

Community Wireless Infrastructure Research Project

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K-Net/Lac Seul Case Study Map

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1. Brief Case Study History:

Lac Seul Community Wireless Network is a mixed WiFi and 3.5 GHz licensed spectrum radio network owned and operated by the three communities of Lac Seul First Nation: Frenchman's Head, Kejick Bay, and Whitefish Bay. The network is intended for public access, administrative use, and high-capacity QoS applications in support of health, education, and other community services. The QoS applications include videoconferencing, limited voice-over-IP telephony and telemedicine.

The network does not currently operate on a business model. Operating costs are defrayed by a special telecom arrangement, related administrative costs have been recovered from limited Band funds, special operational costs including some staffing and equipment replacement are covered by federal program funds (KO Telehealth and First Nations SchoolNet), and residential and/or public access is currently free of charge. A 2003 funding partnership between Industry Canada FedNor (which paid approx. CAD \$500K) and Lac Seul First Nation (which paid approx. CAD \$100K) covered the initial capital costs of the network (including a comprehensive computerization package for Band offices and community services – See **Appendix B**).

The initial network build (in 2004/05) also involved (not-for profit) K-Net Services of Sioux Lookout, who advised free of charge, and (contractor) Superior Wireless, of Thunder Bay, who designed the network, and coordinated the build through an agreement with Lac Seul. Subsequent equipment failures (due to a mismatch with Lac Seul's environment) led to a redesign of the network in Fall 2005.

In 2005/06, K-Net Services and Industry Canada's First Nations SchoolNet and FedNor programs stepped in with new funds from their SchoolNet and e-Communities partnerships, and paid for the capital costs of the redesign. Superior Wireless led the redesign, and in the process, acquired enhanced capacity for its cellular-broadband network. By the Summer of 2006, after multiple equipment failures and tests, the Lac Seul Community Wireless Network acquired the functional components it required for QoS applications. It is currently operational as far as technical standards are concerned.

In August 2006, Superior Wireless was bought out by TBay Tel (of Thunder Bay). Superior's service agreement with Lac Seul First Nation was transferred to the new company,

where it remains today. K-Net Services, although not legally involved in their transactions, is the ISP and facilitator of broadband QoS applications in Lac Seul, including videoconferencing, and KO Telehealth. (KO Telehealth is currently set to operate only in Kejick Bay, but due to the recurring network problems a successful telehealth consult had yet to occur). It also appears that videoconferencing has not yet become an effective practice in the Band offices and schools (where FedNor/K-Net Services had placed units). Moreover, as far as we know K-Net Services has yet to charge the Band of Lac Seul for Internet service or packet switching for broadband applications (again, due to the unreliability of the network in the past). Network operational costs and online service costs (e.g., for telemedicine and v/c applications) are recovered by K-Net through their arrangements with First Nations SchoolNet and Keewaytinook Okimakanak Telehealth programs.

2. Mission Statement and Goals:

The Lac Seul Community Wireless Network (LS WCN) is owned by Lac Seul First Nation and is jointly operated by the Band Offices of Lac Seul's three member communities of Frenchman's Head, Kejick Bay, and Whitefish Bay. Goals for the network's development and use have to be jointly shaped by the three communities, which is difficult given their geographic separation and relative independence from one another. The Band Offices of Lac Seul have issued no mission statements regarding their network or its purpose. The funding proposal to FedNor that catalyzed the network build in 2003 was based on a generic template provided by K-Net Services – see **Appendix A**). One may assume that the Band of Lac Seul has accepted K-Net's mission. The generic template states the following (see **Appendix A**):

The goal of this project is to provide a shared high quality connection to affordable bandwidth for all the First Nation organizations that are interested in being connected to broadband services. This goal is supported by two objectives. The first objective is to create a sustainable and scalable point of access to high speed services. A parallel and complementary objective is to use the local network to enable the development and delivery of a wide variety of e-services and applications (using IP video, data and voice services) being planned among First Nation service organizations in other centres with access to K-Net, such as Sioux Lookout, Thunder Bay and elsewhere. Many groups such as Health Canada, NAPS and Tikinagan will increase efficiency of client services through the anticipated expanded technology.

Today the network serves a number of residents and organizations in the communities of Lac Seul. Ostensibly this communications service would appear to represent the network's immediate goal, i.e., to support the communications needs of community services and residents with Internet access, and provide telemedicine, and videoconferencing, and other high-capacity applications over K-Net's broadband WAN.

3. Network Type:

The Band of Lac Seul operates the Wireless Community Network as a not-for profit public infrastructure. The network model distinguishes two forms of access/service provision: 1) Community services – schools, constabulary, nursing station/health clinics, Band Offices/Community centres – have access to 3.5 GHz licensed spectrum radios, and 2) community residents and local businesses have access to unlicensed spectrum radios for WiFi Internet access, provided they purchase WiFi client units and operate within 'line of sight'.

The capital cost structure of the network is based on a partnership model devised by K-Net Services and Industry Canada FedNor. This model requires the participation of key funders (i.e., FedNor) to provide a major contribution of funds to the network build (around 90%). Since the mid 1990s FedNor's mandate has been to support telecommunications in remote northern Ontario and it has invested approx. CAD \$50M to related ICT initiatives over the past ten years (of which First Nations projects constitute approx. 50%). Per community investments have ranged in the CAD \$500K ballpark.

The operating cost structure of the network, especially with regards to the licensed spectrum radios, depends on the willingness of community organizations to purchase capacity for network services. The not-for profit K-Net Services (with support from FedNor) brokers the participation of key client services, especially regional and federal, though it does not maintain a legally binding agreement with Lac Seul or charge for its brokerage services. Clients may include the local constabulary, First Nations Inuit Health Branch of Health Canada/KO Telehealth, Indian and Northern Affairs Canada/First Nations SchoolNet or KiHS, Tikinagan Family Services, Nodin Mental Health Counselling Services, Wahsa Distance Education Services, and so forth. The Lac Seul Band currently has an agreement with KO Telehealth, which provides 'credits' to reduce the cost of operating a licensed spectrum transceiver in the health clinics. Similarly the Band's two schools (in Kejick Bay and Whitefish Bay) as well as the Wahsa Distance Education Centres in each community, are eligible to have operating costs defrayed under First Nations SchoolNet (via K-Net Services RMO¹), which provides 'credits' to support their use of a licensed spectrum transceiver. Some organizations have been reluctant to join the Community Wireless Network. We were told that Tikinagan for example, is currently satisfied with dialup from Bell Canada. (**See section 8: Financial and Other Resources**).

4. Organization:

Network Manager Role and Responsibilities

At the time of our visit (August 2006) the Lac Seul CWN employed one fulltime Network Manager. The Network Manager's term was closing in on one year. (Previously, two other community members had been trained under the 2003 FedNor grant to maintain the network, but they stayed no longer than a year or two after training).

Working on his own, the Network Manager operated out of the Kejick Bay Band office (his home community) and visited Frenchman's Head and Whitefish Bay as needs arose. He reported directly to the Band Office at Kejick Bay, and indirectly to the Band offices of Whitefish Bay and Frenchman's Head. It appears that communications between the Network Manager and the offices of Whitefish Bay and Frenchman's Head were irregular. The various parties involved did not schedule regular meetings, nor did they have a system in place through which to document network issues/problems and prioritize related needs and tasks. The Network Manager's work time was loosely structured around incidents and requests as they arose, and there was no time set aside for him to work on 'big picture' tasks, such as surveying the network's potential and actual client base, or strategizing a business model with the three Band offices. The Network Manager also did not have reliable access to vehicles that would allow him to provide regular visitation and inspection of the three communities and their access points.

In his daily work the Network Manager was required to maintain the licensed and unlicensed spectrum radios and client units, as well as any accompanying switches. He was

¹ K-Net Services is the Ontario Regional Management Organization for First Nations SchoolNet (cf. Fiser 2004).

required to maintain the servers for Band Office email accounts and administrative portals. He was required to maintain office LANs and PCs (e.g., antivirus, "Deep Freeze", software upgrades, password maintenance, printer/peripherals configuration, etc.). He was required to maintain videoconferencing units, phones, and troubleshoot connectivity problems. Such ongoing maintenance tasks filled the greatest portion of his workday. The Network Manager was also responsible for negotiating Superior Wireless's service agreement with Lac Seul. Any problems with the radio towers required their assistance, as the Network Manager did not have certification to climb towers; and more complicated technical repairs or upgrades required their consultation.

At his discretion the Network Manager also assisted residents with hardware/software purchasing decisions and PC/LAN repair (mostly for free, but sometimes for a nominal fee). The residents we spoke to from all three communities appeared to be under the impression that the Network Manager had a responsibility to look after their personal connectivity and computing needs, (which was not actually the case as specified by his employment contract). Residents from Whitefish Bay were most critical of his performance, apparently due to their WiFi radio configuration's constant problems with connectivity. As far as we could tell the Network Manager, as the 'living embodiment' of the Community Wireless Network, absorbed a lot of criticism for complex network problems that were often out of his hands (requiring assistance from the service contractor Superior Wireless).

When we spoke to the Chief (David Gordon) and an Economic Development Officer (Grace Strang) at Frenchman's Head, they suggested that residents may have been too hard on the Network Manager, and told us that the administration at least, placed their confidence in him. They told us that he did the best he could under the circumstances and that knowledge he regularly demonstrated was a scarce asset and therefore in high demand in Lac Seul. (The Network Manager's salary however, was approximately CAD \$30K/year, which the Chief and EDC agreed was probably too small to base a career on, but was all the Band could afford to pay).

K-Net Services' Role

K-Net Services' partnership with Lac Seul was a critical knowledge and morale booster for the Network Manager. The organization provided him with technical and moral support, and assisted him in his negotiations with Superior Wireless (over radio warranties and repair contracts). One of K-Net Services' technicians (Jamie Ray) acted as the liaison to Lac Seul. He had an interest in wireless technologies and made himself available to the Network Manager on an ongoing informal basis (billing hours to K-Net Services for his time).

Superior Wireless' Role

As discussed, repairs to the radios required third party intervention brokered by Superior Wireless through its service agreement with the Lac Seul Band. Neither the Network Manager nor the technicians of K-Net Services have a tower climber's license and as a result, any physical repairs to installed radios required the Band to contract a bucket truck or tower crew. We were told that no tower crews operate directly out of the Sioux Lookout District. Since Superior Wireless (now TBay Tel) contracts tower crews to maintain its cellular network in the region, the Network Manager would contact Superior Wireless to contract one of the crews it used. Superior Wireless usually contracted crews from Manitoba or Thunder Bay and as a result waited on contracts until there were a series of tower repairs to be done on its cellular network between Lac Seul and Thunder Bay. As a result, Lac Seul sometimes had to wait

weeks for a tower crew to arrive. For residents (especially in Whitefish Bay) the long waits became unbearable and frequent complaints were reported to the Network Manager.

Organizational Change in 2006

It appears the organization of the Lac Seul CWN as we came to know it from discussions with the Network Manager, Band office staff, residents, and K-Net Services constituted a kind of adhocery. It proved extremely flexible and responsive to incidents, but was severely limited by a lack of personnel. The Network Manager set his own schedule and worked around the shifting constraints of the network. He visited Frenchman's Head and Whitefish Bay when problems arose and did not appear to have developed a rapport with administrators and residents in those communities. Although the Network Manager position was to serve all three communities (and was paid for through a common Band fund), the Network Manager's direct supervisor was the finance officer at Kejick Bay.

In August 2006, there was an incident at the Kejick Bay Band Office where staff disconnected servers without consulting the Network Manager. After this incident the Network Manager decided he had had enough and walked off the job, apparently to protest for better treatment and possibly more pay. He was later confronted by the Kejick Bay finance officer who unilaterally fired him without negotiation. The Band Offices of Frenchman's Head and Whitefish Bay were not consulted in this process. We were told that it was within the finance officer's powers to fire the Network Manager at his discretion. By early Fall 2006 the Network Manager had left Lac Seul to work in Thunder Bay (at KORI). As a result Lac Seul no longer has a Network Manager, and maintenance duties are currently contracted out to PM Computers of Sioux Lookout.

5. ICT Infrastructure

The LS CWN is a hybrid network of WiFi (Smart Bridges/Airpoint Pro) and 3.5 GHz licensed spectrum radios (Aperto). The following diagram specifies the network configuration of the WiFi and licensed spectrum radios, as well as their connections to any switches at each community access point. Starting from top-left the diagram specifies the backhaul between K-Net (Sioux Lookout) and Lac Seul:

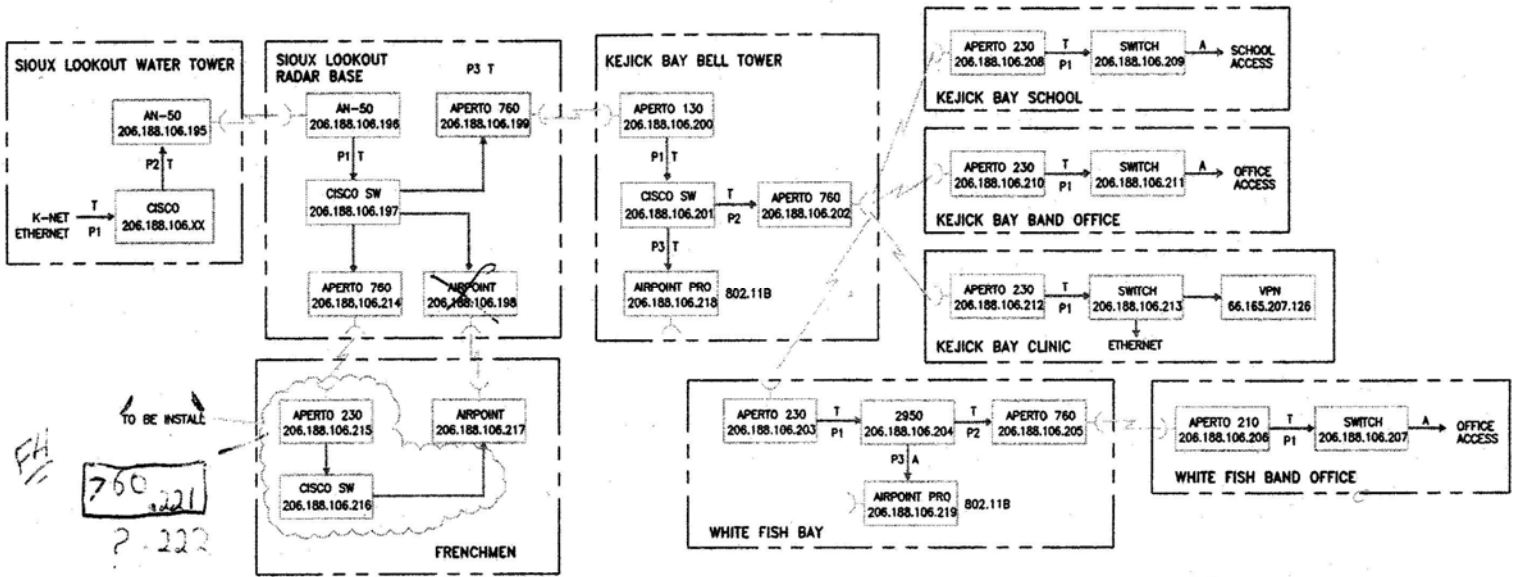


Figure 1: Lac Seul Network Diagram/IP Scheme circa 2005 (courtesy of Superior Wireless)

As of August 2006, the WiFi and licensed spectrum radios are currently operational after extensive repairs in the summer of 2006 (during our field visit). Frenchman’s Head now has an Aperto client unit in its health clinic (the portion under ‘to be installed’ in **Figure 1**). The following subsections describe the radios in use and their configurations.

WiFi radio configuration:

Airpoint Pro radios (by Smart Bridges) are in use in all three communities. These radios provide publicly accessible WiFi to any available access points within ‘line of sight’ of each community’s radio tower(s). (No passwords or security keys are required). As the network diagram indicates (**Figure 1**, above) Redline (AN-50) radios provide a backhaul between Lac Seul and K-Net in Sioux Lookout. Starting at the Sioux Lookout water tower (head end), the data stream travels west to the Radar Base where two Aperto 760 base stations (fed through a Cisco switch) communicate with the Redline (AN-50). The Aperto base stations then transmit to either Frenchman’s Head or Kejick Bay to both licensed spectrum and WiFi radios (via a switch configuration). From Kejick Bay a data stream travels to Whitefish Bay.



Figure 2: Smart Bridges Airpoint Pro WiFi radio

[The initial network build under the 2003 proposal was designed around all WiFi equipment (Smart Bridges). The design team (Superior Wireless, K-Net, Lac Seul) soon discovered that the unlicensed spectrum radios could not handle the demands of videoconferencing and telemedicine applications].

3.5 GHz Licensed Spectrum Radio Configuration:

The licensed spectrum radios in use at Lac Seul operate at 3.5 GHz (under a class A license). As indicated in **(Figure 1, above)** Redline (AN-50) licensed spectrum radios link the Lac Seul network to K-Net (Sioux Lookout) in two hops. The data stream from K-Net travels from the Sioux Lookout water tower to the Radar Base where a switch redirects data from the AN-50 to two Aperto 760 base stations pointed either at the Band Office tower in Frenchman’s Head (approx. 15 km away) or the Bell tower in Kejick Bay (approx. 32 km away). Each tower in Lac Seul carries an Aperto transceiver that feeds into a Cisco switch, which redirects QoS data to another Aperto 760 base station for retransmission (and remaining bandwidth to a WiFi unit for public access (where available)).

Once inside Lac Seul the following radio configuration takes over: Aperto Packetwave 760 base stations communicate with either a Packetwave 130 or 230 transceiver placed at each of the communities’ health clinics, Band Offices, and schools. The base station in Kejick Bay communicates with the transceivers in Whitefish Bay. **Table 1** below summarizes the capabilities of the Aperto radios.

Aperto 760 Base Stations	Aperto 130/230 Transceivers
The PacketWave 760 unit is designed to deliver services to subscribers in areas where foliage and buildings can make line-of-sight access a problem. The unit integrates with wireline network infrastructures to maintain Quality of Service (QoS).	PacketWave 130/230 models provide bridging, VLAN, PPPoE, NAT, and IP routing, with support for up to 250 hosts with DHCP server.



Figure 3: Schema for Aperto 760 (Aperto 2006)

To facilitate network services K-Net Services configured the licensed spectrum radios to create four Virtual Local Area Networks in the communities. VLANs are all programmed through a router on the Sioux Lookout water tower. Each end location that requires QoS needs a Cisco switch (with ports dedicated to each VLAN). Following this configuration the WiFi units then utilize the remaining bandwidth. (These are 20 Meg radios, and real time use is 8 Megs symmetrical). The VLAN’s are configured as follows:

- **VLAN 1** – Reserved for network management, testing, etc.
- **VLAN 410** – Reserved for data
- **VLAN 411** – Reserved for Telehealth
- **VLAN 412** – Reserved for video
- **VLAN 413** – Reserved for Voice over IP

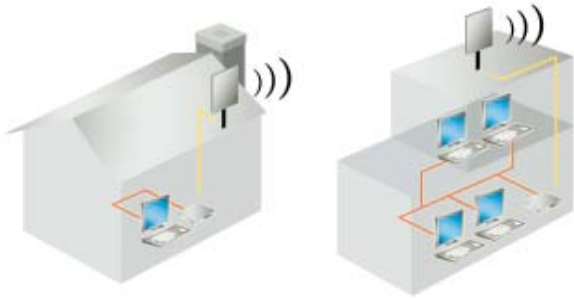


Figure 4: Schema for Aperto Packetwave 230 (Aperto 2006)

Challenges

At the time of our field visit the Network Manager had indicated a number of challenges for wireless infrastructure deployment in Lac Seul. The First Nation straddles Lac Seul, a large lake that attracts frequent electrical storms that have damaged radios in Kejick Bay and Whitefish Bay. The general environmental conditions of the region also wear down equipment faster than warranties would normally expect. Moreover, Kejick Bay and Whitefish Bay are remote communities (currently accessible by boat or winter road), and the region Lac Seul inhabits is a CRTC designated 'high cost serving area' not normally supported by telecom providers. These environmental and geographic conditions lead the community to depend on the expertise and resources of outside partners in Sioux Lookout (1 hour away) and Thunder Bay (6 hours away). Builds are therefore prone to long delays.

Residential access is also potentially hampered by geography. Lac Seul First Nation encompasses an area of approximately 26.82 square km that is heavily forested and hilly. Residents are distributed in clusters that render ubiquitous WiFi difficult to establish.

Vandalism has been a recurring problem in the communities. Young people have been caught tampering with antennae and related radio equipment in the schools and clinics. The Bell tower in Kejick Bay is painted with graffiti and appears to be a regular 'hang out' for teenagers. Public safety issues related to network equipment, such as vandalism, or misuse of internet access and public access facilities, have not been specifically encoded in any use policies or bylaws. These issues are negotiated by each community Band office on an ad hoc basis.

6. Key Services:

WiFi

LS CWN provides free WiFi internet access to residents. Residents must be within 'line of sight', and are required to purchase their own equipment. At the time of our visit the Network Manager had been providing free assistance to a number of residents, helping them with the purchase and installation of WiFi client units and related equipment. The Network Manager did not keep track of how many residents actually use the WiFi service.

Web Portal & Email

LS CWN hosts local content development on the community portal lacseul.firstnation.ca (under the firstnation.ca domain registered by K-Net Services). The portal features information about Band office services and the health authority, as well as a history of the LS communities, events pages, and a photo gallery. Users may also access LS's webmail service (@lsfn.ca) through the portal. The webmail service is reserved for Band office staff (who may access webmail services remotely). Staff members of the LS Band offices and Health authority (including the schools) do not currently utilize IP telephony over the K-Net VOIP network (although a VLAN is dedicated to VOIP). There is one IP phone located at the nursing station in Kejick Bay for use by the Community Telehealth Coordinator. General phone systems are maintained by Bell.

Education

LS CWN supported Keewaytinook Internet High School (KiHS) in Kejick Bay (2002 – 2004), and Frenchman's Head (2002 – 2003). We were told that in both cases the classrooms were closed down due to a lack of student interest.

Through First Nations SchoolNet K-Net Services Regional Management Organization (RMO) provides funding and technical support to the elementary schools in LS on behalf of Indian and Northern Affairs Canada (formerly of Industry Canada as of 2006). The initiative includes high-capacity connectivity to the schools, multimedia computers and devices for schools, and helpdesk services. The White Pine Ridge School in Kejick Bay has approx. 60 students and seventeen computers. The Morris Thomas Memorial Christian School in Whitefish Bay has approx. 21 students and 5 computers. The schools access LS CWN's licensed spectrum network.

Wahsa Distance Education (out of Sioux Lookout) operates in each of the Lac Seul communities, and offers adult education programs. Wahsa centres benefited from the FedNor 2003 computerization package (and there are approx. 5 computers in each centre). The centres currently access LS CWN WiFi. The student body in each of the centres fluctuates between 12 and 20.

Telemedicine

KO Telehealth is presently available in Kejick Bay and began operations in the summer of 2006 (shortly before our field visit). There is one Community Telehealth Coordinator (CTC) working for KO Telehealth in the nursing station of Kejick Bay. (<http://lacseultelehealth.myknet.org/>). At the time of our field visit (August 2006) the status of the Kejick Bay Telehealth unit was in question due to the unreliability of the network. With subsequent repairs it appears that Telehealth is ready to operate.

7. Users:

To date there is no actual user list for the LS CWN WiFi network (e.g., subscribers, patrons, etc.). There is also no official list of administrative users (apart from accounts on the email server), but the licensed spectrum network is reserved for administrative use and community services (e.g., KO Telehealth, and school connectivity) and is in place (as **Figure 1** showed above).

Computerization

The 2003 FedNor grant constituted a comprehensive computerization package for Band offices, health clinics, and participating community services such as Wahsa distance education centres,

elementary schools, and constabulary (See **Appendix B** for a complete list of equipment and services). It included computers, multimedia tools, admin software and design tools (MS Office, AutoCAD, etc.) for these various centres, as well as switching equipment and radios to interconnect essential services, and WiFi client units for participating organizations. This package was intended to include a number of training workshops for the admin staff of the various participating offices and centres as well as members of the public.

As far as our preliminary research shows, based on interviews with the former Network Manager and various current LS Band office staff members, the most commonly used network services are low-capacity applications, particularly email and chat. Of the higher-capacity applications, V/C units are available on site in the Band Offices, schools, and nursing stations, but are not in regular use. (At the time of our visit the V/C unit at Frenchman's Head's Band office was disconnected and placed in storage).

Web Presence

Other resources suggest that Lac Seul has attracted a moderate user presence online. A search of MyKnet.org homepages found 426 pages that made reference to Lac Seul First Nation. (This figure is only an approximation and is not statistically significant. Duplication was in effect during the page count). By comparison, a search of MyKnet.org for homepages referencing other K-Net communities of comparable size, (including duplicates), were as follows: Deer Lake found 606 pages, Sandy Lake found 1150 pages, and 'KI' found 616. Lac Seul's page count is lower than these others, suggesting a less developed user base. Obviously the comparison is only an approximation, but it raises the question as to why Lac Seul has not attracted more online content relative to its size.

Within the 426 collected pages we found a sample of Lac Seul community groups, services, and entrepreneurs on MyKnet.org, including sports teams, local SMEs, community services, and hobbyists. The first five pages listed below follow a standard template offered by MyKnet.org. The final two pages were designed with assistance from K-Net Services:

- <http://lacseulladiesbroomballteam2004.myknet.org/>
- <http://keewaycabobuslines.myknet.org/>
- <http://littlebandshockey.myknet.org>
- <http://ecphotography.myknet.org/>
- <http://pelican2002.myknet.org/>
- <http://biiwaasaya.knet.ca>
- <http://raisingthechildren.knet.ca/>

The sample indicates that established residents (of varying ages) as well as visiting non-indigenous personnel at the schools and health clinics, utilize K-Net to communicate their interests to a wider audience within and beyond Lac Seul.

Public Facilities

Band offices/community centres in each of the communities provide public access facilities and computer services to residents and visitors. The common configuration is of one to three desktop PCs, with Windows and MS Office. As far as we know, there have not been any systematic consultations with community members regarding the design and use of the network or the public access facilities. The 2003 FedNor grant called for workshops to introduce community members to the facilities. None of our respondents could recall the extent of these workshops or comment on their impacts.

That said, the network manager indicated that members of all three communities actively sought updates on the status of the network when it was down, filed complaints, made requests for assistance with personal computing activities, and so forth.



Figure 5: Public Access at Kejick Bay

Internet Service Provision to SMEs

Local small Medium Enterprises (SME) may acquire WiFi/internet connectivity through the LS CWN (at no cost other than the purchase of access units). Lac Seul's two largest resort/sport fishing camps are clients. Mahkwa Lodge of Whitefish Bay, the largest SME in LS, utilizes internet access for communications and administrative purposes, and maintains a web presence at www.mahkwa.ca, and on various outdoor tourism portals. Visitors to the Mahkwa Lodge site may book accommodations online. Our respondents at Mahkwa Lodge said they have increased their outreach to American tourists as a result of their web presence. Lac Seul Resort, operating out of Frenchman's Head, caters to similar clientele and maintains a web presence at <http://www.lacseulresort.com>. Neither resorts currently offer internet access to their patrons but deploy the LS CWN and K-Net for admin purposes.

8. Financial & other resources:

The original 2003 Lac Seul proposal to FedNor estimated total project capital costs at CAD \$432K. To this the Band of Lac Seul added approx. CAD \$100K. **Appendix B** specifies how the FedNor funds were to be spent. We were told the Band funds (viz. Casino Rama) purchased tower facilities in Frenchman's Head and Whitefish Bay. As far as we can tell the requirements specified in **Appendix B** were met by the Band and its collaborators. Subsequent repairs and upgrades in 2005 totaled at CAD \$78,166.23. The Network Manager's salary was approximately CAD \$30K per annum (and paid out of Band funds).

At the time of our field visit there were no actual operating costs paid by the Band, apart from service contract repairs paid to Superior Wireless. Through an informal agreement made between Superior Wireless, K-Net Services, and FedNor, the Lac Seul network became the property of Lac Seul, and the backhaul became joint property of K-Net Services and Superior Wireless. It is noteworthy to compare the cost structure of this arrangement with the last mile costs of the majority of K-Net communities, which lease T1 drops from Bell (Ontario's ILEC). Bell charges from CAD \$1675 to \$3740 per month for 1.544 Mbps (versus Lac Seuls 8 Meg symmetrical capacity).

K-Net Services, the ISP for LS CWN, has not charged Lac Seul for shared network costs because the network was not fully operational until Fall 2006. (We were told that Lac Seul's portion of K-Net's common link costs amounts to approx. CAD \$160 per month).

After Superior Wireless was bought out by TBay Tel in August 2006, TBayTel stated that it would abide by the existing 'agreements' in place with K-Net Services. As far as we know the service agreement between Lac Seul and Superior Wireless have been transferred to TBay Tel, and the joint ownership of the backhaul from Lac Seul to Sioux Lookout now involves TBay Tel.

Table 2 below summarizes the capital and operating costs and their relation to relevant past, present and future funding programs. (All funds are in CAD):

Lac Seul Network	Past, Present, and Future Funding Programs					
	Partnership Model	FNIHB/KO Telehealth	INAC/KiHS	INAC/First Nations SchoolNet	FedNor	Lac Seul Casino Rama Fund
Capital Cost Structure: 2003 FedNor grant – computerization package and initial network build					At a max. investment of 90% of Total Costs. FedNor invested \$432K	At a min. investment of 10% of Total Costs. The Band invested approx. \$100K
Capital Cost Structure: 2005 FedNor/K-Net e-Communities – Network Redesign					e-Community-1: \$52,017.99 (3.5 GHz Multipoint Wireless Local Loop) e-Community-2: \$26,148.24 (Radios to complete job) Total= \$78,166.23	
Operating Cost Structure: Note – (from 2003 to 2006 – There have been no operating costs).	Pays Community Telehealth Coordinator Salary (Kejick Bay), and would contribute \$800/Month for connectivity charges	In the past KiHS operated in Kejick Bay (until 2005) and Frenchman’s Head (until 2003). It paid \$450/Month per school	FNS would pay for school connectivity (including Wahsa) @ \$300/Month per school			

As **Table 2** indicates, federal funding agencies were critical for LS CWN’s build and federal programs are important potential CWN clients. We were told by respondents from K-Net Services and FedNor that FedNor was also an arbitrator of the informal agreement between K-Net Services, Superior Wireless, and Lac Seul. When Superior Wireless was bought out in August 2006 for example, K-Net Services and FedNor jointly negotiated with TBayTel/Superior Wireless to determine the conditions of their informal agreements under new management.

The federal funding programs related to KO Telehealth and FNS would play a substantial role in covering connectivity charges if the agreement with TBayTel were to change or if K-Net began to charge for network services such as videoconferencing and telemedicine. For example, when telehealth services become reliable in Kejick Bay, K-Net services will begin to charge for v/c and vpn tunneling related services. As K-Net Services is the broker for these federal program 'credits' it may apply them to the Lac Seul CWN at any time (as long as the program funds exist). By comparison, the majority of K-Net communities acquire T1 service through a contract between Bell Canada and K-Net Services. In their case the 'credits' created by KO Telehealth, FNS, KiHS, and regional services such as Nishnawbe Aski Police Services constitute approx. 70% of the total cost of bandwidth; in other words, reducing the community portion to approx. 30% of total cost (based on a projected total cost of approx. CAD \$2170/month for shared access to 1.544 mbps). (Some communities pay more, and others pay less).

9. External stakeholders:

Lac Seul's principal external stakeholders in the community wireless network are Industry Canada FedNor, K-Net Services and KO Telehealth, and Superior Wireless (now TBay Tel). See sections 3, 4, and 8 for details on their relationships.

10. Impact and benefits:

To date there has been no attempt by Lac Seul First Nation, or by any research group on behalf of Lac Seul First Nation or its stakeholders, to assess the impacts and benefits of the wireless network in the communities. Our respondents in the communities have indicated interest in undertaking a survey of users towards designing a local ISP business model.

The 2003 FedNor funding proposal for the LS CWN, based on K-Net Services' template and advice, specified benefits to the communities and to Superior Wireless (now TBay Tel). As for the communities, it stated that:

Lac Seul would own the equipment and have the ability to manage their broadband communications network. Examples of broadband data service access will mean the ability to do telehealth and tele-education along with video remands and Justice of the Peace appearances, among other things.

Our respondents at the Band Office in Frenchman's Head emphasized the importance of a community owned infrastructure. They admitted however, that the ability to manage this infrastructure was severely limited by inadequate human resource development. To place so much responsibility for the network on one member of the community meant that maintenance and daily operations overshadowed strategic planning. As far as we know the Network Manager had very little time to devise a local ISP business model or work on network expansion, e.g., to conduct a market survey, to reach out to local residents, businesses (outfitters) or community services (e.g., Tikinagan) that were not using the service. That said, we understand that he had been planning a commercial ISP service and would have been prepared to work out a model for charging residents and businesses if the Band had provided him with extra personnel, resources, and political support.

As for Superior Wireless (now Bay Tel), the 2003 proposal stated:

Benefits to Superior Wireless are access to the Lac Seul customer base for their regional cellular service.

Our respondents at Superior Wireless (prior to the takeover) stated that they were interested in expanding cellular service to the environs of Sioux Lookout, but that there were no actual agreements in place to provide cellular service to Lac Seul. We were told that Superior Wireless benefited from the 'free' use of K-Net Services' data network in exchange for the use of SW towers (e.g., Sioux Lookout Water Tower and the Radar base), and a redundant microwave backbone between Sioux Lookout and Thunder Bay. (This agreement continues to be in place with TBay Tel). (First Nations SchoolNet/K-Net Services made a CAD \$80K contribution to this backbone (for radio equipment) in order to connect First Nations schools in Eagle Lake and Wabigoon).

11. Community Profile:

The Lac Seul Reserve is the oldest reserve in the Sioux Lookout District of INAC. The reserve was established pursuant to Treaty #3 (not Treaty #9, which is represented by Nishnawbe Aski Nation). By 1912, there were at least 45 homes along the shoreline of what is now referred to as Kejick Bay and Whitefish Bay. The lake was the main transportation route and an important source of food. In 1929 Ontario Hydro constructed a dam at Ear Falls to produce Hydro electricity. Lac Seul Lake was flooded and to this day, the Ear Falls Dam controls the lake level. The flooding caused the area known as Kejick Bay to become an island, permanently separated from the mainland and splitting the community into two parts. The community of Whitefish Bay is located on the mainland. The electrification of Lac Seul First Nation did not occur until the early 1980s. (Note: a recent settlement with Ontario Hydro was awarded to Lac Seul First Nation in 2006. It amounts to approx. CAD \$11M and may contribute to the construction of a bridge between Kejick Bay and the mainland).

The total population of members registered with Lac Seul First Nation is approximately 2710. Approximately 70% of Band members live off reserve (see **Appendix C** for a genealogical description of settlement patterns in Lac Seul).

Frenchman's Head is the largest of the Lac Seul communities, population 425. FH is accessible by road from Sioux Lookout (approx. 38 km away). There are two radio towers located in FH, one adjacent the Band Office, the other on the roof of the Tikinagan admin office. Both towers are community owned. The FH Band office administers most Lac Seul programs (including ancillary funds such as Casino Rama). However, Kejick Bay and Whitefish Bay are relatively independent and maintain local Band offices and community services.

Kejick Bay is the second largest of the Lac Seul communities, population 416. KB is on an island accessible by watercraft and by an ice road during the winter season. There is one freestanding radio tower in KB. Currently ownership of the tower is in dispute. Bell Canada, the original owner, appears to have decommissioned the tower (e.g., disabled the warning lights), yet the company recently extended fiber into KB at the tower. Admin at KB have discussed purchasing the tower but no plans have been confirmed. At the time of our visit, K-Net Services was working with KB's health clinic to finalize the establishment of a KO Telehealth station on their new premises. KB has one elementary school, the White Pine Ridge School.

Whitefish Bay is the smallest of the Lac Seul communities, population 98. WB is on the mainland (separated from FH and KB by water) and is accessible by watercraft and by an ice road during the winter season. There is one radio tower in WB affixed to the community centre. WB has had the greatest number of problems with its radio (directed at KB). Located at WB is Mahkwa Lodge, Lac Seul's largest recreational resort and the largest SME in the

communities to utilize the wireless community network. Whitefish Bay has one elementary school, Morris Thomas Memorial.

12. Policy/regulatory/legal context:

- *Access to spectrum?*

The 3.5 GHz radio portion of the LS CWN operates under a class A license.

- *Are the services provided subject to any sort of regulation? By whom?*

The Band of Lac Seul has no specific service policies regulating access or use. However, partnerships with federal programs do involve patterns of regulation. KO Telehealth for example, is probably the most complicated partnership. It operates under Health Canada FNIHB in partnership with the Ontario Telemedicine Network, which jointly require all Telehealth sites to be certified in the following terms:

- Local Community Telehealth Coordinators employed by KO Telehealth must certify through the organization (e.g., demonstrate competencies and write an exam).
- The equipment used for telehealth must be certified through K-Net Services (i.e., cart assembly).
- The network itself must demonstrate QoS during a series of tests staged between K-Net Services-KO Telehealth and the Ontario Telemedicine Network.

Once all these requirements are met, KO Telehealth becomes an official service and a paying client of the community network.

- *Impact of new privacy legislation?*

As far as we know there is no specific privacy policy for the LS CWN. Individual services such as KO Telehealth apply their own privacy policies for particular scenarios of network use (e.g., patient-doctor consultations).

13. Critical success factors and lessons learned:

The key factors that led to the Lac Seul Community Wireless Network's initial build in 2003 were federal, regional, and local. The federal factor was Industry Canada FedNor's mandate to develop telecommunications infrastructure in remote communities of Northern Ontario, with a special focus on First Nations and connectivity for local community services. Also instrumental was FedNor's decision to distribute substantial community development grants (e.g., CAD \$500K) earmarked for the delivery of a comprehensive computerization package (i.e., addressing capital costs, capacity building, and in some cases operations). It has been estimated that FedNor invested approximately CAD \$50M on computerization and connectivity related projects in Northern Ontario since 1998 (about half of which went to First Nations community initiatives).

The regional factor was K-Net Services, a not-for profit organization in the Sioux Lookout District that, since 1994, had been actively building partnerships amongst 25 regional First Nations (including Lac Seul) and regional community services, to facilitate computerization and internet infrastructure development in the remote communities and related urban service hubs (such as Sioux Lookout, Red Lake, Thunder Bay etc.). In 1998, K-Net Services began to facilitate a series of funding partnerships between Industry Canada FedNor and the First Nations of the region. By the 2003 proposal we see that the process had become quasi-

standardized around the structure of K-Net's reputation and growing influence (see **Appendix A**). Regional First Nations adapted K-Net Services' original funding proposals and letters of intent, personalizing them while adopting K-Net's brand to their advantage.

The local factor was a group of influential community members who occupied positions of influence within the triune Band offices of Lac Seul. We have been told that relative to K-Net's development model, Lac Seul was unique in the way the Band mobilized community funds (via Casino Rama) to make the 2003 FedNor build happen. (More conventionally, we were told, a tribal council would have gotten involved to assist its member First Nation. Lac Seul is an independent First Nation).

14. Assessment:

- *How well has this organization/network done in meeting its stated objectives? Do the stated objectives meet the needs of stakeholders?*

As far as we know, as of August 2006 the LS CWN has been operating with minimal interruptions to WiFi and licensed spectrum services. It remains to be seen whether stakeholders (especially residents) are satisfied that their needs have been met as no needs assessment has been undertaken.

A number of external stakeholders appear to be satisfied with the fulfillment of related objectives: The Lac Seul computerization and network build meets FedNor's telecommunications development mandate. As the private contractor Superior Wireless/TBay Tel has acquired a potential cellular market as well as enhancements to its telecom infrastructure, and developed new expertise (intellectual assets) from its experiments with licensed spectrum radios during the network design/redesign. K-Net Services has facilitated connectivity for a local First Nation (and one of the largest in the region), and added another node to the KO Telehealth network and First Nation SchoolNet.

- *Does this network/organization provide a public benefit? How?*

If we limit our investigation to the stated objectives of the 2003 FedNor proposal, the network demonstrates a public benefit. It is community owned. It supports and delivers community services, and is scalable to serve more clients and residents. Prior to the 2003 FedNor grant Lac Seul residents had fewer communications options and had very little opportunity to access computing devices for personal and daily work needs. Now they have more options.

- *What are the strengths and weaknesses of this network/organization?*

Strengths of the network include its ability to handle high-capacity bandwidth applications, its scalability, its connection to K-Net (and the K-Net brand), and its potential value as an infrastructure and joint development project that unites the three communities of Lac Seul.

Weaknesses of the network include its inadequate human resource capacities, its ambiguous governance structure, its past (and potential) technical mismatch with Lac Seul's environment, and its dependence on nonbinding agreements with external service providers.

- *How could this network/organization be improved?*

Immediate improvements could be made in the direction of human resource development. Lac Seul has for various reasons trained and subsequently lost three network/computer technicians since 2004. With an adequate human resource system in place (i.e., focused on staff retention and career development), the Band could then concentrate on developing a business model to tap residential and business customers. To facilitate human resource and business model development, the Lac Seul Band administrators of each of the three communities may need to clarify their roles in network governance. An inter-community network workgroup, comprised of administrators and network clients from each community, might provide useful oversight and capacities for joint planning and governance. [Are there any best practices to be learned from other K-Net communities?]

There is potential for scaling the network. A number of community services continue to use dialup instead of the LS CWN. We do not currently know why. Moreover, high-capacity QoS applications could potentially be developed in conjunction with Lac Seul's Police Force (e.g., Telejustice), and various community/family services such as Nodin and Tikinagan.

At an administrative level it appears that the network could be leveraged further. More emphasis could be placed on the value of videoconferencing as a tool for inter-administrative coordination among the three Band offices of Lac Seul. Creative uses of the V/C units to bring community members together (e.g., such as inter-community virtual Bingo Nights, or Elders lunches) could be explored further. Capacity Building initiatives for teachers and teachers aids might be facilitated over v/c. Similar v/c based initiatives could be provided for nurses and community health workers out the Kejick Bay health clinic. Finally, the potential of VOIP over the network appears to not have been explored, and the Band continues to pay Bell for telephone services. A comparison of ILEC versus network services could be made to discover potential value savings from migrating more communication services to the network.

Appendix A: K-Net Services Request for Funds Template used in 2003 proposal to FedNor

February __, 2002

Carl Seibel, Telecommunications Officer
FedNor, Industry Canada
244 Lincoln Street
Thunder Bay, ON, P7B 5L2

Dear Carl:

RE: Connecting Lac Seul First Nation to Broadband Data Services

Lac Seul First Nation is proposing to work with FedNor and other partners to construct and operate a broadband data connection across our community. Our goal is to have a **high speed local wireless network (the local loop)** to complete the last mile to every home, organization and business in the community.

The work to complete this project will be done in two phases. The first phase will involve working with the Kuh-ke-nah Network (K-Net) to establish a local point-of-presence (POP) in Lac Seul and connecting all the service agencies to this POP. The second phase will involve contracting a cable company in partnership with K-Net staff to establish a two way cable system throughout Lac Seul First Nation.

The connection to the Kuh-ke-nah Network will be completed to ensure that the different organizations in Lac Seul will be able to connect to all the different service agencies already on this network and those who will be joining the network in the near future (including the other First Nations in the region, Zone Hospital, Zone Nursing Office, the different tribal council offices, Nishnawbe Aski Nation, Northern Nishnawbe Education Council, etc). We understand that each of these groups is getting connected to the K-Net service under separate FedNor projects. Our connectivity project will ensure that all the organizations in Lac Seul are connected to this new broadband telecom data service.

The local network will create a common high speed network interface between Lac Seul and each First Nation and distribute affordable access to advanced network services between all the local economic, cultural, health, education and political organizations and new initiatives occurring in each community.

The goal of this project is to provide a shared high quality connection to affordable bandwidth for all the Lac Seul First Nation organizations that are interested in being connected to broadband services. This goal is supported by two objectives. The first objective is to create a sustainable and scalable point of access to high speed services. A parallel and complementary objective is to use the local network to enable the development and delivery of a wide variety of e-services and applications (using IP video, data and voice services) being planned among First Nation service organizations in other centres with access to K-Net, such as Sioux Lookout, Thunder Bay and elsewhere. Many groups such as Health Canada, NAPS and Tikinagan will increase efficiency of client services through the anticipated expanded technology.

The initial phase of the project will be delivered over the next 14 months and proceed in two phases. The first phase (February to March 31) will include the ordering and delivery of the hardware requirements, interconnection with the hub in Lac Seul First Nation to K-Net and provisioning of high speed services to the local organizations. During the second phase (April 1 to March 31, 2003) the project will see all the local organizations connected, the development of a complete local loop development strategy that will include connectivity in the homes (for example using cable), the fundraising for the construction of the cable system (the business case), the assessment, development and support for local applications and organizations to utilize this service.

Lac Seul First Nation is requesting \$500,000 from FedNor to complete this initial phase of development for this \$507,181.00 project. Our contribution, along with our other partners will make up the difference of \$7,181 so that we can successfully complete this project.

Sincerely,

Chief David Gordon
Lac Seul First Nation

cc: Lac Seul Council and Organizations
Brian Beaton, K-Net Services Coordinator

Appendix B: FedNor Budget Notes from 2003 Computerization Package and Network Build

Activities

Computer equipment will be installed and linked in a local network within at least the following 17 sites on Lac Seul First Nation; three band offices, three nursing stations, (by June 30, 2003) Wahsa adult education centre, three recreation centres, two elementary schools and the Lac Seul police office by August 31, 2003.

the band offices, schools and nursing stations will be equipped for videoconferencing by August 31, 2003;

multimedia equipment including digital still and movie cameras and projectors will be provided to each of the band and to the school;

one local technician will be trained over a year in the installation and maintenance of the network;

a community web site will be created including pages for all significant band services and businesses by November 30, 2003;

public access to the Internet will be established in three sites by August 31, 2003;

training in the use of computer and Internet applications will be provided to staff. At least two of these training sessions will be provided to the general public.

Costs

Labour **\$40,000**

Wages and benefits for technician trainee

Equipment **\$374,000**

Special Equipment needed to create local computer networks in at least 17 public buildings at Lac Seul First Nation. This equipment will include:

- 15 Switches (Cisco 2950 series or better) re LAN connection
- 8 IP Video Conferencing Units complete with stands, monitors and accessories
- 80 Computers (with accessories) - some of which will function as servers in small buildings
- 6 laptop computers with docking station
- 6 Scanners
- 6 Digital Still Cameras

4 Digital Video Cameras
18 printers - inkjet plus 3 each laser and colour laser
miscellaneous cable, fittings, tools and network accessories
1 PC to Video converter
3 multimedia projectors
8 Servers, with tape backup and accessories
software including - MS Office, I Mail, AutoCad, ARCInfo, Windows 2000 server or equivalent
3 GPS units
Freight

Purchased Services **\$18,000**

Local Network design services and contracted installation of LANS in at least 17 sites

Installation and maintenance of videoconference and other ICT applications

Development of a web site for the First Nation and its services and businesses

Training of technician and key users in operation of LAN and videoconferencing

Training of staff in use of computer software

Workshops to introduce community members to Internet and other computer applications

Purchased services for work in excess of \$5,000 must be secured through a competitive process.
Travel of service providers is to be included within contract prices.

FedNor funds **\$432,000**

Appendix C: Genealogical description of Settlement patterns in Lac Seul (from lacseul.firstnation.ca)

(Note: Keesic Bay = Kejick Bay).

Land wise, Lac Seul (Obishikokaang) is one of the largest Indian Reserves in the Treaty #3 region in northwestern Ontario. The general membership consists of about 2,700 people, two thirds of which live off reserve.

In the 1930's, hydro development at Ear Falls resulted in massive flooding of the traditional territory of the people. This forced many families to relocate to higher ground. Families like the Ocheewasawan, Quedent, Keesic, Angeconeb, Southwind, Ashin and now their descendents continue to live in the surrounding area of Red Lake, Trout Lake and Ear Falls.

Historically it appears that the main community of the reserve was Keesic Bay. It was close to the Hudson's Bay post which was situated on the north shore of Lac Seul itself. Adjacent to the Hudson's Bay post were both the old Roman Catholic Mission and St. Mary's Anglican Church. This is in and around the current site of the Buchanan ferry landing.

There were many fishing camps and trap lines located throughout. For fishing camps were located from Bear Narrows to Root River on the northeast side of Lac Seul. As well, there were many fish camps and trap lines at the west end of lake including Manitoba Point all the way to Ear Falls.

The Keesic Bay island, which was once part of the main land, had smaller communities or family groupings that lived there. For example, right across the lake from the Hudson's Bay post, lived the Ross family. This point of land is now called Ross' Point. Just a few steps to the east of Ross' Point, is what is referred to as Treaty Point. On the opposite side of Ross' Point toward the northwest tip of Keesic Bay island, was the site of the old Nursing Station. Near the old nursing station, one would find the Bearman, Keesic, Quedent, Pemmican, and Wesley families.

Keesic Bay consisted of the Keesic, Ashin, Southwind, Littledeer, Lac Seul, Kenny, Cromarty, Thomas, families.

Just north of Keesic Bay, in the next bay, there is Ningewance Bay. This small community consisted mostly of the Ningewance and Angeconeb families. Across the little bay lived the Quoquat and Bull families. Later, in the 1960's and 1970's the Quezence, Kenny, Southwind and Brisket families lived in Ningewance Bay.

In the early 1970's, there was a movement to relocate families from the surrounding communities of Canoe River and Whitefish Bay to Keesic Bay. This was because a school was built in Keesic Bay. Meanwhile many students from Frenchman's Head continued to live at the Pelican Indian Residential School while attending public schools in Hudson and Sioux Lookout. In 1977/78, when a year round access road was constructed from Hudson to present day Frenchman's Head, the Pelican Indian Residential School was closed down for good.

Historically, the Chisel, Gray and Hill families lived on Pelican Lake, near and around the Indian Residential School site, a site which was not on the reserve.

Toward the south side of the reserve, there was the old original community of Frenchman's Head. The newer Frenchman's Head is now located directly across the lake from the hamlet of Hudson. The old Frenchman's Head community (around various locations) consisted of the Chisel, Hill, Ackewance, Binguis, Ignace, Morison, Copenace, Ogemah, Gray, Bunting, Lac Seul, Petawaway and Littledeer families. Today there are many family groupings that live in Frenchman's Head. They have come from the other communities including off reserve.

The relocation of families from Canoe River to Keesic Bay basically ended this community. Some families relocated to Hudson and the newer community of Frenchman's Head. Today only one family remains in Canoe River. Canoe River was once a thriving community with families on both sides of the river. These were the Trout, Carpenter, Bottle, Brisket, and Wesley families.

Closer to Keesic Bay is the present day community of Whitefish Bay nestled along both sides of a river's mouth - sakeeng. On the north village of Whitefish Bay, near the traditional ceremonial grounds live the Bull, Thomas, Capay, and Angecone families. On the south side of Whitefish Bay live mostly the Angecone families.