RESEARCH REPORT

External Research Program

GIS: A Useful Tool for First Nations Housing Management, Planning, Maintenance and Safety

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GIS: A Useful Tool for First Nations Housing Management, Planning, Maintenance and Safety

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- Mr Richard Shecapio, Director of Community Development,
- Mr Johnny Matoush, Land Registrar and GIS Technician,
- Mr Robert Shecapio, Former Land Registrar,
- Members of the Housing and Public Works Departments and;
- The Board of Directors

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- Mr Clarence Miniquaken, Information Agent, Housing Department

Ouje-Bougoumou First Nation
- Mr Alan Gull, Housing Administrator

Cree Nation Of Wemindji
- Ms Sarah Hughboy, Housing Director

Cree Nation Of Eastmain
- Mr Stanley Gilpin, Director of Housing

The Cree Regional Authority
- Mr Emmett Macleod, Coordinator of Technical Services and former Land Registrar for the Cree Nation of Mistissini.

Executive Summary

The Cree First Nation of Mistissini, one of the James Bay Cree (JBC) First Nations in northern Quebec, was an early adopter of a Geographic Information System (GIS). A GIS is a computer-based tool for information collection, modification, analysis and output in the form of maps and reports. While the community of Mistissini use their GIS for community housing and public safety needs, most other First Nations with a GIS have limited its use to forestry and natural resource management. This study describes the implementation and ongoing use of GIS in Mistissini.

There were two important influences on Mistissini's adoption of GIS (which involves a significant investment of time and money by the community). The first was the availability of information, at no cost to the community, in the form of air photos and digital map files provided by the federal government every five years as part of the James Bay Agreement. The second was the interest and capability of one of their own community members who had GIS skills and formal GIS training.

Mistissini realized early that a key factor in the understanding and solving of problems is having information in a usable organized format and having tools for its analysis. GIS helps analyze problems through the visualization and quantification of spatial relationships. Many housing and public safety issues respond particularly well to visual analysis through use of maps. A GIS can contain any amount of spatial information but by splitting it up into layers, rather than showing it all at the same time, the GIS allows users to focus on the problem at hand. This makes it easier to see critical relationships via patterns and adds an extra dimension to the understanding of problems. The value of organized information such as a GIS has become more and more apparent as Mistissini has grown in size and complexity.

While the focus of the study is on the use of GIS for housing and related purposes, there are also important lessons to be learned for those communities that do not feel the need or do not yet have the resources to consider implementing a GIS. These lessons include best practices such as: backing up data, organizing, storing, converting and linking housing data. The case study discusses and compares a number of options for organizing information (both for GIS and non-GIS applications such as spreadsheet, database, word processing, graphics and computer-aided drafting programs that are commonly available) that have met many of the information needs of the other JBC communities.

This case study will be of interest to First Nations Councils and staff who oversee or manage housing resources and have responsibility for public safety as well as agencies such as First Nations School Boards, Health Authorities and large First Nations commercial ventures that have housing and building resources

Résumé

La Nation crie de Mistissini, l'une des Premières nations cries de la Baie James, dans le nord du Québec, a été un utilisateur précoce d'un système d'information géographique (SIG). Un SIG est un outil informatique servant à la collecte, à la modification, à l'analyse et à l'impression d'information sous forme de cartes et de rapports. Bien que la collectivité de Mistissini se serve de son SIG pour loger les gens et assurer les besoins de sécurité publique, la majorité des autres Premières nations disposant d'un SIG limitent son utilisation à la foresterie et à la gestion des ressources naturelles. Cette étude décrit la mise en œuvre et l'usage continu du SIG de Mistissini.

Deux motifs importants sont à l'origine de l'adoption du SIG (qui exige de la collectivité un investissement considérable de temps et d'argent) par Mistissini. Le premier a été la disponibilité de l'information, sans frais pour la collectivité, sous la forme de photos aériennes et de fichiers cartographiques numériques fournis tous les cinq ans par le gouvernement fédéral dans le cadre de la Convention de la Baie James. Le deuxième était l'intérêt et la capacité de l'un des membres de la communauté qui avait les compétences nécessaires en matière de SIG et avait suivi la formation officielle portant sur le système.

Les Cris de Mistissini ont vite compris que l'un des facteurs clés de la compréhension et de la résolution de problèmes est de disposer d'informations dans un format structuré utilisable et d'avoir les outils pour les analyser. Le SIG aide à l'analyse des problèmes en permettant de visualiser et quantifier des relations spatiales. Bon nombre de problèmes liés à l'habitation et à la sécurité publique peuvent être résolus plus facilement par une analyse visuelle grâce à l'utilisation de cartes. Un SIG peut contenir n'importe quelle quantité de renseignements spatiaux, mais comme il les sépare par couches plutôt que de les afficher tous en même temps, il permet aux utilisateurs de mettre l'accent sur le problème en cause. Ce système facilite la visualisation des relations essentielles au moyen de modèles et ajoute une dimension supplémentaire à la compréhension des problèmes. L'importance de l'information structurée, comme celle que fournit le SIG, est devenue de plus en plus apparente au fur et à mesure que la taille et la complexité du village de Mistissini se sont accrues.

S'il est vrai que le centre d'intérêt de l'étude est l'utilisation du SIG pour l'habitation et des usages connexes, il y a aussi des leçons importantes à tirer par les communautés qui ne ressentent pas le besoin de mettre en œuvre un SIG ou qui n'ont pas les ressources pour le faire. Parmi ces leçons, on trouve les pratiques exemplaires telles que la sauvegarde, la structuration, le stockage et la conversion des données sur l'habitation ainsi que l'établissement de liens entre elles. L'étude de cas examine et compare un certain nombre d'options pour la structuration de l'information (tant pour les applications du SIG que celles qui n'en font pas partie, comme les tableurs, les bases de données, le traitement de texte, les graphiques et les programmes de dessin assistés par ordinateur courants), qui ont permis de combler de nombreux besoins en information des autres collectivités cries de la Baie James.

Cette étude de cas intéressera les conseils de Premières nations et le personnel chargé de surveiller ou de gérer les ressources en logement, les responsables de la sécurité publique de même que les organismes, tels que les conseils scolaires des Premières nations, les autorités sanitaires et les grandes entreprises commerciales appartenant aux Premières nations, qui disposent de ressources en logements et en bâtiments.

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1.0 Introduction

A key aspect in understanding and solving any housing or public safety problem is to have the necessary information in a usable organized format and to have the tools for the analysis, visualization and solution of problems. The GIS is such a tool and this case study will describe in detail the implementation of GIS for housing and public safety applications in the (JBC) community of Mistissini. Mistissini is one of the largest and most developed of the nine JBC communities. Several other JBC communities of various sizes (Waswanipi, Eastmain, Wemindji and Ouje-Bougoumou) are also reviewed to determine which elements of the Mistissini project, in terms of problems, data sources and methodology, could be relevant to other First Nations communities.

The Cree Regional Authority (CRA) was contacted for general housing and public safety data and software usage information for the JBC communities to determine what data and data formats are available. The inclusion of communities of different sizes with a range of resources and problems, will allow other First Nations to use this study to determine to what extent GIS may be of use to them in assisting with their housing and related needs of community management.

The study is illustrated with examples of data inputs, analysis that can be performed using GIS and samples of GIS products that were produced to answer community needs. The organizational benefits of using a GIS or related approach are discussed in relation to the current approach in place with most First Nations communities. The information is presented in a non-technical manner illustrated with examples that show, where possible, a range of GIS and non-GIS solutions.

The case study also focuses on how communities not currently using GIS, or only using GIS for resource management, can still benefit from some of the organization, data management and data linking aspects of the project. The case study draws on information collected in the JBC communities as well as interviews with JBC community officials.

2.0 Objectives

The main objective of the case study is to provide First Nations communities with information on what the different levels of GIS software can do to assist them in the management of their housing and related public safety problems by showing their use in a First Nations community setting.

The second objective is to provide information on how to best organize and standardize current information for those First Nations that do not have access to GIS software. Almost all First Nations have some computer capacity and familiarity with word processing, graphics, spread sheet and database programs. This case study shows how First Nations can use this capacity to improve their approach to housing problem solving in terms of better organization and backing up of paper and

digital files. This is of use as a standalone objective with the benefit of preparing and standardizing their data for: discussions with various levels of Government; working with outside contractors or consultants; or as a preliminary to setting up their own in house GIS.

The third objective is to show how Government and other regulations regarding housing standards, mortgages, insurance, and public safety can be met using data, analysis and output products from the GIS.

While the focus is on the use of GIS for housing and related purposes, there are important lessons to be learned in best practices, backing up data, organizing, storing, converting and linking housing data for those communities that do not feel the need or have the resources to consider implementing a GIS even at the viewer or desk top mapping level. Organized information makes it easier to respond to requests for information, statistics generation and record keeping. Linked databases allow for more information to be searched and queried. Backing up computer files will ensure that, unlike paper records, there is always a copy of community data available.

3.0 Background

3.1 Location

The Cree Nation of Mistissini community is located in North Central Quebec near the southern end of Lake Mistassini between Abatagouche Bay and Post Bay on the tip of the Watson Peninsula. The community is located at approximately 50 degrees 23 minutes North and 73 degrees 55 minutes West on National Topographic map sheet 32 I/05. The community grew around a former Hudson's Bay Post and there has been a noticeable community presence since the 1930's. The current population is around 3600 and is expanding quite rapidly. The main languages are Cree and English with some French.

Mistissini has all year paved road access to the southern Quebec via highways through Chibougamau and to other Cree communities and trapping areas by gravel and paved roads, air service, boat and skidoo (in season). The community site is shown in figure 3.1

The other JBC communities are:

- Whapmagoostui, the northern most community only accessible by air or water,
- Chisasibi, the next most northern community, is accessible by gravel and paved roads,
- Wemindji is accessible by gravel and paved roads,
- Eastmain is accessible by gravel and paved roads,
- Waskaganish is accessible by gravel and paved roads,
- Nemaska is accessible by gravel roads,
- Ouje-Bougoumou is accessible by a short gravel road, and,

- Waswanipi is accessible by gravel and paved roads.

The community locations are shown in figure 3.2

Figure 3.1 Overview of Mistissini (public buildings are in yellow, homes are in brown)

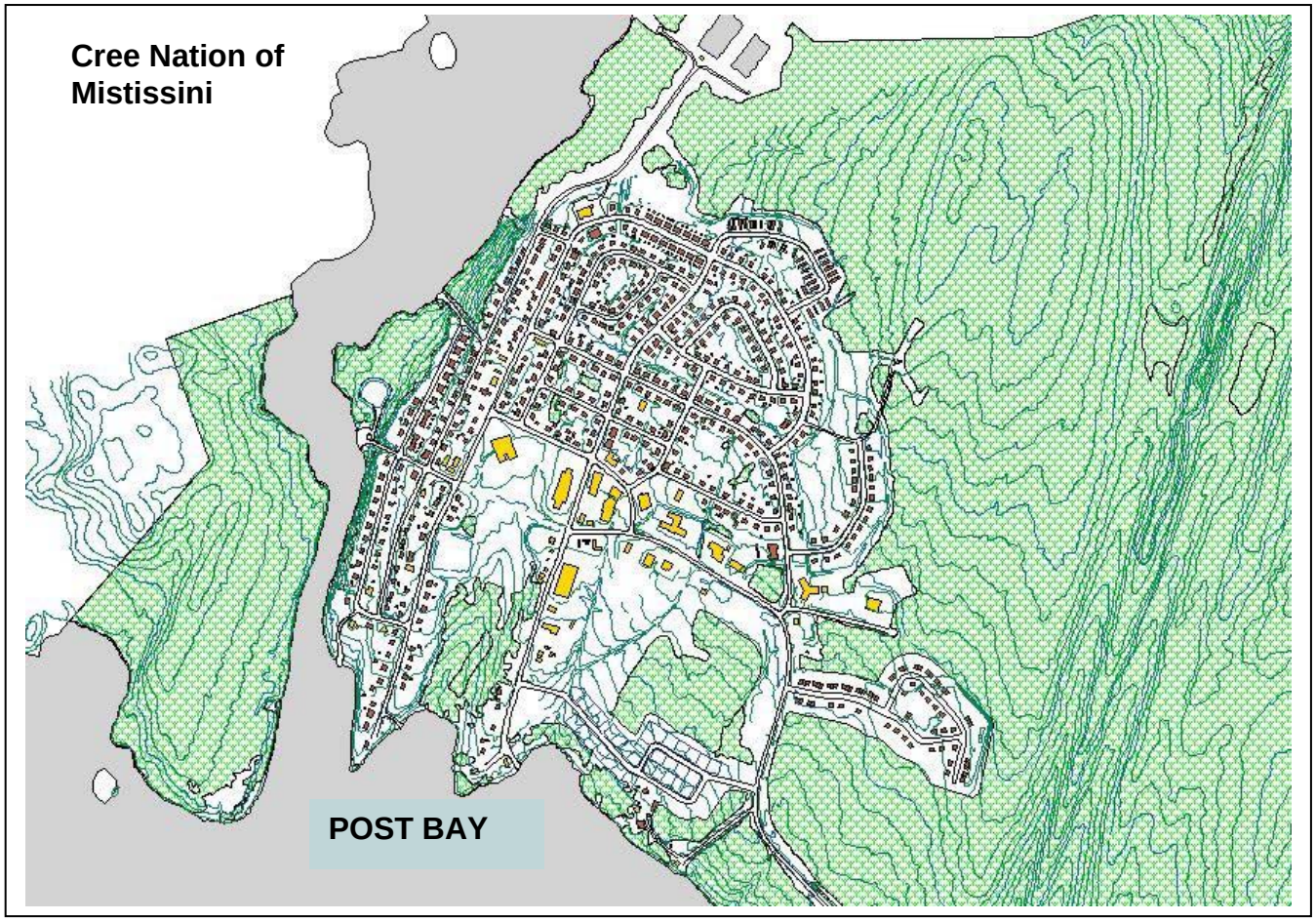
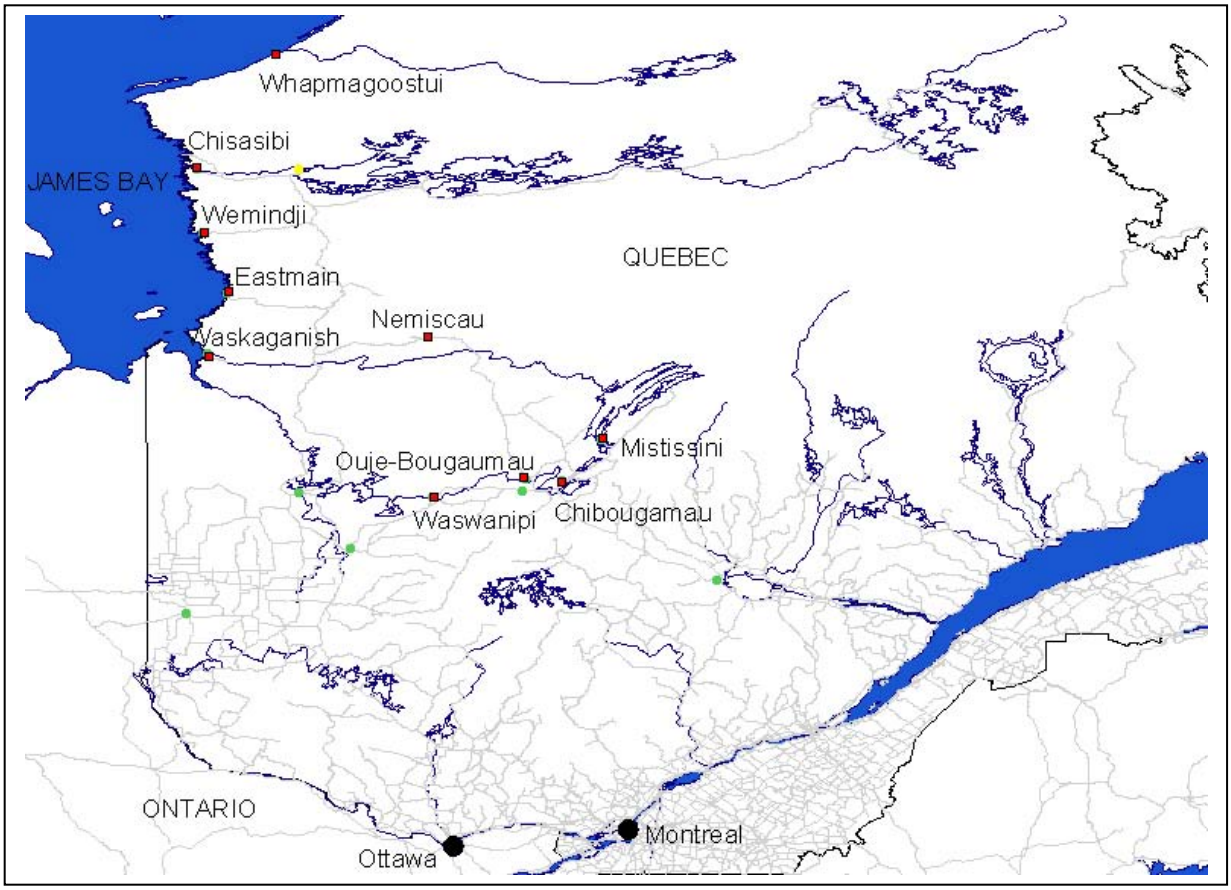


Figure 3.2 James Bay Cree Communities.



3.2 Community and Regional Government

The Cree Nation of Mistissini is one of the 9 Cree First Nations that make up the James Bay and Northern Quebec Agreement, which provides The Cree Nation of Mistissini and the other JBC First Nations with control over their community and surrounding Category II lands as per conditions of the agreement. An umbrella organization known as the Cree Regional Authority (CRA) assists the communities to work together for common aims.

The Cree Nation of Mistissini has responsibility for planning and managing:

- Housing stock (a mix of social and private housing),
- Community buildings (offices and public works buildings)
- Potable water supplies (a complete water network is in operation),
- Sewage treatment and disposal (a complete sewer network, including treatment is in operation),
- Fire hydrants and fire fighting (all homes are within reach of a fire hydrant and the community has full time and Volunteer fire fighters and several trucks),
- Police services (consisting of full time police services with Cree officers),
- Public safety (including fire safety and animal control)

- Roads, sidewalks and snow removal (community operated)
- Garbage disposal (community operated), and
- Recreation facilities (arena, sports and play areas, trails).

The Cree Nation of Mistissini works with the Cree School Board (CSB), Cree Health Board (CHB), Cree Regional Authority (CRA), Government of the Province of Quebec and Government of Canada on areas of mutual concern.

The other Cree communities have similar responsibilities for their own geographic and political areas.

3.3 The Cree Nation of Mistissini and GIS

Mistissini has had a GIS Technician and GIS capabilities for community mapping for over 8 years. The GIS Technician is a community member and has been trained at the CEGEP (Quebec Community College) level in GIS theory and the use of GIS software. He has followed up his formal CEGEP training with vendor operated courses and other training over the past few years. The GIS software that the Technician was trained on and that is used by the community consists of Environmental Systems Research Institute (ESRI™) products such as, ArcView ™, ArcGIS, ArcInfo™ and related products. ***(No endorsement of any company or software is implied by the mention of this or any vendor or software mentioned in this study.)*** The GIS Technician has been through several GIS software product upgrades and the upgrading of computer equipment and peripherals over the last 8 years.

The GIS Technician uses a well-equipped recent model computer with two screens that allows him to increase his computer "work area", view different versions of the same file at once and to clearly see both the map layers and associated attribute information at the same time. He also has full Internet and network access, which allows him to transfer information to other users, obtain data from others in the community as well as outside sources. The GIS Technician also has direct access to several different format colour inkjet printers as well as black and white laser printers. One of the colour printers is an Hewlett Packard (HP) large format (24" wide by up to the length of a paper roll (100') that can easily print the larger map sheets required for more detailed community needs as well as standard topographic map sheet sizes. The Technician also has access to an HP colour printer that supports tabloid (11" x 17"), legal (8.5 x 14") and letter (8.5" x 11") formats. The colour printers are very useful for the many colour maps that can be created using the GIS while the black and white laser printers are cost effective for printing small maps, tabular (attributes) and statistical data.

Air photos and maps have been supplied to the CRA and each of the JBC Communities following a 5-year cycle from the Federal government as part of the 1978 James Bay Agreement. Up until 1993 the government supplied colour or black and white air photos. Starting in 1993 digital information was supplied in the form of an AutoCAD file consisting of layers of community information obtained from orthophotos (accurately located air photos) flown over the communities and

surrounding Category II Lands that are directly controlled by the JBC First Nations. Mistissini has used the data to create GIS map layers and attribute information, such as the locations and addresses of homes and buildings.

Each community creates other data that can be used in a GIS such as the "Civic List". The civic list shows the owner/occupiers of all buildings and homes in the community along with the street address and lot number. In addition housing, insurance, public safety, hazardous materials, water network and water quality information are available from community records for inclusion into the GIS. Data are also available from other sources, such as planning (Master Plan and subdivisions) and building contractors (home model plans, as built roads etc.). Digital and paper lot surveys are available from Government and private surveyors. All of this information can be incorporated into a GIS and some of the above information is currently included in the Mistissini GIS.

A digital photo of each existing house and building in Mistissini was recorded as part of the data quality and accuracy field checks performed in the fall of 2004. The photos will eventually be hot linked to the map and attribute files so that a picture of a particular building may be seen when clicking on either the building outline in the map layer or the attribute (information) record in the attribute table.

3.4 GIS and the CRA and Other James Bay Cree First Nations

The CRA has used GIS in the past to assist in negotiations with Hydro Quebec and various levels of government as well as for environmental, forestry, natural resource and trap line applications. Several of the southern JBC communities, such as Mistissini, Waswanipi and Ouje-Bougoumou have forestry companies that use GIS for forestry mapping and monitoring.

4.0 GIS and Other Approaches to Organizing JBC Community Information

4.1 What is a GIS?

A GIS is a computer-based tool for information collection, modification, analysis and output in the form of new information, maps and reports. In order to work, the GIS requires maps and non-map information, in the form of tables of information (attributes). The non-map information (tables) in a GIS it must be referenced to one or more maps. The information tables are what gives the GIS so much more usefulness and capability than a map or AutoCAD™ drawing alone can have. Rather than show all of the available map information at the same time the GIS allows users to look at one, several or all of the map layers you require. This makes it easier to see things and extract the information or create the required map.

The map information is displayed in a GIS as either:

- Points - one dimensional features that have a location (i.e. a utility pole, hydrant or water sampling site)

- Lines - two dimensional features having length, width and direction (a river, road, path or a fence)
- Polygons – two-dimensional features having area and location existing with or without a specific (separate) line defining them (i.e. a fence or other boundary is considered as a linear feature not necessarily as part of a field polygon). Polygons are defined either naturally (a vegetation type or a lake) or as man-made (features such as a building lot, play ground, parking lot, sewage lagoon etc.).

Attributes, the information in a database, are any alphanumeric (number or letter, individually or combined) information (names, addresses, water sample results, house models etc.) that relates to one or more layers of map information. The attribute information contained in the database attached to a map can be entered into a GIS by using the computer keyboard, from a spreadsheet (MS Excel) or database (MS Access etc.) file or from purchased data from a vendor or government source.

Attributes can be connected to:

- Points (i.e. hydrant flow, year installed, manufacturer etc.)
- Lines (i.e. potable water pipe size, material, installation date etc.)
- Polygons (i.e. buildings, driveways, lots, playgrounds, fire districts etc.)

The database information that is attached to a GIS map has the same characteristics as the databases found in programs such as Microsoft Access, Paradox (Corel) and other common database software and may often be linked or use these programs for attribute storage.

Figure 4.1 shows a satellite image of the Mistissini area. Most modern maps are made from either satellite images or air photos. Looking at the image it is possible to tell land from water and see roads, the community site, treed areas and other details but there is no information regarding the location of the image, the type of roads present or any other details. The image is useful but not overly informative.

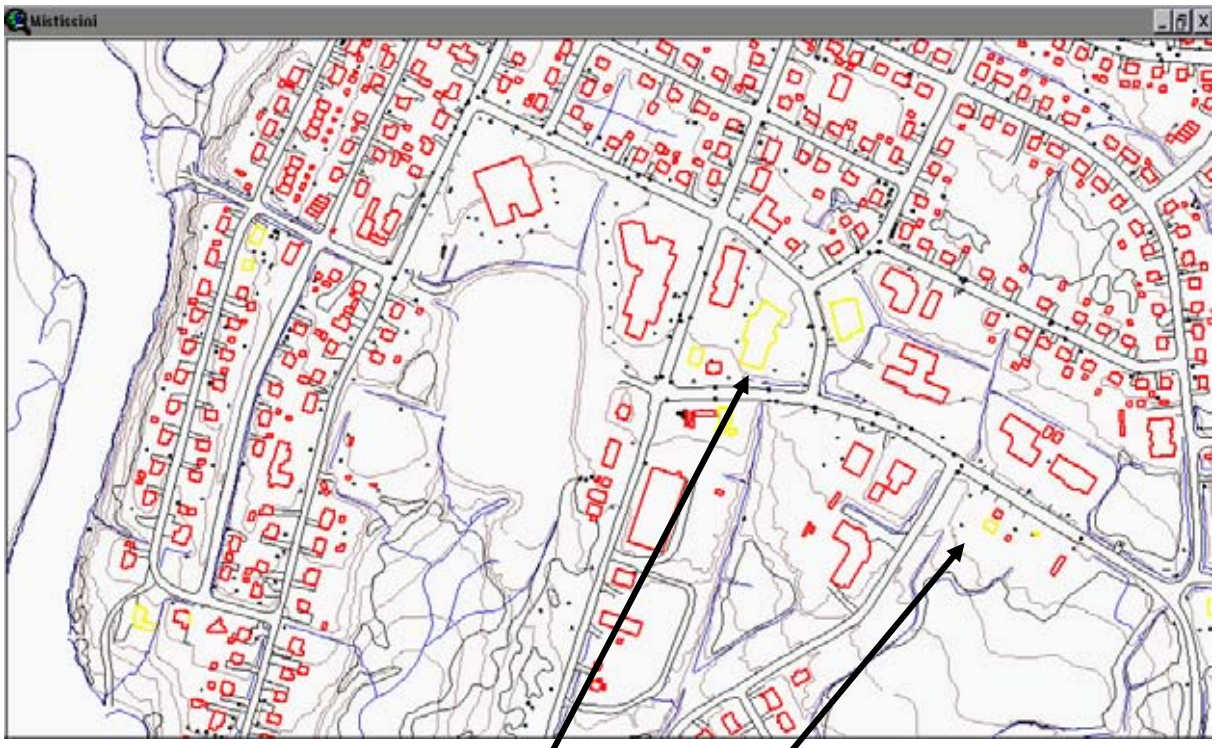
Figure 4.2 shows a map made from satellite images and air photos of almost exactly the same area as in figure 4.1. There are lake and place names on the map, the roads are well defined and located and water and land are easy to distinguish. This map is actually made up of layers of information, just like a GIS. The lakes are one layer and the rivers and streams are on other layers. Roads are another layer as are manmade features such as towns. This map is very useful but more information and detail would make the map more useful to a larger audience.

Figure 4.1 shows a satellite image covering the Mistissini area (image courtesy of NRCan)

Figure 4.2 shows a topographic map of the area of Mistissini shown in figure 4.1. (Map courtesy of NRCan)

Compared to the satellite image and the portion of the 1:50 000 scale topographic map, shown in the previous two figures, the GIS offers so much more information both on the map and in the attached database. However the air photos used to make the GIS map were obtained at a better scale than the satellite image and the database includes information collected from a number of different sources, such as the Civic List.

Figure 4.3 shows just a small portion of the GIS information (map on top and database on the bottom of the figure) that is available for Mistissini. All of the commercial properties have been identified using GIS capabilities. There is both more detail and more information at a variety of scales than on a paper map.



Id	Address	Owner	Use	Hazmat	Camera_num	Number	Letter	Street	St	Lot
139	176 Mistissini Blvd		H			176		Mistissini	Blvd	266
140			S			0				
141			S			0				
142	163 Riverside St		H		DSCN3668	163		Riverside	St	
143	227 Amisk St		I			227		Amisk	St	
144	136 Amanda St	Caisse Populaire	C	C		136		Amanda	St	
145	155 Amanda St	Mistissini Coop Store	C	C O		155		Amanda	St	
146	112 St. John's St	Awash Day Care	I	C O	DSCN3805	112		St. John's	St	
147	104 St. John's St	St. John's Church	I		DSCN3804	104		St. John's	St	
148			S			0				
149	152 Amisk St	Arena	B	O		152		Amisk	St	
150			S			0				
151			S			0				
152	8 Cheno Meskinam	Elders Home	B	O Ox	DSCN4210	8		Cheno Meskinam		20
153	200 Main St		C	G P O		200		Main	St	
154	200 Main St		C	P		200		Main	St	
155	2 Blazo-U-Meskinam St		H		DSCN3673	2		Blazo-U-Meskinam	St	
156	5 Blazo-U-Meskinam		H		DSCN3674	5		Blazo-U-Meskinam		
157	13 Waapstan West St		H		DSCN3587	13		Waapstan West	St	
158	15 Waapstan West St		H		DSCN3588	15		Waapstan West	St	
159	17 Waapstan West St		H		DSCN3590	17		Waapstan West	St	
160	24 Amisk St	Tourism Lodge	C	C		24		Amisk	St	
161			S			0				
162			S			0				
163			S			0				
164	4 Blazo-U-Meskinam		H		DSCN3670	4		Blazo-U-Meskinam		
165			S			0				
166			H			0				
167			S			0				
168	267 Amisk St		H			267		Amisk	St	287
169			S			0				
170	7 Blazo-U-Meskinam		H		DSCN3672	7		Blazo-U-Meskinam		
171			S			0				
172	3 Blazo-U-Meskinam		H			0		Blazo-U-Meskinam		
173	Amisk	Band (Lodge)	C	O		0		Amisk		

A GIS has the capability to show as many or as few map layers as are required. Any layers that may confuse users can be turned off rather than deleted allowing maps to be made of only the information layers that are required at the time.

One example would be an Administrator trying to locate all of the commercial buildings in Mistissini. Figure 4.3 shows how a GIS can be queried (questioned) to find all of the buildings that match the question. The commercial buildings that answer the question are highlighted by the GIS on the map (in yellow) displayed on the computer screen. By switching screens or displaying the map with the attribute information it is possible to see all of the information that is available on the buildings in question including the address, tenant information etc. The map or database information can be printed off for further use or saved and sent to other users in a variety of formats. Figure 4.3 also shows that it is possible to see both the Community map and database at the same time and to find answers to your specific questions.

4.2 GIS Software Levels

Environmental Systems Research Institute (ESRI) software is discussed in the following sections, not because it is necessarily better than other currently available GIS software, but because it is the standard GIS software used by most First Nations (including The Cree Nation of Mistissini and the CRA) that are currently using GIS, by all provincial and federal governments and by many private companies in Canada and the USA.

There are three levels of ESRI GIS software available. ArcExplorer is a free GIS viewer with limited capabilities that is easy to learn and use. ArcView (ArcGIS) is a much more capable program that requires an initial investment of $2500 and some training to be of use. ArcInfo is the most expensive and capable GIS program, however the initial expense of approximately $20,000 combined with a steep learning curve make ArcInfo less likely to be used by some communities. ArcInfo and ArcView are available in French versions.

ArcExplorer (for almost anyone)

ArcExplorer was created to help non GIS computer users view, change, save and print GIS maps and tables without a lot of GIS knowledge or the need to buy and expensive GIS program. It works on almost any computer and doesn't take up much space. It is provided as a free download from the Internet and can be used at no cost. Many community files, AutoCAD files and files from different levels of Government can be viewed, modified, printed or saved using ArcExplorer. It is not possible to create new maps from scratch in ArcExplorer but map colours, lines, symbols and text can be modified. The resulting changes may be printed as a map with a legend, scale bar, north arrow and title. Basic questions can be asked of the database with the results shown on the map and in the database. Help for the program is available while using the program, from a digital manual supplied with the program and on the Internet.

ArcExplorer has been introduced to all senior and many of the technical staff in Mistissini. Staff and Directors have received training in the use of ArcExplorer. GIS files for each department's specific use have been prepared and distributed to the housing, public safety and operations and maintenance departments

ArcExplorer strengths are:

- Widely known and used commercial GIS software;
- Can be used to view, but not change, CAD and image files in various formats;
- Available free on the Internet;
- Small program that doesn't use much computer space (14 MB) or resources;
- Uses some, but not all, ArcInfo file formats for map and table (attribute) data as well as supporting other file formats;
- Very good documentation and examples, exercises and information are free on the Internet from a variety of sources;
- Backed by a very large multinational company with support facilities;
- Often used by large companies, government agencies and departments to distribute and show people maps and information;
- Can use satellite images and air photos as a backdrop;
- Has a number of tools to deal with map manipulation and analysis;
- Map colours, legends and other details can be easily modified to make your maps look like what you want, and;
- Maps and non-map information can be saved and printed once created using ArcExplorer.
- Measure distances right on the computer screen between any points or features on the screen.
- Calculating summary statistics, such as count, sum, average, and variance.
- Edit maps and tables and see the results immediately on the screen. If you like what you see it can be saved or printed.
- Import maps from Arc/Info and other ArcView sites; import and display image data sources; and importing tabular data from Arc/Info, and a variety of other sources. Many Government Departments and Agencies use ArcInfo formats for map and information distribution on the Internet or on CD ROM.
- Makes an excellent introduction to the ideas and processes used in a GIS.

ArcExplorer limitations are:

- Does not have any remote sensing analysis or manipulation capabilities;
- Cannot do some specialized tasks that are better done using ArcView or ArcInfo, and;
- Some file formats need to be modified to be used in ArcExplorer
- Cannot be used to digitize data from paper maps.
- Cannot make use of some Arc/Info files.

ArcView (for more experienced or demanding users)

ArcView was created for users who require more control over GIS maps and tables. ArcView has all of the capabilities of ArcExplorer using the same or similar commands and ideas. In addition it is possible to do much more in terms of creating new maps from scratch, changing the maps, adding and deleting information and importing and exporting different file formats. ArcView requires more effort and time than ArcExplorer to get up and running with the program but has correspondingly more useful and flexible outputs and capabilities. ArcView sells for $2500.00 to buy and can run on most recent computers.

Most users will not need ArcView but ArcView can be used to create maps for the use of ArcExplorer users.

ArcView strengths are:

- Widely known and used commercial GIS software;
- Uses ArcInfo file formats for map and table (attribute) data as well as supporting other file formats;
- Very good documentation and examples;
- Skills used in working with ArcExplorer can be used immediately with ArcView;
- Used by most large companies, government agencies and departments. Data are often readily available in ArcView / ArcInfo format;
- Can use satellite and air photo images as a backdrop;
- Has a good set of computer tools to deal with data manipulation and analysis that is enhanced by extra modules (at an extra cost). Using your own computer you can, with some training and experience, design and display maps, charts, tables and images on screen; and print maps.
- Integrates maps, images, tabular data, graphics, and charts into useful displays for viewing and evaluation.
- View and print maps at the scales and sizes you need.
- Search for and select features of interest on the map based on different questions that you could ask the computer.
- Select and display map features based on location.
- Analyzing map data based on conditions of proximity, adjacency, and containment.
- Measure distances right on the computer screen between any points or features on the screen.
- Calculating summary statistics, such as count, sum, average, and variance.
- Edit maps and tables and see the results immediately on the screen. If you like what you see it can be saved or printed.
- Import maps from Arc/Info and other ArcView sites; import and display image data sources; and importing tabular data from Arc/Info, and a variety of other sources. Many Government Departments and Agencies use ArcInfo formats for map and information distribution on the Internet or on CD ROM.

ArcView limitations are:

- Does not have much remote sensing image analysis or manipulation capability;

- Cannot project data (assign latitudes and longitudes), must use ArcInfo, and;
- Has a greater manipulation, analysis and display capability than ArcExplorer but less capability than ArcInfo.
- Cannot make use of some Arc/Info file formats.

ArcInfo (for the GIS Technician to use to create information for Community users)

ArcInfo is the most complex and expensive GIS program, costing up to $25,000 (depending on the options required for a Community) and, while it uses many of the same commands as ArcExplorer and ArcView, ArcInfo is more capable than either ArcExplorer or ArcView. The GIS Technician may use ArcInfo to create new maps and database information, modify existing information or print maps using a variety of map sizes for people using ArcExplorer or ArcView. The Mistissini GIS Technician has been using ArcInfo for a number of years.

ArcInfo has all of the capabilities previously mention with none of the limitations, apart from the increased training and time needed to become familiar with the software and the additional expense of the software compared to the other two versions.

4.3 Matching GIS Capabilities With Housing and Related Public Safety Issues Affecting JBC Communities

One perspective on the use of GIS for housing and public safety needs is to match or cross reference the role and type of information required to the capabilities that the different levels of GIS currently provide. The following paragraphs briefly review GIS capabilities and provide some information on the different levels of GIS software. As with many other software applications areas, such as, graphics, writing and business software there are different levels of GIS programs ranging from free, easy to use viewers with some manipulation and visualization capabilities to increasingly expensive and complex programs.

A GIS can do calculations, modeling, mapping and analysis for users *but* it helps for the user to have some idea of the input information quality, the analysis and manipulation and the expected outcome. It is possible to use poor data and/or the wrong procedures in a GIS to produce a very nice looking image (or map) that is at the correct scale and projection but is partially or totally flawed in the information that it presents.

A GIS is very good at assisting in repetitive, complex and otherwise boring or laborious tasks, if done by hand. The GIS comes equipped with the capability to:

- Measure (points, areas, distance) from maps and table information;
- Maintain and edit (updates, new information or changes) maps and table information;
- Search for and retrieve map and table information (where is, how many etc.),
- Transform maps (change scales, add maps together, split maps apart),
- Classify map and table information (residential homes by age, square footage, builder, owner etc.),

- Make it easier to import digital information from a variety of sources ranging from satellites to maps and reports,
- Make it easier to export digital information to a variety of users and to database, spreadsheet, Power Point presentations graphics and GIS programs, and:
- Produce useful digital (to view on the computer) and paper maps without being a cartographer, however cartography experience can hep to make a better map.

The GIS should be thought of as a smart measuring tool that can convert units (metric to imperial etc.), measure angles, distance, perimeter and numbers of items. Common measuring tasks are:

- measure the number of points i.e. how many utility pole, water sampling sites, utility poles, manholes etc. are there in the Community;
- measure the number of points within polygons i.e. How many fire hydrants are in the commercially zoned area of the Community;
- measure the perimeter of a polygon i.e. how many metres (or km) of fencing is required to close off a sports or play area.

While there are a number of useful things that a GIS can help users with there are some things that are better done by a non-GIS program such as:

- A GIS is not the best tool for doing drawings or plans, which are better left to CAD (Computer Aided Drawing) just as a CAD system does not have the mapping and analysis capabilities of a GIS. However it is possible to include drawings and plans from a CAD system in a GIS.
- A GIS will not provide information if the necessary map and table information is not present. The Mistissini GIS Technician can easily add information to a GIS for community users.
- A GIS will not work with data that does not have a geographic basis – hand drawn maps cannot be used directly in a GIS!
- Legal measurements and descriptions are best obtained from a survey document rather than measurements using a GIS (they will probably not be quite as accurate using a GIS).

4.4 Categorizing JBC Communities' Information Needs

The JBC communities housing and public safety information needs can be categorized as follows:

- Visualization – what is the best way to show the information based on the audience or information user's level of comfort with information. Are the users or audience familiar with the area, with numbers, such as spreadsheet or database tables, or would it be better to illustrate the problem with a map, a photo or a plan that could be discussed and reinforced with verbal or written information as required.

  Most people can orient themselves with community maps that are at a suitable scale and that use annotation for street and buildings and that include local features of note such as, streams, shorelines, parks and schools. Having photos of buildings, infrastructure or house plans available can make visualization and understanding much easier. It is even easier for users if all of these diverse sources of information are available in the same form, be it on paper or in a computer ready to show to the Community.

- Manipulation – are modifications needed to the maps or information to clarify or update the situation? It may be better to change a map or drawing scale or the line width, colours or symbols to make understanding easier. Fonts or type styles on maps or in documents may require changes to make it easier to use the information. Symbols identifying features of interest, such as valves, hydrants or utility poles, can be modified by shape, size and colour for better visibility and clarity.

  A common requirement in most JBC communities is the addition of new housing areas, new hydrant locations and new roads. This information must be updated on a regular basis. In Mistissini there have been over 30 new houses added to the community each year for the last 4 or 5 years as well as a number of new roads and extended infrastructure.

  New Quebec regulations require all hydrants in the province, including the JBC communities, to be tested and rated for water flow. Depending on the flow rate the hydrant will be painted a different colour to identify the flow rate. Fire hydrants have been mapped and numbered in Mistissini and many of the JBC communities but the new provincial regulations require more information on each hydrant. The database attached to the hydrant map layer will require modification once each hydrant has been tested for flow and pressure. This can be easily done using the GIS and has the benefit of allowing all hydrants with a certain flow or pressure to be easily identified.

- Questions / Analysis – There are a number of often asked questions that the GIS specializes in answering in as much detail as the information and user needs require. The main GIS questions relate to:

Location – What is at or where are?

Using a GIS it is possible to click on any feature or building on the GIS map and find out all of the available attribute information. Location is an important question, as many paper maps, even at scales like 1:2 000, cannot hope to show the level of detail that this question requires. For example there is a limit to the size, font style and positioning of text or the number of colours that can be used to identify different types of urban features, forest types, contours etc on a map. However if the map is associated with database attributes, such as the address numbers of single-family homes on a block etc., can be shown on a computer screen while also displaying a map of the area in question.

Condition – Where is it?

- A GIS can easily locate and obtain address and occupant information for all of the Band houses versus Cree School Board, Cree Health Board and private homes.

- The location, working condition and servicing level of all of the fire hydrants in a community can be determined and mapped.

The GIS map on the computer screen will show the locations while the information table attached to the map can show addresses, tenant names, house models and anything else that relates to the building or feature. Any area(s) that meet the queried conditions will be highlighted on the map and associated table.

The information must be in the digital map or attached database in order for this to work. Questions can be applied progressively to see which sites, if any, answer some or all of the questions.

Trends or Patterns. – What has changed since?

- Where are all of the streetlights installed since 1999?
- Where are the largest houses in the community?
- Are all of the hydrants near the Tourist Lodge the same model and age?
- What are the locations of certain model homes? Are they found on a certain street or area of the community?
- What are the locations of various hazardous sites and are they near homes or schools?

These are all pattern type questions that can be asked of either the GIS map, the GIS database or to both to determine what, if any, patterns exist that are of interest to the community. It is often easier to question the map than to try to determine patterns visually using a paper map or computer printout of numbers and letters. This is especially true as the JBC communities grow and there are more map layers and larger databases. The computer specializes in performing intensive tasks like this in a *very* short time. This allows more time to be spent

on questions, such as “What is the importance of this pattern?” or “ How do I deal with the problem that this pattern may show?”.

Modeling – What if?

- What if a new Day Care is built on the northeast side of the Community? – how many children would be close to the day care and what are the closest Band or office type buildings.
- What if only multi unit buildings were allowed to be to be located on the largest lots? – Are there enough lots located near schools?

As with any spreadsheet it is easy to change one or more pieces of information in the GIS to see the effect of the change in the form of a map. This can help decision making, especially for people who are not familiar with databases, as it is often easier for people to see changes visually on one or more maps. Any changes can be saved, in hardcopy map form or as a file in the GIS to allow comparisons to be made between different options.

Observations and measurements from the community, satellite images, air photos and maps of different scales, ages and sources can be used to help answer the above questions for information about the community. The answers to these questions can be illustrated by both maps and database information.

Analysis – over time and space.

Some analysis relates to either changes in the area (for example new buildings in new areas or infill houses in older parts of the community) or extent of the community and changes over time in the community (new buildings replacing older buildings in the same locations).

Spatial (change over the earth’s surface) analysis – the location and extent of any areas of interest can be determined and highlighted on one or more maps. The information of interest can be used to create a stand-alone map for reference or distribution purposes. An example would be where contaminated land was not identified and a building was placed on the land.

Temporal analysis deals with change over time. This can range from variations in test results done at the same sampling sites over a number of years (water samples from known locations), to changes in water level (from maps or air photos), or variations in the height, extent and volume of community areas (from surface surveys, observations or stereo air photos).

- Reports – Mistissini and other JBC communities require reports for internal and external requirements. These reports can be required on a daily basis, as in the case of housing maintenance, on a weekly basis for fire hydrant operability and water quality to mortgage and related documents that are required on an as needed basis.

Information related to mortgages or government applications by JBC communities is often required for legal purposes. While report requirements vary they can often best be addressed either by using maps, such as a map of all working fire hydrants, or by using details that can be supplied from the database, such as the number of Model 85 homes built in 1992. This can be supplemented with a map as the database and map are always linked together and any questions show answers on both the map and database.

The GIS can also produce statistics from the database information as well as pie charts and other graphs. These graphs or statistics can be used as is or incorporated into reports or presentations. They can also be exported in digital form as email attachments or for use in other programs.

- Mapping – A simple map containing basic details and an idea of scale is often enough to satisfy many of the local requirements in Mistissini and other JBC communities. More formal maps may be required for governments for which a larger format map, a scale bar, north arrow, geographic grid, title and legend are often used. All three GIS program levels can meet these mapping requirements. For example the housing department in Mistissini is required to provide a simple map to CMHC/INAC when applying for a building renovation grant. The map only has to show the location of the buildings under consideration and can be created in ArcExplorer. The planning department can use simple maps to show the impacts, if any, of new roads, zoning and housing expansion in a Community.

Table 4.1 Matching different levels of GIS capabilities to housing and public safety needs, such as visualisation, questions, mapping and reporting. ArcExplorer does not offer the level of mapping and reporting that is offered by ArcView or the more expensive and complex ArcInfo. ArcView offers about 90% of the capabilities of ArcInfo at a lower cost and with less training.

Table 4.1 Matching GIS Capabilities to Housing and Public Safety Needs

Matching GIS Capabilities to Housing and Public Safety Needs				
REPORTING REQUIREMENTS	**FREQUENCY**	**VISUALIZATION QUESTIONS MAPPING (maps cannot be created from scratch and must be provided from another source)** **ArcExplorer (simple GIS)**	**VISUALIZATION MANIPULATION QUESTIONS REPORTS MAPPING (includes new map and database creation capabilities)** **ArcView (more complex GIS)**	**VISUALIZATION MANIPULATION QUESTIONS REPORTS MAPPING (includes extended new map and database creation capabilities)** **ArcInfo/Arc GIS (most complex GIS)**
Council-planning	Weekly	Some	Y	Y
Council-lot distribution	Frequently	Y	Y	Y
Council-housing distribution	Frequently	Y	Y	Y
Council-zoning	Frequently	Some	Y	Y
CMHC New building (lot availability)	Frequently	Y	Y	Y
CMHC Renovations (location, numbers etc.)	Yearly	Some	Y	Y
Insurance (damage etc.) (Board of Compensation)	Frequently	Some	Y	Y
Local Fire Protection (hydrant operation, flow)	Weekly	Y	Y	Y
Quebec fire protection regulations (hydrant ID, flows, operation)	TBD	Some	Y	Y
Water quality reports	Weekly	Some	Y	Y
CONCERNS & INFORMATION REQUIREMENTS				
Housing maintenance	Daily	Some	Some	Some
Housing preventative maintenance	Daily	Some	Some	Some
Planning	Frequently	Y	Y	Y
Insurance	Frequently	Some	Y	Y
New housing	Frequently	Y	Y	Y
Lot availability	Frequently	Y	Y	Y
Lot registration for mortgages	Frequently	Some	Y	Y
Community maps	Frequently	Basic	Y	Y
Potable water network	Frequently	Y	Y	Y
Water heating cables	Seasonally	Y	Y	Y
Sewer network	Frequently	Y	Y	Y
Fire response, districting, planning	Frequently	N	Y	Y
Hazardous materials	Frequently	Y	Y	Y

4.5 Examples Of How JBC Community Information Can Be Effectively Organized For Input Into A GIS

Many JBC communities have lists of addresses, tenants or building occupiers and lot numbers for use in determining housing allocations, user fees and to provide community services. This information is a key element to understanding the community and can form the basis for a GIS or housing management programs. In the past these lists would be typed up but they are now done using a word processing program on a computer. The information in word processing format, such as MS Word can be imported as a text file into either a spreadsheet or database program by following the "Wizards" common to both programs that walk a user through the process to convert a text file into a format that can be used by the other programs. The same is true for any other information in document form.

When dealing with computer files in general and GIS or database files in particular care must be taken with:

- spelling, for example Mistissini versus Mistassini, a common mistake in Mistissini where the name of the community was changed to clarify things as there was another non-Cree community with the name of Mistassini.
- the identification of individuals with the same name by use of a middle name or initial or Junior / Senior, Mrs. Or Miss.
- The use of short forms. Consistency is required in the use of short forms such as one only of St, St. or Street.
- Numbers and dates. One format should be chosen and followed for identifying the year, month and day for all community records. Some examples are one of YYYY/MM/DD, DD/MM/YYYY or MM/DD/YYYY.

The following figures show a text file that has been transformed into a spreadsheet format that can then be transferred into a GIS or database format.

Figure 4.4 shows a text (MS Word) file that makes up part the Civic List for Mistissini. The file is set up to minimize typing and to make it easy to change information quickly. However the information would require modification for use in either a database, such as MS Access or a GIS.

STREET NAME: AMANDA STREET

TENANT	NEW CIVIC #	OLD CIVIC #	LOT #
A	51	224	183
C	59	123	181
B	67	179	
D	75	243	
Day Care	115		
K	131	225	165
Caisse Populaire	136		
Meechum Inc.	136		
Vacant	152		

Spreadsheets are commonly used for mostly numbers but figure 4.5 shows that it is possible to change the formatting to add information and graphics to a spreadsheet. For example the ability to add a graphic could be of use for insurance or other purposes where digital photos of damaged or renovated homes could be added for reference to a spreadsheet being sent to an adjuster to ensure that the right information is being transferred.

Figure 4.5 An Excel spread sheet with more information, a better format and greater title and logo capabilities. The information is the same as in figure 4.4. (Information has been left out for privacy reasons).

Cree Nation of Mistissini

Civic Addresses

Last Updated:

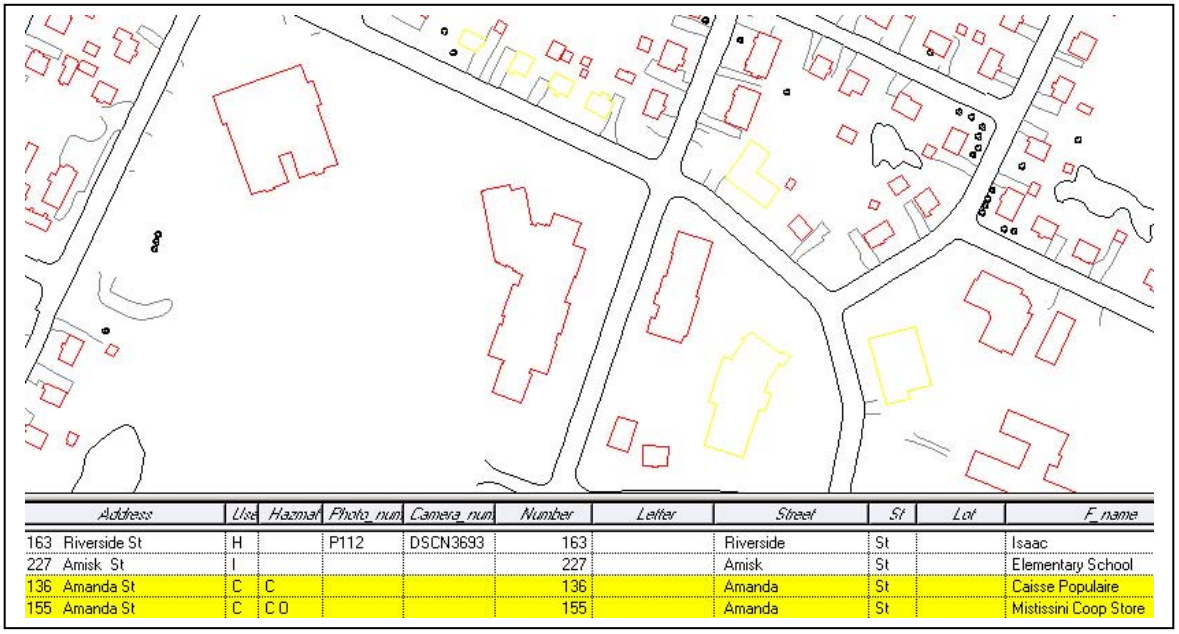
Today: 31-Oct-04

Number of Pages:

Updated by: Robert M. Shecapio - Local Land Registrar

Last Name	First Name	Initial	Street Name	New Civic #	Mistissini ID	Block #	Lot #	Ownership
A			Amanda	51			183	
C			Amanda	59			181	
B			Amanda	67			179	
D			Amanda	75				
	Day Care		Amanda	115				Day Care
K			Amanda	131			165	
	Caisse Populaire		Amanda	136				Caisse Populaire
	Meechum Inc.		Amanda	136				Meechum Inc.

Figure 4.6 shows the same information after it has been incorporated into the GIS and linked to a map. Buildings on Amanda Street are highlighted, using the GIS, in yellow.



Address	Use	Hazmat	Photo_num	Camera_num	Number	Letter	Street	St	Lot	F_name
163 Riverside St	H		P112	DSCN3693	163		Riverside	St		Isaac
227 Amisk St	I				227		Amisk	St		Elementary School
136 Amanda St	C	C			136		Amanda	St		Caisse Populaire
155 Amanda St	C	C O			155		Amanda	St		Mistissini Coop Store

4.6 Effective Non-GIS Approaches to JBC Community Housing and Public Safety Concerns

This section reviews the non-GIS approaches that have been taken to address housing and public safety information requirements. There are a number of options using commonly available software that are meeting most, if not all, of the information needs of the JBC communities. All of the non-GIS programs, ranging from word processing to spreadsheet, database and even AutoCAD, have reasonably priced training guides that can be purchased. Courses in the use of these programs are offered in night schools (often located in the local high school) in larger communities, such as Mistissini or at the new training centre in Waswanipi.

A GIS can provide reliable measurements for most needs but the legal description and measurements required for surveyed lots should be obtained from the documentation (figure 4.7) provided by the surveyor. Often these measurements and descriptions are given to the inch or centimetre, accuracy that is not present for most community GISs.

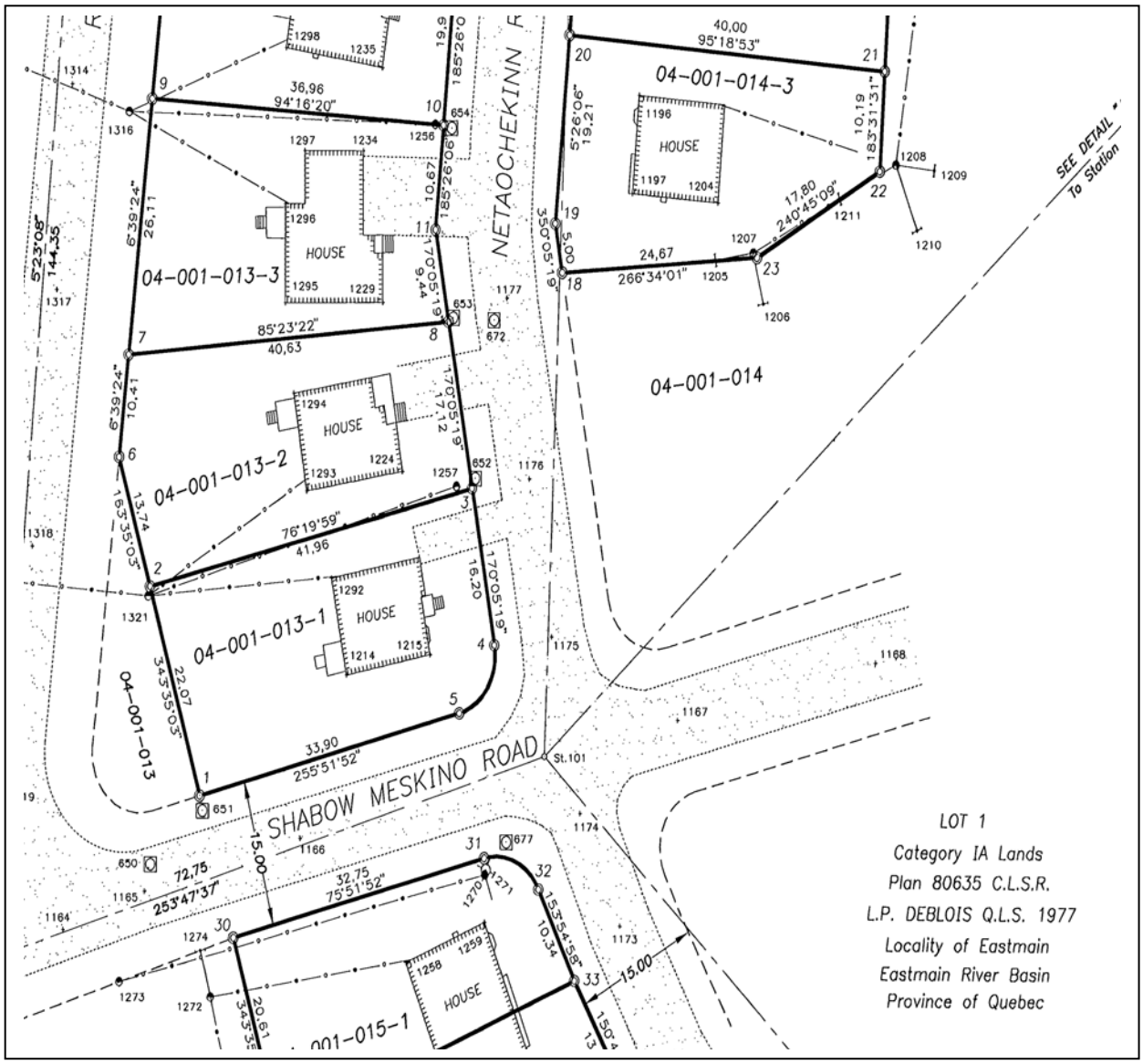
Figure 4.7 shows a government survey plan of a portion of the community of Eastmain. There are important measurements and other information, such as lot numbers and other references, available right on the document. The document was originally prepared in the late 1970's on paper but was scanned by the Legal Surveys Division of NRCan and is available as a digital image file from the Internet. The image file can be printed out using a paint or graphics program or used directly in a word processing document or PowerPoint presentation. It is also possible to scan the document and format it, with some work, for use in a GIS.

Detailed housing maintenance information, such as the information used in the CRA Housing software, is used by each community to keep inventories of materiel; to place material orders and to prepare work orders for staff to repair housing problems. While some of this information can be incorporated into a GIS and used to show patterns or problems most of the information is required for inventory or work order purposes. In small communities staff generally know the community so that a location map, while useful, is not required.

Inventories for fire safety, public works and O & M requirements often have specific programs written for the specialized needs that occur in these areas. While these programs may be expensive and require time and effort to learn they will fill the need better than a GIS.

A GIS can show the location and type of hazardous materials in a community as well as the commonly used hazard symbol but the detailed information on the effects of the hazard or how to deal with the hazard may best be found in the "2005 Emergency Response Guidebook". While it is possible to incorporate all of the information from the guidebook into the database of a GIS it would require considerable effort

Figure 4.7 Portion of a survey from the NRCAN website. (Eastmain 1977)



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4.6.1 Word Processing Approach

As shown in figure 4.5 the Mistissini civic address listing can contain useful information for the community but the information needs to be in a format, either as paper documents or computer files that can be easily updated and shared amongst users in the community. The skill required to operate a computer and type in the information is available in all JBC communities. The computer and printing resources are also available in every community and the cost of a computer, operating software and the word processing program is within the reach of almost every Community. There are two main commercial word processing programs; Corel Word Perfect and MS Word.

Word processing programs have been used in Mistissini and other communities to create inventories of buildings, as well as reports, memos and other documents for housing and public safety purposes. Digital photos and other graphics have been added to inventories or other documents. These results can be printed or shared using a computer. Word processing programs provide a document that is often preferable to the quality of a hand written document.

Word processing programs have also been used in Mistissini to create forms for use in the field or where ever computers are not available. The information is written in by hand and the completed forms are returned to the office where the information is permanently added in the computer.

4.6.2 MS Excel (Spreadsheet) Approach

The main spreadsheet program in use today is MS Excel. It can be purchased and used a standalone program or as part of an “Office Suite” which contains a word processing program as well as a presentation program known as PowerPoint. Excel requires a bit more training than word processing programs but, thanks to the Windows operating system used on many computers, the commands required to use the program are often very similar to those used in other MS programs, such as, Word or Access.

Excel is more focussed on mathematical formulas, such as calculating the insured value and contents of all Band buildings or the average age or square footage of housing stock but the program does allow great flexibility when creating inventories in terms of formatting the cells to include information in different fonts and sizes and including charts and graphics. The program uses linked information between cells where a change in one cell is reflected in the linked cell(s) saving time and effort. Excel actually creates better charts than the GIS program as there is much more control over the format and appearance of the information. Digital photos and other graphics can be easily added to these inventories and the results can be printed or shared using a computer.

As with word processing programs the computer and printing capabilities are within the capability of Mistissini and the other JBC communities. Excel is not too

expensive and has many commands in common with other Windows programs. Many federal and provincial government departments, the CRA and private companies prefer to provide information in Excel format and prefer to obtain information, such as insurance values, in Excel format. There are a greater number of experienced Excel users in Mistissini and the other JBC communities than users with either GIS or database experience.

4.6.3 MS Access (Database) Approach

Access is similar to the spreadsheet program Excel in terms of the commands and some capabilities but the program allows you to do much more than mathematical manipulation. Access is used by the Waswanipi Housing Department to monitor the housing stock, the waiting list and other housing items. Access can be used to create or view a database that has already been created and ask "what if". What if we change the number of units to be built next year? Will it :

- Decrease our wait list numbers and time waiting?
- Cost us too much over a short period of time?
- Increase our borrowing cost?
- Increase our insurance rates if we build multiplexes rather than individual homes?
- Allow us to cover our mortgage costs through rents?
- Allow us to cover our costs for services based on the square footage of the new homes?

Another "what if" question that has been of interest to many of the JBC communities that charge user fees based on square footage is "What effects would there be if we include finished basement square footage into our calculation of user fees?" As with the spreadsheet if one item is changed, such as the user fee charged per square foot, the effects on linked items, such as revenues are quickly displayed.

Databases created using MS Access, Corel Paradox or Oracle can be queried or questioned similar to the way that the maps and attached database in a GIS can be question with one major difference – answers to questions appear as numbers and letters but there is no link to a map to show the location of the answer to the question.

Information does not have to be repeated or duplicated in a database – it is possible to link to other databases instead. Using the street address of a house it should be possible to link to the databases that hold maintenance and repair information, insurance information, house details, ownership etc. The house address is a logical identifier and is used by the JBC communities. As there shouldn't be two of the same address in one community the street address is a unique identifier.

Reports can be custom styled in Access in terms of information presentation, fonts, charts etc. Graphics can be incorporated into a database but, unlike word processing and spreadsheet programs, the graphic file or digital photo are not imbedded into the file they are instead linked to the database. This keeps the database file smaller and makes it faster to work with. The Housing Information

Officer in Waswanipi uses Access to monitor and report on housing activity in the community. Most other community housing departments rely on the CRA housing program for their needs.

4.6.4 Add on Programs (CRA Housing Software)

The CRA program was written in Visual Basic to work "on top" of MS Access. This means that the user does not have to know anything about Access as the program appears as a series of forms that are filled in by the user on a question by question basis to determine the work that is required, where the work is to be performed and what materials and personnel are required. The information entered is "captured" and, using the underlying Access program, used to create reports, update costs and show how materials and personnel are used. The capability exists to send out invoices to tenants who have caused damaged to a unit (versus maintenance issues). Other private or non-Band houses may be included if emergency work is required and the owners can be invoiced accordingly. The program has been in use in eight of the nine JBC communities for several years and is used on a daily basis by most Housing Departments to track work and issue work orders to the maintenance staff.

New homes are entered into the database as they are built while older homes are entered when work is required. Every Band home in a community will eventually be part of the database as repairs or maintenance. Each house is identified:

- With a unique identifier assigned by the program when maintenance or repairs are first carried out on the house, and
- By street address. The following information is also noted:
- Model / Project number,
- Year built and contractor
- File number,
- Tenant name, and;
- The housing inspector's name.

All of the housing information is in Access format and can be linked to other databases or to a GIS through either the street address or the unique ID number assigned by the program. The program is linked to a preventative maintenance program that monitors to ensure that preventative maintenance is being performed. The program is also linked to the Capital Assets program and receives regular updates. Inventory information collected by the program will be included in a planned warehouse inventory and purchasing plan where bulk purchases will be made for one or more communities based on historical usage information from the program combined with inventory information.

The program currently updates ten inventories including:

- Siding materials
- Windows
- Heating

- Plumbing
- Electrical

Users are assisted in entering information into the program by the use of drop down menus for street names and material codes for inventory and parts. This speeds up data entry and at the same time decreases “finger problems” where the street name or code might be misspelled or otherwise incorrectly entered.

In over two years of daily use in eight of the nine JBC Communities the program has proven to be user friendly, easy to maintain and update and has been successful enough that additional capabilities have been added to the program based on user needs. More capabilities are in the process of being added to the program based on user needs. Future record handling needs and flexibility have already been built into the program as a unique two-letter community identifier identifies every community (i.e. Mistissini is MI) and the program has the capability to handle 10 000 houses in each community. Each house in the JBC communities is provided with a unique identifier. Further details and a sample of the work order generated by the CRA housing software appear in Appendix B.

Training in the use of the housing software is provided by the CRA and the CRA may assist communities with quarterly updates of their database. Community housing staff that have already been trained act as mentors to other staff in their community. This keeps training costs low and allows housing staff to become familiar with the program using their own data and computer in familiar surroundings. There are enough staff that have been trained in each community to cover vacations and illness.

Table 4.2 Matching Non-GIS Software to JBC Community Information Needs.

Matching Housing and Public Safety Reporting and Information needs to Non-GIS Approaches				
REPORTING REQUIREMENTS	**MS EXCEL**	**CRA Housing Software**	**MS ACCESS**	**PAPER DOCUMENTS Maps or word processing print-outs** (quality, scale & availability will vary)
Council-planning	Numbers	Numbers	Numbers	Y
Council-lot distribution	Numbers	N	Numbers	Y
Council-housing distribution	Numbers	N	Numbers	Y
Council-zoning	Designations	N	Designations	Y
CMHC New building (lot availability)	Designations	N	Designations	Y
CMHC Renovations (location, numbers etc.)	Numbers	Y	Numbers	Y
Insurance (damage etc.) (Board of Compensation)	Numbers	Y	Numbers	Y
Local Fire Protection (hydrant operation, flow)	Numbers	N	Numbers	Y
Quebec fire protection regulations (hydrant ID, flows, operation)	Numbers	N	Numbers	Y
CONCERNS & INFORMATION REQUIREMENTS				
Housing maintenance	Numbers	Y	Numbers	Y
Housing preventative maintenance	Numbers	Y	Numbers	Y
Planning	Numbers	Y	Numbers	Y
Insurance	Numbers	N	Numbers	Y
New housing	Numbers	N	Numbers	Y
Lot availability	Numbers	N	Numbers	Y
Lot registration for mortgages	Numbers	N	Numbers	Y
Community maps	Numbers	N	Numbers	Y
Potable water network	Numbers	N	Numbers	Y
Water heating cables	Numbers	N	Numbers	Y
Sewer network	Numbers	N	Numbers	Y
Fire response, districting, planning	Numbers	N	Numbers	Y
Hazardous materials	Type & address	N	Type & address	Y

4.6.5 AutoCAD

AutoCAD is the program of choice for engineers, architects and planners to create house, water, infrastructure and planning ideas and presentation material. Much of the work done by outside companies and government departments is provided to the JBC communities in the form of paper AutoCAD files or digital files, often on a CDROM. Like a GIS the AutoCAD program requires some training and time to become familiar with the program. The program will run on most recent computers and costs about $2000. New versions of the program come out every year or two. There are two different levels of AutoCAD programs available; the full cost fully functional program, the current version is Auto CAD 2003, and a free or low cost AutoCAD file viewer that, similar to the free ArcExplorer GIS program, allows users to view, print and do some manipulation to a CAD file.

Most, if not all of the JBC communities have at least one copy of the full version of AutoCAD in the housing, capital works or O & M departments. There is often at least one skilled user in each community. Over the last 5 years AutoCAD has become more user friendly and uses the Windows interface with similar commands and structure to other Windows programs that users may already be familiar with.

CAD plans often provide an overview map showing where the particular area is located in the community, detailed information including measurements and notes on the area in question and, if appropriate, an elevation view of the area showing a side profile. The drawing, like a GIS map, is made up of many layers of information that use different coloured lines and different line widths, styles and symbols to identify features. Many of the CAD files provided to the JBC communities are made up of over 100 layers of information!

Contractors should provide a digital copy of each community file – paper copies alone are no longer sufficient for community use. Communities have been charged thousands of dollars to obtain digital copies of their plans after the contract is over!

4.6.6 Paint and Graphics Programs

Paint programs are relatively inexpensive and range from no charge, one is included in all versions of Windows under Accessories, to under $100. Paint programs allow users to scan pictures into their computer and to modify the colours, size and details including text, lines and symbols and to cut, copy or paste some or all of an image. Photos from digital cameras or other sources, such as the survey files, topographic maps or satellite images of your Community that may have been downloaded from the Internet, can also be manipulated in the same way. The house profiles (elevations) in figure 4.9 were scanned by the Mistissini Land Registrar using a paint program.

Figure 4.8 shows a reduced version of a CAD file covering a small area of Mistissini.

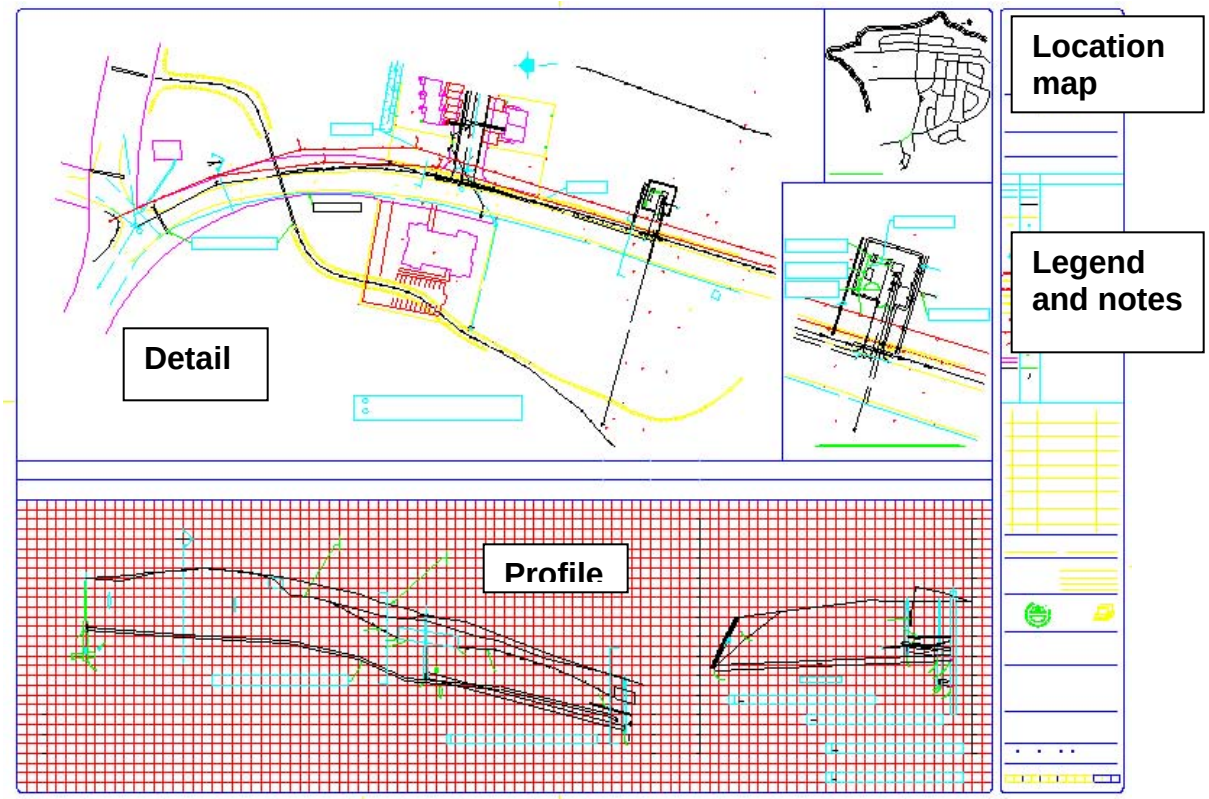
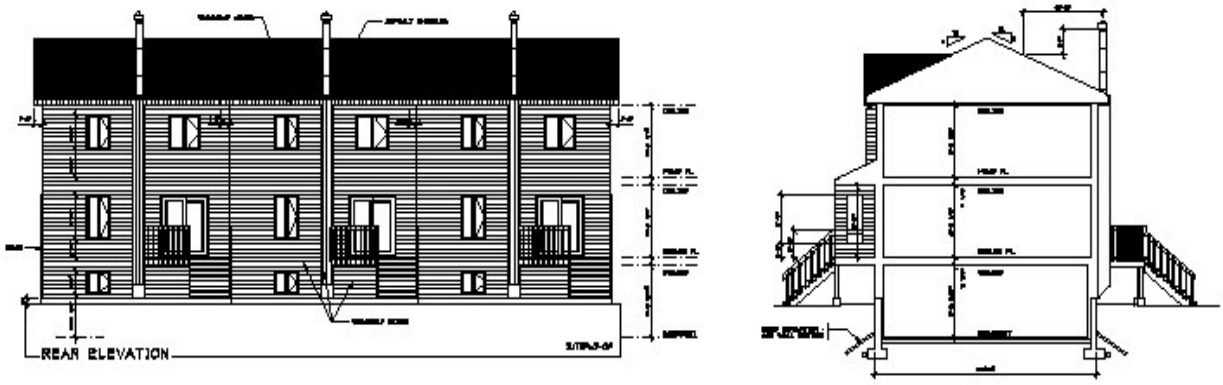


Figure 4.9 Scanned house elevations (originally only on paper).



Graphics programs are more expensive and complex than paint programs but as with GIS, CAD and other programs they provide a greater ability to create, modify and print graphics files for a variety of uses. There are a number of good programs ranging in price from $100 to $700. User friendliness and program capabilities vary but all of the programs will do the job of allowing users to work with scanned images, photos and other documents from a variety of sources. The images that are created or modified can be printed or added to reports or presentations.

The relative usefulness of CAD, paint and graphics programs for community information needs is noted in Table 4.3. The programs are designed to create, modify, present and print plans, photos and drawings but they do not have much in the way of document handling capabilities. Sufficient expertise is available in most JBC communities, especially with younger staff, to use these programs without too much extra training or the purchase of expensive programs.

The decrease in digital camera costs combined with the instant availability of photos has increased the use of digital cameras in documenting insurance claims, monitoring house construction and for O & M and public safety purposes. Digital cameras are easy to use and the photos can be immediately checked for quality and content. Digital photos can be sent over the Internet or added to almost any computer document.

Table 4.3 Non-GIS Approaches Using AutoCAD and Paint Programs

Matching Housing and Public Safety Needs to Non-GIS Capabilities using AUTOCAD and Paint / Graphics Programs		
REPORTING REQUIREMENTS	**AUTOCAD (or CAD VIEWER)** **VISUALIZATION MAPS / PLANS**	**Paint / Graphics Programs (various levels of complexity)** **VISUALIZATION MAPS / PHOTOS/ PLANS (Proper preparation required)**
Council-planning	Y	Y
Council-lot distribution	Y	Some use
Council-housing distribution	N	N
Council-zoning	Y	Some use
CMHC New building (lot availability)	Y	Some use
CMHC Renovations (location)	Some use	Some use
Insurance (damage etc.) (Board of Compensation)	Some use	Some use
Local Fire Protection	Y	Some use
Quebec fire protection regulations (hydrant ID, flows, operation)	Some use	Some use
CONCERNS & INFORMATION REQUIREMENTS		
Housing maintenance	N	N
Housing preventative maintenance	N	N
Planning	Y	Y
Insurance	Y	Some use
New housing	Y	Y
Lot availability	Y	Y
Lot registration for mortgages	Y	Y
Community maps	Y	Y
Potable water network	Y	Y
Water heating cables	Y	Y
Sewer network	Y	Y
Fire response, districting, planning	Y	Y
Hazardous materials	Y	Y

5.0 Case Study Inputs and Sources of Information for First Nations Housing and Public Safety

5.1 Discussions With Staff From Selected Cree First Nations Communities

Several of the JBC First Nations Housing Directors and other staff were approached to participate in the case study by supplying information and details on their housing and related operations so that some comparisons could be made with the situation in Mistissini and other First Nations. In addition the discussions with community Housing Coordinators, water network operators and public safety staff covered the use, if any, of GIS in their community and their knowledge of GIS. The following Cree First Nations have kindly provided information for use in this case study:

- The Cree Nation of Mistissini
- Cree First Nation of Waswanipi
- Ouje-Bougoumou First Nation
- Cree Nation of Wemindji
- Cree Nation of Eastmain

Housing, water network, public safety and other information were provided by the Environment and Technical Services Departments of the Cree Regional Authority.

5.1.1 The Cree Nation of Mistissini

Staff from the Housing, Public Safety, Operations and Maintenance (O&M), Environment, Public Works, Land Registrar, Economic Development and Tourism Departments provided information on the community in terms of actual and potential GIS applications and insights into how the community operates. More information and examples of their input, non-GIS and GIS information usage appears later in this study. Mistissini uses a specifically written housing program, provided by the CRA that works on top of MS Access to assist in capital planning, housing maintenance and record keeping.

5.1.2 Cree First Nation of Waswanipi

Mr. Clarence Miniquaken, Information Officer, provided input regarding housing and related aspects of his Community as well as a short demonstration of the Housing Department's use of MS Access for monitoring various housing issues. Waswanipi also uses a specifically written housing program, provided by the CRA that works on top of MS Access to assist in capital planning, housing maintenance and record keeping. In order to get a better feel for the size, amenities and housing stock in Waswanipi I toured the community and took photos of the housing stock and infrastructure.

5.1.3 Ouje-Bougoumou First Nation

Mr. Alan Gull, Housing Administrator, provided input regarding housing and related aspects of his Community as well as allowing me to take a tour of their unique central heating plant. Ouje-Bougoumou has recently started to use a specifically written housing program, provided by the CRA that works on top of MS Access to assist in capital planning, maintenance and record keeping. I had the opportunity to tour the community and obtain photos of the housing stock and infrastructure.

5.1.4 Cree Nation of Wemindji

Ms Sarah Hughboy, Housing Administrator, provided input regarding housing and related aspects of her community as well as information on the workings of the Community. Wemindji uses the CRA housing program to assist in capital planning, maintenance and record keeping.

5.1.5 Cree Nation of Eastmain

Mr Stanley Gilpin, Director of Housing provided input regarding housing and related aspects of his Community as well as information on the workings of his community. The CRA housing software is used in Wemindji and updated on a regular basis.

5.2 Collection Of Selected Building And Housing Data And Information

Information relating to Mistissini housing, public safety, O&M and water infrastructure was obtained from community members over the last three years during consulting work, training sessions and field work. Information on the other communities was obtained from in person discussions; the use of a standard format questionnaire and, in the case of Ouje-Bougoumou and Waswanipi, community visits. Information regarding CRA operations was obtained from in person discussions, meetings and telephone conversations over the past year. ***For privacy reasons names and other identifiable information have been removed from the examples used in this case study.***

The following three tables have been prepared to show common community information concerns, software usage and available community information as a way of allowing other First Nations communities to see what similarities and differences exist between themselves and the JBC communities profiled in this case study.

Table 5.1 Contains community housing details for the 5 case study communities. All information was obtained from questionnaires and was current as of June 2005. Population numbers are from Indian and Northern Affairs, 2005.

HOUSING DETAILS	MISTISSINI	OUJE-BOUGOUMOU	WASWANIPI	EASTMAIN	WEMINDJI
Population (2005 INAC)	3500+	635	1200	607	1250
Total Number of Housing Units	600+	174	314	141	337
Public Includes (CSB, CHB etc.)	500+	66	278	121	330
Private (includes rent to own)	100+	104	36	20	7
Private vs. Public Housing %	16%	60%	11.50%	14%	2%
Yearly increase in housing stock (# units)	30	5	7	7	6
Land Registrar in Community?	Yes	No (Capital Projects handles)	Yes	No	Yes
Average occupancy (individuals)	6	5	5	6	5
Average size (without basement) (Many units have finished basements)	1200	1400	1200	1000 - 1200	960
Max bedrooms	5	3	5	5	6
Min bedrooms	3	2	2	3	1
Largest multi unit building	12plex	4plex	6plex	Duplex	4plex
Trailers	Yes - 30+	No	25	Yes - some	Yes - some
Prefab homes	A few	2	None	1	No
Special buildings (Elders homes etc)	Elders, Rehab Facility	Elders Apts. Elders 1 bedroom units		1Elders Residence 1 Elder's home (pilot project)	
Main heating source	Electricity	Central heating plant	Electricity	Oil	Oil
Information update cycle	3 months	3 months	3 months	monthly	monthly

Table 5.2 Contains community data and data source information for the 5 case study communities. Many First Nations will have similar sources of information.

DATA/SOURCE	MISTISSINI	OUJE-BOUGOUMOU	WASWANIPI	EASTMAIN	WEMINDJI	CRA
Civic address and name list / each community	P D	P D	P D	P D	P D	
Community GIS maps & air photos / NRCAN (Legal Surveys Division)	P D	P	P D	P D	P D	P D
Community master plans / Contractors	P D	P	P D	P	P	
Lot Surveys /Contracted & Govt. Surveyors	P D	P D	P D	P	P	
Building & House information & Inventories / each community	P D	P	P	P	P	
Building & house photos / each community	P D	As required for insurance claims	As required for insurance claims	As required for insurance claims	As required for insurance claims	
Housing planned & as built plans / each community, CMHC, Contractors	P D	P D	P D	P	P	
Housing maintenance records / community	P D	P D	P D	P D	P D	
Housing & Band building insurance values & information / each community, CMHC, Board of Compensation	P D	P D	P D	P D	P D	P D
Water & Sewer planned and as built plans / Contractors	P D	P D	P	P	P	P D
		P = paper copy	D= digital copy			

Table 5.3 shows the software usage, reporting requirements, concerns and information requirements identified from community questionnaires and interviews. Many First Nations will have similar concerns and needs.

SOFTWARE USED	MISTISSINI	OUJE BOUGOUMOU	WASWANIPI	EASTMAIN	WEMINDJI	CRA
MS WORD	Y	Y	Y	Y	Y	Y
MS EXCEL	Y	Y	Y	Y	Y	Y
MS ACCESS	Y	Y	Y	N	N	Y
CRA Housing software	Y	Just started	Y	Y	Y	Y
GIS	Y	N	N	N	N	Y - limited
REPORTING REQUIREMENTS						
First Nation (Band) Council	Y	Y	Y	Y	Y	Y
CRA / Grand Council	Y	Y	Y	Y	Y	Y
CMHC New building	Y	Y	Y	Y	Y	Y
CMHC Renovations	Y	Y	Y	Y	Y	Y
Insurance (Board of Compensation)	Y	Y	Y	Y	Y	Y
Quebec fire protection regulations	Y	Y	Y	Y	Y	Y
Community fire protection updates (usually weekly)	Y	Y	Y	Y	Y	Y
Water quality reports (Local Environmental Officers)	Y	Y	Y	Y	Y	Y
CONCERNS & INFORMATION REQUIREMENTS						
Housing maintenance	Y	Y	Y	Y	Y	Y
Housing preventative maintenance	Y	Y	Y	Y	Y	Y
Planning	Y	Y	Y	Y	Y	Y
Insurance	Y	Y	Y	Y	Y	Y
New housing	Y - 30 + in 2006	Y	Y 22 in 2006	Y - 45 in 2006	Y	Some
Lot availability	Y	Y	Y	Y	Y	N
Lot registration for mortgages	Y	Y	Y	Y	Y	N
Community maps	Y	Y	Y	Y	Y	Y
Potable water network	Y	Y	Y	Y	Y	Y
Water heating cables	Y	Y	Y	Y	Y	N
Sewer network	Y	Y	Y	Y	Y	Y
Fire response, districting, planning	Y	TBD	TBD	TBD	TBD	Y
Hazardous materials	Y	TBD	TBD	TBD	TBD	Y

5.3 Other Information Requirements

One of the most common needs for information in the JBC communities relates to private individuals wishing to build their own homes or cottages. In most First Nations communities this requires clear permission from the Council to build on what is either leased land or community held land as most land is held in common. This permission must be documented, often by a community resolution, and presented to a bank before mortgage arrangements can be finalized. This process often requires the following activities:

1. Initial determination of:

    - What lots are available? In Mistissini the GIS Technician often prepares maps for individuals so that they can view a home or cottage lot, map in hand, to determine if it meets their needs
    - Where are the lots located? A map shows the distances and routes to local schools, stores and other facilities.
    - What is located in the vicinity? Are you close to a major intersection? Is the school bus drop off area at the end of your driveway? Do you have water and road access to your cottage lot?
    - What, if any, building constraints exist such as easements, allowances or hazardous materials in the soil?

    These questions can often be answered with the use of a map to determine most, if not all, of the above questions. The specific lot identifiers are often kept in a Land Registry book, held by the Local Land Registrar, which follows an approved federal government format.

2. Obtaining or performing a survey showing the lot details such as very detailed location and lot measurements. If the survey has not been previously performed it will be done, often by a contracted surveyor. The surveyor often provides both a paper copy, for bank use, and a digital copy that can be used to update the community GIS.

3. Once this information has been obtained a bank can be approached for a mortgage and, after approval, building can start.

The process in Mistissini requires input from the Council, GIS Technician, Land Registrar and a contracted surveyor.

5.4 Information Sources Used by Mistissini and Other JBC Communities

A review of data and map sources used by the JBC communities as well as contact information appears in Appendix A. Some of the most useful data and sources are listed here:

- Air photos – can be obtained from the National Air Photo Library (NAPL) in Ottawa as either paper prints or digital files. Older prints are black and white

while most prints obtained since the mid 1980's are available in colour. As an example air photos are available for Mistissini as far back as the early 1940's. These photos can be invaluable for showing land use, settlement patterns and potential hazardous sites, such as the old DIAND generator site in Mistissini where there has been some soil contamination from diesel fuel stored there. Air photos are used to make topographic maps and are often obtained on a 5 or 10-year cycle. Air photos are obtained of the JBC Communities every 5 years. In the 5 year time periods between air photo flights in 1993, 1998 and 2003 there have been substantial changes in Mistissini as older buildings are moved or demolished and new roads, houses and community buildings are built.

- Imaging satellites fly over much of Canada on a regular basis taking pictures of the earth's surface at a variety of scales. Images are usually obtained after an order has been placed with the appropriate company or there may be images of your Community in the company's archives. Some satellites can see features, such as manhole covers, as small as 2 feet across. All of the JBC communities can bee seen on Google map! Satellite images are available as paper prints or digital files. Imagery costs varies from $400 – $1 000 depending on the satellite and coverage. The images can also be interpreted and the information added to a GIS.
- Topographic maps – can be obtained from Natural Resources Canada (NRCan), many provincial governments and authorized private industry resellers. The scale (1:50 000 is the largest generally available) may not be suitable for detailed Community work but the maps can provide a good overview. The maps are available in paper or digital form. Mistissini has paper and digital copies of the topographic maps that cover the community and surrounding area.
- Contractors working for Mistissini and other JBC communities are one the main sources of planning and construction maps at various scales. These plans are often provided in paper form but they should also be requested in digital form as AutoCAD files for future use and ease of storage. Mistissini and most other communities have planned and "as built" paper copies in their records as well as AutoCAD files.
- Mistissini has survey documents and maps in both paper and digital (Auto CAD) formats. Older surveys are only available as paper documents but there is some interest by the administration in having these surveys scanned and archived in digital form.
- Historical and current legal surveys for Mistissini and other JBC communities are available from the Community Land Registrar (in most communities) or on line at NRCan's Legal Surveys web site. Surveys for Cree lands and communities go back as far as the 1940's for some communities and are as recent as 2004/5. Ortho photos (corrected air photos used to make community maps) are available for every JBC community and may be available for other First Nations communities. Some survey and photo files are available for downloading at no cost but there may be a charge for some larger files, such as the full size ortho photos.

6 Examples Of The Effective GIS Use For JBC Community Housing And Related Requirements.

There are a number of useful GIS map layers that are currently available for use in Mistissini and other JBC communities and more layers will be made available, courtesy of the CRA water infrastructure mapping project, in the near future. Up to date maps are useful in dealing with different levels of government as well as private companies that may be hired to perform planning, paving, building, maintenance or other work in the JBC communities. These maps can be used by the communities to show what work is required making it clearer to all what exactly is required and where the work is to be done. Having maps available will also decrease costs to the community, as there should be less need for the government or contractor to make new maps and charge for the effort! This should also lessen the length of time required for planning if the maps are already available.

Some of the most useful layers, or maps, for community Departments are:

- The building layer covering all buildings in a community - This includes private homes, community buildings, government, school and other buildings. Ownership of all buildings can be determined, quantified and mapped using the GIS. Further breakdowns as to house size (square feet or number of rooms), home age and model number / builder can also be identified as long as the information is in the database.

  Buildings in Mistissini that are used on a rotating basis for water sampling could be identified using a GIS and monitored through the database information.

- The water Infrastructure layers (potable water, hydrants, valves, storm and sanitary sewers) - Once roads are paved it is easier to identify and locate catch basins, valves and manholes and transfer the information to community records. This has be done for all JBC communities by using a paper copy of the community map where the scale permits workers to locate the infrastructure by measurement or their judgement based on surrounding features. (If expertise permits a GPS can be used with a digital file on the GIS to locate the same features. GPS accuracy varies with the community location, type of GPS used and type of GPS processing – sometimes it is almost as accurate to position water infrastructure features without a GPS! In many JBC communities the planned versus as built drawings, if available, often differ in what has been done for exact building locations, water infrastructure and roads.

  Water infrastructure mapping, supported by the CRA and performed by the Communities, is currently underway in all of the JBC communities. Mistissini is in the middle of mapping the water infrastructure as well as obtaining water information for use in the map attribute tables that are also being created. The attributes consist of water pressure, flow, hydrant make, location and condition. The water network attribute information is required to meet provincial legislation.

- The layers for roads, parking areas and driveways (these should always be on separate layers). It is often necessary update roads to show how they were actually been built as opposed to the "Master Plan" or other plans that are available for most communities. This is the case for Mistissini and other JBC communities.

- The layers covering schools and community recreation and play areas. – Schools are not be a community responsibility in the JBC communities but the provision of services such as fire protection and the provision of water and sewer services, among other services, to the schools are a community responsibility. Play grounds, recreational trail, walkways and other pathways are usually a community responsibility.

- The layers covering surface drains, ditches and streams may be required in all or part of the JBC communities. The use of surface drainage has decreased in Mistissini over the past few years as roads are paved and the water infrastructure expands throughout the community. The JBC communities with paved roads have less surface drainage than those without paved roads and storm sewers.

- The layers covering rivers and lake shorelines and islands. – These layers are very useful in planning water infrastructure installation or expansion. This information helps to ensure that sewage outlets or drainage channels are not located too close to potable water intakes.

- The utility pole layer. – Most communities do not have responsibility for utility poles or electrical infrastructure but they may have responsibility for streetlights or other items, such as cable, attached to a pole. Most utility poles are given a unique identifier by the electric company that can be used to identify the poles and items that are attached.

- The contour and spot height layers are useful for planning purposes in terms of community layout to minimize cut and fill requirements and provide reasonable slopes for building and roads.

- The vegetation and tree canopy layers. – are useful for planning purposes. All conditions being equal, in terms of soil and slope etc., it is easier to build on land with fewer trees. Trees can also be used to provide windbreaks and as noise barriers.

- The hazardous material presence or hazardous site layers are becoming more important as more hazardous materials are coming into communities in the form of medical (for clinics, Elder's homes and rehabilitation Centres), cleaning (schools, offices and some businesses) or other hazardous materials (maintenance garages, gas stations, aircraft refuelling areas, propane storage, etc.). The information is very useful for fire and public safety. Knowledge of hazardous sites can be useful for planning and budgeting purposes.

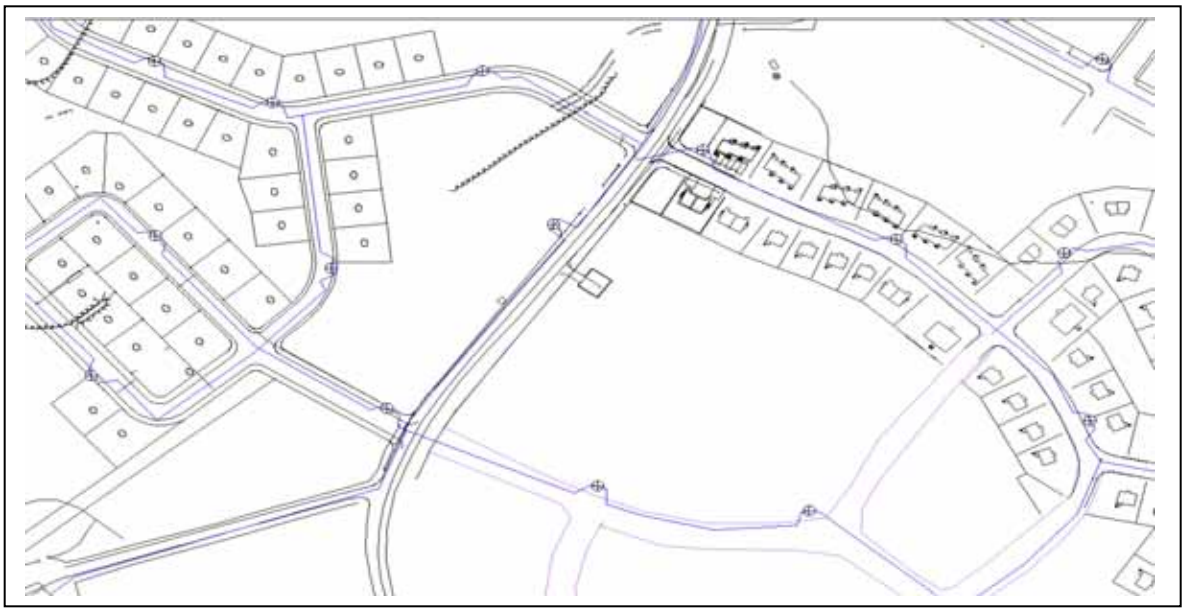
Mistissini has performed a preliminary community assessment of hazardous materials for various locations.

Mistissini and other Cree communities are in the process of creating maps for water sampling sites, water, storm and sewer lines as part of a CRA lead project to map the water infrastructure. The information will also be used for fire safety purposes.

One of the best ways to show the usefulness of GIS or database information for First Nations communities is to present community examples. These examples are from the Cree Nation of Mistissini. Some material has been modified for privacy reasons. Seven areas have been illustrated for this case study although other uses are possible but have not yet been developed by the community. The first 4 examples have been developed by and for Mistissini while the last three examples have been developed for Mistissini by a multi community based water and sewer infrastructure mapping project sponsored by the CRA.

6.1 Mapping for New Housing

Home ownership is increasingly being encouraged in Mistissini and some of the other JBC communities. **Figure 6.1** shows new lots (upper left) and planned roads (lower right) in Mistissini.



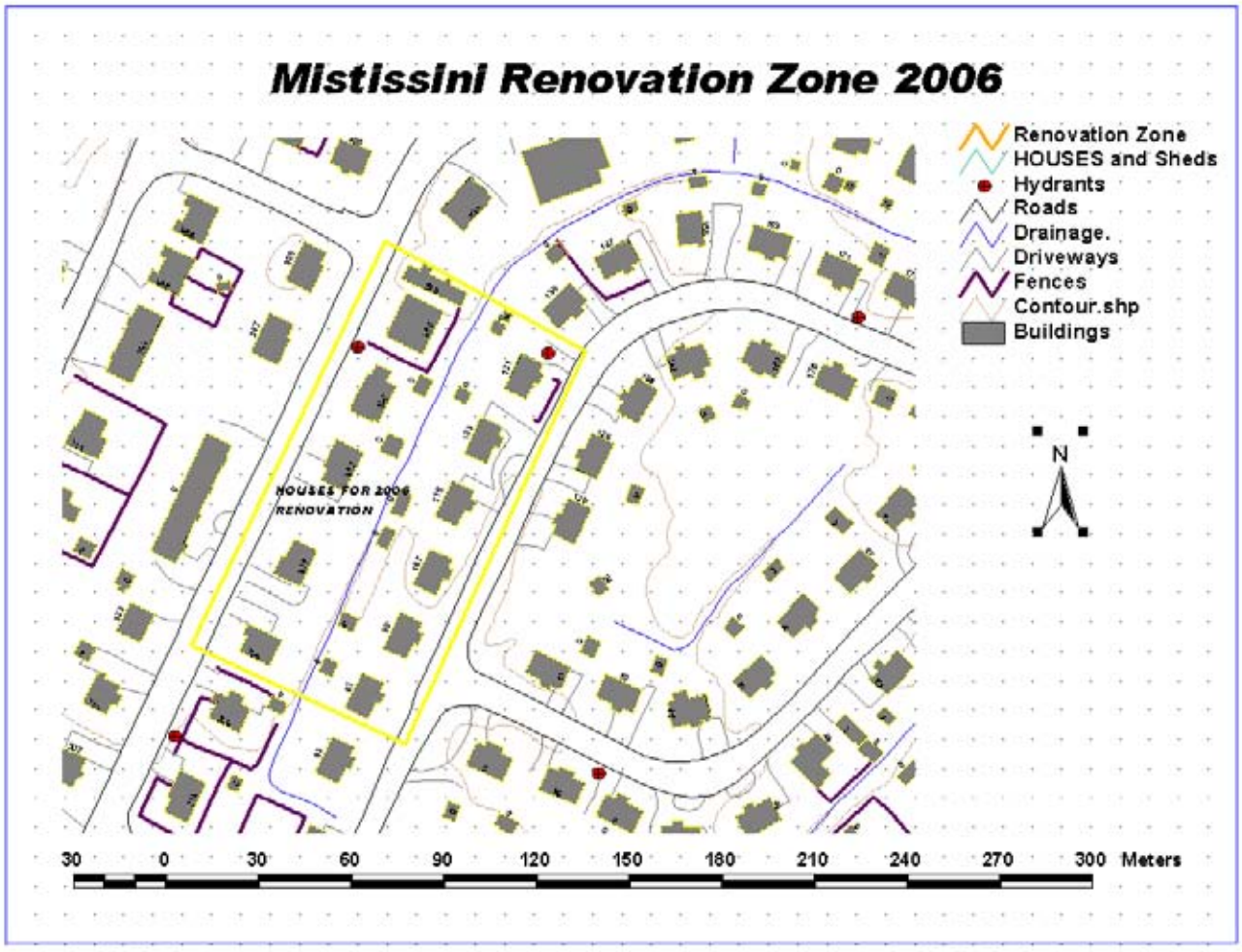
Potential private homeowners in Mistissini can use the information available from the GIS map along with lot dimension details from a survey to review and choose a lot.

6.2 Mapping for Renovations

CMHC and INAC are both involved with the JBC and other First Nations housing efforts including home renovations. These renovations need to be planned in advance and must be supported by photos, written reports and a map of the area

showing the houses for renovation and the surrounding area. In the past this has required that the Mistissini Housing department obtain a map from "somewhere" and photocopy the required area. Staff in the renovation section of the Mistissini housing department can use ArcExplorer and GIS files that have been prepared specifically for the housing department to print maps at the scale and for coverage areas that they require using their own computers, colour printer. These maps can show the exact area, home footprints, road access and other details that are required to support renovation-funding requests.

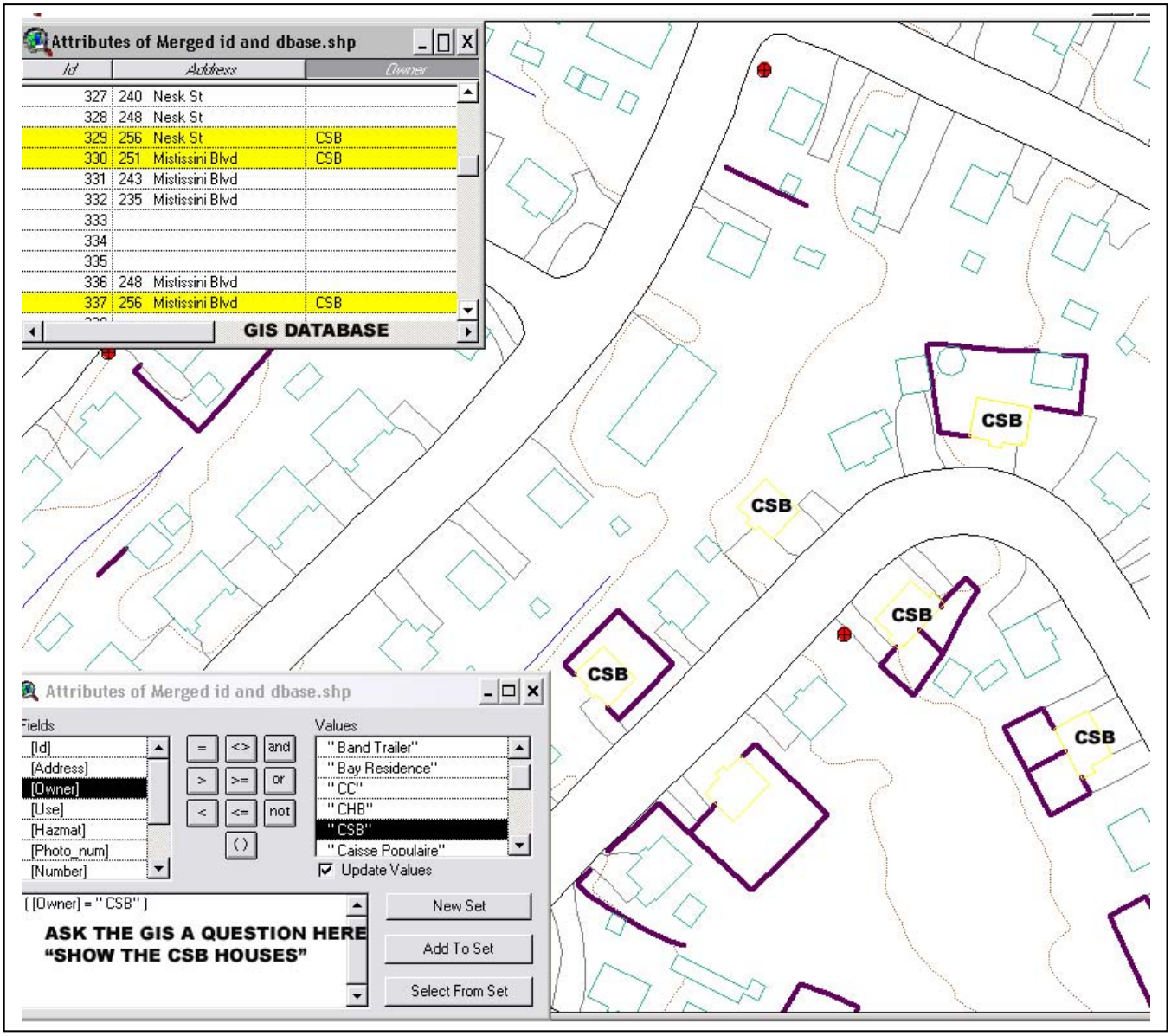
Figure 6.2 is similar to a map prepared by the Mistissini Housing Department using ArcExplorer.



6.3 Insurance and Inventory Home Information Questions

Mistissini has enough information in their preliminary GIS database and supporting maps to allow queries to be made to find out specific information, such as home ownership, from the database as well as the specific location and address of the homes in question on the attached GIS map. The information can be printed out either in the form of a database listing or a map showing the home locations. The information can also be exported into documents and reports

Figure 6.3 shows the database in the top left corner, the query box in the bottom left corner while the map show where the houses are that answer the question "show the CSB houses". The CSB houses are highlighted automatically in the database and on the map.



6.4 Hazardous Material Information

In this example several of the hazardous material sites in Mistissini have been identified, such as the two gas stations, the propane refill tank and the Cree School Board warehouse. A 500-metre buffer (a circle centred on the gas station) was created using the GIS to show areas that would have to be evacuated in the event of an emergency. Some of the key buildings within the buffer that contain large numbers of people are the CSB office, the Band office, the Elementary School and the Daycare. Different size buffers can be drawn based on the hazardous material characteristics. Circular buffers allow the calculation of effects regardless of wind direction. Additional information such as surface drainage, storm sewer catch basin locations and sewer line locations can also be added to the GIS maps. The map scale for this figure is 1:1000. The maps can be printed at a variety of scales and could show the whole community if required. Work is on going to more precisely determine the hazardous materials present in Mistissini.

Figure 6.4 shows hazardous sites and areas to evacuate in the central area of Mistissini.

6.5. Water Infrastructure and Fire Hydrant Coverage

Mistissini has a well-developed water infrastructure that includes potable water, fire hydrants, sanitary and storm sewers. A GIS can help to provide maps to staff for field inspections and to determine the locations of hydrants with problems and keep track of maintenance. The GIS can also show the distance from a fire hydrant to every home and building in the community. A buffer of 100 metres is shown in figure 9.5 from every hydrant in the community. This information is used to make sure that the fire hydrants have an even distribution through out the community and allows the fire department to lengthen hose lengths for harder to reach areas.

Figure 6.5 shows 100-metre buffers around the existing fire hydrants in Mistissini. The coverage is very good with few gaps in populated areas.

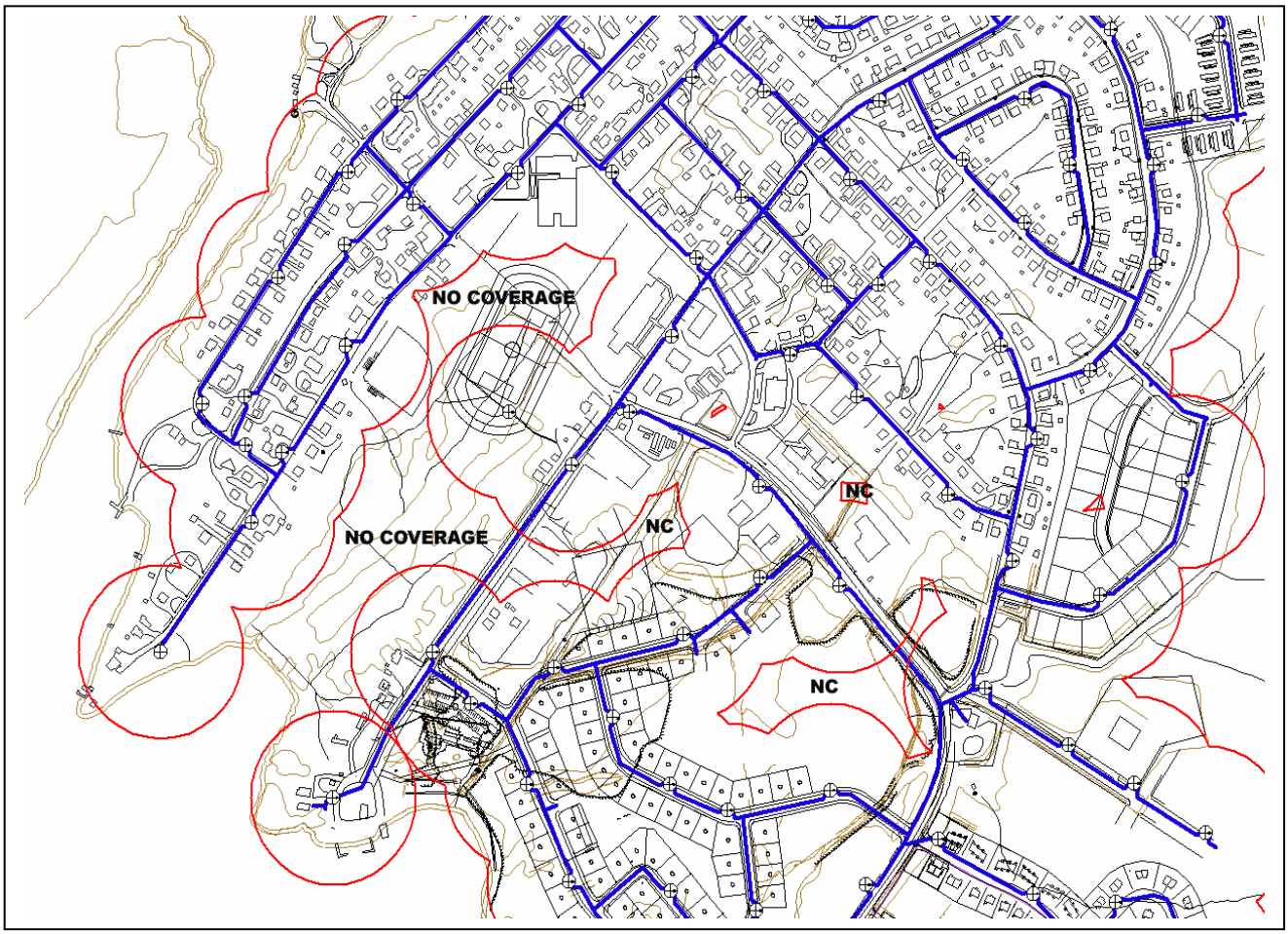
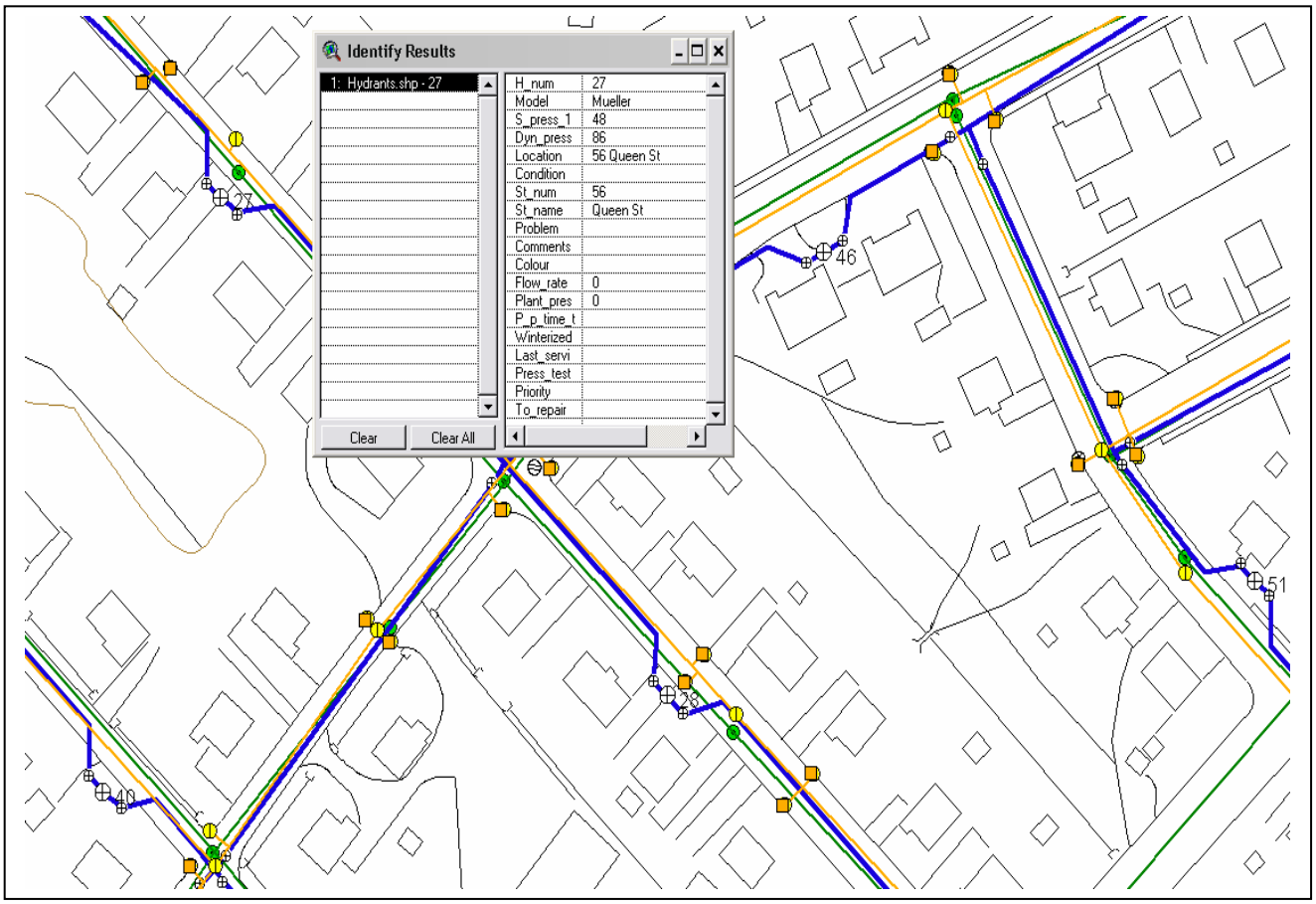


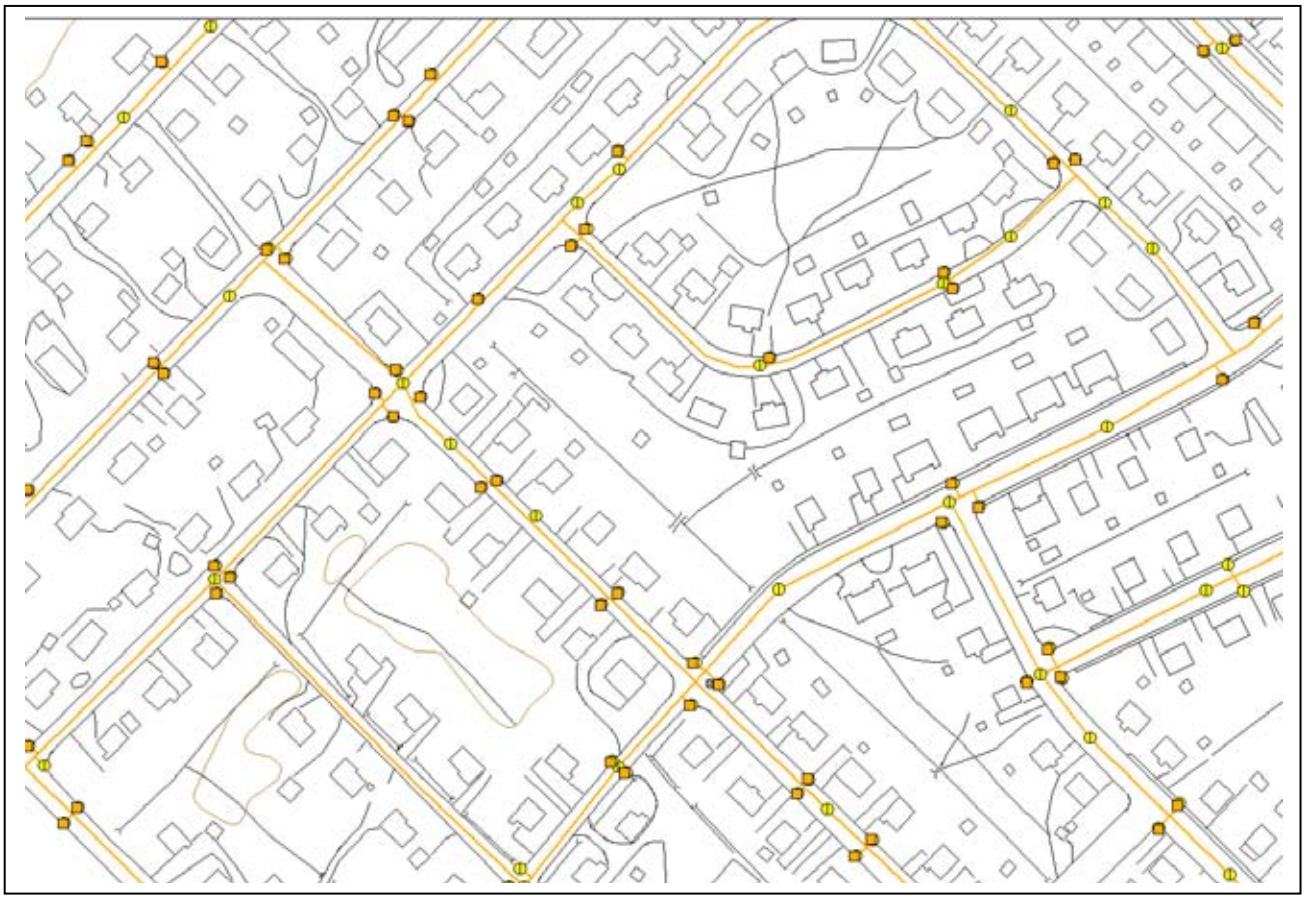
Figure 6.6 shows some of the database information that is available for each hydrant (or valve and pipe segment) at the click of a mouse.



6.6 Storm Sewer Infrastructure

Mistissini is a growing community that can benefit from knowing exactly where sewer lines and catch basins are located. In addition to location on a map the database attached to the GIS allows information to be recorded and retrieved, such as repair and cleaning details. The catch basins are of more interest to the communities with paved roads.

Figure 6.7 shows the catch basins (orange squares), manholes (yellow circles) and sewer lines in orange. As shown in **figure 6.8** the catch basins, manholes and individual pipe segments can each be identified and information recorded in the database.



6.7 Sanitary Sewer Infrastructure

All JBC communities have sanitary sewer infrastructure. The sanitary sewers are less complex than the hydrant network with all of associated the valves and hydrants but still require information as some communities use lift stations to assist waste to the sewage lagoons located on the outskirts of all JBC communities. **Figure 6.8** shows the sanitary sewer network for the same area of Mistissini as shown in the previous figure. Each sewer manhole and sewer pipe segment has been individually identified and linked to the GIS database.

7.0 JBC Community Examples of How Information Can Be Effectively Organized Using A Non-GIS Approach

Mistissini has organized information on a non-GIS basis in several housing and public safety areas such as:

- The Civic List, created with MS Word, contains the name of every tenant or homeowner in the community along with his or her address and lot number. The Civic List is prepared using MS Word and updated on a regular basis. The list is used to monitor house availability and to contact people as required.
- An inventory of community buildings including all Band houses has been prepared on a regular basis using MS Word and used to identify resources, building and contents value, building materials, type of building and hazardous material presence. The inventory includes photos of the main community buildings and representative house models. The inventory was prepared using MS Word.
- Excel spreadsheets are used to inventory all Band buildings and contents. Reports are made to the CMHC, INAC and insurance agencies using this information. Most external contacts expect to receive spreadsheets rather than hand written material.
- AutoCAD files are used by the housing inspector to record model details and for planning and insurance purposes. AutoCAD files, in paper form, are used by O & M for road monitoring (as built versus planned roads) and for water network purposes. CAD drawings are kept in different locations in the community and range from pump schematics and pump house plans to water distribution network plans. A copy of all pump diagrams is kept at the main office and at the appropriate pump house or lift station around the Community. As part of the CRA lead project to map the water and sewer infrastructure this information is being migrated to a GIS.

  All JBC community master plans have, for the last few years, been prepared for the communities by outside consultants using AutoCAD. These have previously been delivered as large format paper plans and, more recently at Mistissini and other JBC communities' request, in digital form.

- A complete photo inventory of the Mistissini was undertaken in the fall of 2004 for all existing buildings. The photos were taken using a digital camera and provide a useful resource that is available to any of the departments. All existing buildings had their street addresses verified during the photo inventory
- As of the summer of 2005 the Mistissini housing database covers over 600 houses and provides inventory information, repair costs, repair frequency, cost recovery information and person-time costs, all of which are very useful inputs into the budgeting and forecasting process. Band owned and operated housing is often one of the main resources in the JBC communities so it is understandable why this program was developed by the CRA and why it is supported by every JBC First Nation.

8.0 Considerations Regarding the Use Of GIS For Mistissini and JBC Community Housing And Public Safety

GIS may be just what a community needs but, on a personal basis, GIS is not for everyone. A community GIS expert, such as the GIS Technician in Mistissini, requires a skill set that covers computer operations, map familiarity and database skills. These skills are often in demand for other community needs and priorities. In Mistissini the computer operations position and the GIS Technician were, for many years, combined leading to some backlogs in GIS work while computer support was provided to community staff from all departments. This was resolved by removing the computer support role from the GIS Technician and creating a new full time computer support position.

To date none of the other JBC communities are actively using GIS for housing and public safety applications although several of the communities do use GIS for natural resource and forestry applications. Some of the concerns and considerations that need to be addressed by the JBC communities before implementing a GIS in their community are noted in the following sections.

8.1 Initial Costs

GIS viewer software is free so that anyone with a need to see or use maps can access the GIS data at no cost. There is very little in the way of “off the shelf” data and maps currently available for any of the JBC communities so some effort will be required to either create maps and a database or to modify existing data from various free and government sources. The GIS software, computer, printer, peripherals and start up materials can range from $7 000 (ArcView and standard printer and computer) to over $30 000 (full GIS software, larger printer and heavy duty computer) depending on the level of software chosen and the cost of the computer and related equipment. More specific cost information is given in the following sections.

Mistissini made a considerable investment in initial GIS software (ArcInfo and ArcView), computers, printers and associated training and has also upgraded several times over the last eight years.

8.1.1 Software

Arc Explorer is available for download from the Internet at no charge and comes complete with a manual. ArcView GIS has more capabilities as noted earlier and can be purchased for approximately $2 500 base price. There are additional add on programs that may be of use to more experienced staff or larger more complex Communities. These programs range from $2 500 to $4 000 per program. ArcInfo costs approximately $25 000.

8.1.2 Training

There are several options available for GIS training depending on how comfortable a person is with GIS theory and computers and the proximity of a community to a larger city. The options are:

- GIS books – there are a number of reasonably priced books that come with GIS exercises on CDROM. It should be possible to obtain a time limited education review license for ArcGIS with some ESRI GIS books that will allow users to try out GIS and become familiar with the theory and practical aspects of the program before committing to the purchase of the GIS program license. This approach is more useful for someone who has some computer experience. The GIS Technician in Mistissini has used several different ESRI books and books from other sources over the years. The titles of some useful books are noted in Appendix D.
- On line GIS exercises – ESRI offers some free GIS tutorial lessons via the Internet. If this approach is satisfactory additional courses can be taken over the Internet at a cost of approximately $100 per module. As with the use of GIS books this approach works best for those with some computer experience. In order to use these training modules you must have a legal version of the GIS program loaded on your computer. Online resources are noted in Appendix A.
- Community college / CEGP / University – Most provinces have at least one college that provides GIS (and CAD) training in the form of either a one year diploma, a two year technician or a three year technologist program. Night courses covering specific GIS or CAD programs or program functions may also be available. There is at least one English language and one French language CEGP in Quebec offering GIS training. Many universities offer Geography or Environmental Science degrees that incorporate GIS. Universities may also offer evening school courses for specific aspects of GIS. The GIS Technician in Mistissini and several of the Forestry GIS staff in Mistissini, Ouje Bougoumou and Waswanipi have taken GIS courses at the CEGP level.
- Vendor or third party training may be available, at a cost, in your community and should be available at one or more of the larger cities in each province. Having the trainer come to your community to train a number of people can reduce your travel costs. Training can be tailored to you specific program and data needs. Mistissini has had third party trainers provide GIS courses in the community and the GIS Technician has taken a number of GIS vendor courses in Ottawa.

8.1.3 Computers, Supplies and Peripherals

The computer used to run the non-GIS and GIS programs must meet the standards that have been specified by the program vendor. Windows XP is a requirement for many GIS programs but some there are some GIS programs available for Apple computers (Apple computers will not be discussed in this case study). Some computer specifications for a computer used to run ESRI programs are:

- A Pentium IV computer,
- 512 MB of RAM (RAM is fairly cheap so the more the better)
- A large hard drive (80 GB +)
- A non integrated graphics card with more than 128 MB of memory
- A CD or DVD read /write drive,
- USB ports to attach a scanner and printer or other peripherals,
- A 21' monitor, two monitors can be useful if the budget allows,
- A scanner can be very useful when importing graphics or scanning in old maps or plans,
- An Ethernet connection for Internet access
- An uninterruptible power supply (UPS) to filter the power and allow safe shut down in the event of a power failure,
- A computer service contract to cover possible repairs and equipment failure.

A laser printer provides cost effective legal or letter size documents and maps. Colour laser printers sell for under $ 500 while black and white laser printers sell for under $200. Large format maps can be printed on tabloid size ink jet printers that sell for under $ 600 while ink jet printers that can print large (24" x 36 " maps) are available for under $5 000. Ink jet printers are more expensive to operate than laser printers. Prices for paper and supplies will vary depending on the community location and arrangements with suppliers.

The computer and printer information noted above is based on the current GIS computer system in use in Mistissini and the program requirements specified by ESRI. A computer to meet the above specifications should be available for between $2 000 and $3 000. Mistissini and other First Nations are usually not liable for tax on items delivered to the community for use in the community.

In addition to the computer hardware and software allowance will have to be made for space to set up the GIS. A separate office has been made available for the GIS in Mistissini.

8.1.4 Data

As part of the James Bay Agreement signed in 1975 the federal government provides Mistissini and the other JBC Communities with updated maps and air photos every five years. This information is provided as a CAD file that needs to be converted to GIS format. Most other First Nations do not have similar agreements and would have to apply to the government for access to air photos over their communities or to purchase the data. NRCan Legal Surveys may have the photos that have been used to create the CAD files and this data may be available to First Nations.

First Nations that are just getting into GIS should approach NRCan and INAC for assistance in locating survey plans, air photos, CAD and GIS files for their community. The Legal Surveys department of NRCan are legally obligated to map First Nations Reserves, at least in terms of boundaries and often do much more. Community files are often available on line or for purchase through the Internet.

Contractors working in Mistissini and other JBC communities often use AutoCAD to create plans and working maps. These plans should be provided to the community either during or after a project. The government supplied CAD files of Mistissini have been converted to GIS files by the Mistissini GIS Technician since 1998. The GIS Technician also adds additional attributes such as house addresses, tenant details and other information that is not available from the CAD file.

A Global Positioning System (G**P**S as opposed to the GIS discussed in this case study) hand held unit allows features to be located in the community with great accuracy and can be used to map features either to update current maps or to make a map from scratch. Some GPS training is required as is a GIS program to use the GPS information. The level of accuracy varies with the cost of the GPS unit. Mistissini, Ouje Bougoumou and Waswanipi have forestry departments with trained GPS users who could train other staff in the use of GPS in the community.

8.2 Ongoing Costs

In Mistissini funds are budgeted for on a yearly basis to cover the items noted below that related to the operation of the GIS and the production of maps and associated documents. Items that are covered in Mistissini's budget are:

- Yearly maintenance for the GIS software. This is usually a percentage of the original purchase price and is included in the price for the first year. Maintenance varies from $900 to $1800 per year depending on the number and type of programs in use. The maintenance package allows users to phone for technical support; to receive new program versions, program "patches" and information in the form of User conferences and magazines.
- Paper for large format printers. This size of paper is not available in Mistissini and has to be ordered from outside suppliers
- Ink and toner for printers. These items are not available in Mistissini and must be ordered from outside suppliers.
- Computer and peripheral maintenance costs. A maintenance contract is usually a percentage of the purchase price of the equipment. A maintenance contract is advised if staff are not comfortable with computers. The GIS Technician handles some of the computer and associated trouble shooting in Mistissini and can call on support personnel from a third party support company for major problems.
- Blank CDROMs or DVDs for backup and distribution purposes.
- Training and book purchases.
- Office space, heat and light may have to be identified and accounted for a budget item in some Communities.
- The GIS expert's salary and benefits.

8.2.1 Software Upgrades and Updates

Major GIS software upgrades occur about every two years and may, in some cases, introduce new capabilities or new ways of using the program. GIS program upgrades four years ago required users, including the Mistissini GIS Technician, to become familiar with a completely new interface and approach to using the program.

8.2.2 Ongoing Training

Ongoing training, whether self taught through on line courses or with books and training exercises, should be considered if the GIS staff are new to GIS or are required to use new aspects of the program. Third party or vendor training may be required to perform new tasks or after major upgrades to the program. Many communities are located some distance from training facilities leading to concerns about travel and extended stays away from the community and family members.

8.2.3 Computer and Peripheral Upgrades

Computer upgrades are usually only required if there are major changes to the programs you use or there is an increase in the amount of information that you handle. A slow computer can be improved with more RAM or a faster processor while increase in information can be handled by obtaining a second or larger hard drive. Laser printers can often work well for years with a regular cleaning and change of toner when it runs out. Ink jet printers require regular cleaning and there may be problems with any printer in dry or winter conditions. Adding a humidifier to the room will help increase print quality and decrease printer problems.

8.2.4 Supplies and Consumables

Paper and ink can be a large expense depending on the printer type and paper size. Laser printer toner and smaller ink jet printer cartridges and paper can be sourced from many business supply stores and even ordered on line. Large format paper often comes in rolls and can only be ordered from special suppliers in larger cities. Extra toner, paper and ink should be kept on hand based on experience from previous usage or vendor recommendations. Supplies should, if possible, be stored in a cool dry dark location.

9.0 GIS and Non-GIS Implementation Issues from the JBC Communities

9.1 Common Issues, Problems and Solutions

There are a number of issues that have arisen in the past in Mistissini that may apply to other First Nations currently using GIS, considering GIS or using non-GIS programs to assist them in Housing and Public Safety management. The following section presents issues and solutions that worked in Mistissini. The issues are:

- Working with CAD plans

- Contractor supplied Cad plans
- Historical Data or information loss
- Maintenance record accuracy
- Data ownership
- Data sharing and availability to different departments
- Access and use by non-GIS staff / turn around time
- Data loss, computer damage and regular backups
- Privacy concerns and legal aspects
- Increases in demand for maps and cost considerations

Problem – Working with CAD Plans

Most contractors who are involved in building, public works and infrastructure projects provide plans to Mistissini in either paper form or, increasingly, in digital form. While there are usually staff with sufficient expertise in the Housing and Public Safety departments to read and use paper CAD plans the same is not true for staff with CAD software expertise. Computer based CAD plans are made up of many layers of information with very little attached information to aid users who are not familiar with the software.

Solution

The lack of expertise in some parts of the housing department combined with the cost of the CAD software and associated training makes the use of a simplified CAD viewer or easy to use GIS viewer software the most appealing approach to viewing CAD files. However both programs are limited in that they cannot be used to make changes to a CAD file.

Problem – Contractor Supplied CAD Plan Limitations

Contractor supplied plans to Mistissini often use either French terms or a combination of English and French short forms. This has lead to difficulties in understanding exactly what is being show in some CAD files. Another difficulty arises when contractors provide only paper plans and do not provide a digital copy. Requests for digital copies after a project has been completed often require additional expenditures by the Mistissini for material that should have been provided as part of the contract.

Solution

Contract provisions should be made so that terms and definitions used in drawings are clear to all and that any paper copies of plans should be supported by digital CAD files on CD Rom or DVD. These digital copies can then be safely archived or put on the First Nations servers for ongoing use as required. Contractors providing documents, maps, graphics, database or spreadsheet files to Mistissini or the other communities should be required to provide digital copies of their work in addition to any paper copies of reports or material that has been provided. In some cases this can be provided as an email attachment for convenience.

Problem - Historical Data or Information Loss

Mistissini and the other communities have several decades' worth of paper records in the form of maps, plans, documents and reports. Older material may exist only in the

community and in Government archives. Paper documents can degrade over time and become unusable due to either the material properties or storage methods. These records form an important source of information that, in many cases, cannot be duplicated or replaced without considerable effort. As community staff grow older and retire the information that they know may be lost to the community if the only other source is old paper records.

Solution

Important records should be identified by the communities and steps should be taken to ensure that their storage meets minimum requirements in terms of their identification and storage in a safe environment. Electronic copying of more valuable or useful material should be considered. Montreal, Quebec City and Ottawa all have one or more document management companies that specialize in electronic copying of paper reports and documents. These companies also have the capability to scan large format (36" x 48") blue prints and maps in either Black and White or colour, depending on the original.

Scanned documents can be converted into text or word processing format files and stored on DVD or CD Rom. Figure 7.3 showed a scanned in profile of a home that was only available as a paper copy. Blue prints containing plans and diagrams can be scanned and converted into image (jpg format) files. The cost is approximately $ 7-8 per sheet with a further reduction for larger volumes. For a moderate extra charge the scanned files can be converted to CAD files with a 60 – 80% accuracy rate in feature identification. Some companies with overseas operations can provide almost 100% accurate CAD files for a more substantial additional charge. The CAD files are reviewed by an overseas engineer and converted to complete and proper CAD files and provided in digital form. Once the scanned material is in CAD file format it may be possible to import the file into a GIS and create GIS files.

Digital photos, scanned plans and other information can be linked to the GIS map and database using "hot links" that can be created in the GIS program. Hot links can also be added to spreadsheets to link documents, photos or other digital material to the spreadsheet. This can be done after some database or GIS training and the capability is built into the mid level GIS program and into the MS Access database program.

Problem - Maintenance Record Accuracy

A key element in creating either paper or computer based records is accurate record keeping in the form of correctly spelled street and family names as well as the correct use of short forms, such as St versus ST. or street in order to designate a "Street". The same family (last name) may be very common in many Communities leading to some problems, especially when more than one family or an extended family share a home. There have been occasional problems in Mistissini with data entries when summer or temporary staff have been used.

Solution

Names and conventions (St, Blvd, Ave etc.) should be used consistently by all staff over time, including new, replacement or temporary summer staff. A decision should

be made by relevant staff on names and conventions, such as “Main St” not “Main st.” and all staff should be informed as to the correct spellings to be used.

Middle names, nick names (if commonly known) and Jr (Junior) or Sr (Senior) designations can all be used to help to correctly identify people in the community. In Mistissini there are over forty families where Jr and Sr or a middle name must be used for identification. The use of hyphenated family names should be accommodated in every community database.

Problem - Data Ownership
With the increased use of computers and email ownership of data becomes more of an issue and increases in importance.

Solution
Mistissini has started to require that data created by outside contractors be provided in digital and paper form, where appropriate, and has required agreements to be signed regarding the use of Mistissini data by outside parties. Mistissini has been including graphics in the form of the community logo on maps, plans, documents and spreadsheet or database files. Figure 6.3 is a good example of the effective use of a graphic on an Excel file. The Mistissini graphic makes it clear that the material is official and the property of the Cree Nation of Mistissini. The copyright symbol © should appear on all material prepared for and by Mistissini departments.

Problem - Data sharing and availability to different departments
The Mistissini Housing Department, along with Public Works and Operations & Maintenance, have sections that deal with different concerns and priorities. The planners may need information that the person looking after insurance claims does not need and the maintenance people may have different requirements and require regular access to information.

Solution
A central record-keeping source that updates and distributes information may be useful in Mistissini. Decisions must be made as to where sensitive material will be stored and who has access to the material. One effective way to allow material to be revised, updated and distributed already exists in Mistissini in the form of a network server with password controls on access to certain files. Read only material can be placed in one or more public or restricted access drives to allow anyone with approved network access to obtain the latest information at his or her level of access. Material that must be kept secure, such as financial or legal information should probably not be placed on a network.

Problem - Access and use by non-GIS staff / turn around time
The information contained in the GIS maps and database has proven to be of interest to many non-GIS staff and community members in Mistissini. This often leads to the situation where there are many users who want maps or other information but there is only one source for maps or one or two staff available to provide the maps and information.

Solution
One approach is to keep regularly requested maps, such as house and cottage lot availability or hazardous material locations, available as pre-printed maps complete with a legend, scale, community logo and other useful information. This leads to decreased on demand printing and ensures that maps are always available regardless of staff, printer or computer availability. This will also decrease the turn around time for commonly requested items allowing GIS staff to focus on community updates, new maps and special items.

Standardized logos labels and layouts will assist in decreasing map turn around time. The same colours, line styles and other conventions should always be used to create maps and other materials.

Problem - Data loss, computer damage and regular backup
Any information from an outside source, such as a contractor or government department, should be immediately duplicated, verified and the original stored in a safe, secure location. Individual computers may be damaged by viruses, static electric charges and other accidents that can occur without warning.

Solution
As First Nations increase their computer capabilities and the amounts of data that they work with some consideration should be given to secure off site storage of data. An example could be that backup CDs of work done at the Band Office are stored in a secure location at the Fire or Police Station in the event of a fire or water damage to Band Offices.

Users on network computers should make sure that their data is stored on a network drive that is backed up on a regular basis. Both networked and stand-alone computers should be backed up on a regular basis using a secure method, such as a CD, and secure storage as noted previously.

Problem - Privacy concerns and legal aspects
Mistissini has information relating to community members, such as personal information, housing inventories and insurance information, which must be kept private.

Solution
It is possible to leave off this information when providing information in spreadsheet or map form by leaving out parts of the records (called fields) that contain sensitive information. It is also possible to keep this information on only the computers or secure network drives of staff that are authorized to use the information.

Problem –Increased demand for maps and cost considerations
Colour maps, especially large ones, cost money to prepare and print. Legal or letter size maps can be printed using colour laser or inkjet printers to keep costs down. Cost recovery is not currently an issue in Mistissini as all resources are used for Band purposes. The GIS Technician produces maps for other departments or community members, in reasonable quantities. Some consideration is being given to

keep a log of maps that are produced as well as sizes and users for possible cost recovery in the future.

Solution
File sets and maps of Mistissini have been prepared for the housing, public safety and operations and maintenance departments to allow these departments to produce their own maps using their own printing resources and staff time. This can transfer the preparation and printing costs to the Departments that use the maps on a regular basis.

10 Best Practices Based on Lessons Learned From Mistissini and The JBC Communities

The case study concludes with a section on best practices that ties together the experience that has been obtained from the Cree Nation of Mistissini GIS work and work performed for other GIS clients, including the CRA. Best practices are suggestions for ways to help communities to be more effective in their work. These practices have been developed over time from practical experience using real information obtained from Mistissini and other communities. The suggestions are useful for both experienced and new users. Many of these best practice suggestions are valid for both non-GIS and GIS approaches to problem solving. An important consideration is the cost of lost information and opportunities versus the expense of using non-GIS and GIS problem solving approaches to First Nations housing and public safety concerns.

10.1 File Management

- The use logical file names that describe the file, for example *Mist_hydrants* provides a better description than *M_hydrants* or just *hydrants*. The date is automatically added as part of the information that is stored on the computer as is the type of file (for example **.doc** = MS Word document, **.xls** = MS Excel spreadsheet)
- The use file folders that describe what is in the file folder, for example *Mist water network* to contain hydrant, valve and water pipe files make it easier to use the information. It is better to use names of files and folders that are obvious to most users rather than personal “short forms”.
- It is better to not have too many folders inside each other – some programs cannot keep track of files and folders if the number of characters used to name the file/folder(s) exceed 128 characters.
- If a record of files and folders on your computer is required the print screen key can be used to take a picture of the screen as it appears. This screen picture can then be then be “pasted” into a blank document in a paint or graphics program.

10.2 Information Updates

- Information should be updated on a regular basis. If there are too many updates to do on a quarterly basis consider performing updates on a monthly basis.
- Discuss the best time and date for updating with people who use the information and with those that supply information to the GIS specialist.
- Users should be advised of the schedule for updates so that the required information can be supplied to the GIS specialist. In return the GIS specialist should advise users as to how and when updated material will be available.
- It is advisable to have only one contact and updating person, with an alternate, for each department.
- Advise users as to how updated information will be distributed. Advise if information will be updated using the network or if updates will be provided on CDs for users to load the updates onto their own computers.

10.3 Information Backup / Historical Information Retention

- GIS and other information should be backed up on a regular basis. GIS computers on a network are usually backed up by the network operator on a regular basis (usually each day after work). Lost or corrupt files can usually be recovered by the network operator
- Off site back up storage for important information should be considered especially if there is a chance of fire, flooding or other damage.
- Important old paper plans and other paper documents should be scanned and stored in computer form on CD ROMs or DVDs before they are destroyed or fall apart.
- Organized records should be maintained so that location of old plans is known – there may be a need to find an old water main or part number one day!

10.4 New Information Management

- Information from contractors be should be provided as computer files as well as paper copies. The companies do their work on computer and shouldn't charge extra for a copy on a CDROM or DVD – it takes very little time and effort to copy the files and CDs and DVDs are very inexpensive! Information requests should be written into the contract and specify a date that the information should be received by and the form that it should be received in (CD versus DVD).
- Community logos and other identifying marks should appear on community material
- Documents, maps and other information should be copyrighted © – just to be on the safe side.
- GIS and other community computer programs should be kept reasonably up to date
- Virus checkers and email screening programs should be used on a regular basis

10.5 Cost Recovery and Map Usage

- A charge for maps should be levied where possible. In addition a record of how the GIS is used and what maps are request should be maintained. This will help to determine the amount of paper and ink that should be budgeted for on a yearly basis.

10.6 Information Availability

- Regularly used information should be available in paper form for quick referral, for example fire hydrant locations and information on pressure and operation capabilities.
- Information of interest to the community such as new lot location and availability should be posted in a prominent location in the community
- HAZMAT locations and extent may be mapped in advance, added to the GIS, printed and placed in binders for use by the Fire Department and Police in case of an emergency.

The information presented in the case study has been supplemented by examples and information appearing in the following appendices. Some of the contact information and website will change over time but a search using keywords from this case study will help with an Internet search for GIS and related information.

11 Conclusions

In addition to the ongoing work discussed in this case study the Cree First Nation of Mistissini has the capability to advance and work on the linking of the building photo database and the available scanned house plans to the GIS. The expansion of the hazardous materials database would greatly benefit the community for greater public safety and understanding of local environmental constraints for building and water quality purposes. The databases connected to the potable water, storm and sanitary sewers, when completed, will benefit the community with better control of information relating to repairs, maintenance and, where necessary, replacement of the existing infrastructure.

The support of the management of Mistissini over the past 10 years and the capabilities of various staff have allowed the role of GIS in the community to increase, to become more visible to the community and to become more mainstream in nature rather than something that is produced by a few staff for few users. Many people in the community see GIS maps in public places on a regular basis. GIS maps assist staff in the Housing, Operations and Maintenance and Public Safety departments on a regular basis. Other departments such as recreation and tourism have also benefited from the GIS maps and capabilities.

Training of senior management in the capabilities of GIS and its use in the community along with instruction in the creation of their own simple maps using

ArcExplorer has also increased the exposure of decision makers to the advantages and wealth of products – and the information and staffing needs – of GIS. At least one addition community member has been interested enough in GIS to pursue college education in the field in anticipation of employment with his community or another Cree Nation or agency

Appendices

Appendix A Some Canadian GIS and First Nations Related Information Sources

Appendix B CRA Housing Software Examples

Appendix C Some non-GIS and GIS Training Books

Appendix A

Some Canadian GIS and First Nations Related Information Sources

The websites noted below were active at the time the case study was prepared and should be of interest to First Nations interested in GIS for various applications from housing to natural resources. These are just of few of the hundreds of GIS sites available but they are some of the only ones that focus on Canada and First Nations.

The Aboriginal Mapping Network - Networking the Aboriginal Mapping Community
www.nativemaps.org

Free maps and satellite images courtesy of the Government of Canada.
www.geogratis.cgdi.gc.ca

Free topographic maps and satellite images at various scales for all of Canada.
http://toporama.cits.rncan.gc.ca/

Free training material at various levels from ESRI (ArcView etc)
http://k12.esricanada.com/teachingmaterials/tutorials/index.html

Training information on ESRI courses (ArcView etc)
http://www.esri.ca/english/engine/training.asp

Maps, survey and other information for much of Canada and many First Nations areas.
http://www.geocan.nrcan.gc.ca/

ESRI Canada - Home Page - download ArcExplorer for free from the site!
http://www.esricanada.com/

Mapping Agencies and Organizations
http://maps.nrcan.gc.ca/maps101/map_agencies.html

Maps 101 - Topographic Maps, The Basics
http://maps.nrcan.gc.ca/maps101/index.html

Appendix B

CRA Housing Software Examples

The work order form on the following page is printed from a specially developed computer program that works with MS Access but requires no experience with Access. The software was developed by the CRA and is used in all 9 JBC Communities. Information from each work order is added to the database using a simple intuitive interface that requires no knowledge of Access. Several different reports and statistics can be generated from this data to assist in managing housing assets and materials.

The street address can be used to link the data in the housing Access database with the GIS database.

COUNCIL OF THE CREE NATION OF MISTISSINI
ISAAC SHECAPIO SR. ADMINISTRATION BUILDING
187 MAIN STREET, MISTISSINI (QUÉBEC) G0W 1C0

TEL.: (418) 923-3461 / FAX: (418) 923-3115
E-Mail: legislative@nation.mistissini.qc.ca
administration@nation.mistissini.qc.ca

Work Order

Mistissini Rental Housing

☐ Rental ☐ Band Owned ☐ Invoice to Tenant ☐ Invoice to Other Dept.

No:_____

Departement: _____
Project: _____ Date: _____
Unit # : _____
Tenant's Name: _____
Address: _____
Authorized Coord: _____ Work Request Ref. #

Work required:

List Of Material

Quantity	Description	Unit Price	Total

Labour Cost

Employe Name	Number of Hrs.	Rate	Total

Grand Total

Work Performed:

Comments

Worker's Signature:_____

Tenant's Signature:_____ Date Completed:_____

Call Type:

☐ Routine Maintenance ☐ Preventive M. ☐ Urgent call ☐ Negligence ☐ Special request

This is one of the summary reports that is generated using the CRA software.

Summary annual cost for all project

Year	*Material*	*Labour*	*WorkOrder*	*Warehouse*	*Hol iday*	*Office*
2003 - 2004						
Cost:	$	$				
Hours			680	0	56	140
Total Cost:		$		*Total hrs:*		**876**
2002 - 2003						
Cost:	$	$				
Hours			1092	0	0	0
Total Cost:		$		*Total hrs:*		**1092**
Grand Total:		$		*Grand Total hrs:*		**1968**

This is one of the reports from the CRA software showing:
NuAuto – a computer given unique ID number in the database
TxtNomProjet – the model name/project of the houses
TxtUnits – the number of houses in that model style
The year built and contractor are also stored in the database.

NuAuto	txtNomProjet	txtUnitsNumber	txtYear	txtContractor
1	001-Model 1D	25	1979-80	Cree Construction
2	002-Model 1D	24	1980-81	Cree Construction
3	003-Quebco D	19	1983-84	Cree Nation of Mistissini
4	004-Model 21 SD	14	1984-85	Cree Nation of Mistissini
5	005-Boplex D	20	1984-85	Cree Nation of Mistissini
6	006A-Model 22 SD	28	1985-86	Cree Nation of Mistissini
7	006B-Row House	8	1985-86	Cree Nation of Mistissini
8	007-Model 22 D	19	1986-87	Cree Nation of Mistissini
9	008A-Model 22 SD	4	1986-87	Cree Nation of Mistissini
10	008B-Model 22 D	12	1986-87	Cree Nation of Mistissini
11	009A-Model 90 D	2	1987-88	Cree Nation of Mistissini

Appendix C

Some non-GIS and GIS Training Books

This case study has focussed on ESRI GIS products because they are what is being used by many of the First Nations that have GIS expertise. Many First Nations started with ArcView and ArcInfo because that was what their suppliers or Government departments were using. This is a perfectly valid reason but it should be pointed out that there are other GIS software programs on the market, such as MapInfo and Idrisi, to name just two of the more popular programs. These programs can handle data and have many of the same capabilities as ESRI software.

A selection of books that the author has used in the past are presented here. These books should be available from various Internet sites, such as (without prejudice) amazon.ca and esri.ca. The books that are available from Amazon seem to be cheaper than the same book from the ESRI website. Some of these books may be available at larger bookstores. Most of these books are used in college and university level computer and GIS courses and should be available at university and college bookstores. For the most pat the books are well organized, well illustrated and logically present the material. This is just a short reference and many other books are available. ***Please be sure to purchase the version of the book to match the software that you are using!*** New books are published all the time and older ones become unavailable. All of the books noted were available at the time of preparing this case study.

MS Excel – Spreadsheet Program

Excel for Windows (Visual Quickstart Guide)
By Maria Langer
Peachpit Press, ISBN 0-201-35427-6
www.peachpit.com
About $20-25.00

MS Access – Database Program

Access for Windows (A Visual Quickstart Guide)
By Deborah S. Ray and Eric J. Ray
Peachpit Press, ISBN 0-201-35434-9
www.peachpit.com
About $20-25.00

AutoCAD – Computer Aided Drawing

AutoCAD 2000 Bible (later versions are also available)
By Ellen Finkelstein
IDG Books Worldwide, Inc., ISBN 0-7645-3268-5
www.idgbooks.com
About $80

GIS Books

Both of the books that are noted below have the considerable advantage of including colour examples and a 180-day educational licence as well as worldwide GIS data to use in exercises from the books. The software should not be used for commercial purposes but is a great way to become familiar with the software and how to do most of the tasks that you would need to cover on a daily basis. The software can only be loaded once on one machine so make sure that you have a good enough computer and that you will have ongoing access to that computer as well.

Getting to Know ArcGIS (Basics of ArcView, ArcEditor and ArcInfo)
By Tim Ormsby, Eileen Napoleon, Robert Burke, Carolyn Groessl and Laura Feaster
ESRI Press, ISBN 1-879102-89-7 (this is the 5 th printing in 2003 and there may be later versions)
www.esri.ca or www.esri.com
About $70 – 100 (depending on where you look)

GIS Tutorial, Workbook for ArcView 9
By Wilpen L Gorr and Kirsten S Kurland
ESRI Press, ISBN 1-58948-127-5 (2005)
www.esri.ca
About $70 – 100 (depending on where you look)

Visit our website at www.cmhc.ca