

Introduction to the GRAND Canal

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The GRAND Canal Company Limited
(GRANDCo)

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The Concept

The Great Recycling and Northern Development (GRAND) Canal Concept has been designed to assist in resolving the rapidly growing environmental and water supply concerns of many millions of people living in industrialized and food producing areas of Canada and the U.S.A. The areas involved include the Great Lakes-St. Lawrence Basin and the midwest. Already serious environmental conditions in many of these areas are now forecast to worsen.

At the same time, the GRAND Canal's northern waters recycling system will protect and enhance natural resource development opportunities for the native and other residents of the 700,000 km² watershed of James Bay.

To achieve the above goals, GRANDCo proposes the creation of a sea-level, freshwater lake in James Bay which will impound a portion of the very large natural runoff of rivers flowing into the Bay. This entirely new, dyke-enclosed, source of fresh water for Canada will be similar in conceptual design to the prized and highly profitable IJsselmeer of Holland which was created in 1932. That valuable European source of fresh water was once, like James Bay, a salty arm of the sea until it was enclosed by dykes.

The total average flow of James Bay basin runoff is equal to about twice that of all the Great Lakes combined. It is proposed that up to about 20% of the natural runoff into James Bay will be made available for recycling to the Great Lakes via the GRAND Canal. This new system of aqueducts will link the new northern lake with the mid-continent through the Great Lakes. The runoff not required for recycling will be released into Hudson Bay through control structures in the containing dyke system. The control of new inflows and outflows on the Great Lakes will be designed to provide stable levels and flows.

The Canal's series of long, stepped reservoirs with retaining structures at each end will transfer, on demand, the recycled water to the Great Lakes using suitable integrated pumping stations and power plants. The Canal's reservoirs

and aqueducts will lie within those river valleys selected to assure the fully controlled delivery of the volumes of recycled water required as inflow needs change due to changing demands on the Great Lakes.

In California, since the mid-1930s, a similar system of integrated storage reservoirs, aqueducts, pumping stations and power plants has made that state one of the most agriculturally productive areas in the world and has dramatically reduced environmental damage due to flooding and land erosion.

Fresh Water in Canada

Canada, with only a little more than one half of one percent of the world's population, contains some seven percent of the Earth's landmass and nine percent of its fresh water runoff. On a per capita basis, we have about ten times the fresh water runoff of the United States with whom we share responsibility for the international Great Lakes-St. Lawrence Basin as well as other important boundary watersheds.

However, in spite of our riches in water and land, Canada has several major problems involving the management of water quantity. These are outlined as follows:-

First:- Fresh water does not occur uniformly across Canada in time or place. The food producing and hydro-carbon rich mid-western prairies which are now aspiring to industrial diversification, and much of our Northwest Territories have very low average rates of precipitation and water flow. In recent years, drought conditions during the growing season in the midwest have caused annual crop losses in the billions of dollars. Water deficiencies will almost certainly place an unacceptable limit on future industrial development in those areas.

Second:- The international Great Lakes-St. Lawrence Basin, the world's largest concentration of fresh water storage, has already been a magnet for forty million farming and industry-minded Canadian and U.S. citizens. Consumptive withdrawals of water are increasing. The effects of current wide variations between high and low water are costly to industry and cause heavy shore erosion over thousands of miles of shoreline. Forecasts by responsible scientists now predict substantially reduced runoff and lower average lake levels due to the "greenhouse" effect. These are pressing international problems which Canada can only solve jointly with the United States.

Third:- Our neighbors to the south also have serious water shortages entirely within their own country. It is unlikely that they can solve these problems by themselves. In many parts of the United States including the mid- and southwest, agricultural, industrial and urban developments are already severely restricted by both chronic and intermittent drought conditions. Ground water from large aquifers are being steadily depleted. U.S. proposals and studies have suggested a variety of water diversions, including the transfer of water from the Great Lakes as well as importing water from Canada. If it can be shown that Canada can help to solve U.S. problems by recycling northern river water, and at the same time provide benefits to ourselves, then it should be less difficult in the future to work effectively with the United States to solve those joint problems for which solutions can only be found through cooperation.

Fourth:- The greater part of Canada's average river flow is discharged to sea level via north-flowing watersheds where present population densities are very low. At first glance, therefore, northern watersheds might appear to present attractive opportunities for additional southward "diversion". In the 1940's, water was diverted southward into Lake Superior from the headwaters of the north-flowing Albany river watershed. However, as has already been stated, if additional southward diversions are implemented, future northern development, the northern environment and its native and other residents would be compromised. Northerners would, in fact, become major "losers," in perpetuity. The hope that northern development will broaden the present unbalanced demographic distribution of Canadians would be substantially diminished.

Many Canadians feel that our northern development has been delayed for much too long and that there is a real need to establish a significant nation-wide northern development corridor at the latitude of James Bay. Therefore, the protection of Canada's north-flowing rivers from southward "diversions" is clearly a major concern for Canada.

To summarize:- In Canada, we must recognize and deal with four major water quantity issues.

- (a) A shortage of water on the Canadian prairies.
- (b) Water volume instability and impending shortages on the Great Lakes-St. Lawrence Basin.

- (c) Water deficiencies in the United States with resulting pressures for increased diversions, such as those at Chicago, on the Great Lakes.
- (d) The protection of northern watersheds against increased southward diversions which would reduce the natural riverflow of northern rivers before they have completed their flow to the sea.

The resolution of these problems may well call for Canadian and U.S. citizens to look to the north for additional water supplies. However, it seems certain that answers acceptable to the Canadian public will only be found in those concepts of water management which clearly result in the northern watersheds of Canada becoming "winner" and not "loser" areas.

Diversions and Recycling:- Losers and Winners

The need to divert water from its natural flow in one watershed to serve the needs of agriculture, hydro power industry and/or community use in other watersheds has been with us for centuries. Where such diversions occur in single democratic jurisdictions, or within the one economic region, there is usually no major problems in obtaining public approvals providing those who may be directly injured in the process are properly compensated. Canada is no stranger to such diversions. We have seen at least sixteen major diversions of riverflow. Most have been carried out for hydro power development in remote, sparsely settled areas of our country.

However, the very word "diversion" suggests that the receiving watershed is a "winner" and the donor watershed is a "loser". Therefore, where competing nations or jurisdictions are involved, public approvals for diversions will naturally be difficult to obtain.

In contrast to southward "diversions" of northern riverflow, "recycling" is defined here as a system in which water that has run its natural course to the sea is there impounded in a suitable shallow arm of the sea to form a new freshwater lake. This will be done by means of dyke enclosures designed to prevent tidal mixing of fresh water runoff with the salt water of the sea. Some of this newly created fresh water may then be transferred as required to areas of need. It should be emphasized that this concept results in the creation of new water which did not formerly exist. Furthermore, it does not interfere with or hinder future instream development on rivers flowing into the new lake. With such a "recycling" concept, the north can become a "winner" instead of a "loser" area.

THE KIERANS GRAND Canal Concept

FOR
RECYCLING (NOT DIVERTING)

JAMES BAY RIVERS

FOR CANADIAN & NORTH AMERICAN WATER NEEDS

ANNUAL VALUE OF RECYCLED
WATER TO CANADA
WOULD EQUAL VALUE OF PRAIRIE
WHEAT CROP

WATER FOR CANADA'S WEST

HUDSON BAY

DIKE
ENCLOSED
FRESH WATER
LAKE

JAMES
BAY

LEVEL CONDITIONING

RECYCLED WATER
TRANSMISSION
NEW
NAVIGATION

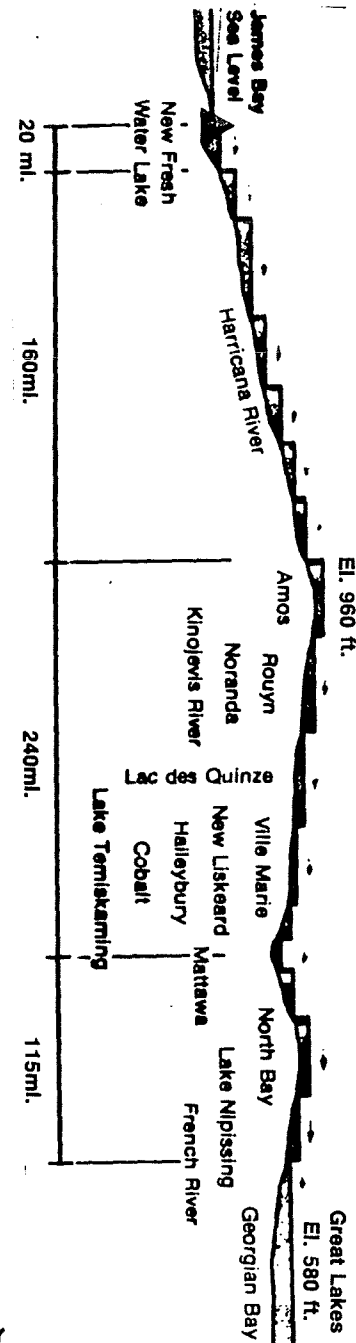
POWER

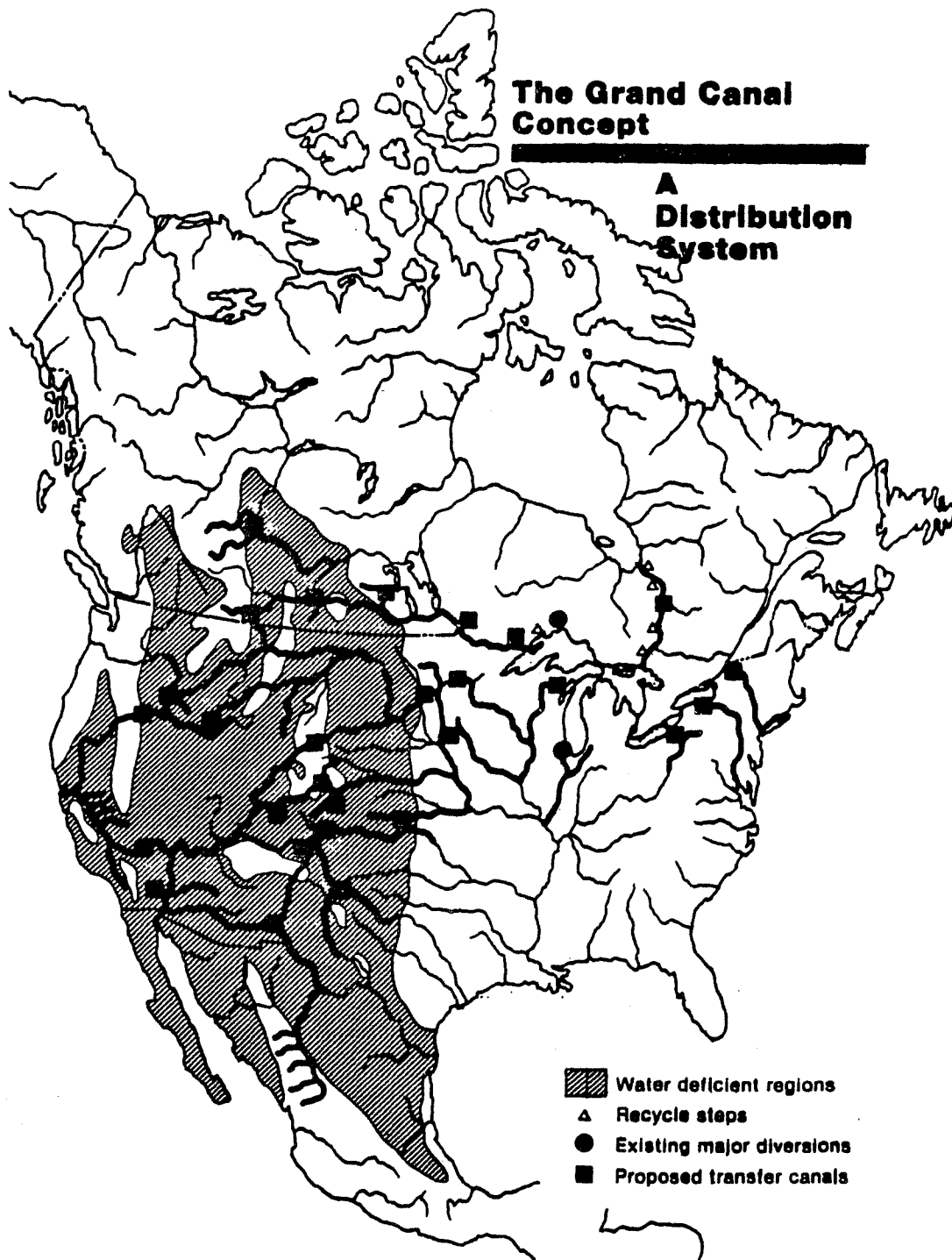
DISTRIBUTION

DISTRIBUTION

DIVERSION

-  SALT WATER
-  FRESH WATER
-  WATERSHED BOUNDARY
-  EXISTING DIVERSIONS





DIRECT TRANSFER BY CANALS AND PUMPING

INDIRECT TRANSFER BY REPLACEMENT OF UPSTREAM WITHDRAWALS

Clearly, in order to permit recycling to take place, there must be a large natural arm of the sea in which the new lake can be created. James Bay is now a salty, shallow, shrinking, under-utilized arm of the northern sea. It has a natural flow into it equal to twice that of all the Great Lakes combined. Thus, it qualifies, as no other location in Canada, as a new fresh water lake and a new source of fresh water. The GRAND Canal, which will connect this new lake to the Great Lakes, will consist of a series of stepped reservoirs with integrated power and pumping facilities. These will lift the water to be recycled to the height of land separating the north- and south-flowing watersheds.

In 1932 in the Netherlands, the new sea-level, freshwater lake, the IJsselmeer, was created in what was formerly the salty Zuider Zee, a tidal arm of the North Sea.

In California, about the same time, the U.S. Bureau of Reclamation was beginning to recycle fresh water from the delta of the Sacramento river just east of San Francisco Bay. There it was collected by canals just before it would otherwise be lost to the sea in San Francisco Bay. From the delta, it was "recycled" for many further uses for hundreds of miles to the south. In addition, the formerly, widely fluctuating Sacramento river flow has been regulated by controlling the discharge from new, large upstream, man-made reservoirs. This flow regulation has benefited the whole northern river systems by preventing floods and erosion. These upstream reservoirs, which were later added to by the State of California, also produce electric power which is used, in part, to provide the energy for pumping water to the south.

Both in California and in Holland, these modern integrated water management concepts have resulted in substantial increases in agricultural and industrial production. Per capita incomes and standards of living now rank with the highest in the world. Most of all, they have dramatically shown that it is now possible to have "all winner" concepts as well as "winner and loser" concepts of water management. The GRAND Canal is designed to be an "all winner" concept.

Concept Benefits

The capacity of the GRAND Canal will be designed to provide adequate and controlled volumes of new water to the Great Lakes. The new inflows will be adjusted in conformity with changing natural precipitation, anticipated increased consumptive use of water, and new water outflows to relieve water-short areas in Canada and the United States. This capability to fully control new inflows and outflows for the Great Lakes will improve their water volume stabilization by about 50% over the wide natural fluctuations presently endured. This new volume control capability will also tend to improve water quality, particularly during natural low-flow conditions because of the reduction in the concentrations of irreducible pollutants in the Lakes during low-flow periods.

Water levels in the new northern lake will also be controlled so as to stabilize the shoreline of James Bay. For many years this shoreline, vital to migrating waterfowl, has been shrinking due to natural, post-glacial uplift. Additional benefits resulting from the implementation of the Concept will include:

- Hundreds of thousands of new employment opportunities.
- An important new network of base load and peak use electric power. This energy system will promote the international use of Canadian hydro and Candu sources of energy. This should result in a significant reduction in acid rain from fossil fuel burning power plants.
- Improved trade between the people of Canada and the United States.

Concept Recognition

The GRAND Canal Concept was first developed by T.W. Kierans, P.Eng., of St. John's, Newfoundland, when he was a northern prospector in the early '30s. It was first proposed to the Canadian government in 1960 and elaborated again in 1965. More recently it was described to the MacDonald Royal Commission, the Canadian Inquiry on Federal Water Policy and the 1984 Ontario Government's Futures in Water Conference. It has elicited widespread comment in conferences and the press throughout the past year.

Former Quebec Premier Robert Bourassa has strongly supported studies into its implementation in his recent book Power From The North and in public interviews.

The GRAND Canal Company Ltd.

The GRAND Canal Company Limited (GRANDCo) is a Canadian, investor-owned Company with its head office in St. John's, Newfoundland. It has been incorporated to implement the Concept as an environmentally beneficial project and to ensure that leadership in the implementation of the Concept originates in Canada.

GRANDCo Objectives

GRANDCo's ultimate goal is to develop the GRAND Canal Concept as Project Developer/Manager under contractual arrangements with each and all of the many participating national and international public jurisdictions. The Company's long-term objective is to create the means whereby all cooperating regions of Canada and the United States with water deficits can maintain the quality of their lifestyle and environment with access to adequate and dependably managed, good quality water supplies, suitable drainage and associated protection against flooding.

The GRANDCo Engineering Joint Venture

GRANDCo now has an agreement with a Joint Venture of four leading Canadian engineering and construction management companies who are carrying out engineering studies and providing related services directed towards the development of a project embodying the Concept. The Joint Venture is sponsored by SNC of Montreal. The other participating companies are Bechtel Canada Ltd. of Toronto, The UMA Group of Calgary, and Rousseau, Sauve and Warren Inc. of Montreal.

Costs, Revenues and Assets

Recent studies and experience in both Canada and the United States suggest there is now a growing demand for secure supplies of fresh water. This demand can be met by the new water source proposed for James Bay. The development will be phased in response to demand. Early estimates suggest that the construction of dykes, aqueducts, pumping stations and power sources that may comprise the first phase of development could be accomplished in a decade. Ultimately, the cost of facilities to impound and transmit water to the Great Lakes may be in the order of \$50 billion. The water distribution, storage and management systems required to deliver water on demand to the Canadian west and to the south of the Great Lakes may cost as much.

As an investor-owned company, with some of the investors being crown corporations such as the hydro corporations of Ontario, Quebec and Manitoba, GRANDCo revenues will, for the most part, be derived from contracts with the benefiting jurisdictions. These revenues will be related to substantially improved long-term resource utilization in all participating regions of Canada and the United States. As shown in California, large and widespread increases in economic activity can be expected to occur following the introduction of improved water management and the provision of adequate water supplies to the public service infrastructures of areas now suffering from water shortages.

To assist in providing construction funding GRANDCo will seek natural resource grants which will be associated with project development in participating jurisdictions.

Activity

GRANDCo is now conducting a phased, multi-year, social, environmental, technical and economic research, design and development program. This work, now in its early stages, is to be carried out in conjunction with native people's organizations, with environmental and regulatory bodies, as well as with research and other public and private groups interested in the development of the Concept.

The first phase, now underway, is the preparation of a Project Statement and Assessment which will describe the proposal in comprehensive social, engineering and economic terms. It will cost in the order of \$1.5 million and will be completed in 1986. The full program of engineering, environmental and economic studies and other preconstruction activities will require at least five additional years and cost an estimated \$100 million.

The Project Statement and Assessment will be used to seek approval in principle from public authorities for ongoing engineering work and investor financing. Information and public response sessions are planned for all areas involved in the Concept.

Le projet du siècle: Un homme, une idée, un canal

Tom Kierans, ingénieur en retraite de St-Jean (Terre-Neuve) caresse un vieux rêve: fermer la Baie-James par une digue qui la séparerait de la Baie d'Hudson, afin d'en faire un lac. Une partie de l'eau serait alors acheminée par canaux ou par cours d'eau jusqu'aux Grands Lacs, d'où elle irait ensuite irriguer les terres arides de l'Ouest. Kierans l'appelle le Great Recycling And Northern Development Canal qu'il a abrégé en GRAND Canal.

Personne auparavant ne pensait l'idée réalisable, mais Tom Kierans a trouvé plus qu'une oreille attentive. Le chef du parti libéral du Québec, Robert Bourassa, dans son livre *L'énergie du Nord*, s'en fait l'avocat. Le GRAND Canal a également éveillé l'intérêt de SNC.

SNC appuie le concept de Kierans

Le Groupe SNC s'est intéressé à une entreprise du nom de GRANDCO, mise sur pied l'an dernier pour en étudier et en préciser le concept puis procéder aux études techniques et en diriger la réalisation sous contrat, avec les organismes publics dont relèvera le projet. SNC a ensuite créé une coentreprise d'ingénieurs-conseils qui regroupe Bechtel Canada, de Toronto, le Groupe UMA, de Calgary et Rousseau Sauvé et Warren, de Montréal. La première tâche de la coentreprise serait de réaliser des études techniques.

«Cela ne veut pas dire que le GRAND Canal se construira demain, ni même un jour, explique Camille Dagenais, président du conseil de GRANDCO et membre du conseil de SNC, mais je pense que le fait que nous nous soyons lancés dans l'aventure suffit à prouver que nous la croyons possible. 10 % des réserves d'eau douce de la planète se trouvent en territoire canadien. Devant le drame des sécheresses qui s'amplifient de par le monde, nous ne pouvons rester indifférents et ne pas partager. De toute façon, dans l'état actuel des choses, cette eau des fleuves débouchant dans la Baie-James nous échappe puisqu'elle s'en va à la mer. Mais elle se renouvelle, alors pourquoi ne pas s'en servir?»

Surmonter les obstacles

C'est Gilles Mannier qui, après

quelques années passées comme vice-président de la SEBJ est maintenant directeur du projet GRANDCO, nous apporte un élément de réponse. «Le concept du GRAND Canal n'a jamais été étudié sérieusement. Les associés considèrent qu'il faudra consacrer environ 1 million \$ aux études afin de déterminer si le concept est viable. Il faudra d'abord se pencher sur l'aspect écologique et social, puis procéder à une étude de faisabilité technique pour savoir si on peut fermer la Baie-James par une digue puis en acheminer l'eau vers les Grands Lacs. Si l'étude préliminaire permet de conclure que le projet est valable, il faudra consacrer ensuite de 10 à 20 millions de dollars supplémentaires à d'autres études techniques avant de commencer la construction.»

Si le projet voit le jour, il en coûtera environ 100 M \$ sur 15 ans. L'autre obstacle à surmonter est l'opinion largement répandue qui veut que le Canada ne doive pas vendre son eau. «Je trouve cela curieux», nous dit Gilles. Nous vendons allégrement nos minéraux, notre pétrole et notre gaz naturel alors que ce sont des ressources non renouvelables et on se refuse à commercialiser notre eau qui, par contre, est renouvelable? De plus, si le GRAND Canal s'avère réalisable, nous récupérerons de l'eau douce qui pour l'instant se mélange à l'eau salée de la Baie-James.»

Les difficultés techniques

Il n'est pas tout à fait juste de dire que l'on endiguait la Baie-James, en fait, elle sera séparée de la Baie d'Hudson par des digues et des vannes. Il y a un précédent. Il existe déjà, en Hollande, un bras de mer, le IJsselmeer, qui fut fermé par une digue de 32 km de longueur en 1932.

Le volume moyen des eaux de ruissellement du bassin de la Baie-James est environ le double de celui des Grands Lacs. La plupart des eaux de ruissellement du lac ainsi créé continueraient à s'écouler vers la Baie d'Hudson, en passant par des ouvrages de régularisation alors qu'environ 20 % pourraient être acheminées par un canal, vers les Grands Lacs.

Le canal se composerait d'une série de retenues en escalier avec des ouvrages de retenue à chaque extrémité. L'un des tracés proposés rejoint la vallée de la Harricana, où l'eau serait pompée sur toute la longueur et traverserait le bassin supérieur de l'Outaouais près de Rouyn. De là, l'eau s'écoulerait par gravité jusqu'au confluent de la Mattawa puis serait pompée de nouveau pour remonter la vallée de la Mattawa puis gravir le dernier obstacle naturel et être finalement déversée dans le bassin des Grands Lacs par le Lac Nipissing, d'où elle suivrait le cours de la French River jusqu'au Lac Huron en passant par la Baie Georgienne.

Les stations de pompage qui jalonnent ce long péripécule consomment 10 000 MW. L'une des possibilités pour les alimenter consisterait à bâtir le long du canal des centrales nucléaires qui pourraient aussi fournir l'énergie d'appoint aux réseaux du Québec et de l'Ontario. Une fois l'eau arrivée aux Grands Lacs, il faudra construire d'autres canaux pour la conduire jusqu'aux consommateurs.

D'heureuses retombées

Outre ceux de la région des Grands Lacs, 10 états du Mid-Ouest américain en tireraient des avantages directs car le niveau des Grands Lacs, qui actuellement fluctue énormément, se stabiliserait. L'ajout d'eau fraîche ferait baisser le niveau de pollution. Le nombre des régions qui profiteraient du projet augmenterait encore bien davantage quand les eaux du nouveau lac viendraient gonfler le réseau hydrique du Missouri et du Mississippi. Des canaux de dérivation pourraient aussi relier au Lac Supérieur les terres arides de Saskatchewan et d'Alberta.

Rien de sûr

Gilles Mannier tient à préciser: «Nous n'en sommes encore qu'au stade des si et des peut-être. Tant que les études ne seront pas faites, rien n'est sûr, mais ça doit être réalisable. Si le projet voit le jour, le GRAND Canal nous vaudra des milliers d'emplois dont beaucoup seront permanents, sans parler des retombées sur l'économie canadienne. Ce sera le projet du siècle.»

Project of the century

A man, a plan, a canal

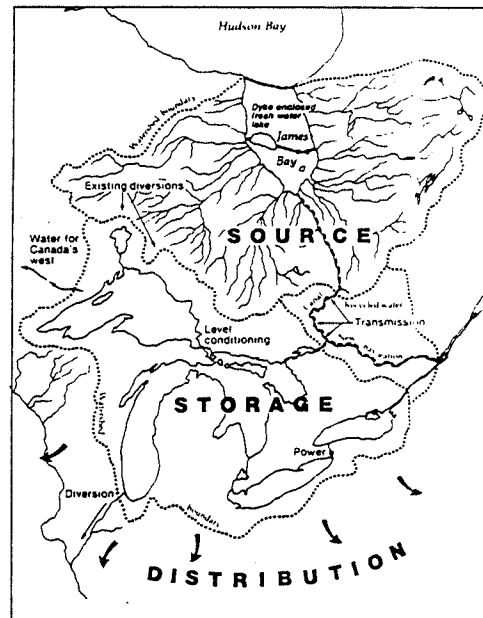
Tom Kierans, a retired engineer living in St. John's, Newfoundland, has long had a dream. In bare outline, his idea is to dam James Bay, cutting it off from Hudson Bay and turning it into a freshwater lake. Some of the water would then move through canals and natural watercourses to the Great Lakes and beyond to irrigate the drylands of North America and supply water to regions faced with shortages. Kierans calls his project the GRAND Canal.

In the past, no one wanted to consider it. But lately Tom Kierans has roused more than a flicker of interest in his idea. Quebec Liberal leader Robert Bourassa has lent it support, and publicity, in his best-selling book, *Power from the North*. The GRAND Canal has kindled SNC's interest, too.

SNC backs Kierans concept

The SNC Group took an interest in a company called GRANDCO, set up last year to explore and define the GRAND Canal concept and act as project developer and manager in contract with participating public jurisdictions. SNC then formed an engineering joint venture with Bechtel Canada Ltd. of Toronto. The UMA Group of Calgary and Rousseau Sauvé and Warren Inc. of Montreal. Its first task will be technical studies.

"That doesn't mean the GRAND Canal will be built tomorrow - or ever," says SNC chairman Camille Dagenais who is on the GRANDCO board of directors. "But I think the fact that we've invested in it as a venture shows that we believe it could go ahead one day. Canada has at least 10 per cent of the world's water reserves, and with the growing problems of drought in so many countries we cannot in good conscience keep them to ourselves forever. As things stand now, we're not even conserving the water from James Bay rivers for our own use; it just runs out to sea. It is constantly



replenished. Why should it not be put to good use?"

Obstacles to overcome

Gilles Mannier, back with SNC after some years as a vice-president of the James Bay Energy Corporation and now GRANDCO's project manager, can answer part of that question. "The GRAND Canal concept has never been studied seriously. The GRANDCO partners estimate that a \$1 million study will be needed to find out if the idea is basically sound. This initial study would concentrate mainly on ecological and social effects and the technical feasibility of damming James Bay and then bringing the water to the Great Lakes. If findings in the first study favour the project, we reckon another \$10 to 20 million would be needed for more engineering studies before construction could start."

If it goes ahead, the project will cost an estimated \$100 billion over a period of 15 years. Another obstacle the project developer faces is the widespread belief that Canada should not sell its water. "I find this belief curious," says Gilles. "We gladly sell our minerals, oil and natural gas, yet these resources are irreplaceable. Water is a constantly renewing resource. And if the GRAND Canal scheme proves feasible, we would be recuperating fresh water that now becomes salt when it flows into James Bay."

The technical challenges

To say the plan is to dam James Bay is misleading; in fact, the bay will be cut off by dykes and gates. There is a precedent. IJsselmeer, in Holland, was a salty arm of the sea until it was enclosed by a 32 km-long dyke in 1932.

The average flow of James Bay Basin run-off is about twice that of the Great Lakes combined. Most of this run-off would continue to flow into Hudson Bay through control structures, but about 20 per cent would be diverted through the canal system to the Great Lakes.

The canal would be made up of a series of long stepped reservoirs with retaining structures at each end. One proposed route leads up the Harricana Valley, where the water would have to be pumped all the way, and near Rouyn crosses over to the Upper Ottawa Basin. From there the water would flow by gravity to the junction with the Mattawa, and would then be pumped up the Mattawa Valley and over the height of land to enter the Great Lakes Basin through Lake Nipissing. From there it would flow down the French River into Lake Huron through Georgian Bay.

Pumping stations for the long route would call for 10,000 MW of power. One possibility, says Gilles, would be to build nuclear stations along the canal which could be used to supply peak power to Ontario and Quebec grids. Once the water reached the Great Lakes more canals would be needed to bring the water to some potential users.

Who would benefit?

Ten western states would benefit directly, as would all the Great Lakes states. Water levels in the Lakes, that now fluctuate widely, would be stabilized. With fresh water flowing in, pollution would be reduced. But benefits would be wider spread as water from the northern lake was conveyed into the Missouri and Mississippi River systems. Through canal links with Lake Superior some of the water could be recycled to the drylands of Saskatchewan and Alberta.

Nothing definite yet

"So far we're dealing only with ideas and possibilities," Gilles Mannier points out. "Until we've made more studies nothing is definite. But if should be feasible. If it does go ahead, the GRAND Canal will create thousands of employment opportunities, many of them permanent. And think of the boost to the Canadian economy! We're looking at the project of the century."