

**EASTMAIN-1
HYDROELECTRIC
DEVELOPMENT**

**Environmental Activities,
2002–2013 – Highlights**

October 2014



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Cover photo: Dam and spillway

Photo inset: Lake sturgeon released into the Rivière Eastmain

FOREWORD

This report presents the highlights of the environmental activities carried out from 2002 to 2013 as part of the Eastmain-1 hydroelectric development, with a view to describing the environmental component of the project in general terms. The document is not intended to be exhaustive or to describe all of the measures Hydro-Québec has implemented to protect the natural and social environments but rather, provides an overview of the main actions taken in this regard.

Further information can be obtained by consulting the Eastmain-1 project's environmental reports from the 2009–2011 period, summaries of which are available on the Québec Hydropower: Energy for the Future page of the Hydro for the Future Web site (hydroforthefuture.com/home). For subsequent years, please refer to the reports from the Eastmain-1-A/Sarcelle/Rupert project on the same site. Since the two projects overlapped, their environmental follow-up programs were combined and have been included in a single annual summary report since 2012.

It is important to note that the Eastmain-1 project was carried out in a spirit of cooperation between Hydro-Québec, Société d'énergie de la Baie James (SEBJ) and the Cree communities. In fact, the project's social acceptability was significantly strengthened through a number of collaborative measures, including individual, group and working committee meetings, frequent communication and Cree participation in the studies and project work.



Eastmain-1 powerhouse

THE EASTMAIN-1 DEVELOPMENT AT A GLANCE

The Eastmain-1 hydroelectric development was constructed on the Rivière Eastmain upstream of Opinaca reservoir, in the Baie-James region.

PRINCIPAL CONTRACTOR: SEBJ

OPERATOR: Hydro-Québec Production

DURATION OF WORK: 2002–2006

MAIN COMPONENTS:

- › A 480-MW generating station (three 160-MW generating units)
- › A dam
- › 33 dikes
- › A 603-km² reservoir
- › A spillway
- › A 315-kV transmission line running between the generating substation and Nemiscau substation
- › A 78-km road linking the development to the Route du Nord

Hydro-Québec and SEBJ developed and implemented an extensive, 12-year environmental follow-up program with the following objectives:

- › To compare the project's actual effects on the environment with those forecast in the Environmental Impact Assessment (EIS)
- › To evaluate the effectiveness of the mitigation measures implemented

Eastmain-1 powerhouse intake





Project location

Generating station

Spillway, looking downstream



CONSULTATION WITH THE CREES

The Eastmain-1 project stands out because of the remarkable commitment on the part of the Cree communities throughout its construction. The Crees participated in all aspects of the project, from developing and implementing the mitigation measures to building the structures and conducting the environmental follow-up studies.

Cree businesses obtained contracts worth \$430 million to conduct these activities. In addition, by sharing and putting their traditional knowledge to use, the Cree communities and the tallymen of the traplines affected by the project played an active role in carrying out the environmental studies and work. Contracts were awarded directly to the tallymen for different types of work, including land clearing and removal of wood debris. This was a first for both SEBJ and the Crees.



Crees working at the lake sturgeon production lab



Cree participant fishing for lake sturgeon in the Eastmain



Crees helping to plan the wood debris inventories in Eastmain 1 reservoir

COMMITMENTS AND AGREEMENTS



Signing of the Paix des Braves (2002)

The *Agreement Concerning a New Relationship between the Gouvernement du Québec and the Crees of Québec* (also known as the Paix des Braves) was signed on February 2, 2002. That same day, Hydro-Québec, SEBJ and the Crees of Québec signed nine agreements—one of which was the *Nadoshtin Agreement*—concerning the use of hydraulic resources in the Baie James region.

The *Nadoshtin Agreement* made it possible for Hydro-Québec to go ahead with the Eastmain-1 project. In exchange, the company has made a number of commitments with a view to meeting the following objectives:

- › To reduce the project's impacts on the environment
- › To protect the Cree way of life and encourage cooperation with the Cree communities
- › To promote the awarding of contracts to Cree businesses
- › To promote the training and hiring of Cree workers

The program implemented to carry out mitigation measures and conduct environmental follow-up studies for the Eastmain-1 development stems from the above-mentioned commitments. Developed in cooperation with the Crees, the program reflects their concerns, as well as the experience acquired during the building of the La Grande complex.

ENVIRONMENTAL ISSUES

The impoundment of Eastmain 1 reservoir involved flooding 603 km² of the territory. To preserve their way of life, the Crees had to adapt to the new conditions by changing the way they traveled in the territory and seeking out new hunting grounds, among other things.

Furthermore, the creation of the reservoir led to significant changes in the hydrological regime in the stretch of the Eastmain between Eastmain-1 dam and Opinaca reservoir. This section of the river is frequented by lake sturgeon, a species highly valued by the Crees.

Major environmental work was carried out to minimize the impacts arising from these changes. Downstream of the dam, the objective was to protect the aquatic environment and ensure the continued survival of lake sturgeon. In the reservoir, measures were taken to facilitate use of the area by the Crees and reduce the effect of impoundment on land animals and some species of fish. In jobsite areas, work was done to accelerate plant growth and prevent soil erosion.

Cree camp



Rivière Eastmain (KP 203)



A Cree participant releases a sturgeon back into the water



MITIGATION MEASURES AND FOLLOW-UP

RIVIÈRE EASTMAIN DOWNSTREAM OF THE DAM – BIOPHYSICAL ENVIRONMENT

The stretch of the Eastmain between KP 217 and KP 200 provides quality habitat for lake sturgeon and many other fish species. It is also one of the traditional navigation routes used by the Crees for subsistence hunting and fishing and to access areas farther east via the Rivière à l'Eau Claire.

Evidence of erosion was already visible in a number of places along this stretch under natural conditions. The change in water level meant that erosion would likely increase and water quality could be affected.

The flows released through the Eastmain-1 structures make it possible to maintain an instream flow of 140 m³/s at Eastmain-1 powerhouse.



Banks protected with stone riprap downstream of KP 207

Vegetated drainage ditch at KP 214.5 of the Eastmain



Objectives

- › To stabilize the riverbanks and thereby preserve water quality
- › To protect riparian habitat areas
- › To preserve favorable habitat areas for fish populations and, in particular, for sturgeon spawning

Actions and follow-up

Bank protection structures

Upstream of KP 207, stone riprap was laid on the left bank to stabilize the 12-m clay slopes at KP 214.5. The slope was made less steep, then covered with anti-erosion matting and seeded. Length of shoreline protected: 400 m.

Downstream of KP 207, stone riprap and natural gravel pavements were laid at five sensitive sites. Length of shoreline protected: 1,468 m.

Weir

A weir was built at KP 207 to keep the water level at 219 m up to KP 215, with a view to preventing bank erosion and maintaining favorable water quality for sturgeon.

Four years of follow-up studies showed that these actions had produced the desired results, once a few remedial measures were carried out. The banks in the section upstream of KP 207 and as far as KP 215 are now permanently under water and are thus protected from erosion due to runoff and wave action. The riparian habitat areas are also protected, since the water level never rises higher than the surface of the marsh or the foot of the slope. The same positive results have been observed downstream of KP 207.

At the end of the follow-up period in 2009, the physical integrity and effectiveness of the weir and bank protection structures were confirmed. The target areas are now stable and are little affected by erosion.



Slope protected with stone riprap at KP 214.5 of the Eastmain

Monitored section of banks at KP 203 of the Eastmain



LAKE STURGEON

Lake sturgeon is an exceptionally long-lived, late-maturing species. Males reproduce every two to four years and females, every four to six years.

The creation of Opinaca reservoir in 1980 enabled lake sturgeon to access the Rivière Eastmain.

Prior to the development project, the lake sturgeon population in the Eastmain (approximately 800 adults) was considered to be at risk. At that time, the species normally spawned at KP 215 and occasionally in the Rivière à l'Eau Claire. In winter, lake sturgeon would concentrate in pools free of frazil ice in the Eastmain.

The modification of the hydrological regime between the dam and powerhouse led to the loss of the lake sturgeon spawning ground at KP 215. Lake sturgeon is a species highly valued by the Crees and is registered on the *Liste des espèces de la faune vertébrée susceptibles d'être désignées menacées ou vulnérables* (list of vertebrate species likely to be designated threatened or vulnerable).

Objectives

- › To protect the lake sturgeon population downstream of the dam
- › To enhance the reservoir's use and potential by establishing a self-sustaining lake sturgeon population there
- › To compensate for the loss of the spawning ground at KP 215
- › To create favorable conditions for lake sturgeon spawning and migration between KP 203 and KP 215

Actions and follow-up

Lake sturgeon production and stocking

From 2004 to 2008, SEBJ implemented a pilot program to farm lake sturgeon in a hatchery. The program comprised the following main components:

- › Spawners were caught in the Eastmain and Opinaca rivers.
- › Eggs were artificially fertilized.
- › The eggs were incubated until they reached the larval stage and the young were reared.
- › The farmed sturgeon were then stocked in the river, downstream of Eastmain-1 dam.

During the last three years of the program, most of the sturgeon stocked were young-of-the-year (6 to 10 cm long), as they were hardier and less vulnerable to predation than larvae.

Rearing lake sturgeon in a laboratory set up at Eastmain workcamp proved to be an innovative and effective solution.



Incubating lake sturgeon eggs

Lake sturgeon production lab

STOCKING OF LAKE STURGEON IN THE EASTMAIN – 2004–2008							
Stage of development	Annual objective	Number of sturgeon stocked					
		2004	2005	2006	2007	2008	Total
Larvae (2 cm)	15,000	71,000	–	18,000	–	–	89,000
Larvae (3 to 4 cm)	10,000	–	10,000	14,747	–	9,169	33,916
Young-of-the-year (6 to 10 cm)	5,000	71	19	7,998	13,832	8,095	30,015

Stocking lake sturgeon in the reservoir

This eight-year program (2005–2012) was carried out at the request of Cree trappers. The program was developed in cooperation with the trappers and the Niskamoon Corporation, which took over its operation in 2009. Two techniques were used:

Transfer: Every year, some 30 lake sturgeon (15 juveniles and 15 adults) were caught in the Opinaca and released into the Bauerman, which flows into Eastmain 1 reservoir at KP 326. Several of the fish were tagged with transmitters.

Stocking: Every year, thousands of larvae and young-of-the-year from the hatchery were released into the Bauerman, for a total of over 100,000 individuals. As of 2009, only young-of-the-year were released (an average of 5,000 fish per year).

The follow-up study showed that lake sturgeon had been successfully stocked in Eastmain 1 reservoir and were using the spawning ground developed at KP 6.2 of the Bauerman. The presence of this important species for the Cree will greatly enhance the value of the reservoir

Developed spawning grounds

Three spawning grounds were developed downstream of Eastmain-1 dam.

- › The first (3,000 m²) was created at KP 203 of the Eastmain in winter 2004.
- › The second (200 m²) was developed at the mouth of the Rivière à l'Eau Claire near a natural spawning ground in winter 2006.
- › The third (2,600 m²) was created at the foot of the weir at KP 207 in winter 2007.

Lake sturgeon began to frequent the KP 207 spawning ground in spring 2007. The follow-up studies done in 2008, 2009, 2012 and 2013 confirmed that the spawning ground was still being used.

By 2013, lake sturgeon were not using the spawning grounds developed for them in the Rivière à l'Eau Claire and at KP 203 of the Eastmain. However, the KP 203 spawning ground was highly frequented by some species, including suckers, northern pike and walleye.

Release of a lake sturgeon into Eastmain 1 reservoir



Stocking of young-of-the-year sturgeon (8 cm) in Eastmain 1 reservoir



Spawning ground developed at KP 207 of the Eastmain



*Construction of a weir and fish pass
at KP 207 of the Eastmain*

In 2005–2006, a 174-m weir was built at KP 207 to prevent the water level from dropping beneath the lower limit of the riparian herbaceous vegetation in the stretch up to KP 215. The objective of maintaining a minimum level of 219 m was to prevent erosion and ensure favorable water quality for lake sturgeon.

The weir at KP 207 was equipped with a fish pass 150 m long and 15 m wide to allow lake sturgeon and other fish to migrate upstream through a series of pools.

In 2007, a follow-up study of fish using the pass revealed that flow there was too fast (about 2 m/s) to allow for upstream migration. The remedial work carried out in 2008 resulted in more suitable flow velocities (between 1 and 1.4 m/s).

Between 2008 and 2010, over 400 of the 1,624 fish tagged with transmitters swam through the fish pass. Most of them were longnose suckers, white suckers, walleye and northern pike. However, only seven sturgeon swam through the pass between 2008 and 2012.

The turning point came in 2013, when 90 tagged individuals were detected in the fish pass and 15 crossed through it.

Bringing up egg traps at KP 207 of the Eastmain



Juvenile sturgeon



Fish pass built at KP 207
of the Eastmain (looking downstream)

Lake sturgeon spawning



EASTMAIN 1 RESERVOIR – AQUATIC ENVIRONMENT

The creation of a 603-km² reservoir involved flooding 125 km² of aquatic habitat. Since certain fish species are sensitive to fluctuations in water level, there was a risk that they would be affected by the reservoir's drawdown zone.

Objective

To encourage sustainability of fish species sensitive to fluctuations in water level.

Actions and follow-up

Two types of development work were carried out:

- › Spawning grounds were developed at the new mouths of the reservoir's main tributaries
- › Dikes were built to close off bays

Spawning grounds

In 2005 and 2006, spawning grounds were developed for brook trout, walleye and lake whitefish in five of the reservoir's tributaries. The new spawning grounds covered a total area of 574 m².

As of fall 2005, two of the four brook trout spawning grounds were being used.

In 2007, walleye and lake whitefish were using several of the spawning grounds developed for them, but brook trout only spawned at one.

The last follow-up study in 2009 confirmed that walleye and lake whitefish were spawning at several of the developed sites.

Overall, the follow-up study confirmed the physical integrity of the spawning grounds developed in the reservoir's tributaries and their use by target species.

Diked bays

In 2004 and 2005, two bays located on the perimeter of the reservoir were diked. The objective was to establish a hydrological regime similar to that of a lake to increase potential use of these areas by wildlife, particularly waterfowl.

A fish pass was also built in each of the bays to allow fish to move about freely between the new areas and the reservoir. A spawning ground was also developed downstream of each fish pass. The follow-up studies carried out in 2007 and 2008 revealed that the fish passes were being used very little.

However, the developed spawning grounds were being used by walleye and lake whitefish.

Studies—particularly those carried out in the La Grande complex—have shown that the fish biomass of a hydroelectric reservoir is higher than that of the best lakes in the same region. Therefore, bays do not have to be diked to sustain the fish populations in a reservoir.

Dike and entrance to the fish pass in bay BE-07



Brook trout spawning ground developed in a tributary of Eastmain 1 reservoir



EASTMAIN 1 RESERVOIR – LAND AND SEMI-AQUATIC ENVIRONMENTS

The creation of the reservoir involved flooding 478 km² of land and semi-aquatic habitat.

Objectives

- › To increase productivity in land and semi-aquatic wildlife habitat areas around the perimeter of the reservoir
- › To compensate for the loss of hunting and trapping grounds

Actions and follow-up

Development of borrow pits for waterfowl

To improve wildlife potential around the reservoir, the tallymen favored the development of waterfowl hunting areas. Following a field study, it was decided that favorable waterfowl habitat areas would be created in several borrow pits (quarries used during the project's construction phase).

This measure was made up of three components:

- › Remodeling of the terrain
- › Creation of shallow ponds
- › Seeding with herbaceous plants that attract waterfowl

According to the tallymen concerned, the areas developed for waterfowl are highly frequented, particularly by Canada geese.

Osprey nesting platforms

The Environmental Impact Assessment (EIS) carried out for the project had established that impoundment of the reservoir would cause the loss of five or six osprey nests. To protect the species in this sector, 11 nesting platforms were erected around the reservoir in 2004 and 2005, in cooperation with the tallymen concerned.

The 2006, 2007 and 2009 follow-up studies showed that occupation of the osprey nesting platforms had increased. In 2009, the presence of seven osprey chicks on three of the platforms confirmed that the measure had been successful.

Osprey on a nesting platform



Waterfowl pond developed in a borrow pit



Aerial view of a waterfowl pond developed in a borrow pit



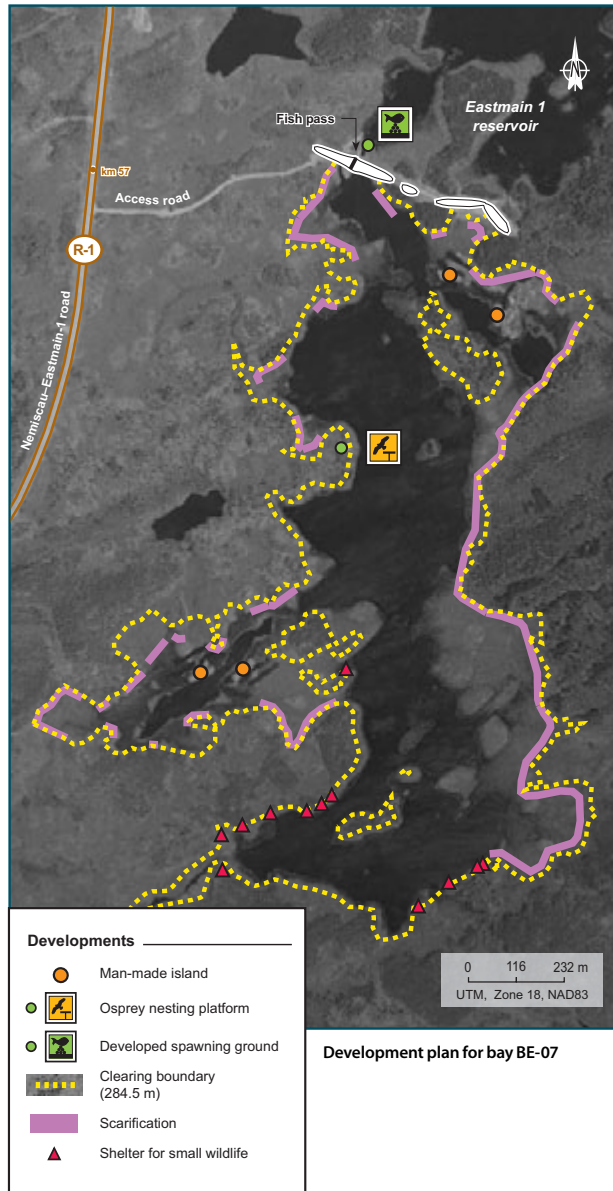
Development of diked bays

Hydro-Québec diked two bays in Eastmain 1 reservoir to protect them from the effects of the drawdown zone. The bays are located on traplines that were 20% to 25% flooded. This had a significant impact on land users. In compensation, a number of measures were put in place in the diked bays, mainly to benefit waterfowl.

In 2010, a follow-up study on the riparian habitat and wetlands in the diked bays showed that the scarification and seeding of the banks had not produced the anticipated results. This was likely because of the soil composition and browsing pressure by Canada geese.

However, indigenous seedlings and plants generally grew well on the small islands and along the shores of bay BE-07. Thus, the moss layer cover (made up of lichens and moss) increased from 5%–25% in 2007 to over 75% in 2010. In addition, there was evidence of increased use of the small islands by waterfowl.

Three years of monitoring have shown that migrating waterfowl seem to prefer ice-free, undiked bays, whereas nesting pairs and broods are more often attracted to diked bays.



Development plan for bay BE-07

Nest box for tree-nesting ducks in bay BE-05



Small island developed for waterfowl in a diked bay



BAYS BE-05 AND BE-07		
	Bay BE-05	Bay BE-07
Development	2005–2006	2004–2005
Aquatic area	106.1 ha	108.7 ha
Dikes	93.2-m main dike with weir and fish pass 116.5-m retaining dike 47.5-m freeboard dike	220-m main dike with weir and fish pass Two retaining dikes, 50 m and 215 m, respectively
Cleared bank area	48 ha	30 ha
Creation of small islands	Four small islands made up of two 8-m by 40-m modules	Four small islands, 10 m by 50 m
Seeding of small islands	3.2 ha of herbaceous plants	3 ha of herbaceous plants
Scarified bank area	12 ha	12 ha
Shelters for small animals	–	20 shelters
Nest boxes	Four for goldeneyes and four for mergansers	–

Eight nest boxes were built for tree-nesting ducks (goldeneyes and mergansers) in bay BE-05. In 2009, the last year of the follow-up study, two nest boxes were used by common mergansers and at least ten ducklings appear to have hatched, according to the number of egg membranes recovered.

There was little evidence that any of the shelters built for small animals had been used.

Overall, the development of bays BE-05 and BE-07 produced modest, relatively limited results, despite the scope of the work carried out. However, this measure was put in place as part of a series of measures designed to improve wildlife potential on traplines specifically affected by the reservoir, with a view to encouraging the Crees to use the area.

Less than a year after bay BE-07 was developed, the tallyman concerned felt that the area offered such promising wildlife potential that he asked that no helicopters fly over the area during the spring goose hunt.

Canada geese in a seeded area of bay BE-07



Beaver relocation and trapping

An inventory conducted in 2002 revealed that there were 122 beaver colonies spread over five traplines around the perimeter of Eastmain 1 reservoir.

As part of a pilot project carried out at the request of two tallymen, around 30 beavers were captured and relocated during the summer of 2003. Nineteen of the animals were tagged with transmitters. In the fall, seven of the ten beavers whose transmitters were still working were using a lodge or showed signs of activity in their new environment. On average, the beavers had traveled 13 km from the spot where they had been released.

Beaver captured as part of a pilot project



The pilot project showed that, although technically possible, beaver relocation was very costly in terms of personnel, equipment and helicopter transport. Therefore, it was decided that the beavers would be trapped out before the reservoir was impounded. By fall 2005, the tallymen had trapped out 71 beaver colonies.

Radio transmitter attached to a beaver's tail



Beaver released outside the flood zone



CLEARING AND CLEAN-UP OF EASTMAIN 1 RESERVOIR

Selective land clearing was carried out in a number of sectors of the reservoir, over a total area of 50 km².

In addition, a follow-up program was implemented to clean up wood debris from flooded forest vegetation.

Objectives

To reduce the impact of residual forest vegetation on Cree use of the reservoir and on landscape quality. Target areas:

- › Boat ramps
- › Landing areas
- › Navigation corridors
- › Net-fishing sites
- › Multipurpose areas near the main structures and permanent road

To encourage biological productivity. Target areas:

- › Tributary mouths
- › Riparian habitat areas

Actions and follow-up

Land clearing

Nine land-clearing contracts were awarded to tallymen with traplines directly affected by the reservoir, five more were negotiated directly with Cree businesses and one was awarded through a call for tenders.

The awarding of land-clearing contracts to the tallymen was a first for SEBJ. Almost all of the work involved was done manually, which favored the hiring of Cree workers.

Deforestation in the reservoir by ice



Accumulation of wood debris in the reservoir



Follow-up of natural deforestation

Under the terms of the *Nadoshtin Agreement*, Hydro-Québec undertook to encourage natural deforestation of the reservoir by ice as soon as possible after impoundment, over the course of two winters. Ice proves to be a particularly effective natural deforestation agent in reservoirs. The ice becomes attached to the trunks of emergent trees and, as the water level drops, the trunks break under its weight. To maximize this effect, Hydro-Québec operated the generating station in such a way as to keep the reservoir level high during freeze-up and then lower it quickly as of late January.

A follow-up study was done on natural deforestation of the reservoir by ice, wind and drawdown. The study results were used to plan the removal of wood debris and produce a navigation chart.

Two years after impoundment, natural deforestation agents had eliminated 72% of the emergent forest cover in the reservoir.

Removal of wood debris

In 2008, four contracts to remove wood debris were awarded to tallymen with traplines affected by the reservoir. By the end of the follow-up study in 2011, the trappers had removed over 40 ha of wood debris.

Removing wood debris in some sectors of the reservoir helped improve conditions for use of the area by the Crees.

Removal of wood debris



Wood debris at the Eastmain-1 powerhouse intake



Floating peatlands

Some of the peatlands flooded during impoundment had floated up to the surface. Since these floating peatlands can hinder the operation of hydroelectric structures, their movement was monitored in critical areas of the reservoir, such as near the spillway and powerhouses.

During the year following impoundment, 72 floating peatlands with an average area of 650 m² were found (total area: 21.7 ha).

In June 2011, floating peatland debris and deadwood had drifted up against the grate of the Eastmain-1 powerhouse intake. Since an obstructed grate can affect the performance of the generating units, the debris was removed using lifting equipment.

Hydro-Québec needs to monitor floating peatlands in critical areas of the reservoir to ensure that they do not hinder operation of the facilities.

Floating peatland in the reservoir



CREE LAND USE

Many generations of Crees have used the territory affected by the Eastmain-1 development.

The creation of the reservoir involved partially flooding several traplines belonging to the Cree communities, which resulted in the loss of 6% to 36% of their surface areas. The main impacts are as follows:

- › Loss of hunting, fishing and trapping grounds
- › Disappearance of some traditional travel routes
- › Loss of campsites
- › Flooding of burial sites

The reduction in flow downstream of the dam also had an impact on fishing sites and traditional travel routes.

Objectives

- › To facilitate use of the territory by the Crees
- › To compensate for the loss of camps and facilities
- › To improve wildlife potential around the perimeter of the reservoir

Actions

Improved access to the territory:

- › Clearing of snowmobile trails
- › Construction of roads to new camps or facilities
- › Replacement of flooded permanent camps
- › Construction of parking areas

Improved navigation:

- › Installation of eight boat ramps, six of which required road access and a parking area
- › Creation of two landing areas
- › Construction of a towing ramp

Land-clearing work was also carried out to facilitate navigation and boat landing.

Seven permanent camps within the reservoir's perimeter were dismantled prior to impoundment. The tallymen were awarded contracts to clear the land and set up new campsites elsewhere on their traplines.

Waterfowl-friendly habitat areas were created in three borrow pits and on a small, wooded island.

Camp under construction on Lac Mitsumis



Boat ramp



Follow-up

Based on the interviews held with the tallymen of the six traplines affected by the project, land users made very few changes to their hunting, fishing and trapping activities during the first two years of construction on the Eastmain-1 project (2002–2004). The only significant changes were the way they accessed their traplines and their participation in the environmental component of the project.

From 2004 to 2006, the tallymen were highly involved in the project's environmental program. However, they continued to pursue their harvesting activities, particularly in the areas to be flooded.

After impoundment, the tallymen and trapline users continued to divide their time between the ongoing environmental work and studies and their hunting, fishing and trapping activities.

The tallymen have gradually adapted to the transformation of a portion of their territory. In general, they are satisfied with the mitigation measures carried out on their traplines, particularly the habitat areas developed for waterfowl. They are also pleased with the success of the lake sturgeon spawning ground developed at KP 207 of the Eastmain.

Drying beaver skins



Navigation on Eastmain 1 reservoir



JOBSITE REHABILITATION AND ENHANCEMENT

The jobsite areas (storage and disposal sites, sandpits, gravel pits and quarries) were restored to their original condition as soon as they were decommissioned. In total, 700 ha (7 km²) of jobsite areas were rehabilitated.

Various tourist facilities were also erected.

Seedling production and reforestation

To accelerate plant growth and minimize soil erosion in the jobsite areas, millions of seedlings were grown and an area of 489 ha was reforested.

REFORESTATION OF EASTMAIN-1 JOBSITE AREAS			
Year	Number of seedlings		Area reforested (ha)
	Green alder	Jack pine	
2004	138,351	210,132	79
2005	741,281	271,354	181
2006	840,533	0	190
2007	44,945	141,625	39
Total	1,765,110	623,111	489

Hydro- and manual seeding were also carried out in various sectors, over a total area of 217 ha.

The areas targeted were road corridors, borrow pits, diked bays and wetlands.

The follow-up studies showed that the green alder and jack pine that had been planted were doing well. The same observation applied to the seeded areas.

Enhancement of structures and environment

Three scenic lookouts were created to provide a view of the intake, powerhouse and dam. Interpretation panels describing the nature of the structures and the history of the project were also erected.

The workcamps were treated against biting insects throughout the project. The spreading of larvicide reduced the problem by at least 90%. According to a survey conducted in August 2006, 92% of the personnel at Eastmain workcamp were satisfied with this measure.

Hydroseeding along roads



Lookout with a view of the reservoir



SPORT HUNTING AND FISHING DURING CONSTRUCTION

Sport hunting and fishing activities were monitored throughout the construction phase.

Objectives

- › To assess the impact of sport hunting and fishing
- › To promote the conservation of wildlife and ecosystems
- › To manage the harvesting of wildlife resources

Methods implemented

- › A special hunting and fishing zone was created. The zone covered an area of 8,900 km² and was made up of two sectors subject to specific regulations (including the prohibition of recreational moose hunting in the Eastmain Sector).
- › The Weh-Sees Indohoun Corporation was established to manage and monitor sport hunting and fishing in the special zone.

In cooperation with the Ministère des Ressources naturelles et de la Faune (Québec department of natural resources and wildlife), the Weh-Sees Indohoun Corporation established fishing quotas and a system for issuing day fishing passes and registering catches.

Follow-up

On average, 19% of the workers at the Eastmain-1 jobsite went fishing in their free time. Very few of them hunted. During the construction phase (2002–2006), about 700 anglers a year fished in the special zone and 80% of them worked at the jobsite.

In total, over 6,700 day fishing passes were issued during the construction phase.

Some 400 water bodies were open to sport fishing in the special zone. Those most often fished (fewer than 50, on average) were located near the workcamps and along roads.

The catch registry enabled the Weh-Sees Indohoun Corporation to prevent overfishing of these water bodies.

Between 2003 and 2006, 22 moose were killed by sport hunters. Workers living at the Eastmain camp killed three to five moose a year.

Thanks to the Weh-Sees Indohoun management plan, fishing and hunting pressure by jobsite workers did not have the negative effects anticipated in the EIS and the Nadoshtin Agreement.

Angler with an employee of the Weh-Sees Indohoun Corporation



Measuring fish (walleye)



WILDLIFE MONITORING DURING RESERVOIR IMPOUNDMENT

The impoundment of Eastmain 1 reservoir led to the loss of 478 km² of land habitat.

Objectives

- › During impoundment, to assess at-risk situations and harvest threatened wildlife resources, as needed
- › During impoundment and throughout the following year, to monitor wildlife movement and behavior
- › During impoundment and throughout the following year, to study the behavior of migrating caribou

Follow-up

Generally speaking, land animals were able to leave the reservoir during impoundment. There was no evidence of animals in distress. As a preventive measure, one black bear and one moose were killed at the request of the tallymen.

The follow-up study revealed that the reservoir did not hinder the movement of animals. The reservoir is frequented by about a dozen species, including caribou and moose. In addition, the islands created by the reservoir served as a refuge during impoundment and then became permanent habitat areas for several species.

Caribou on the reservoir



Black bear



Moose cow with her calf

ARCHAEOLOGICAL RESEARCH

Hydro-Québec, SEBJ and the Crees jointly developed two programs to conduct archaeological research in the territory affected by the Eastmain-1 project. One of the programs was carried out as part of the environmental work and studies done by SEBJ and the other stemmed from the Archaeology and Cultural Heritage Fund set up under the terms of the *Nadoshtin Agreement*.

Objectives

- › To mitigate the project's impacts on the region's archaeological heritage
- › To provide a more detailed picture of the region's history and the way of life of the people of Eeyou Istchee ("Land of the Crees") through the incorporation of traditional knowledge shared by the elders
- › To encourage Cree participation in the acquisition of knowledge about occupation of the territory

Results

Between 2002 and 2006, over 400 zones with archaeological potential were inventoried and remains were discovered at some 140 sites. Carbon dating of the wood found in hearths along the Eastmain revealed that Aboriginal people have occupied the Baie-James region for about 5,000 years, as opposed to 3,500 years, as was previously believed.

Digs were also carried out at sites dating back to the 1940s. In combination with the information provided by the elders, these investigations helped shed more light on recent use of the territory.

A summary analysis of the discoveries made as part of the two research programs was produced and published in 2010. In addition, the Cree Regional Authority (CRA) prepared a traveling exhibit of the artifacts and other objects unearthed during the archaeological digs.

The Eastmain-1 project provided Hydro-Québec with an unprecedented opportunity to incorporate complementary approaches to archaeology, including one method based on the tools normally used in archaeological research (e.g., mapping, aerial photography and databases) and another that focused on Cree traditional knowledge. The work was carried out in a spirit of cooperation between SEBJ, Hydro-Québec and the CRA.

Chipped stone tools discovered in the project study area



Excavation of an archaeological site near Eastmain workcamp



Meeting of archaeological research teams from SEBJ and the Nadoshtin Corporation



MERCURY IN FISH

Creating a reservoir involves flooding a large quantity of organic land material that contains naturally occurring inorganic mercury. During the first few years after impoundment, rapid bacterial decomposition of this material transforms the inorganic mercury into methylmercury, which is then transferred from the vegetation and soil into living organisms, including fish.

Objective

To update fish consumption guidelines to enable sport anglers and the Cree population to enjoy the health benefits of eating fish while avoiding the ill effects of mercury.

Follow-up

Two years after the impoundment of Eastmain 1 reservoir, mercury concentrations in lake whitefish, northern pike and walleye had not yet reached the levels anticipated for standard-length fish. However, mercury levels were significant in small lake whitefish and walleye specimens.

Six years on, average mercury levels in northern pike and walleye were much higher in the study area than in the region's natural lakes. Since mercury is transported downstream of reservoirs, all of the species found immediately downstream of Eastmain 1 and Opinaca reservoirs and the piscivorous species in Opinaca reservoir itself contained mercury levels that were high in comparison to those in the natural lakes.

In Eastmain 1 reservoir, the curve produced to assess changes in mercury levels in northern pike and walleye corresponded to the curve obtained after impoundment of Opinaca reservoir.

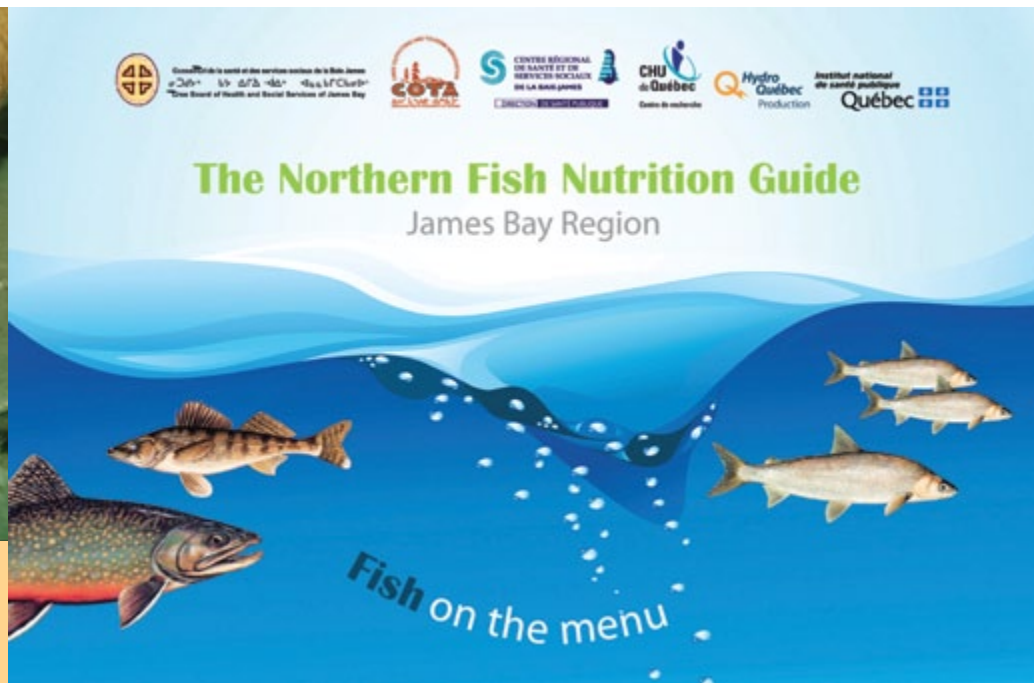
The results of the fish mercury follow-up study were factored into the recommendations of the Cree Board of Health and Social Services of James Bay (CBHSSJB) and the fish consumption guidelines for the region, which were updated in 2013.

The Northern Fish Nutrition Guide – Baie-James Region *encourages people to eat fish. In fact, despite the presence of mercury, fish has excellent health benefits when consumption guidelines are followed.*

Sampling for analysis of mercury levels in fish



Fish consumption guidelines



ACTIVITIES STEMMING FROM THE *NADOSHTIN* AGREEMENT

The *Nadoshtin Agreement* sets out the main commitments made by Hydro-Québec and SEBJ in regard to the Crees affected by the Eastmain-1 development. The agreement essentially has two objectives: to protect the way of life of the Crees and ensure their participation in all phases of the project.

A number of organizations have been created under the terms of the *Nadoshtin Agreement*, including the Nadoshtin Corporation, the Technical and Environmental Committee, the Weh-Sees Indohoun Corporation and the Working Group on the use of the Fisheries Resources in Eastmain 1 Reservoir.

In August 2004, many of the entities established under the different agreements signed by the Crees were grouped together as one organization, the Niskamoon Corporation.

Niskamoon Corporation

The Niskamoon Corporation has representatives in each of the Cree communities affected by the project. The corporation's mandate is to:

- › Facilitate access to the funds and programs set up under the agreements signed by the Crees and Hydro-Québec
- › Provide a more effective framework for cooperation between the Crees and Hydro-Québec

In regard to the Eastmain-1 project, the Niskamoon Corporation has focused on the following issues in particular:

- › The project's impacts on traditional activities pursued by the Cree community and Cree trappers
- › Economic spinoffs and employment in the Cree community
- › Environmental studies
- › Planning and implementation of the environmental follow-up program and mitigation measures

In carrying out its mandate, the Niskamoon Corporation can call on the services and expertise of the Technical and Environmental Committee.

Technical and Environmental Committee (Monitoring Committee)

The Technical and Environmental Committee was created in 2002 with a mission to incorporate the concerns expressed by the Crees into the Environmental Follow-up Program developed for the Eastmain-1 project and to validate the terms of reference and results of the environmental studies carried out for the project. The entity was renamed the Cree-Hydro-Québec Monitoring Committee in 2007, when its mandate was extended to include the Eastmain-1-A/Sarcelle/Rupert project.

The Monitoring Committee visits the Cree communities on an annual basis to present a summary of the mitigation measures and environmental follow-up studies completed the previous year.

Information session in a Cree community



Weh-Sees Indohoun Corporation

The Weh-Sees Indohoun Corporation is a joint Cree–Hydro–Québec company, which was established under the provisions of the *Nadoshtin Agreement* and the *Boumhounan Agreement*. Its mission is to manage a special sport hunting and fishing zone used by Eastmain-1 jobsite workers and other land users. In 2007, the mandate of the Weh-Sees Indohoun Corporation was extended to include the territory affected by the Eastmain-1-A/Sarcelle/Rupert project.

Working Group on the use of the Fisheries Resources in Eastmain 1 Reservoir

The task of the Working Group on the use of the Fisheries Resources in Eastmain 1 Reservoir was to develop a strategy to enhance the reservoir's use and potential in cooperation with the Cree communities concerned.

In 2005, the Working Group conducted feasibility studies for two projects: the establishment of a commercial lake sturgeon fishery and a sturgeon farm to produce caviar. An in-depth analysis ultimately led to the conclusion that neither venture would be profitable.

The Working Group also studied a number of tourism and recreation projects.

The tallymen are very interested in the idea of developing tourism in the region. However, there are many challenges involved in terms of marketing, workforce availability and financing, among other things.

Meeting of the Monitoring Committee



Cree monument



Meeting with the tallymen at Eastmain workcamp (August 2010)



REGIONAL ECONOMIC SPINOFFS

Hydro-Québec and SEBJ put a number of measures in place to encourage the active participation of Cree and Jamesian businesses and workers in the project.

Over 15,000 people worked at the Eastmain-1 jobsite. The fact that about 13% of them were from the Nord-du-Québec region indicates that regional participation in the project was exceptional.

Cree communities

By July 2007, project-related contracts worth \$430 million had been awarded to Cree businesses. Hydro-Québec had committed to awarding a minimum value of \$300 million in contracts.

Jamesian communities

Hydro-Québec put incentives in place to benefit Jamesian businesses and workers. The company also worked with ComaxNord to maximize employment and contracts for the region.

The economic spinoffs from project-related contracts and purchasing totaled \$150 million in the Baie-James region, \$135 million in Abitibi-Témiscamingue and \$184 million in Saguenay-Lac-Saint-Jean.

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