

Key Issues:

2- Hydrological Regimes

3-Fish Migration and River Navigation

10-Landscape and Cultural Heritage

13-Improvement of Infrastructure



Climate Zone:

Severe

Subjects:

- Construction of water control weir with fish passage
- Construction of fish spawning channel
- Construction of community marina
- Rehabilitation of disturbed landscape
- Pre and post development ecological monitoring

Effects:

- Restoration of water regimes
- Provision of aquatic habitat
- Enhanced recreational and tourism opportunity
- Improved resource management capability
- Improved community relations

Project Name: Churchill River Diversion Project, Churchill Weir

Country: Province of Manitoba, Canada

Implementing Party & Period

- **Project:** Manitoba Hydro
1970's

- **Good Practice:** Manitoba Hydro, Town of Churchill
1998/1999

Key Words:

Water Management, Weir, Fish Passage

Abstract:

The Churchill Weir mitigates water supply, recreational and fish/wildlife habitat impacts resulting from Churchill River Diversion hydroelectric development in the 1970's. The weir, developed to meet objectives identified by the local community, is the first of its type in Canada. The weir project is also noteworthy because it involves marine and freshwater habitats, marine mammals, rare birds and anadromous fish.

1. Outline of the Project

In the mid 1970's Manitoba Hydro undertook the Churchill River Diversion Project (CRD) in northern Manitoba to significantly enhance its power generation capability on the Nelson River (Figure 1). Approximately 80% (1000 m³) of the Churchill River flow was diverted into the Nelson River, resulting in significantly reduced discharge at the mouth of the Churchill River near the community of Churchill. The habitat values of the broad (1.5 - 2.0 km wide) river channel for indigenous wildlife were significantly reduced and recreational use of the area declined due to extremely poor conditions for boat travel.



Figure 1 Map of CRD and Lower Churchill

The CRD project was developed and implemented according to conventional processes of the time - existing environmental conditions were documented, impacts were predicted and recommendations were made regarding means to mitigate anticipated impacts by a multidiscipline team (The Lake Winnipeg, Churchill River and Nelson Rivers Study Board). One of the Study Board recommendations identified the possible need for a weir on the Lower Churchill River to re-establish pre -development water conditions.

In the early 1990's Manitoba Hydro and the Town of Churchill commenced discussions regarding the development of a weir to restore the water regime; a



Figure 2 Weir under construction

number of alternatives for the location and design of the structure were reviewed with the community. The selected option was a rockfill overflow structure which raised water levels approximately 2 meters and created a reservoir extending 10 kilometers upstream with a total surface area of approximately 4700 Hectares.

The weir was constructed “in the wet” with local rock, impervious fill and sand on the existing river bed over a single summer. Approximately 220,000 m³ of rock and 65,000 m³ of sand were used in constructing the weir and associated dykes. Section 4 following discusses the various special features that were incorporated into this project to meet project objectives.

2. Features of the Project Area

The lower reaches of the Churchill River and its estuary are situated on a coastal plain at 58°45' North latitude on the west shore of Hudson Bay. The mean annual temperature is -7.2° C with frost occurring in all months. Annual precipitation is approximately 400 mm.

The underlying bedrock is primarily carbonates overlain by marine deposits of sand and gravel. Glacial contact mineral deposits and organic peat are the dominant surficial materials. Cryosols are also present in this zone of continuous permafrost. Drainage is poor due to the ice bonded fine grained substrate; standing water covers more than 50% of the land surface in summer.

Peak stream flows occur during late May and early June coincident with runoff from winter snow melt. Winter ice build-up in streams can become extensive (1.5 - 2 m thick) and impedes both winter flows and spring run-off.

The mainstem of the Churchill River and local tributary streams provide habitat for several freshwater fish and lower trophic species while the estuary supports marine species. A total of 33 fish species have been documented in the project area; 16 species are designated as freshwater species, 3 are considered to be anadromous and the remainder are marine. While there are no rare or endangered species, a freshwater fish, lake sturgeon (*Acipenser fluvescens*) is listed as a Manitoba Heritage Species and is uncommon in the area.

The estuary is used seasonally by approximately 3000 beluga whales. Harbour and bearded seals may be found as far as 55 km upstream into the Churchill River.

The area's short growing season (101) days supports approximately 500 species of vascular plants, 270 species of lichens and 175 species of bryophytes. The harsh climate and coastal exposure limits the abundance and growth of most species; trees are only present along river and lake shorelines. While some 30 rare or endangered plant species are listed for the general area, none were found during project field studies.

The area is important habitat for birds; some 166 species have been recorded, 90 species are known to breed locally. An additional 104 species have been listed as rare or accidental transients. The bird populations include waterfowl, waterbirds, shorebirds and songbirds. Two species, the little gull (*Larus minutus*) and Ross's Gull (*Rhodostethia rosa*), considered to be unique in the area are believed to nest in

vicinity of the reservoir.

Approximately 30 mammal species were found in the vicinity of the weir; the most significant was the polar bear (*Ursus maritimus*) which is seasonally present. Two large ungulate species, (moose and caribou) are present as are several furbearer species.

Fish, marine mammals, birds and other game are harvested for food by local residents. Beluga and polar bears have been collected locally for zoos and aquaria. The diverse local bird and animal species associations and habitat conditions are the focus of an international tourism industry producing approximately \$6 million of expenditure by visitors.

The area has been inhabited by more than 3000 years by aboriginal peoples - both Dene and Cree. European fur traders arrived in the mid 1600's and in the early 1900's Churchill became Manitoba's seaport with rail connection to the interior plains. More recently the community has hosted a major military base, an experimental rocket launch base and now is a tourism center.

3. Major Impacts

The primary adverse impacts of the CRD on the Lower Churchill River were:

- Insufficient water for boating in the river reaches immediately upstream of the estuary. Local residents experienced difficulty in accessing their upstream cabins, recreational boating was not generally possible. Local Resource Users could not access (hunt and trap) desired populations of wildlife.
- Fish habitat in the Churchill River mainstem was reduced and fish were reported to have difficulty moving into tributary streams to carry out life cycle activities. Fish populations declined.
- Marine mammals (beluga whales, seals and polar bears) experienced reduced freshwater inflow to the estuary.
- The general aesthetics of the area were degraded.

4. Mitigation Measures

The construction and presence of the weir addressed each of the primary impacts as well as several secondary concerns:

The weir was designed to raise water levels by 2 m and create a reservoir extending 10 km upstream, re-watering the original Churchill River channel to enable unimpeded boating in the area. (After 2 years in service the crest of the weir at the west end has suffered ice damage and erosion causing a slight lowering of the reservoir level. Larger armor rocks are being placed to stabilize the damaged area.)

The re-watered area upstream of the weir would provide significantly enhanced fish habitat and improve access into tributary streams. The weir was designed with an overflow fish passage channel in the center of the structure; this fishway would allow upstream and downstream movement by indigenous fish species during open water periods. In addition, improvements were made to the lower reaches of a tributary utilized by fish - Goose Creek - to ensure unimpeded passage and provide engineered

overwintering and spawning pools.

The construction work in the river channel and the subsequent discharge from the weir were to be carried out in such a manner that marine mammals - beluga whales, seals were not detrimentally affected. Actions were taken during construction to minimize interaction between polar bears and the construction activities.

An Environmental Protection Plan developed collaboratively by the proponent and regulators was implemented during construction to minimize any further impacts to the environment. The measures in this plan continue to be in effect for weir maintenance.

The weir site and sites providing construction materials were to be left in an aesthetically pleasing configuration.

Secondary measures carried out as part of the weir project included:

- Development of a marina and picnic area to optimize local use of the weir reservoir.



Figure 3 Panoramic view of the marina

- Construction of a viewing tower at the marina to facilitate bird watching and provide security from polar bears.



Figure 4 Viewing tower at the marina

- Enhancement of the rock quarry developed for the project as a recreational site with stocked fish and picnic site.
- Identification of an aboriginal burial site near the quarry as a heritage site to enhance local cultural awareness.
- Rehabilitation of sand/gravel borrow areas developed for the project and of other borrow sites to become productive wildlife habitat.
- Provision of significant ecological information relating to the lower Churchill River, and the project area.
- Economic opportunity for local businesses and contractors supplying goods and services required for the weir project.
- Development of a better working relationship between Manitoba Hydro and the community of Churchill.

5. Results of the Mitigation Measures

Post- construction monitoring and long term monitoring of key indicators confirm the weir project has met its objectives:

- Local residents accessing their upstream cabins by boat; recreational boating occurs in the reservoir and into tributary streams. Resource Users have access to could not access desired populations of fish and wildlife.
- New fish habitat has been provided in the Churchill River mainstem; biological survey confirm the presence of all indigenous species. Both upstream and downstream fish passage over the weir has been documented. Fish do move into the tributary streams for life cycle activities. Fish populations are increasing.
- Marine mammals (beluga whales, seals and polar bears) experienced no adverse impacts from the construction activities. Beluga whales continue to be present in consistent numbers in the estuary, seals move over the weir to freshwater habitat as they desire. An important research project on seal movements and habitat utilization was conceived and is now underway as a result of observations made during weir project surveys.
- The weir is a run-of-river overflow structure so the outflow into the estuary is unchanged.
- The general aesthetics of the area were significantly improved - the river is re-watered and former disturbed areas have been rehabilitated.

In addition the weir project provided:

- A marina and picnic area on the weir reservoir.
- A viewing tower to facilitate bird watching and provide security from polar bears.
- A second recreational site with stocked fish at the rock quarry.
- Identification of a previously unknown aboriginal burial site.
- Significant ecological information relating to the lower Churchill River.
- Economic opportunity for local businesses and contractors.
- Improved relations with the local community.

6. Reasons for Success

The success of this project resulted from several interrelated factors:

- The Town of Churchill and Manitoba Hydro undertook the project as a collaborative effort. The weir was designed and sited to meet the needs of both parties. Local resource users and people familiar with the river prior to CRD contributed to the identification of objectives. Due to the lengthy experience with decreased water levels, people had time to develop clear visions of “how they wanted it to be.”
- The successful tender for the contracted work was very conscientious. He effectively utilized local services and equipment to supplement his own equipment and manpower while maintaining a focus on timely execution of his contracted work despite difficult site conditions.
- The environmental assessment and regulatory review processes were thoroughly conducted using sufficient data, information and expertise to identify and mitigate impacts associated with development of the weir.
- All the key individuals working on the weir project (Project Management, the Contractor, the Town of Churchill and the regulatory authorities) were all striving to make this a “showcase project”. The desire to succeed and to utilize state of the art environmental protection measures resulted in very little impact during construction and evident net benefits following completion of the project.

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