Key Issues:

2- Hydrological Regimes
8-Minority Groups
10-Landscape and Cultural Heritage

Climate Zone:

Semi Arid

Subjects:

- High water management
- Heritage site mitigation plan
- Adaptive fish management practices
- Consultation and Engagement of Community

Effects:

- Preservation of key heritage sites
- A healthy lake and fish population
- Unique and proactive agreement with Department of Fisheries and Oceans Canada

Project Name: Aishihik Hydro Generating Facility – Water License Renewal
Country: Canada

Implementing Party & Period

- Good Practice: Yukon Energy Corporation (YEC)
1991 -

Key Words:

Community Based Measures, Monitoring & Mitigation

Abstract:

Yukon Energy Corporation began the relicensing of their Aishihik Hydro Generation Facility in 1991. The scope of work undertaken to secure a new license has been comprehensive and is unprecedented in the Yukon Territory. Every effort was made to provide ample opportunity for the public, regulators and governments to comment on a wide range of issues that pertain to the water management regime at Aishihik Lake. This project demonstrates that a balance can be achieved with operating the facility and respecting the importance of the environment.

1. Outline of the Project

The relicensing of the Aishihik Hydro generating facility was necessary to secure the long-term supply of energy to Yukon electrical customers. The Northern Canada Power Commission (NCPC) completed the construction of the Aishihik hydro facility in 1975. In 1987, the Yukon Government purchased the assets

of NCPC, including the Aishihik facility. At the time, the supply of electricity to the Yukon became a territorial responsibility and Yukon Energy Corporation was formed to fulfill this responsibility. Yukon Energy inherited a legacy of unresolved environmental and compensation issues from NCPC.

As a renewable and low cost energy resource, and a key component of the Yukon's existing electrical supply system, Aishihik plays a central role in the provision of electricity to residents, business, and industry in the Yukon. On a long-term average, Aishihik generates approximately 105 GWh of electricity each year. The represents about 30% of the total hydro energy of the Whitehorse Aishihik Faro (WAF) system. A unique and valuable feature of Aishihik is that it is the only hydro facility on the WAF system with multi-year storage capability.

Water used to generate electricity at the Facility comes from the East Aishihik River watershed that contains Sekulman, Aishihik, and Canyon Lakes. Sekulman Lake, which drains into Aishihik Lake, provides natural storage, and Aishihik and Canyon Lakes provide regulated storage.

The Aishihik hydro system is composed of three separate facilities: the Aishihik Lake Control Structure at the south end of Aishihik Lake; the Otter Falls Control Structure at the south end of Canyon lake; and the Aishihik Generating Station 6 km south of the Otter Falls Control Structure. The generating station is an underground facility containing two turbines that are feed by a 5.6 km long power canal running from Canyon Lake and a power tunnel.

Overall Aishihik has a very low visual impact. Aishihik was the first underground hydroelectric facility north of 60th parallel in the western world.

Aishihik Control Structure – Aishihik, Yukon

Seasonal Capacity:	Summer: 30MW Winter: 30 MW
Turbine Sizes: (MW and year built)	#1: 15 (1975) #2 15(1975)
Head (m)	175
Control Structures:	Storage Control at Aishihik Lake Outlet Spill Control Dam at Canyon Lake Outlet
Reservoir Area:	3045 sq. km

The Facility has operated for the past 25 years under a water license issued by the Yukon Territorial Water Board (YTWB). The new water license reflects some compromise in order to preserve the health of the lake and the fish population.

When the corporation began the re-licensing project, nine volumes of information were compiled involving over ten years of study. These studies included an environmental impact assessment, legislative requirements, detailed studies on geomorphology, wildlife, aquatic, heritage and socioeconomics. Final reports were compiled in November of 1998, and the original application was made to the YTWB in October, 1999. The environmental assessment was conducted under the Canadian Environmental Assessment Act (CEAA). In 1993, Yukon Energy formed a Technical Advisory Group made up of key stakeholders and regulators as they moved forward with a proposed program of studies that was approved by the YTWB in August, 1992. This group had significant input into the design and review of the environmental impact studies.

There were 12 key features of the relicensing initiative:

- A license term to provide long-term security of energy supply
- A managed storage range on Aishihik Lake
- A third turbine of five to seven megawatt capacity installed inside the existing powerhouse at some future date
- Downstream flows in the upper E.Aishihik River that will continue to support year-round rainbow trout habitat
- Clearly stated environmental performance objectives in the license
- Operational constraints on the use of water to minimize the effects of high water
- Operational constraints on the use of water to avoid potential significant effects on the lake whitefish fishery as indicated by monitoring results
- Annual monitoring of the health of the fishery at Aishihik Lake
- Conditional measures to address the effects of the project on access to the lake and wildlife harvesting
- Shoreline erosion monitoring at sensitive sites
- Heritage sites monitoring and salvage of those that are at risk from erosion. Additional protective and interpretive measures at selected heritage sites.

The company received the new water license on November 29, 2002, at a cost of approximately $6M.

2. Features of the Project Area

The Aishihik Hydro Electric facility is located in the Southwest Yukon, approximately Northwest of Whitehorse. Aishihik Lake occupies a deep glacial valley, with a U-shaped typical of large montane lakes in the area. Aishihik Lake currently serves as the principal for the Hydro Electric Facility.

The project area is located in the Cordilleran climate region and is climatically classified semi-arid region. It is sub-arctic continental, characterized by large seasonal and daily in temperature, low to moderate atmospheric moisture content and low to moderate precipitation.

Mean annual precipitation, of which about two thirds is rainfall, is lower than the Yukon 256 mm. Winds are common and relatively strong; extreme winds tend to occur during months. Extreme temperature

variation has been recorded, both on an annual and Estimated 1 in 10 year temperature extremes are –53.3°C and 28.7°C, a range of 82 °C.

The EastAishihik basin covers an area of 4200 km2 . Its principal hydraulic feature consists of a series of elongated lakes named Sekulmun, Aishihik and Canyon which are connected by relatively short stream channels that drain in the Aishihik river. The Aishihik River is a 29 km long tributary of the Dezadeash River, which drains into the Alsek system, and finally empties into the Pacific Ocean at the Gulf of Alaska. Approximately 7% of the Aishihik Lake shoreline is comprised of friable, permafrost rich glaciolacustrine sediments that are susceptible to erosion.

The Aishihik Lake study area lies within the Kluane Plateau subdivision of the Yukon Plateau. The terrain consists of rolling to undulating hills, with highland areas around the lake reaching elevations of 1220 to 1525 m above seal level. Permafrost is an important factor influencing the landscape. The study area is located in the widespread discontinuous permafrost zone in which 30 to 70% of the ground is underlain by permafrost which varies between 1.5 m to as much as 40 m of ice rich permafrost at the north end of the lake.

The surficial geology of the study area is dominated by glacial deposits including moraine blankets and ridges, glaciofluvial and glaciolacutrine deposits. Recent alluvial deposits, and erosion and mass wasting features such as mudflows and slumping are also present.

Lake whitefish is the predominate species in Aishihik Lake. Lake trout, northern pick and round whitefish are also present. Small numbers of burgot, Arctic grayling , long-nose suckers, pygmy whitefish and slimy sculpin are also present. The occurrence of pygmy whitefish (discovered through the Company's studies) was the first report of this species in the Aishihik system.

The Aishihik Study area is an important traditional land use area of the Champagne Aishihik First Nations People. The richness of the region's pre-contact archaeological sites has been recognized since the 1940's and Aishihik sites have made important contributions to the understanding of the Yukon's

distant past. Stone tools and the by-products of stone tool manufacture and maintenance are found in addition to historic period campsites, cabins and First Nations gravesites.

In the past, the Aishihik people of populated the region using it on a seasonal basis. During the 20th century, a more permanent settlement at the north end Aishihik Lake was established. This village was reduced to seasonal and discontinuous use in the 1950's. Currently, some of the local First Nation population still practice traditional lifestyles based on harvesting, trapping, fishing and hunting.

Part of the old village and graveyard sits on sand dunes. Both the wind erosion and permafrost thaw induced ground subsidence affect this site. Present residences and the grave yard are located on the glaciolacustrine terraces above the new village. The village rests on approximately 12m of sand. There are eleven identified heritage sites around the old and the new villages.

There is a spring located south of Aishihik Village that provides drinking water for Village residents when lake levels are high. The source of the spring is located at the base of the glaciolacustrine cliff on a poorly drained alluvial landform at an elevation of about 915m.

3. Major Impacts

There are several impacts caused by the high water. Firstly, certain areas experience shoreline erosion in fine-grained, permafrost materials when water levels are at or close to the FSL (915.16 m) for several days, combined with severe windstorms.

Comparison of the lake shoreline from 1947 to 1992 air photos revealed that wave induced erosion is taking place along the same shoreline areas exposed to the high wind and wave action. Permafrost degradation known as retrogressive thaw slumps has also occurred along the northern shoreline. In 1993, the graveyard southwest of the Old Village experienced erosion and two graves were lost into the lake when the shoreline slumped.

It has also been identified that there are certain impacts caused by low water effects. Under medium load conditions, periodic occurrences of lake levels below 914 m during the open water season are anticipated. Should this occur, several adverse effects have been identified, including more difficult access to the lake, increased difficulty in harvesting fish, waterfowl and aquatic furbearers and increased difficulty in obtaining drinking water at the village.

Under high load, low water levels may persist, resulting in increase problems with lake access, in setting nets and poor fish harvests at traditional fishing sites. Those families that traditionally fish in shallower parts of the lake are most affected.

Another problem that was identified was the impact on the drinking water. Availability of domestic water supply at Aishihik Village is directly affected by operations at the low end of the range. Below a lake elevation of 914 m the village spring dries up. The effect is seasonal (May through October), but can persist for several years in a row. There is a 76% probability of water levels at or below 914 m in June-September for 2 or more months in any given year.

Finally, it was determined that low water levels were inhibiting Recreational Access to water. While the impact is small during the summer, lake levels below 913.5 m preclude the use of the boat access at the Mile 27 campground and at the north end launch sites. It is to be noted at this time, that this impact was greater prior to improvements that are ongoing. The operating regime somewhat limits the development of water-based recreation and tourism opportunities, due to increased difficulty in boat launching and reduced aesthetic values.

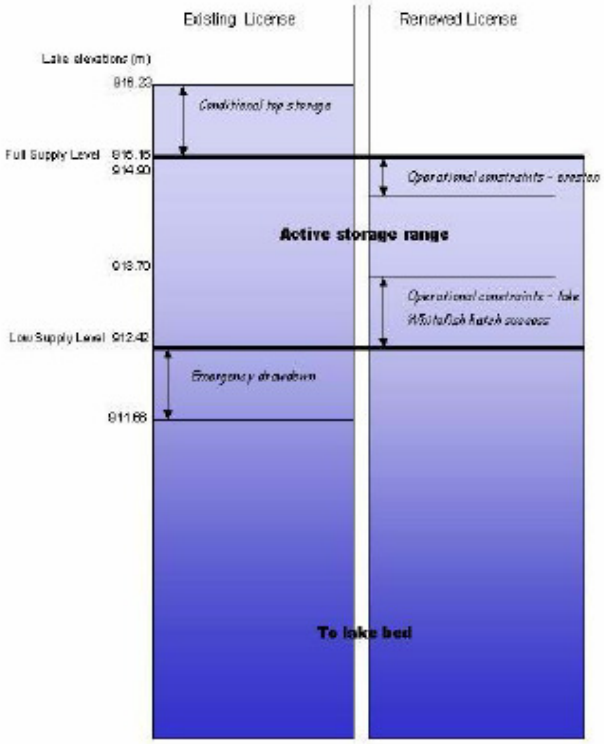
4. Mitigation Measures

In recognition of concerns raised by CAFN and other users of the lake, Yukon Energy initiated work in the early 1990s to address these concerns. An impact management plan was developed to avoid, reduce or mitigate the severity of significant and likely environmental impacts. In 1997, the Yukon Government also issued an order in council. This order effectively reduced the operating range from 2.7 m (9') to 2.1 m (7') by removing access to the bottom 0.6 m of the range. Yukon Energy also designed an Environmental Mitigation Plan that included a high water level management program with self imposed (additional) restrictions and a low water fish management plan, in recognition of the fact that both low and high lake levels need to be properly managed.

If the company does not need to fill up the lake due to significant load, they voluntarily keep the lake about 0.3 m below the high water limit. If the load justifies FSL storage, Yukon Energy would attempt to manage the storage such that FSL levels are achieved late in the open water season.

The primary objective of managing high water effects is to reduce the risk of significant shoreline erosion that can be caused by wave action. Yukon Energy has minimized the risk by limiting the amount of time lake levels are maintained at or near FSL, there by minimizing the risk of concurrent/wind/wave action during the open water season, and by constructing protective berms to stabilize and protect shoreline areas subject to erosion.

Yukon Energy has completed the construction of several erosion protection berms as part of the re-licensing initiative.



Key Features of a Renewed Water License

One of the most important aspects of the project was establishing priority areas in consultation with CAFN and the Government of the Yukon's Heritage Branch as part of a comprehensive heritage resource mitigation plan. Yukon Energy encountered significant challenges in the construction of the berms, including working during severe cold temperatures in the winter construction season, to ensure that the heavy operating equipment did not damage sensitive areas.

The first berm was built in 1992 to the north of Aishihik village. It protects an extensive glaciolacustrine cliff from further erosion damage and also prevents more silt from the cliffs entering the lake waters at that location.

The slope behind the old village gravesite that failed following the 1975 high-water event was covered by a protective blanket of gravelly material to prevent further erosion. As part of the conditions of the existing water license, Yukon Energy continually monitors all berm sites, including this specific one.

Yukon Energy is also assisting the CAFN in the redevelopment of their traditional home at Aishihik Village through the ongoing development of a drinking water well and a boat access, both of which will be designed to provide for the needs of the Aishihik people at all licensed operating levels. These projects are ongoing and include on site meetings with the local village land use committee. Yukon Energy expects to develop these important mitigation projects by summer 2004.

In addition, at the south end of the lake the existing public boat ramp is being extended to accommodate the range of lake levels during the open water season.

Community Water Well – In consultation with the Community, Yukon Energy will build a community water well, which will provide a higher quality of drinking water for the community. In 2002, Yukon Energy discovered extensive permafrost at the Village. A drilling program was conducted and a location free of permafrost was found that would be suitable for the well.

The company is also working with the CAFN with the development and operation of a cultural camp. To the greatest extent possible, Yukon Energy is using local contractors to construct the civil works and assist with the annual fish monitoring. In addition, there are additional local employment benefits, as the CAFN will take the lead for the subsistence harvest monitoring of the lake whitefish.

Yukon Energy came to a unique adaptive fish management plan, one of, if not the first in Canada. The agreement is a commitment to ensure the health of the fish population while maximizing the usefulness of the lake for power generation. The monitoring and adaptive fish management plan will detect changes in the lake whitefish population that could lead to unacceptable decline in the existing fishery. Yukon Energy's monitoring program includes collection of physical data (lake levels, ice thickness) and temperature) as well as population data (abundance, condition, age structure, abundance of the spawning population etc.) The adult lake whitefish population is being monitored using standard index gillnetting (sample size consistent with a 1991 initial monitoring event).

The corporation has agreed that if in fact the present operation is harming the fish population, the company will take additional steps to restrict the operation. Conversely, if the gill net testing in 2007 of the lake whitefish fishery indicates the fish population is healthy, then the company may apply to the

YTWB to remove or decrease the operational constraints.

After the results of the 2007 program have been complied, Yukon Energy and DFO (with participation from CAFN and YTG) will convene a workshop to consider what all of the data demonstrates regarding the potential effects of the hydro facility on fish and fish habitat. In addition, there will be an annual review of the monitoring program.

Yukon Energy contributed to the 1997 Aishihik Awareness Weekend by assisting with the re-opening f the road to the Village, by having its consultants available to answer questions and by attendance of senior officials. This provided an informal opportunity to discuss relicensing issues with CAFN and Aishihik people. Yukon Energy discussed ways that the knowledge gained through EIA studies could be used by CAFN. For example, planning tourism development, school curriculum, heritage protection, environmental monitoring, local works and regional planning. The results of the archaeology and heritage research were jointly conducted and shared with CAFN for their use, out of respect for the sharing of their cultural knowledge of the Aishihik area.

5. Results of the Mitigation Measures

The heritage mitigation plan has been successful in terms of minimizing the risk of damage to heritage resources and sites that may result from the operation of the facility. A component of the plan includes salvage of archaeological material at certain sites.

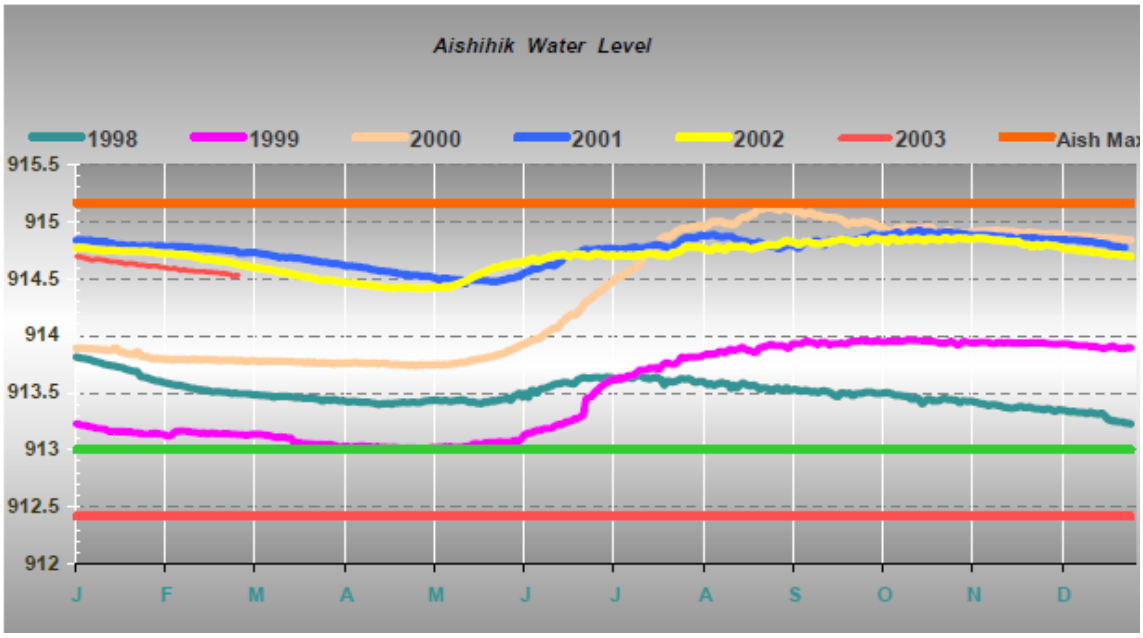
The Aishihik 2000 Site Tour (Jointly conducted by Yukon Energy and CAFN) was successful in that it served to familiarize staff of the CAFN with heritage sites in the north Aishihik area and heritage site management issues.

The construction of the erosion protection berms, in addition to protecting the sites, provided local employment opportunities as CAFN contractors were hired to construct the berms. The berms will improve the water quality as a result of the reduction of sediment loads entering the lake.

The Aishihik people will benefit from a new boat launch at the lake, thereby improving the accessibility to the lake and can contribute to increased recreational and tourism related activities.

As a result of the fish monitoring/measuring, a rare species of pygmy whitefish was discovered at Aishihik Lake, and protective measures are in place as a result of the adaptive fish-monitoring program. The impact on the lake whitefish has been minimized and controlled.

Aishihik Lake levels have been recorded since the early 1970's. The following illustrates the lake levels over time:



FSL: 915.16 m
High water management: 914.86 m
Low Water management 913.70 m
LSL 913.0 m

High water management is to be voluntarily enacted during periods to low power demand on the Whitehorse Aishihik Faro grid. Low water management is a license restriction to keep spring water levels above or equal to 913.7 for at least 3 years ever five years.

Yukon Energy has also benefited from the extensive studies conducted over the past years in terms of increased knowledge in many areas.

6. Reasons for Success

There are social, political and technical reasons for the success of the relicensing project.

The new license reflects a compromise from the existing license. ***The history of the Aishihik project is controversial. Yukon Energy came to a compensation arrangement with the users of the lake to account for the past negative environmental impacts on the area.***

The relicensing process has established the groundwork for the company to build a strong relationship with the Aishihik community.

This work demonstrates how the planning and consultation with affected First Nations Group, in advance of project construction can improve the knowledge of employees and ensure that the work is done in an environmentally friendly manner to effectively mitigate the effect of high water on key heritage sites in the Territory. Working together on the mitigation plan improved the familiarity with, and the

understanding of, the relative significance of the heritage sites considered to be at risk. This earning opportunity served to enhance heritage resource management capabilities for the future and also insured the design aspects of the berms met with CAFN and Heritage Branch approval.

In addition, the significant measures the company has taken with respect to voluntarily managing high water levels will certainly minimize the impacts on traditional ways-of-life at Aishihik.

Yukon Energy has a Fish Act Authorization from DFO, and a renewed water license that encourages adaptive management practices and allows the company to change targets in the best interests of the operation and the Aishihik people.

7. Outside Comments

The relicensing of the Aishihik Facility has been controversial from day one. Yukon Energy received letters of support for the relicensing initiative from the Yukon Chamber of Commerce, the Whitehorse Chamber of Commerce, the Chamber of Mines.

"We are also confident that Yukon Energy is sensitive to the environment as demonstrated by the extent of the environmental studies that have been conducted over the past ten years. Our review of the documents indicates that Yukon Energy does have an environmentally sound plan to relicense the facility. We also support the reduction of the burning of high cost diesel fuel in favor of renewable resources, such as hydro. This leads to long term energy value and rate stability".

The local MLA was originally very vocal against the relicensing application as submitted by Yukon Energy. At the end of the day, he commented that is was "a fair decision".

Initially, the CAFN wanted the lake to be regulated at natural lake levels and were very opposed to the relicensing of the facility. When the decision by the YTWB was rendered, the director of lands and resources for CAFN commented, "Now there is a management regime in place that will allow the lake to heal". "And 17 years down the road, I suspect we will have a fully functioning lake that is also being used as a reservoir, and that is the light at the end of the tunnel".

During the hearing, the former Chief of the CAFN at the time commented that he was pleased that the YTWB and Yukon Energy took the time to consult with the First Nations, as this did not happen when the facility was originally licensed.

At the conclusion of the agreement with the Department of Fisheries and Oceans, it was publicly stated by the department "there would likely be no significant adverse affects on the fish population".

8. Further Information

8.1 References

1) Archaeology and Heritage Study 1995 Permit Report – Sheila Greer, Edmonton, AB, May 1996
2) Aishihik Relicensing Project – 1995 Study Plan
3) Volume 1

4) Volume 2 – Aishihik Relicencing Project – Environmental Impact Assessment
Study Plans, Legislative Requirements, Technical Advisory Group Records,
Public Consultation Records, November, 1998
5) Volume 3 – Hydrology Studies – Acres International Ltd., Calgary, Alberta, November, 1998
6) Volume 4 – Geomorphology Studies – Mougeot Geoanalysis, Whitehorse, Yukon, November, 1998
7) Volume 5 – Wildlife Studies – Rkschmidt Environmental Consulting Services – Qualicum Beach, B.C. November, 1998
8) Volume 6 – Aquatic Studies – North/South Consultants Inc. Winnipeg, Manitoba, November, 1998
9) Volume 7 – Heritage Resource Studies – Sheila Greer, Edmonton, Alberta, November, 1998
10) Volume 8 – Socio Economic Study – Larry Duguay and Associates, Whitehorse, Yukon, November, 1998
11) Volume 9 – Impact Assessment Supporting Material – Yukon Energy Aishihik Relicensing Study Team, November, 1998
12) Aishihik Environmental Impact Assessment – Technical Summary, January 1999
13) Yukon Energy Corporation, Aishihik License Appliation, October 29, 1999
14) Aishihik Site Tour 2000, Shiela Greer, Consulting Anthropology, Archaeology, Edmonton, Alberta, January 2003

8.2 Inquiries

Mr. Hector Campbell, Director Business Development
Yukon Energy Corporation
P.O. Box 5920
Whitehorse, Yukon
Y1A 6S7
Telephone: (867) 393-5331
Tel : +81-3-5275-9824