

PROVINCE OF BRITISH COLUMBIA

INDUSTRIAL DEVELOPMENT ACT

FINAL WATER LICENCE

ALCAN ALUMINIUM LIMITED of Montreal, P.Q., is hereby authorized to store, divert and use water and to construct, maintain and operate works as follows:

- (a) The sources of water supply are the Nechako River above Grand Canyon and all the streams and lakes tributary thereto.
- (b) The points of storage, diversion and use, and the extent of the Nechako Reservoir, are approximately as shown on the plan marked Exhibit "A" which is attached hereto and forms part hereof.
- (c) The date from which this Licence shall have precedence is 3 August 1949.
- (d) The purposes for which this Licence is issued are storage and power as set forth in an Agreement between the Government of British Columbia and the Licensee, dated 29 December 1950, as amended on 29 December 1987, and further amended on August 5, 1997 (the "1950 Agreement, as amended").
- (e)
  - (1) The maximum quantity of water which may be stored is 23,850 cubic-hectometres, of which 7100 cubic-hectometres are live storage.
  - (2) The maximum rate of diversion and use for power purpose is 170 cubic-metres per second.
- (f) The works may be operated to divert and use water for power purpose throughout the whole year. The works may be operated to collect water into storage throughout the whole year.
- (g) This Licence is appurtenant to the land required for the powerhouse indicated on Exhibit "A".
- (h) The works authorized under this Licence are those described in the 1950 Agreement, as amended.
- (i) This Licence is issued in accordance with the terms of the 1950 Agreement, as amended, and supersedes Amended Conditional Water Licence No. 19847.
- (j) At no time will this Licence be cancelled, nor the quantity of water that the Licensee is authorized to store, divert and use be reduced below the quantity set forth in this Licence, except in the case of default by Alcan in the performance of its obligations under sections 5 and 6 of the 1950 Agreement, as amended.

FILE COPY

**APPENDIX 2**  
**The Authorizing Documents**

**1950 Agreement between the Aluminum Company of Canada and B.C.**

THIS AGREEMENT made the 29th day of December a.d. 1950

HIS MAJESTY THE KING in right of the Province of British Columbia (hereinafter called the GOVERNMENT), represented herein by the Minister of Lands and Forests of the said Province (hereinafter called the MINISTER) duly authorized by Order-In-Council No. 2883 under the authority of the "Industrial Development Act".

AND

OF THE FIRST PART

ALUMINUM COMPANY OF CANADA, LIMITED, a Company incorporated under the laws of Canada, having its Head Office in the City of Montreal in the Province of Quebec and duly registered in the Province of British Columbia, having an office in the city of Vancouver, British Columbia (hereinafter called ALCAN) and represented herein by its proper officers duly authorized by resolution of its Board of Directors dated 22nd December 1950.

OF THE SECOND PART

WITNESSETH THAT:

WHEREAS the prosperity of British Columbia depends on development of its natural resources, the expansion of its industry and the establishment of new centres of population within the Province, and

WHEREAS the remote unrecorded waters hereinafter referred to as the Eutsuk and Tahtsa water power are natural resources capable of producing great quantities of electric power, and

WHEREAS the GOVERNMENT is unwilling to provide and risk the very large sums of money required to develop those water powers to provide power for which no market now exists, or can be foreseen except through the construction of facilities for the production of aluminum in the vicinity, and

WHEREAS the GOVERNMENT desires ALCAN to investigate the possibilities of the said water powers for aluminum production, to develop the natural resources of the Province and to establish an economically sound and prosperous business in the Province, and

- 2 -

WHEREAS ALCAN is willing to consider the construction of a large aluminum plant including the required power development at a location where it will have assurance that it may continue to import its raw materials, generate low-cost electric power to process such materials and export aluminum at sufficiently low prices to compete with aluminum and other materials in distant and protected markets with a reasonable expectation of adequate reward for the risks inherent in the business, and

WHEREAS ALCAN has financed and established and is operating large plants in prosperous communities for the generation and use of great quantities of electric power to process imported ore into aluminum, which is largely sold abroad, and

WHEREAS the construction of such an aluminum plant at or near the site of the said water power would accomplish, without investment or risk to the GOVERNMENT, the development of power, the establishment of a permanent industry, and the beginning of a new centre of population, and

WHEREAS His Majesty, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, has authorized the Lieutenant-Governor-in-Council to make, and the Minister to execute an agreement to advance that end, on such terms as the Lieutenant-Governor-in-Council deems advisable and in the best interest of the Province.

NOW THEREFORE in consideration of these premises and of the mutual covenants, provisions and conditions hereinafter set forth and pursuant to the powers conferred upon the Lieutenant-Governor-in-Council by the "Industrial Development Act", the parties hereto agree as follows:

1. Licence and Permit

The GOVERNMENT grants to ALCAN the right, and a licence or licences and a permit or permits under the "Water Act", to store and to use by diversion and otherwise, those unrecorded waters called the Eutsuk and Tahtsa water power and to occupy all Crown Lands pertinent to the full development and operation of the said water power which is identified and described in the forms entitled "Conditional Water Licence" and "Permit Authorizing the Occupation of Crown Land" appended hereto and made a part hereof.

ALCAN may in due course submit to the GOVERNMENT detailed plans and descriptions prepared by a qualified land surveyor showing exactly the Crown Lands required by ALCAN for

- 3 -

flooding and, or, other purposes in respect of the Works (as hereinafter defined in Section 3 hereof) and the parties hereto will forthwith execute a supplementary agreement identifying such plans and descriptions which agreement and plans and descriptions shall be appended hereto and made a part hereof.

The GOVERNMENT hereby authorizes the Comptroller of Water Rights and the Minister to issue under the "Water Act", subject to the provision of Section 14 hereof, the said licence or licences and permit, or permits, and will from time to time execute and deliver or cause to be executed and delivered any and all further instruments that ALCAN may reasonably request to confirm or implement the rights, licences and permits hereby granted.

2. Cancellation of Licence and Permit

If ALCAN commences construction of the Works (hereinafter defined) before June 1953, and installs at the Works generating equipment having a capacity of not less than 400,000 horsepower before 1st January 1963, ALCAN'S rights hereunder (including ALCAN'S rights under the said licence or licences and permit or permits in respect of the aforesaid water power may not be reduced prior to 1st January, 1983 for any cause other than default by ALCAN in the performance of its obligations under Sections 4, 5 and 6 hereof. If, on 1st January 1983, the generating equipment installed at the Works has a capacity of 750,000 horsepower or more ALCAN'S said rights may not be reduced prior to 31st December 1999, for any cause other than default by ALCAN as aforesaid. On 31st December 1999, a final licence will be issued to ALCAN based on the generating capacity then installed at the Works. At no time will the said licence or licences and permit or permits be cancelled or the quantity of water that ALCAN is authorized to occupy be reduced below the quantity and area required for the full utilization of the then installed generating equipment except in cause of default by ALCAN as aforesaid.

If ALCAN, by reason of business or other conditions, should request extensions of the periods specified in connection with the construction of the Works, the Minister may grant such extensions to the extent that he shall consider them reasonable.

If before the installation at the Works of generating equipment having a capacity of not less than 750,000 horsepower ALCAN or any of its subsidiaries should begin construction elsewhere of a comparable aluminum plant, having an annual capacity of 225,000 tons or more and a power development adequate to furnish the requirements of the plant or if Aluminium Limited (if then affiliated with ALCAN) or any of its subsidiaries should begin construction of such a project in Canada, the said rights and the licence or licences and permit or permits granted hereunder may be reduced to the extent that such rights are not required for the full utilization of the then installed generating equipment.

- 4 -

If the GOVERNMENT should at any time reduce ALCAN'S said rights hereunder, on account of the portion withdrawn the GOVERNMENT will include in any licence or permit thereafter granted to anyone other than ALCAN a provision for the payment to ALCAN of equitable compensation for any benefit derived from the construction and operation of the Works by ALCAN.

3. Sale of Crown Lands

Notwithstanding Sections 46 or 57 of the "Land Act", the GOVERNMENT will, from time to time, when required by ALCAN, sell and convey in fee simple, to ALCAN such Crown Lands as may be needed for the Works which are hereby defined as "all dams, canals, tunnels, aqueducts, penstocks, raceways, protection works, powerhouses, spillways, wharfs, docks, townsites, hydraulic structures, roadways, railways, cableways, pipe lines, flumes, transmission lines and all other structures, waste dumps and other facilities capable of or useful in connection with diverting, storing, measuring, conserving, conveying or using the water of the Eutsuk and Tahtsa water power and producing, measuring, transmitting or using the power to be generated thereby and plant sites, wharfs, docks, townsites, roadways, railways, conveyors and all other structures, waste dumps and other facilities capable of or useful in connection with producing aluminum and other materials by using power generated by the said water power".

Such sales shall be made at prices not in excess of the present minimum prices specified in Section 47 of the "Land Act". No stumpage or royalty will be charged on timber which is damaged, destroyed, or removed in connection with the construction or operation of the structures and facilities enumerated in this section, and which is not used or otherwise gainfully disposed of by ALCAN.

On all such lands and lands to be flooded by the Works, the GOVERNMENT agrees to maintain a reserve against staking under the "Mineral Act", "Placer Mining Act" and the "Petroleum and Natural Gas Act" and specifically the reserve placed by Orders-in-Council Nos. 413 and 414 of 6th March 1950 and to refrain from alienating any such lands until completion of construction and/or flooding affecting any portion thereof. During such period ALCAN shall have prior right to locate and record claims to any mineral discovered by reason of the development of the said water power. Subsequent to completion of development of any part of the Works the GOVERNMENT will maintain adequate reserves for the protection of that part of the said Works against encroachment.

The GOVERNMENT will permit ALCAN to occupy and to flood such Crown Lands as may be required for the construction and the operation of the Works but shall not be obligated to sell to ALCAN any Crown Lands that are required only for the purpose of flooding by ALCAN on the rental terms set forth in Section 6 hereof.

Roads built by ALCAN to provide access to and between the various sites of the Works constitute part of the Works and Crown Lands required for such roads may be purchased by ALCAN

as is provided in Section 3 hereof. However, ALCAN may in specific cases requested by ALCAN and subject to approval by the Minister of Public Works improve existing roads, including supplementing them by the construction of new roads without any charges by the GOVERNMENT even when Crown Lands are involved and without assuming the obligations of ownership such as improvements.

Any road constructed by ALCAN and located on its own property, excepting roads used entirely in connection with the operation of the Works, may be declared a public road when such action is considered by the Minister of Public Works to be in the public interest. However, in such event the GOVERNMENT will assume the maintenance of the road and ALCAN will convey to the GOVERNMENT the land occupied by such road without compensation.

#### 4. Initial Rentals

ALCAN has paid to the Minister the sum of \$20,000 receipt of which is hereby acknowledged and the Minister will, in lieu of further rentals or other charges during the period prior to the generation of power at the Works, accept evidence that ALCAN has made expenditures on engineering studies of British Columbia water powers and the designs and specifications for the Works at an average rate from 1st June 1948, of not less than \$40,000 per year up to an aggregate amount of at least \$750,000. ALCAN will deliver to the GOVERNMENT the reports and plans produced by the said engineering studies if and when the said licence or licences and permit or permits are surrendered or cancelled.

#### 5. Rentals for Power Generated

ALCAN will pay the GOVERNMENT in respect of all hydro-electric energy generated by ALCAN at the Works the following annual rentals:

(i) in respect of all hydro-electric energy used by ALCAN and its subsidiaries (defined as companies controlled by ALCAN) engaged in processes contributory to the production of aluminum or sold as secondary power (i.e., energy for the production of steam or otherwise in direct competition with fuel) ALCAN will pay an annual rental per horsepower year equal to one and two-thirds times the average price per pound (f.o.b. British Columbia smelter) realized by ALCAN on aluminum produced in British Columbia and sold by ALCAN during the previous calendar year;

(ii) in respect of all other hydro-electric energy generated at the Works ALCAN will pay an annual rental based on the rental rates paid by others in the Province for the generation of electric energy for similar purposes, taking location and other relevant factors into consideration;

- 6 -

Provided, however, that the annual rentals for the first year and subsequently shall in no event be less than 25 cents per horsepower year in respect of any hydro-electric energy generated at the Works.

6. Rentals for Lands Flooded

ALCAN will, commencing with the generation of power at the Works, pay the GOVERNMENT an annual rental in respect of Crown Lands flooded by the said Works except when occupied by some party unrelated to ALCAN at the rate of 10 cents per acre of such lands; provided, however, that such rental shall be increased if and to the extent that two-thirds of the average price of aluminum (determined in accordance with the provision of Section 5 hereof) is in excess of 10 cents per pound.

7. Removal of Timber

The GOVERNMENT may at its expense remove any timber on lands to be flooded in connection with the Works if and to the extent that such removal will not delay ALCAN in making beneficial use of the water. ALCAN will not be required to remove timber from land flooded or to be flooded except as hereinafter specified. No stumpage or royalty will be exacted on timber which is flooded or which is not used or otherwise gainfully disposed of by ALCAN.

On the lands which are to be flooded ALCAN will clear and make usable to low water level all public road and trail ends, water trails between lakes and such other areas as the GOVERNMENT may direct up to a total cost for all clearing by ALCAN not to exceed \$250,000. ALCAN will re-establish wharfs, landings, docks and other public approaches, or public facilities that exist and are in use at the time of this agreement and will keep the water approaches to such facilities clear of debris, and maintain navigability between them to the extent now enjoyed.

8. Incorporation of Townsites

Whenever the Minister of Municipal Affairs or ALCAN shall so request or upon a petition under the provisions of the Municipalities Incorporation Act, the GOVERNMENT will incorporate into one or more city or district or village municipalities all townsites or other centres of population developed or to be developed in connection with the Works. Also the GOVERNMENT, with the consent of the Legislature, will incorporate into one or more "Industrial Townships" such areas of land as ALCAN may designate, and specifically those areas or tracts of land which will be owned by ALCAN and which will include the dams, tunnels, transmission lines, roads and all other portions of the Works.



9. Sale of Power by ALCAN

In order that the promotion and development of the district and of other industries in the vicinity of the Works may be encouraged, ALCAN may sell to others electric energy generated at the Works and shall not by reason of such sales be deemed a public utility within the meaning of the "Public Utilities Act". However, the terms of sales to persons other than ALCAN'S subsidiaries, employees and tenants shall be subject to the jurisdiction of the Public Utilities Commission, but said Commission shall have no authority to require ALCAN to furnish service to any one in the absence of an undertaking so to do on the part of ALCAN or to require ALCAN to extend any service that it shall have undertaken to furnish.

10 Terms

The rentals payable by ALCAN pursuant to Sections 4, 5 and 6 hereof shall be in lieu of all terms and other charges of any nature whatsoever imposed by or under the authority of the GOVERNMENT on or in respect of the Works on the lands appurtenant thereto including flooded land, or the operation of the Works or the electric energy generated there at except a) Provincial Land and Provincial School Taxes on the value of lands and improvements owned by ALCAN which are not then within the boundaries of an organized municipality or a said "Industrial Township"; b) Taxes imposed by a municipality on property owned by ALCAN; c) Provincial Land and Provincial taxes on the unimproved value of lands owned by ALCAN in an "Industrial Township" within which will provide required public services to Provincial standards; and d) Franchise and Income Taxes, use and consumption taxes (except on electric energy generated and used by ALCAN or its subsidiaries engaged in processes contributory to the production of aluminum) and taxes of a similar nature generally applicable to corporations doing business in the Province.

The GOVERNMENT will not impose or authorize discriminatory taxes or charges of any nature whatsoever on or in respect of the Works, the operation or the products of the Works, or the conduct of business incident thereto.

11. Dependability of Power Supply

It is recognized that ALCAN is a party to this Agreement solely with the expectation that it will have the continuing use of a large quantity of low cost electric energy to be employed according to its needs for the production of aluminum, the cost of such energy being in large part

- 8 -

predetermined by the amount of the carrying charges on its investment in the portion of the Works producing the said energy.

It is, therefore, agreed that ALCAN will not be required or compelled to supply to the GOVERNMENT or to anyone else any of the power generated at the Works, except as provided in Section 9 hereof.

12. Force Majeure

If by reason of any event not reasonably within its control, ALCAN shall be delayed in the commencement or prosecution of the construction of the Works, the dates specified in Section 2 hereof shall be extended by the period of such delay or delays.

13. Sale, Mortgage, etc.

Nothing in this Agreement shall be deemed to restrict or impair the right of ALCAN to sell, mortgage, convey, lease or otherwise dispose of or transfer, in whole or in part, the Works, any associated property owned by ALCAN or the rights and privileges that ALCAN has under this Agreement and all licences, permits and other instruments that have been or may be delivered for the purpose of confirming or implementing the same; provided, however, that with the exception of town lots such sale, mortgage, conveyance, lease or other disposition or transfer shall be made expressly subject to the terms of this Agreement, and provided further that, without the consent of the Minister, no such sale, mortgage, conveyance, lease or transfer shall be made prior to 1st January 1963, except to a subsidiary or an affiliate of ALCAN or to a trustee or otherwise as an incident to the financing of the construction of the Works by ALCAN or a subsidiary or an affiliate of ALCAN.

14. Application of Statutes

The present provisions of the "Water Act" shall be applicable to this Agreement and to the said licence or licences and permit or permits hereby granted to the extent that such provision are pertinent and not in conflict with the terms of this Agreement, or of the said licence or licences and permit or permits. Any provision of this Agreement or of the said licence or licences and permit or permits that is in conflict with any present or future statute of general application shall not be invalidated by reason of such conflict.





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# TAHTSA NARROWS PROJECT



# TAHTSA NARROWS PROJECT

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Kitimat Power Operations  
D. Timlick, Manager

Alcan Primary Metals Group

Corporate Affairs  
Project Communications/  
Public Consultation

R. Prokopanko

Alcan Primary Metals Group

P. Holcak  
Project Manager

Alcan Primary Metals  
Group

Environmental/ NFCEP  
D. Bouillon

Alcan Primary Metals  
Group

Skins Lake -  
Reservoir Operations  
D. McDonagh

Klohn Crippen Consultants Ltd.  
Engineering Design,  
Construction Supervision

C. Wilson

Triton Environmental Consultants Ltd.  
Environmental Studies,  
Reviews and Permitting

C. Mitchell

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## Site and Location Map







# TAHTSA NARROWS PROJECT

## Background

- Reservoir impounded a chain of lakes
- Tahtsa Lake was the highest lake in the chain
- Bed at outlet of Tahtsa Lake higher than reservoir level required to use licensed live storage (844.3 m.)
- Result – currently can only access 48 % of storage





# TAHTSA NARROWS PROJECT

## Current Situation

- 3 years of low inflows
- Reservoir drawn down to historically low levels
- Now compelled to reduce power production by:
  - Declaring force majeure on surplus power sales to third parties
  - Shutting down one pot line



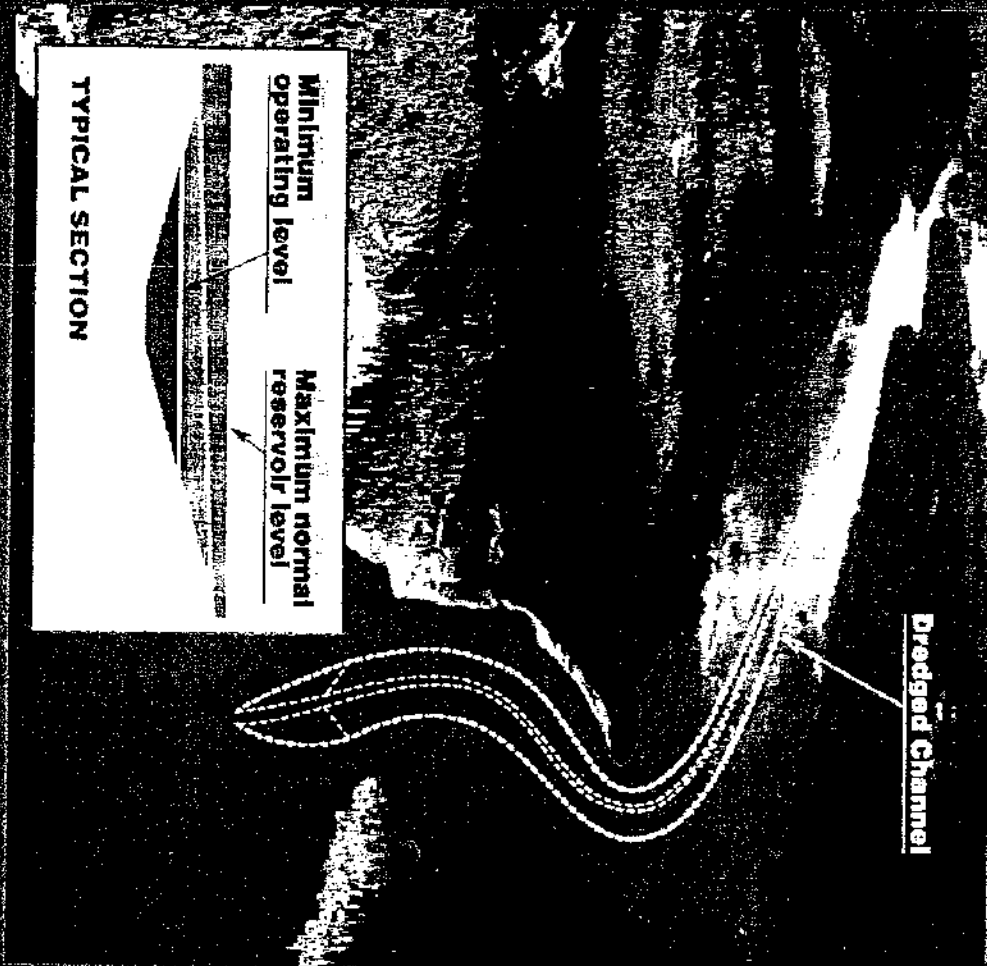
# TAHTSA NARROWS PROJECT



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# TAHTSA NARROWS PROJECT



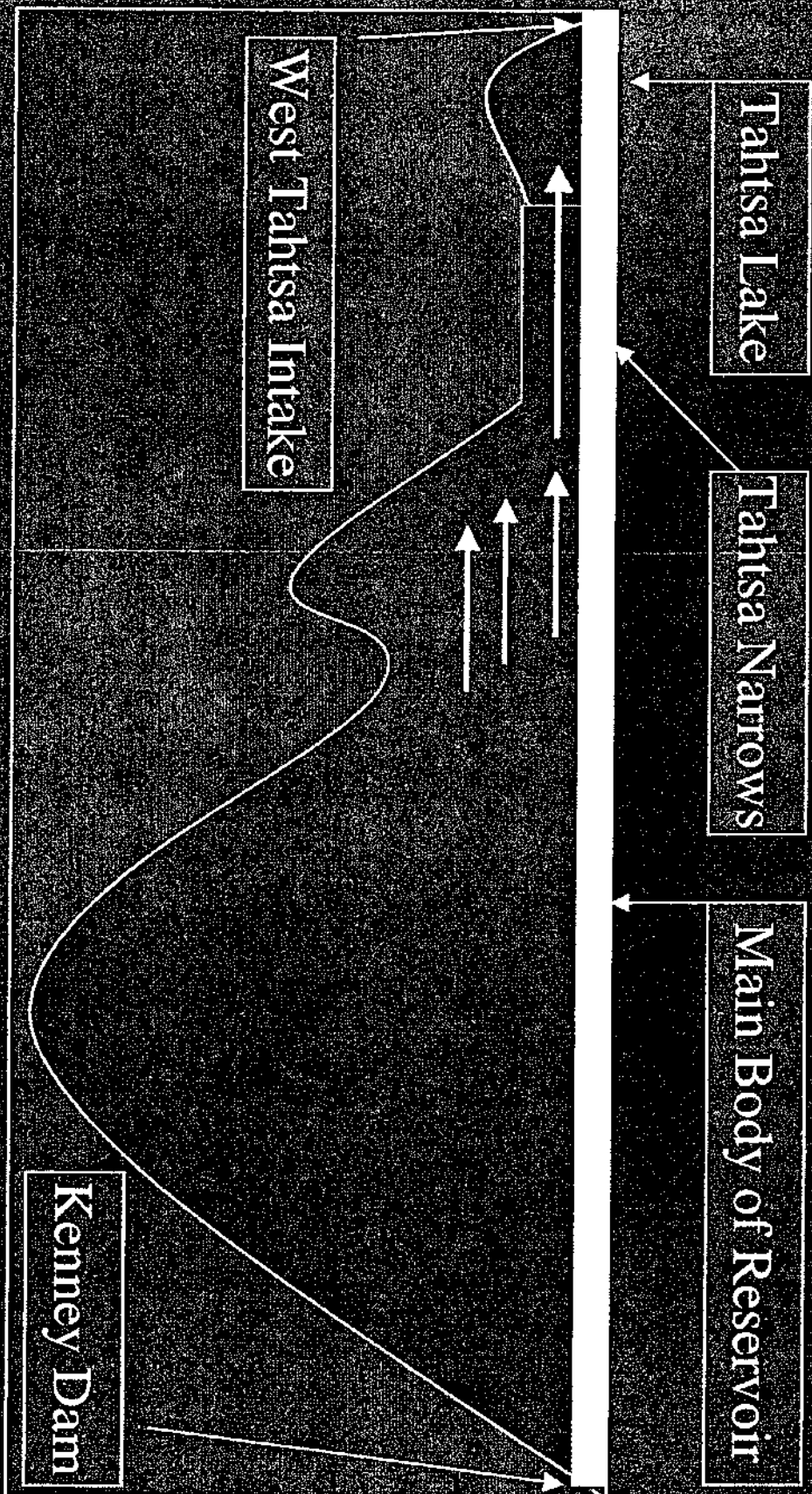
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**ALCAN**



# TAHTSA NARROWS PROJECT



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# TAHTSA NARROWS PROJECT

Tahtsa Lake

Main Body of Reservoir

Old Tahtsa Lake outlet

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# TAHTSA NARROWS PROJECT

Tahtsa Lake

Main Body of Reservoir

Up to 10 meters

Material to be removed

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# TAHTSA NARROWS PROJECT





# TAHTSA NARROWS PROJECT

## Dredging Work

- Dredge 3.3 km of the Narrows to a resultant elevation of 838 m.
- Discharge approximately 1.0 M m<sup>3</sup> of material (excluding logs and stumps) into aquatic disposal site in Tahtsa Lake.







# TAHTSA NARROWS PROJECT

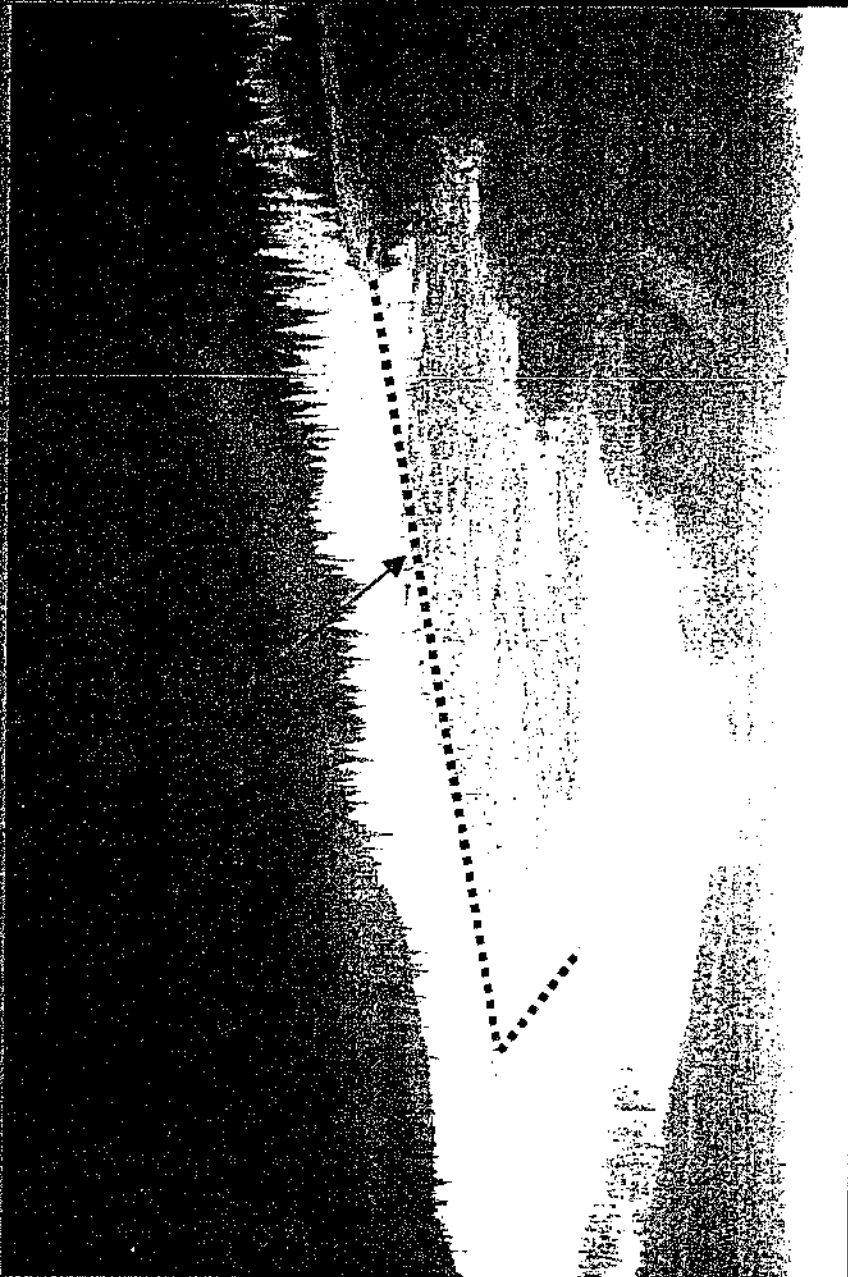
## Channel Protection

- Construction of berm at Rhine Creek.
- Construction of sediment basins on additional tributary creek outlets (2) to the Narrows.
- Coarse gravel/cobble layer on channel bottom.



# TAHTSA NARROWS PROJECT

## Berm Construction

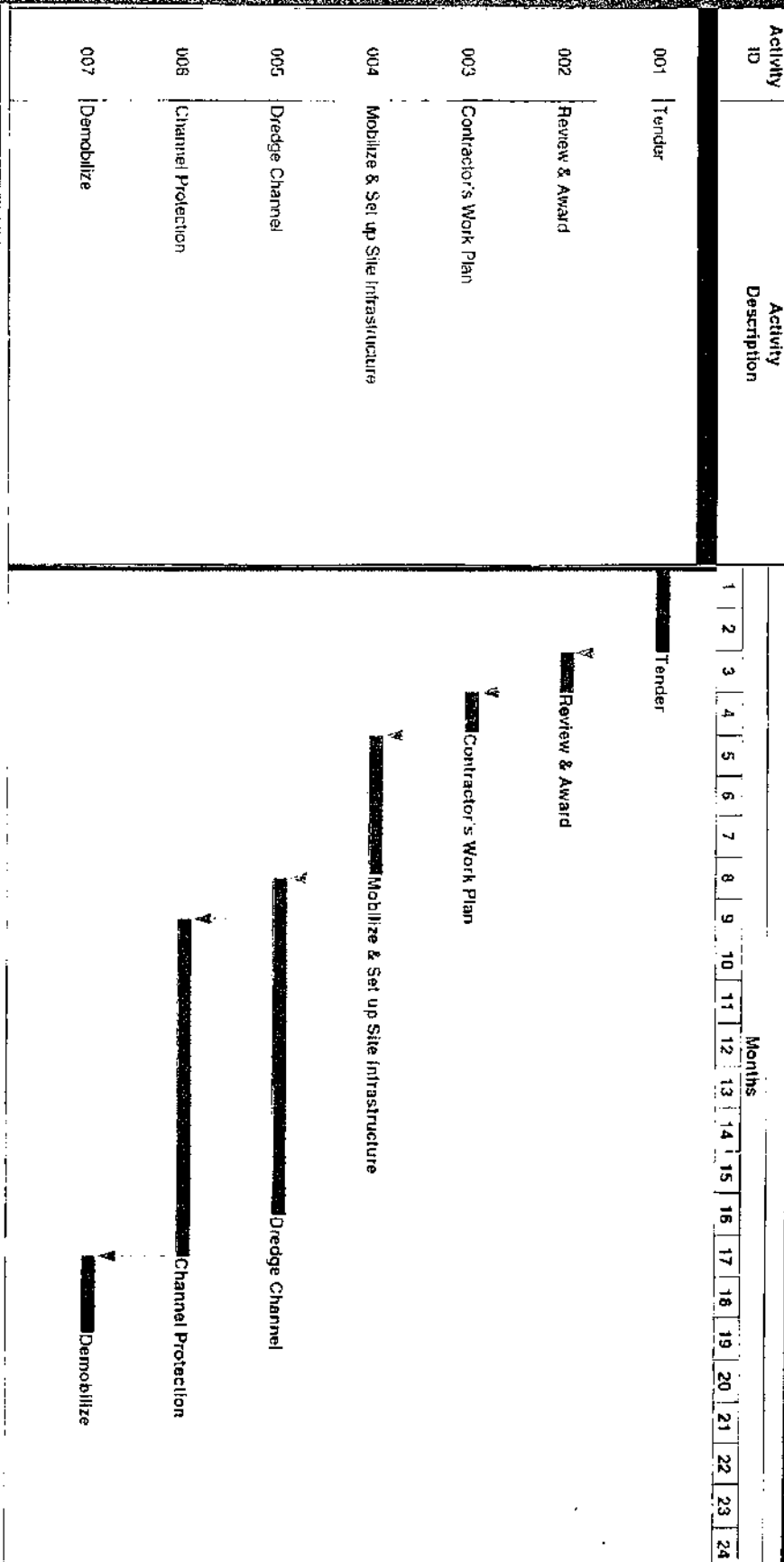


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# TAHTSA NARROWS PROJECT

## Engineering Schedule





# TAHTSA NARROWS PROJECT

## Project Footprint

- Dredged Channel – 20 ha.
- Camp, Laydown and Burning Areas – approx. 1.5 ha (at west end of Narrows)
- Length of Dredged Channel – 3.3 km





# TAHTSA NARROWS PROJECT

## Economic Information

- Est. Construction Cost      \$35 M
- Quantities  
200,000 Person-hours  
1.0 M m<sup>3</sup> Dredged Material
- Construction Camp      40-45 Person Camp



# TAHTSA NARROWS PROJECT

## TN Project - History & Legal Background

- 1950 Agreement with B.C.
  - Under the "Water Act" Alcan received Conditional Water License authorizing Alcan to use water below TN;
  - Alcan's rights under the "1950 Agreement" take precedence over future statutes of general application (e.g. BCEAA);



# TAHTSA NARROWS PROJECT

## TN Project - History & Legal Background (cont'd)

- 1987 Settlement Agreement

- ◆ Alcan's Water Licence amended - dredging of TN specifically authorized (2.4 d);
- ◆ 1989, based on TN project design for KCP, Alcan received following permits from BC:
  - ⇒ Crown Lands License of Occupation - extended in 1993 and 1998
  - ⇒ Permit under Section 9 of the Water Act - expired 1992
- ◆ "Test dredge" was carried out in 1989.





# TAHTSA NARROWS PROJECT

## TN Project - History & Legal Background (cont'd)

- 1993-94 - TN project was reviewed as part of BCUC review of KCP;  
KCP was cancelled in 1995;
- 1995 - Alcan revised the design of TN project - smaller channel;
- 1997 BC-Alcan Agreement - Alcan received Final Water License - authorization to proceed with TN project confirmed;





# TAHTSA NARROWS PROJECT

## Environmental Assessment Review Process

- BC Environmental Assessment Act (BCEAA)
- Canadian Environmental Assessment Act (CEAA)





# TAHTSA NARROWS PROJECT

## BCEAA

- Is Project grandfathered? If not:
- Is the Project reviewable under BCEAA?



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### Comments:

Attached, please find information on Tahtsa Narrows Project.

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## **TAHTSA NARROWS**

### **PROJECT DESCRIPTION**

## TABLE OF CONTENTS

<b><u>1.0</u></b>	<b><u>INTRODUCTION</u></b> .....	<b>1</b>
<b><u>1.1</u></b>	<b><u>BACKGROUND</u></b> .....	<b>1</b>
<b><u>1.2</u></b>	<b><u>PURPOSE OF THE PROJECT</u></b> .....	<b>2</b>
<b><u>1.3</u></b>	<b><u>LEGAL BACKGROUND AND PROJECT HISTORY</u></b> .....	<b>2</b>
<b><u>2.0</u></b>	<b><u>PROJECT DESCRIPTION</u></b> .....	<b>3</b>
<b><u>2.1</u></b>	<b><u>CHANNEL GEOMETRY</u></b> .....	<b>3</b>
<b><u>2.2</u></b>	<b><u>COMPOSITION OF MATERIALS TO BE DREDGED</u></b> .....	<b>3</b>
<b><u>2.3</u></b>	<b><u>PROPOSED DREDGING METHOD</u></b> .....	<b>4</b>
<b><u>2.4</u></b>	<b><u>CHANNEL ARMOURING</u></b> .....	<b>4</b>
<b><u>2.5</u></b>	<b><u>TRIBUTARY OUTLETS</u></b> .....	<b>4</b>
<b><u>2.5.1</u></b>	<b><u>Rhine Creek Berm</u></b> .....	<b>4</b>
<b><u>2.5.2</u></b>	<b><u>South Bank Tributaries</u></b> .....	<b>5</b>
<b><u>2.6</u></b>	<b><u>DREDGEATE DISPOSAL</u></b> .....	<b>5</b>
<b><u>2.6.1</u></b>	<b><u>Timber Disposal</u></b> .....	<b>5</b>
<b><u>2.6.2</u></b>	<b><u>Tahtsa Lake Disposal</u></b> .....	<b>5</b>
<b><u>2.7</u></b>	<b><u>PROJECT SCHEDULE</u></b> .....	<b>6</b>
<b><u>2.7.1</u></b>	<b><u>Project Initiation</u></b> .....	<b>6</b>



## 1.0 INTRODUCTION

The purpose of this document is to provide background information and to describe the Tahtsa Narrows Project. This information will be of use to regulatory agencies, First Nations and the public in their review of the proposed project.

### 1.1 Background

In 1952, as part of Kitimat-Kemano project, Alcan created the Nechako Reservoir with the construction of Kenney Dam in the Grand Canyon of the Nechako River. The dam impounded water and flooded a chain of lakes in the Nechako River valley up to and including Tahtsa Lake (see Figure 1). The valley was flooded to a depth of (?) as much as 100 m near the dam, and as little as 1.7 m on Tahtsa Lake at the upper end of the watershed.

Before the construction of Kenney Dam, natural flows would have passed out of Tahtsa Lake and down the Tahtsa River to Ootsa Lake. The power development reversed the flow of water through Tahtsa Lake, diverting water through the power tunnel from West Tahtsa to the powerhouse at Kemano.

Nechako Reservoir is a multi-purpose water storage facility. In addition to providing water for the powerhouse in Kemano, the reservoir provides continuous releases of water for the protection of fish resources in the Nechako River. This water is released by Alcan through Skins Lake Spillway under the provisions of the 1987 Settlement Agreement signed by Alcan, the federal government and the Provincial government. These releases take precedence over flows available for power generation. As well, the reservoir storage provides attenuation of large reservoir inflows. Finally, the reservoir is a source for domestic and industrial water supplies for enterprises around the reservoir.

The water level of the reservoir currently fluctuates over a range of about 1.5 m annually. Typically, the peak level is reached in July at the end of annual freshet and the minimum level is reached at the end of April before the start of the snow melt. The lowest historic level of the reservoir was about 3.9 m below the maximum normal reservoir level (853.44 m). This maximum drawdown took place over several years of operation. Current reservoir levels are at historic lows for this time of the year - approximately 850.1 meters and could decrease to about 849.5 m by late April, 2001.

Tahtsa Narrows (Figure 1) is a natural restriction in the Nechako reservoir. It divides the reservoir water storage into two parts. About 7% of the total storage is to the west of the Narrows and the remaining 93% is to the east of the Narrows.

To use the stored water for power generation, the water has to pass through Tahtsa Narrows to reach the intake at West Tahtsa. At the current reservoir operating levels, Tahtsa Narrows becomes an hydraulic constriction. That is, water depths decrease and velocities within the Narrows increase sufficiently such that the head losses through the channel restrict the quantity of water that can be passed to the intake.

## 1.2 Purpose of the Project

The Nechako Reservoir has experienced three consecutive years of low inflows. This has resulted in historic low reservoir levels. In order to be able to continue to supply water to the Kemano powerhouse, needed to operate the Kitimat smelter at full capacity and to store and release water from the reservoir for protection of fisheries resources in the Nechako River, Alcan is proposing to dredge the old riverbed at the outlet of Tahtsa Lake to increase the depth of the channel. This would not be the first time dredging has been undertaken at the outlet of Tahtsa Lake. In 1969, Eurocan Pulp and Paper dredged a 500 m long by 70 m wide section of the Narrows to elevation 847.5 to improve navigation for log booms.

## 1.3 Legal Background and Project History

In 1950, Alcan and the B.C. government entered an agreement where-under the Water Act, Alcan received a Conditional Water Licence, authorizing the company to store and divert water for power generation to a total volume of 7,100 million m<sup>3</sup>. This total volume includes water below the bed level of Tahtsa Narrows. In the 1987 Settlement Agreement between Canada, B.C. and Alcan, the Conditional Water Licence was amended – specifically authorizing the dredging of Tahtsa Narrows (Settlement Agreement, clause 2.4 d, 1987).

For construction of the Tahtsa Narrows Project, the following permits were obtained in 1989:

- Crown Lands Licence of Occupation;
- Permit under Section 9 of the Water Act;
- Exemption under Section 5(2) of the Navigable Waters Protection Act.

Test dredging was carried out in the Narrows in October 1989 in order to confirm geotechnical investigations, selection of dredging equipment and environmental aspects of the proposed project.

In 1993-94, the Tahtsa Narrows project underwent review as part of the British Columbia Utilities Commission (BCUC) hearings for KCP. Following the BCUC hearings, the KCP was cancelled in 1995 and the urgency to dredge Tahtsa Narrows decreased. However, the long-term need for dredging Tahtsa Narrows continued and the design was finalized in 1997.

When Alcan and the B.C. Government signed the 1997 Agreement, Alcan received a Final Water Licence, in which authorization for the Tahtsa Narrows project was reconfirmed.

## **2.0 PROJECT DESCRIPTION**

### **2.1 Channel Geometry**

The dredged channel will extend 3.3 km eastward from the outlet of Tahtsa Lake. The channel will be dredged to an invert elevation of 838 m, with a maximum invert width of 10 m.

The project design includes the dredging of up to a local maximum of 10 metres (a volume of approx. 1,000,000 m<sup>3</sup>) of sand and gravel (and some silts and clays) from the natural channel between Tahtsa Lake and Tahtsa Reach. These materials would be deposited at a disposal site in Tahtsa Lake, approximately 500 m west of the Narrows to a maximum elevation of 823 m, 30 meters below the maximum normal operating level. The maximum depth of the disposal area is 70 m below maximum normal operating level.

To provide appropriate factors of safety, the side slopes of the western portion of the channel would be 3.5H:1V and those at the eastern end of the channel would be 3H:1V (Klohn-Crippen, 1997). In addition, the bottom of the dredged channel (at elevation 838 m) would be armoured with a layer of gravel and cobbles to limit erosion following construction. The disposal area would not be armoured as the maximum elevation of the disposal site has been selected to eliminate concerns regarding the effects of wave action on the deposited materials.

### **2.2 Composition of Materials to be Dredged**

Geotechnical investigations were carried out in Tahtsa Narrows and vicinity in 1979, 1980, 1988 and 1989. These programs identified the existing bed and bank material as sand, gravel and cobbles underlain by sand. Soft to firm silt and clay were encountered at or just below the proposed channel invert elevation. The following lists further details of the different sediment deposits, starting from the surface (Klohn-Crippen, 1997 and unpublished 1999 data):

- Organics, tree stumps and silt – ranges in thickness up to 1.2 m. Volume of material to be removed is about 145,000 m<sup>3</sup>.
- Sand, gravel and cobbles – this deposit is found throughout the Narrows and ranges in thickness from 5 m to 10 m. Volume of material to be removed is about 574,000 m<sup>3</sup>.
- Sand – this layer is about 5 m thick, existing below the sand, gravel and cobble layer. It is medium to coarse grained and generally becomes siltier with depth. Volume of material to be removed is about 296,000 m<sup>3</sup>.
- Clay/silt/sand – this deposit consists of varved and interbedded silty clay, silt and fine sand, and is generally present throughout the Narrows. From geotechnical investigations, it is indicated that, along the proposed channel, the top level of this layer is located at an approximate elevation of 835 m to 840 m. Volume of material to be removed is about 3,000 m<sup>3</sup>.

- Bedrock -- seismic refraction surveys in the area of proposed dredging suggest that bedrock is as deep as 40 m below existing ground elevation on the north bank and to greater than 130 m below existing ground level on the South bank.

The total volume of material to be dredged is about 1,000,000 m<sup>3</sup>, of which approximately 6% is silt.

### **2.3 Proposed Dredging Method**

The proposed dredging will be completed using a clamshell dredge. Clamshell dredging involves the excavation of materials from the bottom of the Narrows with a large crane-operated clam shell excavator that fills the excavation "bucket" on the bottom of the channel and then lifts the bucket to the surface and places the material in a bottom dump barge. When full, the barge would be towed to the disposal site and emptied.

### **2.4 Channel Armouring**

To forestall potential erosion in areas of exposed sand, a 500 mm thick blanket of the natural sand and gravel and cobble material excavated from the channel will be replaced on the side slopes and the invert. This blanket is to be placed by clamshell to avoid segregation. The layer will protect the channel for velocities up to 1.5 m/s, the anticipated flow velocities in the Narrows (Klohn-Crippen, 1997).

### **2.5 Tributary Outlets**

#### **2.5.1 Rhine Creek Berm**

Large discharges in Rhine Creek occurring when the reservoir is at lower elevations would result in erosion of the excavated channel banks. The larger discharges would also transport quantities of sediment that would eventually fill in the excavated channel. Sediment infill must be prevented; however, access to Rhine Creek must be maintained at all reservoir levels for migrating fish.

To satisfy the above requirements, a 1.2 km long berm will be constructed along the edge of the existing Rhine Creek delta. The berm has been positioned to minimize erosion from Rhine Creek and still be a minimum of 50 m from the top of the Tahtsa Narrows channel cut. At this distance, the berm does not influence the channel side slope stability.

When the reservoir is at low levels, the berm will divert Rhine Creek flow to the east while maintaining a shallow gradient allowing fish access. The berm crest width has been set at 25 m to minimize seepage gradients and reduce the risk of piping. The 25 m width includes an 8-m-wide zone of coarser material on the northern slope. This zone will serve as an erosion zone to protect the berm from Rhine Creek flows.

The berm crest elevation has been set at El. 852.5m for the western leg, and El. 851.50 m for the eastern leg. The south slope has been set at 4H:1V for stability purposes, and the north slope has been set at repose. The southern slope and the southern 17 m width of the

berm crest is to be constructed from the dredged sand, gravel and cobbles that are also to be used for armouring portions of the channel. The northern slope and remaining 8 m width of crest is to be constructed from dredged, well-graded sand, gravel and cobbles. The berm will require about 150 000 m<sup>3</sup> of fill material.

Berm islands with markers are to be constructed at each end of the berm and at the intersection of the western and eastern legs to aid navigation and meet the requirements of the Canadian Coast Guard.

When the reservoir is at high levels, Rhine Creek will deposit sediment across the delta behind the berm. This material will eventually fill in the area behind the berm and require removal. The area will be inspected annually to monitor the amount of infill. The frequency of removal will be determined by experience. Material can be removed by drag line equipment operating from the berm crest when the reservoir is below El. 851.5 m, and conveyed by barge to the underwater disposal site in Tahtsa Lake (see section 2.6). The timing of removal operations will comply with agency requirements for instream work.

#### 2.5.2 South Bank Tributaries

Two of the four tributaries entering Tahtsa Narrows from the south are expected to transport sediment into and cause erosion of the excavated channel, similar to, but on a much smaller scale than Rhine Creek. A small sediment basin is to be excavated at the mouth of each creek to minimize these effects. Each basin or creek outlet is to have a 30 m long by 20 m wide invert, at El. 844.0 m and side slopes of 3.5H:1V.

The locations of the creek outlet sediment basins are to be adjusted during construction, as required to coincide with local low topography.

Periodic maintenance and sediment removal from the sediment basins will be required. The creeks will be inspected annually to monitor the amount of infill. The frequency of removal will be determined by experience. Removed material could be deposited in the disposal area in Tahtsa Lake (see section 2.6).

### **2.6 Dredgeate Disposal**

#### 2.6.1 Timber Disposal

All trees, stumps and other excavated organic debris which are positively buoyant will be collected and disposed of at the land disposal site near the eastern end of Tahtsa Lake on the north side. The site will be approximately 0.5 ha in area.

#### 2.6.2 Tahtsa Lake Disposal

A disposal site is proposed in deep water in Tahtsa Lake at a distance of about 500 m from the western end of the channel. The site was previously approved by the Ministry of Environment, Lands and Parks (Water Management Branch) in 1989. It is proposed that the dredgeate be disposed of at least 30 m below maximum normal reservoir level.

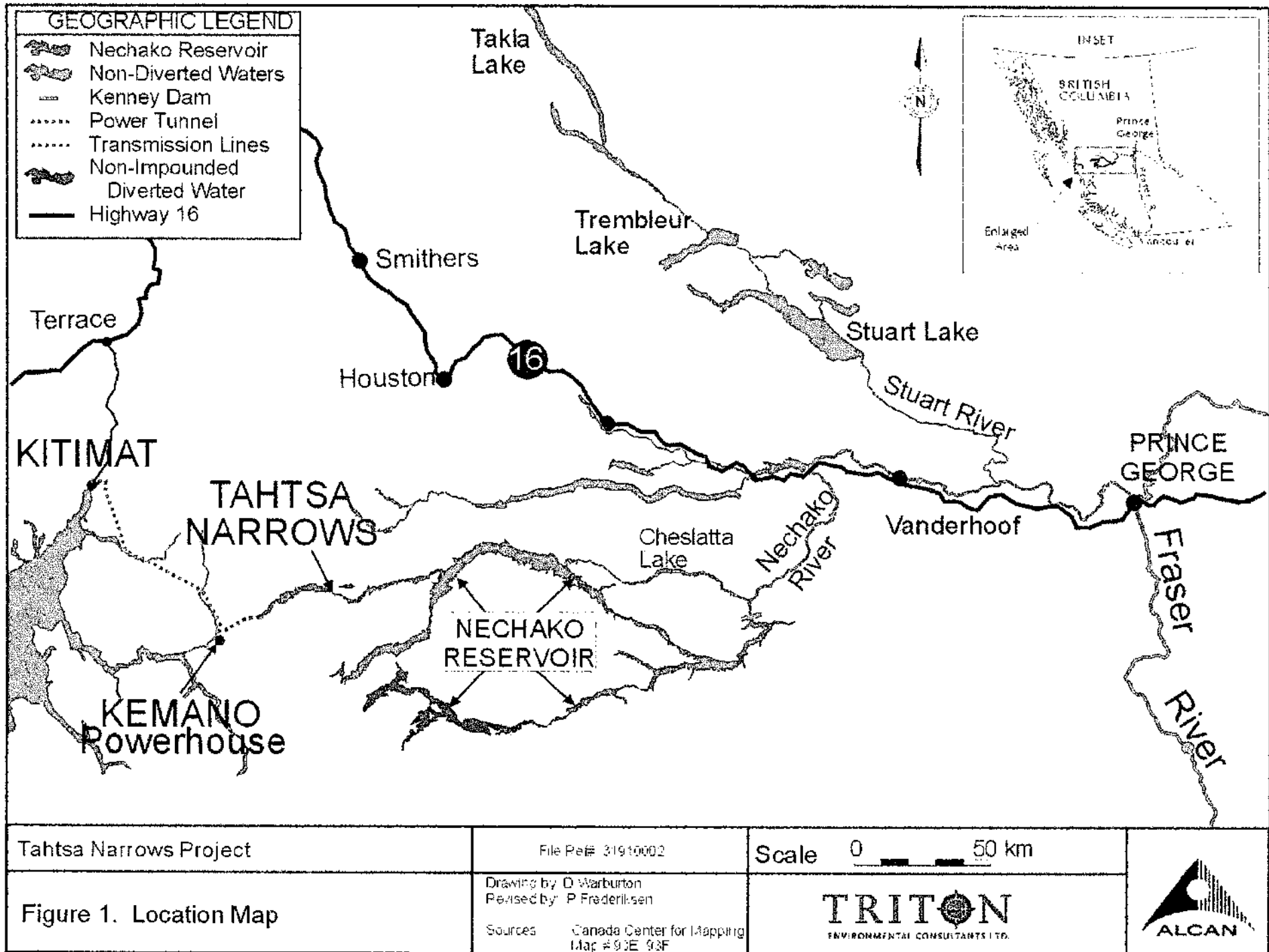


## **2.7 Project Schedule**

Because of the historically low reservoir levels, this project is urgent in order for Alcan to continue generating power for the smelter in Kitimat while providing water for fish protection in the Nechako River. The project will take place over a period of approximately 18 months (through one winter). Alcan anticipates that it will be able to commence dredging of the Narrows in the summer of 2001.

### **2.7.1 Project Initiation**

The environmental review process was initiated in December 2000 and will continue into Q1/2001, with discussions with regulatory agencies and public and First Nation consultations. Environmental permitting issues will also be discussed with regulatory agencies at this time.



Page 45 to/à Page 59

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**Facsimile Cover Sheet**

<b>Date:</b>	January 3, 2001
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**Comments:**

Attached, please find documentation regarding Alcan - December 20, 2000 letter with attachments.

Page 61 to/à Page 67

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