INNAVIK HYDROELECTRIC PROJECT
INUKJUAK RIVER

SUMMARY OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

February 2010

Pituvik Landholding Corporation

Innavik Hydroelectric Project

Summary of the Environmental and Social Impact Assessment

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1. CONTEXT AND JUSTIFICATION OF THE PROJECT

1.1 PROJECT PROMOTER

The promoter of the project is the Pituvik Landholding Corporation (PLC). Incorporated in 1979, the PLC holds the titles to all Category 1 lands associated with the village of Inukjuak and ensures its management on behalf of its beneficiaries. The corporation is a non-profit organization and is defined in Ch. 7 of the *Convention de la Baie James et du Nord québecois* and by the *Loi sur le régime des terres and les territoires de la Baie-James et du Nouveau-Brunswick*.

The PLC also holds the titles to Category 2 lands, as defined in Ch. 4 of the *Convention de la Baie James et du Nord québecois*. Due to this convention, Inuits have the exclusive right to hunt and fish on territory under their administration.

The Environmental Impact Assessment is presented by:

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Person in charge of the Environmental and Social Impact Assessment:	Mr. Éric McNeil

78°10'
78°5'
78°0'
77°55'
77°50'
58°30'
58°25'

Lake Innaarulik
Lake Tasialuk
Lake Qikirtalik
Lake Akullipaaq
Lake Tasiq Tullipaaq
Lake Tikiraaluk
Lake Inussualuk
Small Inussualuk Lake
Lake Qattaakuluup Tasinga
Lake Quurmgulik
Lake Kapisililiapik Anginirsaq
Lake Quurmguup Tasialunga
Lake Matjujuartalik
Lake Tasikallaapik

River
Kongut River
Kuugajaaraaluk Stream
Qallunaaq Mouth
Hopewell Sound

KP 10.3
KP 13.3
KP 7.3
KP 3.7

Inukjuak
Airport
Landing

Category I lands – Inuits
Category II lands – Inuits
Kilometer point of the river
Existing road
Existing ATV trail

Innavik Hydroelectric Project

Limits and Extent of Category I and II Lands near the Village of Inukjuak

February 2010

Sources:

Bases: NTDB, 1:50,000, 2005
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BDGA, 1:1,000,000, 2002
MRN, Québec

Mapping: Carto-Média
File : CM_1843_022_f1-1_100305.mxd

0 0.6 1.2 km
MTM, Zone 10, NAD83
Contour line equidistance: 10 m

Figure 1.1

Prepared by:
ENVIRONNEMENT ILLIMITÉ INC.
RSW Inc.

1.2 CONTEXT AND PURPOSE OF THE PROJECT

Due to its remote location in Northern Quebec, Inukjuak is not connected with the province's main energy distribution grid. Similarly to other villages in Nunavik, electrical energy is provided by diesel-powered plants, operated by Hydro-Québec Distribution's Isolate Grid subdivision. North of the 53rd parallel, a prohibitive rate is applied to electricity in order to limit its use to basic needs, thus favouring the use of fuel-oil to heat living spaces and water. A compensation program for the price of fuel-oil is established in order to ensure a just economic treatment for clients that are not subject to the regular rate which is offered south of latitude 53.

Hydro-Québec Distribution mentions in its *Plan d'approvisionnement 2005-2014 des réseaux autonomes*, presented to the *Régie de l'énergie du Québec*, that alternatives to thermal electrical production must be examined in order to respond to the energy demands of isolated grids particularly due to the foreseeable increase in the price of hydrocarbon fuels. The main ways of attaining this include the development of renewable energy projects (wind power, hydro power, etc.) as alternatives to or complementary sources of energy to existing thermal power plants as well as the connection of isolated grids to the main Hydro-Québec network.

The development of the project will induce a reduction in energy production costs while reducing greenhouse gas emissions. Furthermore, revenues generated from the operation of the power plant will allow the population of Inukjuak to accelerate their economic development by enabling the completion of various community projects, such as, for example, the setting up of a support center for new local companies.

The population of Inukjuak was invited to participate in a contest in which they were asked to find a name for the project. The name *Innavik,* the Inuktituk word meaning "a pouch in which one would keep a stone flint and moss to start a fire", was selected to this end.

In May 2009, an internet site was launched in order to provide information on the project. The site is updated regularly to reflect the completion of project milestones. The site is located at the following url: www.innavik.com.

2. STUDY AREAS AND GENERAL DESCRIPTION OF THE ENVIRONMENT

2.1 STUDY AREAS

The collection of data and evaluation of impacts of a project relies on the definition of two study areas: the Regional Study Area and the Local Study Area. Their boundaries are selected in such a way so as to include all the components of the environment that are likely to be affected during different stages of the project's development.

Due to the very nature of the project, the majority of issues related to its integration into the human environment were considered for the community of Inukjuak, however, certain aspects were found to affect Nunavik as a whole. As a result, the Regional Study Area for this project corresponds to this administrative region (Figure 2.1).

The Local Study Area, whose boundaries are presented in Figure 2.2, was selected in order to encompass all elements of the environment that are likely to be affected during the construction and operational phases of the project. This study area is centered along the Inukjuak river, is 4 km wide and extends from the river's mouth at Hudson's Bay to the upstream-most extremity of Lake Qattaakuluup Tasinga.

2.2 PHYSICAL ENVIRONMENT

The source of the Inukjuak river is located in the hilly terrain of the Canadian Shield. The river travels 300 km from its source before reaching Hudson's Bay, next to the village of Inukjuak.

The Inukjuak river is responsible for draining an estimated 11370 km^2 of land. Along its path, the river is divided by several lakes which include Lake Qattaakuluup Tasinga, located approximately 13 km upstream from the river's mouth. Between this lake and the river's mouth, the longitudinal profile of the Inukjuak river is characterized by several sections of rapids which are separated by relatively long lentic reaches. The mean annual discharge of the river is estimated at 100 m^3/s at its mouth. The downstream segment of the river is affected by tides, which travel 2 km upstream from the mouth and whose progress is limited by a section of rapids.

The village of Inukjuak is located in the tectonic province of Lake Superior in which the geology is dominated by the Minto block. The block extends over an area of 250000 km^2 and is divided into six domains. The Inukjuak domain is located at the western extremity of the province and is home to a rare Achaean geology which contains a belt of greenstone termed the Nuvvuagittuq Belt. False amphiboles, the oldest found on Earth to date, were found in this belt, approximately 40 km south of the village. The age of these rocks is estimated at 4.28 billion years.

Innavik Hydroelectric Project

Regional Study Area

Sources:

February 2010

Base: BDGA, 1:5,000,000, MRN Québec, 2001

Mapping: Carto-Média
File: CM_1843_028_f2-1_100305.mxd

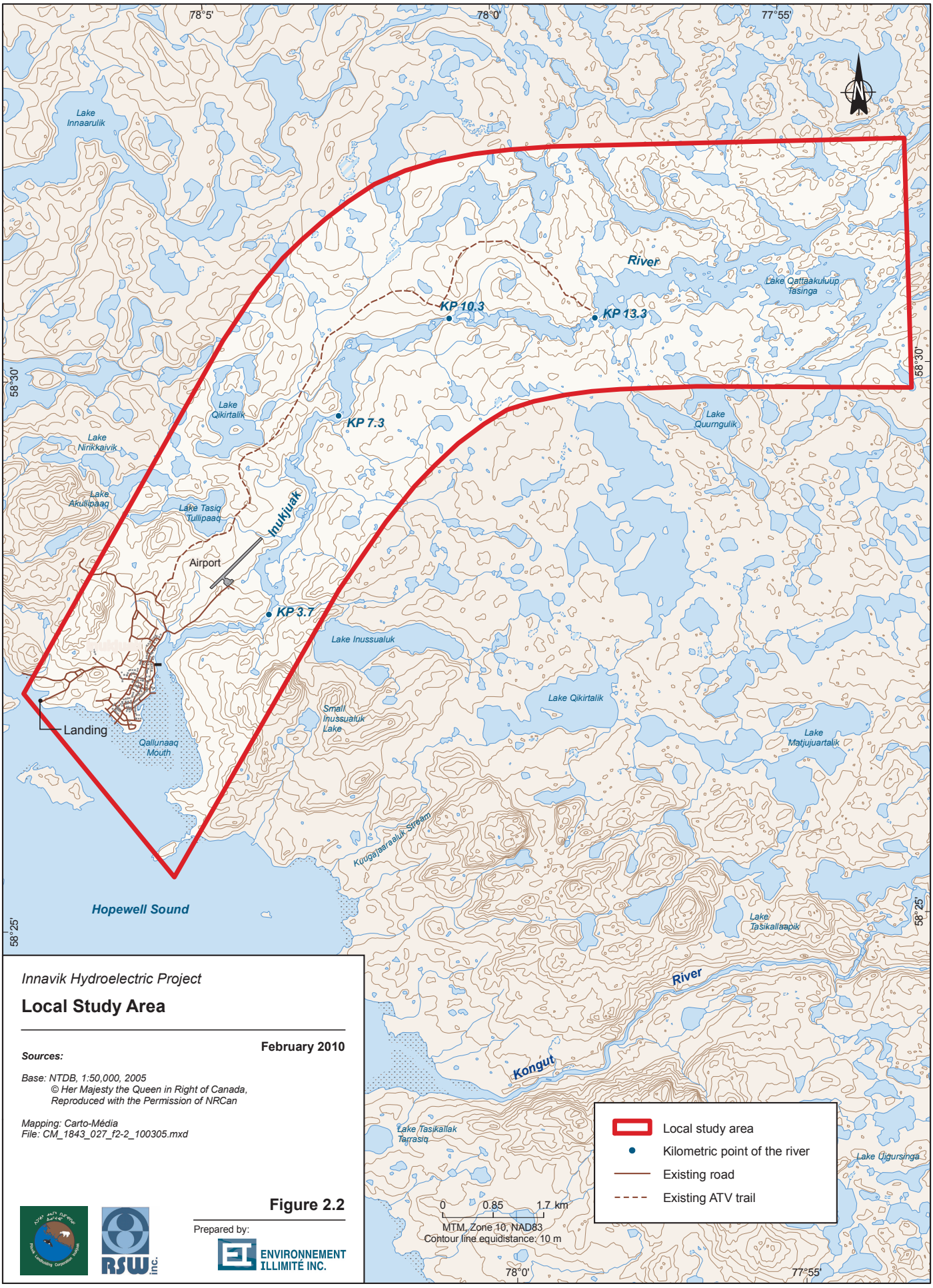
0 95 190 km

Lambert, NAD83

Figure 2.1

Prepared by:

ENVIRONNEMENT ILLIMITÉ INC.



Innavik Hydroelectric Project

Local Study Area

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Sources:

Base: NTDB, 1:50,000, 2005
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Mapping: Carto-Média
File: CM_1843_027_f2-2_100305.mxd

Figure 2.2

Prepared by:

ENVIRONNEMENT ILLIMITÉ INC.

The Wisconsin deglaciation and Tyrrellian transgression left a multitude of visible deposits over the land. The retreat of the inlandsis is estimated at approximately 8000 B.P. Its retreat created the Tyrrell Sea which submerged coastal lands up to an elevation of 190 m.

The climate of Inukjuak is typical of climates found in Northern Quebec. The mean annual temperature is below the freezing mark and is approximately -7 °C. During the summer, the temperature for the months of July and August averages at 9 °C however, in winter, the temperature for the months of January and February is -25 °C. On average, temperatures are below 0 °C 253 days per year. Precipitation in the form of rain can fall between the months of April and November with the most abundant rainfall occurring during the months of July, August and September. However, given the villages northern location, snowfall can occur throughout the year. Generally, this form of precipitation occurs most abundantly during the months of October, November and December with average amounts equal to 33 cm, 50 cm and 30 cm respectively. The river generally begins to freeze over in November and a stable ice cover remains present until the end of May.

2.3 BIOLOGICAL ENVIRONMENT

Inukjuak is located 140 km north of the tree line in the arctic vegetation zone, an area painted with a tundra landscape containing heath, mosses, lichens, grasses and shrubs (ericaceae, willows and birch). Generally, this bioclimatic domain extends from the 58th to the 61st parallel, however, along the eastern coast of Hudson's Bay, this type of climate has been found to descend south as far as the 56th parallel (MRNF, 2003). The absence of larger vegetal specie varieties is primarily due to poor soil conditions (acidic and low in mineral content), the presence of permafrost, short frost-free seasons (average of 40 days), short growing seasons (80 days), short flowering seasons, and the continual presence of cold and dry winds.

Experimental fishing was conducted at the beginning of the fall 2008 season in order to determine the composition of the Inukjuak river's fish population. In all, 10 different species of fish were observed and include: brook trout, lake charr, landlocked salmon, lake whitefish, round whitefish, shallowwater cisco, burbot, longnose sucker, threespine stickleback and lake chub. Brook trout and longnose sucker were found to be the most abundant species in the study area.

The substrate on the river bed is mostly composed of bedrock, cobbles and boulders. Furthermore, several sets of rapids deemed to large for fish to pass are located along the river's length.

Past inventories of bird populations in northern Quebec helped to determine the distribution of bird species near Inukjuak. The most significant work on this subject was published by Todd (1980) and is called "Birds of the Labrador Peninsula and Adjacent Areas, a Distributional List". The work describes 25 separate expeditions which occurred between the years 1901 and 1958 which were lead by the Carnegie Museum of Pittsburgh. Of particular interest are the inventories that were performed during the 1930's on the coast of Hudson's Bay. Since then, further studies have been performed by Godfrey (1986) who presented the distribution of birds in Canada and Gauthier and Aubry (1995) who presented the distribution of birds which nest in Quebec, 50 or so species of which nest in the Ungava peninsula above the tree line. According to these studies, the most abundant and most representative bird species of the region are the: Canada goose, oldsquaw, rough-legged hawk, gyrfalcon, rock ptarmigan, willow ptarmigan, snowy owl, American tree sparrow, white-crowned sparrow, lapland longspur and common redpoll.

A review of the literature regarding the distribution and composition of terrestrial mammals in Quebec (Desrosiers et al. 2002, Environment Canada 2009, MRNF 2009, Prescott and Richard 1982) permits the identification of 20 species that inhabit the Ungava peninsula. These include five large species of mammals (caribou, muskox, polar bear, black bear and gray wolf), eight medium-sized mammal species (two types of hare, one type of erethizontidae, two types of canines and four types of mustelidae) and eight small-sized mammal species (three types of soricidae and five types of cricetidae). The most abundant and representative species of the Ungava peninsula are the caribou, arctic fox, arctic hare and the Ungava collared lemming.

2.4 HUMAN ENVIRONMENT

The village of Inukjuak is located in the administrative region of Nunavik of the province of Quebec. This region encompasses 14 Inuit communities: Kuujjuak, Inukjuak, Salluit, Puvirnituq, Ivujivik, Kangiqsujuaq, Kangiqsualujjuaq, Kangirsuk, Tasiujaq, Aupaluk, Akulivik, Quaqtaq and Imiujaq. Nunavik has a total population of 11627 of which 90 % are of Inuit origin (2006 Census). The region's administrative capital is located at Kuujjuak.

Inukjuak is located on the coast of Hudson's Bay and has a population of 1597 (2006 Census). The village includes approximately 350 private dwelling spaces as well as basic services such as a post office, an RCMP station, a health clinic, a school and a food cooperative.

The active population of the village was evaluated at 500 persons in 2006 (Statistics Canada), of which 25 % work in social and health services and 25 % in education. The retail trade adds another 50 jobs. According to Statistics Canada, the participation and employment rates are 53 % and 47 % respectively and the unemployment rate is 13 %.

3. PROJECT DESCRIPTION

3.1 SITE SELECTION

A total of five sites on two different rivers (Kongut and Inukjuak) were identified during a site visit in July 2007. Figure 3.1 presents their locations with respect to the village of Inukjuak. Each site was compared by calculating its energy potential, estimating the construction costs associated with its development and by identifying its main environmental issues. Based on these criteria, it was found that Site I3 corresponds to the optimal location for development as it has the highest potential and lowest construction costs of any of the identified sites.

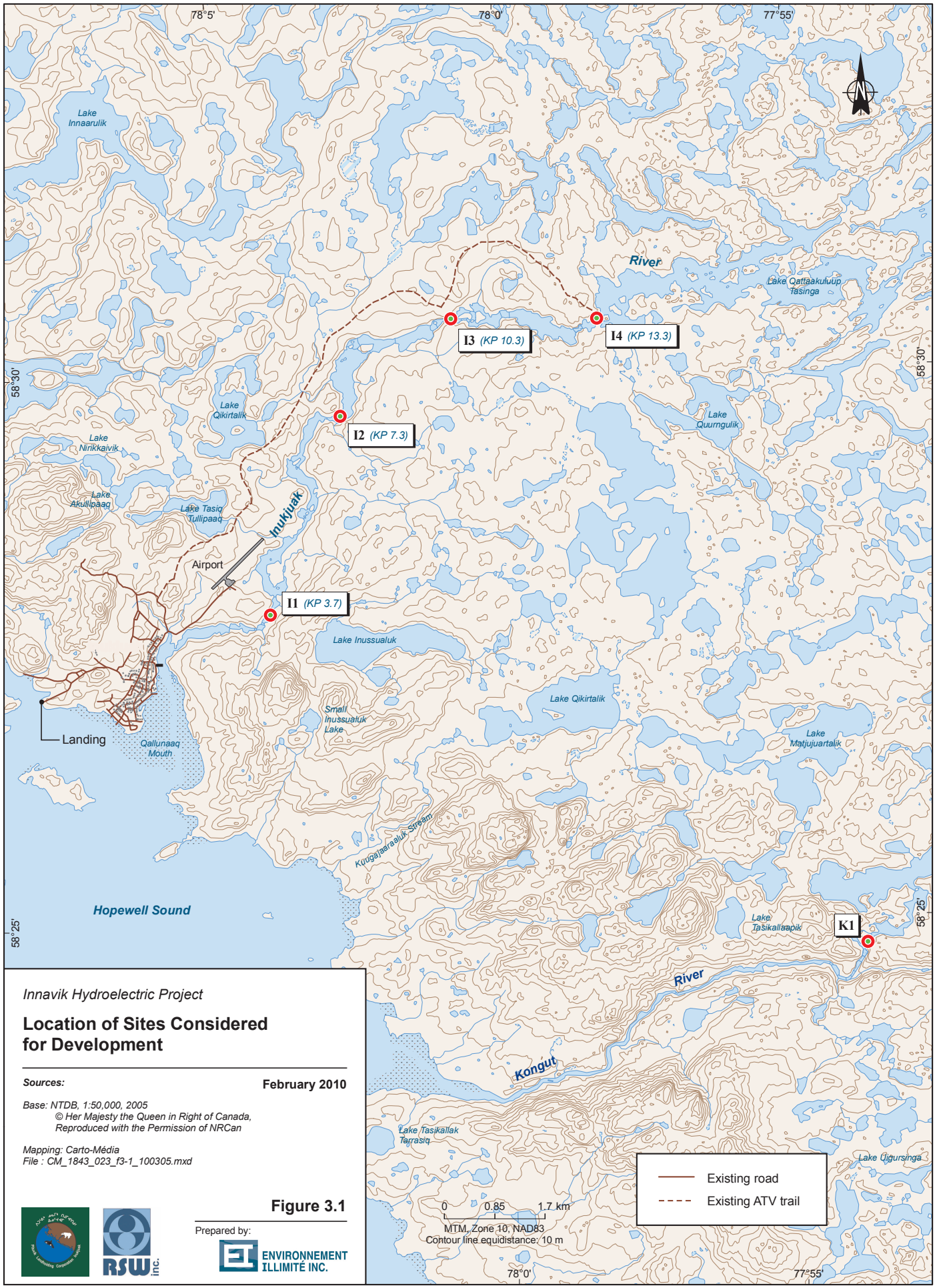
Figure 3.2 presents the main components of the project, both during the construction phase and during the operational phase. Special care was taken during the feasibility phase to design the works using an integrated approach in which the mitigation of environmental impacts was addressed from the earliest stages of the project. The following sections detail the main components of the planned hydroelectric installation.

3.2 DESCRIPTION OF THE SELECTED ALTERNATIVE

3.2.1 Spillway-dam

The spillway-dam will be constructed in roller-compacted concrete (RCC) and would be located directly upstream of the Katattukallak rapids, the largest rapids of Site I3.

As seen in Plate C10 (Appendix A), the upstream face of the spillway-dam is vertical up to an elevation of 42 m; 2 m lower than the minimum water level of the headpond. At higher elevations, the upstream face is inclined at an angle of 30° up to the crest of the dam or spillway, which helps to diminish ice loads on the structure. Due to the additional loading at this location, the crest cap will be constructed in 35 MPa conventional concrete rather than RCC. The downstream face of the structure consists in an inclined stepped surface of 1:1 slope. Each step is to measure 0.6 x 0.6 m, due primarily to the successive layering of RCC which results from its particular construction method.



Innavik Hydroelectric Project

Location of Sites Considered for Development

Sources:

February 2010

Base: NTDB, 1:50,000, 2005
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Mapping: Carto-Média
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Figure 3.1

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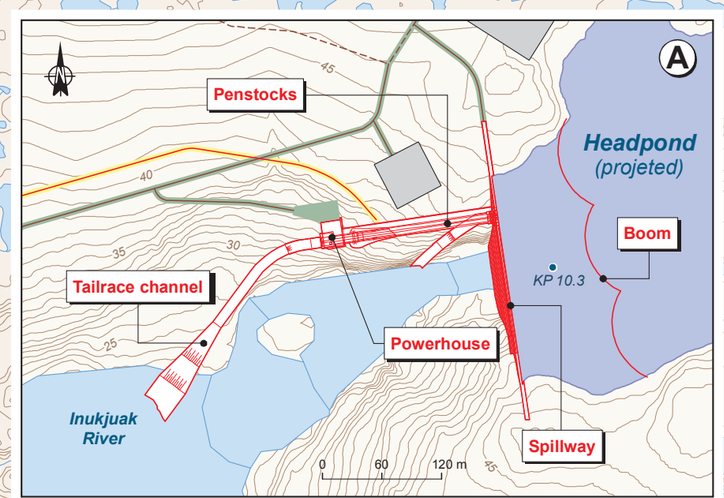
78°10'
78°5'
78°0'
77°55'
77°50'
58°30'
58°25'

Lake Innaarulik
Lake Tikiraaluk
Lake Tasialuk
Qallunaaq Mouth
Lake Inussualuk
Small Inussualuk Lake
Lake Qikirtalik
River
Lake Qattaakuluup Tasinga
Innavik HEP (projected)
KP 10.3
KP 13.3
A Headpond (projected)
Bridge
Lake Qikirtalik
KP 7.3
Lake Akullipaaq
Lake Tasiq Tullipaaq
Inukjuak
Airport
Projected bridge
KP 3.7
Inukjuak
Landing
Kuugajaaraaluk Stream
Hopewell Sound
Lake Kapisiliiapik Anginirsaq
Lake Quurnguup Tasialunga
Kongut River
Lake Tasikallaapik

- Existing road
- Projected access road
- Existing ATV trail to be upgraded as access road
- Existing ATV trail
- Projected transmission line
- Projected permanent work
- Kilometer point of the river



Innavik Hydroelectric Project

Planned Works

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Sources:

Base: NTDB, 1:50,000, 2005
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Mapping: Carto-Média
File : CM_1843_024_f3-2_100305.mxd

0 0.6 1.2 km

MTM, Zone 10, NAD83
Elevation contour equidistance: 10 m

Figure 3.2

Prepared by:
ENVIRONNEMENT ILLIMITÉ INC.
RSW inc.

The middle section of the structure consists in an overflow spillway, 130 m long with a crest elevation of 44.0 m. All river discharge not used for energy generation will flow through this section.

3.2.2 Powerhouse

The generating station will house two Saxo-type turbines, each rated for a 20 m^3/s discharge. As a result, the hydroelectric project would have a nominal capacity of 8.0 MW.

3.2.3 Intake Channel

The intake channel will be constructed in the same channel used for the diversion works of the project and would be excavated in the rock over an approximate length of 80 m with a 10 m width (Plate C06, Appendix A).

3.2.4 Intake Structure

The intake structure (Plates C08 and C09 of Appendix A) will be constructed over the concrete slab placed in the diversion channel during the diversion phase. The structure will consist in two distinct openings separated by a 1.25 to 1.5 m thick pier. Both openings will have an invert elevation of 34.4 m and are designed for a gross velocity of 1.5 m/s at the design discharge (20 m^3/s each). The total length of the intake structure would be 17 m.

3.2.5 Penstocks

The project will be equipped with two separate penstocks, each of which having a diameter of 2.7 m (Plate C14, Appendix A). Beginning at the downstream face of the dam, the conduits would be placed in the diversion channel over a distance of 23 m on a layer of crushed stone. An additional trench would be excavated after the change in direction of the diversion channel in order to allow the continuation of the penstocks.

3.2.6 Tailrace

The tailrace channel (Plate C07, Appendix A) will have a total length of 215 m and would be excavated in rock on the right bank of the river. Its width will vary from 10.25 m at the exit of the powerhouse's tubes to 32 m at its exit into the river. The base of the channel will be located at an elevation of 16.4 m at the tube exits and will discharge into the river at an elevation of 21.6 m.

3.2.7 Access Roads

The project's development will require the construction of a ~10 km long access road from the village to the planned site. In order to limit the environmental impacts that would be caused by its construction, the access road's path will follow that of an existing all-terrain vehicle (ATV) trail over almost its entire length. As shown in Figure 3.2, the access road's path will diverge from the ATV trail near Lake Tasiq Tullipaaq in order to preserve previously identified archaeological sites. Approximately 2 km from the proposed site of the powerhouse, the access road will again diverge from the ATV trail in order to avoid areas that have been identified as potential sources of construction materials. Upgrading of the ATV trail for construction purposes requires its widening to a width of 5 m and its covering with properly selected granular materials.

Upgrading of the trail also requires the replacement of a bridge over the Sanirquamatik stream. The proposed structure can be put in place without affecting the stream's banks. The bridge will be constructed with steel beams and a concrete span and would be placed on the pre-existing concrete abutments. A bridge designed for ATVs and pedestrians will also be constructed near Site I1 to allow for the inspection of the proposed project's works located on the left bank.

3.2.8 Transmission Line

A 25 kV transmission line using wooden poles will be constructed next to the access road in order to connect the proposed generating station with the existing Hydro-Quebec substation. The proximity of the line to the road will facilitate its inspection. During the construction phase of the project and if agreed upon with Hydro-Quebec, the same line will power the construction site by transporting power from the existing thermal power plant. However, if this is not possible, auxiliary generators will be transported on site.

3.2.9 Substations

The substation for the project will be located inside the planned powerhouse and will essentially consist in a 25 kV transformer. The transformer will connect with the newly constructed power lines which will transfer energy to the Hydro-Québec substation located to the north of the village, from which electricity will be distributed to customers using the existing grid.

3.2.10 Dwelling Spaces

Dwelling spaces, either in the form of trailers or as permanent housing, will potentially be installed on a rock outcrop located 100 m or so north-east of the village. The type of lodging is dependant on an agreement between the PLC and the Kativik Municipal Housing Bureau (KMHB).

3.3 CONSTRUCTION ACTIVITIES AND SCHEDULE

The project is scheduled to be completed over a period of two summer seasons, with some additional work anticipated during the winter season of the second year. The construction schedule takes into account several factors including environmental limitations, climatic limitations and logistical limitations (e.g. arrival of boats).

During the first year, as soon as the snow has melted, the existing ATV road, located along the Inukjuak River, will require upgrading using local equipment. Concurrently, the construction camp near the village will also be set up as well as the staging area and the sites designated for the stone crushing plant and the concrete plant (Drawing C03, Appendix A). Once the first barge has docked at Inukjuak, a prefabricated bridge section will replace the bridge that currently spans the Sanirquamatik stream along the construction route and materials and equipment will be transported from the landing to their designated sites.

Once on site, the first major work to be completed is the excavation of the diversion channel, the penstock trench, the powerhouse and the tailrace channel. This work will begin in August and continue into the month of November.

Very little will be conducted during the first winter season, however, crossing the ice in order to construct the piers for the future ATV bridge at Site I2 is planned.

During the following spring (Year 2), construction of the powerhouse will continue and the concrete slab and intake structure will be constructed in the diversion channel. Riverine excavations of the diversion and tailrace channels will be completed in August. Diversion of the river will be conducted between the months of August and November. Once the construction of the cofferdam is completed in August, all foundations will be cleared and treated and construction of the RCC spillway-dam will commence. It is anticipated that this work will take approximately two months to complete.

Finally, during the fall and winter seasons of Year 2, the remaining construction tasks (penstocks, powerhouse) will continue in parallel. It is anticipated that the final installation of electrical generation equipment will occur in February or March of the second construction season.

Figure 3.3 presents the temporary works and affected areas related to the construction period. The figure also presents locations for the potential sources of construction materials as well as staging areas, stockpiling areas, spoil areas, etc. Figure 3.4 presents the Gantt chart of the construction schedule.

78°10'
78°5'
78°0'
77°55'
77°50'
58°30'
58°25'

Lake Innaarulik
Lake Tikiraaluk
Lake Tasialuk
Lake Inussualuk
Lake Qikirtalik
Small Inussualuk Lake
Qallunaaq Mouth
River
Lake Qattaakuluup Tasinga
KP 10.3
KP 13.3
Headpond (projected)
Innavik HEP (projected)
KP 7.3
Lake Akullipaaq
Lake Tasiq Tullipaaq
Inukjuak
Construction camp
Airport
KP 3.7
Inukjuak
Landing
Hopewell Sound
Kuugajaaraaluk Stream
Lake Kapisiliiapik Anginirsaq
Lake Quurnguup Tasialunga
Kongut River
Lake Tasikallaapik

Sources of Material

- Silty sand or sandy silt / Clayed silt or silty clay
- Sand and gravel / sand

Contractor Areas

- Material stockpile
- Staging area
- Spoil area

- Access road during construction
- Existing road
- Existing ATV trail
- Projected permanent work
- Kilometric point of the river

A

D-14
D-13
D-12
D-11
Concrete plant and stone crusher
Headpond (projected)
KP 10.3
Innavik HEP projected
Inukjuak River
0 200 400 m

Innavik Hydroelectric Project

Temporary Works and Construction Zones

Sources:

Base: NTDB, 1:50,000, 2005
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Mapping: Carto-Média
File : CM_1843_025_f3-3_100305.mxd

February 2010

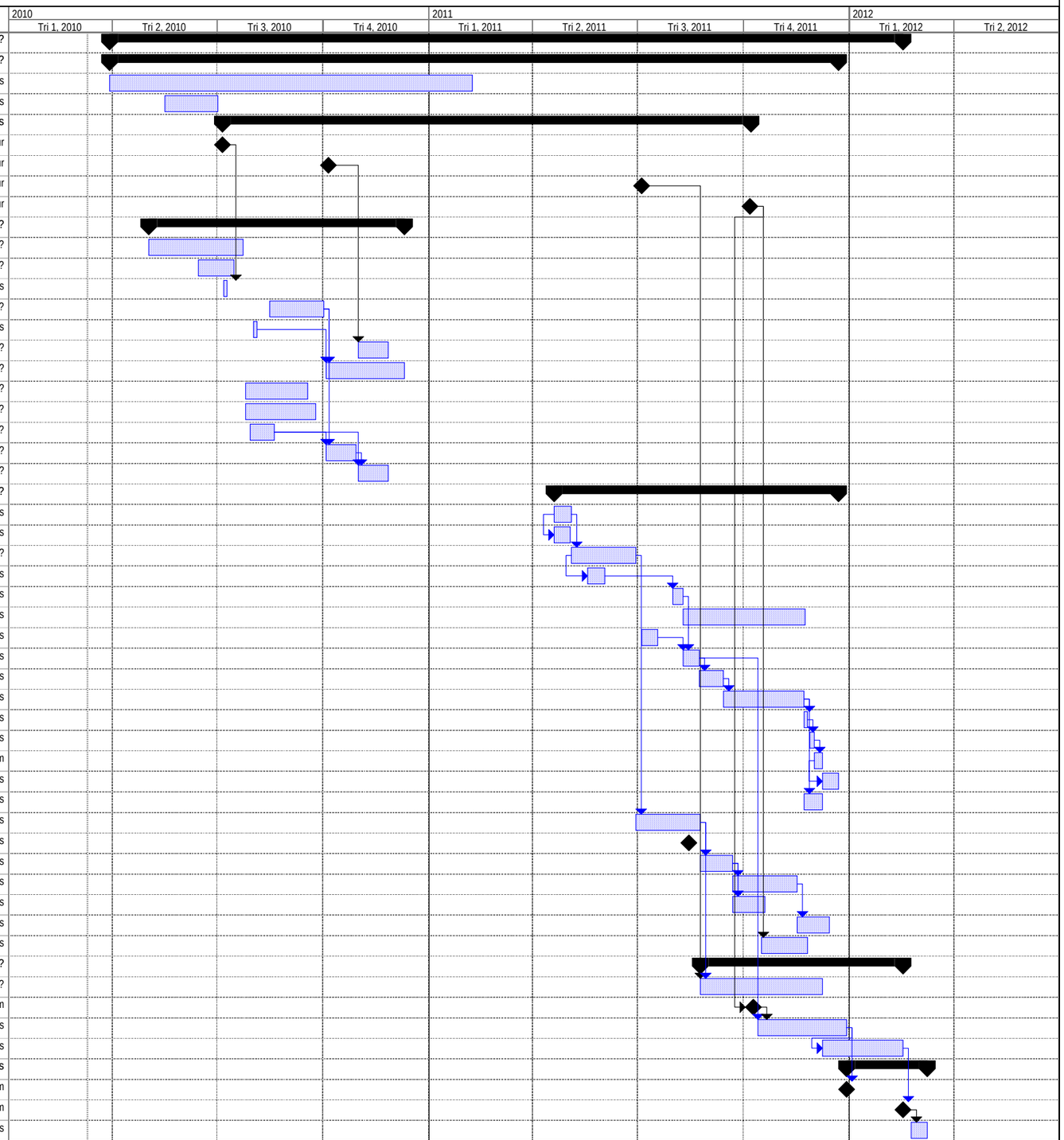
0 0.6 1.2 km
MTM, Zone 10, NAD83
Contour line equidistance: 10 m

Figure 3.3

Prepared by:
ENVIRONNEMENT ILLIMITÉ INC.
RSW inc.

Figure 3.4: Innavik Hydroelectric Project - Construction Schedule

N°	Task Name	Début	Fin	Durée
1	1 Construction	Mar 30/03/10	Jeu 16/02/12	493 jours?
2	1.1 Civil Works	Mar 30/03/10	Jeu 22/12/11	453 jours?
3	1.1.1 Final Design	Mar 30/03/10	Lun 07/02/11	225 jours
4	1.1.2 Mobilization	Lun 17/05/10	Jeu 01/07/10	34 jours
5	1.1.3 Transport of Equipment and Materials	Mar 06/07/10	Ven 07/10/11	329 jours
6	1.1.3.1 First Boat (July 2010)	Mar 06/07/10	Mar 06/07/10	1 jour
7	1.1.3.2 Second Boat (October 2010)	Mer 06/10/10	Mer 06/10/10	1 jour
8	1.1.3.3 Third Boat (July 2011)	Mar 05/07/11	Mar 05/07/11	1 jour
9	1.1.3.4 Fourth Boat (October 2011)	Ven 07/10/11	Ven 07/10/11	1 jour
10	1.1.4 Phase I	Lun 03/05/10	Ven 10/12/10	160 jours?
11	1.1.4.1 Construction of Access Roads	Lun 03/05/10	Ven 23/07/10	60 jours?
12	1.1.4.2 Setup of Construction Camp	Mar 15/06/10	Jeu 15/07/10	23 jours?
13	1.1.4.3 Construction of Bridge over Sanirquamatik stream	Mer 07/07/10	Ven 09/07/10	3 jours
14	1.1.4.4 Excavation of Diversion Channel (Leave Plug)	Lun 16/08/10	Ven 01/10/10	35 jours?
15	1.1.4.5 Setup of Stone Crusher and Worker Areas	Lun 02/08/10	Mer 04/08/10	3 jours
16	1.1.4.6 Setup of Batch Plant and Pugmill at Site	Lun 01/11/10	Ven 26/11/10	1 mois?
17	1.1.4.7 Crushing Operations (Roads, Penstock Fill, RCC, Concrete)	Lun 04/10/10	Ven 10/12/10	2.5 mois?
18	1.1.4.8 Setup of Quarries	Lun 26/07/10	Ven 17/09/10	2 mois?
19	1.1.4.9 Erection of Transmission Line	Lun 26/07/10	Ven 24/09/10	45 jours?
20	1.1.4.10 Construction of Roads to Tailrace and Other Service Areas incl. the site of the Future ATV Bridge	Ven 30/07/10	Jeu 19/08/10	15 jours?
21	1.1.4.11 Excavation of Tailrace Channel (Leave Plug)	Lun 04/10/10	Ven 29/10/10	1 mois?
22	1.1.4.12 Excavation of Powerhouse and Penstock Trench	Lun 01/11/10	Ven 26/11/10	1 mois?
23	1.1.5 Phase II	Mer 20/04/11	Jeu 22/12/11	177 jours?
24	1.1.5.1 Concreting of Slab and Piers over Diversion Channel	Mer 20/04/11	Mer 04/05/11	11 jours
25	1.1.5.2 Construction of ATV Bridge	Mer 20/04/11	Mar 03/05/11	2 sms
26	1.1.5.3 Construction of Intake Structure	Jeu 05/05/11	Mer 29/06/11	2 mois?
27	1.1.5.4 Installation of Penstock Pipes at the Intake	Jeu 19/05/11	Jeu 02/06/11	11 jours
28	1.1.5.5 Removal of Diversion Channel Rock Plug	Lun 01/08/11	Mar 09/08/11	7 jours
29	1.1.5.6 River Diversion	Mer 10/08/11	Mer 23/11/11	3.8 mois
30	1.1.5.7 Construction of Dam Foundations on Right River Bank	Mar 05/07/11	Lun 18/07/11	10 jours
31	1.1.5.8 Construction of Cofferdam	Mer 10/08/11	Mar 23/08/11	10 jours
32	1.1.5.9 Construction of Dam Foundations on Left River Bank as well as on River Bed	Mer 24/08/11	Mar 13/09/11	15 jours
33	1.1.5.10 Construction of RCC Spillway-Dam	Mer 14/09/11	Mar 22/11/11	50 jours
34	1.1.5.11 Filling of Headpond	Mer 23/11/11	Ven 25/11/11	3 jours
35	1.1.5.12 Placement of a Concrete Plug in Diversion Channel	Lun 28/11/11	Jeu 01/12/11	4 jours
36	1.1.5.13 Backfilling of Diversion Channel	Ven 02/12/11	Jeu 08/12/11	1 sm
37	1.1.5.14 Installation of Penstock Pipes (Continuation)	Ven 09/12/11	Jeu 22/12/11	2 sms
38	1.1.5.15 Removal of Access Road to Tailrace	Mer 23/11/11	Jeu 08/12/11	12 jours
39	1.1.5.16 Powerhouse Concreting (Stage 1)	Jeu 30/06/11	Mer 24/08/11	40 jours
40	1.1.5.17 Removal of Rock Plug in Tailrace	Lun 15/08/11	Sam 20/08/11	5 jours
41	1.1.5.18 Installation of Overhead Crane	Jeu 25/08/11	Mer 21/09/11	20 jours
42	1.1.5.19 Powerhouse Concreting (Stage II)	Jeu 22/09/11	Mer 16/11/11	40 jours
43	1.1.5.20 Installation of Draft Tube Gates	Jeu 22/09/11	Mer 19/10/11	20 jours
44	1.1.5.21 Installation of Switch Room	Jeu 17/11/11	Mer 14/12/11	1 mois
45	1.1.6 Demobilization	Lun 17/10/11	Ven 25/11/11	30 jours
46	1.2 W2W	Jeu 25/08/11	Jeu 16/02/12	126 jours?
47	1.2.1 Installation of Embedded Parts and Auxiliaries	Jeu 25/08/11	Jeu 08/12/11	76 jours?
48	1.2.2 Delivery of Rotating Parts	Lun 10/10/11	Jeu 13/10/11	0.8 sm
49	1.2.3 Installation and Testing of Unit 1	Ven 14/10/11	Jeu 29/12/11	11 sms
50	1.2.4 Installation and Testing of Unit 2	Ven 09/12/11	Jeu 16/02/12	10 sms
51	2 Commissioning	Ven 30/12/11	Jeu 08/03/12	50 jours
52	2.1 Commissioning of Unit 1	Ven 30/12/11	Jeu 05/01/12	1 sm
53	2.2 Commissioning of Unit 2	Ven 17/02/12	Jeu 23/02/12	1 sm
54	2.3 Demobilization	Ven 24/02/12	Jeu 08/03/12	10 jours



Project: [2007-12-03 Inukjuak HPP_Pr
Date: Mer 10/03/10

Tâche | Avancement | Jalon | Récapitulative

4. SUMMARY OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

A summary of the impacts associated with the proposed development of the Innavik HEP are presented in Tables 4.1 and 4.2. The tables demonstrate that there are no impacts of medium or major importance during both the construction and operational phases of the project. The use of an integrated approach in which environmental issues are taking into account during the earliest stages of design certainly helped in this respect.

Only minor negative impacts have been identified and are as follows:

- The impingement of terrestrial and riverine vegetation by the construction of access roads and the setup of construction and worker areas during the construction phase
- The temporary loss of fish habitat caused by the construction of the cofferdam and the potential repercussions on fish associated with dynamiting during the construction phase
- The possible disturbing of the bird populations caused by increased noise levels and the presence of workers during the construction phase as well as the impingement of their habitat from the construction of access roads and the setup of construction and worker areas
- The increase in automobile traffic and noise levels in the vicinity of Inukjuak during the construction period which will likely affect the quality of life of the local population
- The impingement of terrestrial habitat caused by the construction of the project's permanent works as well as the submergence of lands upstream of the spillway-dam during the operational phase
- The loss of habitat for 45 bird species including 42 passerines caused by the submergence of lands during the operational phase
- The esthetical effects of the transmission line during the construction and operational phases.

The creation of spawning habitats for riverine fish species will mitigate the negative impacts created by the construction and operation of the project. Figure 4.1 presents areas in the river where suitable substrate for the spawning of brook trout and lake

whitefish will be placed. These areas are designed to foster conditions that are sought after by these specific fish species and are of better quality than those naturally occurring in the river. The new fish habitats are designed to ensure that eggs will remain fully submerged during winter low-flow seasons and that the substrate will remain in place during spring floods. These habitats will be monitored during the operational phase of the project.

With the help of the Avataq Cultural Institute, particular attention was paid to the protection of cultural heritage and archaeological sites during both construction and operational phases. Given that no other projects are anticipated near the Innavik site and that no past or present activities have had any significant impacts on the area, no cumulative effect from the project is expected.

The main concern voiced by several community members during meetings hosted by the PLC is the possibility that the development of the project will affect the water quality of the Inukjuak river. Due to the small size of the headpond and its high turnover rate, no negative impacts on water quality are anticipated nor is the bioaccumulation of mercury in fish. A monitoring program conducted by an independent organization, the Kativik Regional Government (KRG), is expected to be setup during the project's operation in order to better inform community members on this subject.

The development of the project will also allow a reduction of 15000 tonnes of $C0_2$ emissions in 2012, increasing to 32000 tonnes annually in 2022 due primarily to the village's projected population growth (i.e. increase in energy demand). This will ensure the population's role in the fight against climate change. Other spin-offs include socio-economic benefits. The Innavik HEP's construction will provide job opportunities for the community of Inukjuak and, given the scale of the project, will provide additional opportunities for Inuit from other communities in Nunavik. During the operational phase, profits from the sale of energy to Hydro-Québec would be reinvested into the village through different community-driven projects designed to improve the community's standard of living.

The Innavik HEP is compatible with the objectives expressed by the community. These objectives include the development of a project that would crystallize Inukjuak's role in the fight against climate change and the socio-economic development of the community as a whole.

Table 4-1 :Summary of the Impacts created by the development of the Innavik HEP – Construction Phase

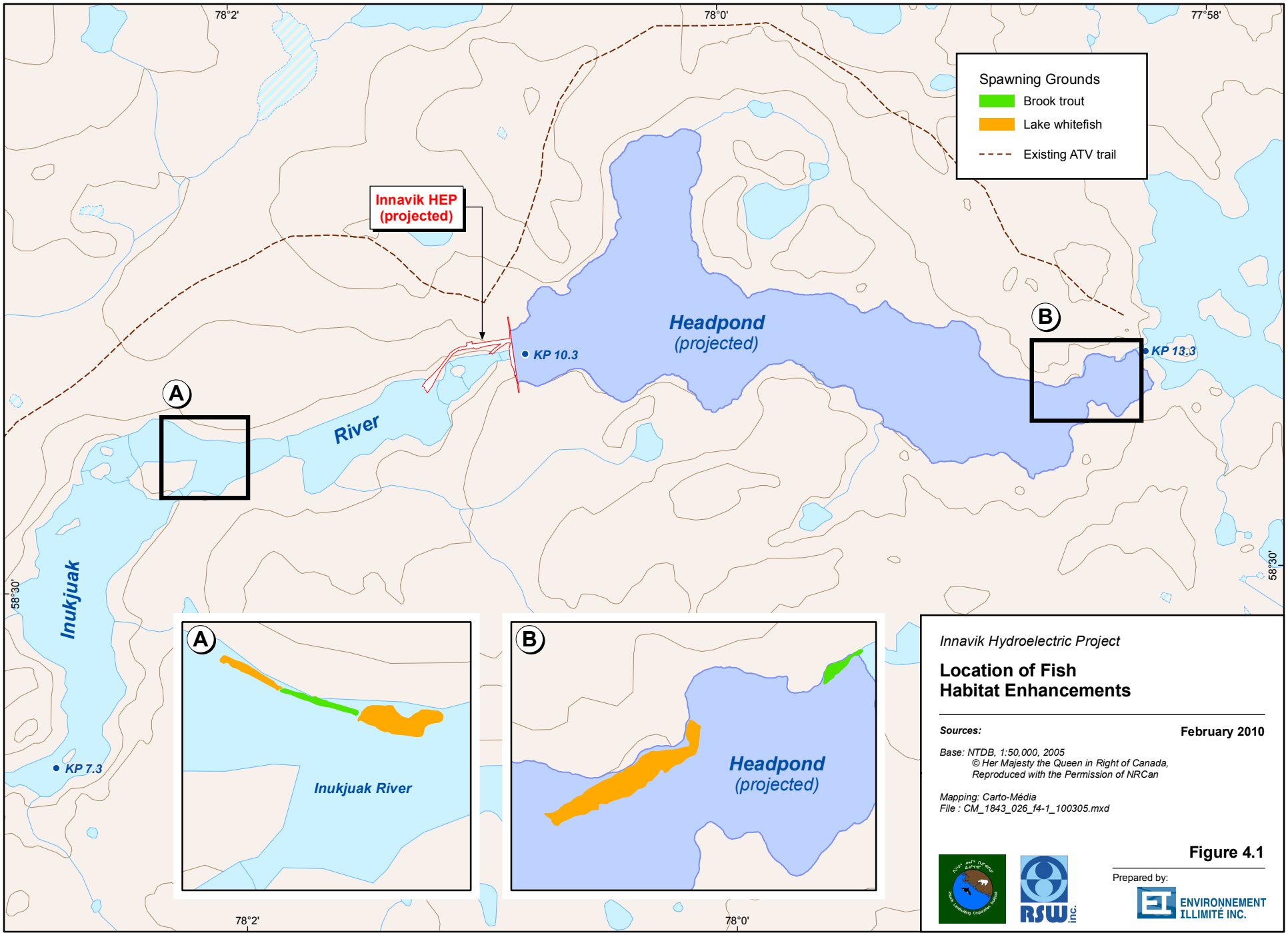
Component	Activity	Description of the Impact	Nature of the Impact	Impact Level	Impact Range	Impact Duration	Mitigation Measures	Impact Importance
BIOLOGICAL ENVIRONMENT								
Vegetation	Construction of contractor and staging areas	Impingement of terrestrial and riverine vegetation	Negative	Low	Isolated	Long	Favour the placing of access roads, work areas and stockpile areas on rock Backfilling of quarries Remise en état des aires des travaux, étendre des matériaux fins en surface et nivellement du terrain de manière à créer des dépressions et développer des zones plus humides propices au développement de la végétation	Minor
Fish Habitat and Fish Populations	Construction of the cofferdam River Diversion Dynamiting for the construction of the diversion channel, intake, powerhouse, etc.	Impingement of 2500 m² of riverine habitat caused by the construction of the cofferdam Potential repercussions caused by dynamiting	Negative	Low	Isolated	Short	Diversion works designed to maintain the natural water levels upstream of the cofferdam Creation of spawning habitat Using methodology outlined by Wright (1998) for explosives	Minor
Avian Fauna	Increase in noise levels at the construction site Dynamiting and stone crushing	Disturbing of birds caused by increased noise levels, increased traffic, human presence and impingement of habitat	Negative	Low	Isolated	Short	Monitoring of the nesting of pelegrin falcons at Site I2 In the event that the pelerine falcon nests in the area, the recommendations outlined in FAPAQ-MRNF (2002) will be followed in order to protect the nest Inform and increase workers' awareness of the presence of pelerine falcons	Negligible
Mammals	Construction site noise levels Traffic Dynamiting and stone crushing	Disturbing of mammals caused by increased noise levels, increased traffic, human presence and impingement of habitat	Negative	Low	Isolated	Short		Negligible

Table 4.1 : Summary of the Impacts created by the development of the Innavik HEP – Construction Phase (cont.)

HUMAN ENVIRONMENT								
Socio-Economic Aspects	Construction of the project	The project's development requires 315 000 man-hours	Positive	Heavy	Regional	Short		Medium
Vehicular Traffic	Transport of materials and workers	The number of vehicles in Inukjuak will increase	Negative	Low	Local	Short	The planned path of the access road runs outside of the village	Minor
Landscape	Presence of equipment and machinerie on site	Temporary modification of the landscape due to the construction site	Negative	Low	Isolated	Short		Negligible
Noise Levels	Dynamiting, stone crushing, traffic and heavy-machine operation	Construction (e.g. dynamiting) will increase noise levels at the construction site Increase in noise levels for persons living near the site access road caused by traffic moving to and from the site	Negative	Low	Local	Short	The planned path of the access road runs outside of the village	Minor
Cultural and Archaeological Heritage	Traffic Creation of a construction camp	No impact					The planned path of the access road avoids two known archaeological sites The planned location of the construction camp is located away from a known archaeological site Setting up of a security perimeter	

Table 4-2 : Summary of the Impacts created by the development of the Innavik HEP – Operational Phase

Component	Activity	Description of the Impact	Nature of the Impact	Impact Level	Impact Range	Impact Duration	Mitigation Measures	Impact Importance
BIOLOGICAL ENVIRONMENT								
Vegetation	Submergence of lands upstream of the works Presence of the powerhouse and other permanent works	Impingement on terrestrial habitat by submerging the land	Negative	Low	Isolated	Long	None, new banks would form naturally within a period of 5 to 10 years	Minor
Fish Habitat and Fish Populations	Increase of water levels upstream of the works Powerplant operation	Loss and modification of fish habitat caused by changes in water depth and loss of rapids Mortality of fish caused by their transit through turbines or by impact	Negative	Low	Isolated	Long	Creation of spawning habitats for whitefish and salmonidae Installation of a fine inclined mesh upstream of the power intakes Construction of a weir at the foot of the spillway to create a pooling area for fish that pass over the overflow section	Minor
Avian Fauna	Increase of water levels upstream of the works	Loss of habitat for 45 bird species including 42 passerines	Negative	Low	Isolated	Long	None	Minor
Mammals	Increase of water levels upstream of the works	Loss of habitat	Negative	Low	Isolated	Long	None	Minor
HUMAN ENVIRONMENT								
Socio-Economic Aspects	Maintenance and operation of the project	The operation of the project will create approximately 10 permanent and temporary jobs Reinvestement of generated profits into programs designed to accelerate the socio-economic development of the community	Positive	Heavy	Local	Long	None	Major
Vehicular Traffic		No impact						
Landscape	Presence of the permanent works Presence of the transmission line	No impact when taking into account the mitigation measures Modification of the landscape	Negative	Low	Isolated	Long	Integration of the project into the landscape	Minor
Noise Levels	Maintenance and operation of the project	Noise created by the operating turbines	Negative	Low	Isolated	Long		Negligible
Cultural and Archaeological Heritage		No Impact					Precautions taken during the design phase of the project	



Innavik Hydroelectric Project

Location of Fish Habitat Enhancements

Sources:

February 2010

Base: NTDB, 1:50,000, 2005
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Mapping: Carto-Média
File : CM_1843_026_f4-1_100305.mxd

Figure 4.1

Prepared by:

ENVIRONNEMENT ILLIMITÉ INC.

REFERENCES

DESROSIERS, N., R. MORIN, et J. JUTRAS. *Atlas des micromammifères du Québec.* Société de la faune et des parcs du Québec. Direction du développement de la faune. Québec, 2002.

ENVIRONNEMENT Canada. *Faune et Flore du Pays : les espèces sauvages du Canada*. Service canadien de la faune et Fédération canadienne de la faune, 2009. Disponible aussi par Internet à l'adresse www.hww.ca/index_f.asp.

FAPAQ-MRNFQ. *Protection des espèces menacées ou vulnérables en forêt publique : Le faucon pèlerin* (*Falco peregrinus*). Société de la faune et des parcs du Québec, Direction du développement de la faune et Ministère des Ressources naturelles du Québec, Direction de l'environnement forestier. Québec, 2002, 9 p.

GAUTHIER, J., et Y. AUBRY (sous la direction de). *Les oiseaux nicheurs du Québec : Atlas des oiseaux nicheurs du Québec méridional.* Association québécoise des groupes d'ornithologues, Société québécoise de protection des oiseaux, Service canadien de la faune, Environnement Canada – Région du Québec, 1995.

GODFREY, W.E. *Les oiseaux du Canada*, édition révisée. Musée national des sciences naturelles et Musées Nationaux du Canada. Éditions Broquet. Laprairie, 1986.

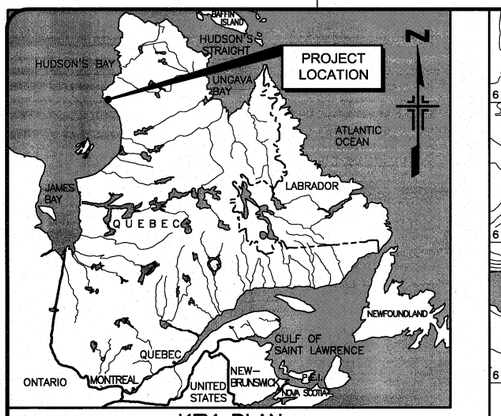
MRNF. *Cartes des déplacements du caribou par télémétrie satellitaire*. Ministère des Ressources naturelles et de la Faune, 2009. Disponible aussi par Internet à l'adresse www.mrnf.gouv.qc.ca/faune/cartes-caribou/cartes.jsp.

PRESCOTT, J. et, P. RICHARD. *Mammifères du Québec et de l'est du Canada*, vol. 2. Éditions France-Amérique. Montréal, 1982.

TODD, W.E.C. *Birds of the Labrador Peninsula and Adjacent Areas*, a Distributional List (réédition de l'original paru en 1963). Carnegie Museum, University of Toronto Press et Buteo Books. Vermillion, 1980.

APPENDIX A

Drawings



KEY PLAN

LEGEND

- EXISTING ROAD
- EXISTING ATV ROAD
- EXISTING ATV ROAD TO BE UPGRADED AS ACCESS ROAD
- NEW ACCESS ROAD
- 25 kV TRANSMISSION LINE

N°	Notes and references
1	TOPOGRAPHY DATA FROM NASA'S SRTM3 SURVEY AND MOSAIC-3D'S LIDAR SURVEY.
2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.

N°	Date	Issued and/or Revisions	Designed	Approved
1	10-02-03	REVISED AS NOTED		
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

Title: PROJECT GENERAL LAYOUT

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Approved	S. ST-PIERRE	Approved	S. ST-PIERRE

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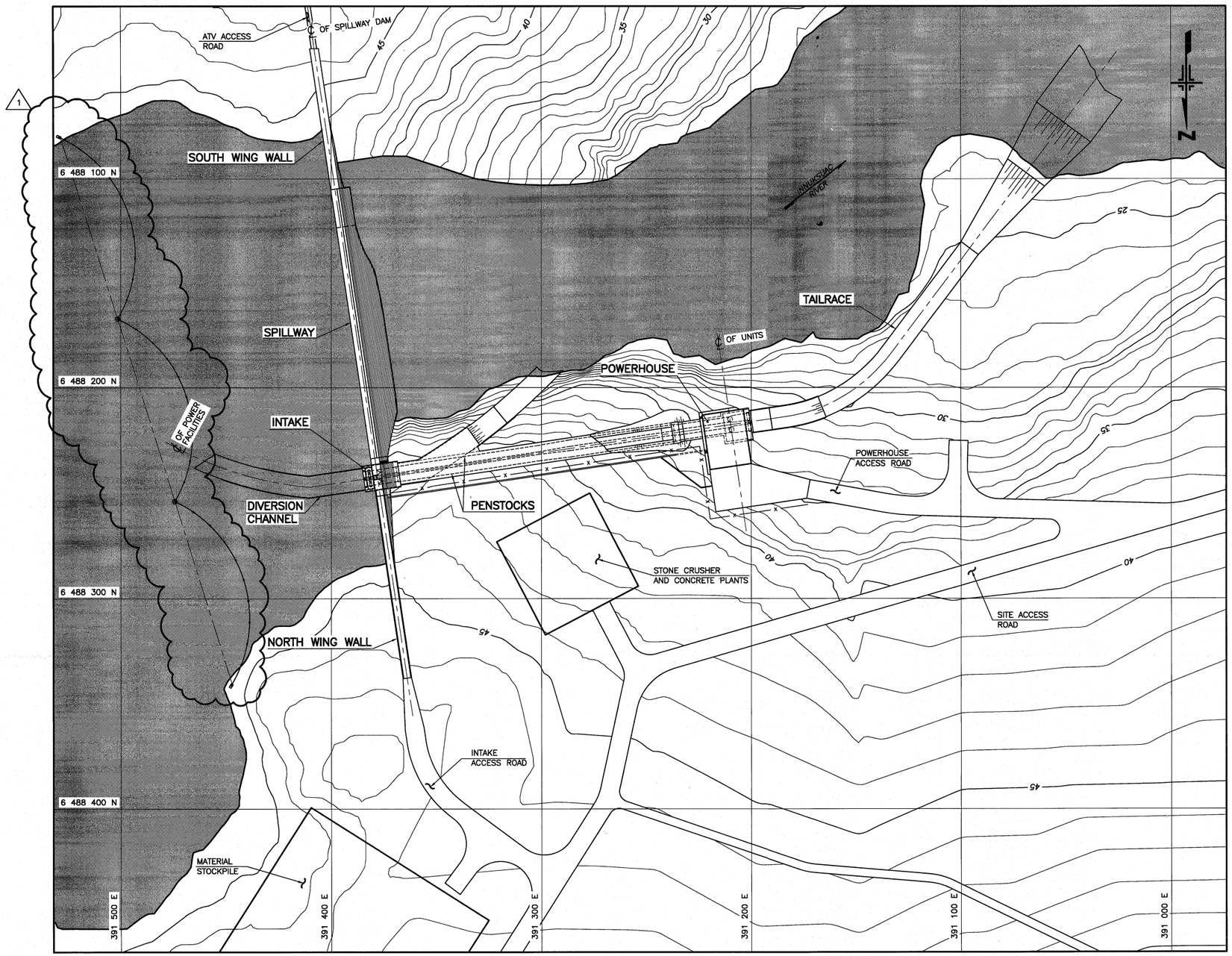

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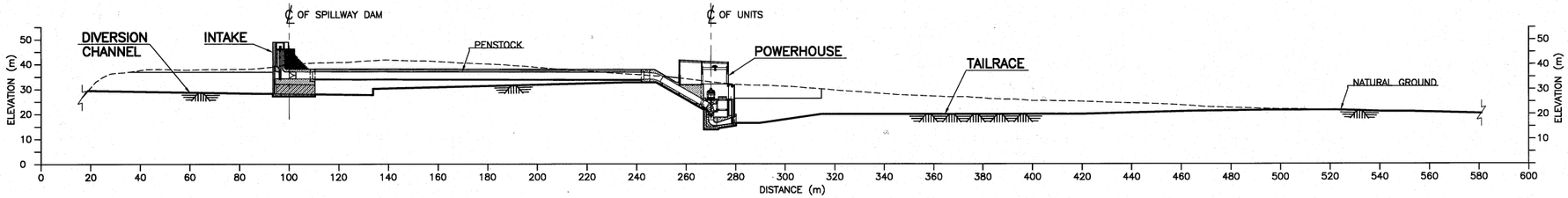

LONGITUDINAL PROFILE

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2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.

N°	Date	Issued and/or Revisions	Designed	Approved
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0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: INNAVIK HYDROELECTRIC PROJECT

Title: POWERHOUSE SECTOR GENERAL LAYOUT

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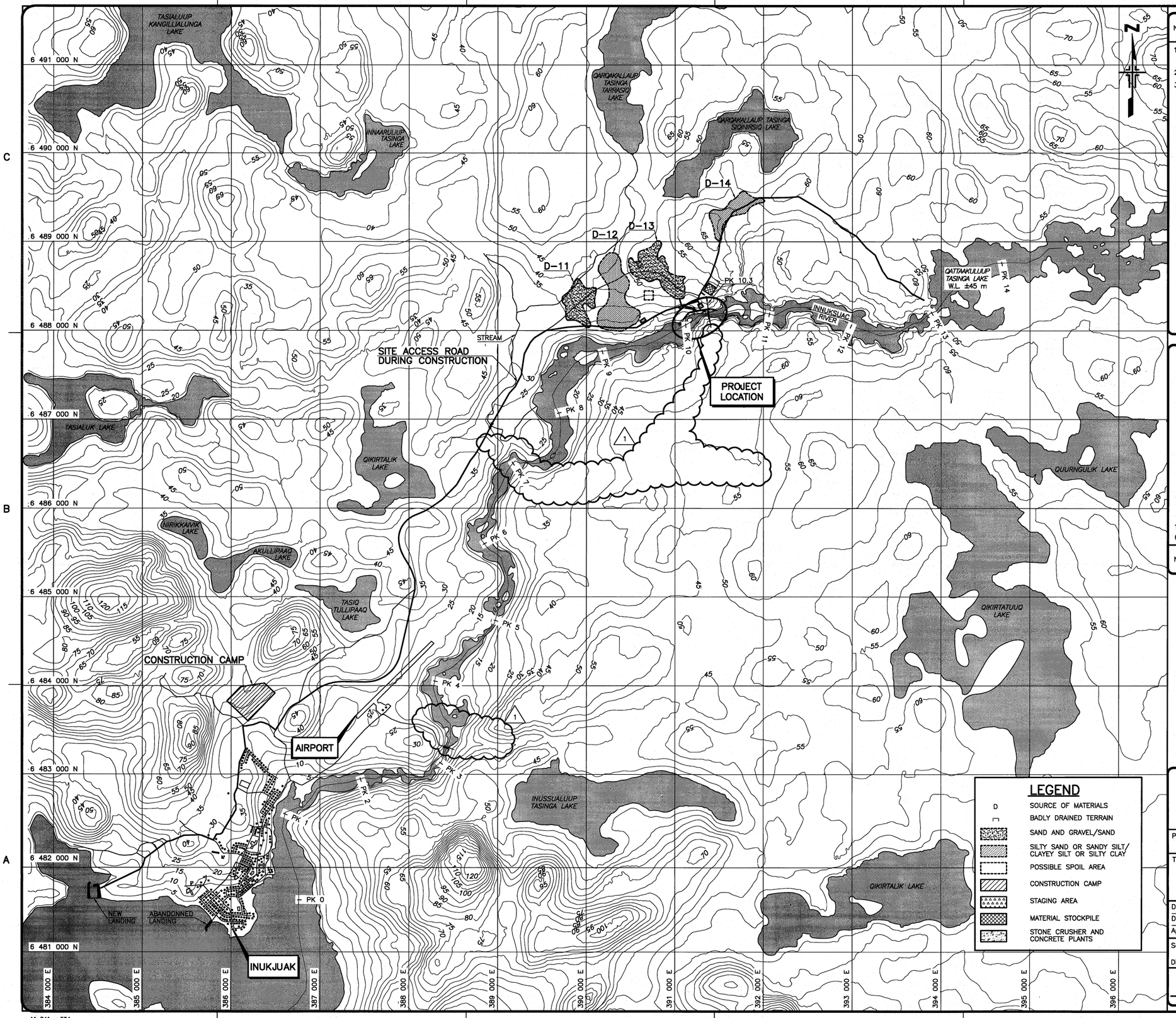

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2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.
3	REFERENCE: POLY–GÉO INC., « PROJET DE MINI–CENTRALE À INUKJUAK, RECHERCHE DE MATÉRIAUX D'EMPRUNT POUR LA CONSTRUCTION DU BARRAGE ET D'INFRASTRUCTURES CONNEXES », FINAL REPORT, JUNE 2009.

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1	10–02–03	REVISED AS NOTED		
0	09–1–03	ISSUED FOR FEASIBILITY STUDY		

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Project: INNAVIK HYDROELECTRIC PROJECT

Title: GENERAL LAYOUT QUARRIES AND DEPOSITS

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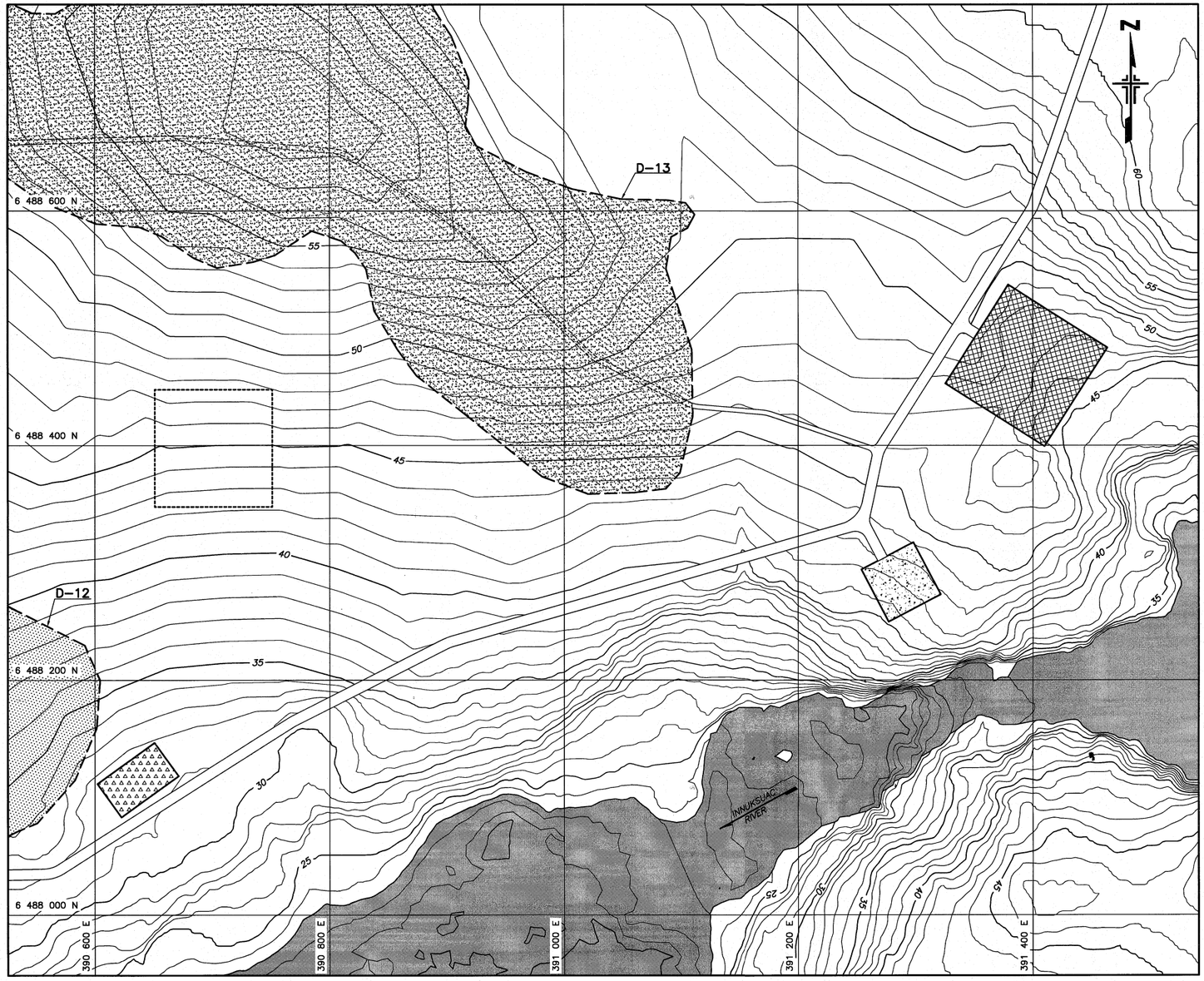

PLAN

LEGEND

D	SOURCE OF MATERIALS
	SAND AND GRAVEL/SAND
	SILTY SAND OR SANDY SILT/ CLAYEY SILT OR SILTY CLAY
	POSSIBLE SPOIL AREA
	STAGING AREA
	MATERIAL STOCKPILE
	STONE CRUSHER AND CONCRETE PLANTS

N°	Notes and references
1	TOPOGRAPHY DATA FROM NASA'S SRTM3 SURVEY AND MOSAIC-3D'S LIDAR SURVEY.
2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.
3	INFO ON MATERIAL DEPOSITS PROVIDED BY POLY-GÉO INC. REFERENCE: POLY-GÉO INC., « PROJET DE MINI-CENTRALE À INUKJUAK, RECHERCHE DE MATÉRIAUX D'EMPRUNT POUR LA CONSTRUCTION DU BARRAGE ET D'INFRASTRUCTURES CONNEXES », FINAL REPORT, JUNE 2009.

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

Title: POWERHOUSE SECTOR
QUARRIES AND DEPOSITS

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Designed	J. GACEK	Checked	S. ST-PIERRE
Approved	S. ST-PIERRE	Approved	S. ST-PIERRE

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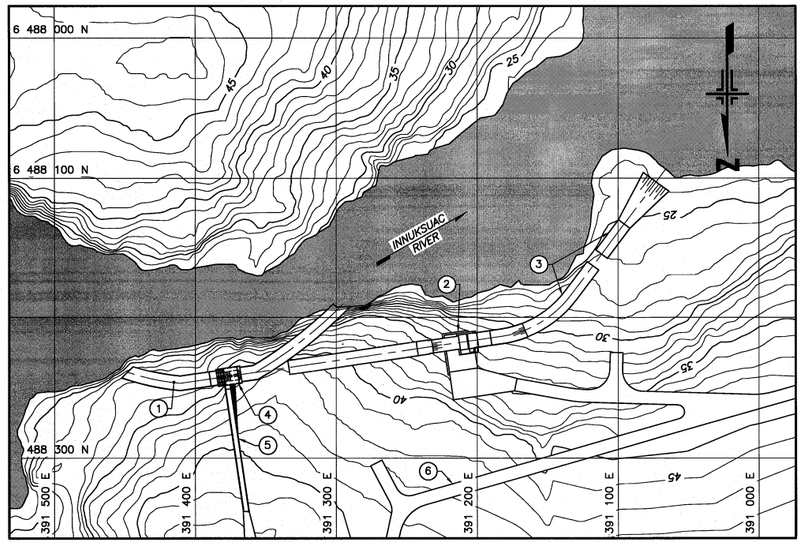
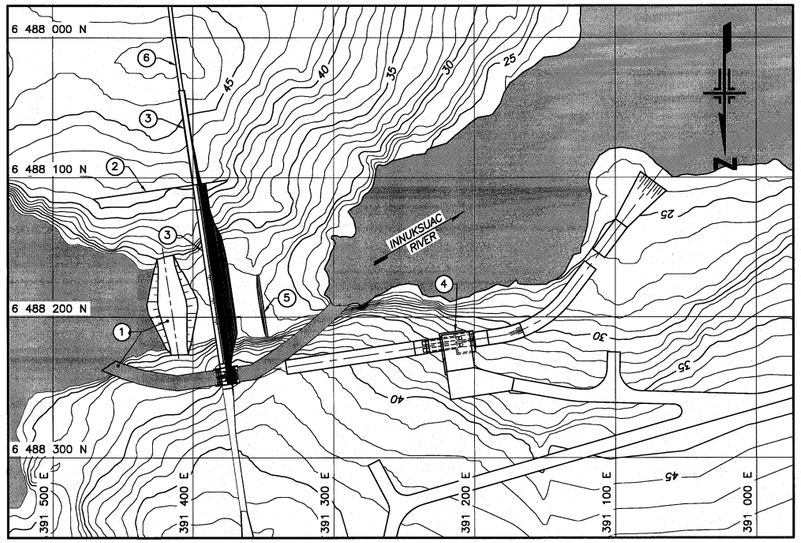


PHASE 1
(YEAR 1 + YEAR 2 – SPRING)

NATURAL FLOW IN RIVER

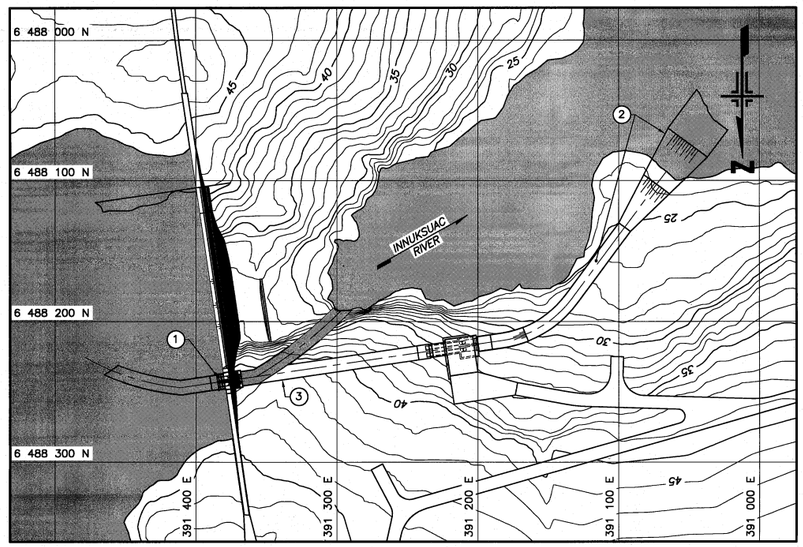
1. EXCAVATION OF THE DIVERSION CHANNEL
2. EXCAVATION OF THE POWERHOUSE AND PENSTOCKS
3. EXCAVATION OF THE TAILRACE CHANNEL
4. CONSTRUCTION OF THE POWER INTAKE
5. CONSTRUCTION OF THE NORTH WING WALL
6. CONSTRUCTION OF THE PERMANENT ROADS AND BRIDGES
7. CONSTRUCTION OF THE TEMPORARY ROADS AND BRIDGES (IF REQUIRED)



PHASE 2
(YEAR 2 – SUMMER)

FLOW IN DIVERSION CHANNEL

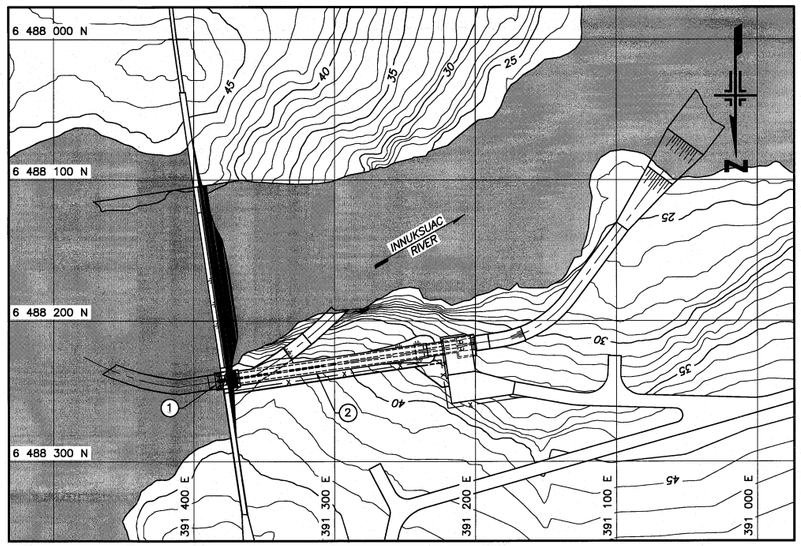
1. CONSTRUCTION OF THE UPSTREAM COFFERDAM / DIVERSION CHANNEL PLUG EXCAVATION
2. EXCAVATION ON THE SOUTH RIVERBANK
3. CONSTRUCTION OF RCC SPILLWAY AND SOUTH WING WALL
4. CONSTRUCTION OF THE POWERHOUSE
5. CONSTRUCTION OF THE WEIR
6. CONSTRUCTION OF THE ATV BRIDGE AND VTT ACCESS ROAD LOCATED ON THE SOUTH RIVERBANK



PHASE 3
(YEAR 2 – FALL)

FILLING OF THE HEADPOND

1. CLOSING OF THE DIVERSION CHANNEL (STOPLOGS)
2. TAILRACE PLUG EXCAVATION
3. FINAL PENSTOCKS TRENCH EXCAVATION



PHASE 4
(YEAR 2 – FALL/WINTER)

OVERFLOW THROUGH SPILLWAY

1. DIVERSION CHANNEL PLUG CONCRETING
2. INSTALLATION OF PENSTOCKS
3. COMMISSIONING

N°	Notes and references
1	TOPOGRAPHY DATA FROM NASA'S SRTM3 SURVEY AND MOSAIC–3D'S LIDAR SURVEY.
2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.

N°	Date	Issued and/or Revisions	Designed	Approved
0	09–11–03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

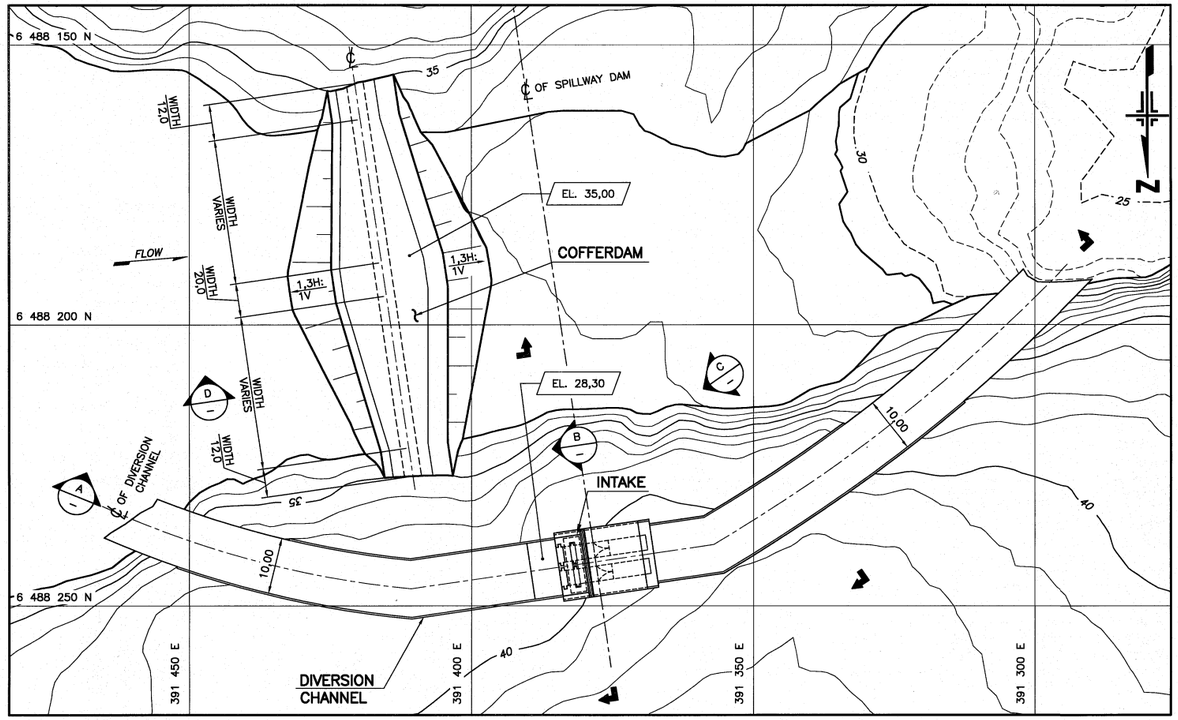
Title: CONSTRUCTION PHASES

Drawn	P. LAMY / V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST–PIERRE	Approved	H. BOUZAÏENE

Scale factor 1:2000 — Scale 0 20 100 — Dimensions in m — Project nº P48–0643

Client	Sector	Project	Drawing nº	Sheet	Rev
	48	0643	C05	1 of 1	0

A1 841 x 594



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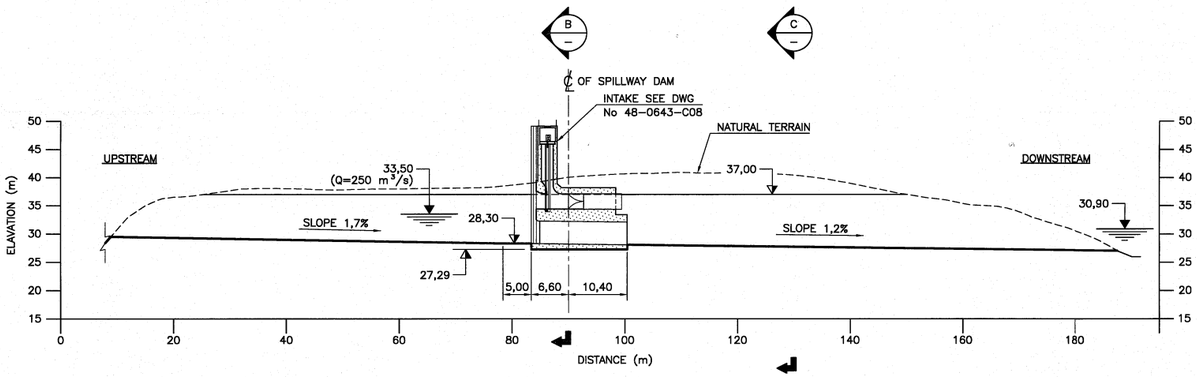
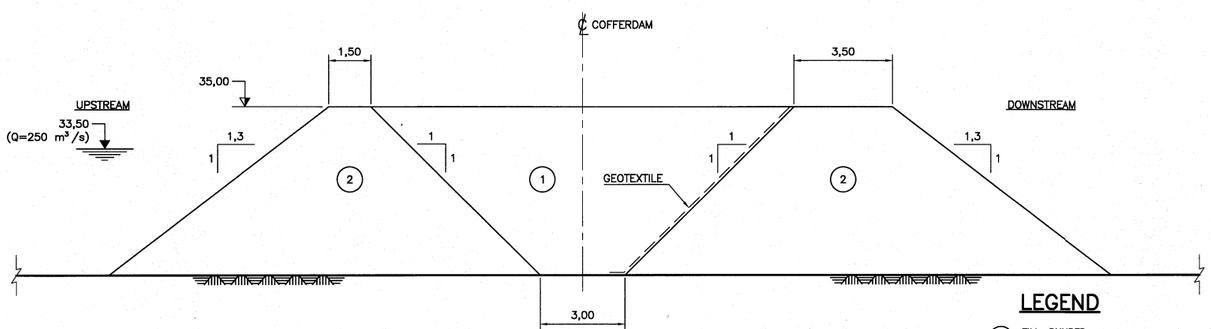


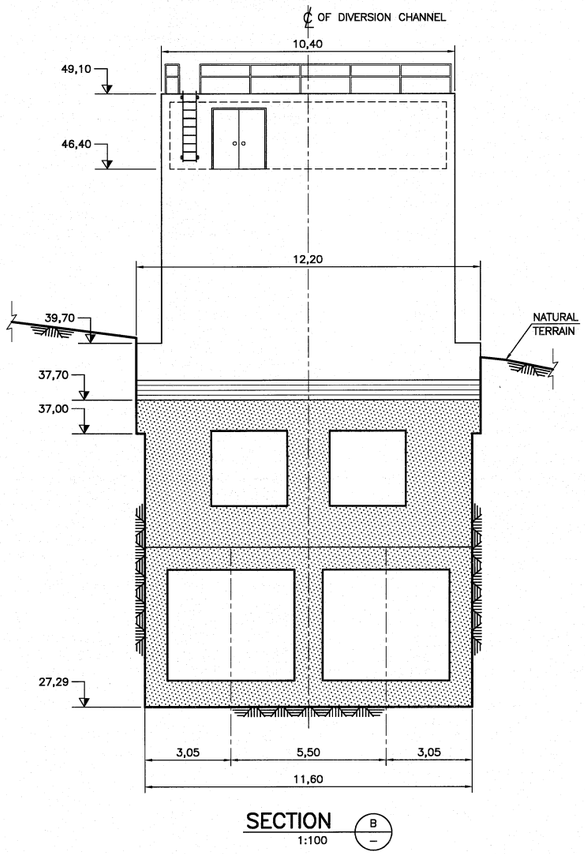
SECTION A



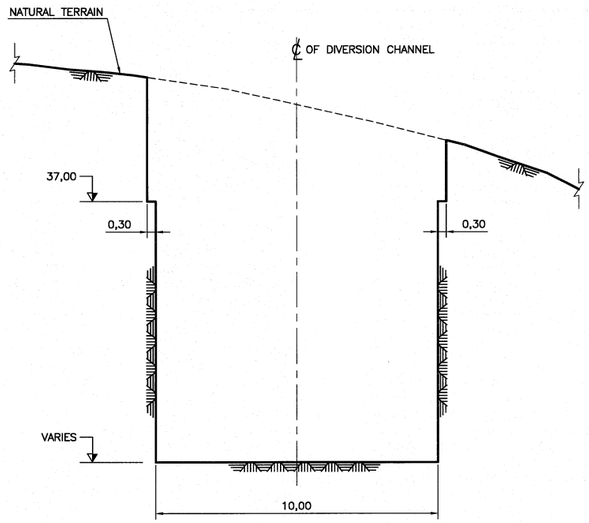
SECTION

LEGEND

1. TILL, DUMPED (NOTE 4)
2. ROCKFILL 900 mm MIN. DUMPED



SECTION B
1:100



SECTION C
1:100

N°	Notes and references
1	TOPOGRAPHY DATA FROM NASA'S SRTM3 SURVEY AND MOSAIC–3D'S LIDAR SURVEY.
2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.
3	A TEMPORARY BRIDGE IS REQUIRED TO CROSS THE DIVERSION CHANNEL TO PERMIT THE CONSTRUCTION OF THE COFFERDAM.
4	TILL MATERIAL SHALL BE WELL GRADED GRANULAR MATERIAL WITH AT LEAST 15% PASSING TROUGH THE SIVE #200 AND WITH A MAXIMUM PARTICLE SIZE OF 300 mm.

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

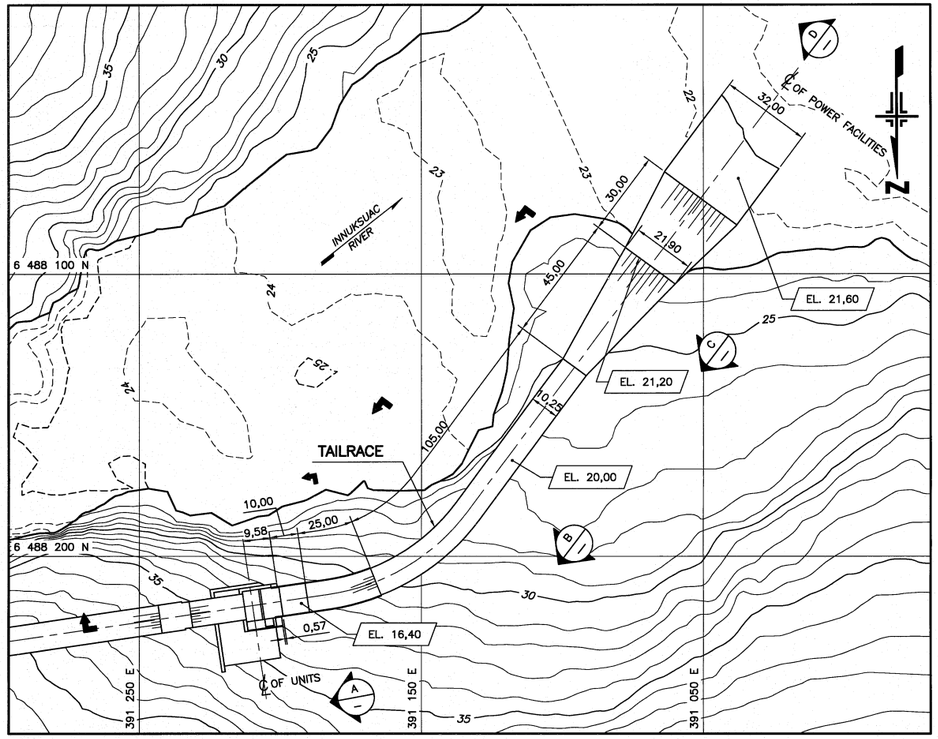
Title: DIVERSION CHANNEL AND COFFERDAM

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	B. BENABDELLAH	Checked	N. BEAUSÉJOUR
Approved	S. ST-PIERRE	Approved	N. BEAUSÉJOUR

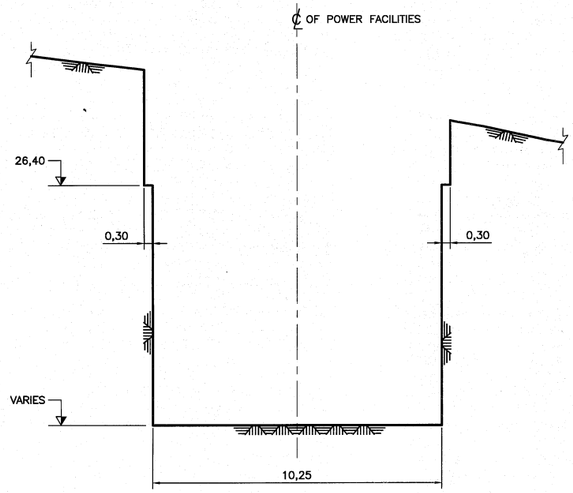
Scale factor 1:500 — Scale 0 5 25 — Dimensions in m — Project n° P48-0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C06	1 of 1	0

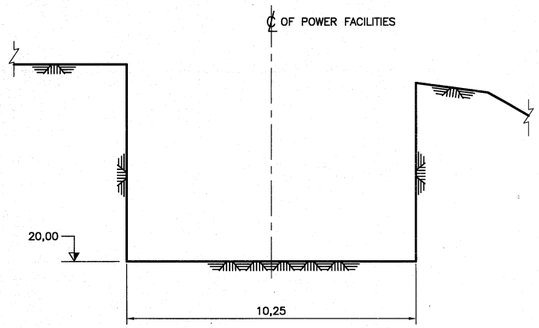
A1 841 x 594



PLAN



SECTION A — 1:100



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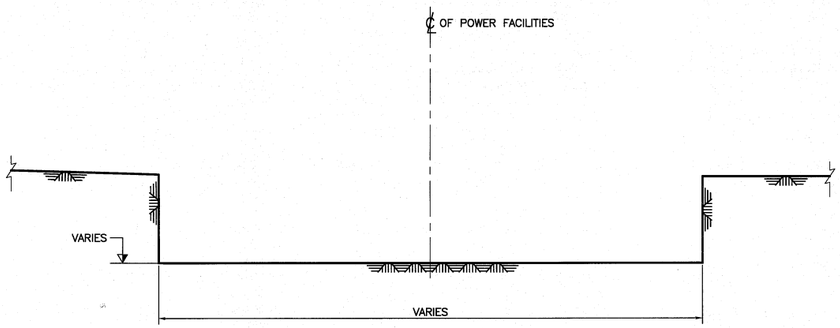
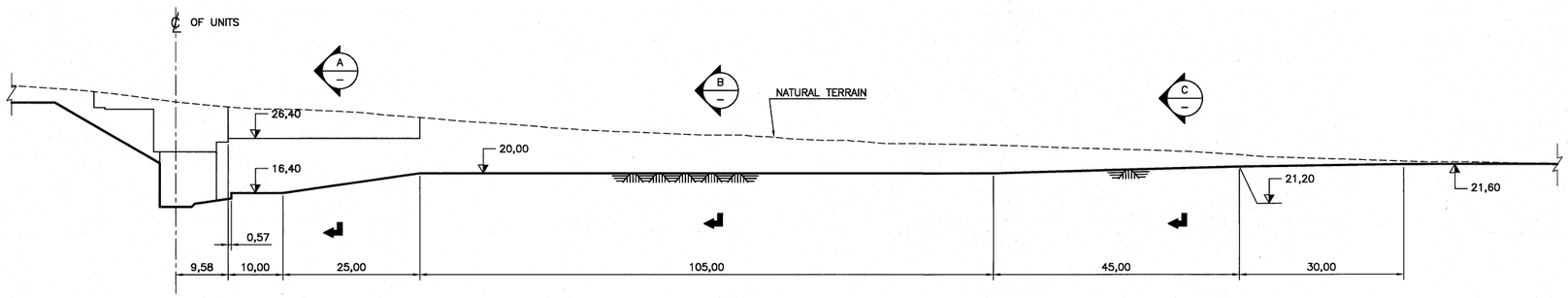


SECTION C — 1:100



SECTION D — 1:500

N°	Notes and references
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2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.

N°	Date	Issued and/or Revisions	Designed	Approved
0	09–11–03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

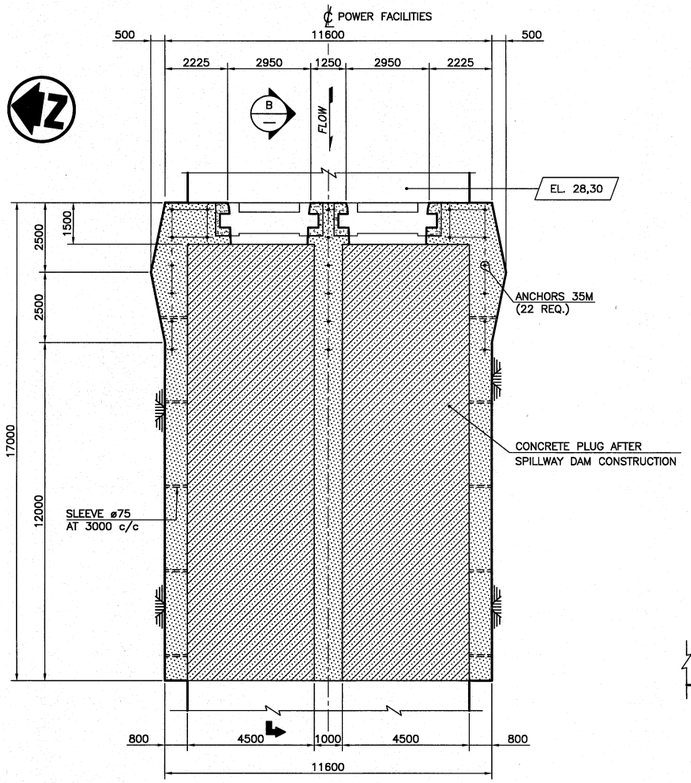
Title: TAILRACE

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	B. BENABDELLAH	Checked	N. BEAUSÉJOUR
Approved	S. ST–PIERRE	Approved	N. BEAUSÉJOUR

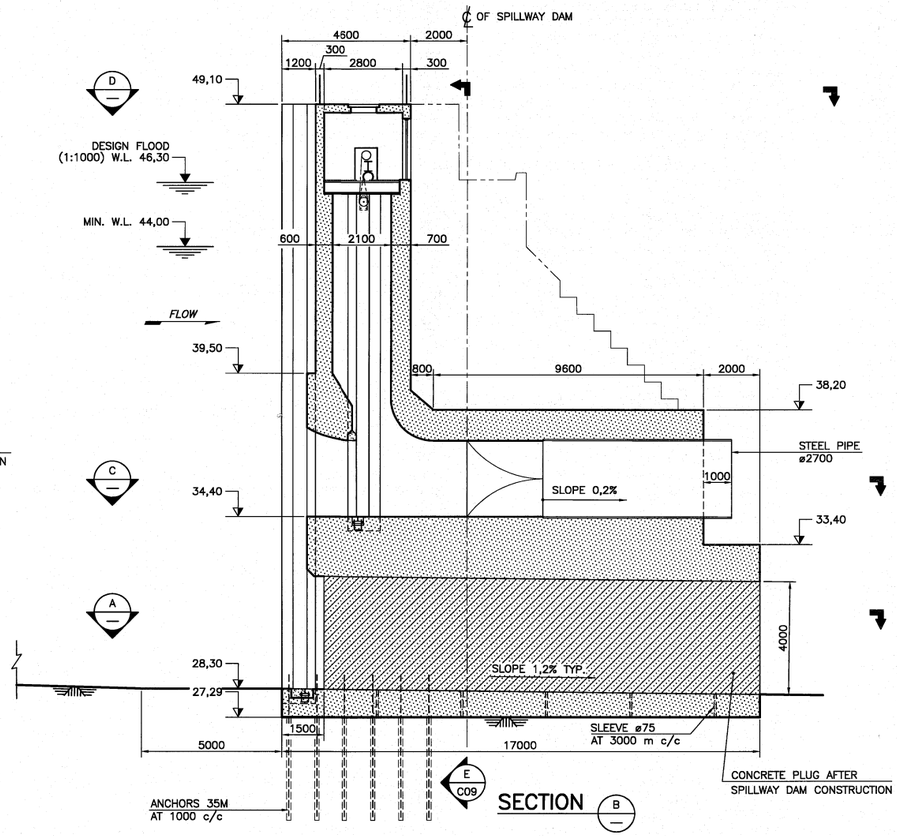
Scale factor 1:1000 — Scale 0 10 50 — Dimensions in m — Project n° P48–0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C07	1 of 1	0

A1 841 x 594



SECTION A



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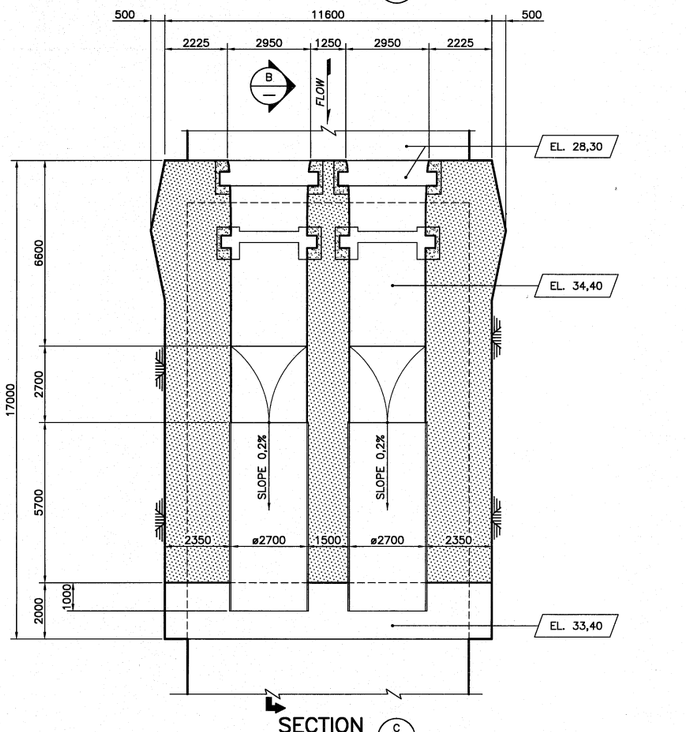

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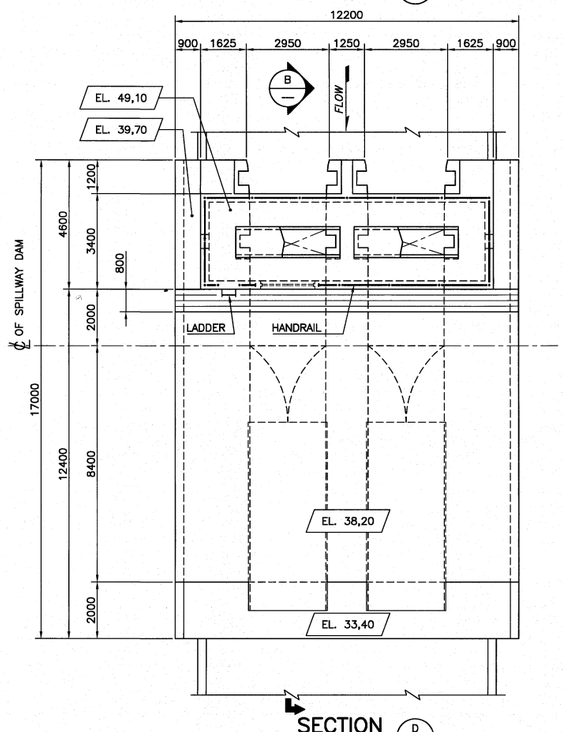

SECTION D

LEGEND

CONCRETE 30 MPa

MASS CONCRETE 20 MPa

N°	Notes and references

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

Title: INTAKE
CONCRETE WORKS
SHEET 1 OF 2

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST-PIERRE	Approved	H. BOUZATENE

Scale factor 1:100 — Scale 0 1000 5000 — Dimensions in mm — Project n° P48-0643

Client	Sector	Project	Drawing n°	Sheet	Rev
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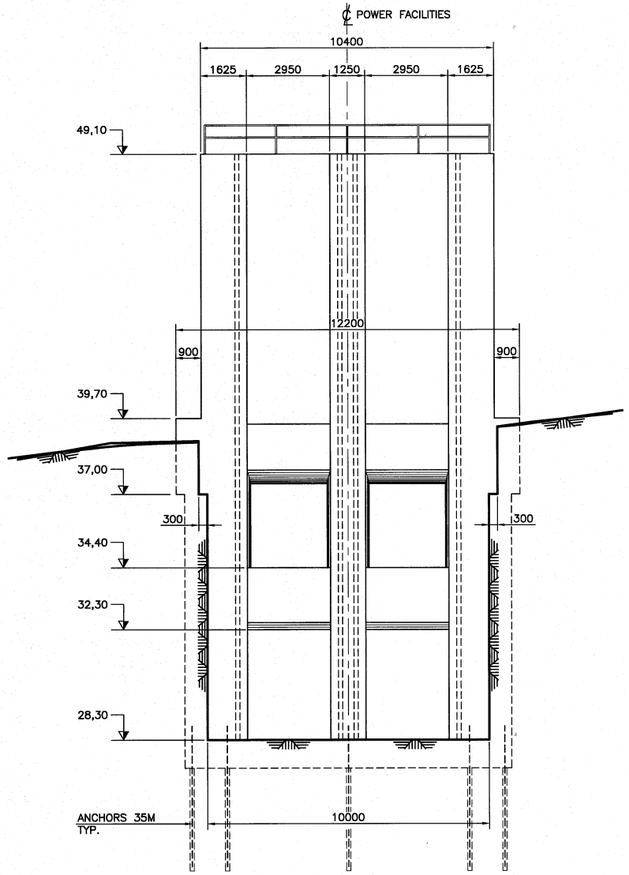
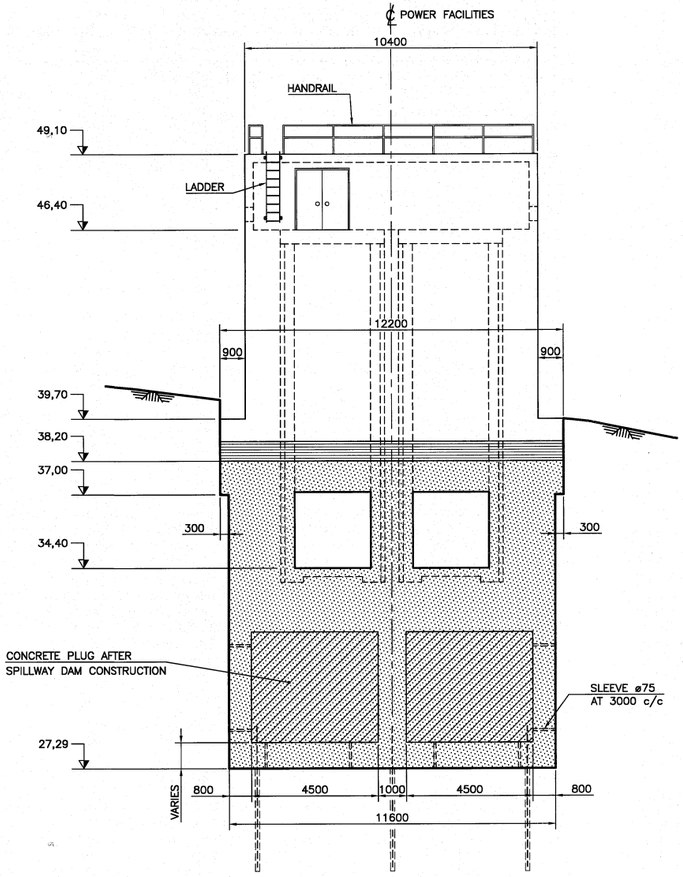
A1 841 x 594



UPSTREAM ELEVATION



SECTION E / C08

N°	Notes and references

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

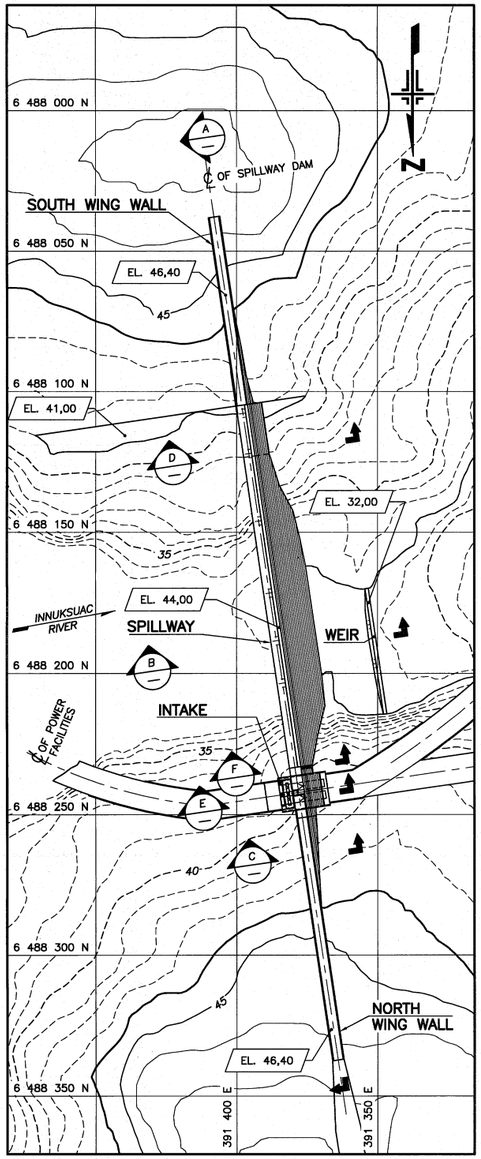
Title: INTAKE
CONCRETE WORKS
SHEET 2 OF 2

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST-PIERRE	Approved	H. BOUZIENE

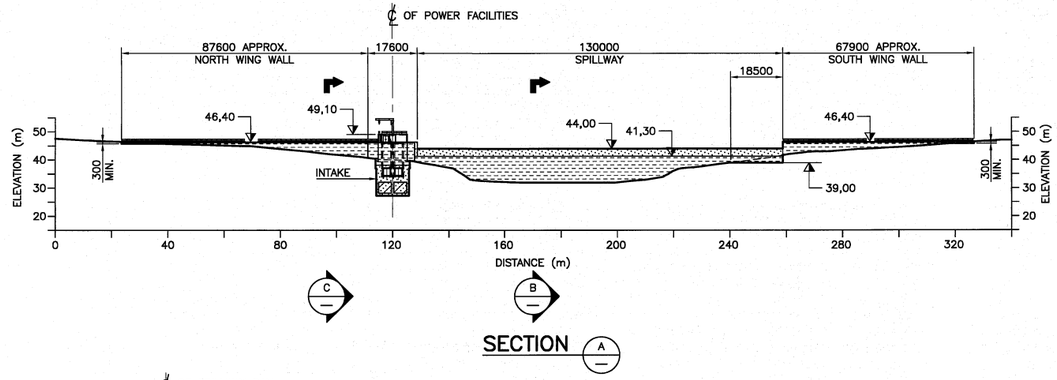
Scale factor 1:100
Dimensions in mm
Scale 0 1000 5000
Project nº P48-0643

Client	Sector	Project	Drawing nº	Sheet	Rev
	48	0643	C09	2 of 2	0

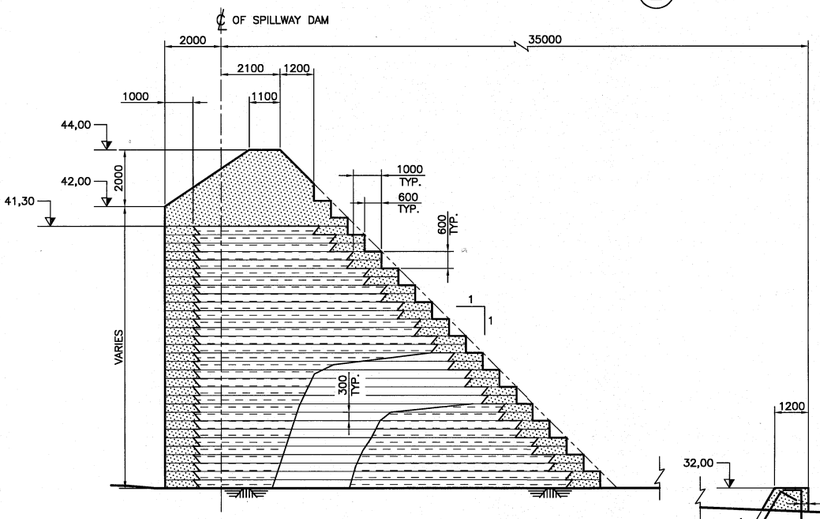
A1 841 x 594



PLAN



SECTION A



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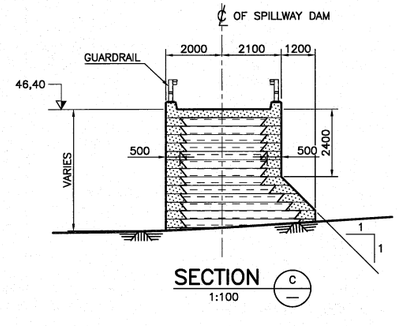

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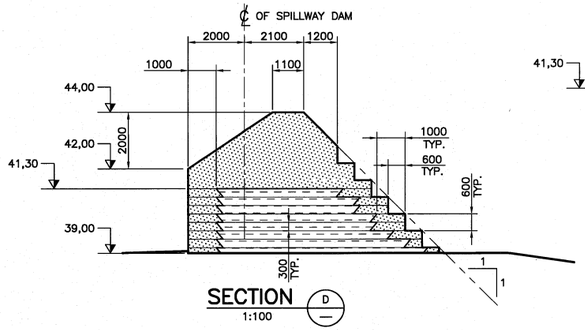

SECTION D
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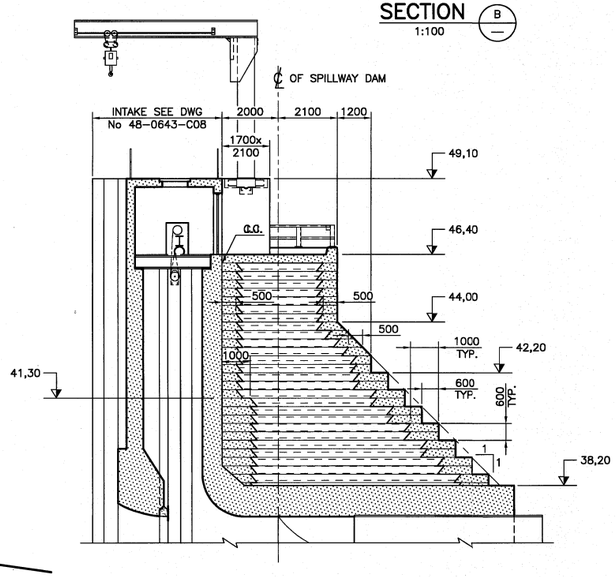

SECTION E
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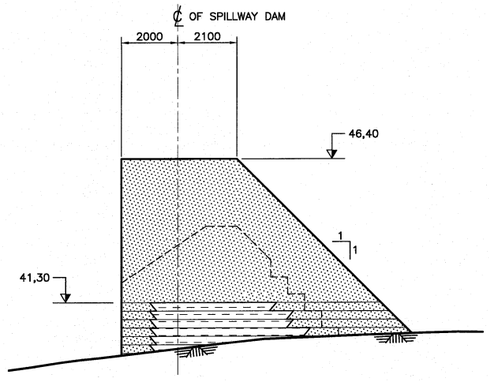

SECTION F

LEGEND

CONCRETE 35 MPa

ROLLER COMPACTED CONCRETE (R.C.C.)

N°	Notes and references
1	TOPOGRAPHY DATA FROM NASA'S SRTM3 AND MOSAIC-3D'S LIDAR SURVEY.
2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: INNAVIK HYDROELECTRIC PROJECT

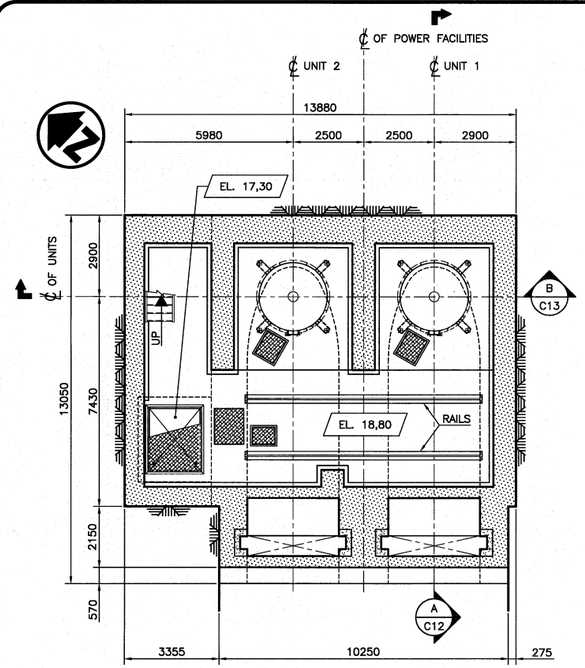
Title: SPILLWAY DAM CONCRETE WORKS

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST-PIERRE	Approved	H. BOUZAÏENE

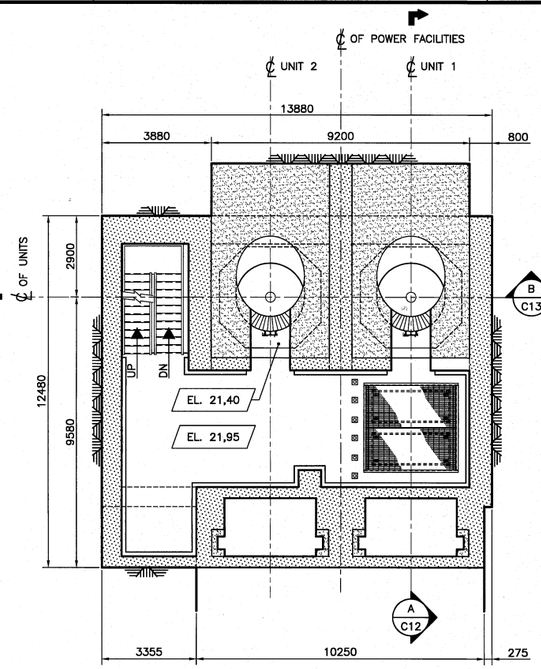
Scale factor 1:1000 — Scale 0 10000 50000 — Dimensions in mm — Project n° P48-0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C10	1 of 1	0

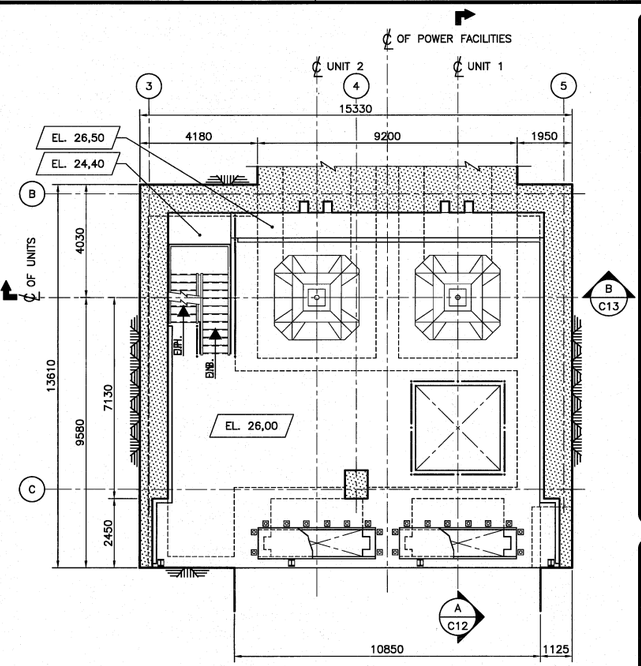
A1 841 x 594



PLAN – LEVEL 18,80



PLAN – LEVEL 21,95



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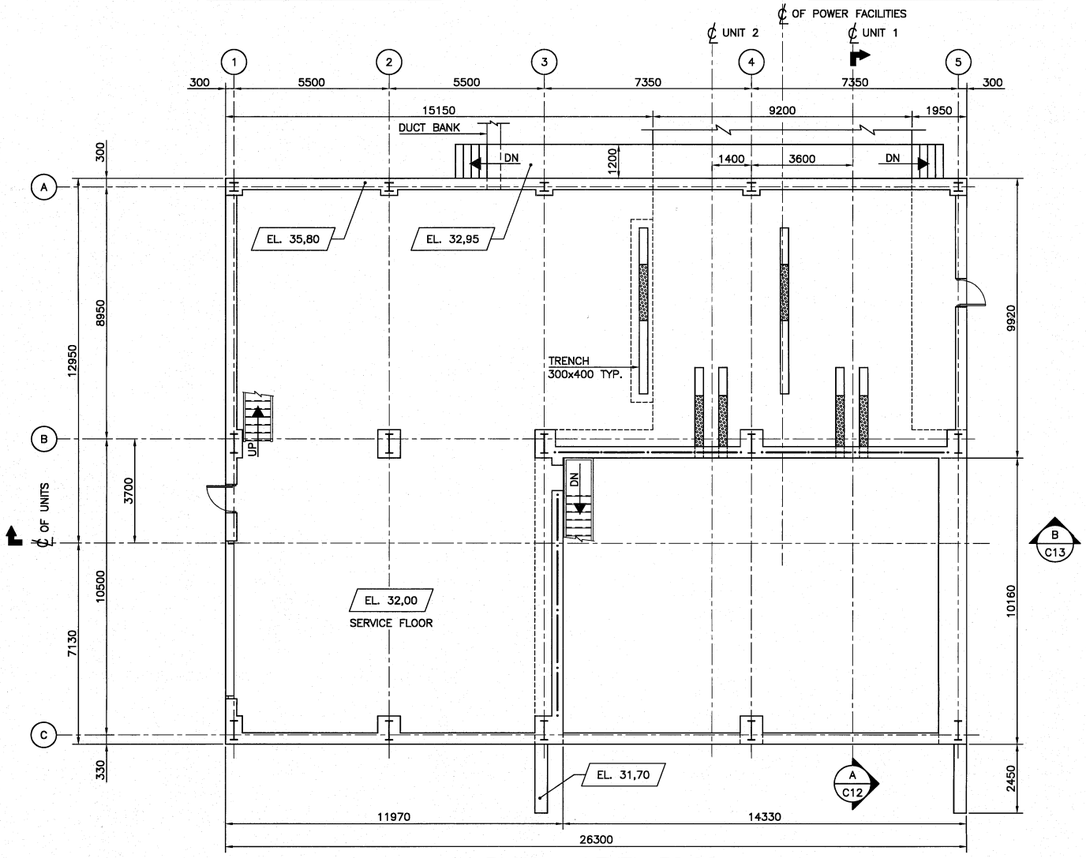
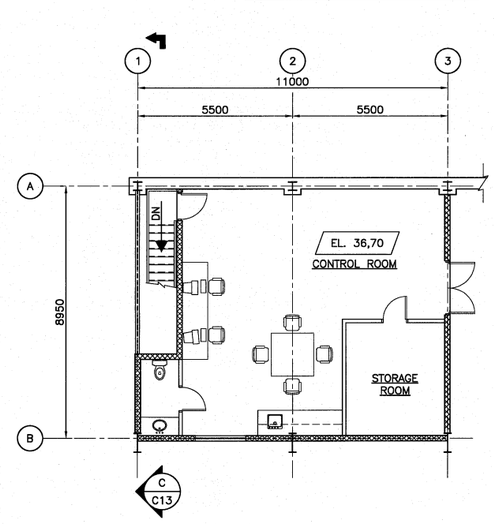


PLAN – LEVEL 32,00



MEZZANINE – LEVEL 36,70

N°	Notes and references

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

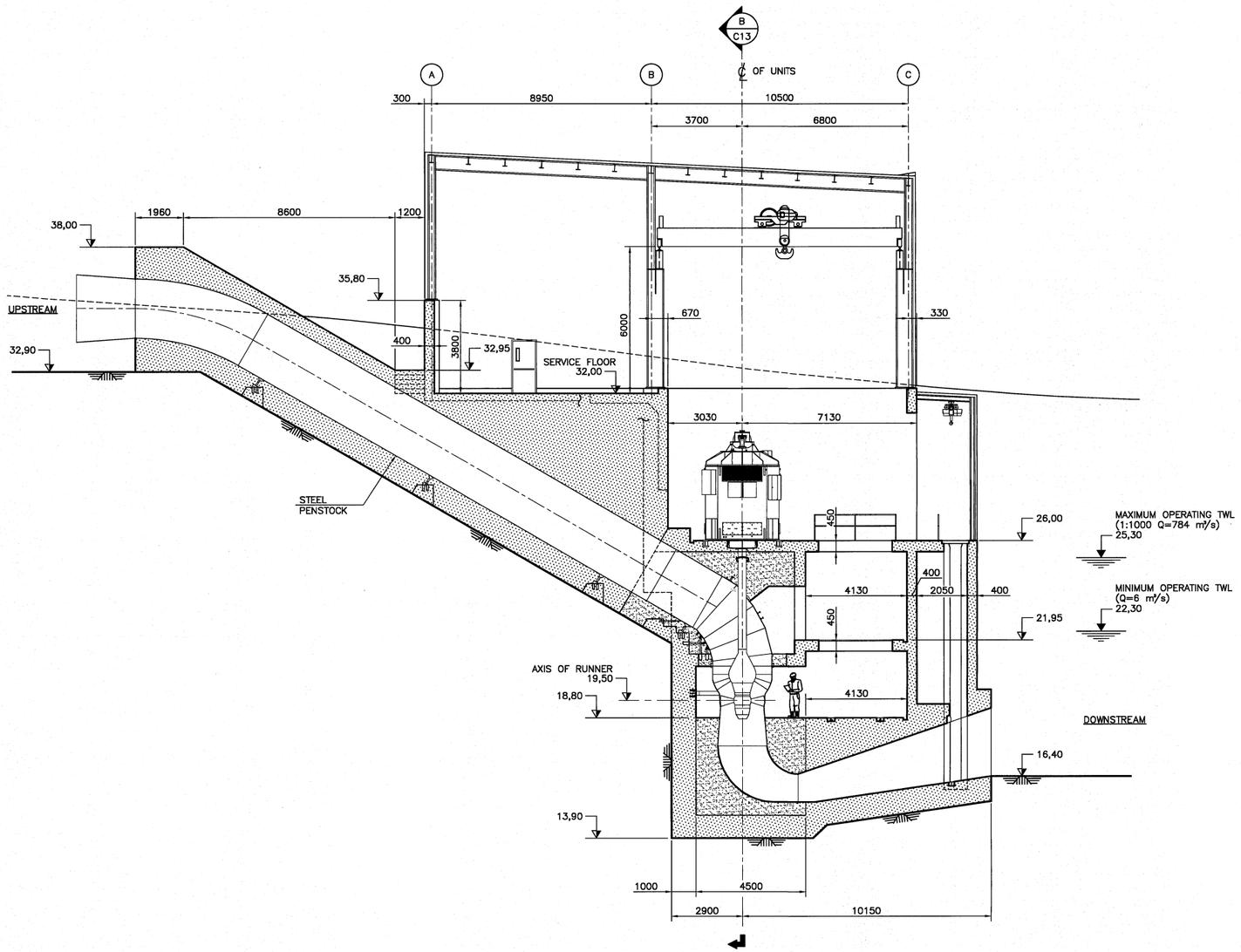
Title: POWERHOUSE
CONCRETE WORKS
SHEET 1 OF 3

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST-PIERRE	Approved	H. BOUZATENE

Scale factor 1:100
Dimensions in mm
Scale 0 1000 5000
Project n° P48-0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C11	1 of 3	0

A1 841 x 594



SECTION A C11

N°	Notes and references

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

Title: POWERHOUSE
CONCRETE WORKS
SHEET 2 OF 3

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST-PIERRE	Approved	H. BOUZATENE

Scale factor 1:100
Dimensions in mm
Scale 0 1000 5000
Project nº P48-0643

Client	Sector	Project	Drawing nº	Sheet	Rev
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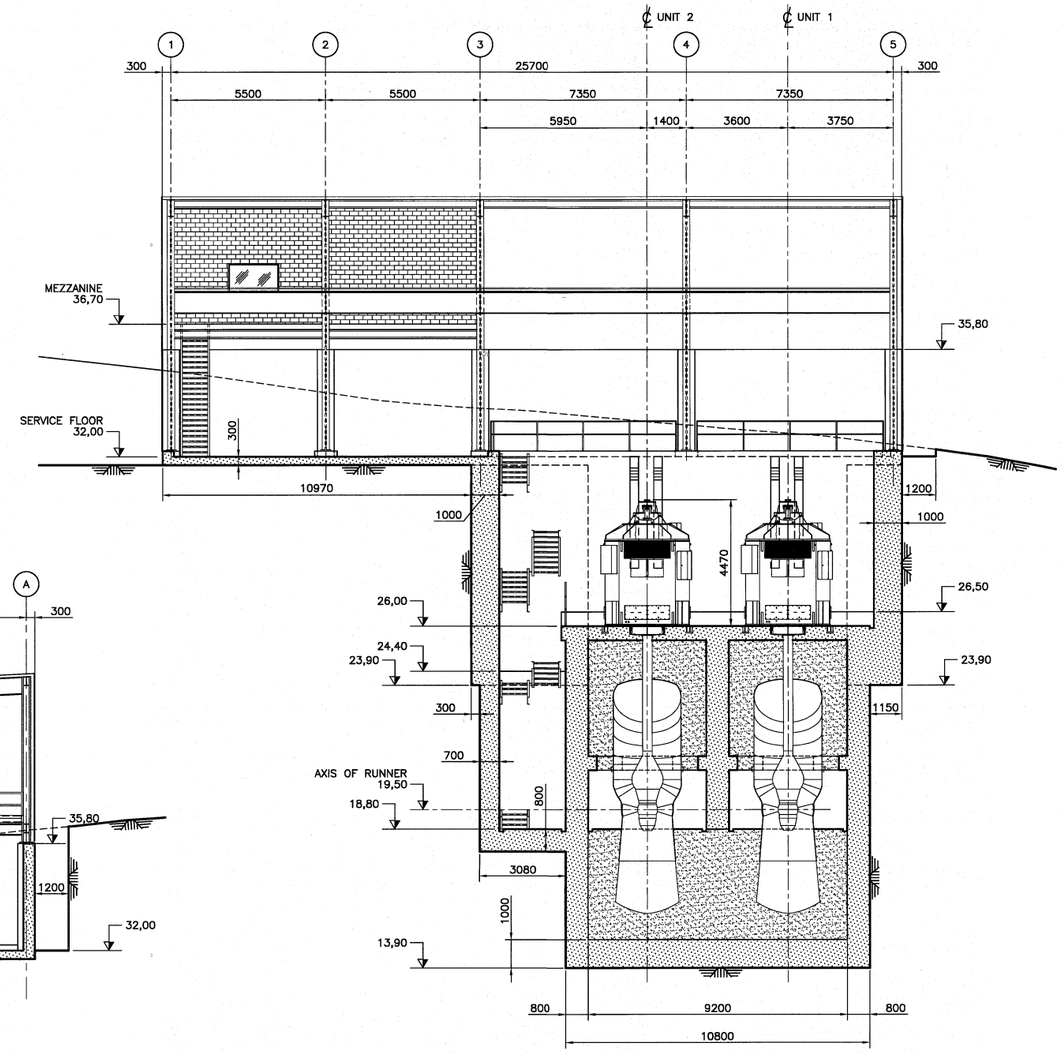
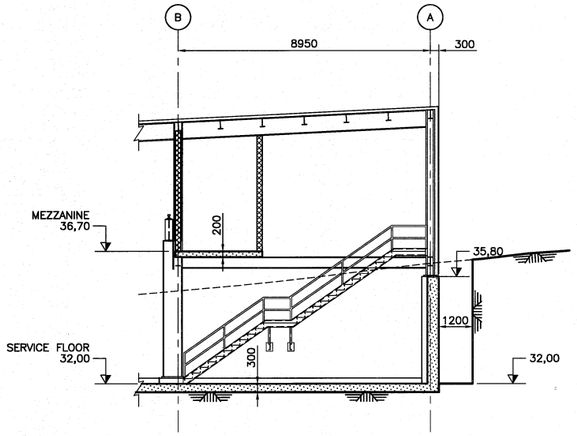
A1 841 x 594



SECTION C11



SECTION B C11 B C12

N°	Notes and references

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

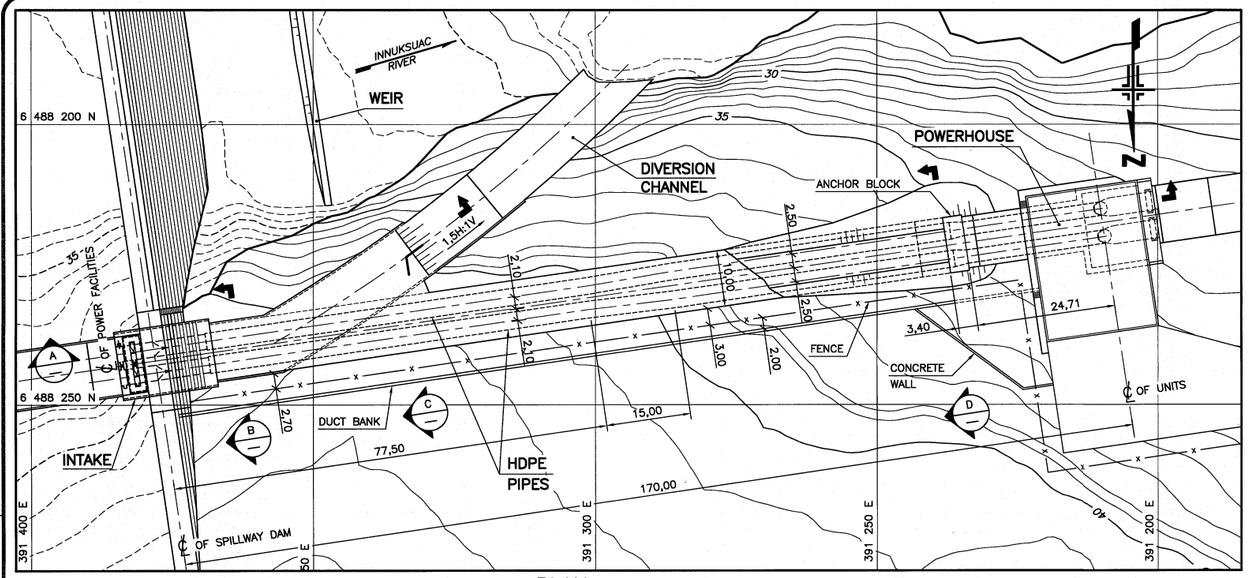
Title: POWERHOUSE
CONCRETE WORKS
SHEET 3 OF 3

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST-PIERRE	Approved	H. BOUZAÏENE

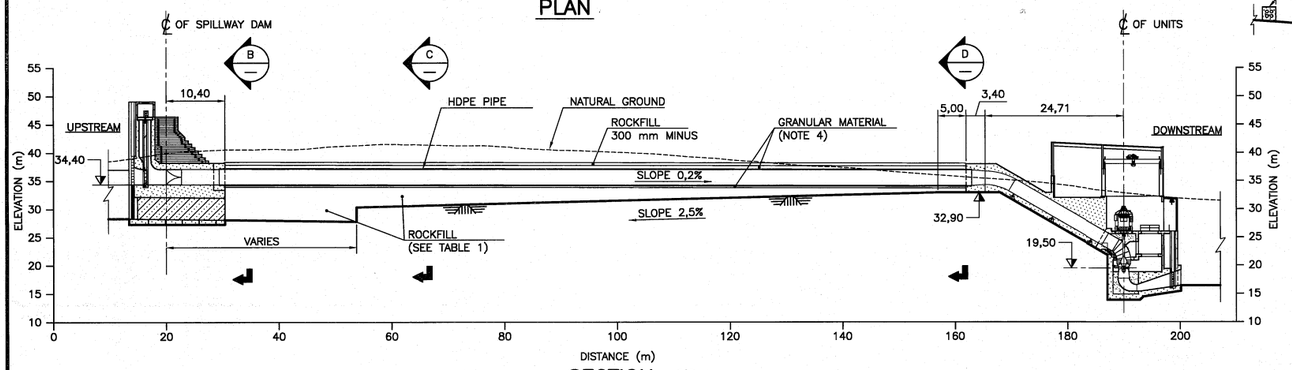
Scale factor 1:100
Dimensions in mm
Scale 0 1000 5000
Project n° P48-0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C13	3 of 3	0

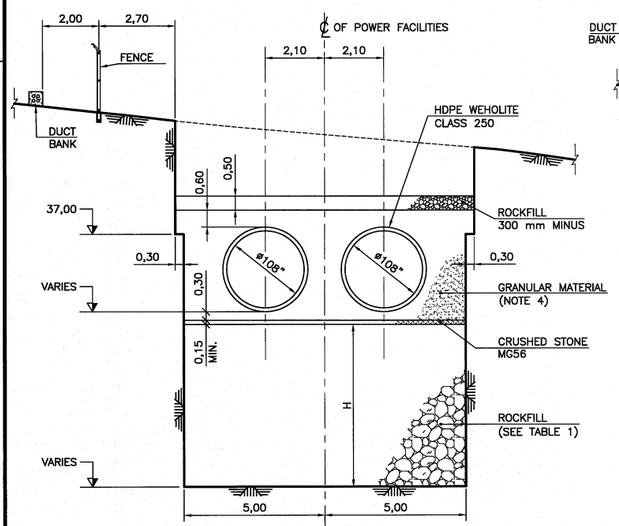
A1 841 x 594



PLAN



SECTION A



SECTION B
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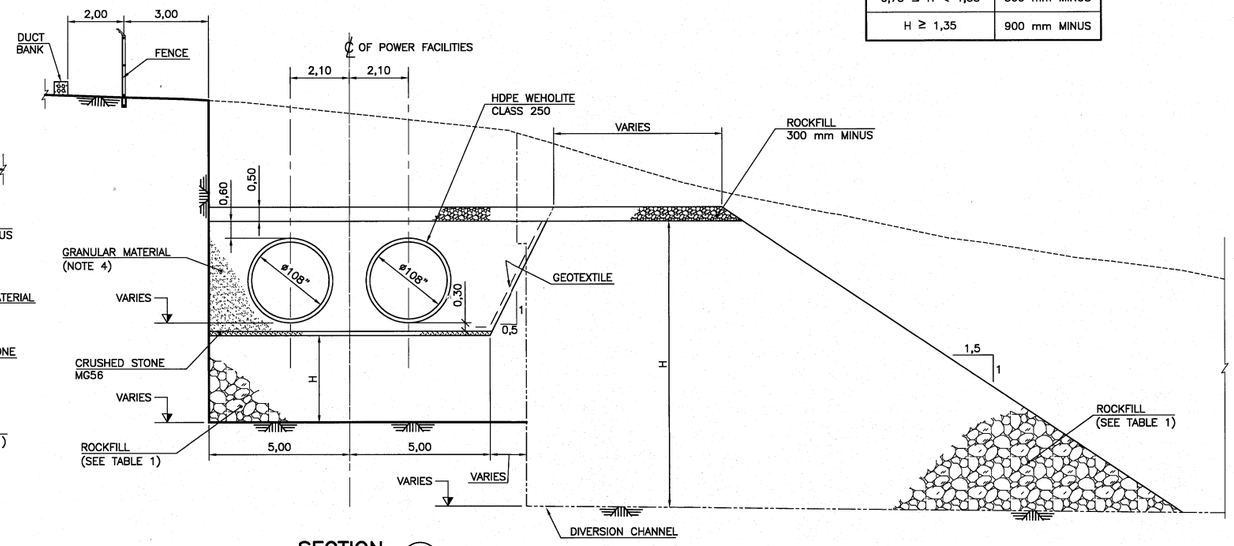

SECTION C
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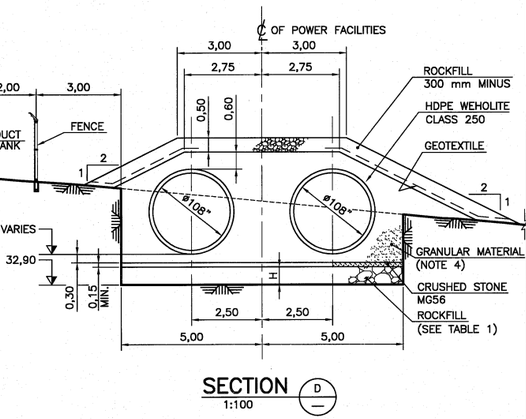
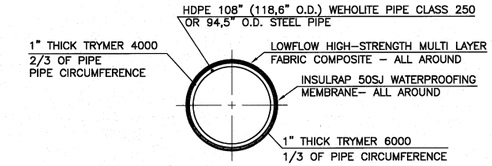


SECTION D
1:100



PIPE INSULATION DETAIL
FOR HDPE & STEEL PIPE
1:100

TABLE 1	
H (m)	ROCKFILL
0,45 ≤ H < 0,75	300 mm MINUS
0,75 ≤ H < 1,35	500 mm MINUS
H ≥ 1,35	900 mm MINUS

N°	Notes and references
1	TOPOGRAPHY DATA FROM SRTM3 AND LIDAR SURVEY.
2	THE REFERENCE SYSTEM USED IS THE MTM NAD83 ZONE 10 WGS84.
3	ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METER EXCEPT WHERE SPECIFIED.
4	GRANULAR MATERIAL SHALL BE WELL GRADED NATIVE MATERIAL WITH LESS THAN 5% PASSING TROUGH THE SIEVE #200 AND WITH A MAXIMUM PARTICLE SIZE OF 30 mm.

N°	Date	Issued and/or Revisions	Designed	Approved
0	09-11-03	ISSUED FOR FEASIBILITY STUDY		

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STÉPHANIE ST-PIERRE
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Project: INNAVIK HYDROELECTRIC PROJECT

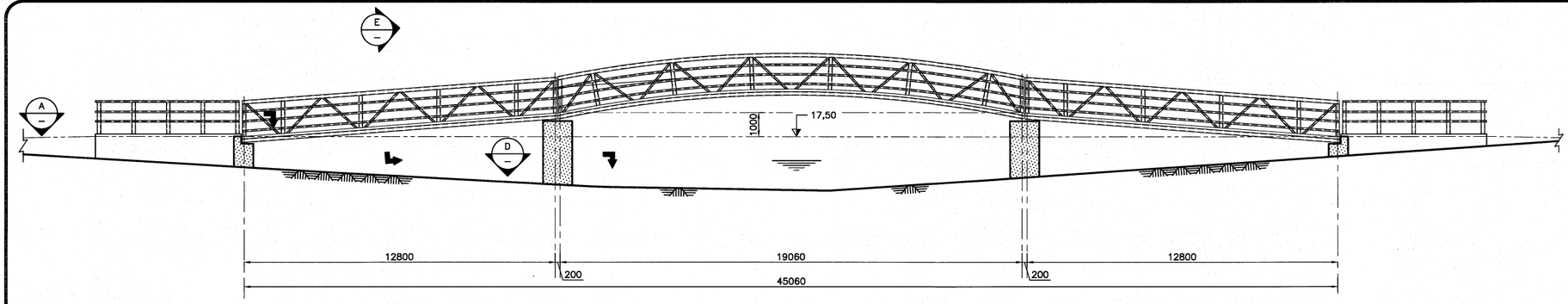
Title: PENSTOCKS

Drawn	P. LAMY/ V. LORENT	Checked	L. LACHAPELLE
Designed	B. BENABDELLAH	Checked	N. BEAUSÉJOUR
Approved	S. ST-PIERRE	Approved	N. BEAUSÉJOUR

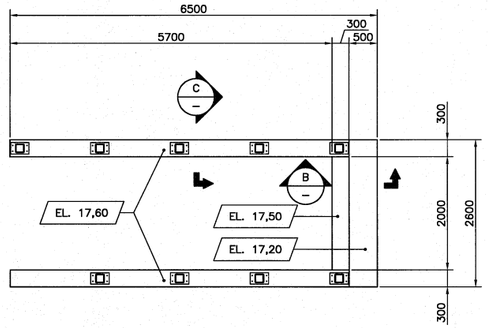
Scale factor 1:500
Dimensions in m
Scale 0 5 25
Project n° P48-0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C14	1 of 1	0

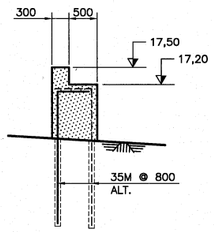
A1 841 x 594



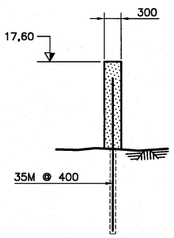
ATV BRIDGE
LONGITUDINAL SECTION



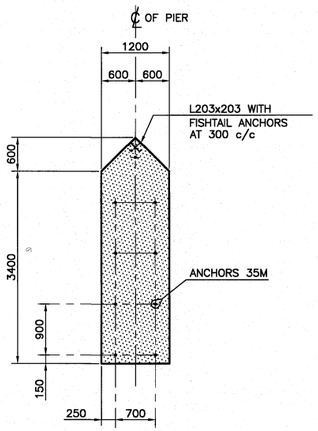
SECTION–PLAN A
1:50



SECTION B
1:50



SECTION C
1:50



SECTION D
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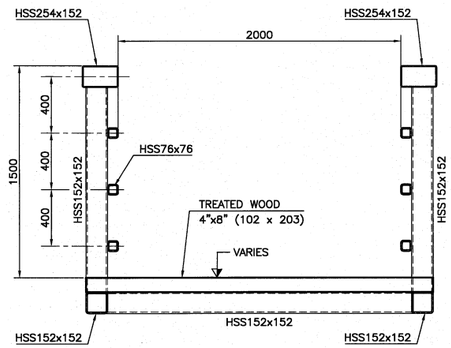
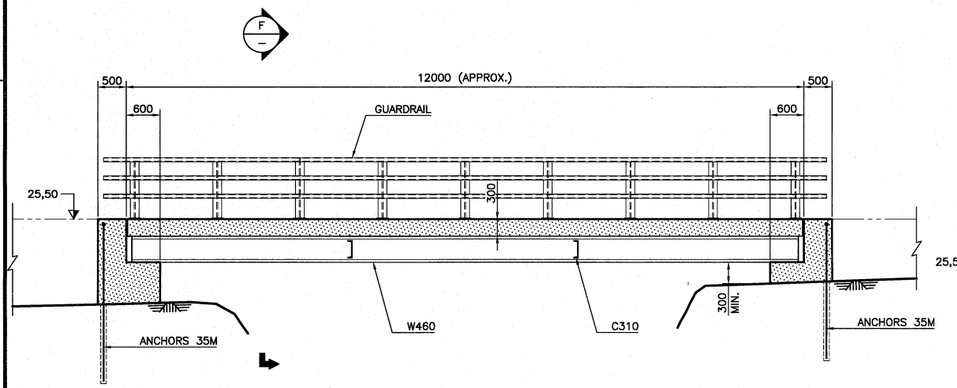
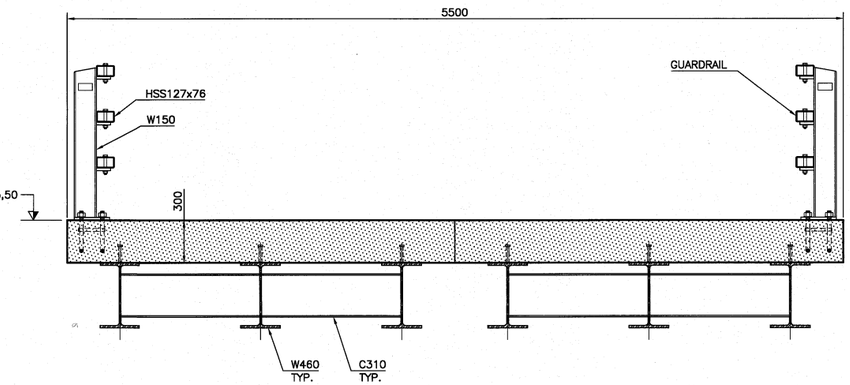


SECTION E
1:20



PRECAST BRIDGE
LONGITUDINAL SECTION
1:50



SECTION F
1:20

N°	Notes and references

N°	Date	Issued and/or Revisions	Designed	Approved
0	09–11–03	ISSUED FOR FEASIBILITY STUDY		

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Project: **INNAVIK HYDROELECTRIC PROJECT**

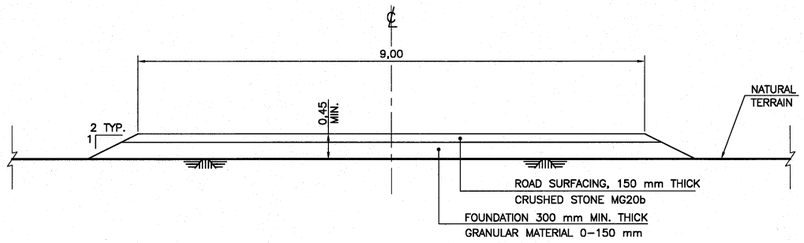
Title: ATV BRIDGE AND PRECAST BRIDGE

Drawn	V. LORENT	Checked	L. LACHAPELLE
Designed	V. FORGUES	Checked	J. MARTIN
Approved	S. ST–PIERRE	Approved	H. BOUZAIENE

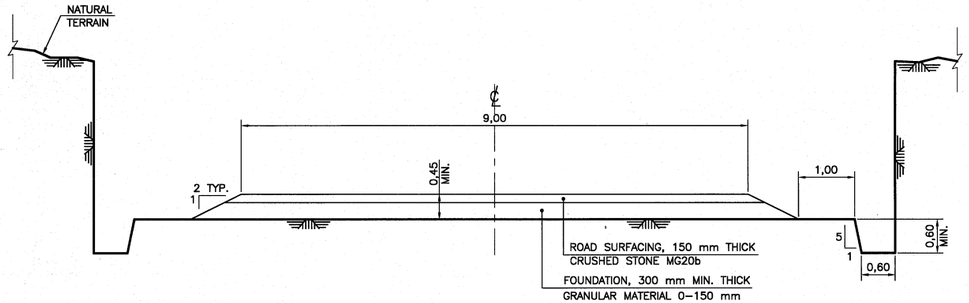
Scale factor 1:100
Dimensions in mm
Scale 0 1000 5000
Project n° P48–0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C15	1 of 1	0

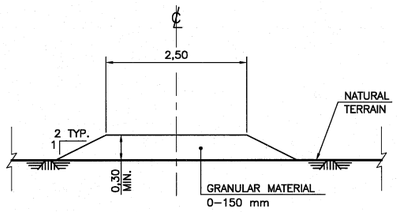
A1 841 x 594



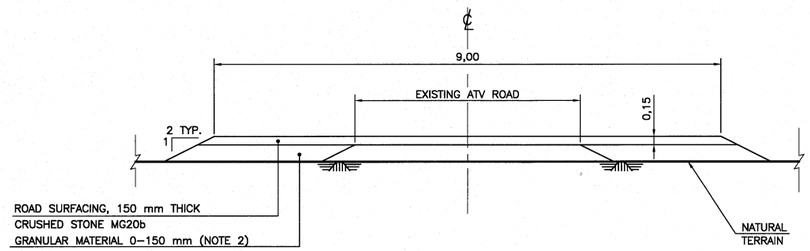
ACCESS ROAD – EMBANKMENT



ACCESS ROAD – ROCK EXCAVATION



ATV ACCESS ROAD



WIDENING OF EXISTING ATV ROAD

N°	Notes and references
1	ALL DIMENSIONS ARE IN METERS UNLESS WHERE SPECIFIED.
2	THE THICKNESS OF THE FOUNDATION DEPENDS ON ADJUSTMENTS, IF REQUIRED, ON THE EXISTING ATV ROAD PROFILE.

N°	Date	Issued and/or Revisions	Designed	Approved
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Project: **INNAVIK HYDROELECTRIC PROJECT**

Title: ROADS
TYPICAL SECTIONS

Drawn	V. LORENT	Checked	L. LACHAPELLE
Designed	B. BENABDELLAH	Checked	N. BEAUSÉJOUR
Approved	S. ST–PIERRE	Approved	N. BEAUSÉJOUR

Scale factor 1:50
Dimensions in m
Scale 0 0,5 2,5
Project n° P48–0643

Client	Sector	Project	Drawing n°	Sheet	Rev
	48	0643	C16	1 of 1	0

A1 841 x 594