digital title records plus all historic records (which were scanned for online retrieval).

The improved process worked as a result of the following:

- The Land Titles Office made digital plan submissions mandatory
- Specifications were developed by stakeholders
- Plans were forwarded to SDW/AltaLIS under agreement with Alberta Registries
- Alberta Land Surveyors provided support

LTO CAD FILE PROCESSING AND INTEGRATION



Cadastral Mapping is now a well organized and quality controlled process.



Improved Accuracy

New Cadastral Plan Integration



Before: Spatial Insertion of New Parcels



After: Spatial Correction and Integration:
Correct spatial placement and integration with surrounding features.



CONCLUSION

In less than one year, SDW/AltaLIS were able to demonstrate the following improvements:

Reduced Costs:

- Operational data maintenance and management costs (\$2.5 to \$3 million annually in 1996 dollars) to the Government of Alberta were eliminated
- Total cost to maintain the data was significantly reduced
- All costs are now borne by the entity creating change or using the data
- Creation of a sustainable financial model

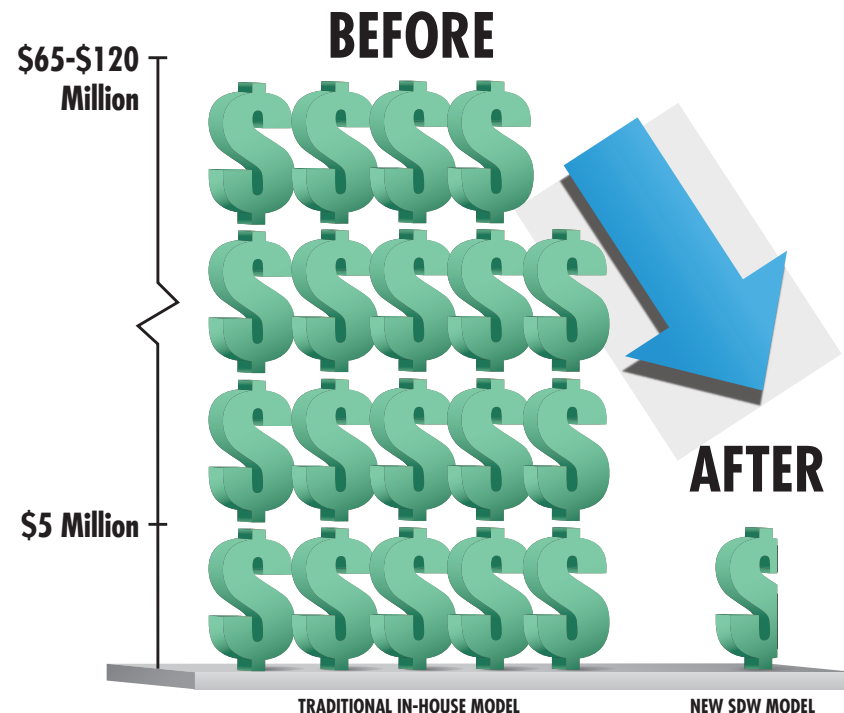
Faster turnaround in data creation, maintenance and distribution:

- Updates are now available between 1 to 7 days from the time a plan is registered at the Land Titles Office (down significantly from the original 2 to 8 months)

Improved accessibility:

- Data order and access was modernized to an online system cutting the wait time from 2 to 6 weeks to real time (i.e. data is delivered within seconds of the request)

SUBSTANTIAL SAVINGS UNDER THE P3 MODEL



SDW/AltaLIS Has Driven Costs Down – For Cadastral, Titles and Crown Disposition Mapping

SDW/AltaLIS has benefited their clients with reduced costs, faster turnaround, improved accessibility and better data accuracy.

Prices to users reduced:

- Significantly reduced end-user costs for purchase and licensing of cadastral data

Data accuracy significantly improved:

- The SDW/AltaLIS system continuously improves the quality and accuracy of the entire mapping fabric and database as new plans are added and integrated
- SDW/AltaLIS created an “intelligent” digital dataset from the old “dumb” graphics mapping – at no cost to the GoA

Client satisfaction significantly improved:

- SDW/AltaLIS has proven to be a client centric model which is highly responsive to the needs of data users in Alberta

In 2001, URISA gave Alberta Registries an Exemplary Systems in Government award for their Spatial Information (SPIN) System. This award is for outstanding achievement in the successful development and application of spatial systems and technologies. SPIN was developed as a web-based digital survey plan registration, archiving, printing and distribution process. Fundamental to the success of the Land Titles Office Spatial Information System (SPIN II) is SDW’s cadastral database – a precise, up-to-date dataset that empowers surveyors to file plans with accuracy and consistency.