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Greenland Hydropower Project Site 6g

Prefeasibility report

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1.1 Project Overview

1.1.1 Background

The Greenland Power Project (Greenland Project) consists of a greenfield aluminum reduction plant to be developed at a site in or near the town of Maniitsoq in western Greenland and a number of hydro developments to provide electricity for the smelter. The project will involve the development of sufficient hydro power resources among two identified hydro areas in Western Greenland to serve the requirements of the aluminum plant and the development of power transmission facilities between the hydro resources and the aluminum plant. Alcoa will develop the aluminum plant facilities on the plant site, as well as a harbor facility near the plant. The hydro sites will be developed and operated to meet the needs of the aluminum plant. During construction, other infrastructures between population centers, the harbor, the hydro sites and the smelter site will also be developed.

In 2007, during Phase I of the Memorandum of Understanding (MOU), PB Power (PB), with the assistance of outside consultants, completed various field studies and technical analyses as part of an initial feasibility study including: Phase I of the geotechnical and hydrologic investigations; field measurements of flow and sediment; transmission line conceptual design and cost study; office studies of scope and cost of three potential hydro sites (7e, 7d and 6g); and aerial survey and topographic mapping. Based on the results of these field and office studies, conceptual engineering for the project such as dams, tunnels, canals, roads and transmission lines were completed. The power availability at each of the three sites was determined based on the results of a hydrologic investigation as well as the field studies. A conceptual hydro project schedule and cost estimate was also prepared.

Originally, there were five hydropower sites considered as sources of energy for the Greenland Project. Prior to Phase I of the MOU, the three most favorable sites were chosen for further study to provide approximately 600 to 750 MW of power to the aluminum smelter. In MOU Phase I, Site 7d was excluded since the available power at the site could be obtained with an increase water storage capacity at site 7e.

1.1.2 Project status

MOU Phase I concluded on April 20, 2008. Additional investigations for the remainder of Phase I, completed in 2008 by Alcoa, included: refinement of the conceptual quantities; further review of future hydrology; further review of project works required for future hydrology; further review/resolution of transmission line technical/cost data and additional evaluation of mechanical/electrical equipment. These studies further updated the cost/schedule estimate for the project and provided input to the preliminary design and 2007 field study program to be coordinated by PB Power.

During the spring of 2008, Alcoa and the Greenland Homerule Government concluded that it was desirable to continue further evaluation and development of the Project and begin the second phase of investigative activities, MOU Phase II. Phase II continued until Fall 2009.

If, following the conclusion of Phase II activities, Alcoa and the Greenland Homerule Government conclude that it is desirable to pursue further evaluation and development of the Project, they will begin the third phase of activities. The third phase is currently expected to start in 2010 with construction beginning in 2011.

1.1.3 Scope of Work for Phase II Studies

The scope of work is for engineering and construction related services during MOU Phase II to provide preliminary design, cost estimates and planning for the development of the hydro site components to meet the needs of the aluminum plant (650 MW), including the development of preliminary design drawings, construction related services, electrical and mechanical works services. Specifically, this includes the following:

- general layouts;
- design criteria and preliminary design for every major project component;
- firm power capacity of the project (650 MW needed at the smelter);
- preliminary construction cost estimate (+25%, -15%) for each site;
- preliminary construction schedule;
- risk assessment.

In addition to that main scope, a single site scheme has been developed to use the full potential of site 7e. This scheme includes higher dams. The firm power availability doesn't meet the full smelter requirement (533 MW with maximum operating level of 726 m) but reduces the capital cost significantly.

1.2 Hydro sites

1.2.1 Site 7e

1.2.1.1 Description

The 7e hydropower project is located at the western end of Lake Tasersiaq, approximately 100 km south of the town of Kangerlussuaq. This high head scheme's main components and key figures are presented in the project metrics table and include:

- A reservoir which will be created by raising Lake Tasersiaq's present water level (690 m) by 24 m. It's normal operating level will be between 680 m and 714 m, with 4 085 hm^3 of live storage.
- The headworks, including:
  - Two asphalt core rockfill dams, with the larger one being approximately 55 m high;
  - A spillway including a 200 m long ungated concrete weir discharging into a side channel spillway, followed by a rock chute;
  - A temporary diversion tunnel and cofferdams;
  - A headrace channel and intake;
  - A 42 km access road between the harbor and the headworks.
- The conveyance structures and power system, including:
  - A 26.6 km headrace tunnel. At this stage of the study, it is planned to excavate the power tunnel using two TBMs.
  - An air cushion surge chamber;
  - An underground powerhouse equipped with 5 Pelton turbines, a transformer cavern, access and cable galleries;
  - A tailrace tunnel whose outlet discharges at Evighedsfjord;
  - A service building and harbor facility.

Table 1.1 7e project metrics

Design Flood	Permanent civil works - 1:10 000 years flood	2 710 m³/s
	Temporary civil works - 1:20 years flood	1 280 m³/s
Water Levels	***Reservoir***	
	Maximum operating level	714 m
	Minimum operating level	680 m
	Water level with the 1:10 000 years flood	717.3 m
	Downstream - Fjord	
	Maximum tide level	2.6 m
	Minimum tide level	-2.3 m
Production Devices	Number of turbines	5
	Types of turbines	Pelton
	Net head (at max level)	697 m
	Unit discharge	17.4 m³/s
	Maximum unit capacity (Generator output)	126.4 MW
	Voltage Output	13.8 kV
	Maximum generator output - total	595 MW
	Firm power	500 MW
Headrace Canal	Length	2 100 m
	Water velocity	0.65 m/s
Intake	Type of intake	Surface - horizontal
	Number of gates	1
Headrace Tunnel	Length	26.6 km
	Diameter	8 m
	Cross-section shape	Circular (TBM)
	Cross-sectional area	50.3 m²
Powerhouse	Width (upstream - downstream)	16.5 m
	Length	86 m
	Height	28 m
Tailrace Tunnel	Length	3.67 km
	Cross-section shape	Reverse-D
	Cross-sectional area	83.2 m²
Dams	Type	Asphalt core rockfill
	Crest width	6 m
	Dam 1 (Alternate axis)	
	Crest elevation	719 m
	Length	330 m
	Maximum height	55 m
	Dam 2	
	Crest elevation	719.5 m
	Length	995 m
	Maximum height	27 m

Spillway (overflow weir)	Crest length	200 m
	Discharge capacity	2 440 m³/s
Catchment Area	Total area	6 789 km²
Access Road	Total length	41.75 km
Transmission Line	Total length	125 km

1.2.1.2 Hydrology

The total area of the drainage basin at Site 7e is 6 789 km², of which 78% are glacier covered. Most of the inflow comes from glacier melting and occurs between June and October.

Daily flow series have been generated for a 50 year period. Three cases have been considered, producing the following set of data:

- historical series, using past climate data from September 1, 1958 to August 31, 2008;
- projected series 2020, using a climate warming scenario (from DMI) to produce an inflow projection at the year 2020;
- projected series with an horizon set at 2040 using a similar methodology to the 2020 run.

The historical synthetic series comes from an energy balance model and was calibrated on observed data.

Table 1.2 Yearly average flow at site 7e

Case	Yearly average (m³/s)
Historical	83.4
2020	96.1
2040	104.0

1.2.1.3 Power production

The net head is approximately 697 m (~2,287 ft) at full pool.

Based on the 2020 projection (or on the last 20 years), the predicted firm power capacity of Site 7e is approximately 500 MW, providing more than 70% of the planned smelter's total power requirement. The expected firm power for 2040 horizon would reach 536 MW. The powerhouse is equipped with 5 Pelton turbines which can produce a maximum output of 595 MW. The units were selected to provide a minimum of 505 MW over the complete reservoir fluctuation range with one unit shut down for maintenance either at Site 6g or 7e; this was done in order to guarantee the firm power availability.

1.2.1.4 Arctic conditions and permafrost

Since the field investigation results showed the presence of deep permafrost in the vicinity of the intake, a number of measures were taken to prevent freezing problems.

- The headrace canal approach velocity was set in order to ensure that a stable ice cover will rapidly form.
- The intake design includes a 200 m high drop shaft to bring the water below the 0 degree isotherm in the shortest possible distance; this is to avoid ice buildup in the tunnel in case of powerhouse shutdown.

- In order to avoid ice formation in the intake gate shaft, electric heating elements are inserted in tubes embedded in the wall of the gain of the gate over the full height of the gain. A 10.6 kV line along the access road is planned.
- It is planned to unfreeze and grout the dams foundations at the most critical section.
- The tailrace tunnel outlet was relocated downstream of a glacial tongue in the fjord to avoid ice obstruction problems.

1.2.1.5 Construction

The construction schedule spans five years. The critical activities are related to the access road and headworks construction. It takes a little less than 2 years to complete the access road to the dam area and a year is required to impound the reservoir, leaving only 2 years for headworks construction.

Two construction camps are required. The main one (Camp a) will be located near the powerhouse access tunnel entrance. The second one (Camp b) will be located in the dam and intake area. It is expected that construction of Site 7e will require 4.2 million man-hours to complete.

1.2.2 Site 6g

1.2.2.1 Description

The 6g hydropower project (Imarsuup Isua) is located approximately midway between the towns of Nuuk and Maniitsoq in the north-south direction, and approximately 120 km east of them. This high head scheme's main components and key figures are presented in the Site 6g project metrics table and include:

- The main reservoir, which will be created by raising Lake Imarsuaq's (Big lake) present water level (675 m) by 7 m. It's normal operating level will be between 669 m and 682 m with 945.8 hm^3 of live storage;
- The lower reservoir, which will be created by raising Lake Tussapp Tasis' (Lower lake) present water level (653 m) by 14 m. It will be operated at a constant level (667 m);
- The headworks, with the dams, regulating structure and intake include:
  - Four asphalt core rockfill dams, with the largest one being approximately 32 m high;
  - Two concrete spillways, one for each reservoir;
  - Two temporary diversion tunnels and cofferdams;
  - A regulation tunnel connecting the two reservoirs;
  - 2 diversion canals to increase inflow to the Big Lake;
  - 2 canals to avoid ice build-up problems in shallow areas of the Lower lake
  - 46.7 km of access roads between the harbor and the various headworks components;
- The conveyance structure and power system
  - A 10 km headrace tunnel. At this stage of the study, the power tunnel is planned to be excavated by one TBM;
  - An underground powerhouse equipped with 2 Pelton turbines, a transformer cavern, access and cable galleries;
  - A tailrace tunnel whose outlet discharges at Godthabsfjord;
  - A service building and harbor facilities.

Table 1.3 6g project metrics

Design Flood	Permanent civil works BIG LAKE- 1:10 000 years flood	400 m³/s
	Temporary civil works BIG LAKE- 1:20 years flood	245 m³/s
	Permanent civil works LOWER LAKE- 1:10 000 years flood	160 m³/s
	Temporary civil works LOWER LAKE - 1:20 years flood	40 m³/s
Water Levels	***Reservoir-Big Lake***	
	Maximum operating level	682 m
	Minimum operating level	669 m
	Water level with the 1:10 000 years flood	683.8 m
	Reservoir-Lower Lake	
	Operating level (constant)	667 m
	Water level with the 1:10 000 years flood	668.3 m
	Downstream – Fjord	
	Maximum tide level	2.1 m
	Minimum tide level	-3.5 m
Production Devices	Number of turbines	2
	Type of turbines	Pelton
	Net head (at max level)	655.7 m
	Unit discharge	16.6 m³/s
	Maximum unit capacity	97 MW
	Voltage Output	13.8 kV
	Maximum generator output - total	194 MW
	Firm power	185 MW
Headrace Canal	Length	65 m
	Water velocity	0.65 m/s
Intake	Type of intake	Surface - horizontal
	Number of gates	1
Headrace Tunnel	Length	9.99 km
	Diameter	5.1 m
	Cross-section shape	Circular (TBM)
	Cross-sectional area	20.4 m²
Powerhouse	Width (upstream - downstream)	15.3 m
	Height	28 m
	Length	29.5 m
Tailrace Tunnel	Length	1.1 km
	Cross-section shape	Reverse-D
	Cross-sectional area	39.4 m²

Tunnel 1	***Connecting the two reservoirs - regulating structure***	
	Upstream and downstream canal length	170 m
	Tunnel length	1 690 m
	Cross-section shape	Reverse-D (Drill and Blast)
	Cross-sectional area	29.4 m²
	Design discharge	40 m³/s
Dams	Type	Asphalt core rockfill
	Crest width	6 m
	Dam 1	
	Crest elevation	671.5 m
	Length	310 m
	Maximum height	31 m
	Dam 2	
	Crest elevation	671.5 m
	Length	290 m
	Maximum height	18 m
	Dam 3 with geomembrane	
	Crest elevation	685.5 m
	Length	560 m
	Maximum height	13 m
	Dam 4	
	Crest elevation	685.5 m
	Length	175 m
	Maximum height	21 m
	Dam 5	
	Crest elevation	685.5 m
	Length	310 m
	Maximum height	32 m
Canals	***Canal 1***	
	Length	190 m
	Bottom width	3 m
	Design discharge	40 m³/s
	Canal 2	
	Length	180 m
	Bottom width	3 m
	Design discharge	40 m³/s
	Canal 3	
	Length	675 m
	Bottom width	5 m
	Design discharge	28 m³/s
	Canal 4	
	Length	28 m
	Bottom width	10 m
	Design discharge	28 m³/s

Spillways (overflow weir)	***Spillway 1***	
	Crest length	50 m
	Discharge capacity	105 m³/s
	Spillway 2	
	Crest length	72 m
	Discharge capacity	305 m³/s
Catchment Area	Total area	1 375 km²
Access Roads	Total length	46.6 km
Transmission Line	Total length	169 km

1.2.2.2 Hydrology

The total area of the drainage basin at Site 6g is 1 375 km², of which 58% are glacier covered. A large part of the inflow comes from glacier melting and occurs between June and October.

Daily flow series have been generated for a 50 year period. Three cases have been considered, producing the following set of data:

- historical series, using past climate data from September 1, 1958 to August 31, 2008;
- projected series 2020, using a climate warming scenario (from DMI) to produce an inflow projection at the year 2020;
- projected series with an horizon set at 2040 using a similar methodology to the 2020 run.

The historical synthetic series comes from an energy balance model and was calibrated on observed data.

Table 1.4 Yearly average flow at site 6g

Case	Yearly average (m³/s)
Historical	34.0
2020	37.4
2040	39.5

1.2.2.3 Power production

The net head is approximately 655 m (~2,148 ft) at full pool. The powerhouse is equipped with 2 Pelton turbines and the predicted firm power capacity of Site 6g is approximately 185 MW based on the 2020 projection.

1.2.2.4 Arctic conditions and permafrost

The field investigation results did not confirm the presence of permafrost at Site 6g. However, a number of measures were taken to prevent freezing problems.

- The canal's design water velocities were set in order to ensure that a stable ice cover will rapidly form;
- In order to avoid ice formation in the intake gate shaft, electric heating elements are inserted in tubes embedded in the wall of the gain of the gate over the full height of the gain. A 10.6 kV line along the access road is planned;
- It is planned to unfreeze and grout the dams foundation at the most critical section.

1.2.3 Construction

The construction schedule spans five years. The critical activities are related to the headworks construction. It takes 2 years to construct an access to the Northern dam area and a year is required to impound the reservoir, leaving less than 2 years (only one summer season) for the headworks construction.

Since the headworks of Site 6g are spread over a large territory, four construction camps are required:

- the main one (Camp 1) will be located near the Godthabsfjord and powerhouse access tunnel entrance;
- camp 2 will be located in the Lower lake dam and intake area;
- camp 3 will be located in the Southern end of Big lake near the tunnel connecting the two reservoirs;
- camp 4 will be located in the Northern end of Big Lake, in the vicinity of its present outlet.

It is expected that construction of Site 6g will require 2.3 million man-hours.

1.3 Project Enhancements

During the FEL 2 studies a number of project enhancements were achieved:

Hydrology

- Redefined catchment after inclusion of sub-ice contour and high resolution topographical data;
- Improved modeling approach after calibration of a new temperature model with meteorological measurement taken from stations operating on the Tasersiaq basin glacier margin;
- Flow series projection to consider climate change effect;
- Refined model and projection approach were reviewed and approved by glaciology experts.

Power generation

- Power production evaluation evolved from a 20 years series to a 50 years projected series taking into account all droughts and the natural variability;
- The firm power generator output was increased from 650 MW to 683 MW in order to take into account transmission losses and station service power to provide 650 MW of firm Power at the Smelter itself;
- Added overload capacity to the turbine-generator units to allow for one unit maintenance over the full range of reservoir level, without power reduction at the smelter;
- While the reservoir elevations were maintained to the FEL 1 levels, the potential to increase storage and power production at Site 7e exists and could be developed economically, although it could require extending the construction period to 6 years in order to fill the reservoir;
- Elimination of two diversion tunnels at Site 6g in the base scheme leaves potential for added power at 6g. This added power has a higher marginal cost than Site 7e's potential added power.

Arctic conditions, permafrost, site remoteness

- The design has been adjusted so that the arctic conditions and permafrost do not represent a fatal flaw;
- The Intake concept was adapted to the deep permafrost at Site 7e;
- Electrical lines and heating are planned at every gated intake and tunnel to ensure year-round gate operation;
- Gate redundancy at tunnel 1 (Site 6g) to guarantee continuous operation and room for maintenance of regulating equipment;
- Construction camp were adapted to the sites' remoteness and access conditions;
- Construction schedules now account for seasonal work and daylight periods.

Miscellaneous

- The Site 7e access road alignment in the power tunnel valley was further studied to give access up to the dam area and eliminate a 65 km portion between the second harbor in Sondre Stromfjord and the dam area that was planned in FEL 1.
- The cost of the redundant transmission line was reduced.
- The surge chamber/shaft was eliminated at Site 6g.

1.4 Project risks

The five main risks that were identified for the hydro are:

- Greater than anticipated infrastructure and logistics difficulties could increase costs and delays project start up ;
- Civil works construction difficulties could increase costs and delays (access road, tunneling, dam construction);
- Unfavorable weather conditions (change in duration of either winters or summers - movement of materials is easier during winter conditions -Fjord ice, fog, movement over snow or ice whereas construction is easier during summer conditions.);
- Difficulties could be encountered along the 300 km transmission lines to be constructed in rough terrain, with long fjord and glacier crossings. Some of them are state-of-the-art
- Environmental issues increase project cost, potentially impact start and completion dates/schedules and reduce available power output (NGO delays, Water releases downstream of dams, Ecosystems or archeological features in flooded areas or T-line corridor, project footprint).

1.5 Potential cost savings

During the FEL 2 studies and design review process, a number of potential alternatives or improvement to the design have been evaluated to reduce the overall project cost but were not actually incorporated in the drawings and base cost estimate. The potential savings (or cost increase) regarding these design modifications are included within the cost summary table for the project and are explained below for both Sites 6g and 7e.

1.5.1 Design modifications and purchasing costs

Headrace canal and intake design (7e): A new location for the intake allowed a reduction in the surface excavation volume by 60%, although slightly extending the headrace tunnel.

Headrace tunnel diameter (6g and 7e): Potential savings included in the cost summary reflect the reduction in headrace tunnel diameter that will likely be adopted after a further optimization study in this area.

Powerhouse location (6g and 7e): Following the results of 2009 field tests, the powerhouse location has to be moved for both sites, to avoid a sub vertical dolerite dyke at Site 7e and an area of low minimum stress level at Site 6g. These changes in the powerhouse location increase the project cost due to slightly longer access tunnels.

Penstocks and manifold optimization (6g and 7e): Potential savings included in the cost summary reflect the reduction in penstock diameter and length that will likely be adopted.

Dam axis (7e): The axis of dam 1 at Site 7e may be moved 200 m downstream to reduce its overall length and volume. At this site, the topography is favorable for the implementation of an ogee weir, unlined chute spillway.

Dam cross-section (6g and 7e): A number of adjustments to the dam cross-sections can be adopted to reduce their construction cost and ease the schedule.

Rock support (6g and 7e): Following the 2009 site investigations, the rock support criteria were reduced compared to those used in the base cost estimate.

Road construction (6g and 7e): The road construction methodology will likely be modified to increase the progression rate, improve the schedule and reduce the number of airlifts. A mobile camp is suggested to follow the road construction during the initial effort, Along with access at both ends of the steep sections, airlifts were proposed. A tunnel could also be excavated during the winter season in one of the section at Site 7e.

Diversion tunnel (6g and 7e): Potential savings included in the cost summary reflect the expected changes in diversion tunnel and cofferdam size after further optimization.

Concrete plugs (6g and 7e): The length and rebar quantities in the concrete plugs can be reduced slightly versus what was included in the base cost estimate.

Cable tunnel (6g and 7e): A new ventilation concept allows elimination of the concrete blocks in the middle of the tunnels, thus reducing the overall cross-section.

Equipment cost: A number of budget prices were received by a Danish supplier for the base cost estimate. Lower prices are expected from a North-American supplier even with addition of freight.

Construction camps: Salvage cost were applied to the construction camps permanent materials and infrastructure as well as temporary construction facilities, which wasn't done for the base cost estimate.

Fuel cost: was set by Alcoa at 0.66$ USD per liter, which is lower than the 0.72$ USD that was used in the base cost estimate.

All of the above potential savings and modifications were applied to the initial cost estimate to determine the overall saving that could be applied to the project. They're estimated at 75 M$ for Site 7e and 53 M$ for Site 6g

1.5.2 Working conditions and project contingencies

Additional savings are possible for the project, depending on the working conditions that are assumed, and the contingencies that are applied to the project. Alcoa suggested various criteria to consider in the cost estimate that are different from the parameters used in the base cost estimate, which roughly represent the actual practices in Canada. It is possible that the working conditions could be below the western countries standards if workers from other countries are employed for the project.

The criteria considered in the base cost estimate concerning the workers conditions compared with the new criteria proposed by Alcoa are the followings:

Table 1.5 Working conditions

	Initial cost estimate criteria	Revised criteria proposed by Alcoa
Hourly rate	24$/hr	10$/hr
Workers shift	40 days of work	120 days
Staff shift	40 days of work	60 days of work

Applying the new hourly rate to the cost estimate yields important cost savings on all project items. As for the longer work shifts, it reduced the cost of man power transportation to and from Greenland, as well as the number of overall trips.

The potential savings that can be obtained from the above considerations are:

New hourly rate of 10$/hr: Alcoa suggested the use of a 10$/h rate for Chinese labor. This change represents approximately 75 M$ total for both sites, considering a productivity reduction of 25%

Reduced man-power transportation due to longer working shifts: approximately 40 M$ total for both sites

Finally, Alcoa suggested to apply an overall contingency of 10% to the project total cost instead of the average contingency of 13% which was applied in the base cost estimate (contingencies varied between 10 and 25% depending on the item).

1.6 Opportunities

In addition to the potential savings outlined above, a number of potential opportunities could be further analysed and developed during 2010. They include:

- Construction of tunnel 2 and 3 at Site 6g which are not included in the base scheme and could increase the power output by 8 MW;
- 7F adjacent catchment could be diverted into 7e reservoir to increase the output of a single 7e scheme;
- Use of 2040 hydrology to plan future expansion or increased capacity;
- Staggered development of 7e and 6g to reduce 6g development cost.
- Other potential savings from the base cost estimate could arise with lower unit cost for the main component of the project, which include the equipments costs, the fuel cost, the labor rate and the man-power transportation.

The possibility to develop only Site 7e is one option that was studied in more depth. It is proposed that the maximum operating water level could be raised to 726 m to increase the firm power at the smelter to approximately 530 MW. The cost increase of implementing such a maximum water level would be of approximately 60 M$ at Site 7e. This estimation considers the increase in the overall cost of camp operations, as it would likely require an extra working year relative to the proposed base schedule.

1.7 Project capital cost

The hydro project capital cost is presented in table 1.6. The difference with the cost presented in section 8 comes from the different contingency level.

Table 1.6 Project Costs by Site

Pos.	Item	Site 7e	Site 6g	Cost (M$ USD)	Potential savings Site 7e	Potential Savings Site 6g	Cost with potential savings (M$ USD)
1. CIVIL WORKS							
1.1	DAMS	37.8	29.0	66.9	-6.3	-3.2	57.3
1.2	TUNNELS						
1.2.1	Headrace Tunnel	137.5	43.8	181.3	-11.4	-6.8	163.1
1.2.2	Tailrace Tunnel	16.0	7.4	23.4	-1.6	-0.7	21.0
1.2.3	All other tunnels	4.4	19.0	23.4	-3.7	-3.8	15.9
1.3	CANALS		2.5	2.5		-0.1	2.5
1.4	INTAKE STRUCTURE	59.0	9.2	68.2	-25.1	-0.2	42.9
1.5	UNDERGROUND POWER STATION	34.5	32.4	67.0	-1.4	7.1	72.7
2. MECHANICAL AND ELECTRICAL EQUIPMENT							
2.1	GENERATING EQUIPMENT	121.5	49.9	171.4	-2.2	-1.0	168.2
2.2	AUXILIARY MECHANICAL EQUIPMENTS	11.1	13.5	24.6	-0.2	-0.3	24.2
2.3	ELECTRICAL EQUIPMENT	37.6	30.5	68.1	-0.7	-0.6	66.8
3. INFRASTRUCTURE							
3.1	HARBORS	5.7	8.8	14.5	-0.1	-0.2	14.3
3.2	ROADS	58.0	50.2	108.2	-3.6	-3.5	101.1
3.3	CONSTRUCTION CAMPS						
3.4.1	Construction	56.3	117.4	173.7	-15.7	-37.2	120.8
3.4.2	Operation and maintenance	50.9	35.1	86.0	-0.9	-0.7	84.3
3.5	Construction material transportation	25.1	16.6	41.7	-0.5	-0.3	40.9
DIRECT COSTS TOTAL		**656**	**465**	**1 121**	**-74**	**-51**	**996**
4. INDIRECT COSTS							
4.1	Construction services and temporary facilities	32.7	39.6	72.3	-0.6	-1.1	70.6
4.2	Travel cost	41.0	25.8	66.8	-26.8	-16.4	23.6
4.6	Insurance	25.9	24.9	50.8			50.8
4.8	EPCM (Home office)	12.3	5.8	18.2			18.2
4.9	EPCM (Field office)	54.2	45.8	100.0			100.0
INDIRECT COSTS TOTAL		**166**	**142**	**308**	**-27.4**	**-17.5**	**263**
5.TRANSMISSION LINE							
5.1	Transmission line	93.9	121.0	214.9	-5.0	-5.0	204.9
5.2	Substations	21.6	18.4	40.0			40.0
TRANSMISSION LINE TOTAL		**115**	**139**	**255**	**-5.0**	**-5.0**	**245**
	SUB-TOTAL	**937.0**	**746.6**	**1 684**	**-105.9**	**-73.9**	**1 504**
	TOTAL (with 10% contingency)	**1 031**	**821**	**1 852**			**1 654**
	Hydro Plant Output (MW)	500	185	685			685
	M$/MW	**2.06**	**4.44**	**2.70**			**2.41**

N-1 TRANSMISSION LINE (ADDED COST)						
Transmission Line	**64.0**	**76.1**	**140.0**			**140.0**
Substations	**2.7**	**3.3**	**6.0**			**6.0**
N-1 Transmission Line Total (added cost)	**66.7**	**79.3**	**146.1**			**146.1**
TOTAL (with contingency)	**1 104**	**909**	**2 013**			**1 815**
TOTAL (M$/MW)	**2.21**	**4.91**	**2.94**			**2.65**

The single site 7e option capital cost is presented in Table 1.7.

Table 1.7 Single Site 7e Cost

Pos.	Item	Single Site 7e Cost (M$ USD)
1. Civil works		
1.1	Dams	40.0
1.2	Tunnels	
1.2.1	Headrace Tunnel	137.5
1.2.2	Tailrace Tunnel	14.3
1.2.3	All other tunnels	0.7
1.3	Canals	
1.4	Intake structure	36.9
1.5	Underground power station	33.1
2. Mechanical and electrical equipment		
2.1	Generating equipment	132.5
2.2	Auxiliary mechanical equipments	10.9
2.3	Electrical equipment	36.9
3. Infrastructure		
3.1	Harbors	5.6
3.2	Roads	54.4
3.3	Construction camps	
3.4.1	Construction	40.6
3.4.2	Operation and maintenance	57.5
3.5	Construction material transportation	26.4
	Direct costs total	627
4. Indirect costs		
4.1	Construction services and temporary facilities	32.1
4.2	Travel cost	15.7
4.6	Insurance	27.8
4.8	EPCM (Home office)	13.2
4.9	EPCM (Field office)	58.1
	Indirect costs total	147
5.transmission line		
5.1	Transmission line	130.1
5.2	Substations	15.9
	Transmission line total	*146*
	Sub-total	*920*
	TOTAL (with 10% contingency)	*1 012*
	Hydro Plant Output (MW)	535
	M$/MW	*1.89*
N-1 transmission line (added cost)		
	Transmission Line	90.4
	Substations	3.2
	N-1 Transmission Line Total (added cost)	102.9
	Total	**1 115**
	Total (M$/MW)	**2.08**

Table 1.8 shows a summary of the project Capex under two working conditions assumptions.

Table 1.8 Summary of the expected hydro project Capex

Case #	Description	Power capacity (1)	Hydro Only Cost	Million's (2) With Base Case T-Line (N)	With Redundant T-Line (N-1)
1	7e & 6g Total – Base Case (w/Contingencies) ($24/hr labor)	650	1 384	1 654	1 815
2	7e & 6g Total – Base Case (w/Contingencies) ($10/hr labor)	650	1 304	1 574	1 735
3	Site 7e only – Single Hydro (w/Contingencies) ($24/hr labor)	520	851	1 012	1 115
4	Site 7e only – Single Hydro (w/Contingencies) ($10/hr labor)	520	797	958	1 061

Notes:
1) Firm power at the Smelter
2) All cases include 10% contingency
3) Labor based on a 4 month on/2 week off work schedule
4) Single hydro options are based on a 12m increase in dam height relative to the base case
5) Single hydro options extend construction schedule to 6 years due to increased fill time

2 Site description

2.1 Topography

Greenland’s topography has a general bowl shape with peripheral mountainous areas surrounding a central basin that extends below the sea level. The Greenland Ice Sheet occupies the central bowl, covers much of the fringing mountains, and in places pushes to the coast where it calves into the sea. Ice-free regions at the fringes of the ice sheet are in most areas mountainous, cut by fjords and contain scattered thin deposits of till and local thick deposits of Quaternary nonglacial sediments of a variety of different ages. The surface elevations of the ice sheet are shown in Figure 2.1.

The general features are a southern and a northern dome with maximum elevations of 2 830 and 3 205 m respectively connected by a long almost horizontal saddle with elevations around 2 500 m.

The main drainage divide runs north-south near the eastern ice margin, living large parts of the Inland Ice to flow towards the west, while only smaller sectors drain eastwards. A major drainage outlet from the Inland Ice is located on the west coast in the Disko Bugt area.

The dominant landscape type in West Greenland is hilly up lane composed of rounded knolls of crystalline bedrock at elevations between 300 and 1 500 meters.

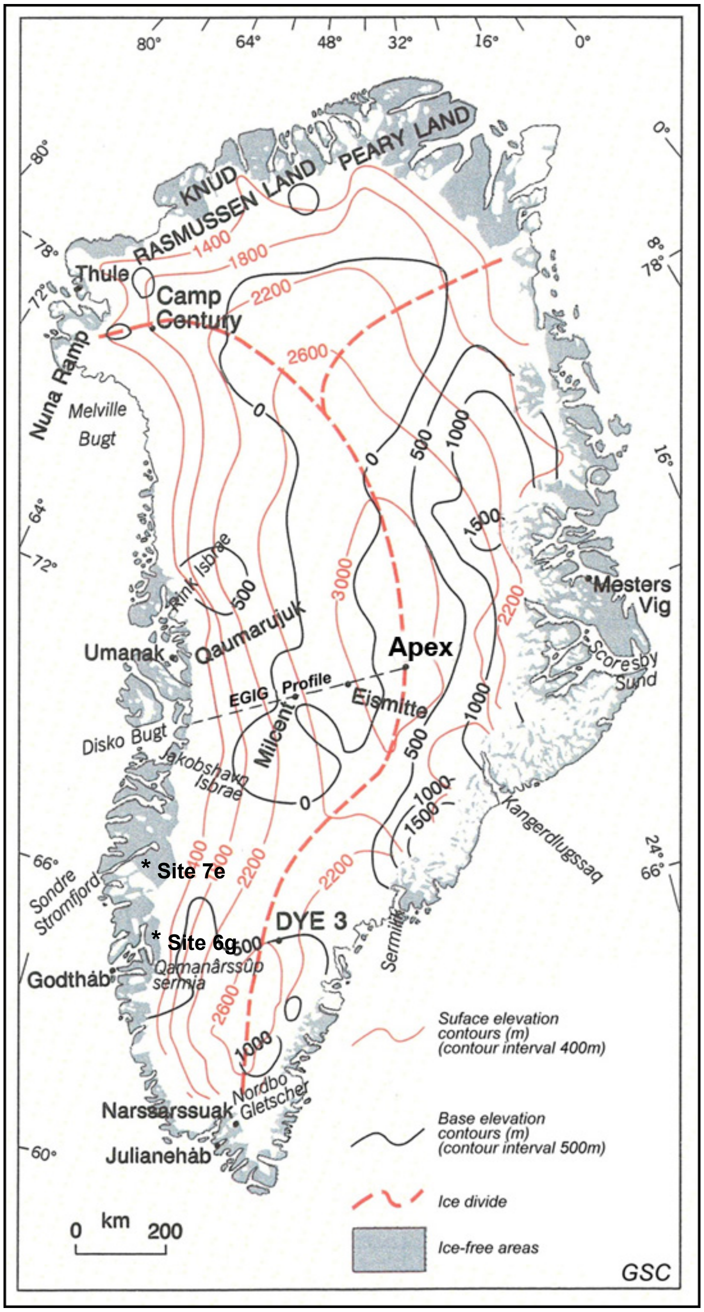
2.2 General geology and seismicity

The geological history of Greenland spans more than 3.8 billion years (Vilumsen et al., 2007). The basement consists largely of composite gneisses that were formed more than 1.6 billion years ago. About 60-55 million years ago, there was widespread volcanic activity in Greenland and extensive volcanic provinces developed. The last major event was the Ice Age over the last two million years, when most of Greenland was covered by ice. All of West Greenland – excluding only some high mountains near the coast – was covered by the Inland Ice during the Sisimiut glaciations of Late Wisconsinan age.

At site 6g, rock is predominantly amphibolites gneiss, although iron-rich rock, fine-grained schist and metasediments were also reported by PB Power (2009). Geologic mapping from 2007, 2008, and 2009 investigations generally agreed with the historic geologic maps, with the exception of some general foliation trends.

Recent glaciations are marked by erosion rather than sediment accumulation in most areas. Thick Quaternary deposits are of restricted occurrence and are generally confined to major valleys and lowlands along the coasts. The Quaternary geology of West Greenland is described in detail by Fulton (1989). The following is a brief summary.

Figure 2.1 Surface and base elevations (m) and main ice divides of the Greenland Ice Sheet



(Reet. N., 1989)

The most widespread glacial deposits are patches of loose gravelly and sandy diamicton and scattered erratic boulders considered to be melt-out till. These materials form a continuous cover in the interior near the Inland Ice margin. Thicker deposits of melt-out till occur in lateral and terminal moraines. Moraines dating from Holocene deglaciation stages occur in all parts of the area, and in their general distribution follow that outlined for till deposits. Moraines generally have developed only along active sectors of the ice margin – lobes and outlet glaciers – while the regionally more extensive passive sectors have created few moraines. The location of moraines along the fjords – at fjord junctions and bends, and at places where the sides change from steep to gentle slopes – suggests that the moraines commonly were formed as an interaction between the glacier and the topography of its bed, rather than in response to climatic change.

Glaciofluvial and fluvial sediments cover the floors of all major valleys, occurring as outwash plains and fluvial terraces deposited from braided rivers. The most extensive plains occur in the valleys between the Inland Ice margin and the heads of fjords. Glaciofluvial sand and gravel also occur as kame terraces along valley sides. Eskers forming from subglacial meltwater are not common.

Marine sediments ranging from coarse littoral gravel to massive or laminated silt are widespread in the coastal areas, occurring up to 140 m above present sea level – the maximum elevation of the Holocene marine limit.

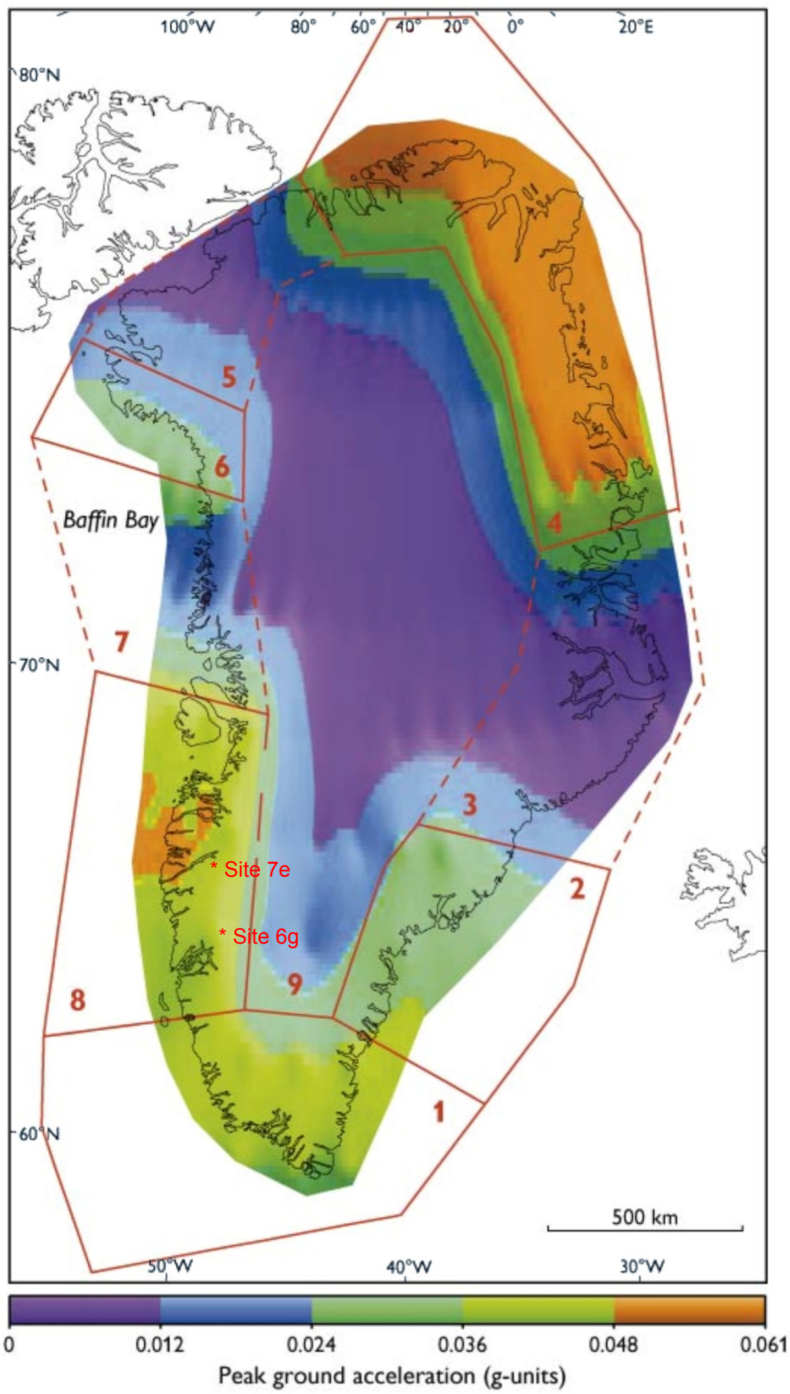
Earthquake activity in Greenland has been registered and mapped since 1907 and thus a long (albeit relatively sparse) record of seismic activity is available for evaluation of seismic hazard and risk.

The seismic hazard assessment of Greenland is computed for a return period of 475 years as shown in Figure 2.2. The maximum hazard is found in seismic source zone 4 at a value of 0.051 g (50.37 cm/s²). From this result, the general seismic hazard in Greenland is considered to be low, following the classification of Jiménez et al. (2003) in which low, moderate and high hazards correspond to peak ground accelerations of 0.0-0.08 g, 0.08-0.24 g and above 0.24 g, respectively, for a 475-year return period (GEUS, 2007 – Geological survey of Denmark and Greenland, bulletin 13, 57-60).

Seismic source zone 4 covering the northern and north-eastern parts of Greenland is the area with the highest seismic hazard; the seismic hazard is below 0.05 g in the other seismic source zones where the highest hazards are encountered in the Disko Bugt – Sisimiut area (seismic source zone 8) followed by southern Greenland (seismic source zone 1).

Site 6g is located in zone 8. Thus, the peak ground acceleration is 0.048 g for a 475-year return period.

Figure 2.2 Seismic hazard in Greenland for a 475-year return period



2.3 Site investigations and local geology

2.3.1 Previous investigations

In 2007, during phase I of the Memorandum of Understanding (MOU), PB Power completed various field studies and technical analyses as part of an initial feasibility study including Phase I of the geological and hydrological investigations. Specifically, the geotechnical investigations consisted of preliminary geologic mapping of proposed civil works alignments and preliminary borrow source assessments as well as aerial and topographic surveys.

Additional investigations were carried out in 2008 during MOU, Phase II. This investigation included geologic mapping in addition to borehole drilling. Two boreholes were drilled and thermistor strings were installed for permafrost characterization. Five samples of rock core were recovered and tested for a variety of laboratory tests.

Electromagnetic (EM) and seismic refraction surveys were carried out along proposed dam, canal and borrow areas. Only overland profiles were obtained; no profiles were obtained beneath major streams and rivers. The geophysical data were processed and interpreted with calibration to observed rock outcrops, but not against geotechnical boreholes.

A summary of the 2007/2008 geotechnical investigations and the main findings are presented on Table 2.1.

Table 2.1
Site 6g – Existing investigations – Main geological and geotechnical characteristics – Summary

Location	Existing investigations	Rock properties	Soil properties and remarks
Power Tunnel (2007/2008 axis)	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Two boreholes : GPT-1 (Inlet)* *GPT-2 (outlet)* *Seismic survey: Inlet (PT-In)* *Outlet (PT-Out)*	*Inlet* • Slightly to moderately weathered gneiss with few sets of discontinuities. Foliation striking NE/SW dipping SE. First recovery at borehole GPT-1 at 7.2 m due to casing and fractured rock. • Rock covers more than 70 % of the surface • RMR Classification: average value of 78 (Class II, Good) • Geo mechanical properties (2 samples) - Uniaxial compressive strength: 112 and 163 MPa - Young's modulus: 33 and 60 GPa - Poisson's ratio: 0.17 and 0.28 - Indirect (Brazilian) tensile strength: 6.8 and 9.6 MPa - Cerchar abrasivity index: 5.8 and 4.9 - Slake durability: 99.6 to 99.4% - Petrographic analysis: quartzo-feldspathic gneiss and biotite-amphibole gneiss *Along the length* • Slightly weathered amphibolite gneiss, jointing and foliation changes very frequently • RMR classification : average value of 81.8 (Class I, Very Good) *Outlet* • Slightly weathered gneiss with few sets of discontinuities. Foliation striking NE/SW, dipping NW • Rock covers more than 70% of the surface • RMR classification: average value of 70.2 (Class II, Good) • Geo mechanical properties (3 samples) - Uniaxial compressive strength: 176 MPa (2 samples) and 243 MPa (1 sample) - Young's modulus: 27 to 40 GPa - Poisson's ratio: 0.04 to 0.16 - Indirect (Brazilian) tensile strength: 5.2 to 10.1 MPa - Cerchar abrasivity index: 5.6 to 6.3 - Slake durability: 99.3 to 99.4% (2 samples) - Petrographic analysis: quartzo-feldspathic gneiss	*Glacial Till* *No overburden in the inlet area (borehole GPT-1)* *Thin soil covers valleys between the gneissic rock hills* *Glacial Till*
Tunnel 1	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey: Inlet: T3-In* *Outlet: T3-Out*	• Gneissic rocks. • Foliation strikes east-west in the northern area, north-south in the south. Some dikes, possibly doloritic • In the inlet area, rock covers more than 60% of the surface, in the outlet area, rock outcrops cover approximately 25% of the surface • RMR classification: average values varie from 71.9 (inlet) to 79.8 (Class II, Good)	*Glacial Till*
Spillway1	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 4 lines (G90, G90-A, G90-B, G-92)*	• Gray gneiss with consistently spaced joints, foliation striking NW/SE, dipping steeply to the SW. • RMR classification: average values of 62.2 (left abutment), 64.7 (middle) and 73.2 (right abutment) (Class II, Good).	*Very little soil (glacial till) cover along the spillway* *Overburden less than 2.5 m*
Dam 1	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 4 lines (G21 to G24)*	• Distinctly banded granitic gneiss. Foliation strikes east-west, dips 45° south. Bedrock mostly exposed (over 80% of the entire dam surface), slightly weathered iron rich rock present at several locations on the left abutment. • RMR classification (left and right abutments): average values of 75.2 and 70.4 (Class II, Good)	*Glacial Till* *Overburden less than 3 m*

Table 2.1
Site 6g – Existing investigations – Main geological and geotechnical characteristics – Summary

Location	Existing investigations	Rock properties	Soil properties and remarks
Dam 2	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 7 lines (G30, G32 to G35)*	• Dinstincly banded granitic gneisses. Foliation strikes east-west, dips 45° south. • Bedrock mostly exposed (over 85% of the surface) • RMR classification: - Left abutment in the granitic gneiss: 25.5 (Class IV, Poor) - Left abutment in the gneiss: average values of 77.3 (Class II, Good) - Right abutment: average value of 64.8 (Class II, Good)	*Glacial Till* *Overburden less than 6 m*
Dam 3	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 7 lines (G40, G41, G43, G44)*	• Gneissic and granitic rock, inclusions of basic rock. • Sound rock covered by big boulders • At left abutment, presence of 2 m wide zone of dark gray to black banding amphibolite gneiss • RMR classification: - Left and right abutments: 71.4 and 71.8 (Class II, Good) - Middle: 67.8 (Class II, Good)	*Glacial Till* *Boulders* *Based on seismic survey, the depth of the overburden reaches locally more than 4 m*
Dam 4 and Spillway 2	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 9 lines (G11, G13 to G16)*	• Mainly greenschist and metasedimentary (sandstone and siltstone) rock. Rock covers more than ⅔ of the surface along the entire dam. • RMR classification (left and right abutments): average values of 62.2 and 59 (respectively Class II, Good and Class III, Fair)	*Glacial Till* *Overburden less than 2.5 m*
Dam 5	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 5 lines (G1W, G1, G1E, G5, G6)*	• Mainly greenschist and metasedimentary (sandstone and siltstone) rock with inferior quality compared to gneiss (left and right abutment). • ⅔ of the surface along the dam is covered by rock outcrops • RMR classification (left and right abutments): average values of 60.1 and 61.3 (Class II, Good).	*Glacial Till* *Overburden less than 2.5 m*
Canal 1	*Aerial photography* *Topographic maps (2 m contours)* *Mapping*	• Slightly weathered gneiss • RMR classification: 80.8 (Class I, Very Good)	*Glacial till* *Boulders*
Canal 2	*Aerial photography* *Topographic maps (2 m contours)* *Mapping*	• Slightly weathered gneiss • RMR classification: average value 76.6 (Class II, Good)	*Limited soil cover*
Canal 3	*Aerial photography* *Topographic maps (2 m contours)* *Mapping* *Seismic survey – 3 lines (North, Middle, South)*	• West side of canal: dark brown to dark gray metasediment, bedding strikes parallel to canal with few sets of discontinuities • East side of canal: Iron-rich rock. Almost haft of the surface is covered by rock outcrops • RMR classification : 80 (Class II, Good)	*Glacial Till* *Boulders* *Overburden less than 3 m*
Canal 4	*Aerial photography* *Topographic maps (2 m contours)* *Mapping*	• Slightly to moderately weathered metasediments, foliation striking NE/SW, dipping steeply NW. Rock along both shores and at falls • RMR classification: average value 70.2 (Class II, Good)	*Glacial Till* *Boulders* *(Overburden less than 3 m)*

2.3.2 2009 Field investigation[1]

An additional geotechnical investigation program was conducted in 2009. The main objective was to gather further data required for the completion of the Phase II engineering study.

Table 2.2 presents the nature and the scope of the 2009 geotechnical investigation. It comprises one deep borehole in the vicinity of the powerhouse, and a total of 10 boreholes at the dam sites. Apart from gathering information of rock characteristics and conducting in situ testing of the rock, the deep borehole in the vicinity of the powerhouse allowed the installation of a thermistor string for the permafrost characterization.

The determination of the stress levels in rock formations will allow to validate the powerhouse location and orientation, rock reinforcement and also the length of the penstock steel liner upstream of the powerhouse.

Boreholes at dam areas will allow to determine the overburden thickness and the rock characteristics of the foundations. Thermistor strings were installed in one of the boreholes in Dam 5 and in the borehole at Tunnel 1. These data will allow to validate the decisions made with regard to foundation treatment and typical cross sections.

2.3.3 Local geology

A summary of the main geotechnical features for each of the civil works as to the layouts studied during MOU Phase I is presented in Table 2.1. Since the beginning of the MOU Phase II engineering study in January 2009, some changes in the previous layouts were made and in some cases the civil works were completely or partially relocated. Therefore, the aim of the 2009 geotechnical investigation was to obtain information at these new sites and to confirm or complete existing data.

2.3.3.1 Powerhouse and power tunnel

Compared to the former power tunnel axis, the inlet and outlet remain at the same locations, while the powerhouse complex was moved some 2 km downstream. Beside the two existing boreholes from the previous investigation (borehole GPT-1 in the inlet area and borehole GPT-2 in the outlet area), one deep borehole in the vicinity of the powerhouse, as part of the 2009 investigation program has been completed. Jacking tests were performed in this last borehole to determine stress levels in rock. Piezometer and termistor strings were installed to determine permeability and permafrost conditions.

Following the analysis of the results obtained from the hydraulic jacking tests, it was concluded that the minimum stress levels in the rock formations are rather low compared to the Norwegian recommendations for the design of underground hydroelectric works. Therefore, in accordance with the topography, it was decided to move the powerhouse complex approximately 500 m away from the fjord. At this location the rock cover is 555 m. This new location has to be investigated.

Available data from the previous geological mapping and boreholes GPT-1 and GPT-2 show that rock formations consist mainly of slightly to moderately weathered gneisses

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[1] Only partial and preliminary 2009 investigation results were available for the production of this report. Consequently, they are not fully integrated into the report. The main outcome of the 2009 investigations is the displacement of the powerhouse as described in section 12.

(quartzo-feldspathic and biotite-amphibolite gneisses). The foliation strikes NE/SW, dipping shallowly or moderately (less than 45 degrees) SE in the inlet and NW in the outlet areas. In both areas, the rock quality is Good (Class II, RMR classification). The average Mohs Hardness of the quartzo-feldspathic gneiss samples range from H=5.82 to 6.26, with lower values attributed to rocks with a higher content of biotite (H= 2.5-3).

Table 2.2 Site 6g – Greenland Hydropower – Early engineering, Phase II – 2009 Investigation Program

Location	Borehole		Testing			
	Number	Total length (m)	Permafrost	Piezometer	Hydrojacking test	Acoustic Survey
Powerhouse	1[(1)]	452	X	X	X	X
Power tunnel intake	---	---	---	---	---	---
Tailrace tunnel	---	---	---	---	---	---
Spillway 1	1	9.6	---	---	---	---
Dam 1	2	27.5				
Dam 2	2	21	---	---	---	---
Dam 3	1	15	---	---	---	---
Dam 4 and Spillway 2	1	15	---	---	---	---
Dam 5	2	30	X	---	---	---
Tunnel 1	1	51	X	---	---	---
Total	***11***	***621.1***	***3***	***1***	***1***	***1***

(1) Borehole at 30° angle from vertical

The geomechanical tests performed during Phase I on 2 rock cores from borehole GPT-1 (see Table 2.1) show that rock properties are typical of those of metamorphic (gneissic) rocks. The uniaxial compressive strength is 112 and 163 MPa qualifying the rock formations as Very Strong (Class R4). The rock has very high slake durability (>99%). In borehole GPT-2, 3 samples were analyzed for Uniaxial Compressive Strength and the values are rather high (175 MPa for 2 samples and 243 MPa for one sample).

2.3.3.2 Spillway 1

Bedrock consisting of gray gneiss of Good quality is mostly exposed on the surface (more than 85%). Most of the joints are aligned with the foliation, striking NW/SE, dipping steeply (more than 45°) SW. Overburden, when present, composed of glacial till, is less than 2,5 m deep.

2.3.3.3 Dams 1 and 2

In both site locations, most of the bedrock is also exposed on the surface. Overburden, when present, is less than 3 m deep. Most of the rock outcrops consist of distinctly banded granitic gneiss. In both sites, at least one of the joint sets is aligned with the foliation, striking EW, dipping 45 degrees south. Iron rich rock is present at several locations on the left abutment of Dam 1. Although in most places, the quality of rock was classified as Good (Class II), poor quality rock with an average RMR value of 25.5 (Class IV) was identified at the left abutment of Dam 2.

2.3.3.4 Dam 3

Based on the seismic survey, the depth of the overburden (glacial till), reaches locally 4.5 meters.

Sound rock, consisting of gneiss and granite with inclusions of basic rock is at many places, covered by big boulders. A two meters wide zone of dark gray to black banding amphibolite gneiss was observed at the left abutment of the dam. Overall quality of rock is Good (Class II).

2.3.3.5 Dam 4 and Spillway 2

Rock outcrops consisting mainly of gneiss cover close to 2/3 of the surface along the dam. Greenschists of inferior quality compared o gneissic rock are present at both abutments. Rock was classified as Fair at right abutment, and as Good at left abutment. Overburden (glacial till) is less than 3 m deep.

2.3.3.6 Dam 5

Geological conditions at this site are very similar to those of Dam 4. Overburden is less than 2.5 m deep. Most of the surface is covered by rock outcrops consisting mainly of greenschist.

2.3.3.7 Canals

Geological conditions at all canals are relatively similar. There is limited soil cover and the overburden (glacial till) is less than 3 m deep. Boulders, some reaching 3 m in diameter, are visible randomly on the surface at Canals 1, 3 and 4, and are generally not nested. At Canals 1 and 2, the rock consist mainly of slightly weathered gneiss of Good and Very Good quality. At Canals 3 and 4, the rock is mainly metasedimentary (sandstone and siltstone). An iron rich rock formation is present at the west side of the Canal 3. At the west site, bedding strikes parallel to the canal.

2.3.3.8 Tunnel 1

In the inlet area, rock outcrops cover more than 60% of the surface; while in the outlet area rock outcrops cover approximately 25% of the surface. Rock is mainly gneissic and is of Good (Class II) quality. In the northern area of the tunnel, foliation strikes east-west, while in the south area, the foliation strikes north-south.

2.3.3.9 Construction materials

2.3.3.9.1 Rockfill

Rockfill is the main material needed for the construction of the dams and for the production of aggregates for concrete. Most of the rockfill will come from the planned excavations. Moreover, rock outcrops for quarries are present at all sites and in the vicinity of the dam sites. Preferably, quarries for the dams should be located immediately upstream of each dam, within the future reservoir areas for environmental reasons.

Representative rock samples should be collected and sent to the laboratory for standard testing as to ensure that the excavated rock meets the requirements for concrete production. Although concrete out of granitic and gneissic rock usually fulfills the requirements for a good aggregate, some essential tests such as alkali-aggregate reactivity and resistance of unconfined coarse-aggregate to freezing and thawing should be performed.

2.3.3.9.2 Till and other granular material

Potential borrow sources consisting of glacial soils in the vicinity of the dams and canal locations were identified during the 2007/2008 investigations. Although the thickness of the overburden seems rather limited (in most cases less than 3 m with exception of Dam 3 site), there are few areas covered with soil along the dam alignments with occasional rock outcrops protruding the surface, in Canal 1 area, and in the power tunnel outlet area. Glacial moraines (till) are essentially needed for the construction of the cofferdams. Based on 2007/2008 field observations, these moraines are generally a widely graded material consisting of silt, sand, gravel and stones (cobbles and boulders). The stones are hard and durable and usually sub-angular or sub-rounded. Boulders reach up to 3 meters in diameter and are spaced randomly on the surface and are generally not nested.

River terrace deposits consisting of granular material such as sand, gravel and cobbles were observed some 1.5 km east of the tailrace discharge to Godthalsfjord, and in the deposits upstream of the Spillway 1. These deposits being poorly graded could be suitable for the supply of fine aggregate for concrete. Areas of interest were identified and investigated by auger sounding during the 2009 investigations. As the information concerning the acceptability of these deposits for the production of fine concrete aggregate is not yet available, it is assumed at this stage that fine aggregates will be processed from blasted rock.

Table 2.3 shows the quantities of rockfill (random rockfill, crushed stone and riprap) and till required for the construction of the dams and cofferdams.

Table 2.3 Site 6g – Borrow material – Quantities required for dam construction

Site	Rockfill (m^3)			Till (m^3)	Total (m^3)
	Random rockfill(1)	Crushed stone(2) (all sizes)	Riprap		
Dam 1	60 900	40 000	7 500	3 000	*111 400*
Dam 2	31 200	37 200	10 000	---	*78 400*
Dam 3	77 000	33 500	9 500	---	*120 000*
Dam 4	35 600	20 650	1 400	2 000	*59 650*
Dam 5(3)	81 500	42 950	5 200	---	*129 650*
Total	*286 200*	*174 300*	*33 600*	*5 000*	*499 100*

(1) Including a small volume of 0-450 mm selected rockfill for Dams 1 and 2
(2) Including asphaltic concrete core aggregate
(3) Including the cofferdam at canal 4

2.4 Climate

Along West Greenland, a 3-4 m thick sea ice (called the west ice) covers most of Baffin Bay during the winter from the Polar Sea to approximately Sisimut. In summer the ice situation in the same waters is influenced by icebergs from the West Greenland Glaciers, mainly the Ilulissat Glacier. Varying quantities of west ice is brought along with the Labrador Sea Current down along the Canadian east coast; only a small proportion of the west ice remains during the summer. The climate in Greenland is an Arctic climate. The climate in Greenland varies considerably, even over short distances. The katabatic wind system of the Greenland Ice Cap results in wind moving from the central portion of the ice cap towards the coast. At the proposed project site, wind is predominantly from the east or southeast.

Along West Greenland, air temperatures vary between the coast and inland. Along the coast, drifting ice or cold water makes the air cold and humid. Further inland, the weather is often warmer and sunny. Differences of up to 5°C have been reported. Temperatures also vary according to altitude. While normally air temperatures decrease with altitude by 6.5°C per kilometer, in the Arctic, the change in temperature is smaller, owing to temperature inversions. One result of such inversions is that spring snow starts melting in the mountains rather than at sea level.

The amount of precipitation is generally higher along the coast than inland. Snow cover is also higher along the coast than inland. Many of the country's long-term meteorological stations operated by the Danish Meteorological Institute (DMI) are situated in Greenland's major population centres, which are mostly located on the coast. In the vicinity of the project area, meteorological stations have been established and maintained by ASIAQ for prior studies. Although the period of record for these stations is generally shorter and frequently with data gaps, these data are useful in better-understanding the climate of the project area. Figure 2.3 shows the locations of the DMI long-term meteorological stations, along with the locations of the nearby ASIAQ stations.

Figure 2.3 Locations of weather stations, West Greenland

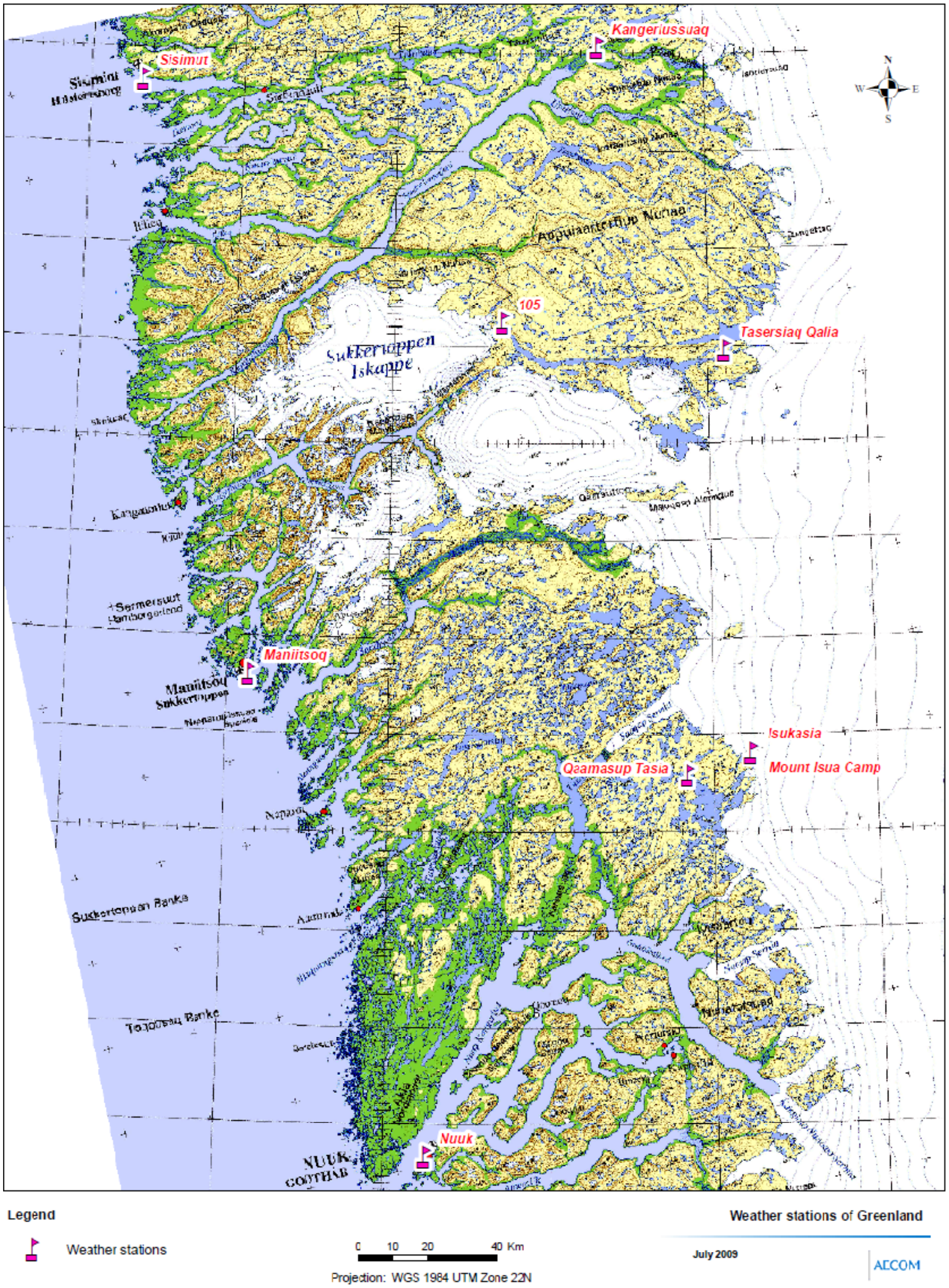


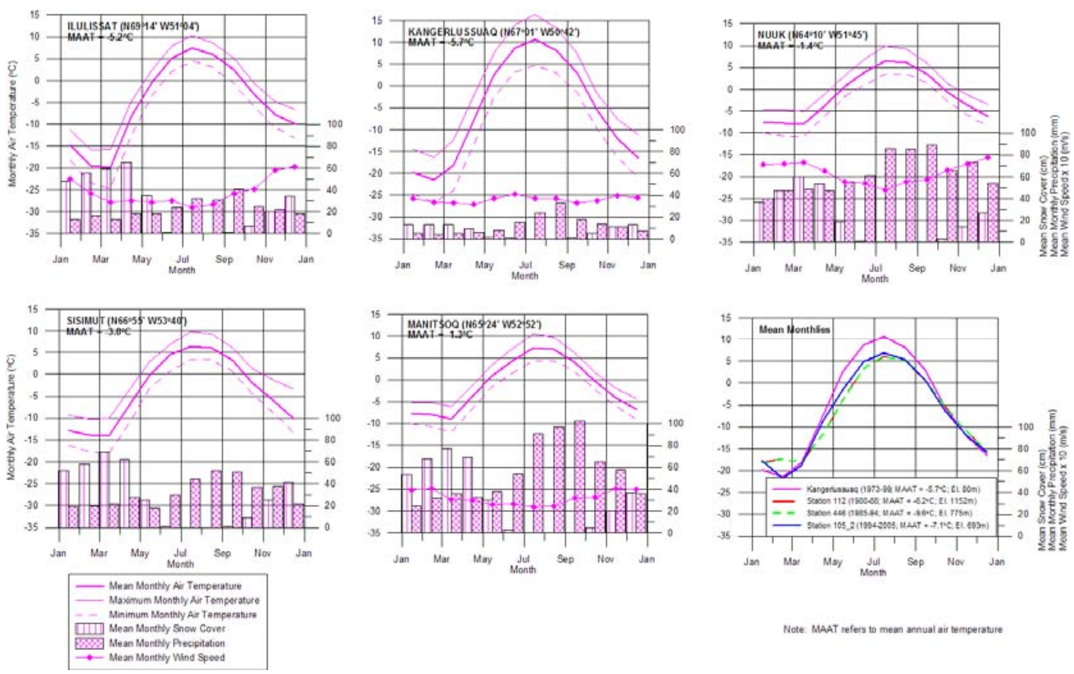
Table 2.4 summarizes the locations, elevations, and period of record for the various stations with air temperature records. Kangerlussuaq is the only DMI station that is located inland; the other DMI stations are located along the western coast.

Table 2.4 List of Meteorological Stations in West Greenland

Station	Name	Period of Record	Operated by	Latitude	Longitude	Elevation (m)
04221	Ilulissat	1961-90	DMI	N 69° 14’	W51° 04’	29
04230	Sisimut	1961-90	DMI	N 66° 55’	W 53° 40’	12
04231	Kangerlussuaq	1973-now	DMI	N67° 01’	W50° 42’	50
04240	Maniitsoq	1961-90	DMI	N65° 24 ‘	W52° 52’	25
04250	Nuuk	1961-90	DMI	N64° 10’	W 51° 45’	80
105	Tasersiaq	1994-04	ASIAQ			~ 750
112	Isukasia	1985-88 (86-87)	ASIAQ	N 65° 12’22”	W49° 45’54”	1152
	Mount Isua Camp	1971-78	ACG-VBB	N65° 12'13"	W49° 46'25"	
114	Tasersiap Qalia	1980-85	ASIAQ	N 66° 14’16”	W49° 53’42”	1000
446	Qaamasup Tasia	1985-94 (87-91)	ASIAQ	N65° 08’48”	W50° 09’47”	775

Figure 2.4 compares the climatic conditions of these stations.

Figure 2.4 Climatic Normals, West Greenland Meteorological Stations



For the DMI stations, monthly air temperatures (mean, maximum, and minimum), precipitation, snow cover and wind speed are presented for the climatic normal period of 1961-90 (Capellan et al., 2001). Figure 2.6 also presents the mean monthly air temperatures for the ASIAQ stations. Figure 2.6 shows that there is no strong relationship between latitude and air temperature. Summers are generally warmer and winters are colder inland (Kangerlussuaq) compared to the coastal stations. Kangerlussuaq also receives much less precipitation and thinner snow cover compared to the coastal stations. By inference, the climate of the project site is also expected to have warmer summers, cooler winters, and less precipitation and snow cover compared to the coastal stations.

The climate at Site 7e is influenced by the rugged topography, the Sukkertoppen ice cap, and the deep fjord. Climate may be variable even over short distances (e.g. from one end of the fjord to the other). The climate at Site 6g is expected to be warmer than at Site 7e because of its location further south, its distance from the ice sheet, and its more flatter and, less-rugged topography.

Table 2.5 lists the mean and extreme maximum/minimum daily air temperatures for the Tasersiaq station. Subfreezing temperatures can be anticipated at any time of year.

Table 2.5 Summary of Monthly Air Temperatures, Tasersiaq Station, 1994-2005

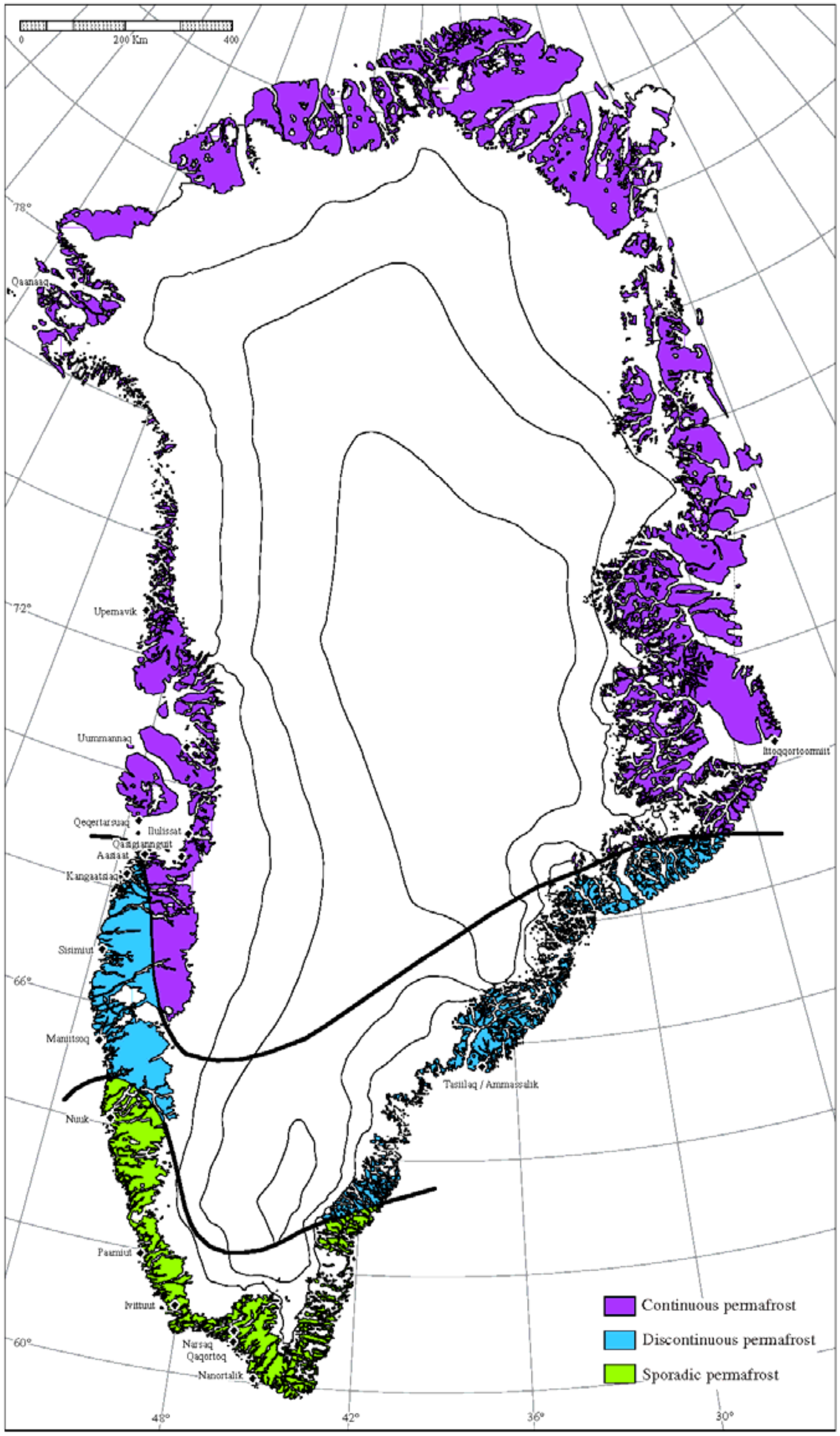
Month	Air Temperature (°C)		
	Mean Monthly	Extreme Minimum Recorded	Extreme Maximum Recorded
January	-17.6	-39.4	6.4
February	-21.8	-41.8	8.2
March	-18.9	-43.6	6.4
April	-8.8	-30.8	6.1
May	-1.5	-23.5	13.9
June	4.8	-5.7	17.9
July	6.9	-2.2	17.5
August	5.3	-3.4	15.2
September	0.7	-13.3	10.4
October	-6.4	-31.0	7.4
November	-11.8	-32.9	8.2
December	-15.6	-41	5.8

The mean annual air temperature at the Site 7e dam areas is expected to be approximately -7°C, based on the monitoring data from the Tasersiaq station. Considering the topographic variations across the site, the climate is expected to be cooler (mean annual air temperature of approximately -9°C) and windier at the top of the fjords near the edge of the ice cap, and warmer (mean annual air temperature approximately -4°C) at the head of Evighedsfjord. At Site 6g, the mean annual air temperature is estimated to range from -5°C to -4°C. Closer to the ice sheet to the east, temperatures are expected to be somewhat cooler.

2.5 Permafrost and ground temperatures

The presence of permafrost, or ground that is perennially frozen for at least two consecutive years, is controlled primarily by climate (air temperature, snow cover, solar radiation), but also by terrain factors such as subsurface conditions, surface cover characteristics, and proximity to water bodies. The project area is within the area of discontinuous permafrost, according to the Greenland permafrost distribution map by Weidick (1968) (see Figure 2.5). The southern limit for continuous permafrost follows approximately the mean annual temperature isotherm of -5°C (Weidick, 1975).

Figure 2.5 Permafrost Distribution Map for Greenland



Permafrost has been categorized into three different types: continuous permafrost, which has continuous regions of permafrost with dispersed frost-free "islands", discontinuous permafrost, which has more and larger areas without permafrost, and sporadic permafrost, where the permafrost is limited to small areas. The map shows the distribution of permafrost in regions at sea level. After Weidick (1968).

Ground temperature data for west Greenland area are available from the following sources:

- Ilulissat Airport (Ingeman-Nielsen, et al., 2008)
- Kangerlussuaq (van Tatenhove, 1994)
- Buksefjord Hydropower Project (N&R Consult A/S, 1994)
- Paakitsup Akuliarusersua Hydroelectric Power Station (Arctic Consultant Group and LIC Consult, 1985)
- Site 7e Power Tunnel Inlet (PB Power, pers. Communication)
- Sites 6g Power Tunnel Inlet and Outlet (PB Power, pers. Communication).

Figure 2.6 compares the measured ground temperature data. Table 2.6 summarizes the available ground temperature data. Permafrost thickness is not expected to exceed 300 m at the project site. Permafrost is expected to be more discontinuous (i.e., dispersed) at Site 6g than at Site 7e.

Figure 2.6 Ground Temperature Profiles, West Greenland

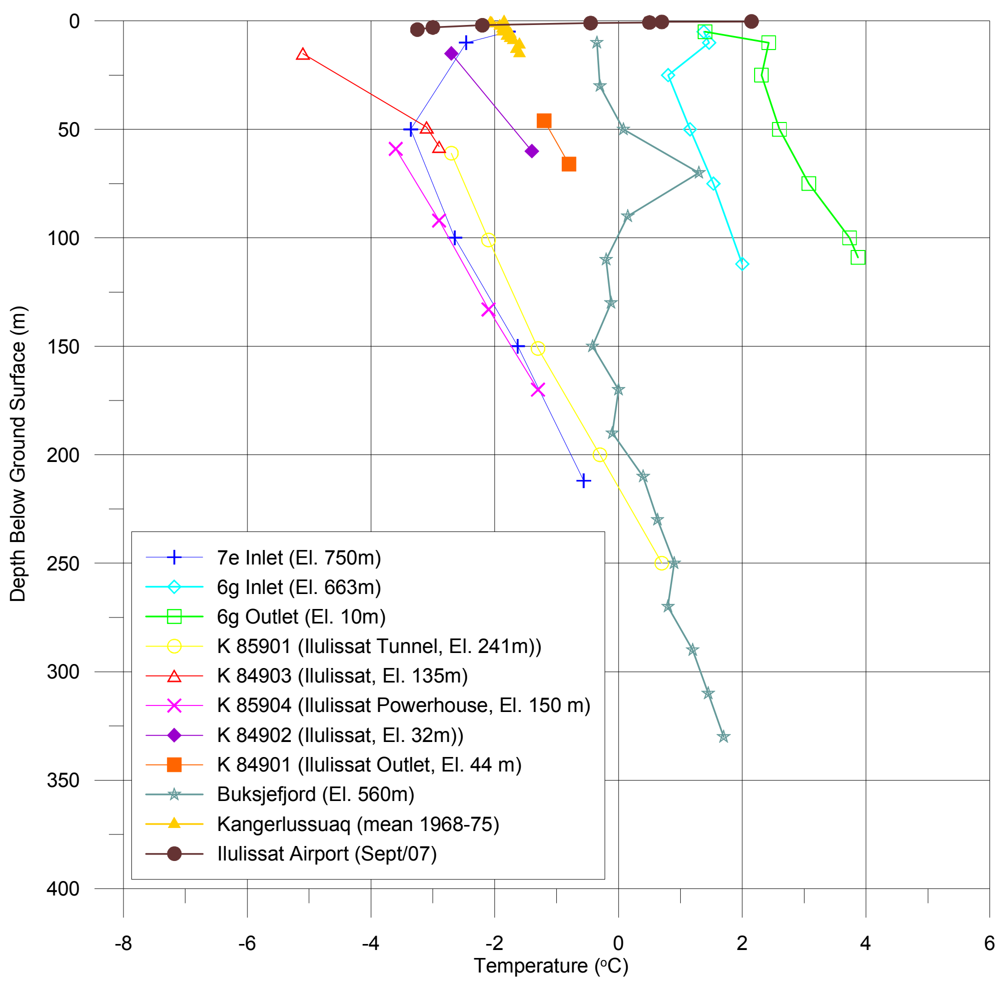


Table 2.6 Summary of Ground Temperature Data, West Greenland

Location	Ground Temperature	Permafrost Thickness	Comments
Ilulissat	-3.25°C at 4 m depth in early September 2007	Indeterminate	Measured ground temperatures up to 5 m depth
Kangerlussuaq	Mean ground surface -1.6°C	Approximately 127 m	Measured ground temperatures up to 15 m depth
Buksefjord stage III	Approximately -0.4°C at ground surface	Up to 170 m depth	Warm (+1.3°C) temperatures at 70 m depth possibly attributed to flowing groundwater
Paakitsup Akuliarusersua	Approximately -5°C to -2°C at ground surface	Up to approximately 240 m; thinner near inlet/outlet of power tunnel because of thermal influence from lake/fjord	5 deep ground temperature profiles, additional shallow temperatures (within 3.5 m depth).
Site 7e	Approximately 4.4°C at ground surface	Approximately 240 m	Measured ground temperatures up to 218 m depth. Located approximately 200 m from lake, only minor thermal influence from lake
Site 6g	Approximately 0.4°C to +1.4°C at ground surface	No permafrost	Holes located within 20 m distance of lake/fjord; thermally influenced by water bodies, Temperature measurements up to 112 m depth

The published ground temperature data summarized in Table 2.6 suggest that ground surface temperatures are between approximately 3 to 4°C warmer than the average annual air temperature; this is consistent with observations from northern Canada.

Ice sheets and glaciers dominate much of the Greenland landscape and impact the project site. It has been postulated by many that the bottom temperature of a continental ice sheet is colder than 0°C (Brown and Pewe, 1973). However, because of the proximity of bottom temperatures to 0°C, permafrost beneath the ice cap or glacier may be thinner than in areas exposed to cold air temperatures.

3 Hydrology

3.1 Previous study

Hydrologic modeling of the study area was carried out by Vatnatskil in 2005, and updated in 2008 and 2009. The modeling work produced long term series (50 years) for the pas climated as well as projected series for 2020 and 2040 time horizons.

3.2 Available data

3.2.1 Hydrography and Drainage Basins

At Site 6g, the proposed project layout takes advantage of the presence of two main lakes: the Lake Tussaap Tasia (labeled Lower Lake) where the intake for the power tunnel will be constructed and to the north, Lake Imarsuaq (labelled Big Lake). The layout of these lakes is presented in Figure 3.1 hereafter.

With a surface area of 76.54 km² at the normal elevation of 675 m, the storage capacity of the Big Lake is much higher than for the Lower Lake whose surface area is 12.51 km² at the normal elevation of 654 m. Between these two lakes is a smaller one (labeled Little Lake) with a normal water elevation of 666 m.

The Big Lake will constitute the main storage for the installations and will be regulated, while the Lower Lake water level will be kept constant to maximize the head.

These two lakes are not connected in natural conditions: the Lower Lake outlet flows southward, while the Big Lake outlet is located in the north part of the lake and flows northward. It is planned to transfer water from the Big Lake to the Lower Lake with Tunnel 1: the water will flow to the Little Lake and then to the Lower Lake. The transfer of the flow from the Little Lake to the Lower Lake will be improved by excavating two channels: Canals 1 and 2.

At the west of the Big Lake and included in his catchment is another Lake (Lake 682) with an area of 15.1 km². It could be interesting to use the proximity of this lake to combine its storage capacity to the Big Lake.

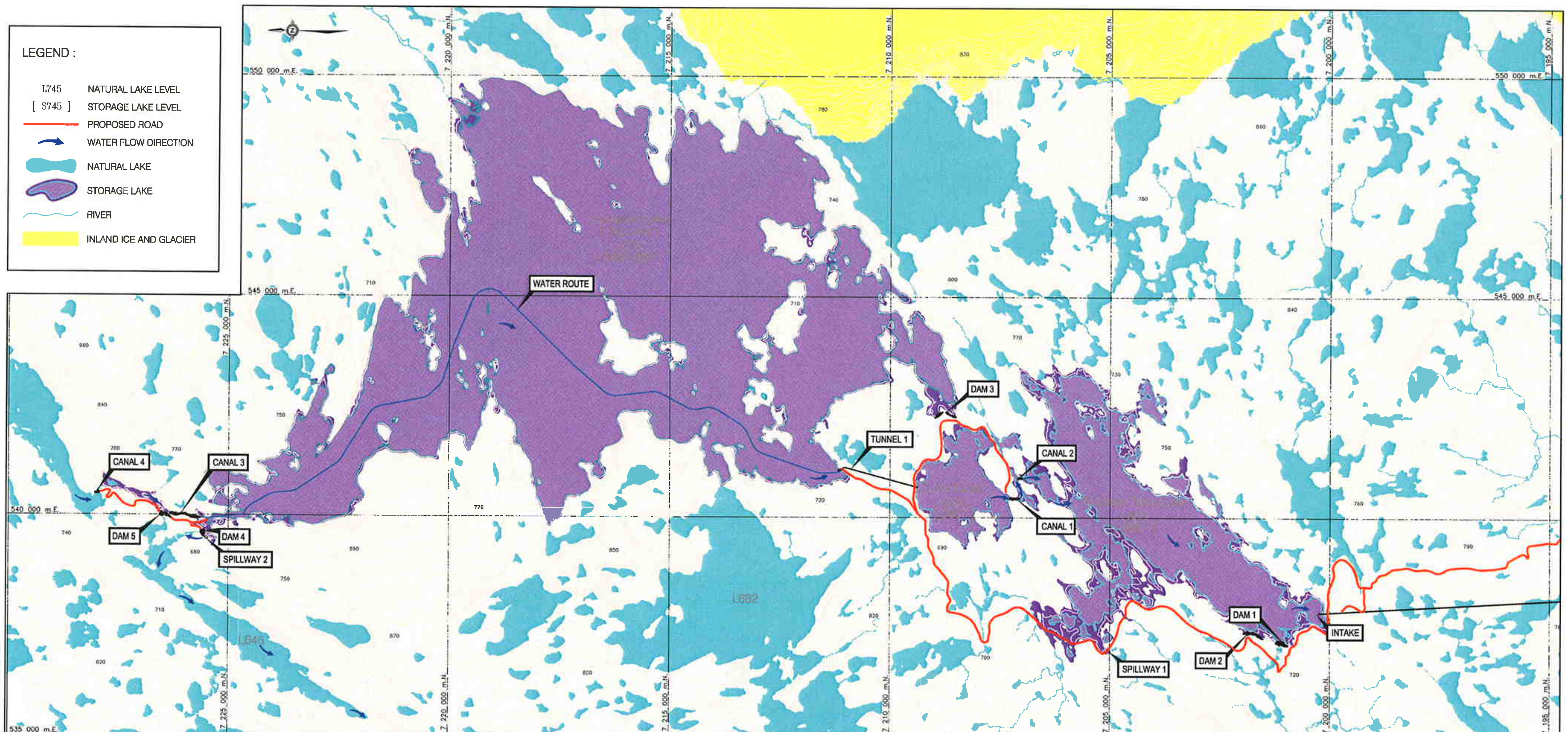
Two adjacent catchments, one northeast of the Big Lake and the other southeast of the Lower Lake, present configurations that would allow the diversion of their flows towards projected reservoirs.

ALCOA

Figure 3.1
Layout of the Reservoirs at 6g

Project : 0518015
Date : November 2009

AECOM



The drainage basins have been delineated in the hydrologic report prepared by Vatnatskil (2005 to be updated). The sub-catchments for site 6g are presented in Figure 3.2. The catchments contributing to the inflows present large parts of glacial areas as indicated in Table 3.1. At site 6g, the total area of the drainage basin is 1 548 km², from which 63% is glacier covered.

The catchment areas as well as the average inflows to site 6g are presented in Table 3.1 below:

Table 3.1 Average inflows at Site 6g

	Catchment area (km²)			Module discharge* (m³/s)
	Non Glacial	Glacial	Total	
Big Lake	419	878	1298	28.1
Lower Lake	95	14	109	3.3
Adjacent Northeast catchment	9	19	28	1.7
Adjacent Southeast catchment	54	59	113	0.88
Total	***578***	***970***	***1548***	***34.0***

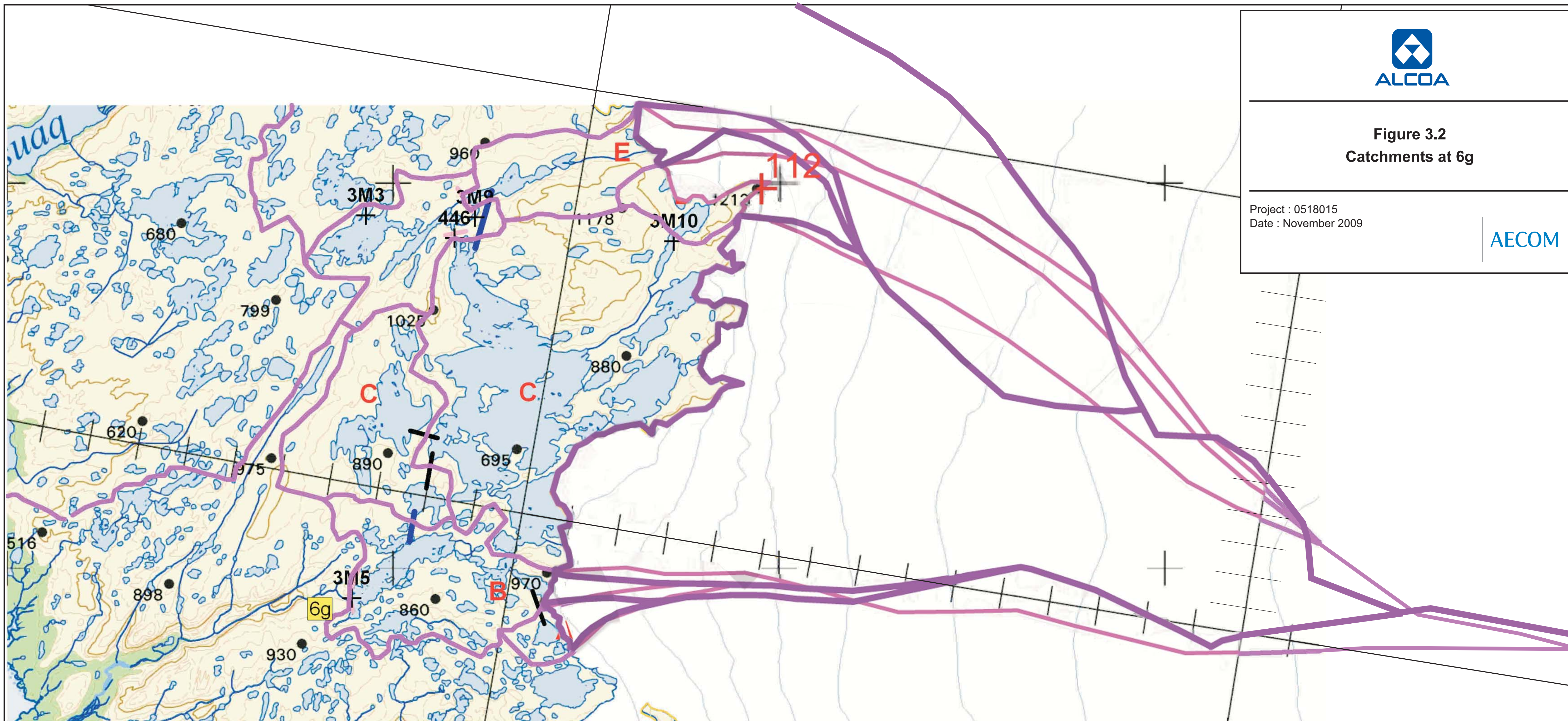
* Estimated from the generated series 1958-2008

From the layout presented in Figure 3.1, the required structures to control the inflows include:

- two dams (Dam 1, Dam 2) and a spillway (Spillway 1) to close the Lower Lake, where is located the intake;
- two canals (Canal 1, Canal 2) to ensure the flow transfer from Little Lake to Lower Lake;
- a regulated tunnel (Tunnel 1) to transfer water from Big Lake to Lower Lake;
- two dams (Dam 3, Dam 4) and a spillway (Spillway 2) to close the Big Lake.

Options including the connection of Big Lake with Lake 682 (labelled Middle Lake) to use the bathymetry of this lake, and also recuperating the flows from adjacent catchments may be considered. Additional structures involve:

- a tunnel to connect Lake 682 with Big Lake;
- a tunnel to transfer the flow from the southeast catchment;
- two canals (Canal 3, Canal 4) and a dam (Dam 5) to ensure the transfer of the flow from the northeast catchment.



ALCOA

Figure 3.2
Catchments at 6g

Project : 0518015
Date : November 2009

AECOM

Legend

- **A** Catchment letter
- **Catchment limit**
- **New watersheds**
- **Tunnels**
- **Canals**

N

Scale

0 10 20 km

Source : VERKFRAEDISTOFAN VATNASKIL
SW-GREENLAND HYDROLOGIC MODELS
Overview of model 6g7d, Figure 8, page 289
Greeland Hydropower - Feasibility assessment
BP Power Boston, MA
January 2008

3.2.2 Water levels and tides

3.2.2.1 Water Level of Lake Imarsuaq Lake and Tussaap Tasia Lake

Water levels of Imasuap Lake (Big Lake / L675) and Tussaap Tasia Lake (Lower Lake, L654) may be obtained respectively from hydrometric observations at the gauging station 446 operated between 1978 to 1990, and the gauging station M6 operated between 1974 and 1985.

Water levels at Site 6g were also measured during the bathymetric surveys. The relevant values are presented in Table 3.2.

Table 3.2 Measured water level at Site 6g from bathymetric survey

Location	UTM Coordinate		Water level (m)
	Northing	Easting	
Big Lake	7 215 790	544 780	674.77
Canal 3 Outlet	7 225 420	539 910	675.08
Canal 1 Inlet	7 207 370	540 430	665.82
Little Lake	7 208 350	540 530	665.87
Middle Lake	7 213 270	537 710	682.33
Power Tunnel Outlet	7 187 504	538 780	0.00
Tunnel 3 Inlet	7 202 200	549 680	761.46
Tunnel 3 Outlet	7 203 960	548 810	744.92
Tunnel 2 Inlet	7 213 310	540 060	682.26
Tunnel 2 Outlet	7 212 560	540 860	674.91
Tunnel 1 Inlet	7 211 130	540 980	674.89
Tunnel 1 Outlet	7 209 370	540 650	665.82

* New numbering are used for the structures.

3.2.2.2 Tides

The tidal water has been measured near the end of the fjord at Anavik for 8 weeks. A 3 year tidal record and a one year 10 minute tidal record for Anavik have been established, by correlating the measured data from Anavik with record tidal data from Nuuk.

Tidal extreme values have been calculated on the basis of the three year tidal record, while mean sea level is calculated on basis of the one year 10 minute tidal record. The values are presented in Table 3.3 hereafter. No estimation has been made on how the water level will be affected by extreme situations with low pressure systems, wind setup, surge flood, and the effects of the periodic tidal cycle of 18.6 years.

Table 3.3 Tides characteristics

	Height (m)
Highest Astronomical Tide	2.07
Mean High Water of Spring Tide	1.64
Mean Sea Level	-0.75
Mean Low Water of spring Tide	-2.96
Lowest Astronomical Tide	-3.49
Delay of the tidal wave, Nuuk, mean value	Approx. 10 minutes

3.2.3 Inflows

The runoff has been modeled by Vatnaskil (2007, 2008, and 2009) to produce synthetic discharge series based on the past climate (1958-2008) and projected series which takes into account climate warming.

The catchments contributing to the inflows present large parts of glacial areas as indicated in Table 3.4. At site 6g, the total area of the drainage basin is 148 km², from which 63% is glacier covered.

Table 3.4 Repartition of the catchments

	Catchment Area (km²)	Contribution* to the module discharge (m³/s)
Non glacial area	578	8.8
Glacial area	970	25.2
Total catchment	1 548	34.0

* Based on historic synthetic series

3.2.3.1 Gauging stations

The gauging stations located in the drainage basin of site 6g cover different sub-catchments. These stations include:

- Station 446, which measures the inflows to the Big Lake (L676), with data from 1978 to 1990;
- Station 3M5, which measures the inflows to the Lower Lake (L654), with data from 1974 to 1985;
- Station 3M9, which measures the inflows to the lake (L701) northeast of the Big Lake, with data from 1977 to 1983;
- Station 3M10, which covers a sub catchment of the Big Lake.

3.2.4 Storage curves

The layout of the lakes at site 6g is presented in Figure 3.1. The storage curves data are based on 2 meters contour topography and 10 meters contour bathymetry. The surface area measured on the maps for various elevations are presented in Table 3.5 for each Lake.

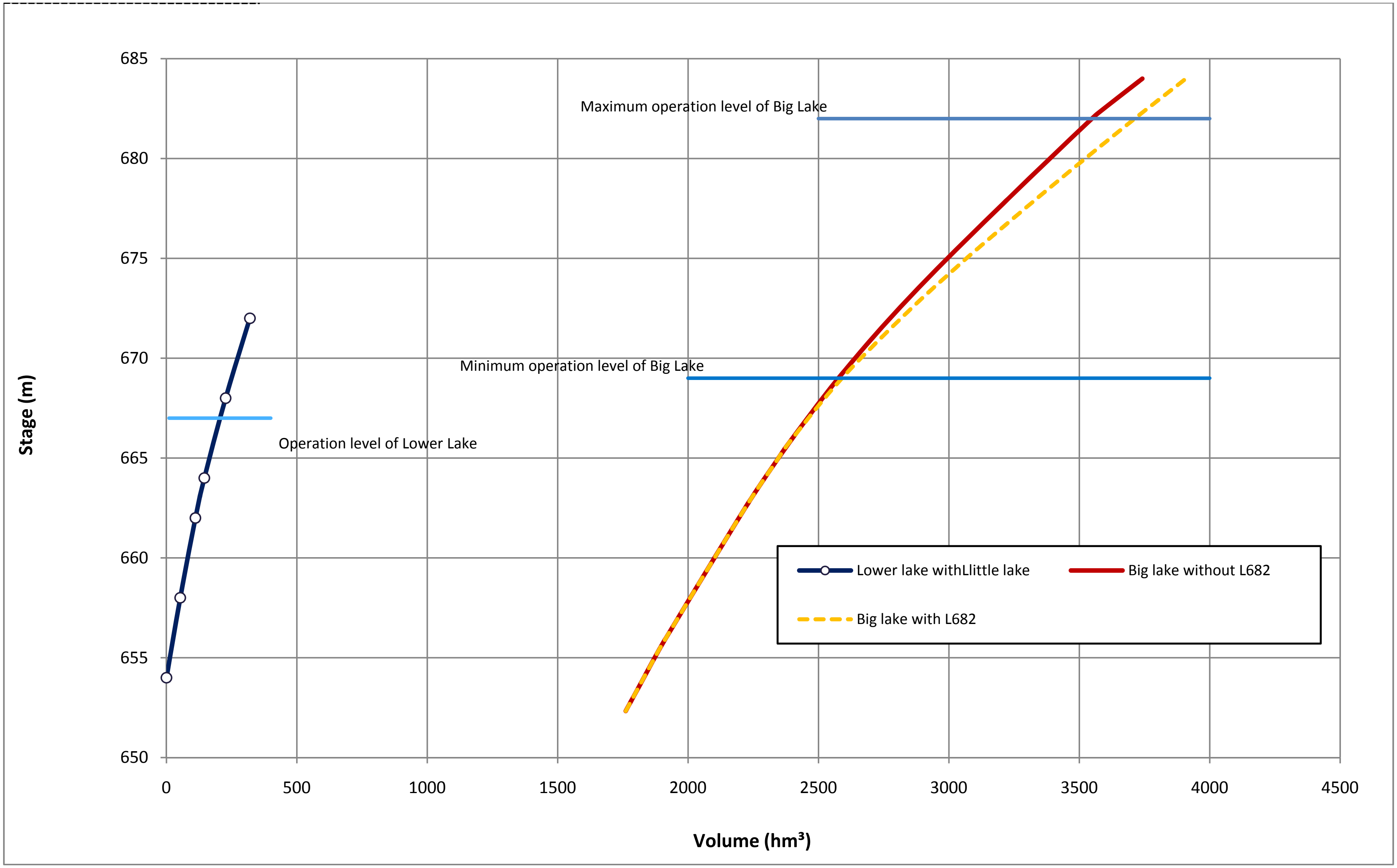
The storage curves used for site 6g are presented in Figure 3.3 hereafter, for the Lower Lake, the Big Lake alone and the Big Lake connected with Lake 682.

Due to the shoals at an elevation of about 669 m in the Big Lake, the minimum operating level of this lake may not be lower than this value. The same limitation would apply if it is planned to use Lake 682 bathymetry.

Table 3.5 Stage - Surface Areas of the lakes at site 6g

Lake 682		Big Lake		Little Lake		Lower Lake (including Little Lake over 664 m)	
Stage (m)	Surface area (km²)	Stage (m)	Surface area (km²)	Stage (m)	Surface area (km²)	Stage (m)	Surface area (km²)
562.33	0.009	444.77	0.002	625.87	0.002	654.00	12.511
572.33	0.040	454.77	0.043	635.87	0.164	658.00	13.860
582.33	0.588	464.77	0.137	645.87	0.491	662.00	15.315
592.33	0.761	474.77	0.259	655.87	1.237	664.00	18.815
602.33	1.605	484.77	0.419	665.87	3.064	668.00	22.000
612.33	2.326	494.77	0.642			672.00	24.537
622.33	2.958	504.77	0.898			676.00	26.571
632.33	3.740	514.77	1.214			682.00	31.410
642.33	5.011	524.77	1.598			684.00	32.940
652.33	6.379	534.77	2.076				
662.33	7.904	544.77	2.777				
672.33	9.723	554.77	3.918				
682.33	15.065	564.77	5.085				
		574.77	6.956				
		584.77	8.758				
		594.77	11.314				
		604.77	14.767				
		614.77	18.438				
		624.77	22.928				
		634.77	28.144				
		644.77	34.796				
		654.77	42.518				
		664.77	51.998				
		674.77	76.540				
		676.00	89.469				
		678.00	91.605				
		680.00	93.791				
		682.00	96.031				
		684.00	99.881				

Figure 3.3 Storage Curves of the lakes at Site 6g



3.3 Observed data and synthetic series

3.3.1 Observed data

The discharges were measured at various gauging stations. The average and maximum measured discharges are presented in Table 3.6, for the inflows to the Big Lake (Station 446), the Lower Lake (Station 3M5) and from the Northeast catchment (Station 3M9).

The available data indicate fairly stable inflows from year to year, with variation coefficients of 16%, 12% and 19% respectively.

Table 3.6 Measured discharges

Year	Station 446		Station 3M5		Station 3M9	
	Average Discharge (m^3/s)	Max Discharge (m^3/s)	Average Discharge (m^3/s)	Max Discharge (m^3/s)	Average Discharge (m^3/s)	Max Discharge (m^3/s)
1974			2.78	10.75		
1975			3.57	17.58		
1976			4.18	21.39		
1977			2.91	13.90	1.77	7.91
1978	25.59	157.42	4.40	24.69	1.47	20.30
1979	17.93	99.13	3.20	15.30	1.42	10.48
1980	25.27	130.91	2.71	10.47	1.60	16.94
1981	27.69	208.98	3.36	18.39	1.67	20.30
1982	19.50	138.88	2.37	12.58	1.34	8.60
1983	20.52	115.80	4.05	22.77	1.89	17.48
1984						
1985	27.29	133.95	3.38	23.24		
1986	25.95	133.80				
1987	31.23	200.77				
1988	27.41	161.31				
1989	26.48	163.81				
Average	***25.0***		***3.4***		***1.6***	

3.3.2 Synthetic series

3.3.2.1 Hydrological model

Daily flow series have been generated for the period September 1958 to August 2008 by Vatnatskil (2007[2], 2008, and 2009[3]). The discharge data considered in this evaluation are those from the 2009 Vatnaskil report.

The hydrological model uses the energy balance approach, which requires climate parameters including air temperature, precipitation, wind speed, air humidity, surface air pressure and incoming long-wave and short-wave radiation data.

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[2] Vatnaskil (2007) Hydrologic modeling in Southwest Greenland, prepared for Alcoa
[3] Vatnaskil (2009) Revised hydrological models in Southwest Greenland and future flows, prepared for Alcoa

The terrain data come from a high-resolution digital elevation model for the glacier surface and glacier base and a geographical map from GTK[4]. The catchments delineation is based on these terrain data. Where the DEM is available, the catchments were delineated based on the Shreve potential theory, which takes into account an ice load factor. (Vatnaskil, 2009).

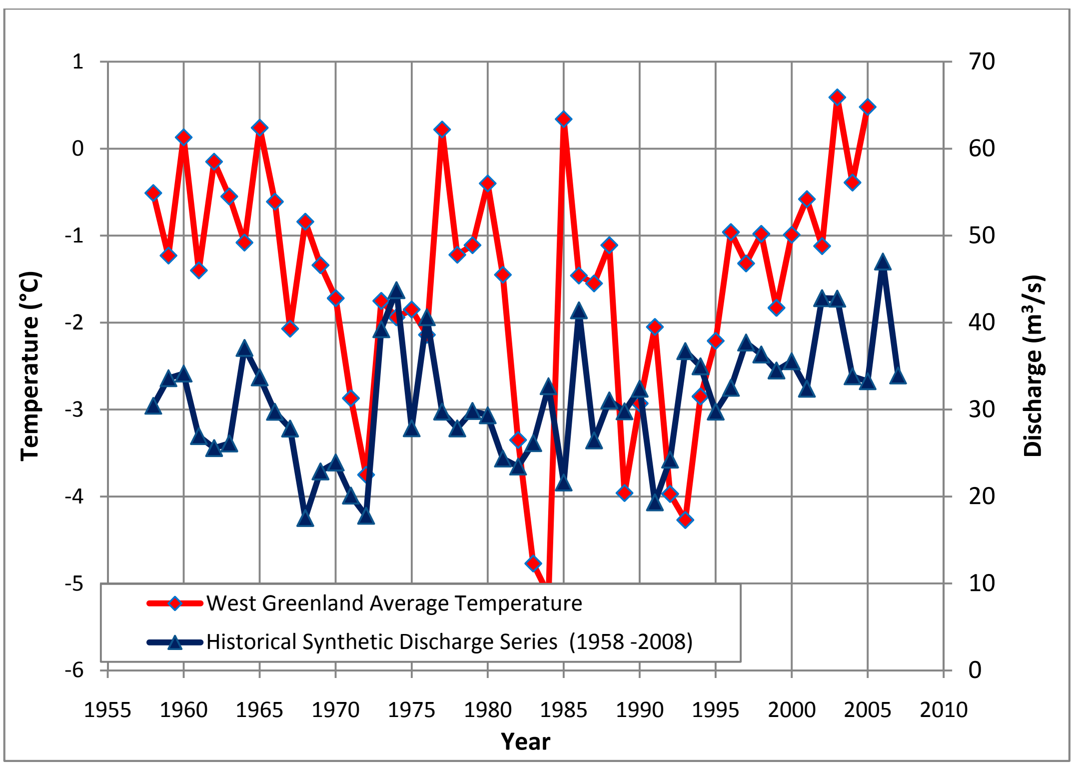
First, the model was calibrated to better fit total water balance, observed average discharge distribution within a year and the measured ablation. It then served to produce historical synthetic discharge series, using past climate data from September 1, 1958 to August 31, 2008.

As a high percentage of the discharges come from glacier melting, the main independent variable is temperature. Figure 3.4 shows a plot of the annual temperatures and discharges.

It was then assumed that future flows can be estimated on the basis of assumption of climate warming projected changes. The simulations have been done for three cases:

- daily historical series, using past climate data from September 1, 1958 to August 31, 2008;
- projected daily discharge series for 2020, using a scenario of climate warming to have a projection of the inflows within the horizon of 2020;
- projected discharge series for 2040, using similar methods to that of 2020.

Figure 3.4 Temperature and discharges



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[4] Grønlands Topografiske Kortværk (GTK)

3.3.2.2 Warming climate effect

The future warming rates have been assessed by several climate model studies, using different scenarios of greenhouse gas emissions. Future melt rates on Greenland ice sheet can be expected to increase on average in the coming decades, due to the anticipated global warming of the atmosphere.

The approach chosen by Vatnaskil was to use monthly average warming rates from a model study, to project historical temperature and longwave radiation fields to the future reference years (2020 and 2040), then running the already calibrated hydrological model using the projected meteorological fields as input. The resulting discharge series can be considered to determine the probability distribution of the discharge for that reference year.

The warming rates used for the projection were extracted from a downscaling of a global climate model run, for Greenland and the surrounding seas (Vatnaskil, 2009). The model used for the downscaling is the regional climate model HIRHAM4. The global climate model data were interpolated to the regional climate model grid (25x25 km) every six hours for the period 1950-2080. The lateral forcing data came from a simulation with the global coupled climate model ECHAM5/MPI-OM1.

The greenhouse gas forcing in the model is from observations up to the year 2000 and follows scenario A1B thereafter. The monthly average warming rates are given in Table 3.7.

Table 3.7 Monthly average warming rates (1960-2040)

Month	Warming rate (°C/Decade)
January	0.28
February	0.50
March	0.48
April	0.52
May	0.30
June	0.21
July	0.13
August	0.05
September	-0.07
October	0.06
November	0.04
December	0.017

The effects of warming of the athmosphere on the melt rates do not emerge only through higher sensible heat flux due to higher temperatures, but also through higher incident longwave radiation. Longwave radiation is actually the thermal radiation of the atmosphere, which basically depends of temperature increments.

The temperature projection for a given date is performed in the following steps:

a) Calculating the number of years from the given date until the reference year;
b) Calculating the temperature change as the product of the number of years and the temperature change per year for the specific month;
c) Adding the temperature change to the historical temperature.

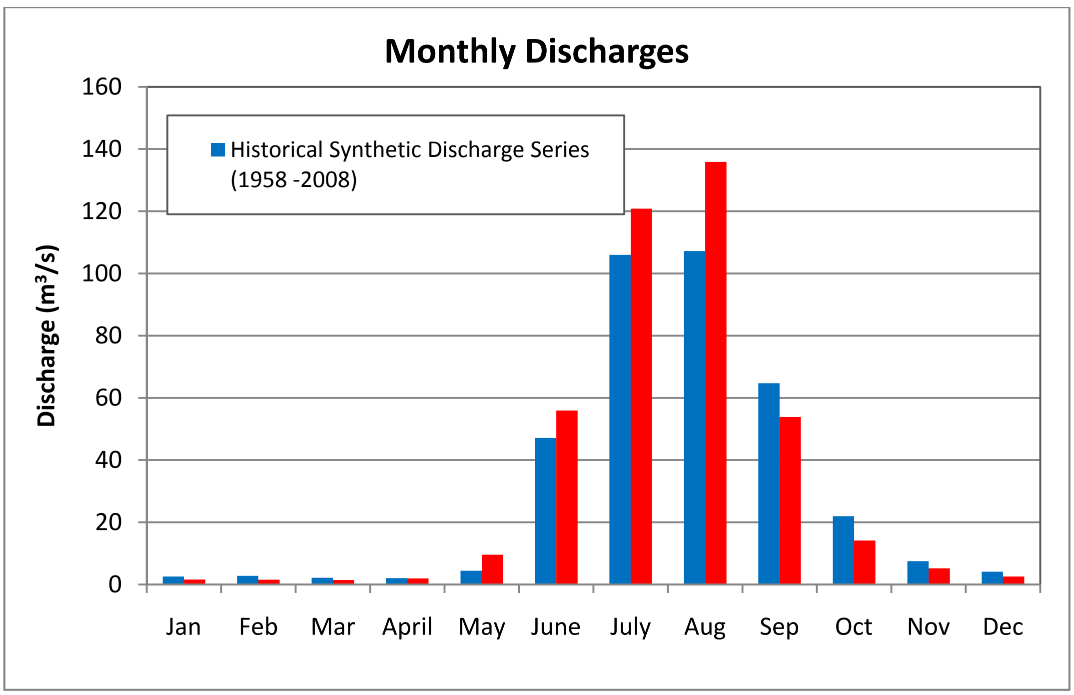
3.3.2.3 Discharge simulation results

For the synthetic historic series, the annual average discharge is 34 m³/s. The projected series for the 2020 horizon has an annual average discharge estimated to 37.4 m³/s, which shows an increase of 10% from the historic data. The Table 3.8 presents the mean and extreme annual average discharge for the three series that were computed, while Figure 3.5 shows the monthly distribution of discharges. The inflows from the northeast catchment (sub-basin E) and the southeast one (sub-basin A) are included in these module discharges.

Table 3.8 Module discharges of site 6g (all catchments)

	Historic synthetic discharge / 1958–2008 (m³/s)	Projected 2020 discharge (m³/s)	Projected 2040 discharge (m³/s)
Minimum	20.8	21.8	22.6
Average	34.0	37.4	39.5
Maximum	56.6	58.9	62.6
Standard deviation	*7.2*	*7.7*	*8.0*

Figure 3.5 Average Monthly Discharges



The inflows coming from the northeast catchment (basin E) were measured at gauging station 3M9, and have been modelized. The characteristics of the synthetic series are presented in the Table 3.9 for this subwatershed.

Table 3.9 Module discharge of the northeast subwatershed (basin E)

	Historic synthetic discharge / 1958–2008 (m³/s)	Projected 2020 discharge (m³/s)	Projected 2040 discharge (m³/s)
Minimum	1.2	1.3	1.3
Average	1.7	1.8	1.9
Maximum	2.4	2.4	2.5
Standard deviation	*0.3*	*0.3*	*0.3*

The southeast catchment (basin A) inflows were also estimated. No gauging station was installed to measure the inflows from the catchment but they could be determined by subtracting the inflows of the other catchments of site 6g from the computed synthetic series. The inflows for this subcatchment are presented in Table 3.10.

Table 3.10 Module discharge of the southeast subwatershed (basin A)

	Historic synthetic discharge / 1958–2008 (m³/s)	Projected 2020 discharge (m³/s)	Projected 2040 discharge (m³/s)
Minimum	0.57	0.60	0.62
Average	0.88	0.96	1.00
Maximum	1.23	1.25	1.30
Standard deviation	*0.14*	*0.14*	*0.14*

The discharged series considered for power availability estimation and design purposes are those estimated for the 2020 horizon.

3.4 Floods

3.4.1 Methodology

The floods estimates were based principally on the 50 years series generated by Vatnatskil (synthetic series). The methodology adopted to determine the flood characteristics considers the following points:

- the time span of observed data is not sufficient to conduct flood frequency analysis. At Site 6g, there is less than 10 complete years of data;
- the annual peak discharges are underestimated in the synthetic series, but the annual volumes are fairly represented;
- the annual flood hydrographs go from June to October, with a peak in July or August.

Two methods have been considered to estimate the floods. The first method is based on the frequency analysis of the annual synthetic maximum discharges and the second is based on the frequency analysis of the annual synthetic volume discharges.

The frequency analysis has been done with HYFRAN (Hydrological Frequency Analysis) a statistic tool developed by INRS-ETE (Institut National de la Recherche Scientifique - Eau Terre et Environnement) of Quebec. It gives a large panel of probability law, applicable to hydro-meteorological series. The retained laws are the Generalized Extreme Value (GEV) and Pearson type III.

The observed data used are the combined observations of stations 446, 3M5 and 3M9.

3.4.1.1 Peak discharge

For this method, the ratio between the observed peak discharges and the synthetic peak discharges are used to adjust 2020 projected synthetic discharges.

A constant estimated ratio of 1.2, representing the average ratio between observed peaks to synthetic peaks, is used to adjust the results of frequency analysis for the projected series.

3.4.1.2 Flood volumes

This method is based on the annual volume inflows. It appears that the volume inflows are independent and can be fitted to probability distributions. The results from frequency analysis of these data are used to determine the flood peaks from calculated ratios evaluated between peak discharges and volume inflows of the flood hydrographs.

The average of the ratio of peak discharge to average discharge of the hydrographs is about 2.4. The relevant characteristic of the hydrographs used is the ratio between peak discharges and the average discharges of the combined observations of stations 446, 3M5 and 3M9.

At site 6g, the base time of the hydrographs is about five months, from June to October. The characteristics of the hydrographs for each year show a ratio of peak discharge to average discharge varying from 2.04 to 2.99. The ratio used is the average coefficient which is estimated to a value of 2.4. The equivalent ratio of peak discharge to hydrograph volume is 0.2 and is easier to use.

3.4.1.3 Inflow hydrograph

The synthetic input hydrographs are based on aggregated observed discharges of 1981, 1982 and 1983 from stations 446, 3M5 and 3M6, and are deducted by proportional transformation.

3.4.1.4 Results of flood frequency analysis

The flood frequencies for Site 6g are presented in Table 3.11. The hydrograph used for the outlets of Big Lake and Lower Lake are presented in Figures 3.6 and 3.7. The 20 years flood will be used as design discharge during construction: for the Big Lake, it doesn’t take into account the inflow coming from the northeast catchment.

Table 3.11 Flood peaks at site 6g

Return Period (years)	Flood discharges (m³/s) Total inflows (Projected 2020)	Total inflows (Projected 2040)	Northeast Catchment (Canals 3 and 4)	Big Lake (Dams 3 and 4, & Spillway 2)	Lower Lake	Lower Lake with Tunnel 1 (Dams 1 and 2, and spillway 1)	Southeast Catchment (Tunnel 3)
10 000	419	425	28	399	62	160	6
2 000	387	394	27	368	56	155	6
1 000	372	380	26	354	54	153	6
200	337	346	24	319	49	148	6
100	321	330	23	303	46	145	6
50	304	313	22	286	44	143	5
20	280	290	21	263	40	140	5
10	260	269	20	243	37	137	5
5	237	247	18	221	34	134	5
3	217	227	17	202	31	132	5
2	198	207	15	183	29	129	4

The design criteria for the permanent structures use the flood discharges for the projected 2020 series. At big lake, corresponding values for the projected 2040 series are about 3% higher and have a little incidence.

Figure 3.6 Synthetic hydrographs used for Big Lake

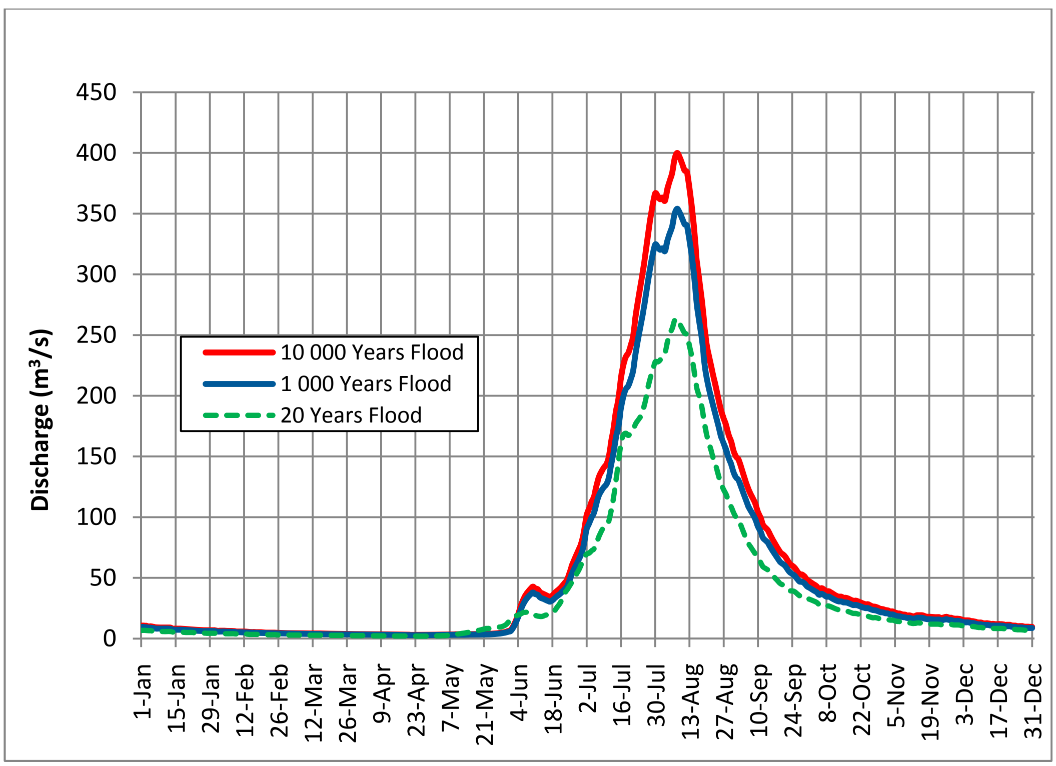
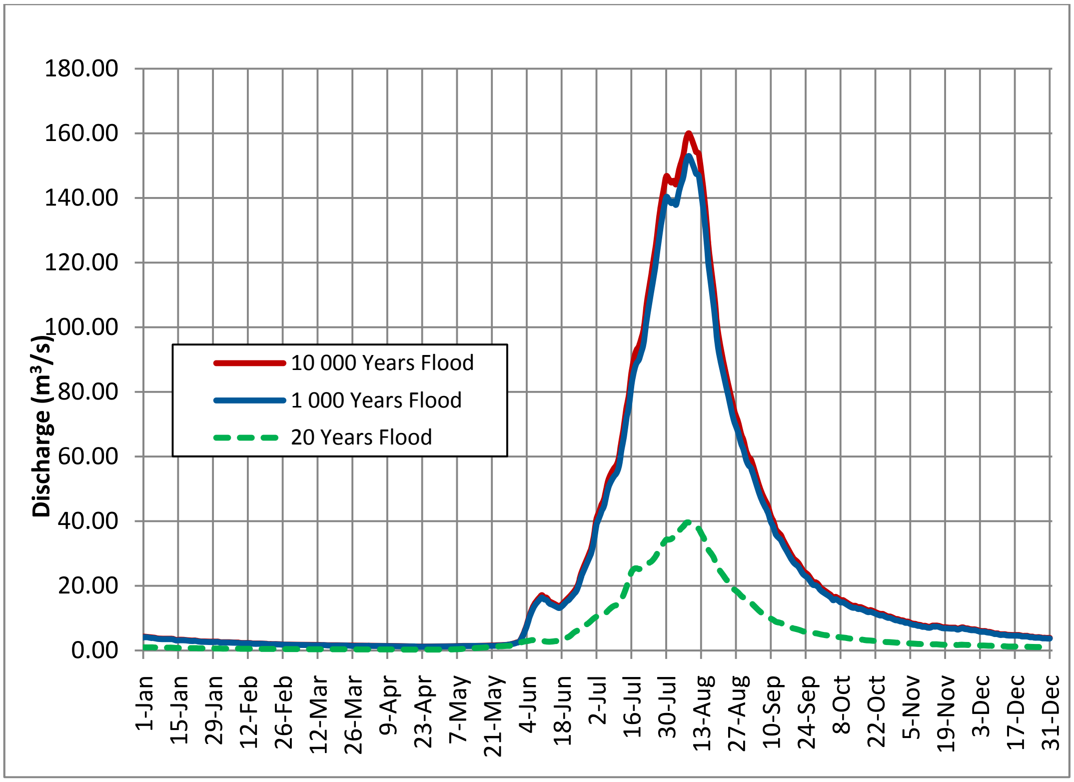


Figure 3.7 Synthetic hydrographs used for Lower Lake



3.4.2 Inflow Design Flood

The selected Inflow Design Flood (IDF) for the 6g structures is the 1:10 000 years flood. It is based on the discharges projected for the 2020 horizon, revised as indicated above.

3.4.2.1 Structures around Lower Lake: Dam 1, Dam 2, Spillway 1

The level of the Lower Lake is controlled by Spillway 1. The IDF is 160 m^3/s, including the catchment of the Lower Lake, and the maximum discharge of Tunnel 1 (gate opened, Big Lake at maximum level). If Tunnel 3 is constructed, the southeast catchment flows to the Lower Lake, thus raising from the IDF of the Lower Lake to 166 m^3/s.

3.4.2.2 Structures around Big Lake: Dam 3, Dam 4, Spillway 2, Dam 5

The level of the Big Lake is controlled by the Spillway 2. The IDF is 400 m^3/s, including the catchment of the Big Lake and the northeast catchment transferred by Canal 4 and Canal 3.

3.4.2.3 Canal 3

Canal 3 is used as a spillway channel for Dam 5 to evacuate the floods coming from the northeast catchment. The IDF is 28 m^3/s.

3.4.2.4 Canal 4

Canal 4 is designed to transfer to the Big Lake the discharges coming from the northeast catchment. Its IDF is 28 m^3/s.

3.4.2.5 Tunnel 1

Tunnel 1 is regulated to supply water for the turbines. It is designed to allow the transfer of a discharge of 40 m³/s upon the most adverse conditions; minimum water level at the Big Lake and maximum water level at the Lower Lake.

3.4.2.6 Tunnel 2

Tunnel 2 is an equilibrium tunnel between Big Lake and Lake 682. Its dimension may be based upon constructability considerations. This tunnel is not part of the initial design but could be constructed to increase the power production.

3.4.2.7 Tunnel 3

Tunnel 3 is designed to transfer to the Lower Lake the discharges coming from the southeast catchment. Its IDF is 6 m³/s. This tunnel is not part of the initial design but could be constructed to increase the power production.

3.4.3 Inflows during construction

For the diversion structures, a risk of exceedance of 5% is allowed during the diversion period, estimated to one year. The flood selected is the 1:20 years flood.

The normal conditions during construction can be based upon the monthly average discharges. The flow-duration values are given in the tables 3.12 to 3.14 hereafter.

Table 3.12 Flow-Duration values at Big Lake

Exceedence probability	January	February	March	April	May	June	July	August	September	October	November	December
Minimum	0.49	0.44	0.41	0.40	0.41	0.48	21.09	28.23	7.04	1.91	0.81	0.55
95%	0.56	0.50	0.46	0.44	0.49	9.29	54.34	63.67	16.73	3.34	1.19	0.71
90%	0.59	0.53	0.48	0.46	0.53	14.21	61.57	75.38	20.92	4.06	1.34	0.77
85%	0.63	0.55	0.50	0.50	0.61	21.30	67.84	83.59	23.74	4.76	1.46	0.80
80%	0.65	0.58	0.53	0.52	1.29	24.44	75.92	89.76	26.04	5.45	1.58	0.84
75%	0.67	0.60	0.55	0.53	1.91	27.15	83.70	96.73	28.56	6.06	1.72	0.87
70%	0.69	0.61	0.57	0.55	2.36	29.10	90.68	103.37	31.25	6.68	1.86	0.92
65%	0.71	0.63	0.58	0.57	3.00	31.51	96.14	110.38	33.79	7.37	2.00	0.96
60%	0.72	0.65	0.60	0.59	3.92	34.79	101.02	116.54	37.09	8.18	2.16	1.00
55%	0.75	0.66	0.61	0.63	5.36	38.88	105.77	123.47	40.42	8.93	2.35	1.05
Average	1.26	1.44	1.59	3.03	12.16	50.21	118.27	135.70	50.06	12.23	4.32	2.04
50%	0.78	0.68	0.63	0.68	7.14	43.57	111.53	129.39	43.42	9.79	2.56	1.11
45%	0.82	0.70	0.66	0.79	8.57	48.43	118.18	135.93	47.09	10.65	2.77	1.17
40%	0.85	0.73	0.69	1.00	10.36	52.72	125.66	143.27	51.39	11.65	3.03	1.26
35%	0.88	0.75	0.72	1.44	12.91	59.07	132.47	151.30	55.71	12.68	3.38	1.38
30%	0.91	0.77	0.75	1.92	15.70	64.82	140.72	159.26	60.56	13.82	3.84	1.55
25%	0.95	0.79	0.80	2.50	18.10	69.52	148.35	168.53	65.54	15.24	4.41	1.81

Exceedence probability	January	February	March	April	May	June	July	August	September	October	November	December
20%	1.03	0.82	0.98	3.44	20.44	75.69	157.70	179.26	70.46	17.01	5.29	2.24
15%	1.16	0.86	2.46	4.64	24.27	83.07	167.85	190.08	76.26	19.26	6.85	3.05
10%	1.39	1.13	4.54	5.94	29.85	93.77	182.11	205.67	84.94	22.29	8.69	4.41
5%	3.31	5.69	7.53	9.95	41.08	109.45	202.12	226.49	102.57	29.56	14.45	6.99
Maximum	22.18	51.04	21.90	89.05	106.12	185.38	258.32	297.62	211.30	82.51	42.60	26.52

Table 3.13 Flow-Duration values at Lower Lake

Exceedence probability	January	February	March	April	May	June	July	August	September	October	November	December
Minimum	0.23	0.21	0.19	0.18	0.18	0.24	6.52	3.89	1.13	0.47	0.29	0.25
95%	0.27	0.23	0.21	0.22	0.23	2.53	8.77	6.94	2.22	0.73	0.40	0.31
90%	0.28	0.25	0.23	0.23	0.25	5.18	9.31	7.68	2.66	0.82	0.44	0.34
85%	0.30	0.26	0.24	0.24	0.27	6.67	9.81	8.29	3.04	0.91	0.46	0.35
80%	0.31	0.27	0.25	0.25	0.31	7.67	10.30	8.75	3.33	1.00	0.49	0.36
75%	0.32	0.28	0.26	0.25	0.46	9.00	10.74	9.25	3.65	1.09	0.51	0.37
70%	0.32	0.29	0.27	0.26	0.61	9.87	11.22	9.62	3.95	1.19	0.53	0.38
65%	0.33	0.30	0.28	0.27	0.76	10.70	11.64	10.00	4.28	1.29	0.56	0.39
60%	0.33	0.30	0.28	0.27	1.00	11.36	11.96	10.46	4.58	1.41	0.58	0.40
55%	0.34	0.31	0.29	0.28	1.34	12.17	12.35	10.88	4.90	1.52	0.62	0.41
Average	0.45	0.47	0.49	0.78	3.19	12.83	13.52	11.49	5.57	2.08	0.99	0.58
50%	0.35	0.31	0.30	0.29	1.61	12.68	12.77	11.23	5.17	1.65	0.64	0.43
45%	0.36	0.32	0.30	0.32	2.00	13.40	13.17	11.58	5.47	1.79	0.68	0.44
40%	0.36	0.33	0.31	0.35	2.45	14.14	13.58	11.91	5.79	1.94	0.72	0.46
35%	0.37	0.33	0.32	0.40	3.13	14.86	14.03	12.40	6.15	2.11	0.79	0.48
30%	0.39	0.34	0.33	0.51	3.87	15.67	14.51	12.94	6.51	2.29	0.87	0.50
25%	0.40	0.35	0.35	0.62	4.53	16.94	15.22	13.50	6.87	2.50	1.00	0.53
20%	0.41	0.37	0.36	0.81	5.53	18.17	16.01	14.24	7.40	2.74	1.19	0.59
15%	0.43	0.38	0.48	1.11	6.99	19.44	17.24	14.86	8.09	3.11	1.47	0.71
10%	0.45	0.41	1.17	1.52	8.63	20.91	18.67	15.61	9.04	3.71	1.93	0.95
5%	0.83	1.32	1.78	2.72	10.77	23.16	21.72	16.80	10.45	5.00	2.96	1.54
Maximum	5.84	12.18	5.32	15.86	23.00	26.22	34.50	22.54	16.97	11.90	7.93	5.11

Table 3.14 Flow-Duration values at northeast catchment (Dam 5)

Exceedence probability	January	February	March	April	May	June	July	August	September	October	November	December
Minimum	0.06	0.06	0.05	0.05	0.05	0.06	1.90	1.85	0.43	0.16	0.09	0.08
95%	0.07	0.07	0.06	0.06	0.06	0.50	4.47	3.34	0.92	0.24	0.12	0.09
90%	0.08	0.07	0.06	0.06	0.07	0.97	4.94	3.82	1.11	0.28	0.13	0.09
85%	0.08	0.07	0.07	0.07	0.07	1.69	5.24	4.24	1.25	0.31	0.14	0.10
80%	0.09	0.08	0.07	0.07	0.09	2.06	5.49	4.64	1.39	0.34	0.15	0.10
75%	0.09	0.08	0.08	0.07	0.13	2.37	5.75	4.90	1.52	0.38	0.16	0.11
70%	0.09	0.08	0.08	0.07	0.16	2.62	5.98	5.11	1.65	0.41	0.16	0.11
65%	0.09	0.09	0.08	0.08	0.20	2.89	6.16	5.30	1.77	0.45	0.17	0.11
60%	0.10	0.09	0.08	0.08	0.27	3.15	6.31	5.52	1.91	0.49	0.18	0.12
55%	0.10	0.09	0.08	0.08	0.35	3.52	6.49	5.80	2.04	0.54	0.19	0.12
Average	0.14	0.16	0.17	0.25	0.89	4.09	6.66	5.93	2.38	0.71	0.33	0.20
50%	0.10	0.09	0.08	0.09	0.45	4.02	6.69	5.98	2.18	0.59	0.21	0.13
45%	0.11	0.09	0.09	0.09	0.57	4.40	6.82	6.15	2.32	0.64	0.22	0.13
40%	0.11	0.10	0.09	0.11	0.73	4.71	6.97	6.37	2.49	0.69	0.23	0.14
35%	0.11	0.10	0.10	0.13	0.90	5.07	7.12	6.57	2.67	0.76	0.25	0.15
30%	0.12	0.10	0.10	0.17	1.07	5.49	7.30	6.76	2.86	0.82	0.28	0.16
25%	0.12	0.10	0.10	0.21	1.25	5.87	7.45	7.01	3.08	0.90	0.33	0.18
20%	0.12	0.11	0.11	0.27	1.51	6.21	7.65	7.24	3.29	0.99	0.41	0.21
15%	0.13	0.11	0.20	0.35	1.92	6.60	7.98	7.52	3.55	1.11	0.53	0.27
10%	0.15	0.13	0.40	0.49	2.27	7.05	8.26	8.02	3.90	1.27	0.71	0.37
5%	0.35	0.59	0.66	0.68	3.12	7.84	9.08	8.45	4.39	1.62	0.99	0.61
Maximum	2.23	4.47	1.94	6.08	7.14	9.98	12.24	9.96	7.28	3.33	3.09	1.91

3.5 Reservoir filling time

It is proposed to close the diversion tunnels at the end of November 2014 (4th year of construction). Since commissioning of the powerhouse is planned starting in March 2015, the Lower Lake will be filled first using part of the volume available in the Big Lake between levels 675 m (natural water level) and 669 m (planned minimum operating level of the reservoir). Tunnel 1 will be opened starting in December 2014 to transfer water from the Big Lake to the Lower Lake.

It would lake two months to fill the Lower Lake if a steady flow of 40 m³/s is transferred through Tunnel 1, which meets the time constraint for the commissioning of the powerhouse. Considering that the initial water level of the Big Lake is at level 675 m, it could be possible to transfer a discharge close to 100 m³/s through Tunnel 1 if it becomes necessary to fill the Lower Lake in a shorter period of time.

Following the filling of the Lower Lake, the Big Lake reaches a low water level of 672 m. The filling of the Big Lake is then done during the summer 2015 season. It is simulated with synthetic hydrographs corresponding to:

- dry year, based on daily flow with exceedance probability of 80%;

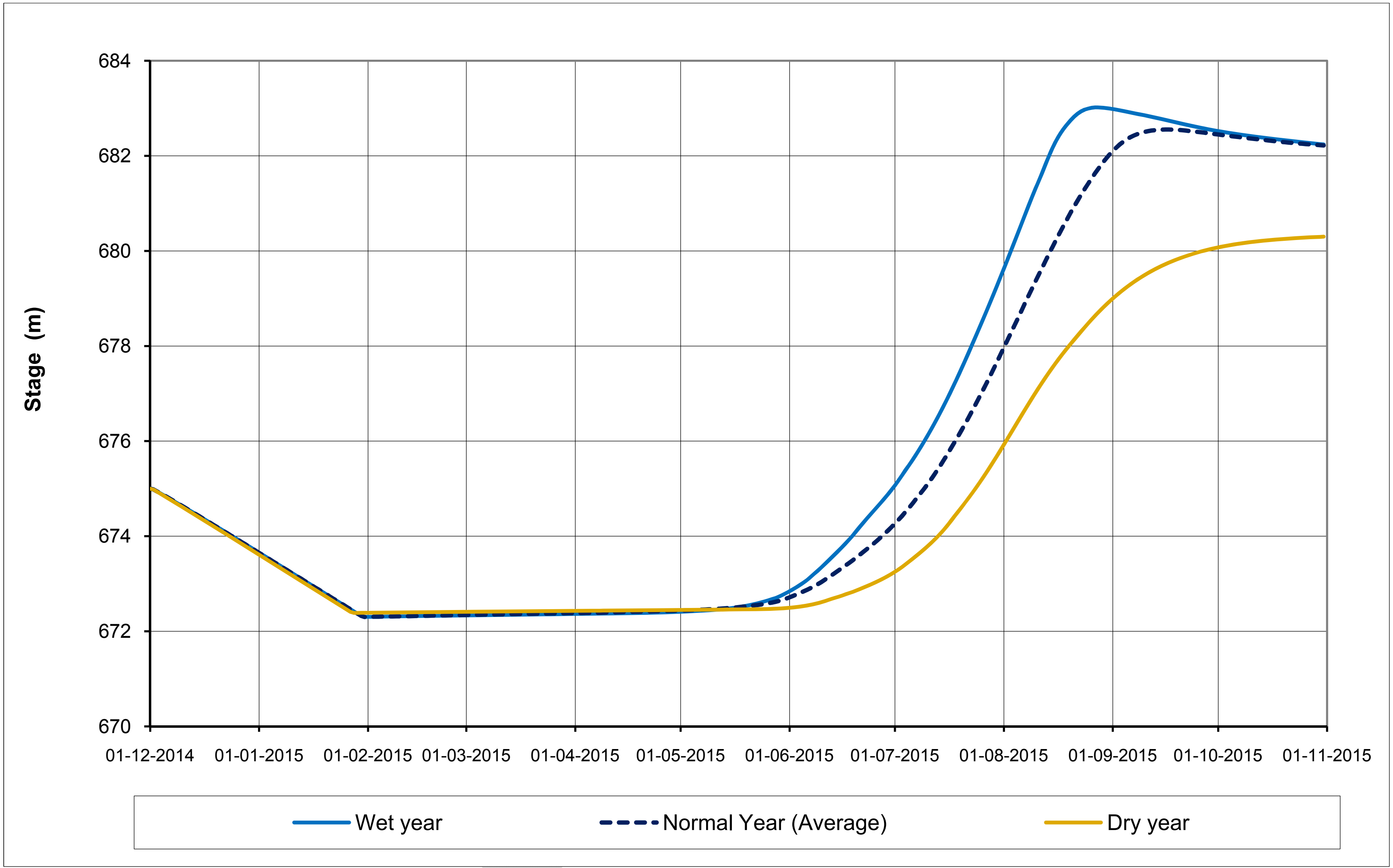
- normal year, based on daily flow average;
- wet year, based on daily flow with exceedance probability of 20%.

The intake gate is closed. Tunnel 1 is closed when lower lake is full. The simulations do not consider the volume that could be used for the commissioning tests of the powerhouse, i.e. additional water would need to be transferred from the Big Lake to the Lower Lake. However, the volume for the tests is planned to be small compared to the available volume (during the remaining of the winter season) and the incoming inflows (during the summer season).

For normal and wet years, the maximum operation level of Big Lake is reached between mid-August and the end of August 2015. In the case of a dry year, the filling of the Big Lake is not completed during the first year: the water level reaches the elevation of 680.3 m but it is expected that this condition will not affect the estimated firm power.

The filling curves of the Big Lake are presented in the Figure 3.8.

Figure 3.8 Filling of Big Lake Reservoir



The Big Lake can be filled during the summer 2015 season, except for a dry year for which the water level would only reach a level near 680 m at the end of 2015. In this case, the normal operations of the powerhouse could still start as the required volume for a reliable power production would be available. The reservoir would reach its maximum operating level during the following summer season. If starting the power simulations that are presented in section 5 of the current report with an initial water of 680 m for the Big Lake, no change is observed in the firm power guaranteed at the site since the inflows are above average for many years at the beginning of the synthetic series.

3.6 Sediments

The potential for sediment transport in the study area is limited since the surface is composed mostly of bedrock. Sand and gravel will be transported by the floods every year but are likely to be deposited at the bottom of the deep lakes used as reservoirs. Sediment deposition will not be an issue at the intake structures since they are planned to be constructed well above the deposition zones at the bottom of the lakes.

4 Power production and installed capacity

4.1 Smelter requirement

The firm power required at the smelter is 650 MW. this power should be guaranteed at all times over a 50 year time frame of operation.

4.2 Firm yield evaluation

For the Greenland Project, hydropower is the only energy source. The generation planning is based on the Smelter energy requirements for the electric power of 650 MW to be provided upon a constant basis, corresponding to 685 MW at both sites combined. The discharge used to generate this power must also be available on an ensured basis. Because of the repartition of the inflows inside a year and their variability between years, storage is needed to regulate the inflows.

The hydroelectric firm energy will be based on the energy output over the most adverse sequence of flows in the inflow series. This adverse sequence of flows is called the critical period.

The evaluation is based upon water resources expected upon the time of operation of the powerhouse: the discharge series used is the projected one for the 2020 horizon. Since the inflows come from numerous catchments at site 6g, the discharges in the series are split according to the percentage of inflows from every sub-catchments obtained from the gauging stations. Only the southeast catchment wasn't gauged, but the inflows from basin can be calculated by subtraction of the other sub-basin inflows from the total discharge for site 6g (for all of the catchments).

4.2.1 Module discharge

The average module discharge for the series is 37.4 m³/s, including the inflows from all of the sub-catchments. The northeast sub-catchment has an average module discharge of 1.9 m³/s while the southeast sub-catchment has an average module discharge of 1.0 m³/s (calculated). Table 4.1 summarizes the average module discharges for the potential development scenarios at site 6g.

Table 4.1 Average module discharges summary

Scenario	Module discharge (m³/s)
All catchments	37.4
Big Lake and Lower Lake, with the northeast sub-catchment only (without Tunnel 3)	36.4
Big Lake and Lower Lake, with the southeast sub-catchment only (without Canal 3 and 4, and Dam 5)	35.5
Big Lake and Lower Lake only (without Tunnel 3, Canal 3 and 4, and Dam 5)	34.6

4.2.2 Alternatives considered

Some alternatives were studied in order to optimize the power production at site 6g.

First, the presence of shoals at elevations between 666 and 668 m in the Big Lake upstream of the intake zone of Tunnel 1 limits the use of the full bathymetry of the reservoir, unless extensive dredging works are done. From the available bathymetry, the option to dredge the shoals was eliminated since it would require very costly excavation. The minimum operating level of the Big Lake is then limited to 669 m.

As for the maximum operating level of the Big Lake, preliminary estimations showed that the proposed maximum level of 682 m in FEL 1 was the optimal level to target. Indeed, raising the maximum water level above this value would necessitate raising the dams, which would be too costly compared to the firm power that can be gained.

As for the Lower Lake, its natural water elevation is around 654 m. The proposed operating level is 667 m, which is the water level required to have an adequate submergence of the intake structure with the intake invert above the natural water level of the lake. It will allow simplifying the construction and reducing the costs since no wet excavations will be required.

The operating level of the Lower Lake will be kept constant to maximize the head, since the potential gain in firm power by varying the operating level is minimal (less than 2 MW). Also, the current turbine design wouldn't allow the turbine to adequately operate with a lower water level in certain circumstance. In an emergency case (severe drought that would empty the useful storage in the Big Lake), it would possible to use some of the small storage volume available in the Lower Lake below elevation 667 m to produce additional energy. Nevertheless, the storage volume available is not large enough to increase the firm power at the site on a yearly basis.

The possibility to join the two reservoirs by raising the water level of the Lower Lake to 682 m, and create only one single large reservoir was also considered. Such an option would simplify the operation at the site by eliminating the transfer Tunnel 1 and would slightly increase the storage available. However, those advantages are overruled by the cost required to raise the dams and the spillway of the Lower Lake. This option was then rapidly eliminated.

4.2.3 Minimum and maximum operation level

Based on the above results, the Big Lake will operate between elevation 669 and 682 m, while the Lower Lake is planned to be kept at a constant elevation of 667 m. The useful storage volume at the site will be of 972 hm³ if Tunnel 2 is not constructed (bathymetry of Big Lake only) or 1 122 hm³ if Tunnel 2 is constructed (bathymetry of Big and Middle Lake).

4.3 Power production study

4.3.1 General methodology

The approach used to determine the energy potential of site 6g is the sequential streamflow routing method, which is the most viable method for evaluating storage projects regulated power or for multiple purposes including power.

The method uses the continuity equation to route streamflow through the project, and thus it accounts for the variations in reservoir elevation resulting from water inflow and outflow. The routing is done over the 50 years streamflow series, with a daily step. For a given time period, the water withdrawn is determined in function of generation needs, which are constant in terms of delivered power. Water spills occur when the water level reaches the weir crest.

The level of firm power is determined by trial and error, and is defined as the output that will utilize the available storage completely once during the period of record.

The firm power is therefore dependant on:

- the drought characteristics;
- the net storage available;
- the net hydraulic head;
- the production device's efficiency.

4.3.2 Model

The simulations were conducted with version 3.0 of the HEC-ResSim model. This model has been designed and developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers to perform Reservoir System Simulation's.

The program can be used efficiently for single reservoir or for complete reservoir systems on either critical period or period of record studies. It can handle multi-hourly, daily, weekly, or monthly intervals. It is designed to simultaneously meet flood control criteria and conservation requirements within other operating constraints defined by the user. Conservation requirements can be expressed in terms of seasonal flow requirements or seasonal generation requirements, at specific reservoirs or as seasonal flow requirements at downstream control points. Each demand may be served by one or more upstream reservoirs based upon input data. System operations may be performed for flood control, water supply, and hydropower, where more than one reservoir is operated for a common location.

4.3.3 Net head

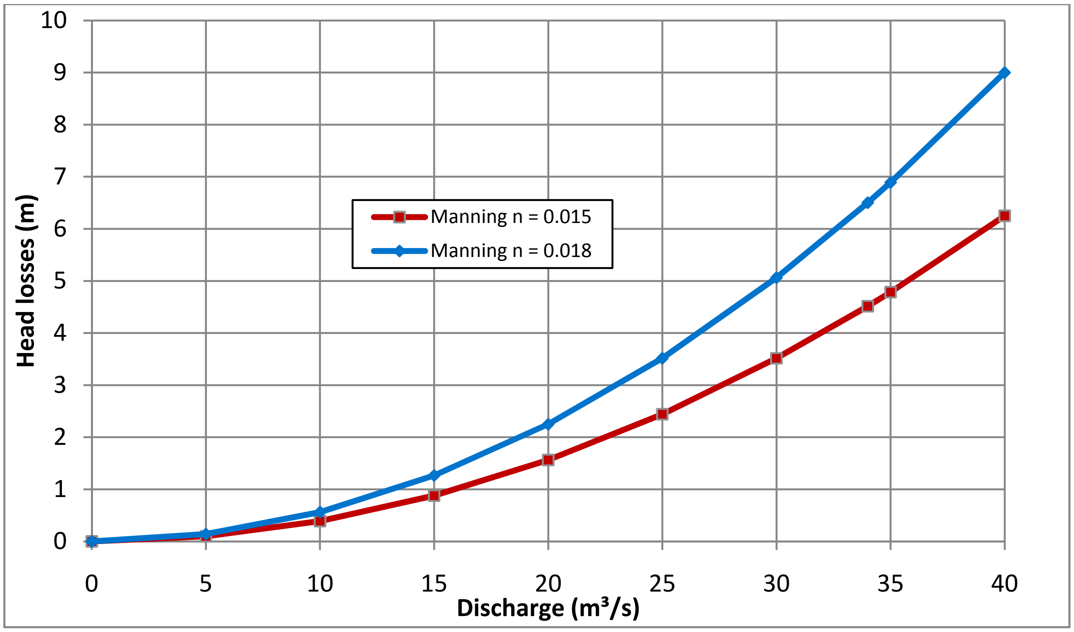
The gross head is taken between the pond surface and the level of the turbines nozzles, set at an elevation of 7.5 m. Such an elevation is chosen to ensure an appropriate clearance between the maximum tailwater elevation and the level of the flywheel. The clearance is set equal to 1.5 the diameter of the flywheel.

For evaluating the net head, head losses due to the intake structures and the power tunnel are taken into account. The characteristics of the power tunnel are:

- length: 9.99 km
- diameter: 5.1 m
- cross-section shape: Circular (TBM)
- cross-sectional area: 20.4 m²

Head losses - Discharge relationships are presented in Figure 4.1 below for Manning coefficient n equal to 0.015 and 0.018. However, the base case considered is a Manning's n of 0.015, which is likely for construction.

Figure 4.1 Friction head losses



4.3.4 Production devices efficiency

The following parameters were defined from the proposed turbines:

- turbines: 91.9%
- generator: 98.6%
- unit: 90.6%
- global efficient used: 90.1% to take into account possibility for high velocity oxygen fuel (HVOF) coating

4.3.5 Water losses

It is supposed that all of the inflows are reserved for hydropower generation.

Water losses may be of various kinds. In this stage, it is assumed that net evaporation losses are minimal. Preliminary values of head loss resulting from leakage through or around the spillway and the dams are considered. Since the water head at the dams in the Big Lake and Lower Lake don't vary a lot (maximum of 13 m difference), leakage is assumed constant over the whole range of operating level. Values of 0.1 and 0.25 m^3/s are considered respectively for the Lower Lake and the Big Lake.

4.3.6 Power simulation results

Power simulations were run using the 2020 projected discharge series previously discusses to determine the firm power available at site 6g.

The base scenario that is currently considered operates the Big Lake between 669 and 682 m, while the water level of the Lower Lake is kept constant at elevation 667 m. The northeast catchment is diverted into the Big Lake with Canals 3 and 4, and Dam 5. Tunnel 2 (to use the storage of the Middle Lake) and Tunnel 3 (to divert the southeast catchment into the Lower Lake) are not constructed with this scenario. Such a scenario yields a firm power of 191 MW.

Additional simulations were run to quantify the possibility to add or eliminate both the northeast and southeast catchments from the project, to increase the firm power or lower the project cost.

The results of those power simulations are presented in Table 4.2, along with the differential construction cost associated with the various sub-components of the project which are considered.

Table 4.2 Minimum reservoir level (with zone near the intake only)

Scenario	Guaranteed power (MW)	Operating discharge (m^3/s)	Construction cost (M$)	Unit incremental cost (M$/MW)
Base – Tunnel 1, Canals 3 and 4	183	32	-	-
With Tunnel 2 (Middle Lake)	186	32	5	1.67
With Tunnel 3 (southeast catchment)	187	32	13	3.25
With Tunnel 2 and 3	191	33	18	2.25
Without Canals 3 and 4, and Dam 5 (northeast catchment)	175	31	8	1.15

From the results presented in the above table, adding the inflows of the southeast catchment is not an interesting option, since the incremental unit cost of this catchment is higher than the unit cost per MW for the project. Moreover, this tunnel located next to the glacier margin presents some clogging risks by ice or snow accumulation which couldn't be economically settled. The northeast catchment has a low incremental cost and should be kept in the base scheme. Tunnel 2 would increase the storage volume with the bathymetry of the Middle Lake, but is not retained in the base scheme.

4.4 Available firm power at smelter location

The electrical power supply to the smelter will be provided by the two powerhouses of site 7e and site 6g.

The operational constraint is that a firm power of 650 MW has to be available anytime at the smelter. The power generated at the generating stations must be sufficient to cover this electricity demand as well as the electricity needs for the powerhouses, the stations service systems, the transmission line and the other different losses.

4.4.1 Station service requirements

Both powerhouses require power to operate, which amounts to a total of 6 MW for both sites. Table 4.3 outlines the needs at the 6g and 7e powerhouses.

Table 4.3 Power station energy requirements

Component	Site 7e (MW)	Site 6g (MW)
Powerhouse	1.6	1.3
Service Station	1.3	1.3
Intake structure	0.25	0.25
Total	***3.15***	***2.85***

4.4.2 Power losses

According to the information supplied by EFLA (transmission line subcontractor), the power losses through the transmission lines are estimated to a total of 22 MW for both sites combined. Finally, a 1% loss in the transformer is considered, which amounts to 7 MW for both sites combined.

4.4.3 Power needed at the generating stations

The power to be generated at sites 7e and 6g is estimated to 685 MW on a firm basis, as shown in Table 4.4.

Table 4.4 Total power production needs

	Power (MW)
Smelter requirement	650
Station service system	6
Transport losses	22
Generator losses	7
Total	*685*

5 Design criteria and assumptions

5.1 Purpose and Scope

This part of the design criteria defines the general and technical requirements for the following civil works:

- main water intake structures;
- power tunnel;
- powerhouse including service bay;
- transformer cavern;
- cable gallery
- access galleries;
- spillway.

5.2 Stability analysis

Classical stability analysis for the water intake structure, and dams is required.

5.3 Design criteria for tunnels

5.3.1 Geometry of the excavations

The following criteria regarding the geometry of the openings are considered when using drill and blast technique for the excavations:

- tunnel have a D-reverse shape;
- height to width ratio of the cross-sections of the power tunnels is at 1.3;
- the arch depth is equal to 25 to 30% of the width of the tunnel;
- the rock pillar between two galleries and/or the rock cover over a galleries is at least 1.5 times the width of the opening;
- the Manning's friction coefficient considered is n = 0.033 for head loss calculations;

Steel lining is placed in the tunnel near the intake and concrete is poured between the rock and the steel lined section. Elsewhere, the tunnels are unlined.

When a TBM is used for the excavations, the design criteria, with regard to the geometry of the openings, are the following:

- tunnels have a circular cross-section;
- the Manning's friction coefficient considered is n = 0.015 for head loss calculations;

Steel lining is placed in the tunnel near the intake and concrete is poured between the rock and the steel lined section. Elsewhere, the tunnels are unlined.

5.3.2 Excavation methods-Special requirements and restrictions

Well controlled drilling and blasting methods are generally used in all underground excavations to obtain relatively smooth, stable excavation rock faces with a minimum of overbreak and requiring minimum scaling and support.

Generally, no excavation sequences or restrictions on methods are imposed that would tend to reduce the contractor's flexibility in planning and add to his costs. However, special requirements are imposed in some zones considered critical and where a greater degree of assurance in the final results of excavation is needed.

In general, the excavation begins with a pilot tunnel on the first 10 meters, followed by slashing to the line within which excavation must be completed. The pilot gallery is excavated so that a layer of rock 2.5 m minimum thick is left in place inside the required excavation line of the walls and the arch of the tunnels. The maximum length of round for the pilot gallery generally does not exceed 2.5 m. Initially, the centre to centre spacing of the perimeter holes for the pilot tunnel is 60 cm. This spacing could be modified depending on the quality of the walls obtained and as to maintain the tolerances which will be specified in the technical specifications.

Pilot tunnel slashing as well as full face heading excavation shall be done using controlled perimeter blasting. Only cartridge type explosive will be used in the perimeter blast holes and in the buffer zone. Benching excavation in tunnel shall have the following specifications:

- maximum height of a bench: 10 m;
- maximum length of a bench: 10 m;
- maximum hole diameter of the perimeter, buffer and production holes: 70 mm;
- initial spacing of the perimeter holes (unless specified otherwise): 0.60 m c/c;
- loading of the perimeter holes: max. 0,65 kg/m² of presplitted surface excluding bottom load;
- bottom load of the perimeter holes: 1.25 kg/hole.

Borehole grid in frozen rocks should be reduced and the explosive ratio increased compared to the same rocks in a thawed state.

5.4 Design Codes and Standards

European standards (EN/ENV) with Norwegian design guidelines shall apply.

Data processing, design and fabrication shall conform to the requirements of European Comittee for Standardization (CEN) codes and standards.

Where an applicable EuroNorm (EN) or EuroNorm Vornorm (ENV) is not available, an appropriate ISO standard, ASTM or other internationally recognized standard may be utilized upon prior approval.

The following European standards (EN/ENV) are the principal standards, codes, guidelines and references to be used for the structural design:

The latest edition of a code or standard shall govern.

- EN 2004 Eurocode - Basis of structural design
- ENV2009 Eurocode 1- Actions on structures
- ENV2007 Eurocode 2- Design of concrete structures
- ENV2009 Eurocode 3 - Design of steel structures (both heavy and light gage)
- ENV1996 Eurocode 6 - Design of masonry structures
- ENV2009 Eurocode 8 - Design of structures for earthquake resistance

The following is the list of other codes to be used in the calculations (the latest edition of the following codes or standards shall govern).

- Rules BAEL 91, modified 99
- UK National Annexes to Eurocodes
- BS 8500-1: Concrete - Complementary British Standard to BS EN 206-1
- BS EN 10080: Steel for Reinforcement of Concrete - Weldable reinforcement steel
- BS EN 206-1: Concrete - Specification, performance, production and conformity
- UK National Application Document for Steel Structures
- BS 4449-2005: Specifications of concrete steel bars for reinforcement of concrete
- ONGC 41-GP-35M, type 2: waterstop in PVC (polyvinylchoride)
- USACE: Conduits, Culverts and Pipes, EM 1110-2-2902, Engineering and Design, March 1998
- USCAE: Shore protection Manual, Waterways Experimental station. Coastal Engineering research Center, 1984. (for tidal waves)
- Byngnings reglement 2006 - Greenland Building Code to be checked by Greenland Engineering Consultant
- Greenland specific Standard for Concrete - to be checked by Greenland Engineering Consultant

5.5 Material Properties

5.5.1 General

- Concrete :
  - Mass — 2 500 kg/m³
  - Compressive strength at 28 days - cylinder — 30 or 40 MPa
  - Concrete/rock adherence coefficient, c — 300 – 1 000 kPa
  - Concrete/concrete friction coefficient — 1.0
  - Thermal expansion coefficient — $10x10^{-6}$/°C
- Lean concrete : compressive strength at 28 days - cylinder — 15 MPa
- Porous concrete : compressive strength at 28 days - cylinder — 10 MPa
- Reinforcing steel :
  - Mass — 7 850 kg/m³
  - Yielding strength of regular rebars — 500 MPa
- Compacted backfill :
  - humid density of sand and gravel — 2 000 kg/m³
  - humid density of rockfill — 2 000 kg/m³
  - saturated density of sand and gravel — 2 150 kg/m³
  - saturated density of rockfill — 2 200 kg/m³
  - concrete/rockfill coefficient of friction — 0.70
  - active coefficient(sand and gravel) : K_a — 0.33
  - at-rest coefficient (sand and gravel) : K_0 — 0.50
- Rock:
  - allowable bearing pressure — 1 000 – 4 000 kPa
- Rock/concrete: friction coefficient — 0,85

Concrete cover:

- Concrete exposed permanently to soil and water (normal) : 60 mm
- Concrete exposed permanently to soil and water (minimum) : 50 mm
- Concrete not exposed permanently to soil and water (normal) : 40 mm
- Concrete not exposed permanently to soil and water (minimum) : 30 mm

5.5.2 Concrete

Greenland standard requirements

The classification of concrete classes is as per EN 206. The following strength classes are to be used:

Table 5.1 Concrete Class

Characteristic Compressive Strength f_{ck} at 28 days (cylinder) [MPa]	Usage
30	Structural concrete
15	Mass concrete, concrete plugs

5.5.3 Reinforcing Steel

Materials and workmanship shall comply with ENV 13670

Reinforcement shall be uncoated grade B500A or B500B, with characteristic yield strength of 500 MPa conforming to ENV 10080, except stirrups and ties, which shall be grade B500C, conforming to NS/Euro Standards.

5.5.4 Steelwork

5.5.4.1 Greenland standard requirements

Following are additions and modifications from Greenland and Danish standards.

The following material properties conforming to European standards are to be used:

Table 5.2 Structural Steel

Mechanical characteristics (t - steel thickness in mm)	Type		
	S.235	S.275	S.335
Elasticity limit f_y (Mpa)			
$t \leq 16$	235	275	355
$16 \leq t \leq 40$	225	265	345
$40 \leq t \leq 63$	215	255	335
Tensile resistance f_u (Mpa)			
$t \leq 3$	360/510	430/580	510/680
$3 \leq t \leq 100$	340/470	410/560	490/630
Minimum (average) elongation ε (%)			
$t \leq 3$	18	15	15
$3 \leq t \leq 100$	23	19	19

5.5.5 Bolts

Because bolts DIN931 cannot be tensioned on-site and thus are susceptible of stripping the threads, the bolts that will be used in the steel work are to be A325 or A490. These shall be used for all main site bearing-type and moment connections. Main connections shall include beam to beam, beam to column, column splices, bracings and all beams carrying non-vibrant equipment machines. The minimum size of bolts shall be M20.

5.6 Design loads

The codes and standards to be used in assessing dead and imposed loads are as listed under Section 5.4. Structures shall be designed for the worst-case loading combination.

5.6.1 Dead loads

Dead loads shall be calculated from the unit weights given in NS 3491-1: or from the actual known weights of the materials used. Where there is doubt as to the permanency of dead loads, such loads shall be treated as imposed loads. The self weights of the materials to be used are as follows:

- mass of reinforced concrete: 2 500 kg/m³
- mass of steel: 7 850 kg/m³

5.6.2 Hydrostatic pressure

The hydrostatic pressure is calculated from the upstream water level.

5.6.3 Wind and snow loads

The characteristic windload is independent of the surrounding terrain and height. For Maniitsoq the Annex specifies a windload of 1.2 kN/m², but because of the exposure of the Smelter plant, a load of 1.6 kN/m² is to be used (this value shall be used at the settlement Kangaamiut, which also is exposed to the ocean)

For snowloads the base values are influenced by the slope of the roof:

- characteristic load for slopes below 15° is sk = 1.8 kN/m²
- characteristic load for slopes steeper than 15° is sk = 0.9 kN/m²

5.6.4 Live loads (Imposed Loads)

Imposed loads consist of variable and/or transient load (operating or maintenance conditions, occupancy and/or due to storage of materials imposed on a specified area and/or on structural elements). Imposed load does not include the weight of fixed equipment, piping etc.

The design imposed floor loads shall be shown both in the calculations and on the design drawings. The minimum imposed floor loads shall be:

Table 5.3 Power House Floor loads

Specific using of areas	qk (kN/m²) uniform	Qk (kN) concentrated
Generator floor and machine hall (excl. generators hatch covers)	50	9
Turbine floor	15	9
Bus bars tunnel	24	-
Other transversal tunnels	10	-
Scroll case, access floor and turbine pit	15	-
Penstock	10	

Specific using of areas	qk (kN/m²) uniform	Qk (kN) concentrated
Water intake crest - uniform loading	20	-
Water intake crest - Mobile crane	-	413
Water intake crest - load of a stabilizer	-	860/0.4 m²

Table 5.4 Service Bay Floor Loads

Specific using of areas	qk (kN/m²) uniform	Qk (kN) concentrated
Floor load	15	-
Oil hall - shells	10	196
Battery hall	35	-
Generator floor:		-
floor load	75	
the rotor	-	2 550
the wheel		510
Cone, support, pivot, winnowing circle		196

Table 5.5 Transformer, ventilation area and miscellaneous

Specific using of areas	qk (kN/m²) uniform	Qk (kN) concentrated
Transformers area	15	1 275
Trackway downstream	20	To be confirmed
Ventilation area	10	-
Stairs, halls and interior pedestrian bridges	5	2.5

5.7 Crane and lifting appliance loads

Crane and monorails shall be designed in accordance with ENV 1993-6:2002 or where information is not available use AISC publication “Report #13”. The crane classification, loads and dynamic effects shall be confirmed by the crane supplier. Crane and other lifting appliance vertical static loads shall be as specified by the manufacturer

Horizontal loads caused by off-vertical lifting shall not be less than 0.10 times the hoisted load.

Static vertical deflection of cantilever beams shall be evaluated allowing for rotation of the beam at the support.

Fatigue shall be checked in accordance with ENV 1993 and shall be based on the relevant number of cycles applicable to the beam or to the detail being designed and shall take into account the fabrication details of the beam and its components

The increase to be applied to the specified vertical static loads for cranes and other lifting appliances shall be calculated in accordance with code or as recommended by the manufacturer but shall be not less than the following:

Table 5.6 Impact

Loading case	Electric operation	Hand operation
Vertical loads – increase static wheel loads by	25%	10%
Horizontal force transverse to rails taken as percentage of wheel load	10%	5%
Horizontal force along rails taken as percentage of static driving wheel load	10%	5%

5.8 Load combination factors and crack width

Partial load safety factors for global analyze:

Table 5.7 Load combinations

Nb. of variable actions	ELU	ELS
1	1.35 G_{max} + G_{min} + 1.5 Q	G + Q
More than 1	1.35 G_{max} + G_{min} + 1.35 ΣQ_i	G + 0.9 ΣQ_i

Partial safety coefficients for materials properties:

Table 5.8 Safety factor

Combination	Concrete γc	Reinforcing steel γs
Fundamental	1.5	1.15
Accidental (without seism)	1.35	1.00

For the hydrostatic load the following factors shall be used:

- 1.25 for the max operating level. (MOL)
- 1.15 for the max flood level.

For crack control the following max crack width shall be used:

- 0.40 mm interior exposure.
- 0.33 mm exterior exposure.
- 0.28 mm exposure to water, structure under bending.
- 0.23 mm exposure to water, structure under tension.

5.9 Stability analysis

Classical stability analysis for the water intake structure, spillway and dams is required.

6 Works description

6.1 General layout

At site 6g, power will be produced from the underground powerhouse located near sea level at the end of a Godthabsfjord. The rapidly rising topography near the fjord made this site a logical choice like site 7e, with a large head available for power production

The proposed project layout takes advantage of the presence of two main lakes: the lake Tussaap Tasia (labeled Lower Lake) where the intake for the power tunnel is constructed and to the north, lake Imarsuaq (labeled Big Lake). The Big Lake is at a higher elevation than the Lower Lake, with a smaller lake (labeled Little Lake) in between.

The Big Lake will constitute the main storage for the installations and will be regulated, while the elevation of the Lower Lake will be kept constant to maximize the head. It is planned to operate the Big Lake between elevation 669 and 682 m, while the Lower Lake will be at a constant level of 667 m. Both lakes will be connected with Tunnel 1 that will transfer water from the reservoir (Big Lake) towards the intake structure. Two small canals (1 and 2) will be excavated downstream of the tunnel outlet, to ensure an adequate flow depth and eliminate the risk of freezing of the water passage during the winter season. The inflows from an adjacent subcatchment will also be diverted into the Big Lake with transfer structures, i.e. canals 3 and 4, along with Dam 6 used to close the natural outlet of this catchment.

The Big Lake will be closed by Dams 3 and 4, and Spillway 2, while the Lower Lake will be closed with Dams 1 and 2 and Spillway 1. A 10 km long power tunnel will connect the intake structure in the Lower Lake with the powerhouse.

The project will necessitate the construction of approximately 47 km of roads to access the various structures. The main road is the one that will climbs the fjord from sea level to reach the intake structure in Lake Tussaap Tasia (Lower Lake). A water route through the Big Lake will also be used to reach the natural outlet of the lake to the north, where Dam 4 and Spillway 2 will be constructed, and the structures used to divert the adjacent catchment (Dam 5 and Canals 3 and 4).

6.2 Dams and Spillways

6.2.1 Dams and spillway locations

The topography and geology of site 6g gives very limited alternatives for dam alignments. In fact, no alternative sites have been considered for dam locations, which still the same as in previous studies. On the other hand, different locations of the spillways were considered in order to minimize concrete volume according to available information.

Dams 1 and 2 and Spillway 1 insure closure of the 6g lower reservoir. Dam 1 is located at the outlet of Lake Tussaap Tasia while Dam 2 is positioned approximately 300 m North-East of Dam 1. Spillway1 is located about 4 km North of Dam 1 in a narrow valley having a thalweg at level 664 m. In order to minimize its concrete volume, the alignment of Spillway 1 is subject to slight changes upon reception of more information on the bedrock topography following additional investigations.

According to the available topography, an additional dam (identified Dam 7 in previous studies) is not required at a high valley located approximately 1.8 km South-East of Spillway 1. At this valley (± 538 150 E, 5 203 650 N), the ground level (>670 m) exceeds the maximum extreme level (668.3 m) of the 6g lower reservoir on a distance of over 250 m. The bouldery till and rock outcrop observed in this valley should impede the groundwater flow from the reservoir sufficiently over this distance.

Dams 3 to 5 and Spillway 2 insure closure of the 6g upper reservoir. Dam 3 is situated between Imarsuaq Lake and Little Lake. In combination with gated Tunnel 1, Dam 3 allows the desired water level control between the upper and lower reservoirs. This dam comprises two segments separated by a bedrock outcrop over a distance of approximately 70 m.

Dam 4 is located on the outlet river of Lake Imarsuaq located at its North-East extremity, about 200 m downstream of the natural sill of the lake. Despite located at a thalweg level about 7 m lower than the upstream natural sill, the selected site for Dam 4 offers a much more interesting topography. This dam comprises two parts slightly separated by a bedrock outcrop. On the left abutment, Dam 4 is terminated on a bedrock outcrop which is not more than 1.5 m lower than the crest elevation but higher than the maximum extreme level of the upper reservoir. This later bedrock outcrop separates Dam 4 from the adjacent Spillway 2 located across a small saddle valley. Spillway 2 is positioned at a location that should minimize its concrete volume according to available information. However, Spillway 2 alignment is still subject to slight changes upon reception of information on the bedrock topography following further investigations.

Dam 5 is located approximately 750 m North-East of Dam 4 on the outlet river of the Northeast sub-catchment. The selected alignment corresponds to the site where the topography clearly minimizes the dam volume.

6.2.2 Hydraulic design

6.2.2.1 Spillways capacity

Two spillways are projected for Site 6g:

- Spillway 1, to evacuate floods at Lower Lake;
- Spillway 2, to evacuate floods at Big Lake.

These spillways are weirs with uncontrolled crest, with discharge given by the equation:

$$Q = C_d \times L \times H\sqrt{2gH}$$

Where:

Q = discharge, in m^3/s

C_d = variable discharge coefficient

L = effective length of crest, in meter

H = actual head on the crest

The crest elevations of the spillways correspond to the maximum operation level of the reservoirs, which are 667 m at Lower Lake and 682 m at Big Lake. The characteristics of the spillways are presented in Table 6.1.

Table 6.1 Characteristics of the spillways

	Crest elevation (m)	Length
Spillway 1	667	56
Spillway 2	682	72

The discharge coefficient, C_d, depends of the type of the weir, the approach height of the weir, and the head on the crest. The type of spillway considered is trapezoidal. For the design flood, corresponding to the 1:10 000 years flood, the discharge coefficient C_d is 0.41. This coefficient varies from 0.34 to 0.41 depending on the hydraulic head. The discharge capacity curve that is considered for the spillway is presented in the Figure 6.1 and Figure 6.2 hereafter.

Figure 6.1 Spillway 1 stage-discharge curve

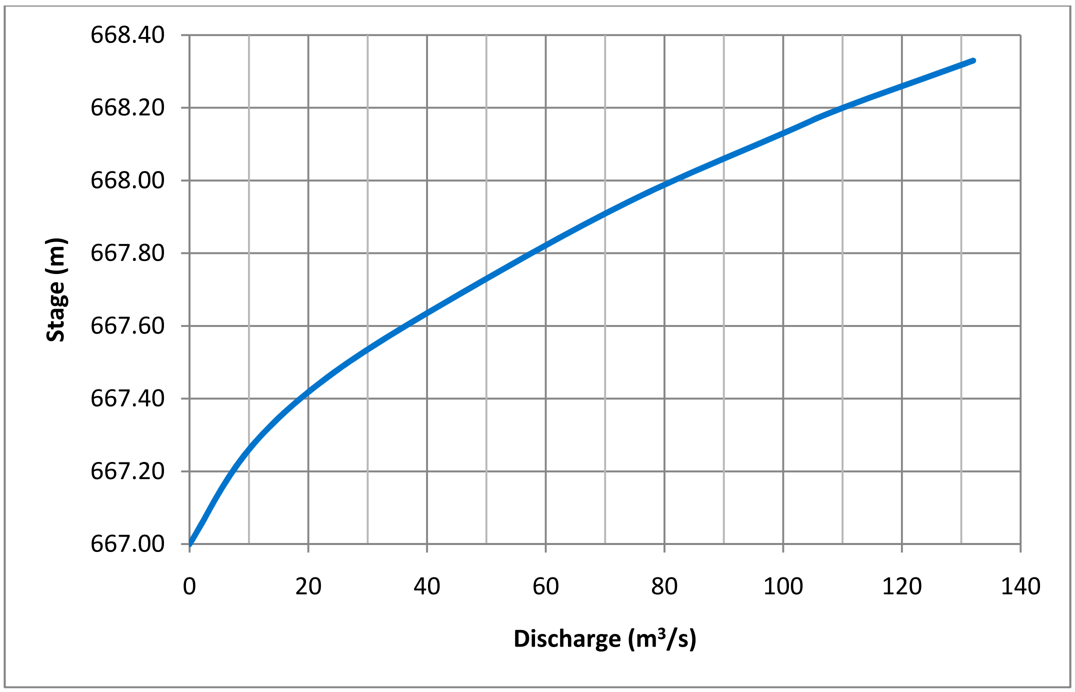
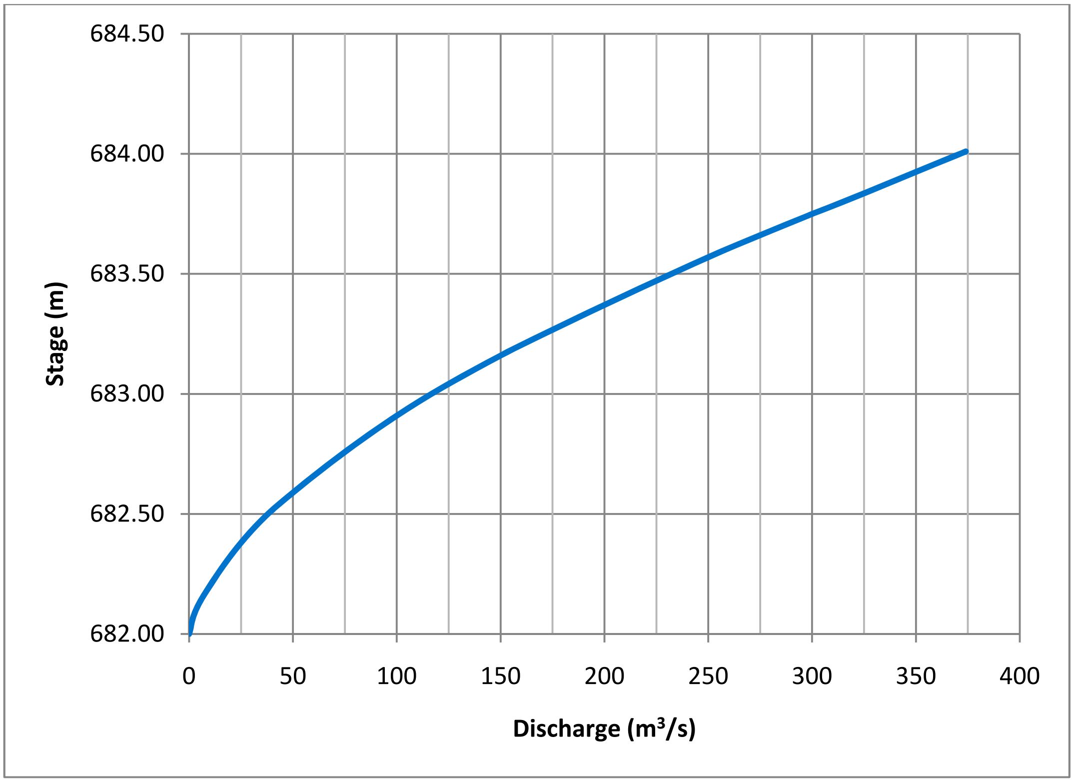


Figure 6.2 Spillway 2 stage-discharge curve



6.2.2.2 Water level during floods

Flood routing has been considered with the hydrographs presented in section 4, for the recurrence intervals 10 000, 1 000, and 100 years. At Big Lake, the calculations begin with a full reservoir (water level at 682 m) at the end of the previous water season: water is withdrawn for power generation during the winter, which lower the level of the reservoir before the arrival of the flood. At Lower Lake, the initial elevation at the arrival of the Flood is the maximum operation level (667 m). When the reservoir is taken full at the arrival of the flood with the powerhouse stopped, water level becomes of about 0.1 m.

The maximum water levels for the different floods are presented in the Table 6.2 and 6.3

Table 6.2 Lower Lake Reservoir (maximum operating level at 667 m)

Return period	Max inflow* (m³/s)	Max outflow at spillway (m³/s)	Max water level (m)
1 :10 000 years	167	132	668,33
1 :1 000 years	159	124	668,29
1 :100 years	151	117	668,24

* Include potential inflows from Tunnel 3

Table 6.3 Big Lake Reservoir (maximum operating level at 714 m)

Return period	Max inflow (m^3/s)	Max outflow at spillway (m^3/s)	Max water level (m)
1 :10 000 years	400	327	683.8
1 :1 000 years	354	244	683.5
1 :100 years	303	147	683.1

6.2.2.3 Freeboard and dam crest elevation

The normal freeboard is defined as the difference in elevation between the crest of the dam and the maximum operation level of the reservoir. Minimum freeboard is defined as the difference in elevation between the crest of the dam and the maximum reservoir water elevation that would result from routing the inflow design flood through the reservoir.

Both normal and minimum freeboard requirements should be evaluated to determine the required crest elevation. The freeboard resulting in the higher crest elevation is adopted for design. It is unlikely that maximum winds will occur when the reservoir surface is at its maximum elevation resulting from routing of the maximum design flood. Computations should incorporate the probability of pool level wind and appropriate durations.

The criteria used here to determine the crest elevations are:

- Criteria 1: Minimum Freeboard of 1.5 m above 1:10 000 years flood level;
- Criteria 2: 1:1 000 years flood level and wave run-up of 1:100 years winds;
- Criteria 3: Maximum operation level and wave run-up of 1:1 000 years wind;
- Criteria 4: Level of PMF.

In this stage, PMF has not yet been evaluated. At the moment, the spillway is designed to provide sufficient capacity to pass twice the routed 1:10 000 years flood below the crest of the dams.

The wave heights and freeboard calculations for the dams use the guidelines provided by different references including: Coastal Engineering Research Center of the United States (1984), SEBJ Guide for Rip Rap sizing (1996), Canada Dam Association, USBR Acer and ICOLD - selection of design floods.

The wind data used in the analysis come from the meteorological stations Sioralik (04242) and Nuuk (04220). Available data are maximum wind speeds (10 minutes average), without distinction of the direction. The wind characteristics are presented in the Table 6.4.

Table 6.4 Frequency of wind speed

Return period	10 minutes wind speed		Hourly wind speed	
	m/s	km/h	m/s	km/h
1:100 years	42	151	40	144
1:1 000 years	49	176	47	168

Preliminary estimations of wave heights are done with these winds for maximum fetches.

The wave run-ups, dam crest elevation and freeboards are presented in the Table 6.5 below.

Table 6.5 Crest elevation and freeboard of the dams at site 6g

	Lower Lake (Spillway 1)		Big Lake) (Spillway 2)		
	Dam 1	Dam 2	Dam 3	Dam 4	Dam 5
Max Operation Level	667.0	667.0	682.0	682.0	682.0
1:10 000 years flood	668.3	668.3	683.8	683.8	682.2
1:1 000 years Flood	668.3	668.3	683.5	683.5	682.2
1:1 000 years wind run-up	3.5	3.4	2.3	1.1	1.2
1:100 years wind run-up	2.9	2.8	1.9	0.9	1.0
Crest elevation	671.5	671.5	685.5	685.5	685.5
Minimum Freeboard (1:10 000 years flood)	3.2	3.2	1.7	1.7	3.3
Freeboard for 1:1 000 years flood	3.2	3.2	2.0	2.0	3.3
Normal Freeboard (Maximum operating level)	4.5	4.5	3.5	3.5	3.5

When the water level reaches the crest of the dams, the discharges are:

- for the Spillway 1 : 1 060 m³/s
- for the Spillway 2: 1 002 m³/s

These values are higher than 2 times the routed 1: 10 000 years flood at the structures.

6.2.2.4 Riprap protection

The riprap protecting the embankments resists the impact of waves by their own weight. The minimum and maximum weights are calculated with the following equations.

$$W_{min} = \frac{\rho_r H_s^3}{K(S_r - 1)^3 \cot g\alpha}$$

$$W_{max} = 3\ W_{min}$$

With:

W_{min} : Minimum weight of the riprap, kg
W_{max} : Maximum weight of the riprap, kg
ρ_r : Specific mass of the riprap, kg/m³
ρ_w : Specific mass of water, kg/m³
S_r : Riprap density
$cotg(\alpha)$: Embankment slope
K : Stability factor

The parameter K can take the following values:

- K= 3.5 for the 1:1 000 years wave (acceptable damage)
- K= 1.75 for the 1:100 years wave (no damage)

The minimum thickness for the riprap is equal to 2.5 times the minimum diameter.

The preliminary riprap designs for the dams are presented in the Table 6.6.

Table 6.6 Riprap size for the dams of Site 6g

		Dam 1	Dam 2	Dam 3	Dam 4	Dam 5
W min	kg	820	730	200	30	40
D min	mm	800	800	500	300	300
D max	mm	1100	1100	700	400	400
Minimum thickness	mm	2000	2000	1250	750	750

6.2.3 Typical dam cross sections

6.2.3.1 Asphaltic concrete core rockfill dam

The dam type selected for dams 1, 2, 4 and 5 is an asphaltic concrete core rockfill dam (ACRD). Considering the arctic conditions and the scarcity of soils and the short period of time where unfrozen soils maybe found only over small depths makes very difficult the option of building earth dam. The ACRD's have proven to be economical and reliable and show excellent performance in all cases. Furthermore, the asphaltic concrete core construction offers interesting flexibility with respect to weather conditions; it should be interrupted only during heavy rain and can restart as soon as the rain stops. The placement of the asphaltic concrete core can be conducted without problem at temperatures slightly below 0°C. However, under colder temperatures special measures such as the insulation of the asphaltic concrete transportation/storage facilities and heating of aggregate are likely to be needed in order to respect the hot temperature criteria (140 to 155°C) required for placement of the asphaltic concrete core.

All ACRD's are to be founded on bedrock. The only exception is for part of Dams 1, 4 and 5 sited over the river where it is judged acceptable to leave in place the overburden (assumed thaw-stable material) present beneath the dam (upstream cofferdam) outside the limits of the 1H:1V slopes from the crest.

For all ACRD's, the width of the asphaltic concrete core is equal to the standard minimum value of 0.4 m. The asphaltic concrete core is made of crushed stone aggregate with a maximum size of 16 to 18 mm, containing 12% of filler and mixed with about 7% (by weight) of bitumen.

A 4 m wide concrete plinth connects the asphaltic concrete core to the bedrock foundation and serves as a grouting cap. The thickness of the concrete plinth varies according to rock surface topography and an average value of 0.55 m had been considered for cost estimate.

The width of the crest of the ACRD's is fixed at 6 m and the slopes of the upstream and downstream faces are respectively of 1.5H:1V and 1.4H:1V. The crest elevation of ACRD's varies according to water levels and waves as determined in the hydraulic design section. The crest elevation and length, the top elevation of the asphaltic concrete core, the maximum height and the total fill volume of each dam are presented in Table 6.7. The top of the impervious asphaltic concrete core is set at levels which are 0.5 m above the applicable extreme maximum level (1:10 000 years).

Table 6.7 Dams characteristics

	Crest elevation (m)	Top elevation of impervious element (m)	Total crest length (m)	Maximum height[(1)] (m)	Total fill volume[(2)] (m^3)
Dam 1	671.5	669.0	295	21	78 400
Dam 2	671.5	669.0	485	15	97 300
Dam 3	685.5	684.5	480	17	120 000
Dam 4	685.5	684.5	170	18	40 200
Dam 5	685.5	684.5	285	28	123 000

(1) According to available subsurface information and assuming a 2 m thickness of overburden at rivers location.
(2) Excluding the cofferdams volumes when present.

The asphaltic concrete core (zone 5) and the adjacent support/filter zones (2B) are all placed simultaneously by the specialized paving machine. The total width of these zones consequently depends on the width of the machine, which typically varies from 3.5 to 4.0 m. For all ACRD's, the combined width of the asphaltic concrete core and the support/filter zones had been fixed to 4.0 m. The support/filter material is made of crushed stone, max. diameter 60 mm.

Transition zones (3E) made of crushed stone, max. diameter 225 mm are placed next to the upstream and downstream support/filter zones. A random rockfill, max diameter 900 mm (zone 3D) completes the body of the dams upstream and downstream of the transition zones. For construction purposes, the width of the transition zones (3E) is set to 3.0 m. For the same reason, the random rockfill zones (3D) are stopped at the level where their width is equal 3.0 m in the upper part of the dams. At these locations, the transition zones (3E) are extended upstream and downstream.

An appropriate riprap (zone 4) is placed on the upstream face of the each dam up to the crest. In the case of Dams 1 and 2, the minimum level of the riprap is set 4.0 m (twice the height of the significant wave) below operating level of the lower reservoir (667.0 m). For Dam 4, the minimum level of the riprap is set 2.0 m below the crest elevation of the upstream cofferdam (kept in place after construction) since its presence constitutes an effective protection of the lowest part of the dam. In the case of Dam 5, the minimum level of the riprap is set 1.5 m (twice the height of the significant wave) below the minimum operating level of the upper reservoir. The crest elevation and length, the top elevation of the geomembrane liner, the maximum height and the total fill volume of Dam 3 are presented in Table 6.7.

For Dams 1 and 2, an additional zone (3F), made of selected rockfill, max. diameter 450 mm is required to support the upper part of the 800 to 1 100 mm rockfill riprap (zone 4) where the random rockfill (zone 3D) is not present. For Dams 4 and 5, the 300 to 400 mm rockfill riprap (zone 4) is compatible with the transition zone (3E) and there is no need of an additional zone in the upper part of these dams.

6.2.3.2 Lined Dam

The dam type selected for Dam 3 is a lined rockfill dam. As for the other dams, earth dam is not considered feasible for Dam 3 given the arctic conditions and the scarcity of soils, despite less rare in this area. For Dam 3, an ACRD appears less attractive in reason of the high mobilization cost of an asphalt plant compare to its relatively small asphaltic concrete core volume that would be required and its isolation. In theses conditions, a lined rockfill dam seems appropriate for Dam 3.

Given the observation of stepping permafrost (or solifluction phenomenon) at Dam 3 site, it is considered that the overburden material is not thaw-stable and the whole dam should consequently to be founded on bedrock. The body of the dam consist in a random rockfill, max. diameter 900 mm (zone 3D) with a geomembrane liner located near the upstream face of the dam with appropriate protection and transition materials. On each side of the geomembrane, a geotextile protects the liner from puncture by the adjacent crushed stone, max. diameter 20 mm (zone 3C). Between this later cushion zone and the adjacent coarser materials, a transition made of crushed stone, max. diameter 225 mm (zone 3E) is required. This transition zone supports the 500 to 700 mm rockfill riprap (zone 4) and separates the random rockfill (zone 3D) of the dam body from the cushion material (zone 3C) placed below the geomembrane liner.

The geomembrane liner is connected to the bedrock foundation by the means of a narrow concrete sill casted into a cut-off trench (see also the foundation treatment section). The geomembrane liner is attached to the concrete sill with a watertight anchorage. Upstream of the concrete sill, the rock excavation is filled with low permeability till material to impede the flow through the bedrock foundation.

To decrease the riprap volume, it is projected to backfill the upstream toe of the dam with a random fill up to the initial natural ground level. Similarly, it is planned to backfill the downstream toe of the dam with a random fill up to the initial natural ground level in order to avoid the creation of a small pond at this location and to facilitate the dam access for inspection.

Different types of geomembrane could be selected for Dam 3 liner. According to current project status, it is not required to install the geomembrane liner under cold winter conditions. Consequently, it is not necessary to select particular geomembrane liner (such as “arctic liner” or “low temp PVC”) suitable for installation during very cold temperatures that are generally more expensive. Considering its relative low cost, ease of welding and seems testing, a textured high density polyethylene (HDPE) geomembrane appears to be one of the most interesting liner for Dam 3. According to the information available, the friction angle between HDPE textured geomembrane and geotextile (product’s specific) is so that the upstream slope of the dam maybe 2.0 to 2.5H:1V in order to insure its stability. At this stage of the project, the upstream slope of Dam 3 is set at 2.5H:1V.

The downstream face of the dam corresponds to a 1.4H:1V slope. Given the riprap thickness, the minimal 2.5 m width of zones 3E and 3C located upstream of the textiles and the geomembrane (for construction purposes) and the working surface required for the geomembrane liner installation, the crest width of the dam should be nearly 9 m.

6.2.4 Foundation treatment

The nature and extent of the foundation treatment of the dams are based on the existing data obtained from the previous field investigations: topography, geological/geotechnical conditions (soil and rock formations) and permafrost characterization. Since the requirements for foundation treatment depends on dam type, they are separated in the two following sections according to the typical cross sections selected. The foundation treatment for the spillways is presented in a third section.

6.2.4.1 Asphaltic concrete core rockfill dam

The selection of the typical cross section of asphaltic concrete core rockfill dam (ACRD) for Dams 1, 2, 4 and 5 reduces the extent of the foundation treatment compared to an earth dam. In fact, the foundation treatment is essentially concentrated below the concrete plinth which is 4 meters wide. Outside the concrete plinth area, rockfill and crushed stone are placed directly on the rock surface after stripping and removal of all organic materials, without any special treatment. As mentioned previously, there is exceptions to that: assuming the presence of thaw-stable material, it is judged acceptable to leave in place the overburden present beneath Dams 1, 4 and 5 (upstream cofferdams) outside the limits of the 1H:1V slopes from the crest.

Table 6.8 shows the design criteria selected for the foundation treatment in the concrete plinth area. There are two main types of treatment: rock excavation and vertical curtain grouting. As the grouting cannot be conducted in frozen rock (defrosting required), the excavation of the top layer of rock surface, where rock is generally altered and more fractured, is prioritized. Therefore, the need to proceed with grouting operations, which besides being time consuming and considerably increasing construction costs, is greatly reduced. The choices made offer the advantage to treat the foundation adequately therefore reducing the need for further work after construction. However, in the worst case scenario, should this need arise (important water infiltrations through the foundation after reservoir impoundment), the ACRD offers the possibility to realize grouting after construction.

Table 6.8 Foundation treatment in the concrete plinth area

Water head, Hw (m)	Depth of rock excavation (m)*	Depth of curtain grouting (m)* (Holes 3 m c/c)	Length (m)				Total (m)	%
			Dam 1	Dam 2	Dam 4	Dam 5		
Hw < 5	1	0	78	287	90	98	553	45
5 < Hw < 15	2	0	185	199	28	131	543	44
15 < Hw < 25	5	0	0	0	0	7	7	1
Hw > 25 and at river bed area (including 6m on each side)	2	Hw / 3 (min 8 m)	32	0	52	52	136	10
		Total	***295***	***486***	***170***	***288***	***1239***	***100***

Dams 1 and 2: constant operating level = 667 m, Dams 4 and 5: maximum water operating level = 682 m
* For preliminary estimation. To be revised according to further investigations and observations during construction.

This approach is valid with the assumption made that rock is sound and of good quality and it is mainly fractured and altered only in the first few (2-3) meters from the surface. The exact depth of the excavation however will be determined by senior geologist on the site once the overburden is excavated and the rock surface is cleaned by high air pressure.

In order to minimize the formation of addition cracks in the foundation bed, rock excavation in the concrete plinth area should be done using controlled drilling and blasting techniques with reduced charges.

If frozen rock is encountered (permafrost or active layer frozen when works to be conducted) prior to grouting, the foundation has to be thawed by injecting warm water (hydro-defrosting) or steam (steam defrosting) in holes drilled at the required depth for grout curtain. Defrosting holes has to be drilled upstream and downstream of the grout curtain line (at less 2 meters) to allow the grout to penetrate the surrounding rock mass. After grouting, all holes must be backfilled from the bottom up with a 0.74:1 water-cement grout by volume. Field tests and ground temperature monitoring are required to verify the effectiveness of both defrosting and grouting methods applied.

The presented criteria and associated quantities are used at this stage mainly for cost estimates. Although the table gives the impression that the decision making depends entirely on the water head of the dams, rock quality will govern the final decisions during construction. Based on the preliminary 2009 investigation results, those criteria and associated quantities should be maintained. However, this should be later reassessed following any subsequent investigation.

It was determined from the 2007/2008 geological mapping that there are typically three orthogonal sets of joints in the rock throughout site 6g, one near horizontal and the other two near vertical. The predominant joint set is aligned with the foliation and tends to be steeply deeping (more than 45°). This conclusion was based only on surface geological mapping with no boreholes done in the dam site areas. Therefore, the presence of sub horizontal stress relief joints, result of elastic rebound following glaciations, typical for the northern hemisphere, will be reassessed when the 2009 investigation results will be fully integrated in the report. Should the subsequent investigations prove otherwise, other types of measures may be considered in order to reduce water losses through the foundation without treatment, such as the addition of an upstream till blanket over the exposed bedrock and a downstream reverse filter consisting of granular material (crushed stone) outside of the steep valleys.

6.2.4.2 Lined rockfill dam

Dam 3 requires different foundation treatment since it is a lined rockfill dam. In addition, Dam 3 has the particularity that leaking water through it and its foundation are not losses from power production point of view since the leakage water would reach the lower 6g reservoir. In this context, the foundation treatment at Dam 3 is limited.

The foundation treatment consists essentially in a small excavation (cut-off trench) into the most weathered bedrock at the upstream toe of the dam in order to connect the geomembrane liner to sufficiently competent rock and to increase the length of the seepage path. Based on the available information, the excavation into the most weathered bedrock is assumed to be in average 2.0 m deep. According to the borehole drilled at Dam 3, this depth maybe reduced. This assumption should be review according to further investigations. However, the exact depth of the excavation will be determined during construction once the overburden will be excavated and the rock surface cleaned by high air pressure.

For construction needs, it is required for the cut-off trench excavation into bedrock to be formed of straight segments at the upstream toe of the dam. Consequently, the geomembrane liner will be placed in contact with the rock surface on a distance that depends on the rock surface topography variation. In order to offer a suitable foundation for the geomembrane liner at this location, it is assumed that this rock surface will need to be treated. The treatment consist in small rock excavation and lean concrete placement in order to offers a smooth surface and avoid puncturing the geomembrane liner.

6.2.4.3 Spillways

The spillways are founded on bedrock of Good (Spillway 1) to Fair (Spillway 2) quality. The rock at Spillway 1 is mainly sound gneiss with consistently spaced joints, the rock at Spillway 2 is mostly greenschist (a metamorphosed basic igneous rock which owes its color and schistosity to abundant chlorite). It was assumed, in both cases, that at less one meter of rock on the surface has to be excavated (after removal of all boulders, top soil and cleaning by high air pressure), as to remove all fractured and weathered rock as well as for correction of unfavorable foundation slopes.

6.2.5 Spillway characteristic

Two spillways will be constructed at site 6g, Spillway 1 for the Lower Lake and Spillway 2 for the Big Lake.

Spillway 1 will close the Lower Lake to elevation 667 m on its western side. The spillway is a 50 m long concrete weir with a maximum height of 6 m. The crest of the weir has a trapezoidal profile.

Spillway 2 will close the Big Lake at elevation 682 m near Dam 4. The spillway is a 72 m long concrete weir with a maximum height of 7 m. The crest of the weir also has a trapezoidal profile.

The design flood for the spillways is the 1:10 000 years flood as mentioned in section 7.2.2.

6.2.6 Temporary works

6.2.6.1 Generalities

In order to build the dams in the dry, cofferdams and diversion works are required. At Dam 1 site, a diversion tunnel is projected at the right abutment to evacuate the water from adjacent Tussaap Tasia Lake during construction. An upstream cofferdam is necessary at Dam 1 while nearby Dam 2 does not require any cofferdam since located where ground level is above the 1:20 years water level during construction.

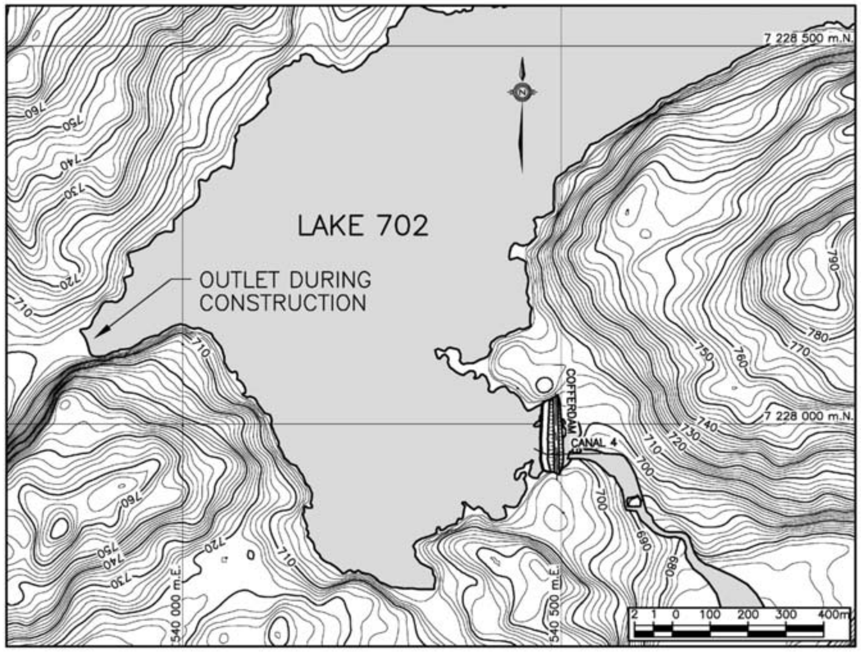
Spillway 1 is also located where ground level is above the 1:20 years water level of Tussaap Tasia Lake during construction and consequently does not require any cofferdam. However, dewatering works will be necessary for the Spillway 1 in reason of the presence of a small pond that intersects its alignment.

Dam 3 is located on a dry site where ground level is above the 1:20 years water level of the upstream Imarsuaq Lake during construction and consequently does not require any cofferdam.

At Dam 4 site, the water control during construction is realized by a combination of an upstream cofferdam and a diversion tunnel located on the right abutment to constitute an outlet for the adjacent Imarsuaq Lake. Spillway 2, adjacent to Dam 4, is located where ground level is above the 1:20 years upstream water level during construction and consequently does not require any cofferdam.

For Dam 5 construction, two small upstream cofferdams are projected. A first cofferdam is positioned at the entrance of Canal 4 in order to temporary divert the water of Lake 702 watershed (northeast sub-catchment) to a secondary natural outlet located South-West (see Figure 6.3). A second upstream cofferdam is required just upstream of Dam 5 in order to protect the site from flooding by inflows coming from the small intermediate catchment between Canal 4 and Dam 5. The inflows from this catchment may be controlled by pumping.

Figure 6.3 Temporary water diversion at Lake 702 (northeast sub-catchment)



6.2.6.2 Diversion tunnel at Lower Lake

The diversion works are designed for the 1:20 years flood during the construction period.

The diversion will be done by way of a tunnel built at Dam 1 location. The diversion tunnel will have an estimated length of 100 m with a reverse-D shaped cross-section. The base width will be 5 m with a maximum height of 6 m, for a cross-sectional area of 27 m². The invert of the tunnel will be respectively of 652 and 642 m at its upstream and downstream ends.

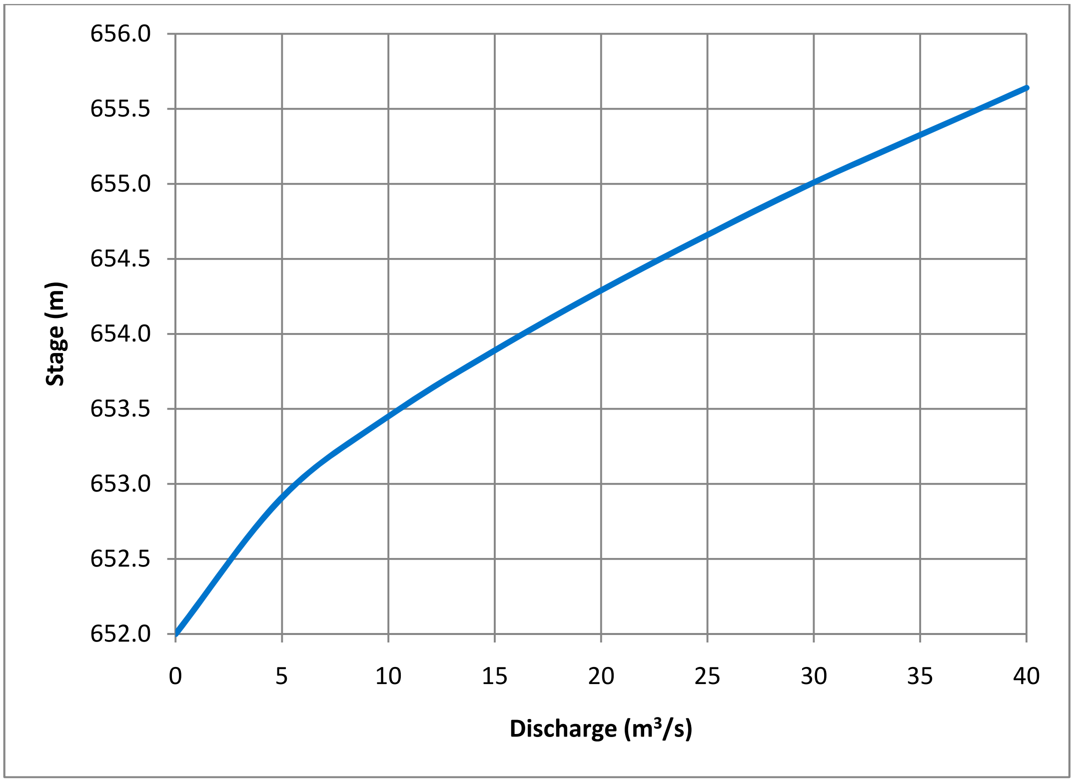
The natural outlet of Lower Lake is located at the site of Dam 1. In natural conditions, the water levels of the lake are controlled by this outlet, which is at an estimated elevation of 652 m according to the topography measured at the site. The capacity of the diversion tunnel will govern the water level in the lake during construction.

The Table 6.9 summarizes the water levels in the Lower Lake during the construction phase. A stage-discharge curve of the diversion tunnel at Dam 1 is presented in the Figure 6.4 hereafter.

Table 6.9 Site 6g – Water levels at Dam 1 site

	Discharge (m³/s)		Water levels during construction (m)
	Inflow	Tunnel outflow	
May average discharge	1	1	652.17
July average discharge	17	17	654.05
1: 20 years flood	40	34	655.28*

Figure 6.4 Stage-discharge curve of Diversion Tunnel of Lower Lake



6.2.6.3 Cofferdam at Dam 1 and diversion tunnel cofferdam

At Dam 1, the upstream cofferdam is positioned to be integrated as much as possible to the body of the dam. However, a minimal distance of 10 m is kept between the downstream toe of the cofferdam and the estimated limit of the cut-off trench excavation under the concrete plinth of the dam in order to limit the risk of conflict at this location.

From downstream to upstream, the upstream cofferdam comprises the following zones:

- a random rockfill, max. diameter 900 mm (zones 3 and 3D) that constitutes the body of the cofferdam;
- a transition zone made of crushed stone, max. diameter 225 mm (zone 3A);
- a geotextile filter;
- a low permeability till core (zone 1) that reaches the bedrock into a previously excavated cut-off trench;
- a random rockfill, max. diameter 900 mm (zone 3D) which protects and confines the till zone.

The crest elevation of the upstream cofferdam is set with a 2.0 m freeboard relative to the maximum water level during construction with a return period of 20 years[5].

At the end of the construction of Dam 1 (Dam 2 being also complete or sufficiently advanced), a cofferdam is required at the entrance of the diversion tunnel located on the

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[5] The water levels during construction indicated on the drawings had not been updated according to the latest hydrologic data.

right abutment of Dam 1 for the construction of a concrete plug into this temporary tunnel. This cofferdam consists in dumped random rockfill, max. diameter 900 mm (zone 3) with a low permeability dumped till (zone 1A) upstream of it that reaches the bedrock. A geotextile filter separates the two fill zones. The crest elevation of the diversion tunnel cofferdam is set 1.5 m above the estimated level of Tussaap Tasia Lake resulting from water accumulation without outlet from December to mid-May.

6.2.6.4 Diversion tunnel at Big Lake

The diversion works are designed for the 1:20 years flood during the construction period. The diversion tunnel will be build at Dam 4 Location. The diversion tunnel will have an estimated length of 120 m with a reverse-D shaped cross-section. The base width will be 8 m with a maximum height of 7 m, for a cross-sectional area of 50 m². The invert of the tunnel will be respectively of 670 and 668 m at its upstream and downstream ends.

The natural outlet of Big Lake is located upstream of the proposed site of Dam 4. In natural conditions, the water levels of the lake are controlled by this outlet, which is at an estimated elevation of 674 m according to the bathymetry measured at the site. During the construction, it is estimated that the natural outlet will control the water levels in the lake up to a discharge of 90 m³/s. For higher discharges, the capacity of the diversion tunnel will govern water level in the Big Lake.

Stage-discharge curves of the Big Lake and the diversion tunnel at Dam 4 are presented the Figure 6.5 hereafter.

The Tables 6.10 and 6.11 summarize the natural hydraulic conditions at the sites of Dam 3 and Dam 4 and the expected conditions during the construction works (with the upstream cofferdams and the diversion tunnel in operation). It is expected that no downstream cofferdams will be required at both site.

Figure 6.5 Stage-discharge curve of Diversion Tunnel of Big Lake

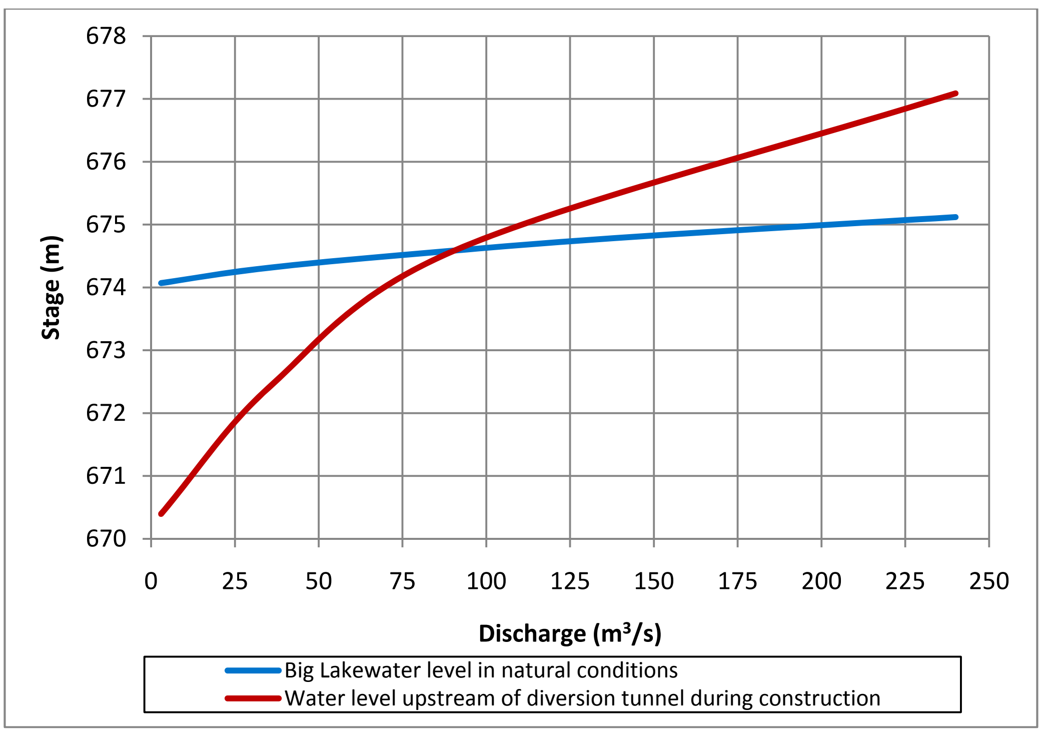


Table 6.10 Site 6g – Water levels at Dam 4 site

	Discharge (m³/s)		Water levels in natural conditions (m)	Water levels during construction (m)
	Inflow	Tunnel outflow		
May average discharge	3	3	669.25	670.40
June average discharge	36	36	669.89	672.45
August average discharge	91	91	670.61	674.60
1: 20 years flood	240	178	671.83	677.16

Table 6.11 Site 6g – Water levels at Dam 3 site

	Discharge (m³/s)		Water levels in natural conditions (m)	Water levels during construction (m)
	Inflow	Tunnel outflow		
May average discharge	3	3	674.07	674.07
June average discharge	36	36	674.32	674.32
August average discharge	91	91	674.59	674.59
1: 20 years flood	240	178	675.12	677.16

6.2.6.5 Cofferdam at Dam 1 and diversion tunnel cofferdam

At Dam 4, the upstream cofferdam is positioned to be integrated as much as possible to the body of the dam. However, a minimal distance of 10 m is kept between the downstream toe of the cofferdam and the estimated limit of the cut-off trench excavation under the concrete plinth of the dam in order to limit the risk of conflict at this location.

From downstream to upstream, the upstream cofferdam comprises the following zones:

- a random rockfill, max. diameter 900 mm (zones 3 and 3D) that constitutes the body of the cofferdam;
- a transition zone made of crushed stone, max. diameter 225 mm (zone 3A);
- a geotextile protection;
- a geomembrane liner that reaches the bedrock into a previously excavated cut-off trench;
- a confining material at the toe of the cofferdam made of crushed stone, max. diameter 20 mm (zone 3B).

This later 3B zone is required over the geomembrane at the toe of the cofferdam and on the abutments to confine the liner and to push it against the bedrock surface.

As shown on the drawings, a working platform made of random rockfill, max. diameter 900 mm (zone 3), is assumed to be required for the cut-off trench excavation, the geomembrane liner installation and the placement of the 3B zone confining material.

Different type of geomembrane maybe considered as the liner of the cofferdam. One of those is the EPDM liner, a synthetic rubber waterproofing membrane made of ethylene – propylene – diene terpolymer (also mixed with carbon black, oils, curing agents and others). This type of geomembrane has a high flexibility even at very low temperatures (down to –45°C) and is available in large seamless panel sizes resulting in fewer field joints made by wide overlaps. Theses properties make this inexpensive type of geomembrane very interesting for the cofferdams liner.

The crest elevation of the upstream cofferdam is set with a 2.0 m freeboard relative to the maximum water level during construction with a return period of 20 years.

At the end of the construction of Dam 4 (Dam 5 being also completed or sufficiently advanced), a cofferdam is required upstream of the diversion tunnel located on the right abutment of Dam 4 for the construction of a concrete plug into this temporary tunnel. In order to reduce its height and facilitate its construction, this cofferdam is positioned at the natural sill of Imarsuaq Lake located about 200 m upstream of Dam 4. The diversion tunnel cofferdam consists in dumped random rockfill, max. diameter 900 mm (zone 3) with a low permeability dumped till (zone 1A) upstream of it that reaches the bedrock into a previously excavated cut-off trench. A geotextile filter separates the two fill zones. The crest elevation of the diversion tunnel cofferdam is set 1.5 m above the estimated level of Imarsuaq Lake resulting from water accumulation without outlet from December to mid-May.

6.2.6.6 Dam 5 diversion works

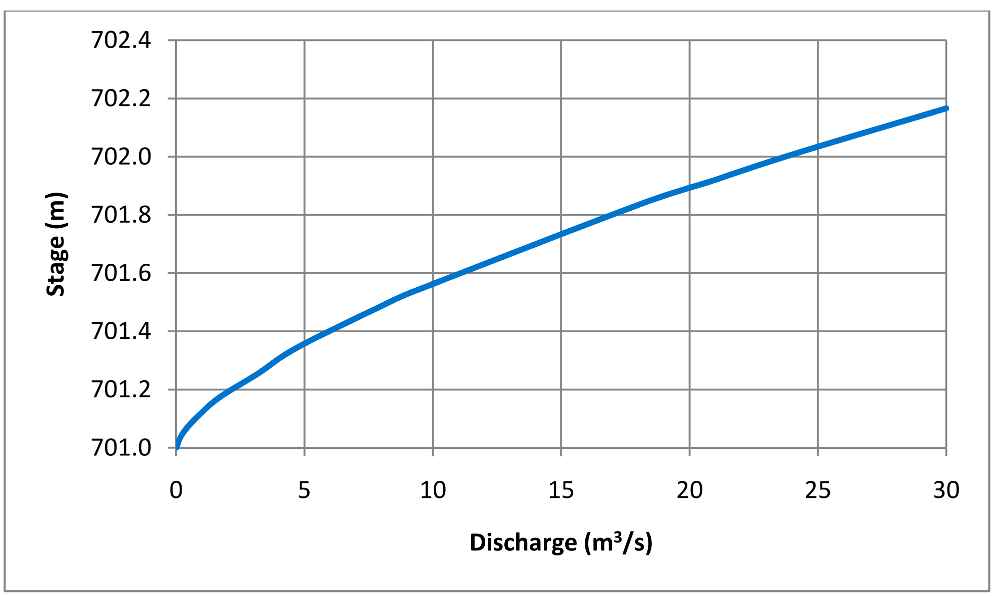
The water flowing from the northeast sub-catchment will be diverted into the Big Lake with Canal 3, Canal 4 and Dam 5. For the construction of those structures, a cofferdam will be built upstream of Canal 4 to divert the flow toward a second natural outlet. The low point of this outlet upstream of Canal 4 is measured at 701 m from the available topographical maps. A stage-discharge curve of the outlet is presented in the Figure 6.6 hereafter.

Table 6.12 summarizes the water levels expected at the cofferdam upstream of Canal 4 during construction.

Table 6.12 Site 6g – Water levels at cofferdam upstream of Canal 4.

	Discharge (m^3/s)	Water levels during construction (m)
July and August average discharge	9	701.53
1: 20 years flood	21	701.92

Figure 6.6 Stage-discharge curve of the natural outlet upstream of Canal 4



The natural outlet at the site of Dam 5 is at elevation 660 m (measured from the topographical maps) and is lower than the invert of canal Canal 3. Dam 5 will then be built behind an upstream cofferdam. The inflow from the secondary basin (between the cofferdam upstream of Canal 4 and the site of Canal 3 and Dam 5) is evaluated to about 0.4 m^3/s for a return period of 20 years. This discharge can be diverted by pumping or by way of a culvert.

6.2.6.7 Dam 5 cofferdams

As mentioned previously, two small upstream cofferdams are projected for Dam 5 construction. The first one is positioned at Canal 4 entrance located about 1.5 km upstream of Dam 5. The second cofferdam is situated just upstream of Dam 5 and partially integrated into the dam body.

From downstream to upstream, both upstream cofferdams comprise the following zones:

- a random rockfill, max. diameter 900 mm (zone 3) that constitutes the body of the cofferdam;
- a transition zone made of crushed stone, max. diameter 225 mm (zone 3A);
- a geotextile protection;
- a geomembrane liner that reaches the bedrock into a previously excavated cut-off trench;
- a confining material at the toe of the dam made of crushed stone, max. diameter 20 mm (zone 3B).

This later 3B zone is required over the geomembrane at the toe of the cofferdam and on the abutments to confine the liner and to push it against the bedrock surface. As mentioned previously, among the various geomembrane type that could be used as cofferdam liner, the EPDM liner appears to be one of the most interesting.

The crest elevation of the upstream cofferdams is set with a 2.0 m freeboard relative to the maximum waters level during construction with a return period of 20 years.

6.3 Canals and Tunnel 1

6.3.1 Tunnel 1

Tunnel 1 is a gated tunnel which transfers from the Imarsuaq Lake (Big Lake) to the Tussaap Tasia Lake, the inflows needed for generation at the powerhouse.

It is designed to pass the discharges of 35 m^3/s in the worst conditions, that is during winter and when the Big Lake approaches its minimum operation level 669 m.

The Tunnel 1 has a length of 1 690 m, with a reverse-D shaped cross-section. The invert of the tunnel is sub-horizontal at the elevation of 660 m. The base width will be 5.00 m with a maximum height of 6.25 m, for a cross-sectional area of 29.4 m^2. The Manning coefficient used is 0.033.

The entrance channel is about 90 m long and has a slope of 10%. Its upstream sill is at the elevation of 665 m.

6.3.2 Canals 1 and 2

Canal 1 and Canal 2 are excavations required between Little Lake and Lower Lake, to insure appropriate conveyance of the flows from the Tunnel 1 to the powerhouse intake. The criteria used to design these canals are:

- flow during winter, with an ice cover of 2 m thickness;
- discharge of 35 m^3/s;
- velocity limited to 0.65 m/s.

The bottom width of Canal 1 and Canal 2 is set to 20 m. The excavations are done for each channel with an elevation of 663 m for the upstream invert, and 662 m for the downstream invert.

During construction, shallow water conditions will permit to easily handle those excavations underwater.

6.3.3 Canal 3

Canal 3 is primarily planned to transfer water coming from the Northeast catchment to Big Lake. The average flows are in the range of 0.2 m^3/s (in winter months) to 9.0 m^3/s (in July or August). It is also designed as channel spillway for Dam 3, with a design discharge of 28 m^3/s.

Canal 3 is 5 m wide at its bottom[6] and about 725 m long. The level of the bottom of Canal 3 varies between 680 m at the entrance to 679 m at the exit. According to available geological information, both extremities of Canal 3 are sited entirely on overburden while the bedrock excavation could reach about 18 m in height into its middle portion. In order to avoid erosion problems, it is planned to protect the overburden excavated faces (canal bottom and slopes) with random rockfill up to level 684 m (2.0 m above maximum normal water level into the canal). Since the bottom of Canal 3 is entirely above the maximum water level of the adjacent water bodies during construction, it can be excavated in the dry without cofferdam.

6.3.4 Canal 4

Canal 4 is located at the main outlet of Lake 702, about 1.5 km upstream of Dam 5. It is excavated to force the total flow from the Northeast catchment toward the Big Lake. It is designed to transfer the discharge of the 1:10 000 years recurrence estimated to 28 m^3/s, with a 2 m freeboard at the secondary outlet, located about 1.3 km northwest.

During Dam 5 construction and prior Canal 4 excavation, the flow through this main outlet is blocked by a cofferdam in order to divert water from Lake 702 to the secondary outlet of the lake. In case that this secondary outlet reveals to be deepen by erosion during the temporary diversion, the Canal 4 should be accordingly adjusted to insure the withdrawal of water from the northeast catchment as desired.

The downstream part of Canal 4 could be excavated in the dry in presence of the cofferdam required for Dam 5 construction while its upstream part could be easily excavated under shallow water when dismantling this later cofferdam.

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[6] This is the minimal width according to hydraulic needs. Excepted for its 2.0 m lowest part, the canal maybe widened into bedrock for construction purpose and as rockfill source.

6.4 Rock excavation and reinforcement

6.4.1 Open cut rock excavation

Well controlled drilling and blasting methods are used in all open-cut excavations to obtain relatively smooth, stable excavation rock faces with a minimum of overbreak and requiring minimum scaling and support.

Generally, no excavation sequences or restrictions on methods are imposed that would tend to reduce the contractor's flexibility in planning and add to his costs. However, special requirements are imposed in some zones considered critical and where a greater degree of assurance in the final results of excavation is needed.

Consequently, standard clauses covering definitions, special and performance requirements will be included in the technical specifications. The essential of these requirements is given below:

- use of controlled perimeter drilling and blasting, techniques such as presplitting, cushion blasting, smooth blasting and line drilling;
- reduction of presplitting hole spacing (usually 0.60 m c/c) in zones considered critical;
- maximum height of a bench: 10 m. The average slope of the final wall consisting of several benches should be vertical;
- diameter of perimeter; buffer and production holes: 70 to 100 mm max;
- maximum weight of explosive per delay period, including controlled perimeter blasting: 150 kg;
- installation of preset grouted rocks dowels before blasting to reinforce the periphery of some particular areas;
- seismic monitoring.

According to the study done by Bertsov et al. (1980), borehole grid in frozen rocks should be reduced by 13% and the explosive ratio increased by 28% compared to the same rocks in a normal (thawed) state.

In areas where concrete will be placed against the rock surfaces, financial penalties for excessive overbreak will be included in the technical specifications (for example, penalty will be applied when overbreak exceeds 0.15 m on walls and 0.30 m on horizontal surfaces).

Scaling, rock reinforcement and surface production, if needed, have to be done as soon as access to a freshly blasted face is available and before the subsequent blast.

6.4.2 Underground excavation-Excavation methods and sequence

6.4.2.1 Powerhouse complex

The excavation of the powerhouse complex including all access tunnels, penstocks, powerhouse cavern, transformer chamber, tailrace gallery and cable tunnel is achieved by using the drill and blast method. These excavations occur during a period of 18 months. This is achieved by using several access galleries allowing simultaneous progress on three headings at any time. Indeed, other than the main permanent access tunnel to the powerhouse cavern there are three additional accesses: one to the transformers cavern, a second one to the tailrace tunnel and a third one to the power tunnel.

The excavation begins from the access road close to the harbor with the simultaneous open-cut excavation of the two portals: access tunnel to the powerhouse and cable tunnel. Depending on the size of the galleries, once the excavation of the tunnel portals is completed, progress is made by full face heading or pilot tunnel breakthrough followed by slashing and bench excavation.

The excavation of the transformer chamber is firstly completed, and then followed by the simultaneous excavations of the access to the tailrace tunnel and the tailrace tunnel itself. The excavation of the powerhouse cavern begins after the access to the tailrace tunnel is completed.

The excavation of the transformer chamber will be done by excavating a pilot tunnel to clear the arch, followed by lateral slashing until the final limits of the walls. One bench will complete the excavation.

The excavation of the tailrace tunnel is done using both ends (2 headings) one from the access to the tailrace tunnel, a second one from the outlet. This excavation is realized simultaneously with the excavation of the powerhouse cavern and the cable tunnel.

Once the crown level of the powerhouse cavern reached, the excavation will be done in two phases:

1. excavation of the central section of the arch (approximately 1/3 of the full width) until approximate elevation of 24 m and subsequent lateral slashing on each side of the opening until the final limits of the walls;
2. benching excavation until reaching the button of the powerhouse cavern.

More details on some special requirements and restrictions to be included in the technical specifications are presented in the section “Design criteria for tunnels”.

6.4.2.2 Power tunnel

The excavation of the power tunnel is achieved using a TBM’s (Tunnel Boring Machine) allowing completion of the excavation in 17 months, excluding the time of delivery and erection of the TBM. Excavation begins at PM ±10+800 and it is completed at PM ±0+150.

6.4.3 Rock reinforcement and surface protection

The objective of rock reinforcement and surface protection is to ensure the security of personnel and equipment as well the stability of excavated or natural rock faces. Rock reinforcement consist mainly of grouted rock bolts and preinstalled grouted rock dowels. Shotcrete will be also used in zones of very fractured and altered rock, or fault and shear zones. If necessary, shotcrete with a welded wire mesh will be applied to increase the stability of the rock mass. Steel ribs will only be used if required in rock of very poor quality.

As a general approach to rock support, basic reinforcement is provided firstly by using pattern bolting for critical areas such as tunnel portals, vaults of large permanent underground openings and in enlarged intersections on the access galleries. This pattern bolting and other reinforcement material planned in advance will be shown on the drawings. Supplementary support and surface treatment elsewhere in the excavations will be determined as work advances. The extent of rock support will depend both on local geology and the degree of success of drilling and blasting methods used by the Contractor.

Based on the literature review of case studies of powerhouse projects in cold climates, the rock was found to be stable when frozen but when thawed, could not be maintained safely in an unsupported condition. Thawed rock required temporary lining of the arches.

In order to estimate the quantities of reinforcement material required, consolidation criteria were established depending on the rock quality. Those criteria are shown on Table 6.13 for both methods of excavation, Drill and Blast and TBM. Rock is classified using the Rock Mass Rating (RMR) method developed by Bieniawiski, 1989. As the excavation progressed, the rock formations will be classified accordingly and the type of reinforcement will be determined as to meet the existing geological conditions. Moreover, Wedge analysis using version 3 software will be used to determine the reinforcement required in case of the formation of large wedges of rock.

Surface protection during the excavation will be provided by using flexible chain link mesh. The wire mesh is installed systematically as work progresses, generally after each blast. In open-cut excavations, the wire mesh is installed on all rock walls higher than 3 meters. In underground excavations, the wire mesh is installed on the entire vaults until the face of the excavation.

Table 6.13 Site 6g – Consolidation criterias

Rock class	Distribution %	Drill and blast				TBM			
		Rock bolts	Shotcrete (m³)	Wiremesh (m²)	Steel sets (m)	Rock bolts	Shotcrete (m³)	Wiremesh (m²)	Steel sets (m)
Class 1 RMR : 81-100	75	Occasional (1 rock bolt / linear meter) 2.5 m long	Local application 75mm (15% of the crown)	On crown	---	Occasional (1 rock bolt / linear meter) 2.5 m long	Local application 50 mm (15% of the crown)	Occasional (15% of the crown	---
Class 2 RMR : 61-80	15	Pattern 2.25 m c/c 2.5 m long	Local application 75mm (15% of the crown+ walls down to 3 m from the floor)	On crown	---	Occasional (1 rock bolt / linear meter) 2.5 m long	Local application 50 mm (15% of the crown)	Occasional (15% of the crown)	---
Class 3 RMR : 41-60	7	Pattern 2.0 m c/c 3.0 m long	100 mm on 50% of crown + walls down to 3 m from the floor	On crown	---	Pattern 2.5 m c/c 2.5 m long	50 mm on crown	Occasional (15% of the crown)	---
Class 4 RMR : 21-40	2.5	Pattern 1.5 m c/c 4.0 m long	100 mm on 100% of crown 50 mm on 30% of the walls down to 3 m from the floor	On crown	6'' on crown and walls spaced 1.5 m when required	Pattern 2.0 m c/c 3.0 m long	100 mm on crown and 50 mm on walls	On crown	Light ribs spaced 2 m when required
Class 5 RMR < 20	0.5	Pattern 1 m c/c 5 m long	100 mm on 100% of crown 50 mm on 30% of the walls down to 3 m from the floor	On crown	Heavy ribs spaced 0.75 m	Pattern 1.0 m c/c 4.0 m long	150 mm on crown and walls	On crown and walls	Medium to heavy ribs spaced 1.0 m
Adits + access tunnels		---	Local application 100 mm (15% of the crown+ walls down to 3 m from the floor)	On crown + walls down to 3 m from the floor	---	---	---	---	---

6.5 Excavation slopes in overburden

The slopes required to insure the stability of excavations in overburden greatly depends on the properties of soils and conditions associated to thawing of permafrost soils which may include ice lenses. Considering this later unfavorable condition associated to permafrost (assumed mostly present at 6g), the smooth slopes of 3 to 4H:1V are generally adopted for permanent excavation in overburden. Steeper slopes may be realized for small or temporary excavation, especially in granular material. On the opposite, smoother slopes might be required for excavation in ice lenses rich soils subject to thawing conditions.

6.6 Conveyance structure

6.6.1 General concept

Conveyance structures at site 6g include the headrace canal (discussed in section 6.7), the intake structure, the power tunnel, the tailrace tunnel, a transfer tunnel (Tunnel 1), two diversion tunnels and four transfer canals (Canals 1 to 4).

Water is transferred from the main reservoir (Big Lake) to the powerhouse through Tunnel 1 that empties into the Lower Lake, and then through the 10 km long power tunnel excavated into bedrock, eventually discharging into the 1.1 km long tailrace tunnel that empties in Godthabsfjord. At present study level, the power tunnel is planned to be excavated with a tunnel boring machine. All of the other tunnels are planned to be drilled and blasted.

The transfer Tunnel 1 is design to pass the operating flow of the powerhouse since the main storage for the project in the upstream lake. All other conveyance structures, except for the diversion tunnels, are design to transfer flow from adjacent catchments towards the main reservoir.

Two other transfer tunnels have been considered, i.e. Tunnels 2 and 3, but were rejected for reliability reasons and due to a low power gain compared to the cost of implementation (discussed in section 4). The reliability issue of constructing those tunnels is discussed hereafter

6.6.2 Ice issues

At site 6g, no permafrost was encountered during the investigations, as it was the case at site 7e. However, sporadic permafrost is still possible in the higher areas surrounding the proposed reservoirs (Big and Lower lakes).

The design of the conveyance structures has to prevent the risk of freezing of the water passages during the winter season, due to frazil ice and ice blocks on the water surface.

6.6.2.1 Canals

For the free surface works, like the headrace canal of both the intake and Tunnel 1, a stable cover has to form early in the winter season to reduce frazil ice formation that can eventually block water passages if it accumulates into blocks. The canals are then designed for a maximum flow velocity of 0.65 m/s at the minimum operating level, which allows the formation of a stable ice cover according to Hydro-Quebec standards. When a stable ice cover is formed, water that is constantly flowing underneath will not freeze as it is the case in the headrace canals.

The canals proposed at site 6g (Canals 1 to 4) are also design according to the design velocity of 0.65 m/s for the formation of a stable ice cover. Free surface canals flowing too fast, thus impeding the formation of a stable ice cover, would likely freeze rapidly due to frazil ice that would eventually accumulate into large blocks and reduce the useful section of the canals. A minimum depth of 2 m of water under the ice cover is targeted at any time to reduce the risk of freezing. A 2 m ice cover thickness assumption is conservatively used.

Another concern is the excavation of parts of canals 3 and 4 into overburden. To reduce the risk in of slope stability problem in overburden to an acceptable level of confidence, the excavation slopes should be not steeper than 4H :1V due to unfavorable conditions associated to thawing of permafrost.

6.6.2.2 Tunnels

For the power and tailrace tunnels, there is no risk of freezing since they are excavated deep into the bedrock, and no permafrost was encountered in the proposed area. Even if there was sporadic permafrost, depths would likely be small, and the tunnels are excavated in depths largely greater than 100 m on most of the proposed longitudinal axis.

The only zone at risk for freezing would then be near the intake. Heating of the intake structure will be provided to ensure a reliable operation of the closing gate. Indeed, this gate will be open most of the time so heating is required to eliminate potential ice formation on the steel elements and in the embedded parts if it has to be closed (or opened, following maintenance works for example).

Tunnel 1 is also a key component in the project at site 6g, since it withdraws water from the main reservoir (Big Lake) and transfers it towards the intake. The tunnel is then designed to be submerged at its upstream and downstream ends, thus eliminating the risk of ice blocks or cold air entering the tunnel. The intake structure of the tunnel will be equipped with two gates to regulate the flow passing through the tunnel, allowing for one gate to be closed for maintenance or other purpose. The gate system will also be heated to prevent the risk of freezing as power production at site 6g relies on the operating of this regulating structure.

Finally, the two diversion tunnels (at Dam 1 and Dam 4) be dry during the winter period, since flow is intermittent The tunnels will most likely flow only during the summer months, from May to September. Ice blocks may accumulate either at the entrance of or in the tunnels, but the presence of numerous workers and machinery at the sites can allow for a fast intervention in case of a problematic situation.

6.6.2.3 Discarded tunnels

As mentioned earlier, two other tunnels have been considered and been discarded of the base scheme at site 6g: Tunnel 2 to increase the storage volume of the reservoir with the Middle Lake (equilibrium tunnel) and Tunnel 3 to divert an additional catchment towards the Lower Lake.

Tunnel 2 was considered safe regarding the risk of freezing, as the tunnel would have been excavated in bedrock free of permafrost and it would have been submerged at both ends for the full range of operating conditions (low-setting tunnel). However, Tunnel 3 would present risks of freezing as it would have to be a high setting – free surface flow tunnel. The tunnel would be located in a remote area near the margin of the Greenland glacier, approximately 15 km from the Lower Lake. The presence of permafrost in this area is more likely. Also, the tunnel would experience almost no flow during the winter, which would likely end up freezing parts of the tunnel. Since the tunnel would have been constructed far from the other facilities, inspection and intervention in case of a problematic situation would have been difficult. These issues along with the low gain in power production with the inflows from this catchment justified not to include this tunnel in the base scheme.

6.7 Headrace canal and intake

6.7.1 Location and sizing

6.7.1.1 Intake structure

At site 6g, it is possible to construct the intake structure above the natural water level of the Lower Lake (654 m), since it is planned to operate the lake at a constant water level of 667 m. Another intake structure has to be constructed at the entrance of Tunnel 1 in the Big Lake. The intake structure for the power tunnel will have only 1 gate, while the intake structure of Tunnel 1 will have 2 gates.

The location of the intake structure was chosen to minimize the excavation quantities of both the intake structure and headrace canal, and the power tunnel. The options that were studied targeted zones were the rock was observed at the surface on the orthophotos for stability purpose of the structure.

The cross-sectional area of the water passage at the intake structure is of the same size as the power tunnel, which is 20.4 m². The cross-section is set rectangular with a width of 3.75 m and a height of 5.5 m, to minimize the size of the gates.

It is necessary to provide an adequate submergence at the intake structure to eliminate the risk of vortex formation that could reduce the performance of the turbines due to potential air entrainment, and cause debris entrainment towards the thrashracks. The well-known Gordon's law[7] is used to estimate the required submergence. The minimal submergence required is calculated as follow:

$$h = C_a v d^{0.5}$$

Where:

H = minimal submergence (in m)

C_a = coefficient relative to the approach flow conditions (0.54 for symmetric approach and 0.73 for asymmetric)

V = water velocity through the intake structure (in m/s)

D = height of the intake structure (m)

Since a small headrace canal will be excavated in the reservoir to ensure adequate flow conditions upstream of the intake, it is assumed that the approach flow conditions will be mostly symmetric. A minimal submergence of 2 m (rounded to the higher integer) was

[7] Gordon, J.L. (1970). Vortices at intake, *Water power*, No. 4.

calculated for a height of 6.1 m at the entrance of intake structure, which is set to make the entrance smoother and reduce head losses. The minimal invert elevation of the intake would then be 657 m to ensure safe operations at the Lower Lake operating level of 667 m, with including a 2 m thick layer of ice. Since the water level of the lake during construction will be approximately 654 m, the invert elevation of the intake structure is set at elevation 655 m which increase even more the submergence of the intake.

Another intake structure has to be constructed at the entrance of Tunnel 1 in the Big Lake. The same criteria did apply for the design of the intake structure. The invert elevation of the structure is set at elevation 660 m to ensure safe operation at the minimum operating level of 669 m of the reservoir.

6.7.1.2 Headrace canal

The design criteria for the headrace canal is to have a maximum flow velocity of 0.65 m/s upstream of the intake to ensure the formation of a stable ice cover for the winter season. This criterion is based on the current practice employed by Hydro-Quebec in the northern region of James Bay in Quebec. Without a stable ice cover, there is a large risk of clocking of the thrashracks with ice due to constant frazil ice formation.

Since the shores of the Lower Lake at the intake structure location are quite steep, the headrace canal is short. The cross-sectional area needed for the headrace canal is calculated for a constant operating level of 667 m. Since the average operating discharge at the site will reach close to 35 m^3/s, a minimum cross-section of 55 m^2 allows to meet the design criteria. The section near the intake will be excavated into dry bedrock at elevation 657 m, since the water level during the construction period will be close to 654 m only.

6.7.2 Heating

Heating will be provided at the intake structure and at the intake of tunnel 1, to prevent freezing and to ensure an adequate operation of the gates. Both of these structures will be exposed to cold conditions, especially the upstream wall of the structure that can be exposed to very low temperatures due to the fluctuations of the water level in the reservoir. A surface electrical line will bring power to the intake.

The proposed scheme is to provide round tubes embedded in the periphery of the concrete walls of the intake shaft. Most of these pipes are located in the upstream wall of the shaft. These pipes will cover the full height of the shaft from the shelter floor down to 2 m below the minimum water level. Electric heating elements with 150 watts/m will be inserted in the pipes.

6.7.3 Lined section of power tunnel and manifold

This section describes the lined portion of the power tunnel upstream of the powerhouse including the manifold.

The lined portion of the power tunnel represents only a small length of the predominantly unlined power tunnel.

Generally the surrounding rock in the region consists largely of composite gneisses. Preliminary geologic mapping confirmed that the rock is predominantly hard and sound. There was no permafrost encountered in the area of site 6g during the investigations.

The height of the rock covers 200 m upstream of the 6g power station varies from 700 m to 600 m.

The hydrostatic head in the tunnel in the case of the 6g power station is about 660 m. The rock cover would be adequate assuming a normal distribution of rock stresses.

For final design in-situ testing, hydraulic jacking and door stopper test should be done on the rock in the vicinity of the powerhouse in order to evaluate the ability of the rock to withstand the designed internal pressure.

In order to prevent excessive leakage through the tunnel in the region close to the powerhouse and in absence of three dimensional seepage analyses, ASCE recommends using a length of watertight liner equivalent to 25% of design head for preliminary evaluations.

Part of the designed length of steel lined tunnel can be replaced with reinforced concrete liner, the amount of which will be determined based on actual permeability parameters and detailed seepage analysis through the liner.

For this preliminary analysis about the in-situ rock properties, the value of the concrete liner was chosen conservatively to be 50 m for the power tunnel at site 6g.

The tunnel diameter was optimized based on an economical analysis with an actualization rate of 4%, however for the final design this actualization rate needs to be reviewed for a more accurate value which can range between 3% up to 6%. The lined tunnel diameter was calculated to be 3.0 m for the 6g power station.

The steel lined portion of the tunnel should be designed to resist internal and external hydrostatic pressure and the liner should also be designed to resist buckling using the Amstutz formula.

In the zone where sound rock is available partial rock participation should be considered in the analysis.

The concrete cover that will be used around the steel liner and between the liner and the rock excavation is 750 mm.

The manifold is designed to withstand the full internal hydrostatic pressure plus the hydrodynamic pressure.

The diameters of the manifold sections were designed to maintain a constant speed taking into consideration a possible shut down of one unit for maintenance.

Steel liner material should be made out of pressure vessel quality steel with grades corresponding to the European standards (EN/ENV) with accompanying Danish National Annex Documents (NAD) and Danish Building regulation.

The steel liner should be designed to conform to ENV2009 Eurocode 3 - Design of steel structures and based on the latest edition of design codes and standard as listed in section 7.3 of the design criteria. For material properties see section 7.4 of the design criteria.

The elastic limit of the steel (fy) can vary between 235 MPa up to 500 MPa. In addition to steel work specified in section 7.4.4 of the design criteria, high yield strength structural steel (S460Q and the S500Q) can also be utilized but must be certified as pressure vessel quality. The recent trend is towards using a higher strength steel.

6.8 Power tunnel

6.8.1 Tunnel axis and longitudinal profile

The overall length of the tunnel is 11 km and has a diameter of 5.10 m (circular shape). Compared to the former power tunnel axis, the inlet and outlet remain at the same locations, while the powerhouse complex was moved some 2 km downstream and 500 m west. The powerhouse was displaced so to avoid a major fault zone which was almost parallel to the previous axis.

The powerhouse has a 6.1% slope so to eliminate the need of a shaft about 500 m high and at the same time it facilitate the drainage.

6.8.2 Transient regime and surge chamber analysis

The main objective is to analyse if the transient regime conditions are acceptable along the headrace tunnel without the installation of a surge chamber. The three independent phenomenon of the transient regime to be analysed for the site 6g power plant includes the following:

- Pressure rise “water hammer” due to the turbine load rejection.
- Speed rise influence by the water hammer effect,
- Governing stability regulation.

Detailed analysis of the transient regime as well as the decision related to the necessity of providing a surge chamber is presented hereafter. The basic data used for the calculations is the following:

• Tunnel length (m)	9 990
• Tunnel cross section (m²)	20.4
• Tunnel mean velocity (m/s)	1.5
• Friction head loss (m)	3.4
• Net head (m)	655.3
• Generator output (MW)	88.9
• Electrical output (MVA)	98.75
• Turbine output (MW)	90.1
• Synchronous speed (rpm)	500
• Reservoir water level (m)	667
• Elastic pressure wave in the roc (m/s)	1 415

The design criteria used in the transient regime analysis are defined as follow:

- The pressure rise ($\Delta H/H_o$) resulting from a load rejection of the Pelton unit is accepted within a range of 10 to 15%;
- The speed rise ($\Delta n/n_o$) shall be less than 35%;
- Both Routh-Hurwitz and Seeberger criterion are used to check against the governing regulation stability.

6.8.2.1 Water hammer analysis

Both methods used to determine the pressure rise during load rejection are: i) the method of characteristics based on the numerical resolution using explicit scheme, and ii) the Allievi inter-lock series resolution of the pressure wave propagation along the headrace tunnel.

As the characteristic of the headrace tunnel (ρ) < 1, it could be expected that the maximum pressure rise associated to the pressure wave propagation (a) will occur at the end of time interval equal to 2 L/a.

The pressure rise ($h = \Delta H/H_o$) is presented in the table below as a function of the time of closure (T_f).

Table 6.14 Pressure rise

Time of closure (sec)	Pressure rise (%)
20	22.3
30	14.3
40	10.6
50	8.4

As previously stated, the allowable pressure rise for the Pelton unit is within a range of 10 and 15%. It corresponds to a closure time varying between 30 and 40 sec. It results that the water hammer effect due to load rejection is not a major concern.

6.8.2.2 Speed rise analysis

During load rejection, the deflectors can be activated within a short period of time: generally between 2 to 6 sec. Considering the maximum allowable pressure rise equal to 15%, the speed rise ($\Delta n/n_o$) influenced by the water hammer during load rejection is presented as a function of the deflector closure time in table below.

Table 6.15 Speed rise

Deflector closure time (sec)	Speed rise (%)
2	13
4	25
6	36

It requires activating the closure of the deflector between 4 and 6 sec to maintain the speed rise within a permissible value of 30%. It thus results that the speed rise effect is not a major concern for the Pelton turbine equipped with a deflector device.

6.8.2.3 Governing stability

The characteristics of the generator including the power output (P_o), the flywheel inertia (PD^2), the accelerating time of the flywheel (T_m) as well as the accelerating time of the water column (T_w) are presented below:

- P_o 88.9 MW
- PD^2 1106 t x m^2

- T_m 8.54 sec
- T_w 2.34 sec
- T_m/T_w 3.64

The governor regulation system is controlled by the servomotor speed mechanism. A proper adjustment of speed - responsive element according to small oscillations will provide an adequate governing stability. The following criteria can be used to verify the governing stability conditions:

i) Seeberger criteria

Based upon the Seeberger criteria, for the accelerating time of water column (T_w) in the headrace tunnel equal to 2.34 m/s, it requires a minimum accelerating time (T_m*) equal to 7.54 sec to ensure the governing stability condition. As shown previously, the parameter T_m corresponding to the natural flywheel inertia is greater than T_m*: T_m/T_m* = 3.65. The governing stability is then adequate.

ii) Routh-Hurwitz criteria

The table below presents the different combination of the governing regulation setting - type PID for ensuring the governing stability associated to small oscillations.

Table 6.16 Required inertia of the flywheel for stability

T_r = 8 sec and σ = 40%	T_m (sec) = 7.40	PD^2 (t x m^2)=958.66
T_r = 8 sec and σ = 35%	T_m (sec) = 8.46	PD^2 (t x m^2)=1095.61
T_r = 8 sec and σ = 30%	T_m (sec) = 9.87	PD^2 (t x m^2) = 1278.21

Notes: T_r = relaxation time of the dashpot and σ = statism = -dω/dx

From the above figures, for T_r = 8 sec and σ = 35%, both parameters T_m and PD^2 are respectively 8.46 sec and 1 095.61 t x m^2, i.e. values practically similar to the values as determined based upon the natural weight of the flywheel rotor (PD^2 = 1 106.0 t x m^2), it results that the regulation stability is adequate.

Considering for example the oscillation of the power output ($\Delta N/N_o$) being equal to 5% and for given parameters: σ = 35% and T_r = 8 sec, the frequency oscillation (Δf/f) estimated based upon the method of Esscher Wyss - bulletin 52/53 is approximately equal to 4%.

6.8.2.4 Conclusion

From the standpoint of the transient regime, the results obtained in the above analysis showed that a surge chamber is not required at site 6g.

6.8.3 Penstocks and manifold

The geometry and the sizing of penstocks and the manifold were based on the general criteria presented in section “Design criteria for tunnels”. The manifold has a circular final shape with the following dimensions: length of 17 m with variable diameter from 3.1 to 1.8 m. The penstocks (number of 2) have equally final circular shape (inside diameter of 1.8 m) with an overall length of 22 m.

6.9 Turbine-generator units

6.9.1 Pelton turbine selection

6.9.1.1 General criteria for turbine type selection

Before selecting Pelton rather than Francis units, both being theoretically feasible, the main issues which were considered included:

- efficiency at full load;
- facility to deal with silt erosion and long term performance preservation;
- turbine stability;
- manufacturing difficulties of extreme high head Francis runners and precision;
- availability of competent suppliers and repair capability at site;
- cost and schedule;
- sensitivity to tailwater level variations;
- cold region operation;
- space requirements;
- consequences on transients;
- high speed generator reliability.

The very large majority of high head hydroelectric projects are equipped with Pelton turbines. The Pelton turbine has no real limitation in head, size, operating constraints and hydraulic design of the conveying system.

On the borderline, the Francis turbine design favors a higher specific speed which results in a more economical rotational speed with cost and space reductions on both the generator and turbine at the border between both designs.

The comparison made for 7e is definitely true for 6g, Pelton turbines have to be preferred to Francis. Indeed, it would be even more difficult to manufacture the smaller units precisely and to protect them against erosion.

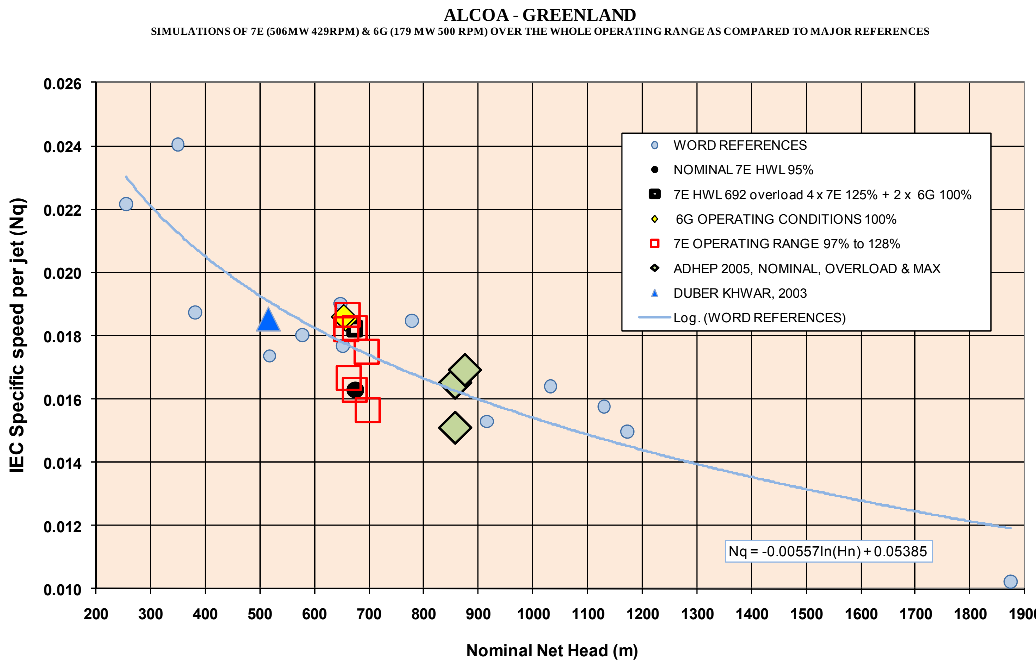
6.9.2 Pelton turbine final selection and sizing - Overload capability

Two options are presented in the 7e powerhouse report:

1. Optimized 6 jets units at 7e (429 rpm) and 6g (500 rpm) of complete different sizes and designs (our dwgs.)
2. Same 429 rpm generators and same runners (to be confirmed) with a special 5 jet spiral distributor for 6g. This option would reduce spare costs and simplify maintenance with a comparable global cost.

6.9.2.1 Different unit design - Overload capability ensured by 7e only

Figure 6.7 Specific speed per jet at 7e and 6g as compared to major references



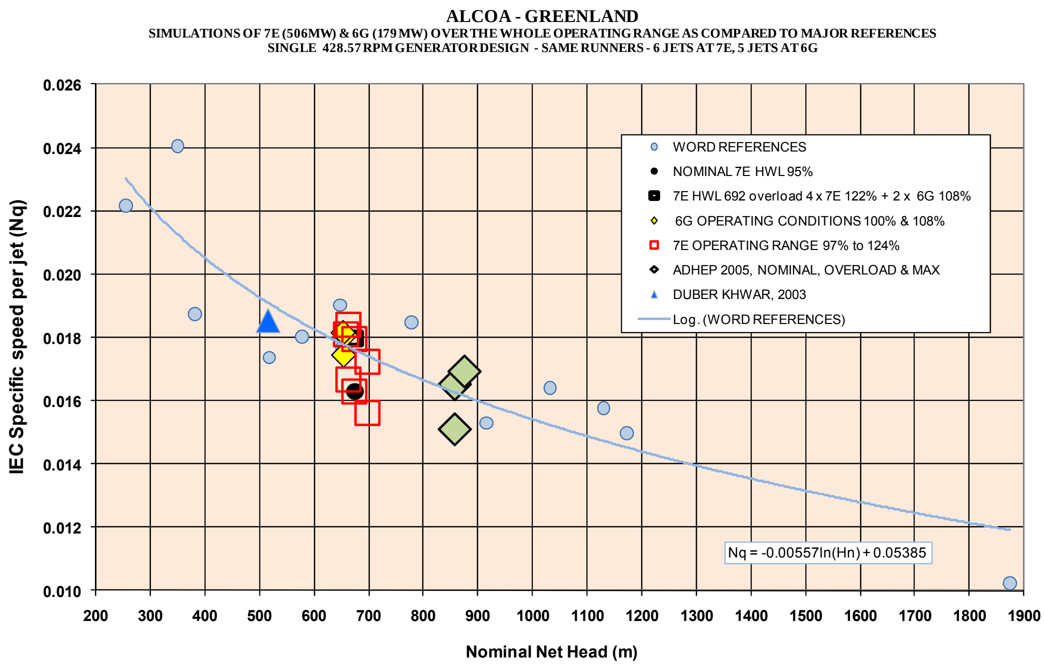
Considering the already high specific speed per jet of the 6g turbines (to be confirmed by manufacturers in view of silt content and general operating conditions), overload operation is excluded and 7e units will have to absorb the necessary overload during the maintenance or unplanned outage of anyone of the units.

6.9.2.2 Same generator design as 7e using 5 jets and 429 rpm rotational speed at 6g

This solution is better balanced in terms of specific speed. However, to be able to use the same runners at 6g, with a nominal net head at 6g being slightly less than the minimum net head of 7e, some compromise will be necessary on the Pelton diameter.

On the graph below, 6g operating conditions are limited to two yellow lozenges corresponding to the normal headwater level and either normal operation (just below the trend line) or 108% overload (above the trend line) when anyone of the 6g or 7e unit is out of service for inspection or maintenance. We can expect the overload situation to occur at least 6 times in a year, assuming units are inspected yearly, at least during the guarantee period.

Figure 6.8 Specific speed per jet at 7e and 6g as compared to major references



Overload capability was balanced between 6g and 7e units in order to attain the same severity degree when the 7e reservoir is at its 95% probability of occurrence. If unplanned outages of 7e units occur simultaneously with deep draw down after sustained low inflows, the remaining 7e units might have to operate at up to 124% overload, the reason why their nominal operating condition was selected sufficiently below the statistical trend line. This is also the reason why the number of units was fixed to 5, the overload percentage for a four unit powerhouse becoming excessive.

Table below lists typical 6g operating conditions, with or without one unit out of service, either from 6g or 7e, and headlosses corresponding to a smooth headrace tunnel (TBM).

Table 6.17 Typical 6G operating conditions

Operating condition	500 rpm optimized 6g			429 rpm common generator and runner		
	Nominal	1 6g unit Out of serv.	1 7e unit Out of serv.	Nominal	1 6g unit Out of serv.	1 7E unit Out of serv.
Number of units in operation	2	1	2	2	1	2
HWL	667	667	667	667	667	667
Powerhouse discharge	30.7	15.4	30.7	30.7	16.6	33.1
Generator output	89.4	89.8	89.4	89.4	97.0	96.4
Turbine model efficiency	91.80%	91.81%	91.80%	91.90%	91.88%	91.87%
% of nominal discharge	100%	100%	100%	100%	108%	108%
Turbine discharge	15.4	15.4	15.4	15.3	16.6	16.6
Turbine output	90.6	91.1	90.6	90.6	98.3	97.7
Turbine net head	653.4	656.8	653.4	653.4	656.5	652.5
D nozzle opening	0.216	0.215	0.216	0.236	0.245	0.245
nq/nq opt	1.232	1.227	1.232	1.156	1.197	1.203
ns jet	18.60	18.53	18.60	17.46	18.08	18.16
Nq jet	0.019	0.019	0.01859	0.017	0.018	0.018
Unit Efficiency	90.56%	90.57%	90.56%	90.66%	90.64%	90.63%

Unit common characteristics and sizing corresponding to above performances appear at table below:

Table 6.18 Unit characteristics for both options

Output at generator terminals 7e + 6g = 684.5 MW	Units	500 rpm optimized 6g	429 rpm common generator and runner
Synchronous speed	rpm	500	429
Nozzle level	m	7.500	7.500*
# jets		6	5
Pelton diameter Dp	m	2.068	2.411 *
Bucket width B	m	0.540	0.621 *
Dp/B		3.83	3.88 *
Runner weight	kg	6252	9788 *
Efficiency corr for HVOF coating		-0.4%	-0.4%
"Zero" cavitation ¼ Annex A IEC 60609	kg	0.18	0.24
High tide for full load MSL	m	2.63	2.63
Future Ocean rise provision	m	0.30	0.30
# Pole pairs		6	6
Cos Phi		0.9	0.9
Generator Eff.		98.65%	98.65%*

* Dimensions to be adapted for a common speed and runner design with 7e

6.9.3 Summary of extreme operating conditions

Option	6 jets 500 rpm	5 jets 429 rpm
Maximum generator output MVA at 0.9 power factor	100 MVA *	108 MVA *
Maximum power at 6g generator terminals	178.8 MW **	194 MW **
Maximum power at 6g switchyard	175 MW **	190 MW **
Maximum discharge of 6g powerstation	30.7 m³/s	33.1 m³/s **
Nominal net head	653.4m	653.4m
Maximum static head	658.7 m	658.7 m
Maximum net head at full load	656.8 m *	656.5 m *
Minimum net head	653.4 m	652.5 m **

* One 6G unit out of service
** One 7E unit out of service

6.9.4 Unit configuration: Generator foundation combined with Pelton housing

The arrangement shown on drawing A-403 is for a two bearing compact unit, which combines the advantage of a reduced cavern height and of generator foundations less sensitive to rock relaxation after excavation. Now that most major turbine and generator suppliers are integrated in single companies such as (Voith-Siemens (Riva), Alstom (Neyrpic, ABB), Andritz Hydro (Va Tech EscherWyss Ellyin GE Kvaerner), as well as suppliers from Asia, it is no longer necessary nor commercially valuable to separate the turbine and generator contracts in order to combine the best price and best technology, once a reason for separate foundations.

La Batiaz (Switzerland), San Carlos (Colombia) operate satisfactorily using this arrangement at similar heads as well as a number of high head powerhouses, old or new.

Irrespective of cavern compression sensitivity, the operator also benefits of the two bearing arrangement, which is much easier to commission and maintain than a long shaft three bearing unit.

The only inconvenience is the reduced working space in the deflector and jack/ brake zone. These equipments require very little maintenance with the extensive use of stainless steel, self lubricating materials and LVDT feedbacks. Furthermore units attached to a smelter are less exposed to premature wear as compared to Pelton peaking units combined with pump turbines which may start and stop many times a day.

6.9.5 Turbine and valve design and manufacturing

As mentioned previously, these units shall operate with the highest possible availability factor and require the minimum possible maintenance:

a) Runners: All runners shall be 100% machined out of a solid forged stainless steel disk from low carbon, low sulfur CA6NM grade. Most probably, all runners will have to be hard coated with a Cobalt base Tungsten carbide layer using the HP-HVOF process. However, we are afraid that the first runner to be commissioned cannot be fully protected against impacts, whatever the care given to the tunnel cleaning and the importance of rock traps. It could be of interest to commission the first unit with a non coated smooth runner whose initial performance would be optimal and repair easier.

   It will serve as a test for erosion rate and hard coating profitability. This first runner will be delivered with a coated spare runner for early replacement in case erosion puts the first runner at risk of irreversible damage. Conservative stress amplitude will be specified.
b) Nozzle tips and needle tips: All nozzles shall be equipped with superfinished Co-W-C hard coated nozzle and needle tips.
c) Cut-in deflectors, nozzle roofs and nozzle heads shall be forged stainless steel for sustained operation with deflected jets.
d) Turbine housing liners, gratings and air admission pipes shall be designed for sustained operation with deflected jets.
e) Spiral distributor shall be delivered in three sections with numerically machined weld preparations for minimum works at site and flange connection to the test head first and spherical valve makeup pipe later. Radiography should be avoided on the site circumferential joints. All spiral construction shall be made of plates and forging.
f) All tooling inside the turbine housing, trolleys, runner coupling, needle attachment and all lifting devices shall be designed for minimum maintenance downtime and skill requirement.
g) Double counterweight, double servomotor spherical valve with service and maintenance seal and seat, fully replaceable using turbine HPU for opening only.

6.9.6 Generator design and manufacturing

Characteristics given for the nominal power factor:

a) stator winding Class F T. rise 75°K, Max T 115°C at maximum overload and maximum water temperature;
b) rotor winding Class F T rise 80°K, Max T 120°C at maximum overload and maximum water temperature;
c) stator core T rise 70°K, Max T 110°C at maximum overload and maximum water temperature, 85dB max;
d) accelerated aging test for all series of Roebel bars;
e) ripple spring radial packing;
f) bolted stator frame with stator core stacked at site;

g) single piece fans;
h) hot air drainage capability for powerhouse heating with filtering of air makeup;
i) partial discharge detectors;
j) closed loop stainless steel cooling system;
k) self equilibrated thrust bearing;
l) stabilization of bearings at maximum overspeed (corresponding to full load rejection);
m) runaway site test;
n) short circuit test.

6.9.7 Governor, Excitation system and auxiliaries

The overall responsibility for the T/G unit, main inlet valve, governor, excitation system and associated auxiliaries including control, command and protection, man-machine interface, compressed air for the units, cooling water system shall be the responsibility of the main Contractor and include signal and power cables, batteries, chargers and inverters, and all embedded air and water piping.

6.10 Powerhouse, transformer cavern and annex building outside

6.10.1 General layout

Powerhouse and transformer gallery are located inside of two main caverns.

The overall length of the powerhouse (including the service bay) is 67.05 m at level 13.80 m, its width is 15.25 m and it has a height of 30.80 m. The overall length of the transformer gallery is 84.45 m, its width is 13.50 m and it has a height of 12.55 m at its centerline. The sizing of both caverns was established with accordance with the criteria presented in section “Design criteria for tunnels”. The distance between the powerhouse and the transformer galleries is 1.5 times the width of the powerhouse.

The powerhouse is subdivided in two sections: the first one includes all the energy producing equipments; the second one is located on the left hand side of the main cavern, which is the service bay area. Access to these caverns is possible through two tunnels located at their extreme left.

The dimensions and locations of the energy production areas and the service bay area of the powerhouse are conforming to the requirements of all disciplines. The main level of the Powerhouse, service bay, bus bar galleries, transformer cavern, electro-mechanical tunnel and escape tunnel is 13.8 m.

The service bay includes several locals at different levels including the service building, one assembly area and unloading area with the same level as the main level of the powerhouse namely 13.8 m.

The transformer cavern is located downstream of the powerhouse and parallel to it. The overall length of the transformer cavern is 84.45 m, its width is 13.5 m and it has a height of 12.55 m at its centerline. Its floor level is 13.8 m, same as the principal level the Powerhouse.

The annex building is located outside; it has two floors and a flat roof. The overall dimensions of this building are: 68 m length, 30 m width and 7.5 m height.

6.10.2 Powerhouse layout

The principal floor level of the powerhouse is 13.8 m, the generator floor level is 8.85 m and the turbine floor level is 4.14 m.

The powerhouse is comprised of two bays, one for each turbine-generators unit. The distance between the centerline of each unit is 14.0 m. The unit number 1 is adjacent to the service bay and the unit number 2 is located at the far right of the cavern.

An overhead crane, with 265 t capacity, located at the elevation of 22.6 m, is serving the whole length of the powerhouse and major part of the service bay. This crane covers the whole length of the service bay, up to column line 10, during construction. After construction, the overhead crane serves part of the service bay, up to column line 7.

A suspended ceiling at the elevation 28.0 m is located above the powerhouse and the service bay area.

Table 6.19 Different levels of the powerhouse

Level (m)	Description
1.55	Discharge basin
4.14	The valve floor with valve and servomotor bases
7.3	Centerline of the turbine, distributors and the penstock
8.85	The generator floor with generator housing, oleopneumatic assembly and turbine wheel hatch
13.8	The powerhouse main floor with turbine wheel hatch, generator cover, electrical control panel. The bus bar galleries, contains the electrical equipments, is at the same level.

6.10.3 Service bay layout

The service bay is located at the extreme left side of the powerhouse.

One elevator and one stair case provide access from level 4.14 m to 26.6 m.

Service bay, at the main floor elevation of 13.8 m, is composed of the assembly area and the unloading area. The five other floors, namely elevations 4.14 m; 8.85 m; 18.3 m; 22.3 m and 26.6 m, are used for different locals.

Table 6.20 Floor description

Level (m)	Description
4.14	Pump room; Hydrocarbon room
8.85	Potable water room; Sanitary waste system room; Oil room; Compressors room; Washrooms
13.8	Accumulator /battery room; Charger (battery) room
18.3	Control room; Computer room; washrooms

Level (m)	Description
22.3	Telecommunication room; Battery Télécom; Substation protection &control center room; Technician office; Engineering office; Lunch room (command room); Computer room; Meeting room; Lunch room; washrooms
26.6	Elevator mechanical room (lift well); Mechanical and ventilation room (HVAC)

The overhead crane and suspended ceiling as described above are also located in this area.

6.10.4 Transformer cavern layout

The transformer gallery is located downstream and parallel to the powerhouse in a separate cavern. The overall length of the transformer cavern is 84.45 m, its width is 13.5 m and it has a height of 12.55 m at its centerline. Its floor level is 13.8 m, which is the same as the principal level the Powerhouse. It has two floors at 13.8 m and 22.3 m.

The cable gallery tunnel and access gallery are connected to its extreme right and its extreme left respectively.

Two bus bar galleries, one escape tunnel, one electro-mechanical tunnel at the level at the level 13.8 m and one ventilation tunnel at the level 28 m connect the transformer cavern to the powerhouse cavern. An underground oil separator at 10.3 m level is located at extreme left side of the cavern.

The transformer gallery accommodates two power transformers, two auxiliary transformers and one reserve power transformer. A gantry crane and two draft tube gates are also located in this cavern.

6.10.5 Annex building outside

The annex building is located outside of the caverns. It has two floors and a flat roof. The overall dimensions of this building are 68 m in length, 30 m in width and 7.5 m in height.

This building consist of living spaces, offices, maintenance area, mechanical and electrical rooms.

6.10.5.1 First floor

- Workshop: civil / electrical/ mechanical
- Mechanical warehouse
- Electrical warehouse
- Civil warehouse
- Electrical room
- Wood workshop
- Welding workshop
- Handling maintenance room
- Visitor room office
- Transmission room
- Mechanical and ventilation room

6.10.5.2 Second floor

- Infirmary room
- Technician office
- Powerhouse chef office
- Maintenance chef office
- Administrative office
- Documentation / reproduction office
- Engineering office
- Meeting room
- Lunch room
- Men shower room and bathroom
- Men washroom
- Women shower room and bathroom
- Women washroom

6.10.6 Structure

Concrete floors are mainly used for the Powerhouse, Service bay area, Transformer Cavern and Annex building .The overhead crane in the powerhouse and service bay area is supported by the steel girders. These steel girders are designed as simply supported beams. Steel columns are used to transfer the crane loads to the floor level 14.7 m. Vertical bracings provide stability for the crane supporting steel structures.

The suspended ceiling at the elevation 28.0 m is designed with the light weight steel channels and plates. This ceiling is hanging from the roof by means of cables. These cables are attached to the rock anchors.

6.11 Tailrace tunnel

The overall length of the tailrace tunnel is 1.1 km, its width is 5 m and it has a height of 8.25 m. It's a free surface flow tunnel with a reversed-D shape. The cross-sectional area is 39.4 m². In order to allow the excavation in the dry, a rock plug is left in place in the extreme end of the tunnel. This rock plug is excavated only after the gates of the draft tubes are installed. There is no gate required at the extreme end of the tailrace tunnel.

6.12 Access tunnels

There are several access tunnels available that allow not only the transportation of the construction materials and personnel required for the construction, but also allow the simultaneous excavation of the powerhouse complex on at least tree headings. These access tunnels are: main access tunnel to the powerhouse, access tunnel to the transformer chamber, access tunnel to the power tunnel and access to the tailrace tunnel.

The sizing of the access tunnels shown on the drawings and their sections were established depending of the dimensions of the equipments required for the construction.

The layout of all access tunnels was designed as to allow the drainage by gravity.

The crown of all access tunnels will be covered by a wire-mesh so to ensure the safety of the personnel and the equipment.

6.13 Auxiliary services

6.13.1 Electrical

6.13.1.1 Equipment at the Stator voltage (10.3 kV)

6.13.1.1.1 General

The nominal voltage at the generator terminals is 10.3 kV. The equipment between these terminals and the terminals on the LV side of the unit transformers are the following;

6.13.1.1.2 Excitation transformer

The excitation transformer shall be dry type, and shall be able to operate at its nominal rating on a permanent basis

Insulation level shall be class F, resin encapsulated. The transformer shall be encased in an IP 31 (minimum) cubicle, as for the standard IEC 60529 and shall be equipped with bars and all accessories for direct connection to the phase isolated bus bars by tee connection close to the generator terminals.

6.13.1.1.3 Static Excitation

The static excitation system includes mainly:

- the rectifier bridge;
- the field circuit breaker (contactor);
- the field flashing contactor from the battery;
- the field discharge resistor;
- the local / remote control devices;
- the protection relays;
- the power stabilizer.

6.13.1.1.4 Current transformers

The 10,3 kV input at the excitation transformer shall be equipped with a current transformer for the generator differential protection and a second current transformer with a ratio for the excitation transformer overload protection.

6.13.1.1.5 10.3 kV natural air cooled isolated phase bus bar system components and accessories

Isolated phase bus bar

The 10.3 kV isolated phase bus bar shall be the natural air cooled type. The design shall incorporate cubicles and connection points for voltage transformers, excitation transformers, lightning, arrestors, capacitors and cable connections.

Generator voltage transformer cubicles

These cubicles shall be metal clad, air insulated, entirely factory fabricated, and shall contain two voltage transformers with fuse protection on their primaries. The transformers, with their fuses, shall be installed on drawers, withdrawable from the energized 10.3 kV section.

Capacitor and lightning arrestor cubicles

These cubicles shall allow the connection of the capacitors and lightning arrestors to the 10.3 kV main bars.

Generator isolating cubicles

In order to be able to feed the auxiliary services of the power station from the network, an isolating switch is required between each unit transformer and its generator. We can thus isolate each generator from its unit transformer and the 10.3 kV board can be fed from the HV network (refer to the single line diagram). Each switch shall be metal clad, air insulated, with isolating material between the phases.

Generator neutral cubicles

The neutral cubicle for each generator shall include:

- a set of bars, forming the neutral;
- a neutral transformer;
- a neutral resistance, connected to the neutral transformer secondary;
- three protection CTs on each of the three phases.

The neutral cubicle shall be installed close to the generator neutral zone.

Generator phase cubicles

For each generator set, a set of cubicles including, for each phase:

- one CT and one VT for the voltage regulator;
- a two winding VT for:
  - the speed regulation;
  - metering, measuring and protection;
- three CTs for:
  - measuring and metering;
  - over-current and unbalance protection;
- an outgoing section for excitation.

The isolated phase bus bar shall be equipped with provision (connections) so that short circuit tests are possible. One set of bars is foreseen for the five generating sets.

6.13.1.2 Power transformers

6.13.1.2.1 General requirements

The three phase transformers 100 MVA, 10.3 kV – 225 kV. (The dimensions can change after the brought modifications to compensate a group in maintenance).

The winding connections are dYn11. The HV windings are star connected with the neutral solidly grounded.

The direct sequence impedance is 12% and the transformers shall be supplied with 2 x ±2.5% off-load tap changers.

Cooling shall be OFWF.

All the transformers shall be equipped with removable wheel sets. The transformers in their bays will be installed on rails via shimming plates. The rails shall be connected to the transformer concrete base.

The 225 kV bushings shall be SF6 type.

Insulated cable at 245 kV shall make the connection between the power transformer and the substation.

At the power transformer SF6 bushing there shall be the SF6 transformer termination module a small section of GIB, gas insulated bus and the GIS cable termination module.

The cable shall terminate at the transformer with it's GIS sealing end and in the substation with its outdoor sealing end.

The tanks shall be rectangular with a bolted cover.

The material shall be in accordance to the most recent IEC recommendations; the principal recommendations to consider are:

- IEC 60060 High voltage test techniques;
- IEC 60071 insulation coordination;
- IEC 60076 Power transformers;
- IEC 60137 Insulated bushings for ac voltages above 1 000 V;
- IEC 60296 Specifications for new mineral insulating oils for transformers;
- IEC 60076-5 Loading guide for oil-immersed power transformers;
- IEC 60076-10 Noise level determination for transformers and inductances.

Other internationally accepted standards, which are either as or more demanding, such as the American ANSI, IEEE or the German DIN/VDE will also be accepted.

The transformers shall be designed to minimize harmonics and to avoid deforming the sinusoidal wave which may hamper the telecommunications circuits. The neutral points shall be made available and appropriately grounded.

6.13.1.3 Alternating current sources for the 400 V auxiliary services

6.13.1.3.1 10.3 kV switchgear

Two 10.3 kV principal switchgears shall be energized directly from the main bars; they can be fed from one generator or another, the supply source can be switched from one to the other via a circuit breaker.

The section feeding the 400 V auxiliary services shall include the following:

- one 10.3 kV circuit breaker cubicles (only PSG1);
- two 10.3 kV circuit breaker cubicles (only PSG2);
- one transformer feeder;
- one 10.3 kV switchgear feeder (PSG3);
- one measuring cubicle.

The incoming cubicles (10.3 kV circuit breaker) shall also include a 50: 1A current transformer, whose role is to protect the bus bars and the auxiliary service transformer.

The measuring cubicle shall include two voltage transformers, 11 kV / √3: 110 V / √3; the role of one shall be to measure the voltage on one generator and the role of the other shall be to measure the voltage on the adjacent generator.

The 10.3 kV principal switchgear (PSG1) supplied by the groups 1 and 2 constitute the source for Auxiliary Transformer no. S1, and the 10.3 kV principal switchgear (PSG2) supplied by the groups 1 and 2 constitute the source for Auxiliary Transformer no. S2. An appropriate interlock associated with an automatic transfer system will guaranty that there is no inadvertent paralleling of the groups on the 10.3 kV bar. Transformer no. 1 can be energised from either group 1 or group 2; likewise transformer 2 can be fed either from group 1 or group 2. As a single transformer is sized to carry the entire alternating current load from both the power station, it is sufficient to have a single group running for all the auxiliary loads to be fed.

The 10.3 kV/400 transformers S1 and S2 are each rated at 1 500 kVA. They are oil type, air cooled (ONAN). The transformers are fitted with on-load tap changers, with 2 x 2.5%.

The 10.3 kV switchgear (PSG3) supplied by the 10.3 kV principal switchgear (PSG1) and (PSG2) constitute the source for Auxiliary Transformer no. S3 and S4.

The 10.3 kV/400 transformers S3 is rated at 1 500 kVA. They are dry type, natural cooled (ANN). The transformers are fitted with on-load tap changers, with 2 x 2.5%.

The 10.3 kV/400 transformers S4 is rated at 300 kVA. They are dry type, natural cooled (ANN). The transformers are fitted with on-load tap changers, with 2 x 2.5%.

6.13.1.3.2 400 V switchgears

Two main switchgears and seven secondary switchgears are previewed for the auxiliary services of the power house, intakes and services building.

The main switchgears shall be metal clad, self standing cubicles, with withdrawable circuit breakers as well as control and measuring.

The secondary switchgears power the auxiliary services in the areas located in proximity to the switchgears. The motor control centers are integrated in the same switchgear. The incoming breakers are of the withdrawable unit design equipped with automatic switching system, such that if the normal power source is lost, the auxiliary services are not lost.

Two of the ten secondary switchgears have a circuit breaker serving to relieve the non essential loads.

6.13.1.3.3 Auxiliary power sources

The cubicle auxiliary power sources shall be as follows:

- control, interlock and signaling circuits: 125 V d.c.;
- motor cranking circuit: 125 V d.c.;
- heater resistances : 230 V a.c.;
- alternating current for auxiliary electric loads.

400 V Distribution network

The neutral is not distributed, except for the lighting and socket outlet circuits, for which a neutral is created in the 400 V/230 V transformers.

The auxiliary loads are distributed via 400 V panels, as follows:

- Power plant:
  - one panel per turbine-generating set, to feed the set's auxiliary loads;
  - one panel for the backed-up (essential) general auxiliary loads (hydraulic set or diesel generating set);
  - one panel for the non backed-up (non essential) auxiliary loads.

The circuit breaker which sheds the loads on the non essential panel can be manually closed, if there is a requirement to feed certain non essential auxiliaries during a prolonged power outage. Care must then be taken to not overload the power source.

6.13.1.4 Emergency Generating Set (EGS)

The EGS constitutes the primary 400 V back-up source for the auxiliary loads.

The EGS, which has an automatic electric starter, has the following main characteristics:

- it is designed for continuous service.

Its principal components are as follows:

- diesel engine and generator on a common chassis, with an elastic coupling between the engine/generator and chassis;
- slave pump on the engine lubricating circuit, forced air cooling the water/oil coolant;
- exhaust circuit;
- diesel tank, and 500 liter day tank in the EGS room;
- preheating;
- electric starting;
- WOODWARD electric speed regulator;
- brushless generator, self-cooled, rotating diode excitation, static voltage regulator;
- high mechanical inertia;
- control and protection panel;
- local room ventilation;
- load resistance, with automatic start and two-step load contactors, all installed on the roof of the EGS room.

6.13.1.5 Direct current feeds

6.13.1.5.1 125 V dc source

The equipment is as follows:

- two sets of battery/chargers, 125 V, each connected to a set of busbars, connected in parallel and each sized to feed all the auxiliary loads;
- one sets of battery/chargers, 125 V, for the generator field flashing

The battery will be composed of 60 lead acid elements.

The chargers will be of the silicon diode type. The chargers will feed the battery to which it is associated in maintenance mode. They are fed from the essential services (backed-up) 400 V panel.

A 125 V dc distribution board, comprising:

- two sets of busbars, each fed from a battery/charger set;
- outgoing circuits, connected in parallel to the 2 sets of busbars, with protective fuses and diodes to eliminate circulating currents between the batteries, and equipped with a two pole circuit breaker.

6.13.1.5.2 48 V dc source

This equipment is used for the telecommunication systems.

It is made up of a 48 V battery/charger and a distribution panel. The battery is a 60 Ah lead-acid type, and is installed in the battery room. The charger has a 25 A rating.

6.13.1.6 Lightning and socket outlets

Plant lighting will be fed from two auxiliary service panels (normal or backed-up) via 400 V/230 V transformers.

Battery pack fixtures will light exit ways until power is restored.

The plant's socket outlet circuit will be fed from the normal auxiliary service board, via a 400 V/230 V transformer.

6.13.1.7 Telephone

Telecommunications will be via a telephone system with a private PABX internal to the plant. There will be telephones in the various rooms in the plant and connections to the 225 kV substation, to the water intake at the dam and to the workers' town.

A line from the HF telecommunication system over the 225 kV network is dedicated to the plant.

6.13.1.8 Fire detection

The power plant is equipped with a fire detection system including:

- fire detectors spread out in the various rooms;
- a fire alarm panel in the control room.

6.13.2 Mechanical

6.13.2.1 Piping

6.13.2.1.1 General

This chapter describes the piping systems that are not supplied by the units' supplier. The systems are the following one:

- raw water;
- fire protection;
- potable water;
- service water;
- drainage of clear water;

- drainage of waste water;
- drainage of oily water;
- compressed air for general service.

The following systems are supplied by the unit's supplier:

- cooling water;
- filtered water;
- oil handling and storage;
- compressed air for regulation;
- compressed air for breaking;
- units dewatering.

6.13.2.1.2 Raw water

This system supply water to the fire protection system and to the service water system.

The equipment of this system are self cleaning filters and piping networks.

6.13.2.1.3 Fire protection

This system insures the protection of the alternators, the transformers as well as the rooms in the powerhouse that may present a fire hazard.

The system uses water as the extinguishing media.

The water is distributed in a network of pipes to the locations where automatic fire protection is required. For alternators and transformers, deluge valves and dry sprinklers are used. For the rooms, wet sprinklers are used.

There are also sufficient fire hoses and manual extinguishers installed on every floor to complement these systems of automatic protection. The fire hoses are also fed by the same piping network that feed the automatic systems previously described.

Two main pumps are provided to feed the water in the system, taking their water from the raw water system. One pump is able to supply the full flow required. The other is a standby pump in case of failure of the first one. A jockey pump is also provided to maintain the pressure at a suitable value when there is no need for fire protection.

Facilities are also provided to allow for the periodic testing of the pumps and the sprinklers systems.

The fire pumps are located in the service area at level 8.85.

6.13.2.1.4 Potable water

This system insures the supply of potable water suitable for use in lavatories and sinks.

To save on the required flow, the sanitary apparatus like the toilets and the urinals flushes are fed with service water. This system is described hereafter.

Water heaters are provided to supply warm water to the lavatories and sinks.

The water comes from a well (to be confirmed) and is distributed in the powerhouse by a piping network. A storage tank is provided to avoid too frequent starts and stops of the well pump as well as to provide a reserve in case of a pump failure.

The tank and all equipments are located in the service area at level 8.85, except for the well pump which is installed in the well.

6.13.2.1.5 Service water

This system insures the supply of water to the service stations located in the powerhouse and in the transformers gallery as well as to the sanitary apparatus located in the service area.

It takes its water from the raw water system and distributes it, by the means of pumps and a piping network, to the service stations.

The pumps and their control panel are located in the service area at level 8.85.

6.13.2.1.6 Drainage of clear water

This system insures the drainage of clear water from all locations in the powerhouse. All waters that may contains contaminants are drained by dedicated systems like the waste water and oily water described hereafter.

Whenever possible, the water is drained by gravity toward the units' downstream channels.

For locations that are lower than these channels, the water is directed toward a sump where pumps are provided to move the water in the closest unit's channel.

6.13.2.1.7 Drainage of waste water

This system insures the drainage of waste water from all sanitary apparatus.

The wastes are directed to a septic tank whose effluent is transferred to a pumping pit. From there, a pump move the liquids from this pit to a leach field located outside the powerhouse. A second pump acts as a standby for the first.

The septic tank, the pit and the pumps are located in the service area at level 8.85.

6.13.2.1.8 Drainage of oily water

This system insures the drainage of oily water from equipment that may leak oil, namely, the transformer and the units governors and oleo pneumatic systems.

The water is directed to a oil/water separator whose effluent is transferred to the system insuring the drainage of clear water described here above. The oil is confined in the separator from which it can be removed by a vacuum truck or any suitable pumping apparatus.

There is one separator in the service area of the powerhouse in the service area at level 4.14 and another in the transformers gallery at level 13.8.

6.13.2.1.9 Compressed air for general service

This system insures the supply of compressed air to the service stations located in the powerhouse and in the transformers gallery.

The compressors, the storage tank and all accessories are located in the service area at level 8.85.

6.13.2.1.10 Compressed air for the surge chamber

This system is provided to maintain an adequate pressure in the surge chamber by compensating the leaks through rock fractures and also the loss of air due to dissolution in the water.

Two compressors are provided with each one able to supply 100% of the required flow. The required pressure is calculated as 6.9 MPa.

6.13.2.2 HVAC

6.13.2.2.1 Introduction

This section describes conceptual engineering for heating, ventilation and air-conditioning of the hydroelectric power plant.

The HVAC systems have for objective to keep a contaminant free atmosphere for the safety and comfort of personnel. These systems, as per specifications, have the following functions:

- air change;
- evacuation of contaminated air;
- maintain of temperature and relative humidity;
- evacuation of smoke and pressurization of emergency exits in order to facilitate the evacuation of personnel and fire control.

6.13.2.2.2 Principles of ventilation

The principles of ventilation of major spaces are shown on the drawings.

In normal operation, the outside air required for the ventilation of the complex comes from ventilation units located in a mechanical room near the exit of the cable tunnel. In the mechanical room, the outside air is mixed with inside air from the complex to adjust the supply air temperature in order to cool the powerhouse, the transformer gallery and the cables tunnel. The supply air is delivered to the powerhouse and the transformer gallery through a plenum located in the cables tunnel.

For the needs of ventilation and safety exit, the cables tunnel is divided in two sections by a firewall:

- one section is reserved as a supply air plenum for the undergrounds installation and as emergency exit. This section is divided in two: a lower and an upper part. In normal operation, the lower and upper part are used as a supply air plenum. In case of fire, the upper part is pressurized with outside air for the pressurization of the lower part, which becomes an emergency exit, and for the pressurization of the galleries (see smoke exhaust chapter);

- the other section is used as a return air plenum from the undergrounds installations to the ventilation units and for the passage of the power cables.

A part of the air supplied to the underground is evacuated through the main access tunnel to assure a minimum air change and the evacuation of combustion gas from vehicles.

6.13.2.2.3 Design criteria

Temperature and ventilation

The temperature and ventilation criteria of inside rooms are given in Table 7.18

Table 6.21 Temperature and ventilation criteria

	Heating T.S. °C	Cooling T.S. °C	Outside Air Change*
Powerhouse	16	30	0.25
Transformer gallery	16	30	0.25
Office	21	25	1
Cables gallery	10	35	0.25

* Calculated for a height of 3 600 m

Climate

The outside temperatures used for the preliminary design are presented in the section "Site description".

Rock temperature

The rock face is an important source of cooling which must be considered in the conception of HVAC systems. To establish the criteria, the heat transfer coefficient presented in the ASHRAE manual (Application Handbook, edition 1999, chapter 26) is used. Two coefficients have been retained for the conception of systems in heating and cooling mode. These coefficients take into account the evolution of the surface rock temperature. The stabilization period is estimated at three years:

- for the sizing of HVAC systems in the cooling mode, the heat transfer coefficient used is 0.57 W/m²°C;
- for the sizing of HVAC systems in the heating mode, the heat transfer coefficient used is 1.2 W/m²°C.

The rock temperature, at the depth of powerhouse, is estimated at 15°C.

Heat loss of production equipments

The permanent heat losses of the production equipments are estimated as follow:

Table 6.22 Major equipment heat loss – Powerhouse

Identification	Heat loss (kW)		
	Quantity	Per unit	Total
Lighting	---	---	25
Excitation cabinet	2	15	30
Excitation transformer	2	20	40
Bus duct	---	1,3 kW/m/3ph.	80
Total heat loss			***175***

Table 6.23 Major equipment heat loss – Transformer cavern

Identification	Heat loss (kW)		
	Quantity	Per unit	Total
Lighting	---	---	20
Power transformer	2	25	50
Total heat loss			***70***

Table 6.24 Heat loss – Cable Tunnel

Identification	Heat loss (kW)		
	Quantity	Per unit	Total
Lighting	---	---	10
Cables	7 200 m	0.015 kW/m/ph.	108
Total heat loss			***118***

Smoke exhaust

The principles of smoke evacuation are shown on the drawings.

In case of fire detection, the ventilation systems are used for the exhaust of smoke and the pressurization of emergency exits. According to the location of detection, the operation is as follow:

1. Fire in the transformer gallery

In case of fire in the transformer gallery, the emergency exit and the powerhouse are pressurized with outside air.

Following the fire alert, the smoke exhaust system is started, to remove the smoke from the transformer gallery. To compensate the air evacuated with smoke, the main access door and the transformer gallery door are opened.

2. Fire in the powerhouse

In case of fire in the powerhouse, the emergency exit and the transformer gallery are pressurized with outside air.

Following the fire alert, the smoke exhaust system is started to remove the smoke from the powerhouse.

To compensate the air evacuated with smoke, the main access door and the powerhouse door are opened.

3. Fire in the main access gallery

In case of fire in the main access gallery, the emergency exit, the transformer gallery and the powerhouse are pressurized with outside air.

Following the fire alert, the smoke exhaust system is started to remove the smoke from the main gallery.

To compensate the air evacuated with smoke, the main access door is opened.

6.13.2.2.4 Heating

The heating of major space and make-up air from outside is principally assured by the heat rejected by the electrical production equipments. Locally, in certain rooms, the heating is completed by the use of forced flow heaters or baseboards.

When required, the heat loss from one generator may also be used.

6.14 Hydro-mechanical equipment

This section describes the hydro mechanical equipment that will be provided for site 6g and gives the summary of the technical characteristics of this equipment.

6.14.1 Intake

6.14.1.1 Gate and Hoist

The water intake is equipped with one intake gate.

The Intake gate is of the fixed wheel type, with wheels mounted on tapper roller bearings. It is fabricated from carbon steel welded construction with upstream skinplate and seals. It is designed to close on its own weight against the full incoming flow to the turbine. The seals are of the elastometer music note type with fluorocarbon cover that reduces friction.

The gate structure is designed and the number and location of wheels are selected in order to withstand the full pressure corresponding to the maximum upstream water level of 667.00 m, the downstream side of the gate being considered empty.

The gate guides are comprised of one upper light section from elevation 670.00.00 m down to about elevation 662.00 m that serves to guide the gate to the heavy lower section from elevation 662.00 to the sill elevation 655.00 m. This heavy section is comprised of one lintel beam, one sill beam and two heavy side guides that are designed to resist the full load of the wheels of the gate and transfer these loads to the concrete structures. The gate guides are made of carbon steel with a high strength machined wheel rolling path and machined stainless steel sealing surfaces.

Opening and closing of the gate the gate are made by a cable drum hoist located at the upper end of the gate shaft at elevation 670.00 m. The hoist mechanical components are designed to withstand the full maximum motor torque that will be limited to 210% of the motor nominal torque.

The hoist is equipped with an electro-mechanical brake that holds the gate in any position but mainly in the normal open position at 300 mm above the lintel.

Normal opening and closing of the gate are set at 1.20 m/minute but the hoist is also equipped with a fan brake that enables emergency closing of the gate, without electric power and by its own weight at a speed of twice normal closing speed.

The hoist is protected by a heated shelter

In order to avoid ice formation mainly on the in inside surface of the upstream wall of the gate shaft, electric heating elements are inserted in tubes embedded in the wall of the shaft of the gate over the exposed height of the shaft above the water level at elevation 667.00 m

6.14.1.2 Trashracks

The trashracks are intended to prevent rocks and debris from entering the intake tunnel and eventually damaging the turbine.

The upstream guides are used mainly for the installation of the trashrack but they are also designed to enable the insertion of a set of stoplogs whenever maintenance is required on the intake guides, lintel and sill and the adjacent liners and concrete structure.

6.14.1.3 Stoplogs

One set of stoplogs is provided. The set of stoplogs is kept outside in a storing area provided on the downstream side of the shelter at elevation 670.00 m. The stoplogs are of carbon steel welded construction. with a downstream skinplate and seals. They are about 1.50 m high and are all identical and interchangeable except for the upper one that is equipped with a filling valve to fill the space between them and the gate. The stoplogs are designed to be put in place or removed only under dead water condition.

Handing of the stoplogs is made by a mobile crane and a lifting beam.

6.14.1.4 Summary of the characteristics of intake equipment

The following table gives the general characteristics of intake equipment.

Table 6.25 Summary of the characteristics of intake equipment

Reference drawings	A 401 A 402
Basic data	
W/L	667.00 m
Sill elevation	655.00 m
Trashracks	
Quantity	1 set
Nominal dimensions	W= 4 300 mm, H= 6 100 mm, t= 900mm
Number of sections	3
Total mass	22 000 kg
Lifting beam	1 500 kg

Stoplogs	
Quantity	1 set
Type	upstream skin plate downstream seals
Nominal dimensions	W= 4 300 mm, h= 6 100 mm, t= 900 mm
Number of stoplogs	4
Total mass	10 000 kg
Lifting beam	1 000kg (different from that for the trashrack)
Embedded parts *(common for the trashrack and the stoplogs)*	
Quantity	1set
Total mass	12 000 kg
Intake gate	
Quantity	1
Type	Fixed wheel , upstream skinplate and seals
Nominal dimensions	W= 3 750, H= 5 500 mm, t= 600 mm
Total mass	12 000 kg
Embedded parts	12 500 kg
Gate hoist	
Quantity	1
Type	cable drum
Lifting capacity	160 kN
Power	4 kW
Mass	7 500 kg
Concrete	
Intake and shelter	760 m³
Intake steel liner	8 000 kg
Gate shaft & shelter heating	(approx)100 kW

6.14.2 Powerhouse

6.14.2.1 Machine Room Crane

6.14.2.1.1 General Description

The machine room of the powerhouse is equipped with one crane which nominal lifting capacity is selected to lift the heaviest load to be handled in the powerhouse that is the alternator rotor.

The crane is a double girder, overhead electric travelling crane. It is equipped with one main hoist and one auxiliary hoist. The auxiliary hoist is overhanging on the side of one of the crane girder and it travels independently from the main hoist and along the bridge main girder.

The crane is operated either using a pendant control station or remote control by the operator standing and walking on the alternator floor at elevation 13.80 m.

6.14.2.1.2 Summary of the technical characteristics

The following table gives the general characteristics of the machine room crane:

Table 6.26 Machine room crane – General Characteristics

Reference Drawing	A 403
Quantity	1
Type	Double girder- Overhead Electric travelling
Lifting capacity	
Main hook	265 metric ton
Auxiliary hook	25 metric ton
Class of service	
Bridge and main hoist	Light duty- infrequent use
Auxiliary hoist	Heavy duty- frequent use
Span	14 350 mm
Overall travelling distance	41 500 mm (approx)
Travelling speed	
Bridge	0-30 m/m
Man hoist trolley	0-25 m/m
Auxiliary hoist trolley	0-25 m/m
Lifting Speed	
Main hook	0-1 m/m
Auxiliary hook	0-10 m/m
Lifting Height	
Main hook	18.00 m
Auxiliary hook	18.00 m
Elevation	
Top of rail	22.80 m
Operator's floor	13.80 m
Control	Variable speed drives Pendant station moving along bridge girder Remote Radio control
Installed Horsepower	
Bridge	45 kW
Man hoist trolley	15 kW
Auxiliary hoist trolley	4 kW
Main hoist	56 kW
Auxiliary hoist	45 kW

6.14.2.2 Tailrace gate

6.14.2.2.1 Description

One gate is provided to isolate either one of the turbine discharge tunnels in order to protect the powerhouse and the turbines from the high tide when the portion of the discharge tunnel in the powerhouse has to be emptied for maintenance purpose.

The tailrace gate is of a simple bulkhead type. It is fabricated from carbon steel welded construction with upstream skinplate, seals and bearing pads. The seals are of the elastometer music note type.

The gate is designed to be put in place and removed only under dead water condition. It is designed to withstand the hydrostatic load corresponding to the high tide water level, the upstream side of the discharge tunnel being considered empty.

One set of embedded guides is provided for each gate shaft. Each set of guides is made of two sections. One light section runs from the floor level of the transformer cavern at elevation 13.80 m and guides the gate down to the heavy lower section from elevation 5.1 m to the sill elevation 1.10 m. This heavy section is comprised of one lintel beam, one sill beam and two heavy side guides. The gate guides are made of carbon steel with a machined bearing path and machined stainless steel sealing surfaces.

The gate is fabricated in two sections and is handled, transferred from one gate shaft to another, and put in place by means of the gantry crane travelling the length of the transformer cavern at elevation 13.80 m.

The gantry crane hoist is of the fixed position and cable drum type, and is equipped with a lifting beam.

When not used, each section of the tailrace gate 1s stored at the upper end of the gate shaft, under the floor elevation.

6.14.2.2.2 Summary of the characteristics of tailrace equipment

The following table gives the general characteristics of tailrace equipment.

Table 6.27 Summary of the characteristics of tailrace equipment

Reference drawing	A 403
Basic data	
W/L	5.05 m
Sill elevation	1.10 m
Tailrace gate	
Quantity	1
Nominal dimensions	W= 3 000 mm, H= 3 200 mm, t= 300 mm
Number of sections	2
Total mass	2 500 kg
Lifting beam	750 kg
Embedded parts	
Quantity	1 set per turbine unit
Mass	5 000 kg per set

Gate lifting equipment	
Quantity	1
Type	Gantry carne- fixed position, cable drum hoist
Lifting capacity	50 kN
Travelling speed	0-30 m/mn
Lifting speed	0-3 m/mn
Mass	3 000 kg

6.14.3 Tunnel No 1 Intake

6.14.3.1 Gates and hoists

The flow passing through the intake of tunnel No1 is controlled by a control structure containing two flow regulating gates.

Since the reliability of this regulating work is very important, two small gates have been provided rather than only one big one, so that if failure of one gate occurs, the flow can be regulated by the adjacent gate.

The gates are of the fixed wheel type. They are fabricated from carbon steel welded construction with upstream skinplate and downstream seals. The seals are of the elastometer music note type with fluorocarbon cover that reduces friction

The gate guides are comprised of one section from the sill elevation 660.00.00 m up to 668.00 m. This heavy section is comprised of one lintel beam, one sill beam and two side guides that are designed to resist the full load of the wheels of the gate and transfer these loads to the concrete structures. The gate guides are made of carbon steel with a high strength machined wheel rolling path and machined stainless steel sealing surfaces.

The gates are designed to close under is own weight an under the full flow passing through the tunnel when the water level is at elevation 682.00 m, the downstream side of the gate being considered empty.

When totally open, the gate are kept about 300 mm above the lintel beam.

Opening and closing of the gates are made at a speed of 0.600 m/min by a means of valve actuators with rising stem. These two gate operators are located in a heated shelter at the upper end of the gate shafts at elevation 683.00 m. The hoist structure and mechanical components are designed to withstand the full dead weight of the gate and frictions and the hydraulic load corresponding to the maximum water level of the tunnel intake canal.

6.14.3.2 Stoplogs

To complete the reliability of this control structure, two sets of stoplogs are provided, one upstream set that can be put in place in either one of the upstream shaft and one downstream set complete with embedded guides. Also to prevent ice formation in the gate shafts, the upstream shaft portion down to 2 m below the minimum water level is heated by means of electric heating elements inserted in tubes that are embedded in the concrete walls of the shaft.

Each set of stoplogs is comprised of two stoplogs that, when not used, are stored in the shelter at elevation 683.00 m and are transferred from one shaft to the adjacent shaft by a upstream and a downstream monorail equipped with a lifting beam.

6.14.3.3 Summary of the characteristics of Tunnel no 1 equipment

The following table gives the general characteristics of Tunnel no 1 equipment.

Table 6.28 Summary of the characteristics of Tunnel no 1 equipment

Reference drawing	A 404
Basic data	
Maximum W/L	682,00 m
Min water level	669.00 m
Sill elevation	660.00 m
hoist floor elevation	683.00 m
Gates	
Quantity	2
Type	fixed wheel, upstream skinplate downstream seals
Nominal dimensions	W= 2 500 mm, H= 3 750 mm, t= 600 mm
Number of sections	2 per gate
Mass of gate	8 500 kg each (total 17 000 kg)
Mass of embedded parts	2 sets @ 11 000 kg each (total 22 000 kg
Gate actuator	
Quantity	2
Type	Electric valve actuator with rising stem
Lifting capacity	170 kN
Power	3 kW
Mass	3 000 kg
Stoplogs	
Quantity	2 sets
Type	Upstream: upstream skinplate and downstream seals downstream: downstream skinplate and seals
Nominal dimensions	W= 2 500 mm, H= 3 750 mm, t= 600 mm
Number of sections	2 per set
Mass	5 000 kg per set (total 10 000 kg)
Mass of embedded parts	4 sets @ 9500 kg each (total38 000 kg)
Monorail	
Quantity	2
Type	Electric cable drum hoist
Lifting capacity	50 kN
Concrete	
Total volume	900 m^3
Gate shaft and Hoist shelter heating	100 kW

6.15 Harbor

6.15.1 Need for Harbor

It is foreseen to have three different phases for the use of harbor facilities at site 6g:

- Initial Phase: for unloading of initial personnel, preliminary camps and civil works equipment for building of camp(s), harbor structure(s), roads, tunnels etc.
- Construction Phase: for unloading personnel for civil works construction, consumables including arctic diesel, additional civil works equipment.
- Operation Phase: for consumables, personnel, spare parts and equipment necessary during the Operation Phase.

Initial phase

It is assumed that all equipment necessary for the initial civil works will be brought to the sites by large transatlantic ships, which will unload their cargo onto barges; which will then be beached on the shore, to transfer the equipment to the shore.

This is common practice for civil works of this nature.

Construction Phase

During this phase, it is expected that heavy equipment will be beached as above during the entire period. The harbor structure will be built and will be used for personnel and light goods when completed. The heavy civil works equipment will be landed by barge as in the Initial Phase.

Operation Phase

During the Operation Phase, it is foreseen that most equipment, personnel and consumables will be unloaded directly to a quay structure. This quay shall be designed for a vessel similar to the Pajuttaat, operated by Royal Arctic Line.

Large type equipment, which is brought to the site(s) by sea-going vessels or which is heavier than the allowable load on the quay, shall be unloaded to the beach by use of barges.

Oil products, like arctic diesel can be brought to the site either in barrels or directly to the quay and pumped to a tank farm.

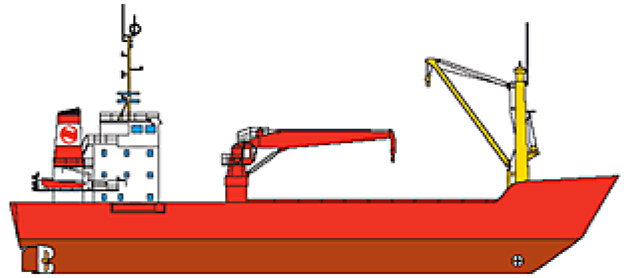
6.15.2 Design ship

During operation of the hydro power facilities equipment, personnel and consumables can be transported by ship to the quay, as mentioned above.

We have been in contact with the operations department of Royal ArcticLine (RAL), which has informed us that RAL is considering modernizing its fleet, serving the smaller towns. The “Design ship” for serving the hydro power facilities in Evighedsfjord and in Godthaabsfjord should be a type similar to the existing Pajuttaat, which can carry a number of 20 ft. containers and other general cargo.

The features for the Pajuttaat are shown on Figure 6.9.

Figure 6.9 Design ship for harbor (Pajuttaat)



Pajuttaat Specs (source: Royal Artic Line)

• ship type:	General Cargo ship with container capacity
• length (m):	63
• beam (m):	12
• draught (m):	3.71
• service speed (knots):	13
• number of containers (TEU+FEU) / loading capacity (m³):	18+4 / 1349
• reefer slot / Cold store capacity (m³):	12 / 396
• loading capacity (ton):	887
• cranes:	1 x 20 SWL + 1 x 30 SWL
• year:	1979

6.15.3 Water levels

Information on water levels and tidal variation is taken from reports published in 2008 by Asiaq for both site 7e and 6g. It is presented in Table 6.29.

Table 6.29 Water levels in Anavaik (Ujarassuit) – Site 6g

	Anavaik (Ujarassuit) Site 6g
Highest Astronomical Tide (HAT)	2.07 m
Mean High Water of Spring Tide	1.64 m
Mean Sea Level	-0.75 m
Mean Low Water of Spring Tide	-2.96 m
Lowest Astronomical Tide (LAT)	-3.46 m
Delay of the tidal wave, Maniitsoq (mean value)	Approx. 10 minutes

6.15.4 Proposed design basis for the quay structure

The design basis proposed for the conceptual/preliminary design of the quay structures in connection with the hydro power facilities for the Operation Phase is presented in tables 6.30 and 6.31.

Table 6.30 Water depth at quay at mean sea level

	Site 6g
LAT (from table above)	2.8 m
Extra over for wind setup/low pressure	0.5 m
Maximum draught	4 m
Keel clearance	1 m
Necessary water depth	*8.3 m*

Table 6.31 Quay height above mean sea level

	Site 6g
LAT (from table above)	2.8 m
Extra over for wind setup	0.5 m
Quay level above high water	1.4 m
Necessary quay depth	*4.7 m*

The quay length is set to 50 m, with bollard of 50 tons. The uniform load on the quay apron is 3 ton/m². The proposed quay plan is shown on drawing no. 104 of the set of drawings.

6.15.5 Beaching and harbor facilities

The proposed location for the harbor at site 6g in Godthabsfjoprd is shown on figures 6.10 and 6.11.

Figure 6.10 Proposed location of harbor at site 6g

Figure 6.11 Close up view of proposed location of harbor at site 6g

The photo on Figure 6.11 confirms the statements that the fjord – Ujarassuit (location of many stones) - is shallow and visibly turbid. The bottom of the fjord was described by the field team as very shallow with stones and rocks and possibly with soft sea bed materials.

There is moreover an indication of a possible threshold marked “Limit for icebergs” at which the icebergs apparently ground, again indicating shallow water.

Two possible locations have been studied for the quay structures. Each position has features for and against the location. One location has been shown for location of beaching.

It is essential for locating the harbor at the most feasible position that water depths are known in the area both in relation to the quay structure and for the navigability for ships using the quay. It is therefore essential that an in-depth bathymetric survey will be carried out in the area. These information were received shortly before issuing this report.

Figure 6.12 is shown on the following page.

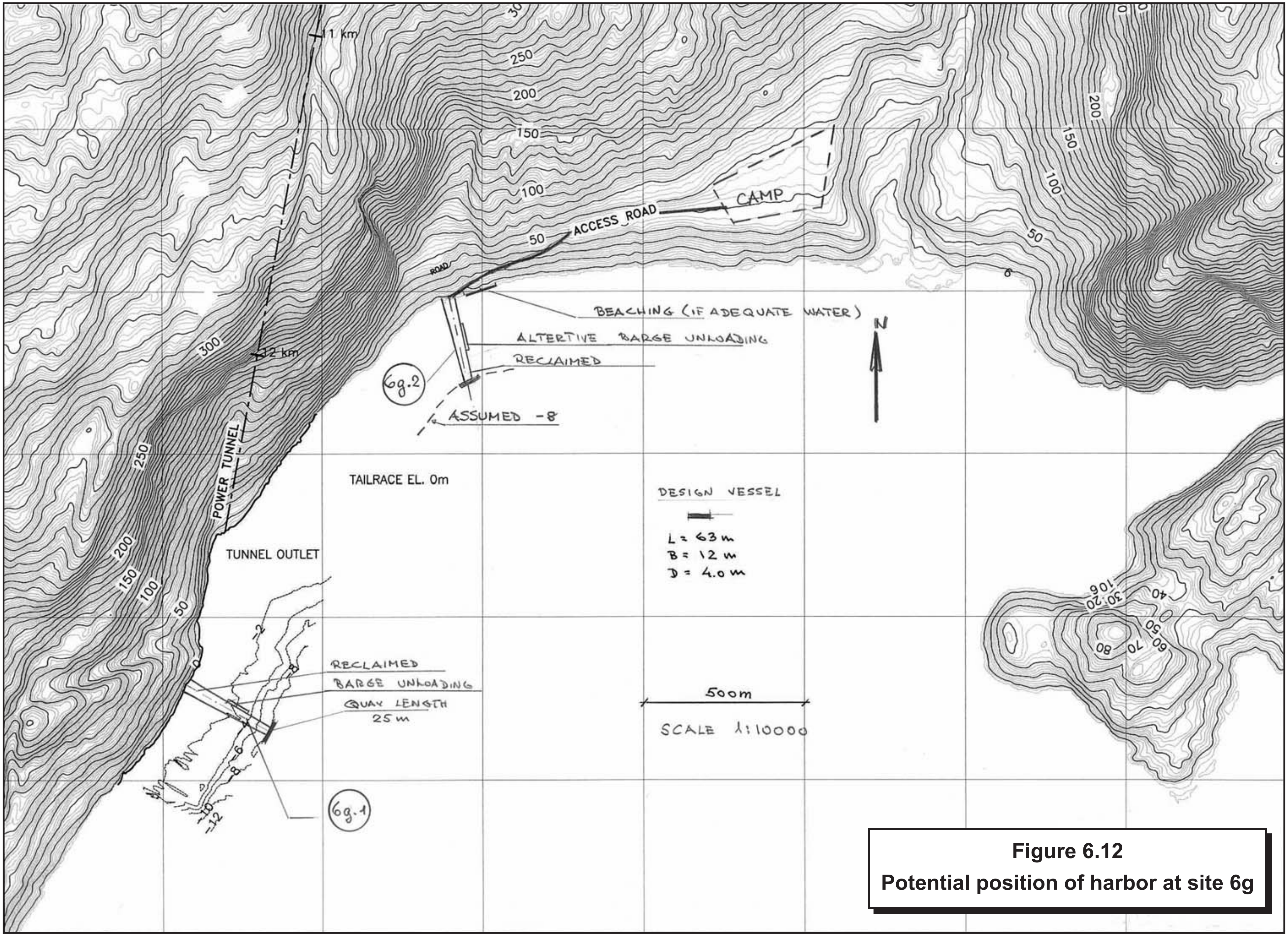


Figure 6.12
Potential position of harbor at site 6g

0518015_Figure 6_12_6g.FH11

6.15.5.1 Beaching and barge transport

Initial beaching of barges is envisaged on the beach at the bottom of the fjord. It is at this point of the project not possible to determine the most feasible location, because there is still missing information on the actual water depths in the bottom of the fjord.

Location for beaching during the construction will be determined based on the most feasible location for the quay structures.

6.15.5.2 Potential location for the quay

The potential locations for the quay are presented in tables 6.32 and 6.33. For all cases, the quay front shall be located at 8.0 m water depth, approximately 250 m from the shore. For location 6g-2, the contour lines have been assumed to be similar to the contours at location 6g-1, since no bathymetry is available at that site. All of the locations are shown on Figure 6.12.

Table 6.32 Position 6g – 1

Position 6g - 1	Pro	Con
Navigability	Easy access, bathymetry available	
Access to camp site and main roads for tunnel and dam work	Reasonable access	Possible road from quay to hinterland shall be cut in the steep rock side.
Access to storage area in valley		Small back area for quay can be established near the quay, by blasting a shelf.
Hinterland for camp	Reasonable conditions for establishing camp facilities on plateau.	

A harbor structure at location 6g-1 is considered acceptable, but back areas for storage near the quay shall be established on reclaimed land and access between quay and hinterland shall be established on the steep mountain slope.

Table 6.33 Position 6g - 2

Position 6g - 2	Pro	Con
Navigability	Acceptable because of the assumptions on water depth at the quay front.	Bathymetry not available
Access to camp site and main roads for tunnel and dam work	Easy access	Major reclamation for quay structure
Access to storage area in valley	Easy access to the sandy valley at the bottom of the fjord Back area for quay can be established near the quay	
Hinterland for camp	Reasonable conditions for establishing camp facilities on plateau above harbor	

Location 6g-2 is considered the most favorable location for the harbor structure and adjacent storage areas, provided that the ships will have access to the quay by having 8 m of water at the bottom of the fjord.

6.16 Access roads

6.16.1 General design basis

6.16.1.1 Road Types

Two types of roads are considered: primary roads and secondary roads. The primary roads will be used both in the construction phase and later on in the operation phase. All primary roads are shown on the drawings.

The secondary roads will mainly be used in the construction phase and are not shown on the drawings. The design of the secondary roads will be the responsibility of the contractor.

6.16.1.2 Phases

Two different phases for the use of the roads are envisaged:

- **Construction Phase**: The roads will be used for transportation of heavy loads, containers, equipments for civil works construction, fuel for vehicles, generators, materials and consumables for the camps and personnel, from the harbor or landing areas to tunnel adits, camps and dam areas.
- **Operation Phase**: The roads will be used for transportation of spare parts and equipment necessary during the operation phase. During the Operation Phase it is foreseen that most equipment, personnel and consumables will be unloaded at the harbor. It is expected that helicopters will be used in both phases for transport of light spare parts and personnel as a supplement to road transport. The helicopters shall operate from approved heliports.

6.16.1.3 Geotechnical conditions

There are no records of permafrost in the area of site 6g, but sporadic permafrost may be expected at high altitude. The roads are designed accordingly to the expected permafrost occurrence.

6.16.1.4 Traffic volume

No traffic forecasts are available. The following design criteria have been used.

During the Construction phase

- The primary roads are recommended to be designed for ten passages of heavy vehicles every day or 4 000 passages per year.

During the Operations phase

- The primary road between the harbor and the power station is recommended to be designed for two passages of heavy vehicles everyday or 500 passages per year.
- The primary road beyond the power station is recommended to be designed for two passages of heavy vehicles every week or 100 passages per year.

6.16.1.5 Vehicles and Axle Loads

The roads are expected to be used by ordinary heavy vehicles, and the pavement is planned for 10 ton axle load with two passages per passing vehicle, according to Danish Standards.

The bearing capacity of the roads must be sufficient for a heavy truck like a CAT 740. The empty weight is 33.1 tons and 72.6 tons when loaded. The truck has 6 wheels. It is expected to carry excavation materials at the construction sites outside the primary roads. The calculated pavement for ordinary heavy vehicle is sufficient for one passage per day with a loaded CAT 740. If the primary roads are used for heavy traffic with the CAT 740 each layer of the pavement and the total thickness has to be increased.

6.16.1.6 Road geometry

The road surfaces will be gravel-paved and shall be carried out with a transverse slope of 4% one-sided or double-sided. According to the literature[8] , the maximum longitudinal slope of roads is 10% at a length of 100 m only. As all roads are constructed outside urban areas and mainly as construction roads, the roads may have a maximum longitudinal slope of 10 % for longer distances and steeper slope, up to about 15%, for shorter distances.

Primary Roads

Primary roads will have one lane, 4-5 m wide with a 0.75 m wide shoulders, for a total of 5.5-6.5 m width. The 5 m wide roads will be used for permanent roads and for roads from the harbor to the main construction sites. The width is increased at narrow bends and in cut-sections to allow for transport of long units and 8 m wide units. Lay-bys are located at maximum distances of 500 m and with free sight. The road width at lay-bys is 8.0 m.

Secondary Roads

Secondary roads run from the primary roads to minor construction sites and borrow areas. They are designed by the contractor.

6.16.1.7 Cross sections

Typical cross sections for the primary roads are shown on drawing no- 103 of the drawings set.

In soil areas where permafrost is expected, the excavation is limited to a minimum to avoid thawing of the frozen soil. In these road sections, there will be no balance of cut and fill. Large quantities of NFS material must be brought in from borrow areas, unless the excavated soil is of NFS quality.

A study of the orthophotos has provided an indication of the surface and cross-section to use along the alignment.

In steep sloping areas the roads will have ditches (refer to section 6.15.1.9).

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[8] Greenland Home Rule, Roads, in Greenlandic towns, Directions for design and execution, Oct. 1987 (in Danish only)

6.16.1.8 Pavement

Based on the traffic volume and axle load mentioned above and a calculation of bearing capacity, the recommended pavement thickness is shown in Table 6.34 below. The material for the wearing course is mechanically stabilized gravel size 0-32 mm. Base course can be the same or screened gravel size 0-50 mm. The sub-base and filter can be selected gravel size 0-80 mm or screened gravel 16-80 mm. The fill below the pavement is selected gravely soil with less clay and silt.

Rock fill is used at steeper rock surfaces. Dents in the surface are filled with minor stones or screened material before the pavement is placed. In areas with heavy traffic with the CAT 740 truck, each layer of pavement and the total thickness have to be increased.

6.16.1.9 Water control

Where the surrounding terrain is rising from the road side, water control measures are included with ditches at a short distance from the road embankment. Where the road is located on fill and the surrounding terrain is sloping away from the road side, no water control measures are specified.

Embankment slope shall be 1:2, if possible. Where the roads cross springs, streams, rivers, etc., different kinds of structures are used:

- bed-level causeways constructed by stones or concrete at a width of 8 m, when the water flow is limited and the water depth can be limited to 0.15 m;
- vented causeways with culverts and concrete superstructure (Irish bridges) where the stream and water flow are larger than above, and where the water flow over the structure can be limited to 0.15 m;
- regular bridges or rock-fill embankments with large diameter culverts where the road crosses major streams or rivers.

Culverts and bridges shall be designed for axle and vehicle loads as mentioned in section 6.16.1.5.

6.16.1.10 Maintenance

Autumn maintenance should be carried out just before the winter season. The cross slope at a gradient of 4% and road shoulders are graded even, in order to allow water to flow from road surface into the ditches. The maintenance also includes cleaning out any poorly working ditches and checking culverts for debris etc.

Spring maintenance should be carried out in early spring and consists mainly of de-icing of culverts and ditches filled with ice. During the spring, dust binding may be done using salt ($CaCl_2$). When the snow has melted the gravel roads are reshaped using a grader. Bed-level causeways are inspected annually, every spring and maintained when necessary. Other culverts and bridges are inspected regularly and maintained when necessary.

During the construction phase, all roads should be maintained as described above.

During the operation phase, only a minor part of the primary road (from the harbor to the power station) is maintained regularly.

The remaining primary and secondary roads will be maintained only if required for new construction or repair works.

6.16.2 Preliminary Design

The design of the roads is based on the alignments shown on drawing 102 of the drawing set. A 3D-model is also received and is prepared for calculation of fill and cut along the planned roads for site 6g.

Longitudinal sections of each part of the roads are prepared based on the information in the 3D-model and orthophotos, and cut and fill quantities are calculated at site 6g using the proposed cross-sections (drawing no. 103).

The alignment is divided into eight parts, for the various structures. For each part, longitudinal sections have been prepared to fit the terrain. The number of water body crossings has been evaluated with orthophotos.

Typical cross sections are shown on drawing no. 103 of the drawing set. The most suitable cross-section was then applied to every stretch of the road, as presented in Table 6.34, along with the cut and fill quantities for every stretch. The number of water body crossings is also presented in Table 6.34.

Table 6.34 Road design at site 6g (by Niras)

Stations		Length (m)	Road type	Width (m)	Pavement (m)	Soil excavation (m^3)	Fill (m^3)	Rock cut (m^3)	Rock fill (m^3)
Harbor to intake									
0+000	0+330	330	C3	5 (6.5)	0.25			18.943	0
0+330	0+500	170	F1	5 (6.5)	0.65	236	3.593		
0+500	1+150	650	C3	5 (6.5)	0.25			37.312	0
1+150	1+300	150	F2	5 (6.5)	0.65	87	3.170		
1+300	2+500	1,200	F2	5 (6.5)	0.65	693	25.364		
2+500	2+900	400	F2	5 (6.5)	0.65	231	8.455		
2+900	3+450	550	F3	5 (6.5)	0.65	445	3.240		
3+450	4+000	550	F2	5 (6.5)	0.65	318	11.625		
4+000	5+100	1,100	F3	5 (6.5)	0.65	889	6.480		
			VC	3	nos.				
5+100	5+990	890	C2	5 (6.5)	0.25			7.093	5.859
5+990	6+100	110	F2	5 (6.5)	0.65	64	2.325		
			VC	2	nos.				
6+100	6+340	240	C2	5 (6.5)	0.25			1.913	1,580
6+340	6+370	30	Bridge	5 (6.5)					
6+370	6+950	580	F3	5 (6.5)	0.65	469	3.416		
			VC	2	nos.				
6+950	7+100	150	C2	5 (6.5)	0.25			1.195	988
7+100	7+600	500	C3	5 (6.5)	0.25			28.702	0
7+600	7+800	200	F2	5 (6.5)	0.65	116	4.227		
7+800	8+230	430	C3	5 (6.5)	0.25			24.684	0
8+230	9+300	1,070	C2	5 (6.5)	0.25			8.527	7,044
9+300	10+000	700	C1	5 (6.5)	0.25			2.911	1,860

Stations		Length (m)	Road type	Width (m)	Pavement (m)	Soil excavation (m^3)	Fill (m^3)	Rock cut (m^3)	Rock fill (m^3)
			VC	1	nos.				
10+000	10+500	500	F2	5 (6.5)	0.65	289	10.568		
10+500	10+950	450	F3	5 (6.5)	0.65	364	2.651		
10+950	11+250	300	F2	5 (6.5)	0.65	173	6.341		
11+250	11+450	200	F3	5 (6.5)	0.65	162	1.178		
11+450	11+900	450	C1	5 (6.5)	0.25			1.871	1.195
			VC	1	nos.				
11+900	13+200	1,300	F1	5 (6.5)	0.65	1.802	27.477		
13+200	13+650	450	F2	5 (6.5)	0.65	260	9.511		
13+650	14+300	650	F3	5 (6.5)	0.65	526	3.829		
14+300	14+700	400	F1	5 (6.5)	0.65	554	8.455		
14+700	15+500	800	F3	5 (6.5)	0.65	647	4.712		
			VC	1	nos.				
15+500	15+900	400	F1	5 (6.5)	0.65	554	8.455		
15+900	16+100	200	F3	5 (6.5)	0.65	162	1.178		
16+100	16+600	500	F2	5 (6.5)	0.65	289	10.568		
			VC	1	nos.				
16+600	16+950	350	F1	5 (6.5)	0.65	485	7.398		
16+950	18+200	1,250	F3	5 (6.5)	0.65	1.011	7.363		
18+200	18+500	300	F1	5 (6.5)	0.65	416	6.341		
			VC	1	nos.				
18+500	18+650	150	F2	5 (6.5)	0.65	87	3.170		
18+650	18+754	104	C2	5 (6.5)	0.25			829	685
	Subtotal	*18,754*				*11,329*	*191.090*	*133.980*	*19.211*
Intake to Lake Imarsuaq									
0+000	0+300	300	F3	4 (5.5)	0.45	254	1.670		
VC	nos.								
0+300	0+520	220	F1	4 (5.5)	0.45	186	3.887		
0+520	0+610	90	C2	4 (5.5)	0.25			610	468
0+610	1+420	810	F3	4 (5.5)	0.45	686	4.508		
1+420	1+550	130	C2	4 (5.5)	0.25			881	676
1+550	1+750	200	F1	4 (5.5)	0.45	169	3.533		
1+750	1+810	60	C2	4 (5.5)	0.25			407	312
1+810	1+910	100	F3	4 (5.5)	0.45	85	557		
1+910	2+200	290	C1	4 (5.5)	0.25			1.053	597
2+200	2+470	270	F3	4 (5.5)	0.45	229	1.503		
2+470	2+550	80	C1	4 (5.5)	0.25			290	165
2+550	3+000	450	F1	4 (5.5)	0.45	381	7.950		
			VC	1	nos.				
3+000	3+390	390	C1	4 (5.5)	0.25			1.416	802

Stations		Length (m)	Road type	Width (m)	Pavement (m)	Soil excavation (m³)	Fill (m³)	Rock cut (m³)	Rock fill (m³)
3+390	3+500	110	F3	4 (5.5)	0.45	93	612		
3+500	3+880	380	C1	4 (5.5)	0.25			1.379	782
3+880	4+000	120	C2	4 (5.5)	0.25			813	624
4+000	4+940	940	C1	4 (5.5)	0.25			3.412	1,934
4+940	5+010	70	Bridge	4 (5.5)					
5+010	5+800	790	C1	4 (5.5)	0.25			2.868	1,625
5+800	5+900	100	F3	4 (5.5)	0.45	85	557		
			VC	1	nos.				
5+900	6+840	940	C1	4 (5.5)	0.25			3.412	1,934
6+840	8+300	1,460	F3	4 (5.5)	0.45	1.237	8.126		
8+300	8+460	160	C1	4 (5.5)	0.25			581	329
8+460	8+640	180	F3	4 (5.5)	0.45	152	1.002		
8+640	9+000	360	F2	4 (5.5)	0.45		6.360		
9+000	9+390	390	F1	4 (5.5)	0.45	330	6.890		
9+390	10+300	910	C3	4 (5.5)	0.25			43.604	0
			VC	1	nos.				
10+300	10+400	100	F1	4 (5.5)	0.45	85	1.767		
10+400	11+000	600	F2	4 (5.5)	0.45	0	10.600		
			VC	1	nos.				
11+000	12+630	1,630	F3	4 (5.5)	0.45	1.381	9.073		
			VC	2	nos.				
12+630	12+800	170	C1	4 (5.5)	0.25			617	350
			VC	1	nos.				
12+800	12+950	150	F3	4 (5.5)	0.45	127	835		
12+950	13+100	150	C2	4 (5.5)	0.25			1.016	780
13+100	13+930	830	F3	4 (5.5)	0.45	703	4.620		
13+930	14+100	170	F3	4 (5.5)	0.45	144	946		
			VC	1	nos.				
14+100	16+150	2,050	F3	4 (5.5)	0.45	1.736	11.410		
			VC	1	nos.				
16+150	16+730	580	C1	4 (5.5)	0.25			2.105	1,193
16+730	17+070	340	F3	4 (5.5)	0.45	288	1.892		
17+070	18+100	1,030	F2	4 (5.5)	0.45	0	18.196		
			VC	1	nos.				
18+100	18+350	250	F2	4 (5.5)	0.45	0	4.417		
18+350	18+510	160	C2	4 (5.5)	0.25			1.084	832
18+510	18+800	290	F1	4 (5.5)	0.45	246	5.123		
18+800	19+000	200	C2	4 (5.5)	0.25			1.355	1,041
19+000	19+600	600	F3	4 (5.5)	0.45	508	3.340		
19+600	19+805	205	C2	4 (5.5)	0.25			1.389	1,067
	Subtotal	*19,805*				*9,105*	*119.374*	*68.292*	*15.511*

Stations		Length (m)	Road type	Width (m)	Pavement (m)	Soil excavation (m³)	Fill (m³)	Rock cut (m³)	Rock fill (m³)
Access road to Canals 1 and 2									
0+000	0+400	400	F3	4 (5.5)	0.45	339	2.226		
0+400	0+750	350	F2	4 (5.5)	0.45	0	6.183		
0+750	1+070	320	F3	4 (5.5)	0.45	271	1.781		
1+070	1+200	130	F2	4 (5.5)	0.45	0	2.297		
1+200	2+710	1,510	F3	4 (5.5)	0.45	1.279	8.405		
			VC	1					
2+710	3+100	390	C2	4 (5.5)	0.25			2.643	2,029
3+100	4+280	1,180	F3	4 (5.5)	0.45	999	6.568		
			VC	2					
4+280	4+800	520	F2	4 (5.5)	0.45	0	9.186		
4+800	5+197	397	F1	4 (5.5)	0.45	336	7.013		
	Subtotal	*5,197*				*3,224*	*43.659*	*2.643*	*2.029*
Access road to Dam 5									
0+000	0+878	878	C2	4 (5.5)	0.25			5.949	4,568
Access road to Canal 4									
0+000	0+500	500	C1	4 (5.5)	0.25			1.815	1,029
0+500	1+000	500	C2	4 (5.5)	0.25			3.388	2,602
1+000	1+500	500	C1	4 (5.5)	0.25			1.815	1,029
1+500	2+047	547	C2	4 (5.5)	0.25			3.706	2,846
	Subtotal	*2,925*	*0*					*16.673*	*12.074*
Bed level causeways			***122***	***nos.***					
	Grand total	***46,681***				***23,658***	***354.123***	***221.588***	***48.825***

6.17 Construction Camps

6.17.1 Camp capacity

The projected capacity of the camps is estimated and is listed in Table 6.35. They are planned to be used during all of the construction period. Space for the transmission line workers is included in the projected capacity of the camps.

Table 6.35 Projected capacities of camps

	Camp 1	Camp 2	Camp 3	Camp 4
Workers	306	162	111	132
Staff	102	54	37	44
Total	***408***	***216***	***148***	***176***

The work will be carried out in shift work. The accommodation buildings are based on 100% capacity, while the camp facilities are based on 70% capacity, corresponding to the working day shift. The service buildings must then accommodate respectively 286, 152, 104 and 124 persons at the same time for camps 1, 2, 3 and 4.

The camps shall be self supporting with power and water supply while the sewage treatment plant (STP) and waste disposal are common for the camp and the construction site. The camp will consist of a number of accommodations blocks, service facilities such as kitchen, dining and laundry (KDL), recreation hall (RH), offices, storage facilities and workshops. A helicopter pad is included in the layout.

At the beginning of the first year of construction, a “starter” camp will be constructed at camp 1, which shall accommodate 70 people (60 workers and 10 staff).

All buildings and other facilities shall be designed to a Greenlandic standard observing the Greenland Building Code.

6.17.2 Description of camps facilities

6.17.2.1 Camp area layout

At site 6g, four camps will be constructed:

1. Camp 1near the powerhouse and the tailrace tunnel exit at sea level, where workers for the powerhouse and adjacent tunnels will live.
2. Camp 2 near the intake structure, near the shores of Lake Tussaap Tasia. Workers for the intake structure, Dam 1, Dam 2 and Spillway 1 will stay at this camp,
3. Camp 3 near the Tunnel 1 on the shores of the Little Lake. Workers for Tunnel 1, Canals 1 and 2, and Dam 3 will stay at this camp,
4. Camp 4 at the northern end of Lake Imarsuaq, only accessible by water route. Workers for Dams 4 and 5, Canals 3 and 4 and Spillway 2 will live at this camp.

The layouts for the camps are shown on drawings no. 105 to 108. The layouts of the camps consider a minimum of ground leveling. The long accommodation buildings are located along the topographical contours and the larger service buildings are located on flat areas.

The material from rock excavation for the accommodation buildings are used for leveling the ground for the service buildings.

Each camp consists of four areas:

1. central area with RH, KDL, offices;
2. accommodation area north;
3. accommodation area south;
4. industrial area with storage, workshops and power station.

The distance between the buildings must comply with the distance criteria in the Greenland Building Code. They are shown in Table 6.36.

Table 6.36 Distance criteria for camp buildings

Distance criteria in meters	Wooden facing	Steel facing
Accommodation buildings with more than 10 beds	10	5
Buildings more than 600 m² or with more than 50 persons assembled	10	5
Buildings containing inflammable storage, power stations, fire stations etc.	10	5
Other buildings one storey	5	2.5
Other buildings, more than one storey	5	3.5

For calculating the distance between two buildings the distance criteria for both buildings must be added.

6.17.2.2 Accommodation buildings

The accommodation buildings are constructed of two story modules.

Each building comprises:

- sleeping rooms having an area of 9 m²;
- living rooms;
- private bathrooms, toilets and washbasins;
- washing machines and dryers;
- two modules for staircase.

Each building contains a total of 58 modules, each of them 2.9 m × 8.4 m (24.36 m²). The modules are constructed with timber, with a wood facing and insulation for arctic climate. The foundations are steel beams on gravel pads. The beams are tied to anchors in the gravel pad or rock anchors.

The buildings for workers will be equipped with two bed sleeping rooms, while the buildings for the management staff will have single rooms.

The distance between two accommodation buildings is not less than 20 m for fire safety. Each sleeping room must be a fire cell and each wing with 20 rooms is considered a fire section. Each room is equipped with fire alarm system, and a fire hose with water pressure is installed in each corridor

All rooms are heated with electrical radiators. Hot water is produced in water heaters in each module. Water installations are limited to the central common rooms with bath, toilets and laundry facilities.

6.17.2.3 Service buildings

Office for camp administration and infirmary

One two storey building, constructed by the same type of modules as the accommodation buildings, contains offices and rooms for the infirmary. Foundation, heating, fire safety and other installations are as for the accommodation buildings.

Kitchen, dining and laundry (KDL)

The dining hall is designed to accommodate the number of workers during the day shift all at the same time (286, 152, 104 and 124 persons respectively for camps 1 to 4). The necessary area is estimated to 1.2 m² per seat. The kitchen area including day storage is estimated to 50% of the dining area. The laundry area is estimated to one module (2.9 x 8.4 m) per 200 people.

The KDL is arranged in one large building constructed by modules like the accommodation buildings or as a steel frame building with insulation and corrugated steel facing. The foundation is steel beams on a gravel pad. A small KDL is first established at the “starter” camp.

All of the buildings are heated with electrical heaters.

Recreation hall

The recreation facilities comprise gymnasiums, meeting hall, bar, shops, internet suite, etc. The facilities are included in one or two buildings next to the KDL. The area is estimated to 1.5 m² per person. Construction and heating of the buildings are similar to the KDL.

6.17.2.4 Storage facilities

The supply of goods will take place by ship to the harbor in Godthabsfjord.

The container storage area at the harbor is limited and the containers for the camp must be moved to the camp area shortly after the ship arrival. Between ship arrivals, the containers are stripped to the storage buildings or directly to the kitchen storage rooms. The storage facilities in the camp comprises container yards and three storage buildings for cold storage (unheated), heated storage and refrigerated storage respectively.

Local storage of gasoil for the power station, heating and vehicles is established.

The storage buildings are constructed by steel frames with corrugated steel facing. The foundation is steel beams on gravel pads and ground anchors may be necessary. The heated storage and refrigerated storage buildings are insulated, and the heating of the buildings is with oil fired unit heaters.

6.17.2.5 Workshop and garage

One building similar to the storage buildings comprise workshops for camp maintenance, mechanical, carpenter etc. The electrical workshop is included in the power station building. A garage for vehicle repair and firefighting equipment is also established in a steel building similar to the storage buildings.

6.17.2.6 Power supply

The design criterion for the power supply is to provide 8 kW of power per person. Diesel generators to meet the required power at each camp are provided. The generators are placed in an insulated steel building which also holds switchboard and operation panel for the power station, electrical workshop and water treatment plant.

6.17.2.7 Water supply

The water supply comprises a reservoir, a raw water pipeline, water treatment plant, storage tank for treated water and water mains to consumers. The water consumption is estimated to 200 liters per person per day.

The reservoir will consist of an insulated storage tank designed for a 1 month capacity of water. The water will run from the reservoir to all the buildings by gravity through a siphon and pipelines. The pipelines are pre-insulated and heat traced, placed on sleepers on the ground. The pipelines will cross the roads in culverts.

At the site of camp 1, it is planned to pump water from a small temporary reserve created by damming the small river near the camp, while for camps 2 to 4, it is planned to pump water directly from the adjacent lakes.

The water treatment plant is located in the same building as the power station. Water quality from the lakes varies over the year. It must be taken into consideration when dimensioning the water treatment that in the snow melting period the level of organic matter will rise (called “Flom”).

The water is treated to obtain a water quality accordingly to Greenlandic standards.

6.17.2.8 Waste water

All waste water is collected in a sewer system and led to a sewage treatment plant (STP). Sewer mains consist of insulated pipelines from all buildings to the STP. The sewer mains will follow the same alignment as the water mains. The daily volume to be treated corresponds to the projected water consumption of 200 liters per person per day.

6.17.2.9 Waste disposal

The waste from the camps comprises:

- combustibles material, wood, garbage, waste oil, etc.;
- metal scrap;
- hazardous and toxic waste;
- STP sludge.

The production of waste in Greenlandic towns is estimated to 1.5-2 kg per person per day. A value of 2 kg per man is used for the estimation of the waste volume to be produced at each camp. The proposed solution is a containerized incinerator.

6.17.2.10 Roads

The roads include:

- primary road between the construction site and the central part of the camp;
- secondary roads between camp centre and buildings.

The primary road is design for heavy traffic with two lanes, for a total width of 6 m, and 1.5 m shoulders. The pavement is a thickness of 0.65 m of gravel. The distance between the centerline of the roads and buildings shall be not less than 10 m.

All accommodation buildings are connected with the primary road by secondary roads. They are used during construction of the buildings, but shall be maintained for light vehicle traffic for the fire engine and in connection with repair, waste removal etc. The width of the secondary roads is 4 m and 1.5 m shoulders.

Outside entrances to the buildings and level area of gravel fill serves as parking area and turning area at dead end roads.

A gravel area with a diameter of 22.2 m is also established near the camp for the heliport. It is equipped with wind sock and fire extinguishers.

6.17.2.11 Telecommunications

The telecommunication comprises telephone, cellular phone transmission, internet connection, TV signals and radio broadcast.

All telecommunication will be ensured by a link to the existing radio link (TELE-Greenland) via a repeater station. The repeater station must be established on a mountain top at the same standard as a normal TELE Greenland – site. It includes a diesel generator with intermediate operation with solar battery and traditional batteries. The capacity is 8 x 2 Mbps un-doubled.

A cable from the telecom mast leads to all buildings following the power cable alignment. The cable also carries alarm signals to a central room in the office building.

Stationary telephones are installed in the office building, RH, KDL, garage, workshops and power station. In the accommodation buildings only one stationary telephone is installed. All other telephone connection is by cellular phone to a transmitter on the telecom mast.

TV connections are installed in the RH, and TV rooms in the accommodation buildings. Hotspots are established in all buildings for Wi-Fi internet connection. A number of local and international radio stations will be broadcasted from a transmitter on the telecom link mast, facilitating radio listening all over the area including the construction site.

6.17.2.12 Vehicles

The fleet of vehicles for operation of each of the camp includes:

- double cabin 4WD pick-ups, for managers, maintenance, cleaning, power house, security, etc.;
- trucks with crane for transportation and snow clearing;
- forklift truck for handling containers;
- tractor for waste handling and snow clearing;
- snow clearing equipment for trucks;
- fire engine.

6.17.3 Summary of facilities

The facilities that will be included in camps 1 to 4 are presented in Table 6.37, with their respective area.

Table 6.37 Camp facilities at site 6g

	Camp 1		Camp 2		Camp 3		Camp 4	
	Nb.	m²	Nb.	m²	Nb.	m²	Nb.	m²
Site preparation (including roads)	250 m x 250 m = 62,500 m²		250 m x 250 m = 62,500 m²		240 m x 240 m = 57,600 m²		100 m x 300 m = 30,000 m²	
Infrastructures								
• Power station (4.1, 2.2, 1.5 and 1.8 MW)	1	700	1	600	1	500	1	400
• Water supply plan	1		1		1		1	
• Sewer plan	1		1		1		1	
• Incinerator	1		1		1		1	
• Telecommunications	1		1		1		1	
Sleeping buildings								
• Workers : 40 modules/building (2 beds/room)	2	2 825	1	1 410	1	1 410	1	1 410
• Staff : 40 modules/building (1 bed/room) (Common rooms included-18 modules/building)	2	2 825	1	1 410	1	1 410	1	1 410
Service buildings								
• Offices	1	292	1	146	1	97	1	122
• Dining	1	341	1	195	1	122	1	146
• Kitchen (including day storage)	1	171	1	97	1	61	1	73
• Laundry	1	73	1	49	1	24	1	24
• Recreation hall	1	428	1	227	1	155	1	185
• Infirmary	1	49	1	24	1	12	1	24
Workshops								
• Mechanical	1	200	1	150	1	100	1	100
• Electrical	1	200	1	150	1	100	1	100
• Carpenter	1	200	1	150	1	100	1	100
Garage & Fire fighting (incl. fire figthting equip.)	1	400	1	300	1	150	1	200
Storage buildings (2 months + 1 mth reserve)								
• Frozen	1	10 344	1	2 357	1	1 615	1	1 920
• Cold (refrigerated)	1	10 344	1	2 357	1	1 615	1	1 920
• Dry (non perishable)	1	22 412	1	5 107	1	3 499	1	4 161

7 Project schedule

7.1 Introduction

The prefeasibility project schedule yields a 5 year construction program. The project schedule confirms the feasibility of the project as per Alcoa's parameters for site 6g. The project schedule is presented in Appendix 1 of the current report in a summarized high level view. This present section will describe the construction methodology, assumptions, schedule highlights and preliminary critical path.

7.2 Schedule Elements

The attached schedule has been produced in MS Project and is displayed in a Gantt bar chart format with supporting legend. The defined summary activities viewed include activity description, duration and proposed start and finish dates. These activities and summaries represent the high level critical components, including schedule dependencies and constraints.

The project schedule is represented by groups by types of Work.

- Tunnels
- Powerhouse
- Headrace
- Intake
- Spillways
- Dams
- Canals

7.2.1 Schedule Assumptions

7.2.1.1 Daylight/Climatic Conditions

- The summer period has extended daylight, permitting 2 daytime working shifts;
- The limitation of Winter daylight and climatic conditions reduce the amount of above ground construction work;
- Elements such as wind, snow and rain are considerations in the present schedule;
- Helicopter lifting and travel is limited to daytime operation;
- Due to fjord freezing and sea ice , shipments by sea will be received at site between June and October
- Some underground works such as tunnel excavation, concreting and turbine installation are not weather nor daylight dependent allowing for continual activity.

7.2.1.2 Workforce Schedules

- Workcrew 400 hours on and 2 weeks off rotation
- Staff: 1 Month on and 2 weeks off rotation
- 26 working days per month
- 6 day work crew
- 10 hours work shift
- All underground work is calculated on 2 shift per day and is not weather dependent

7.2.1.3 Road Construction Methodology

Many sections of the access road require rock excavation on steep hill side rock terrain. In order to shorten the construction duration of the road, is proposed to start with a 4 meter wide penetration track permitting a faster progression and access for the equipment required to widen the road to final dimensions at a later date.

Some sections can be reached only by air. The 4 meter penetration track is then realized by air lifting construction equipment, materials and personnel by helicopter

7.2.2 Seasonal Work Activities

The main construction activities to be conducted during each season are outlined below.

Summer

- Roads
- Excavation (rock and overburden)
- Backfill
- Tunneling
- Concrete

Seasonal Transition Periods (Spring and Fall seasons)

- Tunneling
- Concrete (with outside shelter)

Winter

- Tunneling
- Rock Excavation and blasting (1 daylight shift)
- Concrete (with outside shelter)

The productivities of the major activities are presented in the table below. The estimated durations are a total amount per type of activity. Excavation shifts follow along with anticipated sea shipment volumes.

Table 7.1 Major Activities Productivities

Name	Month	Day	Days per month
TBM's (Tunnel Boring Machine) excavation (QTY 2) excluding installation and removing)	650	25	26
Drill and Blast excavation (30 to 100 m² – access tunnels)	120	+/-5	26
Drill and Blast excavation (17.4 m² – cable tunnels)	56	+/-2	26

- Earth Moving / Rock excavation: 20 hours@2 Shifts per day if required (Seasonal daylight restrictions);
- Typical shipment by sea: 10,000 metric tons of materials and 20 000 m³ of equipment or a combination of both.

The total excavation volumes along with the main quantities to be used during construction for the five years of the project are presented in the following table.

Table 7.2 Main Quantities

Name	M^3	Tons	Liters
Tunnels excavated by TBM	225 000		
Tunnels excavated by Drill and Blast	346 000		
Open surface excavation Rock	102 100		
Open surface excavation Overburden	232 000		
Dam Rockfill Volume	533 000		
Asphalt Rockfill Volume	4 700		
Concrete	14 900		
Cement		5600	
Rebar		980	
Bitumen		555	
Structural Steel		160	
Steel Liner		460	
Fuel Requirements			56 200 000

7.2.3 Workers and Staff

The total project man hours requirement is the following :

- Workers = 2,400,000 Man Hours
- Staff = 1,159,200 Man Hours

7.3 Program

7.3.1 Critical Items

The isolated fjord is where the first roll out of the project will begin. The site is accessible after June thaw to establish a pre camp, unloading of ship(s) for supplies and equipment.

After establishment of preliminary pre camp and “beaching of equipment” The major activity is the road building and excavation inland towards construction sites and camp.

Based on the schedule provided and analysis the primary critical path are identified as follows.

- Establishing the initial pre-camp and port site
- Road construction to establish (4) work base camps

7.3.2 Primary Logistics

The project site is in a remote location which is dependent on well planned and executed logistic support. Both sea and air support are critical to establish and then continually sustain the project site and operations.

7.3.3 Sea Shipments

Including the initial site beach landing and camp set up, 11 sea shipments are planned over the 5 years project duration. There are 4 sea shipments of 20,000 m³ and 7 material shipments of 10,000 metric tons. Temporary floating docks and transport barges will be utilized to move materials to the project camp site from the ships. This will provide construction equipment and materials for fabrication of aggregates, concrete, rebar, asphalt, fuel and explosives.

Construction equipment, temporary installations, transportation vehicles and camp modules will also be by sea shipments.

7.3.4 Air Support

Personnel working on the project will arrive and depart at Kangerlussuaq, the Greenland International airport. Shuttling of work crews to the main project work sites will be via helicopter. This is the existing condition for the entire project including the 2 hydro projects, the transmission lines and the smelter. Weekly incoming Air cargo shipments to the local airport are required in order to deliver such items as perishable food and other required items. The helicopter will then transport these items and personnel to project sites.

Helicopters are needed for the transmission line construction including heavy type craft. An overall logistic operation for the whole project could be foreseen regarding the air support needs. A good coordination between all the construction sites would represent definite cost saving. This is taken into consideration in the pricing of the utilization of helicopters for access road sections not accessible otherwise. In this case, all transportation of workers, construction equipment and materials is done by helicopter.

7.3.5 Inland Water Route

The road construction to Camp 4 is over difficult terrain therefore the use of an Inland water passage and Ice Bridge has been incorporated in order to optimize schedule and cost.

Tug boats and tow barges will be used to move equipment and materials

Personnel will be transported to work site via outboard motor boats.

Conventional transport vehicles will be used during the season of the ice bridge.

7.3.6 Major activities start time

The following table indicates the start time of the major activities. The dates are shown in months after receipt of order.

Table 7.3 Estimated start date for construction activities

Name	Months ARO (After receipt of order)
Year 1	
Start Pre Camp, Floating docking facilities	6
Start Tunnels	11
Start Powerhouse	11

Name	Months ARO (After receipt of order)
Complete Order Procurement TBM (Tunnel Boring Machine)	13
Year 2	
Start Establish Camp 2	17
Start TBM Erection	18
Start Intake	20
Start Spillway 1	20
Start DAM 1	24
Start DAM 2	21
Start Head Race (TBM) Boring	21
Year 3	
Establish Start Camp 3	29
Start Canal 1	32
Start Canal 2	35
Start Tunnel 1	31
Start DAM 3	32
Start Establish Camp 4	31
Start Canal 4	33
Start Canal 3	32
Start Dam 5	32
Start Dam 4 and Spillway 2	33
Year 4	
Start Intake Structure	40
Start Dam 1 Diversion Tunnel plugs and Grouting	44
Start Tunnel 1 Regulating Structure	37
Start Dam 3, 5 and 4 Rock Fill	42
Year 5	
Complete Wet and Dry Commissioning	55

The following table indicates the summarized activities by summer season. The summarized activities dates are shown in Months after receipt of order and Months after landing.

Table 7.4 Summary of Key Road and Camp construction Activities

Season	Name	Months ARO (After receipt of order)	Months after landing
First summer (5 months duration)	Landing establish pre camp	6	
	Start road construction to Camp 1		1
	Start Camp 1 to Intake area Camp 2		1
	Bridge		2
	Installation of main camp modules	1	
Second summer (5 months duration)	Complete Road Camp 1 to Intake area Camp 2	16	
	Start Camp 2 to Lake Imarsuaq Camp 3	19	
	Installation of camp modules	17	

Season	Name	Months ARO (After receipt of order)	Months after landing
Third (5 months duration)	Complete Road Camp 2 to Lake Imarsuaq Camp 3	28	
	Bridge	21	
	Establish water transport from Camp 3 to Camp 4	31	
	Installation of camp 3 modules	29	
	Installation of camp 4 modules	30	

8 Project cost estimation

8.1 Introduction

This present section describes the organization, assumptions and results of the project financial cost estimate of 6g. The detailed cost estimate is included in Appendix 1 while the high level summary is included on the following page. Highlights are the following:

Total direct cost: $191.2M
Total indirect cost: $498.5M
Total project cost: $689.7M

The cost estimate has been prepared using the Alcoa Project WBS with high level activities being the following:

Direct costs

3100 Harbor site preparation
3200 Port facility
3300 Primary road construction
3400 Civil works related to powerhouse, tailrace, tunnels and surge tunnel
3500 Civil works related to power tunnel
3600 Dams and spillways
3700 Electrical works
3800 Mechanical and electrical works
3900 Architectural works

Indirect costs

6100 Temporary construction facilities
6200 Construction services
6300 Construction equipment, tools and supplies
6400 Material transportation
6500 Construction camps
6600 Insurance, taxes, permits and fees
6700 Miscellaneous freight
7000 EPCM home office
8000 EPCM field office
9000 Contingency

For each of these high level items, the following details are provided:

- Man hours;
- Man power cost;
- Consumable material cost;
- Permanent material cost;
- Equipment operation cost;
- Fuel cost; and
- Total cost

The estimate in Appendix 1 includes a breakdown of the high level activities and a further breakdown per second level WBS element.

The estimates provided are all in US dollars. The exchange rates used for other currency conversions are the following:

- Canadian to US dollar = 0.9
- Euro to the US dollar = 0.65675

8.2 Cost estimate methodology

The cost estimate uses the contractor methodology which takes into consideration construction methods, with previously witnessed productivities (man hour requirements), adjusted to the particular conditions of this project, being the remoteness, permafrost and temperature, summer and winter daylight conditions and the wind, snow and rain statistics of the area and of course, transportation logistics particularities (sea, air and boat).

8.3 Estimate quantities and unit rates

8.3.1 Direct costs

The estimate quantities for the direct construction elements were provided by the designer teams, based on preliminary drawings, but which have included design optimizations. Permanent equipment prices were based on budgetary quotes received from suppliers and material costs based on present world prices. It should be noted that transportation costs related to these last two items are considered indirect costs and discussed below.

All construction equipment operation and maintenance costs are also considered direct costs. The largest quantity commodity is fuel with a unit price at $0.72/liter, which is the present (August 2009) price in Greenland.

Other major commodity unit prices are the following:

- Cement: $73/mt (from North America)
- Reinforcing steel: $689/mt (from North America)
- Bitumen: $625/mt (from North America)

With approximately 1.6 million direct man hours, man power average base labour rate plays a big role in the overall cost estimate; it is considered to be $24/hour (including premiums, overtime and overhead). This rate was calculated using the following assumptions:

- Base labour hourly rate: $14.70 (in Greenland)
- Shift work hourly premium: $ 1.20
- Overtime premium (%): 50%
- Overhead (%): 26.36% (based on Greenland laws)
- Project work week: 60 hours

8.3.2 Indirect costs

The following section describes details concerning project indirects. Although man hours are required throughout most of the indirect budget elements, it is worth noting that the total indirect man hour count is approximately 0.5 million, with the same all inclusive hourly rate of $24//hour, as described above.

Total indirect costs amount to approximately **$500M**, with one third of this total amount required for construction, maintenance, catering and operations of the camps.

Below is a brief description of what has been foreseen in each of the principal indirect cost codes and pertinent cost information.

8.3.2.1 Temporary construction facilities (6100)

The estimate preparation for temporary construction facilities involved determining work site requirements. They are as follows:

- Buildings at all four construction sites (including an office, garage, trade shop, warehouse, dry house, washroom and foreman office), sized to the peak requirement, including site preparation, installation and dismantling;
- Concrete batch plant for each site (installation and dismantling)
- Crushing plant (transportable from site to site)
- Asphalt batch plant (at 2 sites)
- Explosive depots (at the main camp, sites 2, 3 and 4 and road sites)

The above facilities represent **$5.6M** in project cost.

The above facilities require the support of roads and walkways as well as all utilities totaling **$11.1M**.

8.3.2.2 Construction services (6200)

Construction services include all construction site operational requirements (excluding any camp requirements – which are included in 6500). This includes the following:

- Building maintenance;
- Operational vehicles such as fuel trucks, mechanic's and welding trucks, light vehicles (pick ups, SUVs and ambulance), for all four sites;
- Shop operations;
- Road maintenance;
- Communication (radio and cellular);
- Operation of the water route;
- Final site cleanup;
- Material handling and warehousing (including equipment and man hours, especially fuel depots);
- NDE and QA/QC testing;
- Surveying (excluding man hours);
- Site security;
- Man power transportation (point of origin to appropriate camp); and
- General expenses.

The above site operational costs represent **$48.6M**, of which warehousing and material handling accounts for **$10.3M** and manpower transportation **$25.8M**.

Small tools and supplies have also been included under this budget cost code, not having been included with construction equipment. It should be noted that small tool cost has been evaluated at $0.30/man hour and supplies at $0.10/man hour.

8.3.2.3 Construction equipment, tools and supplies (6300)

The list of construction equipment is included in Appendix 1, describing the type and quantity required for the various construction sites. The equipment cost attributed includes only the depreciated value.

Construction equipment represents a budget of **$58.8M**. The tunnel boring machines account for **$11.1M** of this total, the asphalt batch plant accounts for **$3M** and the crusher, **$3.6M**.

All equipment transportation costs (mobilization and demobilization) have been included in “Miscellaneous freight (6700)”.

8.3.2.4 Material transportation (6400)

Material transportation includes freight and insurance costs of all construction bulk materials. This cost element accounts for **$16.6M** of the total project budget.

8.3.2.5 Construction camps (6500)

Almost one third of the indirect cost are attributed to the construction and operation of the construction camps. Site 6g includes 4 camp sites, accommodating a total of 950 workers and staff (including Transmission Line construction requirements). Camp capacities were established using peak requirements at each of the work sites.

Construction and removal of the camps amount to **$117.4M**, while operation amounts to **$35M**, representing approximately $80 per man day, half of this amount to cover food, catering and camp maintenance and the other half for utility requirements (principally fuel for generators).

This project cost item is worth a total of **$152.4M**.

8.3.2.6 Insurance, taxes, permits and fees (6600)

Project insurance has been evaluated at **$24.9M**, including responsibility insurance, calculated at 2.02% of $700M and risk, calculated at 0.62% of the project value. The project Execution bond was calculated at $0.0069/$ value.

Equipment insurance was calculated at 0.5% of the total equipment value, evaluated at **$120M**.

It should be noted that it was assumed that the project would be exempt of taxes, duties and port fees.

8.3.2.7 Miscellaneous freight (6700)

Miscellaneous freight includes all mobilization and demobilization costs for project equipment, camp modules and camps utility equipment. In addition, it includes all inbound costs for permanent equipment such as turbine/generators, electro-mechanical and mechanical components.

Equipment freight, including insurance, was evaluated at **$19.3M** and camp module and utility equipment freight evaluated at **$26.9M**, for a total of **$46.2M**.

8.3.2.8 EPCM – home and field offices (7000 and 8000)

EPCM home office costs have been evaluated by considering the following:

- Contractor home office services are evaluated at 2% of the direct construction costs of $191M, yielding **$3.8M**;
- Contractor home office services for indirects have not been considered;
- General EPCM project management has been evaluated at **$2M**;
- Total EPCM home office estimate is **$5.8M**.

It should be noted that the following other EPCM costs are not considered:

- Engineering FEL2 and FEL3 activities;
- Procurement activities for purchase and contracts;
- Detailed engineering activities during the construction phase; and
- Contractor 10% profit.

EPCM site office costs have been evaluated by estimating the contractor and general management man month requirements. The contractor requirement include site supervisory staff (superintendents) and all higher grades.

Contractor requirements were estimated at approximately 3 000 man months and general management requirements were estimated at 1 600 man months. A common monthly rate of $10 000 was used, yielding a total EPCM site office cost of **$45.8M**.

8.3.2.9 Contingency (9000)

Project contingency has been established by analyzing each project component, as specified in the WBS, and assigned a specific contingency which reflects the confidence level. It should be noted that an average of 15% has been established for all directs and indirects, while 10% was figured for EPCM items.

The total project contingency has been set at **$85.1M**, subdivided in the following way:

- Direct cost contingency: **$33.1M** (17% of total direct value)
- Indirect cost contingency: **$44.2M** (12% of total indirect value)
- EPCM contingency: **$5.0M** (10%of EPCM value)

Transmission line contingencies are included in the overall cost.

8.4 Total project cost including Transmission Line Project

WBS	Description	Site 7e	Site 6g	Total Hydro sites	Men-hours (Both sites)
2100	Harbor site preparation	474 981 $	474 981 $	949 962 $	4 460
2200	Port Facility	4 050 016 $	5 233 722 $	9 283 738 $	2 594
2300	Primary roads construction	45 875 129 $	32 358 790 $	78 233 919 $	431 987
2400	Civil works related to Powerhouse, Tailrace tunnel and Surge tunnel	42 329 062 $	23 233 879 $	65 562 941 $	867 656
2500	Civil works related to Power	130 717 844 $	25 988 319 $	156 706 163 $	1 635 677

WBS	Description	Site 7e	Site 6g	Total Hydro sites	Men-hours (Both sites)
	tunnel				
2600	Dams and Spillway	32 288 698 $	27 603 038 $	59 891 736 $	804 730
2700	Electrical Works	35 132 187 $	26 691 494 $	61 823 681 $	344 493
2800	Mechanical + Electrical Works	120 575 844 $	44 085 105 $	164 660 949 $	791 400
2900	Architectural works	5 497 800 $	5 497 800 $	10 995 600 $	0
	Directs costs - Sub-Total	*416 941 561 $*	*191 167 128 $*	*608 108 689 $*	*4 882 996*
6100	Temporary Construction Facilities	8 595 590 $	16 725 950 $	25 321 540 $	81 403
6200	Construction Services	65 047 197 $	48 642 636 $	113 689 833 $	645 277
6300	Construction Equipment, Tools & Supplies	74 738 361 $	58 817 800 $	133 556 161 $	0
6400	Material Transportation	25 105 518 $	16 568 461 $	41 673 979 $	0
6500	Construction Camp	107 729 334 $	148 628 635 $	256 357 969 $	148 666
6600	Insurance, Taxes, Permits, Fees	25 871 461 $	24 908 494 $	50 779 955 $	0
6700	Miscellaneous	34 785 789 $	46 247 259 $	81 033 048 $	0
7000	EPCM Home Office	12 338 831 $	5 823 343 $	18 162 174 $	0
8000	EPCM Field Office	54 170 000 $	45 840 000 $	100 010 000 $	0
9000	Contingency	120 933 738 $	79 884 241 $	200 817 979 $	0
	Indirects costs - Sub-Total	*529 315 819 $*	*492 086 819 $*	*1 021 402 638 $*	*875 346*
	Miscellaneous non accounted hours				*750 000*
	Total Hydro Costs	***946 257 380 $***	***683 253 947 $***	***1 629 511 327 $***	***6 508 342***

Transmission line (by Efla)	93 900 000 $	121 000 000 $	214 900 000 $	
Substation (by Efla)	21 600 000 $	18 400 000 $	40 000 000 $	
T-line contingencies	11 500 000 $	13 900 000 $	25 400 000 $	
Total Costs	***1 073 257 380 $***	***836 553 947 $***	***1 909 811 327 $***	

With N-1 transmission line (by Efla)	64 000 000 $	76 100 000 $	140 000 000 $	
With N-1 subsation (by Efla)	2 700 000 $	3 300 000 $	6 000 000 $	
N-1 T-line contingencies	6 700 000 $	7 900 000 $	14 600 000 $	
Total Costs (with N-1 transmission line)	***1 146 657 380 $***	***923 853 947 $***	***2 070 411 327 $***	

9 Procurement

The tendering and construction strategy that will be put into place has to meet the project requirements for the construction of the large scale infrastructures that are planned in Greenland. Other constraints include the short time requirement, the remoteness of the proposed construction sites and the cold conditions encountered at the construction sites.

The proposed formula is to follow an accelerated regime in which construction is divided into several lots. Construction of the preliminary facilities such as the harbor and the roads is started as soon as the design and tendering has been done for this part of the project. It will allow the construction of the further works to start earlier as the various accesses will have already been put in place. However, construction of the various lots shouldn't be started prior to the end of the final design of that particular lot. Such a procedure, even if it can reduced the overall construction time, is not recommended since it implies high risk regarding cost control and quality of the design.

9.1 Tendering process

Time appears to be of the essence; also as a long duration development period increases the accrued interest during construction as well as overall general expenses and other financial cost. Accordingly, a practical development approach is essential. The safest alternative considered has the following steps:

1. Pre-bidding the harbor and road construction,
2. Accelerating essential field exploration; aimed at larger risk components,
3. Selecting an engineer for the tender design, without bidding process, who masters valued engineering based on construction driven approach,
4. Giving the selected engineer a maximum of 8 months to develop a proper tender design and overall specification package,
5. Adopting a transparent risk sharing procedure in the tender documents, with bonuses and not only penalties.
6. Encouraging the contractor (bidders) to offer alternative solutions, also during construction, with pre-defined shearing of cost-savings,
7. Selecting highly qualified experts to review design (a person who understands and masters valued construction driven design) as well as supporting construction (construction management expert(s)).

For the design phase, work should be carried out by a designated small project design team, located at one common project office, preferably away from the head office. Past experience has shown that long design period, with project staff located at multiple offices, results in "end-rush work", poorer design, delays and higher overall development cost. The smaller and the higher caliber the design team is, the lower will the overall project development cost be.

9.2 Division of construction contracts

The following sub-divisions of the construction lots appears beneficial, both to accelerate the project completion (local smaller contractors are likely to be able to mobilize earlier than large joint-venture), as well as to lower cost. It is likely that local smaller contractors are more likely to be able to mobilize earlier than large joint-ventures. It is assumed that this approach will be supported by a small high quality project-design team following the above addressed traditional tendering approach.

1. Pre-bid construction of the harbor and of the preliminary camp.
2. Pre-bid construction of all temporary roads and eventually the “first phase” construction road to the upper project area. The downside of this through might be that the “Dam-contractor” and the Power-Intake contractor might claim if the road to those locations is not finished “on time”. Pre-bidding this work, with clear intent of possible combination of all lots, would be useful.
3. Eventually, pre-bid the excavation of the access tunnel to the power cavern, also used for setting up and excavating the TBM driven tunnels.
4. Bid separately upper-project facilities other than the power intake; including construction of the dams, the canals, the diversion tunnels and other upper project auxiliary structures.
5. Bid separately the construction of the:
   - Headrace tunnel and shaft excavation, stabilization and lining, including cleaning and testing. In that bid package, make it clear that the bidders stand free to excavate the waterways with a tunnel boring machine (TBM) or by drill an blast, and they can increase or decrease the tunnel slope and introduce shafts at will, including ventilation shafts, as long as the head loss in the tunnel will not increase beyond prescribed value (and as long as this will not increase tendered cost).
   - The power and transformer caverns, tailrace tunnel and all waterways and power generating and appurtenant structures, including the power intake and tunnel closure plugs, switchyard and operation building, etc.
   - Include in this package the bifurcation and the penstock steel liner (specialized sub for this task). The reason for not separating this task from the civil works is to reduce claims.
6. Bid electro-mechanical equipment as the 6th lot. The various suppliers will likely joint-venture.
7. Bid construction of the transmission lines separately, as the 7th lot.

While some of those lots would be tendered at a different time, allowing the Engineer and the Owner to start up certain critical parts of the project faster than if all would be bid at the same time, the setup should allow any Joint Venture to bid on one, more or all of the lots. The later would encourage large international consortiums to collaborate with smaller “local” contractors, who could mobilize faster for the pre-construction works and who are familiar working under arctic conditions.

10 Risk analysis

The five main risks that were identified for the hydro are:

- Greater than anticipated infrastructure and logistics difficulties could increase costs and delays project start up ;
- Civil works construction difficulties could increase costs and delays (access road, tunnelling, dam construction);
- Unfavorable weather conditions (change in duration of either winters or summers - movement of materials is easier during winter conditions -Fjord ice, fog, movement over snow or ice whereas construction is easier during summer conditions.);
- Difficulties could be encountered along the 300 km transmission lines to be constructed in rough terrain, with long fjord and glacier crossings. Some of them are state-of-the-art
- Environmental issues increase project cost, potentially impact start and completion dates/schedules and reduce available power output (NGO delays, Water releases downstream of dams, Ecosystems or archeological features in flooded areas or T-line corridor, project footprint).

11 Project optimization

Optimization of the project layout was carried out to obtain the largest firm yield possible at the lowest per MW cost, while meeting the project requirements regarding the smelter energy needs. Additional optimization will need to be done in the next project phase to increase the reliability and the revenues of the project.

11.1 Powerhouse location

Following the 2009 investigations and more precisely the results obtained from the hydraulic jacking tests performed in a borehole drilled at the powerhouse location (penstock levels), it was concluded that the minimum stress levels in the rock formations are rather low (4.8-5 MPa at elevation 41 m), compared to the Norwegian recommendations for the design of underground hydroelectric works. It was assumed that these lower stresses are result of stress relief near the steep, free-standing fjord. Higher stresses are likely to be found at greater depth and further back from the fjords. Therefore, in accordance with the topography, it was decided to move the powerhouse complex approximately 500 m away from the fjord. At this location the rock cover is 555 m. The new location reduces the length of the headrace tunnel, while the tailrace tunnel is longer, thus balancing the costs. However, the length of the access tunnels is longer increasing the construction costs.

Figure 11.1 shows the new location of the powerhouse complex.

11.2 Potential savings

For the next project phase, additional activities and investigations could allow to reduce the overall project cost and optimize the power production at site 6g. The main items that are targeted for potential savings are outlined below.

11.2.1 List of items

Headrace tunnel diameter

Optimization of the headrace tunnel should be carried in more details for different actualization rates. Also, since the power plant is not connected to a public network, a smaller tunnel would allow cost reductions without reducing the revenues. The firm power available at the site would however be reduced due to an increase in head losses. However, the firm power could be balanced by raising the dams to increase the useful volume of the reservoir. A more detail analysis on the subject should be carried out.

So far, we have considered a conservative overall potential economy of 4.5 M$ with a reduction in the headrace tunnel diameter.

Penstocks and manifold optimization

The penstocks, manifold and the lined section of the headrace tunnel leading to the turbines can be optimized with further economical analysis. Both the diameter of the excavated cross-section and the concrete and steel thickness should be reviewed in the next project phase to reduce the costs.

Dam axis and cross-section

Following a better knowledge of the overburden foundation conditions, the requirements for the complete excavation of the overburden underneath Dam 3 maybe re-assessed and another type of dam can be considered.

Despite Dam 3 isolation and the high mobilization cost of an asphalt plant compared to its relatively small asphaltic concrete core volume that would be required, it may still be interesting to keep an asphaltic concrete core rockfill dam (ACRD) type for this dam too.

A concrete faced rockfill dam (CFRD) is a type of dam that should be studied in more details in the future. This type of dam is less weather sensitive than ACRD and it can be constructed faster. Despite, CFRD is somewhat more labour intensive and implies the exclusion of the upstream cofferdam from the dam body, it may be a more interesting dam type especially if there in case of construction schedule concerns.

If ACRD is maintained, optimization of the typical cross section maybe conducted. For instance, the reduction of the width of filter and transition zones maybe lead to material cost savings. However, the related more restrictive material placement conditions should be carefully studied.

More detailed economical analysis should be later conducted on the different dam types to determine the optimal solution regarding the in-situ conditions and the scheduling constraints.

Rock support

The rock support assumptions can be reduced compared to the estimate presented in the report, thus reducing the cost of each proposed tunnel (headrace, tailrace, access and diversion tunnels).

Road construction

The construction methodology and the initial cost estimate for the road construction were prepared without a site visit. A site visit made by an experience road contractor would allow optimizing the proposed methodology, thus refining the cost and likely reducing the overall cost since the level of contingency could be reduced. Actual contingencies on the road construction estimate account for 25% of the cost. The airlift is also a major item in road construction and a site visit would potentially allow reducing this cost.

Diversion tunnel

In the next study phase, the excavation volume of the diversion tunnels with regard to the cofferdam heights can be optimized to reduce costs.

Concrete plugs

The concrete plugs are designed with a thickness of 5 m. This thickness could be reduced following a more detail structural analysis to approximately 2 or 3 m.

Cable tunnel

A new concept in the ventilation of the cable tunnels would allow eliminating the concrete blocks that are planned to split the tunnel cross-section in two sections. The cross-section of the cable tunnel could then be kept at a minimum size.

Construction camps

In the initial cost estimate, the full purchase prices of all camp buildings and facilities are considered. However, those items will have a remaining value following the end of the project. A depreciation of 60% of the initial cost was applied to the initial purchase price to determine the remaining values that represent savings that can be applied to the overall cost of the project.

Temporary construction facilities

As for the construction camps buildings, no remaining value was applied to the temporary construction facilities. Some items like pipes, generators and other can be reuse by the contractors. Therefore, a remaining value of 40% of the initial purchase price is also applied on those items, representing a cost saving for the project.

11.2.2 Uncertainties in purchasing costs

The main items of the projects are the fuel cost, equipment cost and the man power. The estimation of all of those items relies on unit costs. A change in unit cost for one of those items could largely influence both positively or negatively the overall project cost. Therefore, it is important to validate those unit costs in the next study phase. The potential savings currently considered from those items are detailed below.

In the initial cost estimate, a cost of 0.72 US$/L was used for the fuel, which correspond to the price of crude oil in Greenland. However, it would be possible to purchase the fuel from another country and transport it to Greenland, at a lower cost per liter. Fluctuations in the price of the crude oil barrel over time can lead to important cost variations as the cost of fuel is one of the major items of the project. At the moment, it is proposed to reduce the price per liter to 0.66 US$ which corresponds to the international August 2009 price.

Also, the purchasing costs of Caterpillar equipments were initially given by Denmark suppliers, which correspond to the costs considered in the cost estimate. A cost reduction is anticipated if equipments were to be purchased in the United States and transported to Greenland.

Finally, a cost reduction in the transportation of the labor to and from Greenland is also possible with chartered flights. Indeed, the initial cost estimate considered the actual market price for a single flight ticket to or from Greenland with the available airlines servicing Greenland.

The cost reductions were weighted on both site 7e and 6g to consider the amount of fuel, equipment and labor used for each site.

11.2.3 Working conditions

Additional savings are possible for the project, depending on the working conditions that are assumed, and the contingencies that are applied to the project. Alcoa suggested various criteria to consider in the cost estimate that are different from the parameters used in the base cost estimate, which roughly represent the actual practices in Canada. It is possible that the working conditions could be below the western countries standards if workers from other countries are employed for the project.

The criteria considered in the base cost estimate concerning the workers conditions compared with the new criteria proposed by Alcoa are the followings:

Tableau 11.1 Working conditions

	Initial cost estimate criteria	Revised criteria proposed by Alcoa
Hourly rate	24$/hr	10$/hr
Workers shift	40 days of work	120 days
Staff shift	40 days of work	60 days of work

Applying the new hourly rate to the cost estimate yields important cost savings on all project items. As for the longer work shifts, it reduced the cost of man power transportation to and from Greenland, as well as the number of overall trips.

The potential savings that can be obtained from the above considerations are:

New hourly rate of 10$/hr: Alcoa suggested the use of a 10$/h rate for Chinese labor. This change represents approximately 25 M$ at site 6g, considering a productivity reduction of 25%

Reduced man-power transportation due to longer working shifts: approximately 15 M$ cost reduction at site 6g

11.2.4 Summary table of potential savings

The following table summarizes the items for which optimization or elimination could reduce the cost of the projected site 6g, except for the potential savings related with a reduction of the hourly labor rate from $24/hr to $10/hr which are presented in Table 11.3. The cost reductions (or increase as for the powerhouse location) anticipated were estimated for every component previously discussed. Similar efforts were conducted by the transmission line design team to obtain a potential saving of 5 M$ for the site 6g transmission line. The potentials savings are presented in Table 11.2.

Table 11.2 Summary of potential savings at site 6g

Item	Potential savings (M$)
Powerhouse location	8.5 increase
Headrace tunnel diameter	4.5
Penstocks and manifold	1.2
Rock support requirements	1.5
Road construction methodology	2.5
Diversion tunnel	3.5
Concrete plug design	0.9
Cable tunnel	1.6
Construction camp	34.8
Temporary construction facilities	1.1
Fuel cost	3.4
Construction equipment cost	6
Labor transportation cost	16.4
Transmission line	5.0
Total	***74***

The cost savings outlined above were distributed in the project cost summary table to match the original subdivisions of the project. The fuel and construction equipment cost reductions do apply to all items of the projects as they are used throughout. As for the potential savings in the labor transportation cost, they include a 1.5 M$ saving using chartered flights and 14.9 M$ with longer working shifts as explained in section 11.2.3.

Potential savings were determined in part with a deeper analysis of some uncertainties that exist in the project. Therefore, the overall contingencies of the project are reduced to 10 % of the total amount of direct and indirect costs.

Table 11.3 in the next page shows the overall cost summary of the site 6g project with the potential savings. Potential savings were determined in part with a deeper analysis of some uncertainties that exist in the project. Therefore, the overall contingencies of the project are reduced to 10% of the total amount of direct and indirect costs.

Table 11.3 Cost impact of workers hourly rate

Pos.	Item	$24/hour (initial cost estimate)	$10/hour (potential alternative)
1. Civil works			
1.1	Dams	25.8	24.3
1.2	Tunnels	58.9	55.3
1.3	Canals and intake	11.4	10.8
1.4	Underground power station	39.6	37.9
2. Mechanical and electrical equipment		92.0	87.2
3. Infrastructure			
3.1	Harbors and roads	55.3	52.3
3.2	Construction Camps	114.6	106.8
3.3	Construction material transportation	16.2	15.4
Direct costs total		***413.9***	***390.2***
4. Indirect costs			
4.1	Construction services and temporary facilities	38.5	36.5
4.2	Travel cost	9.4	9.4
4.3	Insurance	24.9	24.9
4.4	EPCM	51.7	51.7
Indirect costs total		***124.4***	***122.4***
5. Transmission line		134.4	134.4
	Sub-total	*672.7*	*647.0*
	Total (with contingency)	***740***	***712***
	Hydro Plant Output (MW)	185	185
	M$/MW	*4.00*	*3.85*
N-1 Transmission line (added cost)		79.3	79.3
	Total (with contingency)	***827***	***799***
	M$/MW	*4.47*	*4.32*

11.3 Additional opportunities

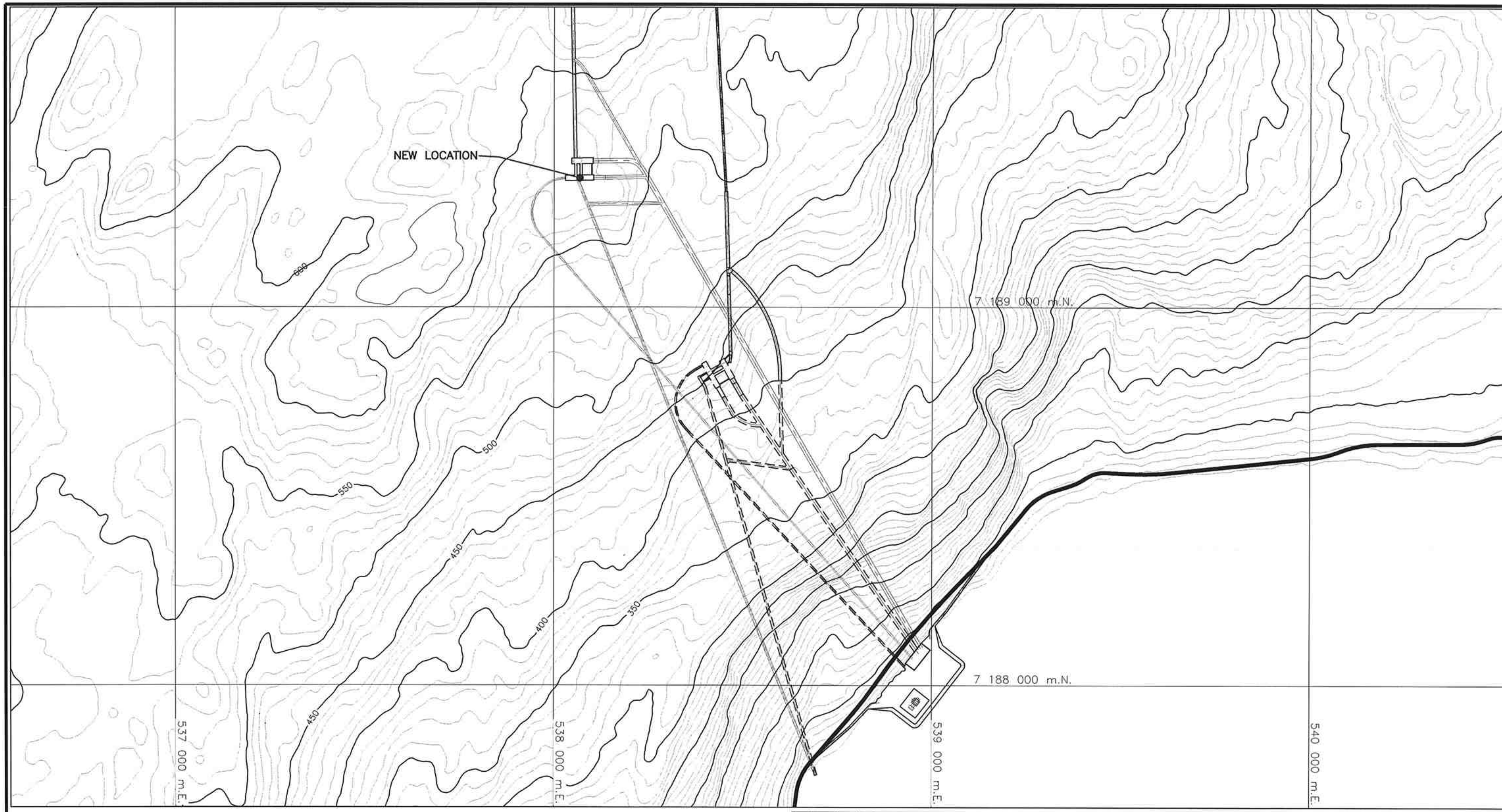
Site 6g is currently design to be operated with two reservoirs in series, the Big and Lower Lake. The inflows will come from the natural watershed of those two lakes along with sub-basin (E) located to the north of the Big Lake, that will be diverted into it.

Two other tunnels could be implemented at site 6g to increase the inflows to the project reservoirs and the firm power available.

First, Tunnel 2 (discussed briefly in section 4) is an equilibrium tunnel that would allow to increase the storage volume of the Big Lake by using the useful volume of the adjacent Middle Lake between elevation 669 and 680 m. Middle Lake is adjacent to the Big Lake but the low point between the two lakes is at elevation 680 m. The estimated construction cost for this tunnel is approximately 5 M$, including the required access road from Tunnel 1. According to the simulations that were ran, this tunnel would allow gaining approximately 3 MW of additional firm power. If it was decided to construct this tunnel, careful attention should be given to the risk of freezing due to potential stagnant water inside the tunnel for a long period of time. As for the required dimensions, constructability issues would govern the sizing of the tunnel since it acts as an equilibrium tunnel only.

Secondly, Tunnel 3 (discussed briefly in section 4) could be constructed a few kilometers to the east of the Lower Lake. This tunnel would allow diverting an additional catchment (sub-basin A) into the project system to increase the inflows, and by the same way the firm power. Although the inflows are relatively low from this sub-basin (average of 1.4 m^3/s), it would still allow to increase the firm power by an additional 4 MW. The estimated cost to implement this tunnel, including a 12 km access road to the site is of 12 M$. The main constraint related to the design of this tunnel is the fact that it would be a tunnel that would only flow for a period of approximately 4 months per year. The tunnel should then be designed to avoid the presence of stagnant water and ice blocks inside the tunnel.

There is also a possible future opportunity regarding the potential increase in run-off, mainly from the glaciers due the forecasted global warming. 2040 projected discharge series were computed by Vatnaskil but were not used to determine the firm power available at site 6g, since those series consider a steady increase in temperature over the next 40 years. However, there exist a potential that such predictions could occur in the future as global warming is forecasted to continue, along with fast glacier melting. It is then possible that the power production at site 6g could be increased with a future rise in inflows. This additional opportunity should be studied in more depth, either to increase the installed capacity at the site or leave space for a future increase in hydro equipments. Indeed, the projected 2040 series were used in the flood determination to reduce the risk regarding dam and structure safety. The opportunity cost of increasing the power capacity at site 6g would then only include the costs related to the conveyance structures and production devices.



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ALCOA INC.
ALCOA HYDRO DEVELOPMENT GPPG

BLDG NO.

GREENLAND
SITE 6G
REVISED POWER HOUSE LOCATION

ENGINEER: TECSULT Inc
PLANT CODE
DESIGNED BY
SCALE: 1:10000
ORIGIN
DWG CLASS
DRAWN BY: Y.T.
CHECKED BY
APPROVED BY

FIG. 11.1

Appendix 1

Cost estimate

Greenland - 6g Cost Estimate
Project Summary

WBS	Description	Man Power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Men-hours
3100	Harbor site preparation	53,520 $	364,785 $	- $	34,022 $	22,654 $	474,981 $	2,230
3200	Port Facility	31,128 $	992,500 $	4,181,360 $	23,562 $	5,172 $	5,233,722 $	1,297
3300	Primary roads construction	4,315,032 $	5,222,000 $	- $	5,704,611 $	12,393 $	32,358,790 $	195,598
3400	Civil works related to Powerhouse, Tailrace tunnel and Surge tunnel	7,359,144 $	5,206,613 $	6,170,052 $	2,576,190 $	1,921,880 $	23,233,879 $	307,693
3500	Civil works related to Power tunnel	7,715,074 $	7,270,316 $	2,334,784 $	3,170,091 $	5,498,054 $	25,988,319 $	321,469
3600	Dams and Spillway	9,120,154 $	6,686,875 $	3,201,243 $	4,531,696 $	4,063,070 $	27,603,038 $	394,692
3700	Electrical Works	3,418,498 $	841,873 $	20,435,654 $	1,644,355 $	351,114 $	26,691,494 $	142,490
3800	Mechanical + Electrical Works	7,894,250 $	799,549 $	34,632,371 $	758,935 $	- $	44,085,105 $	225,550
3900	Architectural works	- $	- $	5,497,800 $	- $	- $	5,497,800 $	0
	Directs costs - Sub-Total	*39,906,800 $*	*27,384,511 $*	*76,453,264 $*	*18,443,462 $*	*11,874,337 $*	*191,167,128 $*	*1,591,019*
6100	Temporary Construction Facilities	1,290,876 $	6,148,065 $	- $	1,773,342 $	7,515,347 $	16,725,950 $	53,706
6200	Construction Services	7,628,510 $	6,196,427 $	- $	3,051,636 $	3,998,382 $	48,642,636 $	317,855
6300	Construction Equipment, Tools & Supplies	- $	- $	- $	- $	- $	58,817,800 $	0
6400	Material Transportation	- $	- $	16,500,000 $	- $	- $	16,568,461 $	0
6500	Construction Camp	1,975,440 $	34,221,083 $	92,763,189 $	2,576,283 $	17,092,640 $	148,628,635 $	84,819
6600	Insurance, Taxes, Permits, Fees	- $	- $	- $	- $	- $	24,908,494 $	0
6700	Miscellaneous freight	- $	- $	- $	- $	- $	46,247,259 $	0
7000	EPCM Home Office	- $	- $	- $	- $	- $	5,823,343 $	0
8000	EPCM Field Office	- $	- $	- $	- $	- $	45,840,000 $	0
9000	Contingency	- $	- $	- $	- $	- $	79,884,241 $	0
	Indirects costs - Sub-Total	*10,894,826 $*	*46,565,575 $*	*109,263,189 $*	*7,401,261 $*	*28,606,369 $*	*492,086,819 $*	*456,380*
							Miscellaneous non-accounted hours	*250,000*
	Total Costs	***50,801,626 $***	***73,950,086 $***	***185,716,453 $***	***25,844,723 $***	***40,480,706 $***	***683,253,947 $***	***2,297,399***

WBS	Description	Quantity	Un.	Man Power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Unit price	Men-hours
3100	**Harbor site preparation**										
3,110	Site development	48,000	m²	20,160 $	100,000 $	- $	16,286 $	10,614 $	147,060 $	3.06	840
3,120	Fences and Gates			13,200 $	64,785 $	- $	1,450 $	1,426 $	80,861 $		550
3,130	Exterior Lighting			**Included in Helicopter Pad**							0
3,140	Helicopter pad			20,160 $	200,000 $	- $	16,286 $	10,614 $	247,060 $		840
3200	**Port Facility**										
3210	Wharf			- $	- $	3,931,360 $	- $	- $	3,931,360 $		0
3220	General Material Receiving and Handling			- $	- $	250,000 $	- $	- $	250,000 $		0
3230	Storage warehouse			10,968 $	68,500 $	- $	15,000 $	- $	94,468 $		457
3240	Workshop and Miscellaneous			**Included in Architectural Works**							0
3250	Office for custom authorities			**Included in Architectural Works**							0
3260	Fuel depot			20,160 $	924,000 $	- $	8,562 $	5,172 $	957,894 $		840
3300	**Primary roads construction**										
3310	Cross section F1	4,967	m	540,294 $	- $	- $	- $	- $	2,727,126 $	549	24,559
3320	Cross section F2	7,750	m	898,036 $	- $	- $	- $	- $	4,540,594 $	586	40,820
3330	Cross section F3	17,690	m	1,032,847 $	- $	- $	- $	- $	5,143,308 $	291	46,948
3340	Cross section C1	6,870	m	383,223 $	- $	- $	- $	- $	1,940,321 $	282	17,419
3350	Cross section C2	5,884	m	385,631 $	- $	- $	- $	- $	1,985,959 $	338	17,529
3360	Cross section C3	3,420	m	932,441 $	- $	- $	- $	- $	4,939,918 $	1,444	42,384
3370	Bridges	2	un	- $	5,222,000 $	- $	- $	- $	5,222,000 $		0
3380	Air Lift			142,560 $	- $	- $	5,704,611 $	12,393 $	5,859,564 $		5,940
3400	**Civil works related to Powerhouse, Tailrace tunnel and Surge tunnel**										
3410	Excavation										
3411	Powerhouse and Access	113,400	m²	1,421,796 $	1,918,245 $	515,387 $	487,537 $	362,764 $	4,705,729 $	41	59,242
3412	Transformer Chamber and Access	21,750	m²	236,179 $	314,039 $	87,608 $	82,760 $	64,412 $	784,998 $	36	9,841
3413	Powerhouse tailrace including Access and Oulet	65,657	m²	1,474,770 $	1,476,471 $	447,337 $	448,741 $	553,891 $	4,401,210 $	67	61,486
3414	Cable and Escape Tunnel	18,425	m²	1,525,863 $	480,011 $	311,523 $	572,639 $	300,161 $	3,190,197 $	173	63,578
3420	Concrete Works										
3421	Transformer Chamber Concrete	1,660	m³	371,912 $	174,081 $	361,425 $	152,985 $	92,075 $	1,152,478 $	694	15,501
3422	Powerhouse - Phase I	1,755	m³	420,379 $	184,046 $	382,126 $	163,283 $	98,490 $	1,248,324 $	711	17,520
3423	Powerhouse - Phase II	1,240	m³	314,828 $	130,042 $	270,034 $	114,218 $	68,735 $	897,857 $	724	13,121
3424	Penstocs and Manifold	650	m³	118,861 $	53,836 $	102,995 $	51,700 $	32,948 $	360,340 $	554	4,954
3425	Intake Tunnel	1,800	m³	474,402 $	163,567 $	391,940 $	167,503 $	101,034 $	1,298,446 $	721	19,771

WBS	Description	Quantity	Un.	Man Power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Unit price	Men-hours
3426	Cable and Escape Tunnel			278,907 $	23,399 $	528,139 $	45,953 $	32,302 $	908,700 $		12,620
3430	Powerhouse crane installation	1	ls	21,600 $	900 $	- $	6,094 $	3,920 $	32,514 $		900
3440	Powerhouse overhead roofing	45	mt	8,100 $	225 $	180,000 $	3,033 $	1,881 $	193,239 $	4,294	338
3450	Structural Steel	160		38,400 $	800 $	604,000 $	10,717 $	6,653 $	660,570 $	4,129	1,600
3460	Steel lining - Penstocks and Manifold	460	mt	154,560 $	5,520 $	1,380,000 $	35,321 $	30,404 $	1,605,805 $	3,491	6,440
3470	Concrete Plugs - Tunnels	2,790	m³	498,587 $	281,431 $	607,538 $	233,706 $	172,210 $	1,793,472 $	643	20,782
3500	**Civil works related to Power tunnel**										
3510	Power tunnel (including Rock Support)	224,138	m³	6,272,315 $	5,940,620 $	1,828,927 $	2,759,258 $	5,209,303 $	22,010,423 $	98	261,349
3520	Power tunnel Access	68,265	m³	1,015,455 $	1,084,886 $	316,303 $	248,717 $	196,146 $	2,861,507 $	42	42,311
3530	Intake excavation	15,000	m³	213,120 $	165,324 $	- $	80,501 $	52,238 $	511,183 $	34	8,880
3540	Intake structure	760	m³	214,184 $	79,486 $	189,554 $	81,615 $	40,367 $	605,206 $	796	8,930
3600	**Dams and Spillway**										
3,610	Diversion Tunnels (including concrete plug)										
3611	Dam 1 - Diversion Tunnel	7,125	m³	131,168 $	152,619 $	25,997 $	46,612 $	32,473 $	388,869 $	55	5,465
3614	Dam 4 - Diversion Tunnel	5,788	m³	134,738 $	174,030 $	24,783 $	45,578 $	30,833 $	409,962 $	71	5,614
3620	Cofferdams										
3621	Dam 1 - Cofferdams			221,952 $	61,591 $	18,975 $	101,976 $	78,021 $	482,515 $		9,284
3624	Dam 4 - Cofferdams			200,670 $	31,815 $	81,938 $	73,698 $	63,604 $	451,725 $		8,328
3625	Dam 5 - Cofferdams			196,560 $	38,904 $	61,851 $	84,252 $	72,770 $	454,337 $		8,136
3630	Foundation										
3631	Dam 1 - Foundation			101,040 $	232,886 $	- $	26,226 $	24,123 $	384,275 $		4,210
3632	Dam 2 - Foundation			180,480 $	243,034 $	- $	73,562 $	61,150 $	558,226 $		7,520
3633	Dam 3 - Foundation			344,899 $	247,572 $	62,953 $	235,382 $	183,794 $	1,074,600 $		14,372
3634	Dam 4 - Foundation			55,440 $	215,567 $	- $	13,950 $	12,820 $	297,777 $		2,310
3635	Dam 5 - Foundation			96,240 $	232,586 $	- $	25,230 $	22,964 $	377,020 $		4,010
3640	Impervious core										
3641	Dam 1 - Impervious core	14,300	m³	417,582 $	199,835 $	336,997 $	244,061 $	172,509 $	1,370,984 $	96	21,639
3642	Dam 2 - Impervious core	13,700	m³	460,365 $	259,699 $	460,833 $	260,334 $	146,232 $	1,587,463 $	116	23,102
3644	Dam 4 - Impervious core	7,300	m³	420,489 $	136,199 $	204,431 $	188,348 $	141,866 $	1,091,333 $	149	19,612
3645	Dam 5 - Impervious core	16,500	m³	561,181 $	233,563 $	356,741 $	296,328 $	206,688 $	1,654,501 $	100	27,858
3650	Rockfill										
3651	Dam 1 - Rockfill	82,950		618,665 $	490,062 $	- $	401,931 $	326,667 $	1,837,325 $	22	25,923
3652	Dam 2 - Rockfill	64,700		501,244 $	415,731 $	- $	349,118 $	289,240 $	1,555,333 $	24	21,033
3653	Dam 3 - Rockfill	160,000		926,340 $	546,595 $	376,818 $	568,409 $	507,989 $	2,926,151 $	18	38,635

WBS	Description	Quantity	Un.	Man Power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Unit price	Men-hours
3654	Dam 4 - Rockfill	32,900		102,441 $	29,906 $	- $	88,110 $	81,095 $	301,552 $	9	4,169
3655	Dam 5 - Rockfill	105,200		282,006 $	69,249 $	- $	233,321 $	208,158 $	792,734 $	8	11,533
3660	Spillways										
3661	Spillway 1			231,937 $	80,649 $	187,096 $	81,447 $	38,680 $	619,809 $		9,669
3662	Spillway 2			356,895 $	120,344 $	258,771 $	126,096 $	50,576 $	912,682 $		14,862
3670	Transfer Tunnels										
3671	Tunnel T1 Excavation			1,874,496 $	1,789,893 $	406,553 $	573,566 $	1,027,010 $	5,671,518 $		78,105
3672	Tunnel T1 Intake structure	900	m³	210,386 $	121,631 $	336,506 $	78,105 $	46,683 $	793,311 $		8,772
3680	Canals										
3681	Canals 1 and 2	20,000	m³	148,780 $	236,914 $	- $	99,549 $	80,602 $	565,845 $	28	6,218
3683	Canal 3	92,000	m³	308,880 $	294,203 $	- $	201,229 $	145,230 $	949,542 $	10	12,843
3684	Canal 4	4,500	m³	35,280 $	31,798 $	- $	15,278 $	11,293 $	93,649 $	21	1,470
3700	**Electrical Works**										
3710	Supply and Installation of Transformers and Power cables			163,200 $	11,400 $	4,000,000 $	153,000 $	- $	4,327,600 $		6,800
3720	Supply and Installation of High voltage distribution plant			1,210,560 $	57,800 $	5,445,000 $	434,600 $	- $	7,147,960 $		50,440
3730	Permanent camp Utilities Substation			**Included in Underground utilities**							
3731	Water treatment Area Substation			**Included in Underground utilities**							
3732	Administration Building Area Substation			**Included in Underground utilities**							
3733	Sewage Treatment Area Substation			**Included in Underground utilities**							
3734	Fire & Process Water Area Pumping Station Substation			**Included in Underground utilities**							
3735	Maintenance Shop and Warehouse Area Substation			**Included in Underground utilities**							
3736	Port Facility Substation			**Included in 3210 - Warf facilities**							
3740	Emergency Generator			2,400 $	1,000 $	170,000 $	1,500 $	- $	174,900 $		100
3750	Plant Communications			156,000 $	25,000 $	780,000 $	100,000 $	- $	1,061,000 $		6,500
3760	Power plant Command Circuitry			1,200,000 $	300,000 $	4,100,000 $	700,000 $	- $	6,300,000 $		50,000
3770	Switch yard Site	50,000	m³	101,670 $	218,160 $	- $	87,778 $	244,763 $	652,371 $	13	4,270
3780	Supply Line to Power Tunnel Intake	19	km	292,616 $	114,303 $	2,832,101 $	86,257 $	55,358 $	3,380,635 $	177,928	12,200
3790	Supply Line to Tunnel 1 Intake	20	km	292,052 $	114,210 $	3,108,553 $	81,220 $	50,993 $	3,647,028 $	182,351	12,180
3800	**Mechanical + Electrical Works**										
3810	Supply and Installation of Turbine/Generators assemblies			5,670,000 $	619,969 $	24,047,921 $	309,985 $	- $	30,647,875 $		162,000
3820	Supply and installation of Power tunnel intake Gates and Valves			570,500 $	- $	838,000 $	- $	- $	1,408,500 $		16,300
3830	Supply and installation of Tunnel 1 Regulating gates			539,000 $	- $	825,000 $	- $	- $	1,364,000 $		15,400

WBS	Description	Quantity	Un.	Man Power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Unit price	Men-hours
3840	Supply and installation of Draft tube Gates			140,000 $	- $	230,000 $	- $	- $	370,000 $		4,000
3850	Supply the overhead crane	1	ls	- $	- $	1,575,000 $	- $	- $	1,575,000 $		0
3860	Underground Utilities										
3861	Fire water System			87,500 $	10,780 $	404,250 $	26,950 $	- $	529,480 $		2,500
3862	Potable Water System			112,000 $	15,920 $	597,000 $	39,800 $	- $	764,720 $		3,200
3863	Sewage and Sanitary System			241,500 $	47,920 $	1,916,800 $	119,800 $	- $	2,326,020 $		6,900
3864	Compressed Air System			61,250 $	12,160 $	486,400 $	30,400 $	- $	590,210 $		1,750
3865	Process Water System			70,000 $	13,600 $	544,000 $	34,000 $	- $	661,600 $		2,000
3866	CVAC			402,500 $	79,200 $	3,168,000 $	198,000 $	- $	3,847,700 $		11,500
3900	**Architectural works**										
3,910	Service Building			- $	- $	5,497,800 $	- $	- $	5,497,800 $		
	Directs costs - Sub-Total			**39,906,800 $**	**27,384,511 $**	**76,453,264 $**	**18,443,462 $**	**11,874,337 $**	**191,167,128 $**		**1,591,019**

Project : 6g Cost Estimate.xlsx

Item : Indirect Summary

WBS	Description	Quantity	Un.	Man Power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Unit price	Men-hours
6100	**Temporary Construction Facilities**										
6110	Work Areas, including Buildings										
6113	Work Areas, including Buildings - Hydro Site 6g			936,972 $	4,374,120 $	- $	207,052 $	119,280 $	5,635,744 $		38,960
6120	Roads , Walkways, Parking Lots										
6123	Roads , Walkways, Parking Lots - Hydro Site 6g			38,880 $	10,000 $	- $	31,408 $	20,471 $	100,759 $		1,620
6130	Utilities										
6133	Utilities - Hydro Site 6g			315,024 $	1,763,945 $	- $	1,534,882 $	7,375,596 $	10,989,447 $		13,126
6140	Weather Protection										
6143	Weather Protection - Hydro Site 6g			**Special weather protection is Included in appropriate items**							
6200	**Construction Services**										
6210	General Site Operation										
6213	General Site Operation - Hydro Site 6g			2,196,638 $	2,998,288 $	- $	715,153 $	2,690,348 $	8,600,427 $		91,527
6220	Final Clean Up										
6223	Final Clean Up - Hydro Site 6g			280,800 $	10,000 $	- $	57,321 $	34,903 $	383,024 $		11,700
6230	Material Handling & Warehousing										
6233	Material Handling & Warehousing - Hydro Site 6g			5,151,072 $	1,592,800 $	- $	2,279,162 $	1,273,131 $	10,296,165 $		214,628
6240	NDE & QA/QC Testing Services										
6243	NDE & QA/QC Testing Services - Hydro Site 6g			- $	- $	- $	- $	- $	2,000,000 $		0
6250	Surveying										
6253	Surveying - Hydro Site 6g			- $	156,000 $	- $	- $	- $	156,000 $		0
6260	Site Security										
6263	Site Security - Hydro Site 6g			- $	586,639 $	- $	- $	- $	586,639 $		0
6270	Man Power Transportation										
6273	Man Power Transportation - Hydro Site 6g			- $	- $	- $	- $	- $	25,767,681 $		0
6280	General Expenses										
6283	General Expenses - Hydro Site 6g			- $	852,700 $	- $	- $	- $	852,700 $		0
6300	**Construction Equipment, Tools & Supplies**										
6330	Construction Equipment, Tools & Supplies - Hydro Site 6g								58,817,800 $		
6400	**Material Transportation**										
6430	Material Transportation - Hydro Site 6g			- $	- $	16,500,000 $	- $	- $	16,568,461 $		0
6500	**Construction Camp**										
6510	Site Preparation										
6513	Site Preparation - Hydro Site 6g	120,100	m²	119,280 $	10,000 $	- $	92,656 $	- $	221,936 $		7,479
6520	Infrastructure										
6523	Infrastructure - Hydro Site 6g			1,710,720 $	7,774,930 $	11,142,230 $	869,498 $	490,379 $	21,987,757 $		71,280
6530	Camps										

Project : 6g Cost Estimate.xlsx

Item : Indirect Summary

WBS	Description	Quantity	Un.	Man Power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	TOTAL PRICE	Unit price	Men-hours
6533	Camps - Hydro Site 6g			- $	13,547,055 $	81,614,737 $	- $	- $	95,161,792 $		0
6540	Catering										
6543	Catering - Hydro Site 6g			- $	12,044,518 $	- $	- $	- $	12,044,518 $		0
6550	Operation										
6553	Operation - Hydro Site 6g			145,440 $	844,580 $	6,222 $	1,614,129 $	16,602,261 $	19,212,632 $		6,060
6600	**Insurance, Taxes, Permits, Fees**										
6630	Insurance, Taxes, Permits, Fees - Hydro Site 6g								24,908,494 $		
6700	**Miscellaneous**										
6730	Freight - Hydro Site 6g								46,247,259 $		
7000	**EPCM Home Office**										
7100	EPCM Home Office - FEL 1 & 2										
7130	EPCM Home Office - FEL 1 & 2 - Hydro Site 6g								5,823,343 $		
8000	**EPCM Field Office**										
8100	EPCM Field Office - FEL 1 & 2										
8130	EPCM Field Office - FEL 1 & 2 - Hydro Site 6g								45,840,000 $		
9000	**Contingency**										
9003	Hydro Site 6g - Contingency								79,884,241 $		
	Indirects costs - Sub-Total							**28,606,369 $**	**492,086,819 $**		**456,380**

	Directs costs - Sub-Total							**11,874,337 $**	**191,167,128 $**		**1,591,019**
	Miscellaneous non accounted hours										**250,000**
	Total Costs							**40,480,706 $**	**683,253,947 $**		**2,297,399**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3100	**Harbor site preparation**																	
3110	**Site development**			**48,000**	**m²**													
	Powerhouse area 30,000 (300 x 100)																	
	Roads 12,000 (3000 x 4)																	
	Parking lot 6,000 42,000 m²																	
	48,000 3,000 m² / sh			14	sh						0	0	0	0	0	0		
	10 h / sh			140	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	840	h	24.00					20,160	0	0	0	0	20,160		840
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	126	h				38.25	28.00	0	0	0	4,820	2,540	7,360		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	3	378	h				24.00	20.00	0	0	0	9,072	5,443	14,515		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	126	h				19.00	29.00	0	0	0	2,394	2,631	5,025		
											0	0	0	0	0	0		
	- Miscelaneous (beach landing, etc..)			1	un		100,000				0	100,000	0	0	0	100,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3110	**Site development**										**20,160**	**100,000**	**0**	**16,286**	**10,614**	**147,060**		**840**
3120	**Fences and Gates**			**800**	**m**													
	Fencing and gates										0	0	0	0	0	0		
	Main camp area 800 m										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Gates			1	un		785.00				0	785	0	0	0	785		
	- Chain link			800	m		80.00				0	64,000	0	0	0	64,000		
	75 m / sh			11	sh						0	0	0	0	0	0		
	10 h / sh			110	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	550	h	24.00					13,200	0	0	0	0	13,200		550
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	99	h				13.65	18.00	0	0	0	1,351	1,283	2,634		
	- Fence post auger 1.00 2.00	90%	1	99	h				1.00	2.00	0	0	0	99	143	242		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3120	**Fences and Gates**										**13,200**	**64,785**	**0**	**1,450**	**1,426**	**80,861**		**550**

Item : 3100

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3130	**Exterior Lighting**																	
	Included in Helicopter Pad										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3130	**Exterior Lighting**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3140	**Helicopter pad**			**0**	**0**													
											0	0	0	0	0	0		
	Helicopter pad										0	0	0	0	0	0		
	Powerhouse area 30,000 (300 x 100) 42,000 m²										0	0	0	0	0	0		
	Roads 12,000 (3000 x 4) 3,000 m² / sh			14	d						0	0	0	0	0	0		
	42,000 10 h / sh			140	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	840	h	24.00					20,160	0	0	0	0	20,160		840
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	126	h				38.25	28.00	0	0	0	4,820	2,540	7,360		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	3	378	h				24.00	20.00	0	0	0	9,072	5,443	14,515		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	126	h				19.00	29.00	0	0	0	2,394	2,631	5,025		
											0	0	0	0	0	0		
	- Misc. (Dust control, fuel depot, accessories, etc..)			1	ls		200,000				0	200,000	0	0	0	200,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3140	**Helicopter pad**										**20,160**	**200,000**	**0**	**16,286**	**10,614**	**247,060**		**840**

Item : 3200

3200 Harbor site preparation

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3210	**Wharf**																	
											0	0	0	0	0	0		
	Mobilisation			1	ls						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Supply and Install										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Steel Sheet Pile Wall- AZ26			195	mt			3,300			0	0	643,500	0	0	643,500		
											0	0	0	0	0	0		
	- Coping plates 73 m 84.0 kg / m²			6,300	kg			4.33			0	0	27,279	0	0	27,279		
											0	0	0	0	0	0		
	- Waling			9,750	kg			5.83			0	0	56,843	0	0	56,843		
											0	0	0	0	0	0		
	- Waling bolts			2,938	kg			6.67			0	0	19,596	0	0	19,596		
											0	0	0	0	0	0		
	- Tie rods Front Wall			9,370	kg			8.33			0	0	78,083	0	0	78,083		
											0	0	0	0	0	0		
	- Tie rods Side Walls			14,124	kg			6.67			0	0	94,160	0	0	94,160		
											0	0	0	0	0	0		
	- Corrosion Protection (Aluminum anodes)			3,000	kg			6.67			0	0	20,000	0	0	20,000		
											0	0	0	0	0	0		
	- Fender units			3	un			5,000			0	0	15,000	0	0	15,000		
											0	0	0	0	0	0		
	- Bollards 50 t			6	un			3,000			0	0	18,000	0	0	18,000		
											0	0	0	0	0	0		
	- Rescue Ladder			2	un			2,000			0	0	4,000	0	0	4,000		
											0	0	0	0	0	0		
	- Concrete reinforcement-			50.90	m³			2,667			0	0	135,733	0	0	135,733		
											0	0	0	0	0	0		
	- Concrete kerb			228	m³			1,167			0	0	266,233	0	0	266,233		
	- Filter Cloth			1,040	m²			5.00			0	0	5,200	0	0	5,200		
											0	0	0	0	0	0		
	- Pavement			4,000	m²			30.00			0	0	120,000	0	0	120,000		
											0	0	0	0	0	0		
	- Lighting			2	ls			15,000			0	0	30,000	0	0	30,000		
											0	0	0	0	0	0		
	- Fill			44,000	m³			16.67			0	0	733,333	0	0	733,333		
											0	0	0	0	0	0		
	- Revetments										0	0	0	0	0	0		
	Fill			13,100	m³			16.67			0	0	218,333	0	0	218,333		
	Filter			4,970	m³			53.33			0	0	265,067	0	0	265,067		
	Armour			11,810	m³			100			0	0	1,181,000	0	0	1,181,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		

Item : 3200

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3210	**Wharf**										**0**	**0**	**3,931,360**	**0**	**0**	**3,931,360**		**0**
3220	**General Material Receiving and Handling**			**1**	**ls**													
											0	0	0	0	0	0		
	- Boom truck 17 tons			1	ls			200,000			0	0	200,000	0	0	200,000		
											0	0	0	0	0	0		
	- Miscelaneous			1	ls			50,000			0	0	50,000	0	0	50,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3220	**General Material Receiving and Handling**										**0**	**0**	**250,000**	**0**	**0**	**250,000**		**0**
3230	**Storage warehouse**																	
	- Supply 10 x 50			500	m²		137.00				0	68,500	0	0	0	68,500		
	- Install 0.913 h / m²			457	h	24.00					10,968	0	0	0	0	10,968		457
	- Equipment			500	m²				30.00		0	0	0	15,000	0	15,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3230	**Storage warehouse**										**10,968**	**68,500**	**0**	**15,000**	**0**	**94,468**		**457**
3240	**Workshop and Miscellaneous**			**0**	**0**													
											0	0	0	0	0	0		
	Included in Architectural Works										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3240	**Workshop and Miscellaneous**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3250	**Office for custom authorities**			**0**	**0**													
											0	0	0	0	0	0		
	Included in Architectural Works										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3250	**Office for custom authorities**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3260	**Fuel depot**																	
	Total fuel consumption on project Directs 16,492,135										0	0	0	0	0	0		
	Indirects 39,731,068										0	0	0	0	0	0		
	56,223,203 liters										0	0	0	0	0	0		
	Say 60,000 kL total										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Needs / kLiters / Months / kL/ month										0	0	0	0	0	0		
	Constr. / Camps / Total																	
	2,011 / 30 / 5,656 / 5,686 / 10 / 569										0	0	0	0	0	0		
	2,012 / 8,835 / 6,788 / 15,623 / 12 / 1,302										0	0	0	0	0	0		
	2,013 / 8,835 / 6,788 / 15,623 / 12 / 1,302										0	0	0	0	0	0		
	2,014 / 8,835 / 6,788 / 15,623 / 12 / 1,302										0	0	0	0	0	0		
	2,015 / 2,920 / 4,525 / 7,445 / 8 / 931										0	0	0	0	0	0		
	29,455 / 30,545 / 60,000 / 54										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Consumption for 12 months »»» 15,623 kL																	
	A 17,490 kL storage tank gives an autonomy of 13 months																	
	This permits a standard 10,000 kL / Shipment / year																	
	Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Vertical steel fuel oil tank 17,490 kL			1	un		760,000				0	760,000	0	0	0	760,000		
											0	0	0	0	0	0		
	- Miscelaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		152,000				0	152,000	0	0	0	152,000		
											0	0	0	0	0	0		
	Installation			12	sh						0	0	0	0	0	0		
	10 h / sh			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	840	h	24.00					20,160	0	0	0	0	20,160		840
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	108	h				13.65	18.00	0	0	0	1,474	1,400	2,874		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	45%	1	54	h				19.00	29.00	0	0	0	1,026	1,128	2,154		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	45%	1	54	h				38.25	28.00	0	0	0	2,066	1,089	3,155		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	108	h				37.00	20.00	0	0	0	3,996	1,555	5,551		
													0	0	0	0		
	- Miscelaneous			120	h		100.00				0	12,000	0	0	0	12,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3260	**Fuel depot**										**20,160**	**924,000**	**0**	**8,562**	**5,172**	**957,894**		**840**

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.75 $			

3300 Primary roads construction

WBS	DESCRIPTION		W (m)	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3310	**Cross section F1**					**4,967**	**m**													
			W (m)																	
	Harbour - Intake	**2,920**	5										0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	5.448 h / m				15,908	h	22.00					349,980	0	0	0	0	349,980		15,908
													0	0	0	0	0	0		
	- Other	486.10 $ / m				2,920	m						0	0	0	0	0	1,419,412		
													0	0	0	0	0	0		
	Intake - Lake Imarsuaq	**1,650**	4																	
	Access road to Canal 1	**397**	4																	
	Access road to Dam 5	**0**	4										0	0	0	0	0	0		
	Access road to Canal 4	**0**	4										0	0	0	0	0	0		
		2,047											0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	4.226 h / m				8,651	h	22.00					190,314	0	0	0	0	190,314		8,651
													0	0	0	0	0	0		
	- Other	374.90 $ / m				2,047	m						0	0	0	0	0	767,420		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3310	**Cross section F1**					**4,967**							**540,294**	**0**	**0**	**0**	**0**	**2,727,126**		**24,559**

WBS	DESCRIPTION		W (m)	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3320	**Cross section F2**					**7,750**	**m**													
													0	0	0	0	0	0		
			W (m)										0	0	0	0	0	0		
	Harbour - Intake	**4,510**	5										0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	5.844 h / m				26,356	h	22.00					579,842	0	0	0	0	579,842		26,356
													0	0	0	0	0	0		
	- Other	522.60 $ / m				4,510	m						0	0	0	0	0	2,356,926		
													0	0	0	0	0	0		
	Intake - Lake Imarsuaq	**2,240**	4										0	0	0	0	0	0		
	Access road to Canal 1	**1,000**	4										0	0	0	0	0	0		
	Access road to Dam 5	**0**	4										0	0	0	0	0	0		
	Access road to Canal 4	**0**	4										0	0	0	0	0	0		
		3,240											0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	4.464 h / m				14,463	h	22.00					318,194	0	0	0	0	318,194		14,463
													0	0	0	0	0	0		
	- Other	396.80 $ / m				3,240	m						0	0	0	0	0	1,285,632		
													0	0	0	0	0	0		
3320	**Cross section F2**					**7,750**							**898,036**	**0**	**0**	**0**	**0**	**4,540,594**		**40,820**

Item : 3300

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.75 $			
3330	**Cross section F3**					**17,690**	**m**													
													0	0	0	0	0	0		
			W (m)										0	0	0	0	0	0		
	Harbour - Intake	**5,780**	5										0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	3.072 h / m				17,756	h	22.00					390,636	0	0	0	0	390,636		17,756
													0	0	0	0	0	0		
	- Other	270.40 $ / m				5,780	m						0	0	0	0	0	1,562,912		
													0	0	0	0	0	0		
	Intake - Lake Imarsuaq	**8,500**	4										0	0	0	0	0	0		
	Access road to Canal 1	**3,410**	4										0	0	0	0	0	0		
	Access road to Dam 5	**0**	4										0	0	0	0	0	0		
	Access road to Canal 4	**0**	4										0	0	0	0	0	0		
		11,910											0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	2.451 h / m				29,191	h	22.00					642,211	0	0	0	0	642,211		29,191
													0	0	0	0	0	0		
	- Other	213.90 $ / m				11,910	m						0	0	0	0	0	2,547,549		
													0	0	0	0	0	0		
3330	**Cross section F3**					**17,690**							**1,032,847**	**0**	**0**	**0**	**0**	**5,143,308**		**46,948**
3340	**Cross section C1**					**6,870**	**m**													
			W (m)										0	0	0	0	0	0		
	Harbour - Intake	**1,150**	5										0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	2.598 h / m				2,988	h	22.00					65,729	0	0	0	0	65,729		2,988
													0	0	0	0	0	0		
	- Other	247.80 $ / m				1,150	m						0	0	0	0	0	284,970		
													0	0	0	0	0	0		
	Intake - Lake Imarsuaq	**4,720**	4										0	0	0	0	0	0		
	Access road to Canal 1	**0**	4										0	0	0	0	0	0		
	Access road to Dam 5	**0**	4										0	0	0	0	0	0		
	Access road to Canal 4	**1,000**	4										0	0	0	0	0	0		
		5,720											0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P	2.523 h / m				14,432	h	22.00					317,494	0	0	0	0	317,494		14,432
													0	0	0	0	0	0		
	- Other	222.40 $ / m				5,720	m						0	0	0	0	0	1,272,128		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3340	**Cross section C1**												**383,223**	**0**	**0**	**0**	**0**	**1,940,321**		**17,419**
3350	**Cross section C2**					**5,884**	**m**													
													0	0	0	0	0	0		
			W (m)										0	0	0	0	0	0		
	Harbour - Intake	**2,454**	5										0	0	0	0	0	0		
													0	0	0	0	0	0		

Item : 3300

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- M-P 3.049 h / m			7,482	h	22.00					164,609	0	0	0	0	164,609		7,482
											0	0	0	0	0	0		
	- Other 291.10 $ / m			2,454	m						0	0	0	0	0	714,359		
											0	0	0	0	0	0		
	Intake - Lake Imarsuaq **1,115** 4										0	0	0	0	0	0		
	Access road to Canal 1 **390** 4										0	0	0	0	0	0		
	Access road to Dam 5 **878** 4										0	0	0	0	0	0		
	Access road to Canal 4 **1,047** 4										0	0	0	0	0	0		
	3,430										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2.929 h / m			10,046	h	22.00					221,022	0	0	0	0	221,022		10,046
											0	0	0	0	0	0		
	- Other 258.30 $ / m			3,430	m						0	0	0	0	0	885,969		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3350	**Cross section C2**										**385,631**	**0**	**0**	**0**	**0**	**1,985,959**		**17,529**
3360	**Cross section C3**			**3,420**	**m**													
											0	0	0	0	0	0		
	W (m)										0	0	0	0	0	0		
	Harbour - Intake **1,910** 5										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 12.475 h / m			23,827	h	22.00					524,200	0	0	0	0	524,200		23,827
											0	0	0	0	0	0		
	- Other 1,220.30 $ / m			1,910	m						0	0	0	0	0	2,330,773		
											0	0	0	0	0	0		
	Intake - Lake Imarsuaq **1,510** 4										0	0	0	0	0	0		
	Access road to Canal 1 4																	
	Access road to Dam 5 **0** 4										0	0	0	0	0	0		
	Access road to Canal 4 **0** 4										0	0	0	0	0	0		
	1,510										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 12.289 h / m			18,556	h	22.00					408,241	0	0	0	0	408,241		18,556
											0	0	0	0	0	0		
	- Other 1,110.40 $ / m			1,510	m						0	0	0	0	0	1,676,704		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3360	**Cross section C3**										**932,441**	**0**	**0**	**0**	**0**	**4,939,918**		**42,384**
3370	**Bridges**			**2**	**un**													
											0	0	0	0	0	0		
	Harbour - Intake 6+340 to 6+370 32,000 $ / m			30	m		32,000				0	960,000	0	0	0	960,000		
	Intake - Lake Imarsuaq 4+940 to 5+010 23,000 $ / m			70	m		23,000				0	1,610,000	0	0	0	1,610,000		
											0	0	0	0	0	0		
	Vented Causeway 80,000 $ / un			24	un		80,000				0	1,920,000	0	0	0	1,920,000		
											0	0	0	0	0	0		
	Bed level Causeway 6,000 $ / un			122	un		6,000				0	732,000	0	0	0	732,000		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.75 $			
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3370	**Bridges**										**0**	**5,222,000**	**0**	**0**	**0**	**5,222,000**		**0**

3380 Air Lift

Helicopter capacity
(for 1 hour trip)

Type	(kg)
Sikorsky S-61N	3,750
AS 350 B3	1,200
Bell 214	2,700
Boeing 234	12,700

Cost per hour

	Mob	liter / hour	($ / hour) Fuel	Rental
		1.67 $		
S-61N		600	1,002.00 $	9,667 $
AS 350 B3	31,350 $	200	334.00 $	2,180 $
Bell 214	39,200 $	600	1,002.00 $	5,416 $
Boeing 234	800,000 $	1,515	2,530.05 $	8,130 $

Air Transportation

Description	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
										0							
Boeing 234 **12,700**										0							
Weight / Air lift # / Qty	Lifts									0							
Cat 311C U 11,980 1 2	2									0							
2 2	2									0							
										0							
Cat 950H Wheel Loader 18,500 1 1	3									0							
2 1	3									0							
										0	0	0	0	0	0		
Compressor XAHS 237 3,000 1 2	2									0	0	0	0	0	0		
(500 cfm) 2 3	3									0	0	0	0	0	0		
										0	0	0	0	0	0		
Furukawa HCR9-ES 9,000 1 3	3									0	0	0	0	0	0		
2 3	5									0	0	0	0	0	0		
										0	0	0	0	0	0		
Miscelaneous	3									0	0	0	0	0	0		
										0	0	0	0	0	0		
- Equipment air lift	26		26	h				8,130		0	0	0	211,380	0	211,380		
										0	0	0	0	0	0		
- Mobilisation Shared with catering and transportation	40%		1	ls				320,000		0	0	0	320,000	0	320,000		
										0	0	0	0	0	0		
Bell 214 **2,700**										0	0	0	0	0	0		
Air lift 1 2										0	0	0	0	0	0		
Days 83 60 143										0	0	0	0	0	0		
4 Trips / day 332 240 572										0	0	0	0	0	0		
										0	0	0	0	0	0		
- Men 572 trips 1 h / trip			572	h				5,416		0	0	0	3,097,952	0	3,097,952		
										0	0	0	0	0	0		
- Miscelaneous 1 trip / day 1 h / trip 143 days			143	h				5,416		0	0	0	774,488	0	774,488		
										0	0	0	0	0	0		

Item : 3300

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.75 $			
	- Mobilisation Shared with catering and transportation	40%		1	ls				15,680		0	0	0	15,680	0	15,680		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	AS 350 B3 **1,200**										0	0	0	0	0	0		
	Air lift 1 2										0	0	0	0	0	0		
	Days 83 60 143										0	0	0	0	0	0		
	4 Trips / day 332 240 572										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Miscelaneous 4 trip / day 1 h / trip 143 days			572	h				2,180		0	0	0	1,246,960	0	1,246,960		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Generator 5 kW (Tower light) 672 1 3	3									0	0	0	0	0	0		
	2 3	3									0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Equipment air lift	6		6	h				2,180		0	0	0	13,080	0	13,080		
											0	0	0	0	0	0		
	- Mobilisation Shared with catering and transportation	40%		1	ls				12,540		0	0	0	12,540	0	12,540		
	Ground crew Global Duration 90 days										0	0	0	0	0	0		
	10 h / d			900	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	4,500	h	24.00					108,000	0	0	0	0	108,000		4,500
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	810	h				13.65	18.00	0	0	0	11,057	10,935	21,992		
											0	0	0	0	0	0		
	Dismantling & Reassembling Equipment			12	sh						0	0	0	0	0	0		
	10 h / sh			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-O		12	1,440		24.00					34,560	0	0	0	0	34,560		1,440
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	108	h				13.65	18.00	0	0	0	1,474	1,458	2,932		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3380	**Air Lift**										**142,560**	**0**	**0**	**5,704,611**	**12,393**	**5,859,564**		**5,940**

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			

3410 Excavation

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3411	**Powerhouse and Access**			**113,400**	**m³**													
											0	0	0	0	0	0		
	Access to Powerhouse			**81,400**	m³						0	0	0	0	0	0		
	Powerhouse			**32,000**	m³						0	0	0	0	0	0		
				113,400	**m³**						0	0	0	0	0	0		
	Access to Powerhouse										0	0	0	0	0	0		
	Horse shoe 10 x 10 92.5 m³ 880 m			**81,400**	**m³**						0	0	0	0	0	0		
	Dia. Area (m²)										0	0	0	0	0	0		
	Arc 11.59 15 17.50										0	0	0	0	0	0		
	Height 10.00										0	0	0	0	0	0		
	Wall 7.50 75.00										0	0	0	0	0	0		
	Width 10.00										0	0	0	0	0	0		
	92.5										0	0	0	0	0	0		
	Excavation										0	0	0	0	0	0		
	Progression 4.66 m										0	0	0	0	0	0		
	Number of rounds 189										0	0	0	0	0	0		
	Number of shifts 265 Prod. Factor 1.4										0	0	0	0	0	0		
	Number of holes (m) (Feet)										0	0	0	0	0	0		
	Production 74 55 mm dia. 70,350 230,747										0	0	0	0	0	0		
	Contour 41 55 mm dia. 38,977 127,846										0	0	0	0	0	0		
	115										0	0	0	0	0	0		
	Cut 3 109 mm dia. 2,852 9,355										0	0	0	0	0	0		
	118										0	0	0	0	0	0		
	Drilling depth 5.03 m 112,179 367,947										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Durations (hours) 189 rounds										0	0	0	0	0	0		
	Drilling 150 m / h 3.96 748 h										0	0	0	0	0	0		
	Blasting 1.15 min / hole 2.26 427 h										0	0	0	0	0	0		
	Scaling & W. mesh 2.00 378 h										0	0	0	0	0	0		
	Mucking 205 m³ / h 2.10 397 h										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling labour										0	0	0	0	0	0		
	Total M-H Bolting W. Mesh Remaining										0	0	0	0	0	0		
	8 21,200 2,968 2,544 15,688										0	0	0	0	0	0		
	14% 12%										0	0	0	0	0	0		
	Drilling 4.00 189 756 h										0	0	0	0	0	0		
	9 h / sh 84 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 6,720 m-h										0	0	0	0	0	0		
	Loading & Blasting 2.26 189 427 h										0	0	0	0	0	0		
	9 h / sh 47 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 3,800 m-h										0	0	0	0	0	0		
	Remaining for services 5,168										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling			840	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	6,720	h	24.00					161,280	0	0	0	0	161,280		6,720
	189 rounds										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- Jumbo E 3C 14.00 4.5 h			851	h				14.00		0	0	0	11,907	0	11,907		
	- Spare parts			1	ls		80,722				0	80,722	0	0	0	80,722		
	- Cat GEP 550 - 400KW 6.50 102.40			851	h				6.50	102.40	0	0	0	5,528	65,318	70,846		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2"Ø 358,593 1,600			224	un		85.00				0	19,040	0	0	0	19,040		
	- Bits 4"Ø 9,355 1,500			6	un		500.00				0	3,000	0	0	0	3,000		
	- Rod 18' 367,947 7,500			49	un		485.00				0	23,765	0	0	0	23,765		
	- Coupling 367,947 3,700			99	un		50.00				0	4,950	0	0	0	4,950		
	- Shank 367,947 12,500			29	un		300.00				0	8,700	0	0	0	8,700		
	- Misc. Materials 367,947			367,947	ft		0.04				0	14,718	0	0	0	14,718		
											0	0	0	0	0	0		
	Loading & Blasting			475	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	3,800	h	24.00					91,190	0	0	0	0	91,190		3,800
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	427	h				37.00	20.00	0	0	0	15,799	6,405	22,204		
	- Fork lift 10 T 11.00 7.00	90%	1	427	h				11.00	7.00	0	0	0	4,697	2,242	6,939		
	- Explosives Truck 5.00 15.00	90%	1	427	h				5.00	15.00	0	0	0	2,135	4,804	6,939		
											0	0	0	0	0	0		
	5.03 m holes 189 Rounds										0	0	0	0	0	0		
	Number Total Length (m)										0	0	0	0	0	0		
	Contour holes 41 7,749 38,977										0	0	0	0	0	0		
	Production holes 74 13,986 70,350										0	0	0	0	0	0		
	115 21,735										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Prima cord 5.5 m 42,620	5%		44,750	m		1.00				0	44,750	0	0	0	44,750		
	- Cap 6m 21,735	13%		24,561	un		3.50				0	85,964	0	0	0	85,964		
	- Dynamite RXL 438 81,400 m³ Powder fact 1.6			130,240	kg		5.60				0	729,344	0	0	0	729,344		
	- XACTEX 7,749 holes 21,310	5%		22,375	kg		7.50				0	167,813	0	0	0	167,813		
	2.75 kg / hole										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Mucking 81,400 m³										0	0	0	0	0	0		
	1.5 Loose »»»» 122,100 m³										0	0	0	0	0	0		
	646 m³ / round										0	0	0	0	0	0		
	Production 140 m³ / h 4.61 h										0	0	0	0	0	0		
	189 rounds 872 h x 10/9 »»			969	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	6,783	h	24.00					162,800	0	0	0	0	162,800		6,783
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	50%	1	485	h				19.00	29.00	0	0	0	9,215	10,549	19,764		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	872	h				39.20	48.00	0	0	0	34,182	31,392	65,574		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	872	h				38.25	28.00	0	0	0	33,354	18,312	51,666		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	1,744	h				24.00	20.00	0	0	0	41,856	26,160	68,016		
											0	0	0	0	0	0		
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 1 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 1 30 km / h										0	0	0	0	0	0		
	13 min.										0	0	0	0	0	0		
	Efficacité : 85% 15 min. / trip										0	0	0	0	0	0		
	0.25 h / trip										0	0	0	0	0	0		
	9.5 h / sh										0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	38 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	456 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rolling Path Length 880										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 2,112										0	0	0	0	0	0		
	Production 1,200 m³ / sh			2	sh						0	0	0	0	0	0		
	10 h / s			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	160	h	24.00					3,840	0	0	0	0	3,840		160
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	18	h				39.20	48.00	0	0	0	706	648	1,354		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	18	h				38.25	28.00	0	0	0	689	378	1,067		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	18	h				24.00	20.00	0	0	0	432	270	702		
											0	0	0	0	0	0		
	Portal excavation 4,000 m³										0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90										0	0	0	0	0	0		
	1.20 1.08 m2										0	0	0	0	0	0		
	Drilling length 3,704 m										0	0	0	0	0	0		
	Production of 230 m / machine / sh			16	sh						0	0	0	0	0	0		
	2 machines			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	640	h	24.00					15,360	0	0	0	0	15,360		640
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	29	h				19.40		0	0	0	563	0	563		
	- Drilling materials			3,704	m		0.70				0	2,593	0	0	0	2,593		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 8 m										0	0	0	0	0	0		
	Number of holes 463 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 4,000 Losses	5%		4,200	kg		5.60				0	23,520	0	0	0	23,520		
	- Caps Losses	5%		486	un		4.50				0	2,187	0	0	0	2,187		
											0	0	0	0	0	0		
	- M-P		4	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	72	h				5.00		0	0	0	360	0	360		
	- Misc. Blasting mat.			4,000	m3		0.10				0	400	0	0	0	400		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 500 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 750 m³ / sh			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 12.0 m³										0	0	0	0	0	0		
	552 m³/mach/sh										0	0	0	0	0	0		
	Nombre de camions par poste : **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	72	h				39.20		0	0	0	2,822	0	2,822		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	72	h				38.25		0	0	0	2,754	0	2,754		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	144	h				24.00		0	0	0	3,456	0	3,456		
	Rock Support										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Horse shoe 10 x 10 92.5 m³ 880 m			**81,400**	**m³**						0	0	0	0	0	0		
	Area (m²)										0	0	0	0	0	0		
	Arc 11.59 17.50										0	0	0	0	0	0		
	Height 10.00										0	0	0	0	0	0		
	Wall 7.50 75.00										0	0	0	0	0	0		
	Width 10.00										0	0	0	0	0	0		
	92.5										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Tunnel										0	0	0	0	0	0		
	Required Length Dia.(m) Arch (m)										0	0	0	0	0	0		
	Class 1 660.0 12.5 11.59	75%									0	0	0	0	0	0		
	Class 2 132.0 12.5 11.59	15%									0	0	0	0	0	0		
	Class 3 61.6 12.5 11.59	7.0%									0	0	0	0	0	0		
	Class 4 22.0 12.5 11.59	2.5%									0	0	0	0	0	0		
	Class 5 4.4 12.5 11.59	0.5%									0	0	0	0	0	0		
	880	100%									0	0	0	0	0	0		
	Class 1 Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m 1 un / m 660 un										0	0	0	0	0	0		
	Shotcrete 50 mm 20.59 m² / m 2,038 m²	15%									0	0	0	0	0	0		
	Wire mesh 20.59 m² / m 11,551 m²	85%									0	0	0	0	0	0		
	Class 2										0	0	0	0	0	0		
	Rock bolts 2,5 m 2.3 un / m 302 un										0	0	0	0	0	0		
	Shotcrete 50 mm 20.59 m² / m 408 m²	15%									0	0	0	0	0	0		
	Wire mesh 20.59 m² / m 2,310 m²	85%									0	0	0	0	0	0		
	Class 3										0	0	0	0	0	0		
	Rock bolts 3 m 2.9 un / m 178 un										0	0	0	0	0	0		
	Shotcrete 50 mm 20.59 m² / m 634 m²	50%									0	0	0	0	0	0		
	Wire mesh 20.59 m² / m 634 m²	50%									0	0	0	0	0	0		
	Class 4										0	0	0	0	0	0		
	Rock bolts 4 m 5.2 un / m 113 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.0 m² / m 59 m²	30%									0	0	0	0	0	0		
	Wire mesh 9.0 m² / m 139 m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 11.6 m² / m 255 m²	100%									0	0	0	0	0	0		
	Reinf. Mesh 11.6 m² / m 255 m²	100%									0	0	0	0	0	0		
	Steel arch (W 100) 1.5 m c/c 15 un										0	0	0	0	0	0		
	26.6 m / arch 399 m																	
	Class 5										0	0	0	0	0	0		
	Rock bolts 5 m 11.6 un / m 51 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.0 m² / m 12 m²	30%									0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Wire mesh 9.0 m^2 / m 28 m^2	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 11.6 m^2 / m 51 m^2	100%									0	0	0	0	0	0		
	Reinf. Mesh 11.6 m^2 / m 51 m^2	100%									0	0	0	0	0	0		
	Steel arch (W 150) 0.75 m c/c 6 un										0	0	0	0	0	0		
	26.6 m / arch 160 m										0	0	0	0	0	0		
	Supply Lenght (m)										0	0	0	0	0	0		
	- Rock bolts 2,5 m 962 un 2,478 Losses	3%		991	un			60.00			0	0	59,460	0	0	59,460		
	- Rock bolts 3 m 178 un 549 Losses	3%		183	un			70.00			0	0	12,810	0	0	12,810		
	- Rock bolts 4 m 113 un 464 Losses	3%		116	un			80.00			0	0	9,280	0	0	9,280		
	- Rock bolts 5 m 51 un 265 Losses	3%		53	un			105.00			0	0	5,565	0	0	5,565		
	1,304 3,756										0	0	0	0	0	0		
	- Injection tubes 150 m roll	3%		26	rolls			110.00			0	0	2,860	0	0	2,860		
	- Oakum 130 bolts / box	3%		11	box			280.00			0	0	3,080	0	0	3,080		
	- Grease 154 bolts / box	3%		9	box			336.00			0	0	3,024	0	0	3,024		
											0	0	0	0	0	0		
	- Wire mesh 14,662 m^2	15%		16,861	m^2			4.60			0	0	77,561	0	0	77,561		
	- Reinf. Mesh 306 m^2	15%		352	m^2			5.60			0	0	1,971	0	0	1,971		
	14,968 m^2										0	0	0	0	0	0		
	- Spikes 1,1 m 1.25 m c/c 11,974 un	3%		12,333	un			4.50			0	0	55,499	0	0	55,499		
	- Wire 0.04 $ / m^2			14,968	m^2			0.04			0	0	599	0	0	599		
	m^2 m^3										0	0	0	0	0	0		
	Shotcrete 50 mm 3,152 0.05 158										0	0	0	0	0	0		
	Shotcrete 100 mm 306 0.1 31										0	0	0	0	0	0		
	188										0	0	0	0	0	0		
	- Cement (40 kg Bags) 0.03 m^3 / bag Losses	7.5%		6,743	bags			10.00			0	0	67,430	0	0	67,430		
	33.33 bags / m^3 6,272 bags										0	0	0	0	0	0		
	- Sand 1.40 mt / m^3 0.11 h / mt			263	mt	2.61	8.08	0.00	2.60	11.98	688	2,129	0	685	2,367	5,869		29
	- Monoset (3% of cement) 250,900 kg	3%		7,527	kg			3.40			0	0	25,592	0	0	25,592		
											0	0	0	0	0	0		
	- Steel arch (W 100) 19.0 kg / m 399 m			7,578	kg			4.00			0	0	30,313	0	0	30,313		
	- Steel arch (W 150) 22.0 kg / m 160 m			3,510	kg			5.00			0	0	17,549	0	0	17,549		
	Rock bolts Installation			**265**	**sh**						0	0	0	0	0	0		
	3,756 m 14 m / sh										0	0	0	0	0	0		
	1,304 un 5 un / sh																	
	0.5 h / un. including positionning																	
	2.5 h / sh			663	h													
	1) Drilling with Jumbo										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Jumbo	90%	1	596	h				102.50		0	0	0	61,090	0	61,090		
	- Cat GEP 550 - 400KW 6.50 102.40			596	h				6.50	102.40	0	0	0	3,874	45,773	49,647		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
	1,304 un 5 un / round										0	0	0	0	0	0		
	0.5 h / un 2.5 h / round including positionning																	
	663 h																	
	9.0 h / sh Eff.			74	sh													
	10 h / sh Eff.			740	h													
	- M-P		3	2,220	h	24.00					53,280	0	0	0	0	53,280		2,220
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	666	h				37.00	20.00	0	0	0	24,642	9,990	34,632		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
							UNIT PRICES				TOTAL COSTS							
											24.00 $				0.75 $			
	- Torque rench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			33	sh						0	0	0	0	0	0		
	10 h / sh			330	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	1,320	h	24.00					31,680	0	0	0	0	31,680		1,320
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	297	h				37.00	20.00	0	0	0	10,989	4,455	15,444		
	- Moyno pump 2.00	75%	1	248	h				2.00		0	0	0	495	0	495		
											0	0	0	0	0	0		
	- Cement (bags) 3,756 m	100%		614	bags			10.00			0	0	6,140	0	0	6,140		
	12,318 ft 0.02269801 sf										0	0	0	0	0	0		
	2 in. Dia hole 280 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 307 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 123 kg	1%		124	kg			3.00			0	0	372	0	0	372		
	- Miscellaneous			1,304	un		0.30				0	391	0	0	0	391		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Installation by Jumbo team										0	0	0	0	0	0		
	Production of 200 m² / sh 14,968 m²			75	sh						0	0	0	0	0	0		
	10 h / sh			748	h						0	0	0	0	0	0		
	Plus										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	674	h				37.00	20.00	0	0	0	24,938	10,110	35,048		
	- Jack leg 2.00	30%	1	225	h				2.00		0	0	0	450	0	450		
	- Miscellaneous materials Spike drilling 13,171 m			13,171	m		1.00				0	13,171	0	0	0	13,171		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**188**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 132 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			18	sh						0	0	0	0	0	0		
	10 h / sh			180	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	1,620	h	24.00					38,880	0	0	0	0	38,880		1,620
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	162	h				37.00	20.00	0	0	0	5,994	2,430	8,424		
	- Shotcrete pump 17.00	60%	1	108	h				17.00		0	0	0	1,836	0	1,836		
	- Hoses	25%	1	45	h		35.00				0	1,575	0	0	0	1,575		
	- Nozzle 66 m³ / un			3	un		275.00				0	825	0	0	0	825		
											0	0	0	0	0	0		
	Arches installation 558 m 27 m / un			**21**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			11	sh						0	0	0	0	0	0		
	10 h / sh			110	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	550	h	24.00					13,200	0	0	0	0	13,200		550
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	99	h				37.00	20.00	0	0	0	3,663	1,485	5,148		
	- Miscellaneous materials			21	un		200.00				0	4,200	0	0	0	4,200		
											0	0	0	0	0	0		
	Powerhouse			**32,000**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Header (m²)										0	0	0	0	0	0		
	Arc 20.50 16.5 57.50										0	0	0	0	0	0		
	Height 9.00										0	0	0	0	0	0		
	Wall 4.00 66.00										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Width 16.50										0	0	0	0	0	0		
	123.5 67.52			8,339	m³						0	0	0	0	0	0		
															0			
	Bench 1 8.8 16.5 145.2 67.52			9,804	m³						0	0	0	0	0	0		
															0			
	Bench 2 10.8 16.5 178.2 67.52			12,032	m³						0	0	0	0	0	0		
	2 13.54 27.08 67.52			1,828	m³						0	0	0	0	0	0		
	205.28			32,003	m³						0	0	0	0	0	0		
											0	0	0	0	0	0		
	474.0 67.52										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Header Excavation										0	0	0	0	0	0		
	Progression 4.66 m										0	0	0	0	0	0		
	Number of rounds 15										0	0	0	0	0	0		
	Number of shifts 21 Prod. Factor 1.4										0	0	0	0	0	0		
	Number of holes (m) (Feet)										0	0	0	0	0	0		
	Production 99 55 mm dia. 7,470 24,500										0	0	0	0	0	0		
	Contour 44 55 mm dia. 3,320 10,889										0	0	0	0	0	0		
	143										0	0	0	0	0	0		
	Cut 3 109 mm dia. 226 742										0	0	0	0	0	0		
	146										0	0	0	0	0	0		
	Drilling depth 5.03 m 11,016 36,131										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Durations (hours) 15 rounds										0	0	0	0	0	0		
	Drilling 150 m / h 4.90 73 h										0	0	0	0	0	0		
	Blasting 1.15 min / hole 2.80 42 h										0	0	0	0	0	0		
	Scaling & W. mesh 2.00 30 h										0	0	0	0	0	0		
	Mucking 205 m³ / h 2.81 42 h										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling labour										0	0	0	0	0	0		
	H-H Bolting W. Mesh Remaining										0	0	0	0	0	0		
	8 1,680 235 202 1,243										0	0	0	0	0	0		
	14% 12%										0	0	0	0	0	0		
	Drilling 5.0 15 75 h										0	0	0	0	0	0		
	9 h / sh 8 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 667 h-h										0	0	0	0	0	0		
	Loading & Blasting 2.80 15 42 h										0	0	0	0	0	0		
	9 h / sh 5 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 373 h-h										0	0	0	0	0	0		
	Remaining for services 203										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling			83	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	667	h	24.00					16,000	0	0	0	0	16,000		667
	15 rounds										0	0	0	0	0	0		
	- Jumbo E 3C 14.00 4.5 h			68	h				14.00		0	0	0	945	0	945		
	- Cat GEP 550 - 400KW 6.50 102.40			68	h				6.50	102.40	0	0	0	439	5,184	5,623		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2"Ø 35,389 1,600			22	un		85.00				0	1,870	0	0	0	1,870		
	- Bits 4"Ø 742 1,500			1	un		500.00				0	500	0	0	0	500		
	- Rod 18' 36,131 7,500			5	un		485.00				0	2,425	0	0	0	2,425		
	- Coupling 36,131 3,700			10	un		50.00				0	500	0	0	0	500		
	- Shank 36,131 12,500			3	un		300.00				0	900	0	0	0	900		
	- Misc. Materials 36,131			36,131	ft		0.04				0	1,445	0	0	0	1,445		
											0	0	0	0	0	0		

										UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION					%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.75 $			
	Loading & Blasting							47	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	373	h	24.00					8,955	0	0	0	0	8,955		373
															0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)		37.00	20.00		90%	1	42	h				37.00	20.00	0	0	0	1,554	630	2,184		
	- Fork lift 10 T		11.00	7.00		90%	1	42	h				11.00	7.00	0	0	0	462	221	683		
	- Explosives Truck		5.00	15.00		90%	1	42	h				5.00	15.00	0	0	0	210	473	683		
															0	0	0	0	0	0		
	5.03 m holes	**15**	**Rounds**												0	0	0	0	0	0		
		Number	Total	Length (m)											0	0	0	0	0	0		
	Contour holes	44	660	3,320											0	0	0	0	0	0		
	Production holes	99	1,485	7,470											0	0	0	0	0	0		
		143	2,145												0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Prima cord	5.5 m			3,630	5%		3,812	m		1.00				0	3,812	0	0	0	3,812		
	- Cap 6m				2,145	13%		2,424	un		3.50				0	8,484	0	0	0	8,484		
	- Dynamite RXL 438	8,339 m³		Powder fact	1.6			13,342	kg		5.60				0	74,715	0	0	0	74,715		
	- XACTEX	660 holes			1,815	5%		1,906	kg		7.50				0	14,295	0	0	0	14,295		
		2.75 kg / hole													0	0	0	0	0	0		
															0	0	0	0	0	0		
	Rock Support			**Length**	**67.52**	**m**													0			
				Area (m²)															0			
	Arc	20.50	16.5	57.50															0			
	Height	9.00																	0			
	Wall	4.00		66.00															0			
	Width	16.50																	0			
				123.5															0			
																			0			
			Header																0			
	Required	Length	Dia.(m)	Arch (m)															0			
	Class 1	50.6	12.5	11.59		75%													0			
	Class 2	10.1	12.5	11.59		15%													0			
	Class 3	4.7	12.5	11.59		7.0%													0			
	Class 4	1.7	12.5	11.59		2.5%													0			
	Class 5	0.3	12.5	11.59		0.5%													0			
		68				100%													0			
	Class 1			Qty															0			
	Rock bolts 2,5 m	1 un / m		51 un															0			
	Shotcrete 50 mm	13.59 m² / m		103 m²		15%													0			
	Wire mesh	13.59 m² / m		585 m²		85%													0			
	Class 2																		0			
	Rock bolts 2,5 m	2.3 un / m		23 un															0			
	Shotcrete 50 mm	13.59 m² / m		21 m²		15%													0			
	Wire mesh	13.59 m² / m		117 m²		85%													0			
	Class 3																		0			
	Rock bolts 3 m	2.9 un / m		14 un															0			
	Shotcrete 50 mm	13.59 m² / m		32 m²		50%													0			
	Wire mesh	13.59 m² / m		32 m²		50%													0			
	Class 4																		0			
	Rock bolts 4 m	5.2 un / m		9 un															0			
	Shotcrete 50 mm	2.0 m² / m		1 m²		30%													0			
	Wire mesh	2.0 m² / m		2 m²		70%													0			
	Shotcrete 100 mm	11.6 m² / m		20 m²		100%													0			
	Reinf. Mesh	11.6 m² / m		20 m²		100%													0			
	Steel arch (W 100)	1.5 m c/c		1 un															0			

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	28.5 m / arch 29 m																	
	Class 5														0			
	Rock bolts 5 m 11.6 un / m 4 un														0			
	Shotcrete 50 mm 2.0 m² / m 1 m²	30%													0			
	Wire mesh 2.0 m² / m 1 m²	70%													0			
	Shotcrete 100 mm 11.6 m² / m 4 m²	100%													0			
	Reinf. Mesh 11.6 m² / m 4 m²	100%													0			
	Steel arch (W 150) 0.75 m c/c 0 un														0			
	28.5 m / arch 0 m														0			
	Supply Lenght (m)														0			
	- Rock bolts 2,5 m 74 un 190 Losses	3%		76	un			60.00			0	0	4,560	0	0	4,560		
	- Rock bolts 3 m 14 un 42 Losses	3%		14	un			70.00			0	0	980	0	0	980		
	- Rock bolts 4 m 9 un 36 Losses	3%		9	un			80.00			0	0	720	0	0	720		
	- Rock bolts 5 m 4 un 20 Losses	3%		4	un			105.00			0	0	420	0	0	420		
	101 288										0	0	0	0	0	0		
	- Injection tubes 150 m roll	3%		2	rolls			110.00			0	0	220	0	0	220		
	- Oakum 130 bolts / box	3%		1	box			280.00			0	0	280	0	0	280		
	- Grease 154 bolts / box	3%		1	box			336.00			0	0	336	0	0	336		
											0	0	0	0	0	0		
	- Wire mesh 737 m²	15%		848	m²			4.60			0	0	3,901	0	0	3,901		
	- Reinf. Mesh 23 m²	15%		27	m²			5.60			0	0	151	0	0	151		
	761 m²										0	0	0	0	0	0		
	- Spikes 1,1 m 1.25 m c/c 609 un	3%		627	un			4.50			0	0	2,822	0	0	2,822		
	- Wire 0.04 $ / m²			761	m²			0.04			0	0	30	0	0	30		
	m² m³										0	0	0	0	0	0		
	Shotcrete 50 mm 158 0.05 8										0	0	0	0	0	0		
	Shotcrete 100 mm 23 0.1 2										0	0	0	0	0	0		
	10										0	0	0	0	0	0		
	- Cement (40 kg Bags) 0.03 m³ / bag Losses	7.5%		367	bags			10.00			0	0	3,670	0	0	3,670		
	33.33 bags / m³ 342 bags														0			
	- Sand 1.40 mt / m³ 0.11 h / mt			14	mt	2.61	8.08	0.00	2.60	11.98	37	116	0	37	129	319		2
											0	0	0	0	0	0		
	- Monoset (3% of cement) 13,664 kg	3%		410	kg			3.40			0	0	1,394	0	0	1,394		
											0	0	0	0	0	0		
	- Steel arch (W 100) 19.0 kg / m 29 m			542	kg			4.00			0	0	2,166	0	0	2,166		
	- Steel arch (W 150) 22.0 kg / m 0 m			0	kg			5.00			0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock bolts Installation			21	sh						0	0	0	0	0	0		
	288 m 14 m / sh										0	0	0	0	0	0		
	101 un 5 un / sh										0	0	0	0	0	0		
	0.5 h / un. including positionning										0	0	0	0	0	0		
	3 h / sh			63	h						0	0	0	0	0	0		
	1) Drilling with Jumbo										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Jumbo	90%	1	57	h	24.00					1,368	0	0	0	0	1,368		57
	- Cat GEP 550 - 400KW 6.50 102.40			57	h				6.50	102.40	0	0	0	371	4,378	4,749		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	189	h	24.00					4,536	0	0	0	0	4,536		189
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	57	h				37.00	20.00	0	0	0	2,109	855	2,964		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	- Torque rench			1	un		280.00				0	280	0	0	0	280		

Item : (3411)

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.75 $			
													0	0	0	0	0	0		
	3) Injection	40 bolts / sh	101 un			3	sh						0	0	0	0	0	0		
			10 h / sh			30	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				4	120	h	24.00					2,880	0	0	0	0	2,880		120
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	27	h				37.00	20.00	0	0	0	999	405	1,404		
	- Moyno pump	2.00		75%	1	23	h				2.00		0	0	0	46	0	46		
													0	0	0	0	0	0		
	- Cement (bags)	288 m		100%		48	bags			10.00			0	0	480	0	0	480		
		945 ft	0.02269801 sf										0	0	0	0	0	0		
		2 in. Dia hole	21 cu ft										0	0	0	0	0	0		
		0.91 cu ft / bag	24 bags										0	0	0	0	0	0		
	- Intraplast "N"	0.4 kg / bag	10 kg	1%		10	kg			3.00			0	0	30	0	0	30		
	- Miscellaneous					101	un		0.30				0	30	0	0	0	30		
																	0			
	Wire mesh installation												0	0	0	0	0	0		
	Installation by Jumbo team												0	0	0	0	0	0		
	Production of	200 m² / sh	761 m²			4	sh						0	0	0	0	0	0		
			10 h / sh			38	h						0	0	0	0	0	0		
	Plus												0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	34	h				37.00	20.00	0	0	0	1,258	510	1,768		
	- Jack leg	2.00		30%		11	h				2.00		0	0	0	22	0	22		
	- Miscellaneous materials	Spike drilling	669.9 m			670	m		1.00				0	670	0	0	0	670		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
	Shotcreting					**10**	**m³**						0	0	0	0	0	0		
	Production of	0.7 h / m³	7 h										0	0	0	0	0	0		
			7.5 h / sh Eff.			1	sh						0	0	0	0	0	0		
			10 h / sh Eff.			10	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				9	90	h	24.00					2,160	0	0	0	0	2,160		90
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	9	h				37.00	20.00	0	0	0	333	135	468		
	- Shotcrete pump	17.00		60%	1	6	h				17.00		0	0	0	102	0	102		
	- Hoses			25%	1	3	h		35.00				0	105	0	0	0	105		
	- Nozzle	66 m³ / un				0	un		275.00				0	0	0	0	0	0		
													0	0	0	0	0	0		
	Arches installation	29 m	29 m / un			**1**	**un**						0	0	0	0	0	0		
	Production of	2 un / sh				1	sh						0	0	0	0	0	0		
			10 h / sh			10	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	50	h	24.00					1,200	0	0	0	0	1,200		50
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	9	h				37.00	20.00	0	0	0	333	135	468		
	- Miscellaneous materials					1	un		200.00				0	200	0	0	0	200		
													0	0	0	0	0	0		
	Mucking	8,339 m³											0	0	0	0	0	0		
	1.5 Loose »»»»	12,508 m³											0	0	0	0	0	0		
		834 m³ / round											0	0	0	0	0	0		
	Production	140 m³ / h	5.96 h										0	0	0	0	0	0		
		15 rounds	89 h x 10/9 »»			99	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				7	695	h	24.00					16,677	0	0	0	0	16,677		695

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	50%	1	50	h				19.00	29.00	0	0	0	950	1,088	2,038		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	89	h				39.20	48.00	0	0	0	3,489	3,204	6,693		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	89	h				38.25	28.00	0	0	0	3,404	1,869	5,273		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	3	268	h				24.00	20.00	0	0	0	6,432	4,020	10,452		
											0	0	0	0	0	0		
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 2 30 km / h										0	0	0	0	0	0		
	15 min.										0	0	0	0	0	0		
	Efficacité : 85% 18 min. / trip										0	0	0	0	0	0		
	0.29 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	31 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	372 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
	BENCHES																	
	H W (m²) L										0	0	0	0	0	0		
	Bench 1 8.8 16.5 145.2 67.52			9,804	m³						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Bench 2 10.8 16.5 178.2 67.52			12,032	m³						0	0	0	0	0	0		
	2 13.54 27.08 67.52			1,828	m³						0	0	0	0	0	0		
	205.28			**23,664**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Progression 10 m														0			
	Rounds 7 rounds / bench														0			
	Line drilling 0.6 m c/c														0			
	Damper holes 16 un / round														0			
	Helper holes 16 un / round														0			
	Production holes 39 un / round														0			
															0			
	DRILLING Lentgh Holes Depth Drilling										0	0	0	0	0	0		
	2,5" dia.										0	0	0	0	0	0		
	B1 Line drilling 168 280 9.3 2,604										0	0	0	0	0	0		
	B2 Line drilling 168 280 11.3 3,164										0	0	0	0	0	0		
	B1 Damper 112 9.3 1,042														0			
	B2 Damper 112 11.3 1,266														0			
	3" dia.										0	0	0	0	0	0		
	B1 Helper 112 9.3 1,042										0	0	0	0	0	0		
	B2 Helper 112 11.3 1,266										0	0	0	0	0	0		
	B1 Production 273 9.3 2,539										0	0	0	0	0	0		
	B2 Production 273 11.3 3,085										0	0	0	0	0	0		
	1,554										0	0	0	0	0	0		
	Preshearing area 3,461 m²										0	0	0	0	0	0		
	Durations 250 m / machine / sh										0	0	0	0	0	0		
	(m) (shift)														0			
	Line drilling 5,768 23										0	0	0	0	0	0		
	Damper 2,308 9										0	0	0	0	0	0		
	Production & Helpers 7,932 32										0	0	0	0	0	0		
	16,008 64 3 mach			21	sh						0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	10 h / sh			210	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	1,260	h	24.00					30,240	0	0	0	0	30,240		1,260
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	3	567	h				19.40	15.00	0	0	0	11,000	6,379	17,379		
											0	0	0	0	0	0		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2,5"Ø 26,496 1,500			18	un		160.00				0	2,880	0	0	0	2,880		
	- Bits 3"Ø 26,023 1,500			17	un		200.00				0	3,400	0	0	0	3,400		
	- Rod 18' 52,519 5,000			11	un		500.00				0	5,500	0	0	0	5,500		
	- Coupling 52,519 3,000			18	un		50.00				0	900	0	0	0	900		
	- Shank 52,519 10,000			5	un		300.00				0	1,500	0	0	0	1,500		
	- Misc. Materials 52,519			52,519	ft		0.05				0	2,626	0	0	0	2,626		
											0	0	0	0	0	0		
	LOADING & BLASTING **23,664** **m³**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Cordex 0.52 m / m³			12,305	m		0.60				0	7,383	0	0	0	7,383		
	- Xactex 0.1 kg m³			2,366	kg		7.50				0	17,748	0	0	0	17,748		
	- Detonators 0.04 un / m³			947	un		7.00				0	6,626	0	0	0	6,626		
	- Dynamite 0.96 kg / m³			22,718	kg		6.00				0	136,307	0	0	0	136,307		
											0	0	0	0	0	0		
	Production of 1,554 5 min / hole 130 h																	
	Eff. Factor 0.75			173	h													
	- M-P		4	692	h	24.00					16,608	0	0	0	0	16,608		692
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	156	h				5.00	15.00	0	0	0	780	1,755	2,535		
											0	0	0	0	0	0		
	MUCKING 23,664 m³ (bank)										0	0	0	0	0	0		
	35,497 m³ (loose)										0	0	0	0	0	0		
	2,535 m³ / round										0	0	0	0	0	0		
	Production of 1,250 m³ / sh			28	sh						0	0	0	0	0	0		
	10 h / sh			280	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		##	2,800	h	24.00					67,200	0	0	0	0	67,200		2,800
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	252	h				39.20	48.00	0	0	0	9,878	9,072	18,950		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	252	h				19.00	29.00	0	0	0	4,788	5,481	10,269		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	504	h				24.00	20.00	0	0	0	12,096	7,560	19,656		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	252	h				38.25	28.00	0	0	0	9,639	5,292	14,931		
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 3										0	0	0	0	0	0		
	Going 1 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 1 30 km / h										0	0	0	0	0	0		
	8 min.										0	0	0	0	0	0		
	Efficacité : 85% 9 min. / trip										0	0	0	0	0	0		
	0.16 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	58 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	696 m³ / truck-sh										0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Number of trucks : 2										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Support L H Area										0	0	0	0	0	0		
	Area 168 19.6 3,294 m^2										0	0	0	0	0	0		
	Suppply										0	0	0	0	0	0		
	- Rock bolts 6 m 5 m^2 / un 659 un Losses	3%		679	un		110.00				0	74,690	0	0	0	74,690		
	- Wire mesh 2,789 m^2 Lapping	15%		3,208	m^2		4.60				0	14,757	0	0	0	14,757		
	- Spikes 0,7 m 1.56 m^2 / un 1,788 un	3%		1,842	un		4.50				0	8,289	0	0	0	8,289		
	- Wire			2,789	m^2		0.04				0	112	0	0	0	112		
											0	0	0	0	0	0		
	Rock bolts Installation										0	0	0	0	0	0		
	Production of 100 m / sh			40	sh						0	0	0	0	0	0		
	17 un / sh																	
	6 m 3,954 m 10 h / sh			400	h						0	0	0	0	0	0		
	- M-P		6	2,400	h	24.00					57,600	0	0	0	0	57,600		2,400
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	360	h				37.00	20.00	0	0	0	13,320	5,400	18,720		
	- Fork lift 15 T 13.00 9.00	90%	1	360	h				13.00	9.00	0	0	0	4,680	2,430	7,110		
	- Boom truck 17 tons 13.65 18.00	90%	1	360	h				13.65	18.00	0	0	0	4,914	4,860	9,774		
	- Drilling rig (on fork lift)	90%	1	360	h				11.00		0	0	0	3,960	0	3,960		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock bolts Injection										0	0	0	0	0	0		
	Production of 40 un / sh			17	sh						0	0	0	0	0	0		
	10 h / sh			170	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	850		24.00					20,400	0	0	0	0	20,400		850
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	153	h				37.00	20.00	0	0	0	5,661	2,295	7,956		
	- Moyno pump 2.00	75%	1	128	h				2.00		0	0	0	256	0	256		
											0	0	0	0	0	0		
	- Cement (bags) 3,954 m	100%		646	bags			10.00			0	0	6,460	0	0	6,460		
	12,969 ft 0.02269801 sf										0	0	0	0	0	0		
	2 in. Dia hole 294 cu ft										0	0	0	0	0	0		
	0.91 bag / cu ft 323 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 129 kg	1%		130	kg			3.00			0	0	390	0	0	390		
	- Miscellaneous			659	un		0.30				0	198	0	0	0	198		
											0	0	0	0	0	0		
	Wire mesh Installation										0	0	0	0	0	0		
	Production of 240 m^2 / sh			13	sh						0	0	0	0	0	0		
	10 h / sh			130	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	650	h	24.00					15,600	0	0	0	0	15,600		650
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	117	h				37.00	20.00	0	0	0	4,329	1,755	6,084		
	- Jack leg 2.00	30%		39	h				2.00		0	0	0	78	0	78		
											0	0	0	0	0	0		
	- Misc. Drilling materials 1,788 un 0.7 m			1,252	m		1.00				0	1,252	0	0	0	1,252		
											0	0	0	0	0	0		
	Wire mesh removing (under level 15)										0	0	0	0	0	0		
	L H Area m^2										0	0	0	0	0	0		
	168 7 1,176										0	0	0	0	0	0		
	Production of 600 m^2 / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
											0	0	0	0	0	0		
	- M-P		5	100	h	24.00					2,400	0	0	0	0	2,400		100
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	270	936		
	- Boom truck 17 tons 13.65 18.00	90%	1	18	h				13.65	18.00	0	0	0	246	243	489		
											0	0	0	0	0	0		
	Reinforced and lined intake tunnel (including Penstocks) **42.3 m²** **210 m**			**8,883**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	7 e																	
	Manifold **3,502 m³** Proportion of 7 e	40%		**1,401**	**m³**													
	Bus bar tunnel **5,340 m³** Proportion of 7 e	40%		**2,136**	**m³**													
	8,842 m³			**3,537**	**m³**													
	Manifold **42.30 m²** **33 m**			**1,401**	**m³**													
	Bus bar tunnel ± **42.30 m²** **50 m**			**2,136**	**m³**													
				3,537	**m³**													
				12,420	**m³**													
	D Shape (average tunnels) **42.3 m³** **294 m**			**12,420**	**m³**						0	0	0	0	0	0		
	Area (m²)																	
	Arc 6.30 9.30																	
	Height 6.50																	
	Wall 5.50 33.00																	
	Width 6.00																	
	42.3 294																	
	Excavation																	
	Progression 4.66 m																	
	Number of rounds 63																	
	Number of shifts 88 Prod. Factor 1.4																	
	Number of holes (m) (Feet)																	
	Production 34 55 mm dia. 10,774 35,340																	
	Contour 27 55 mm dia. 8,556 28,064																	
	61																	
	Cut 3 109 mm dia. 951 3,118																	
	64																	
	Drilling depth 5.03 m 20,281 66,522																	
	Durations (hours) 63 rounds																	
	Drilling 100 m / h 3.22 203 h																	
	Blasting 1.15 min / hole 1.23 77 h																	
	Scaling & W. mesh 2.00 126 h																	
	Mucking 205 m³ / h 0.96 61 h																	
	Drilling labour																	
	H-H Bolting W. Mesh Remaining																	
	8 7,040 986 845 5,210																	
	14% 12%										0	0	0	0	0	0		
	Drilling 3.22 63 203 h										0	0	0	0	0	0		
	9 h / sh 23 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 1,803 h-h										0	0	0	0	0	0		
	Loading & Blasting 1.23 63 77 h										0	0	0	0	0	0		
	9 h / sh 9 sh										0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION					%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.75 $			
	8 men / sh	10 h / sh			687 h-h										0	0	0	0	0	0		
	Remaining for services				2,720										0	0	0	0	0	0		
															0	0	0	0	0	0		
	Drilling							225	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	1,803	h	24.00					43,266	0	0	0	0	43,266		1,803
					63 rounds										0	0	0	0	0	0		
	- Jumbo E 2C		14.00		4.5 h			284	h				14.00		0	0	0	3,969	0	3,969		
	- Cat GEP 550 - 400KW		6.50	102.40				284	h				6.50	102.40	0	0	0	1,843	21,773	23,616		
		Feet	ft / un												0	0	0	0	0	0		
	- Bits 2"Ø	63,403	1,600					40	un		85.00				0	3,400	0	0	0	3,400		
	- Bits 4"Ø	3,118	1,500					2	un		500.00				0	1,000	0	0	0	1,000		
	- Rod 18'	66,522	7,500					9	un		485.00				0	4,365	0	0	0	4,365		
	- Coupling	66,522	3,700					18	un		50.00				0	900	0	0	0	900		
	- Shank	66,522	12,500					5	un		300.00				0	1,500	0	0	0	1,500		
	- Misc. Materials	66,522						66,522	ft		0.04				0	2,661	0	0	0	2,661		
															0	0	0	0	0	0		
	Loading & Blasting							86	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	687	h	24.00					16,486	0	0	0	0	16,486		687
															0	0	0	0	0	0		
	- Explosives Truck		5.00	15.00		90%	1	77	h				5.00	15.00	0	0	0	385	866	1,251		
															0	0	0	0	0	0		
	5.03 m holes		**63 Rounds**												0	0	0	0	0	0		
		Number	Total	Length (m)											0	0	0	0	0	0		
	Contour holes	27	1,701	8,556											0	0	0	0	0	0		
	Production holes	34	2,142	10,774											0	0	0	0	0	0		
		61	3,843												0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Prima cord	5.5 m			9,356	5%		9,823	m		1.00				0	9,823	0	0	0	9,823		
	- Cap 6m				3,843	13%		4,343	un		3.50				0	15,201	0	0	0	15,201		
	- Dynamite RXL 438	12,420 m³		Powder fact	1.6			19,872	kg		5.60				0	111,283	0	0	0	111,283		
	- XACTEX	1,701 holes			4,678	5%		4,912	kg		7.50				0	36,840	0	0	0	36,840		
		2.75 kg / hole													0	0	0	0	0	0		
															0	0	0	0	0	0		
	Mucking	12,420 m³													0	0	0	0	0	0		
	1.5 Loose »»»»	18,630 m³													0	0	0	0	0	0		
		296 m³ / round													0	0	0	0	0	0		
	Production	140 m³ / h		2.11 h											0	0	0	0	0	0		
		63 rounds		133 h x 10/9 »»				148	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						7	1,035	h	24.00					24,840	0	0	0	0	24,840		1,035
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		50%	1	74	h				19.00	29.00	0	0	0	1,406	1,610	3,016		
	- Cat 988H Wheel Loader		39.20	48.00		90%	1	133	h				39.20	48.00	0	0	0	5,214	4,788	10,002		
	- Cat D7R II LGP Track-Type Tractor		38.25	28.00		90%	1	133	h				38.25	28.00	0	0	0	5,087	2,793	7,880		
	- Cat 725 Articulated Dumper 25 T		24.00	20.00		90%	1	133	h				24.00	20.00	0	0	0	3,192	1,995	5,187		
															0	0	0	0	0	0		
	Disposal of excavated materials														0	0	0	0	0	0		
	Distance moyenne de transport :			1.00 km											0	0	0	0	0	0		
															0	0	0	0	0	0		
	Loading		8												0	0	0	0	0	0		
	Going		2	30 km / h											0	0	0	0	0	0		
	Unloading		3												0	0	0	0	0	0		
	Return		2	30 km / h											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	15 min.										0	0	0	0	0	0		
	Efficacité : 85% 18 min. / trip										0	0	0	0	0	0		
	0.29 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	31 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m^3										0	0	0	0	0	0		
	372 m^3 / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
											0	0	0	0	0	0		
	D Shape (average tunnels) 42.3 m^3 294 m			**12,420**	**m^3**						0	0	0	0	0	0		
	Area (m^2)										0	0	0	0	0	0		
	Arc 6.30 9.30										0	0	0	0	0	0		
	Height 6.50										0	0	0	0	0	0		
	Wall 5.50 33.00										0	0	0	0	0	0		
	Width 6.00										0	0	0	0	0	0		
	42.3 294										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Tunnel										0	0	0	0	0	0		
	Required Length Dia.(m) Arch (m)										0	0	0	0	0	0		
	Class 1 220.2 12.5 11.59	75%									0	0	0	0	0	0		
	Class 2 44.0 12.5 11.59	15%									0	0	0	0	0	0		
	Class 3 20.6 12.5 11.59	7.0%									0	0	0	0	0	0		
	Class 4 7.3 12.5 11.59	2.5%									0	0	0	0	0	0		
	Class 5 1.5 12.5 11.59	0.5%									0	0	0	0	0	0		
	294	100%									0	0	0	0	0	0		
	Class 1 Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m 1 un / m 220 un										0	0	0	0	0	0		
	Shotcrete 50 mm 16.59 m^2 / m 548 m^2	15%									0	0	0	0	0	0		
	Wire mesh 16.59 m^2 / m 3,105 m^2	85%									0	0	0	0	0	0		
	Class 2										0	0	0	0	0	0		
	Rock bolts 2,5 m 2.3 un / m 101 un										0	0	0	0	0	0		
	Shotcrete 50 mm 16.59 m^2 / m 110 m^2	15%									0	0	0	0	0	0		
	Wire mesh 16.59 m^2 / m 621 m^2	85%									0	0	0	0	0	0		
	Class 3										0	0	0	0	0	0		
	Rock bolts 3 m 2.9 un / m 60 un										0	0	0	0	0	0		
	Shotcrete 50 mm 16.59 m^2 / m 170 m^2	50%									0	0	0	0	0	0		
	Wire mesh 16.59 m^2 / m 170 m^2	50%									0	0	0	0	0	0		
	Class 4										0	0	0	0	0	0		
	Rock bolts 4 m 5.2 un / m 38 un										0	0	0	0	0	0		
	Shotcrete 50 mm 5.0 m^2 / m 11 m^2	30%									0	0	0	0	0	0		
	Wire mesh 5.0 m^2 / m 26 m^2	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 11.6 m^2 / m 85 m^2	100%									0	0	0	0	0	0		
	Reinf. Mesh 11.6 m^2 / m 85 m^2	100%									0	0	0	0	0	0		
	Steel arch (W 100) 1.5 m c/c 5 un										0	0	0	0	0	0		
	17.3 m / arch 87 m																	
	Class 5										0	0	0	0	0	0		
	Rock bolts 5 m 11.6 un / m 17 un										0	0	0	0	0	0		
	Shotcrete 50 mm 5.0 m^2 / m 2 m^2	30%									0	0	0	0	0	0		
	Wire mesh 5.0 m^2 / m 5 m^2	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 11.6 m^2 / m 17 m^2	100%									0	0	0	0	0	0		
	Reinf. Mesh 11.6 m^2 / m 17 m^2	100%									0	0	0	0	0	0		
	Steel arch (W 150) 0.75 m c/c 2 un										0	0	0	0	0	0		
	17.3 m / arch 35 m										0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Supply Lenght (m)										0	0	0	0	0	0		
	- Rock bolts 2,5 m 321 un 828 Losses	3%		331	un			60.00			0	0	19,860	0	0	19,860		
	- Rock bolts 3 m 60 un 186 Losses	3%		62	un			70.00			0	0	4,340	0	0	4,340		
	- Rock bolts 4 m 38 un 156 Losses	3%		39	un			80.00			0	0	3,120	0	0	3,120		
	- Rock bolts 5 m 17 un 90 Losses	3%		18	un			105.00			0	0	1,890	0	0	1,890		
	436 1,260										0	0	0	0	0	0		
	- Injection tubes 150 m roll	3%		9	rolls			110.00			0	0	990	0	0	990		
	- Oakum 130 bolts / box	3%		4	box			280.00			0	0	1,120	0	0	1,120		
	- Grease 154 bolts / box	3%		3	box			336.00			0	0	1,008	0	0	1,008		
											0	0	0	0	0	0		
	- Wire mesh 3,928 m²	15%		4,517	m²			4.60			0	0	20,778	0	0	20,778		
	- Reinf. Mesh 102 m²	15%		117	m²			5.60			0	0	655	0	0	655		
	4,030 m²										0	0	0	0	0	0		
	- Spikes 1,1 m 1.25 m c/c 3,224 un	3%		3,321	un			4.50			0	0	14,945	0	0	14,945		
	- Wire 0.04 $ / m²			4,030	m²			0.04			0	0	161	0	0	161		
	m² m³										0	0	0	0	0	0		
	Shotcrete 50 mm 841 0.05 42										0	0	0	0	0	0		
	Shotcrete 100 mm 102 0.1 10										0	0	0	0	0	0		
	52										0	0	0	0	0	0		
	- Cement (40 kg Bags) 0.03 m³ / bag Losses	7.5%		1,873	bags			10.00			0	0	18,730	0	0	18,730		
	33.33 bags / m³ 1,742 bags										0	0	0	0	0	0		
	- Sand 1.40 mt / m³ 0.11 h / mt			73	mt	2.61	8.08	0.00	2.60	11.98	191	591	0	190	658	1,630		8
											0	0	0	0	0	0		
	- Monoset (3% of cement) 69,699 kg	3%		2,091	kg			3.40			0	0	7,109	0	0	7,109		
											0	0	0	0	0	0		
	- Steel arch (W 100) 19.0 kg / m 87 m			1,644	kg			4.00			0	0	6,574	0	0	6,574		
	- Steel arch (W 150) 22.0 kg / m 35 m			761	kg			5.00			0	0	3,806	0	0	3,806		
											0	0	0	0	0	0		
	Rock bolts Installation			88	sh						0	0	0	0	0	0		
	1,260 m 14 m / sh																	
	436 un 5 un / sh																	
	0.5 h / un. including positionning																	
	3 h / sh			264	h													
	1) Drilling with Jumbo										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Jumbo	90%	1	238	h				102.50		0	0	0	24,395	0	24,395		
											0	0	0	0	0	0		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
	- M-P		3	792	h	24.00					19,008	0	0	0	0	19,008		792
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	238	h				37.00	20.00	0	0	0	8,806	3,570	12,376		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	- Torque rench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			11	sh						0	0	0	0	0	0		
	10 h /q			110	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	440	h	24.00					10,560	0	0	0	0	10,560		440
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	99	h				37.00	20.00	0	0	0	3,663	1,485	5,148		
	- Moyno pump 2.00	75%	1	83	h				2.00		0	0	0	166	0	166		
											0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES					TOTAL COSTS					GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption			
											24.00 $				0.75 $			
	- Cement (bags) 1,260 m	100%		206	bags			10.00			0	0	2,060	0	0	2,060		
	4,131 ft 0.02269801 sf										0	0	0	0	0	0		
	2 in. Dia hole 94 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 103 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 41 kg	1%		42	kg			3.00			0	0	126	0	0	126		
	- Miscellaneous			436	un		0.30				0	131	0	0	0	131		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Installation by Jumbo team										0	0	0	0	0	0		
	Production of 200 m² / sh 4,030 m²			20	sh						0	0	0	0	0	0		
	10 h / sh			201	h						0	0	0	0	0	0		
	Plus										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	181	h				37.00	20.00	0	0	0	6,697	2,715	9,412		
	- Jack leg 2.00	30%		60	h				2.00		0	0	0	120	0	120		
	- Miscellaneous materials Spike drilling 3,546 m			3,546	m		1.00				0	3,546	0	0	0	3,546		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**52**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 37 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			5	sh						0	0	0	0	0	0		
	10 h / sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	450	h	24.00					10,800	0	0	0	0	10,800		450
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	45	h				37.00	20.00	0	0	0	1,665	675	2,340		
	- Shotcrete pump 17.00	60%	1	30	h				17.00		0	0	0	510	0	510		
	- Hoses	25%	1	13	h		35.00				0	455	0	0	0	455		
	- Nozzle 66 m³ / un			1	un		275.00				0	275	0	0	0	275		
											0	0	0	0	0	0		
	Arches installation 121 m 17 m / un			**7**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			4	sh						0	0	0	0	0	0		
	10 h / sh			40	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	200	h	24.00					4,800	0	0	0	0	4,800		200
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	36	h				37.00	20.00	0	0	0	1,332	720	2,052		
	- Miscellaneous materials			7	un		200.00				0	1,400	0	0	0	1,400		
											0	0	0	0	0	0		
	Outside services are included in TBM Power tunnel										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Services **Using outside installations for TBM**			**1,174**	**m**													
	Access tunnel 880																	
	Intake tunnel and penstock 294																	
	1,174 m																	
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			3,521	h	24.00					84,500	0	0	0	0	84,500		3,521
											0	0	0	0	0	0		
	- Miscelaneous materials			1,174	m		10.00				0	11,736	0	0	0	11,736		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Dewatering										0	0	0	0	0	0		
											0	0	0	0	0	0		

Item : (3411)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- M-P 2.0 h / m			2,347	h	24.00					56,334	0	0	0	0	56,334		2,347
											0	0	0	0	0	0		
	- Miscelaneous materials			1,174	m		10.00				0	11,736	0	0	0	11,736		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			4,108	h	24.00					98,584	0	0	0	0	98,584		4,108
											0	0	0	0	0	0		
	- Miscelaneous materials			1,174	m		10.00				0	11,736	0	0	0	11,736		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Compressed Air										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			4,108	h	24.00					98,584	0	0	0	0	98,584		4,108
											0	0	0	0	0	0		
	- Miscelaneous materials			1,174	m		24.00				0	28,167	0	0	0	28,167		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			4,108	h	24.00					98,584	0	0	0	0	98,584		4,108
											0	0	0	0	0	0		
	- Miscelaneous materials			1,174	m		24.00				0	28,167	0	0	0	28,167		
											0	0	0	0	0	0		
3411	**Powerhouse and Access**			**113,400**	**m³**						**1,421,796**	**1,918,245**	**515,387**	**487,537**	**362,764**	**4,705,729**		**59,242**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			

3410 Excavation

3412 Transformer Chamber and Access

21,750 m²

	(m²)	L	n	Qty	Un.
Transformer chamber access	82.5	140		**11,550**	**m³**
Transformer cavern	179.6	55.7		**10,000**	**m³**
Gate shaft	9.5	10.5	2	**200**	**m³**
				21,750	**m³**

Access

D Shape **10 x 9** **82.5 m³** **140** — **11,550 m³**

				Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES
			Area (m²)	0	0	0	0	0	0
Arc	11.59	10	17.50	0	0	0	0	0	0
Height	9.00			0	0	0	0	0	0
Wall	6.50		65.00	0	0	0	0	0	0
Width	10.00			0	0	0	0	0	0
			82.5	0	0	0	0	0	0
Excavation				0	0	0	0	0	0

Progression	4.66 m			
Number of rounds	30			
Number of shifts	42	Prod. Factor 1.4		
Number of holes			(m)	(Feet)
Production	66	55 mm dia.	9,959	32,667
Contour	38	55 mm dia.	5,734	18,808
	104			
Cut	3	109 mm dia.	453	1,485
	107			
Drilling depth	5.03 m		16,146	52,960

Durations			(hours)	30 rounds
Drilling	150	m / h	3.59	108 h
Blasting	1.15	min / hole	2.05	62 h
Scaling & W. mesh			2.00	60 h
Mucking	205	m³ / h	1.88	56 h

Drilling labour

	H-H	Bolting	W. Mesh	Remaining
8	3,360	470	403	2,486
		14%	12%	

Drilling		3.6	30	108 h	
			9 h / sh	12 sh	
	8 men / sh		10 h / sh		957 m-h
Loading & Blasting		2.05	30	62 h	
			9 h / sh	7 sh	
	8 men / sh		10 h / sh		547 m-h
Remaining for services					983

WBS	DESCRIPTION	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
	Drilling		120	h						0	0	0	0	0	0		
										0	0	0	0	0	0		
	- M-P	8	957	h	24.00					22,964	0	0	0	0	22,964		957

Item : (3412)

WBS	DESCRIPTION					%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.75 $			
					30 rounds										0	0	0	0	0	0		
	- Jumbo E 3C		14.00		4.5 h			135	h				14.00		0	0	0	1,890	0	1,890		
	- Cat GEP 550 - 400KW		6.50	102.40				135	h				6.50	102.40	0	0	0	878	10,368	11,246		
		Feet	ft / un												0	0	0	0	0	0		
	- Bits 2"Ø	51,475	1,600					32	un		85.00				0	2,720	0	0	0	2,720		
	- Bits 4"Ø	1,485	1,500					1	un		500.00				0	500	0	0	0	500		
	- Rod 18'	52,960	7,500					7	un		485.00				0	3,395	0	0	0	3,395		
	- Coupling	52,960	3,700					14	un		50.00				0	700	0	0	0	700		
	- Shank	52,960	12,500					4	un		300.00				0	1,200	0	0	0	1,200		
	- Misc. Materials	52,960						52,960	ft		0.04				0	2,118	0	0	0	2,118		
	Loading & Blasting							68	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	547	h	24.00					13,125	0	0	0	0	13,125		547
															0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)		37.00	20.00		90%	1	62	h				37.00	20.00	0	0	0	2,294	930	3,224		
	- Fork lift 10 T		11.00	7.00		90%	1	62	h				11.00	7.00	0	0	0	682	326	1,008		
	- Explosives Truck		5.00	15.00		90%	1	62	h				5.00	15.00	0	0	0	310	698	1,008		
															0	0	0	0	0	0		
	5.03 m holes		**30 Rounds**												0	0	0	0	0	0		
		Number	Total	Length (m)											0	0	0	0	0	0		
	Contour holes	38	1,140	5,734											0	0	0	0	0	0		
	Production holes	66	1,980	9,959											0	0	0	0	0	0		
		104	3,120												0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Prima cord	5.5 m			6,270	5%		6,584	m		1.00				0	6,584	0	0	0	6,584		
	- Cap 6m				3,120	13%		3,526	un		3.50				0	12,341	0	0	0	12,341		
	- Dynamite RXL 438	11,550 m³		Powder fact	1.6			18,480	kg		5.60				0	103,488	0	0	0	103,488		
	- XACTEX	1,140 holes			3,135	5%		3,292	kg		7.50				0	24,690	0	0	0	24,690		
		2.75 kg / hole													0	0	0	0	0	0		
															0	0	0	0	0	0		
	Mucking	11,550 m³													0	0	0	0	0	0		
	1.5 Loose »»»»	17,325 m³													0	0	0	0	0	0		
		578 m³ / round													0	0	0	0	0	0		
	Production	140 m³ / h		4.13 h											0	0	0	0	0	0		
		30 rounds		124 h x 10/9 »»				138	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						7	963	h	24.00					23,100	0	0	0	0	23,100		963
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		50%	1	69	h				19.00	29.00	0	0	0	1,311	1,501	2,812		
	- Cat 988H Wheel Loader		39.20	48.00		90%	1	124	h				39.20	48.00	0	0	0	4,861	4,464	9,325		
	- Cat D7R II LGP Track-Type Tractor		38.25	28.00		90%	1	124	h				38.25	28.00	0	0	0	4,743	2,604	7,347		
	- Cat 725 Articulated Dumper 25 T		24.00	20.00		90%	2	248	h				24.00	20.00	0	0	0	5,952	3,720	9,672		
	Disposal of excavated materials														0	0	0	0	0	0		
	Average hauling distance :			0.50 km											0	0	0	0	0	0		
															0	0	0	0	0	0		
	Loading		8												0	0	0	0	0	0		
	Going		1	30 km / h											0	0	0	0	0	0		
	Unloading		3												0	0	0	0	0	0		
	Return		1	30 km / h											0	0	0	0	0	0		
			13	min.											0	0	0	0	0	0		
	Efficacité :		85%	15 min. / trip											0	0	0	0	0	0		
				0.25 h / trip											0	0	0	0	0	0		
				9 h / sh											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	36 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m^3										0	0	0	0	0	0		
	432 m^3 / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rolling Path Length 140										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 336										0	0	0	0	0	0		
	Production 1,200 m^3 / sh			1	sh						0	0	0	0	0	0		
	10 h / s			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	80	h	24.00					1,920	0	0	0	0	1,920		80
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	9	h				39.20	48.00	0	0	0	353	324	677		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	9	h				38.25	28.00	0	0	0	344	189	533		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	9	h				24.00	20.00	0	0	0	216	135	351		
	Rock Support																	
	Horse shoe 10 x 9 82.5 m^3 140			**11,550**	**m^3**													
	Area (m^2)																	
	Arc 11.59 10 17.50																	
	Height 9.00																	
	Wall 6.50 65.00																	
	Width 10.00																	
	82.5																	
	Tunnel																	
	Required Length Dia.(m) Arch (m)																	
	Class 1 105.0 12.5 11.59	75%																
	Class 2 21.0 12.5 11.59	15%																
	Class 3 9.8 12.5 11.59	7.0%																
	Class 4 3.5 12.5 11.59	2.5%																
	Class 5 0.7 12.5 11.59	0.5%																
	140	100%																
	Class 1 Qty																	
	Rock bolts 2,5 m 1 un / m 105 un																	
	Shotcrete 50 mm 18.59 m^2 / m 293 m^2	15%																
	Wire mesh 18.59 m^2 / m 1,659 m^2	85%																
	Class 2																	
	Rock bolts 2,5 m 2.3 un / m 48 un																	
	Shotcrete 50 mm 18.59 m^2 / m 59 m^2	15%																
	Wire mesh 18.59 m^2 / m 332 m^2	85%																
	Class 3																	
	Rock bolts 3 m 2.9 un / m 28 un																	
	Shotcrete 50 mm 18.59 m^2 / m 91 m^2	50%																
	Wire mesh 18.59 m^2 / m 91 m^2	50%																
	Class 4																	
	Rock bolts 4 m 5.2 un / m 18 un																	
	Shotcrete 50 mm 7.0 m^2 / m 7 m^2	30%																
	Wire mesh 7.0 m^2 / m 17 m^2	70%																
	Shotcrete 100 mm 11.6 m^2 / m 41 m^2	100%																
	Reinf. Mesh 11.6 m^2 / m 41 m^2	100%																
	Steel arch (W 100) 1.5 m c/c 2 un																	

Item : (3412)

WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.75 $			
		24.6	m / arch	49	m																		
	Class 5																						
	Rock bolts 5 m	11.6	un / m	8	un																		
	Shotcrete 50 mm	7.0	m² / m	1	m²		30%																
	Wire mesh	7.0	m² / m	3	m²		70%																
	Shotcrete 100 mm	11.6	m² / m	8	m²		100%																
	Reinf. Mesh	11.6	m² / m	8	m²		100%																
	Steel arch (W 150)	0.75	m c/c	1	un																		
		24.6	m / arch	25	m																		
	Supply			Lenght (m)												0	0	0	0	0	0		
-	Rock bolts 2,5 m	153	un	395		Losses	3%		158	un			60.00			0	0	9,480	0	0	9,480		
-	Rock bolts 3 m	28	un	87		Losses	3%		29	un			70.00			0	0	2,030	0	0	2,030		
-	Rock bolts 4 m	18	un	76		Losses	3%		19	un			80.00			0	0	1,520	0	0	1,520		
-	Rock bolts 5 m	8	un	40		Losses	3%		8	un			105.00			0	0	840	0	0	840		
		207		598												0	0	0	0	0	0		
-	Injection tubes	150	m roll				3%		4	rolls			110.00			0	0	440	0	0	440		
-	Oakum	130	bolts / box				3%		2	box			280.00			0	0	560	0	0	560		
-	Grease	154	bolts / box				3%		1	box			336.00			0	0	336	0	0	336		
																0	0	0	0	0	0		
-	Wire mesh	2,103	m²				15%		2,418	m²			4.60			0	0	11,123	0	0	11,123		
-	Reinf. Mesh	49	m²				15%		56	m²			5.60			0	0	314	0	0	314		
		2,151	m²													0	0	0	0	0	0		
-	Spikes 1,1 m	1.25	m c/c	1,721	un		3%		1,773	un			4.50			0	0	7,979	0	0	7,979		
-	Wire			0.04 $	/ m²				2,151	m²			0.04			0	0	86	0	0	86		
		m²		m³												0	0	0	0	0	0		
	Shotcrete 50 mm	451	0.05	23												0	0	0	0	0	0		
	Shotcrete 100 mm	49	0.1	5												0	0	0	0	0	0		
				27												0	0	0	0	0	0		
-	Cement (40 kg Bags)	0.03	m³ / bag			Losses	7.5%		983	bags			10.00			0	0	9,830	0	0	9,830		
		33.33	bags / m³	914	bags											0	0	0	0	0	0		
-	Sand	1.40 mt / m³		0.11	h / mt				38	mt	2.61	8.08	0.00	2.60	11.98	100	310	0	100	345	855		4
-	Monoset (3% of cement)			36,575	kg		3%		1,097	kg			3.40			0	0	3,730	0	0	3,730		
																0	0	0	0	0	0		
-	Steel arch (W 100)	19.0	kg / m	49	m				934	kg			4.00			0	0	3,738	0	0	3,738		
-	Steel arch (W 150)	22.0	kg / m	25	m				541	kg			5.00			0	0	2,705	0	0	2,705		
	Rock bolts Installation								42	sh						0	0	0	0	0	0		
	598 m			14	m / sh											0	0	0	0	0	0		
	207 un			5	un / sh											0	0	0	0	0	0		
				0.5	h / un. including positionning																		
				2.5	h / sh				105	h													
1)	Drilling with Jumbo															0	0	0	0	0	0		
																0	0	0	0	0	0		
-	Jumbo						90%	1	95	h				102.50		0	0	0	9,738	0	9,738		
-	Cat GEP 550 - 400KW	6.50		102.40					95	h				6.50	102.40	0	0	0	618	7,296	7,914		
2)	Install with 50t crane with basket															0	0	0	0	0	0		
																0	0	0	0	0	0		
-	M-P							3	315	h	24.00					7,560	0	0	0	0	7,560		315
																0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt)	37.00		20.00			90%	1	95	h				37.00	20.00	0	0	0	3,515	1,425	4,940		
																0	0	0	0	0	0		
-	Impact tool								1	un		300.00				0	300	0	0	0	300		
-	Test rig								1	un		1,200.00				0	1,200	0	0	0	1,200		

Item : (3412)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- Torque rench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			6	sh						0	0	0	0	0	0		
	10 h / sh			60	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	240	h	24.00					5,760	0	0	0	0	5,760		240
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	54	h				37.00	20.00	0	0	0	1,998	810	2,808		
	- Moyno pump 2.00	75%	1	45	h				2.00		0	0	0	90	0	90		
											0	0	0	0	0	0		
	- Cement (bags) 598 m	100%		98	bags			10.00			0	0	980	0	0	980		
	1,961 ft 0.02269801 sf										0	0	0	0	0	0		
	2 in. Dia hole 45 cu ft										0	0	0	0	0	0		
	0.91 bag / cu ft 49 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 20 kg	1%		20	kg			3.00			0	0	60	0	0	60		
	- Miscellaneous			207	un		0.30				0	62	0	0	0	62		
	Wire mesh installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 200 m² / sh 2,151 m²			11	sh						0	0	0	0	0	0		
	10 h / sh			108	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	645	h	24.00					15,490	0	0	0	0	15,490		645
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	97	h				37.00	20.00	0	0	0	3,589	1,455	5,044		
	- Jack leg 2.00	30%	1	32	h				2.00		0	0	0	64	0	64		
	- Miscellaneous materials Spike drilling 1,893 m			1,893	m		1.00				0	1,893	0	0	0	1,893		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**27**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 19 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	150	h	24.00					3,600	0	0	0	0	3,600		150
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	27	h				37.00	20.00	0	0	0	999	405	1,404		
	- Shotcrete pump 17.00	60%	1	18	h				17.00		0	0	0	306	0	306		
	- Hoses	25%	1	8	h		35.00				0	280	0	0	0	280		
	- Nozzle 66 m³ / un			0	un		275.00				0	0	0	0	0	0		
											0	0	0	0	0	0		
	Arches installation 74 m 25 m / un			**3**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	100	h	24.00					2,400	0	0	0	0	2,400		100
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	270	936		
	- Miscellaneous materials			3	un		200.00				0	600	0	0	0	600		
	Transformer cavern										0	0	0	0	0	0		
	14 x 13,2										0	0	0	0	0	0		
	Arc 15.50 60.60										0	0	0	0	0	0		
	Height 13.20										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Wall 8.50 119.00										0	0	0	0	0	0		
	Width 14.00										0	0	0	0	0	0		
	179.6 55.68			10,000	m³						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Excavation										0	0	0	0	0	0		
	Progression 4.66 m										0	0	0	0	0	0		
	Number of rounds 12										0	0	0	0	0	0		
	Number of shifts 17 Prod. Factor 1.4										0	0	0	0	0	0		
	Number of holes (m) (Feet)										0	0	0	0	0	0		
	Production 144 55 mm dia. 8,692 28,509										0	0	0	0	0	0		
	Contour 50 55 mm dia. 3,018 9,899										0	0	0	0	0	0		
	194										0	0	0	0	0	0		
	Cut 3 109 mm dia. 181 594										0	0	0	0	0	0		
	197										0	0	0	0	0	0		
	Drilling depth 5.03 m 11,891 39,002										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Durations (hours) 12 rounds										0	0	0	0	0	0		
	Drilling 4.00 48 h										0	0	0	0	0	0		
	Blasting 3.00 36 h										0	0	0	0	0	0		
	Scaling & W. mesh 2.50 30 h										0	0	0	0	0	0		
	Mucking 2.15 26 h										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling labour										0	0	0	0	0	0		
	H-H Bolting W. Mesh Remaining										0	0	0	0	0	0		
	8 1,360 190 163 1,006										0	0	0	0	0	0		
	14% 12%										0	0	0	0	0	0		
	Drilling 4.0 12 48 h										0	0	0	0	0	0		
	9 h / sh 5 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 427 h-h										0	0	0	0	0	0		
	Loading & Blasting 3.00 12 36 h										0	0	0	0	0	0		
	9 h / sh 4 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 320 h-h										0	0	0	0	0	0		
	Remaining for services 260										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling			53	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	427	h	24.00					10,240	0	0	0	0	10,240		427
	12 rounds										0	0	0	0	0	0		
	- Jumbo E 3C 14.00 4.5 h			54	h				14.00		0	0	0	756	0	756		
	- Cat GEP 550 - 400KW 6.50 102.40			54	h				6.50	102.40	0	0	0	351	4,147	4,498		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2"Ø 38,408 1,600			24	un		85.00				0	2,040	0	0	0	2,040		
	- Bits 4"Ø 594 1,500			0	un		500.00				0	0	0	0	0	0		
	- Rod 18' 39,002 7,500			5	un		485.00				0	2,425	0	0	0	2,425		
	- Coupling 39,002 3,700			11	un		50.00				0	550	0	0	0	550		
	- Shank 39,002 12,500			3	un		300.00				0	900	0	0	0	900		
	- Misc. Materials 39,002			39,002	ft		0.04				0	1,560	0	0	0	1,560		
											0	0	0	0	0	0		
	Loading & Blasting			40	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	36	h				37.00	20.00	0	0	0	1,332	540	1,872		
	- Fork lift 10 T 11.00 7.00	90%	1	36	h				11.00	7.00	0	0	0	396	189	585		
	- Explosives Truck 5.00 15.00	90%	1	36	h				5.00	15.00	0	0	0	180	405	585		

WBS	DESCRIPTION					%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.75 $			
															0	0	0	0	0	0		
	5.03 m holes		**12 Rounds**												0	0	0	0	0	0		
		Number	Total	Length (m)											0	0	0	0	0	0		
	Contour holes	50	600	3,018											0	0	0	0	0	0		
	Production holes	144	1,728	8,692											0	0	0	0	0	0		
		194	2,328												0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Prima cord	5.5	m		3,300	5%		3,465	m		1.00				0	3,465	0	0	0	3,465		
	- Cap 6m				2,328	13%		2,631	un		3.50				0	9,209	0	0	0	9,209		
	- Dynamite RXL 438	10,000	m³	Powder fact	1.6			16,000	kg		5.60				0	89,601	0	0	0	89,601		
	- XACTEX	600	holes		1,650	5%		1,733	kg		7.50				0	12,998	0	0	0	12,998		
		2.75	kg / hole												0	0	0	0	0	0		
															0	0	0	0	0	0		
	Rock Support			**Length**	**55.68**	**m**													0			
				Area (m²)															0			
		14 x 13,2																	0			
	Arc	15.50		60.60															0			
	Height	13.20																	0			
	Wall	8.50		119.00															0			
	Width	14.00																	0			
				179.6	55.68			10,000	m³						0	0	0	0	0	0		
															0	0	0	0	0	0		
			Tunnel												0	0	0	0	0	0		
	Required	Length	Dia.(m)	Arch (m)											0	0	0	0	0	0		
	Class 1	41.8	12.5	11.59		75%									0	0	0	0	0	0		
	Class 2	8.4	12.5	11.59		15%									0	0	0	0	0	0		
	Class 3	3.9	12.5	11.59		7.0%									0	0	0	0	0	0		
	Class 4	1.4	12.5	11.59		2.5%									0	0	0	0	0	0		
	Class 5	0.3	12.5	11.59		0.5%									0	0	0	0	0	0		
		56				100%									0	0	0	0	0	0		
	Class 1			Qty											0	0	0	0	0	0		
	Rock bolts 2,5 m	1	un / m	42	un										0	0	0	0	0	0		
	Shotcrete 50 mm	22.59	m² / m	142	m²	15%									0	0	0	0	0	0		
	Wire mesh	22.59	m² / m	802	m²	85%									0	0	0	0	0	0		
	Class 2														0	0	0	0	0	0		
	Rock bolts 2,5 m	2.3	un / m	19	un										0	0	0	0	0	0		
	Shotcrete 50 mm	22.59	m² / m	28	m²	15%									0	0	0	0	0	0		
	Wire mesh	22.59	m² / m	160	m²	85%									0	0	0	0	0	0		
	Class 3														0	0	0	0	0	0		
	Rock bolts 3 m	2.9	un / m	11	un										0	0	0	0	0	0		
	Shotcrete 50 mm	22.59	m² / m	44	m²	50%									0	0	0	0	0	0		
	Wire mesh	22.59	m² / m	44	m²	50%									0	0	0	0	0	0		
	Class 4														0	0	0	0	0	0		
	Rock bolts 4 m	5.2	un / m	7	un										0	0	0	0	0	0		
	Shotcrete 50 mm	11.0	m² / m	5	m²	30%									0	0	0	0	0	0		
	Wire mesh	11.0	m² / m	11	m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm	11.6	m² / m	16	m²	100%									0	0	0	0	0	0		
	Reinf. Mesh	11.6	m² / m	16	m²	100%									0	0	0	0	0	0		
	Steel arch (W 100)	1.5	m c/c	1	un										0	0	0	0	0	0		
		32.5	m / arch	33	m																	
	Class 5														0	0	0	0	0	0		
	Rock bolts 5 m	11.6	un / m	3	un										0	0	0	0	0	0		
	Shotcrete 50 mm	11.0	m² / m	1	m²	30%									0	0	0	0	0	0		
	Wire mesh	11.0	m² / m	2	m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm	11.6	m² / m	3	m²	100%									0	0	0	0	0	0		

Item : (3412)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Reinf. Mesh 11.6 m² / m 3 m²	100%									0	0	0	0	0	0		
	Steel arch (W 150) 0.75 m c/c 0 un										0	0	0	0	0	0		
	32.5 m / arch 0 m										0	0	0	0	0	0		
	Supply Lenght (m)										0	0	0	0	0	0		
	- Rock bolts 2,5 m 61 un 158 Losses	3%		63	un			60.00			0	0	3,780	0	0	3,780		
	- Rock bolts 3 m 11 un 33 Losses	3%		11	un			70.00			0	0	770	0	0	770		
	- Rock bolts 4 m 7 un 28 Losses	3%		7	un			80.00			0	0	560	0	0	560		
	- Rock bolts 5 m 3 un 15 Losses	3%		3	un			105.00			0	0	315	0	0	315		
	82 234										0	0	0	0	0	0		
	- Injection tubes 150 m roll	3%		2	rolls			110.00			0	0	220	0	0	220		
	- Oakum 130 bolts / box	3%		1	box			280.00			0	0	280	0	0	280		
	- Grease 154 bolts / box	3%		1	box			336.00			0	0	336	0	0	336		
											0	0	0	0	0	0		
	- Wire mesh 1,019 m²	15%		1,172	m²			4.60			0	0	5,391	0	0	5,391		
	- Reinf. Mesh 19 m²	15%		22	m²			5.60			0	0	123	0	0	123		
	1,038 m²										0	0	0	0	0	0		
	- Spikes 1,1 m 1.25 m c/c 831 un	3%		856	un			4.50			0	0	3,852	0	0	3,852		
	- Wire 0.04 $ / m²			1,038	m²			0.04			0	0	42	0	0	42		
	m² m³										0	0	0	0	0	0		
	Shotcrete 50 mm 219 0.05 11										0	0	0	0	0	0		
	Shotcrete 100 mm 19 0.1 2										0	0	0	0	0	0		
	13										0	0	0	0	0	0		
	- Cement (40 kg Bags) 0.03 m³ / bag Losses	7.5%		462	bags			10.00			0	0	4,620	0	0	4,620		
	33.33 bags / m³ 430 bags										0	0	0	0	0	0		
	- Sand 1.40 mt / m³ 0.11 h / mt			18	mt	2.61	8.08	0.00	2.60	11.98	47	146	0	47	162	402		2
											0	0	0	0	0	0		
	- Monoset (3% of cement) 17,204 kg	3%		516	kg			3.40			0	0	1,754	0	0	1,754		
											0	0	0	0	0	0		
	- Steel arch (W 100) 19.0 kg / m 33 m			618	kg			4.00			0	0	2,470	0	0	2,470		
	- Steel arch (W 150) 22.0 kg / m 0 m			0	kg			5.00			0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock bolts Installation			17	sh						0	0	0	0	0	0		
	234 m 14 m / sh										0	0	0	0	0	0		
	82 un 5 un / sh										0	0	0	0	0	0		
	0.5 h / un. including positionning										0	0	0	0	0	0		
	3.0 h / sh			51	h													
	1) Drilling with Jumbo										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Jumbo	90%	1	46	h				102.50		0	0	0	4,715	0	4,715		
	- Cat GEP 550 - 400KW 6.50 102.40			46	h				6.50	102.40	0	0	0	299	3,533	3,832		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	153	h	24.00					3,672	0	0	0	0	3,672		153
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	46	h				37.00	20.00	0	0	0	1,702	690	2,392		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	- Torque rench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh 82 un			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	120	h	24.00					2,880	0	0	0	0	2,880		120
											0	0	0	0	0	0		

Item : (3412)

								UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.75 $			
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	27	h				37.00	20.00	0	0	0	999	405	1,404		
	- Moyno pump	2.00		75%	1	23	h				2.00		0	0	0	46	0	46		
													0	0	0	0	0	0		
	- Cement (bags)	234 m		100%		38	bags			10.00			0	0	380	0	0	380		
		766 ft	0.02269801 sf										0	0	0	0	0	0		
		2 in. Dia hole	17 cu ft										0	0	0	0	0	0		
		0.91 cu ft / bag	19 bags										0	0	0	0	0	0		
	- Intraplast "N"	0.4 kg / bag	8 kg	1%		8	kg			3.00			0	0	24	0	0	24		
	- Miscellaneous					82	un		0.30				0	25	0	0	0	25		
	Wire mesh installation												0	0	0	0	0	0		
	Installation by Jumbo team												0	0	0	0	0	0		
	Production of	200 m² / sh	1,038 m²			5	sh						0	0	0	0	0	0		
			10 h / sh			52	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	47	h				37.00	20.00	0	0	0	1,739	705	2,444		
	- Jack leg	2.00		30%		16	h				2.00		0	0	0	32	0	32		
	- Miscellaneous materials	Spike drilling	914.1 m			914	m		1.00				0	914	0	0	0	914		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
	Shotcreting					**13**	**m³**						0	0	0	0	0	0		
	Production of	0.7 h / m³	9 h										0	0	0	0	0	0		
			7.5 h / sh Eff.			2	sh						0	0	0	0	0	0		
			10 h / sh			20	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				9	180	h	24.00					4,320	0	0	0	0	4,320		180
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	18	h				37.00	20.00	0	0	0	666	270	936		
	- Shotcrete pump	17.00		60%	1	12	h				17.00		0	0	0	204	0	204		
	- Hoses			25%	1	5	h		35.00				0	175	0	0	0	175		
	- Nozzle	66 m³ / un				0	un		275.00				0	0	0	0	0	0		
													0	0	0	0	0	0		
	Arches installation	33 m	33 m / un			**1**	**un**						0	0	0	0	0	0		
	Production of	2 un / sh				1	sh						0	0	0	0	0	0		
			10 h / sh			10	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	50	h	24.00					1,200	0	0	0	0	1,200		50
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	9	h				37.00	20.00	0	0	0	333	135	468		
	- Miscellaneous materials					1	un		200.00				0	200	0	0	0	200		
													0	0	0	0	0	0		
	Mucking	10,000 m³											0	0	0	0	0	0		
	1.5 Loose »»»»	15,000 m³											0	0	0	0	0	0		
		1,250 m³ / round											0	0	0	0	0	0		
	Production	140 m³ / h	8.93 h										0	0	0	0	0	0		
		12 rounds	107 h x 10/9 »»			119	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				7	833	h	24.00					20,000	0	0	0	0	20,000		833
													0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	50%	1	60	h				19.00	29.00	0	0	0	1,140	1,305	2,445		
	- Cat 988H Wheel Loader	39.20	48.00	90%	1	107	h				39.20	48.00	0	0	0	4,194	3,852	8,046		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	107	h				38.25	28.00	0	0	0	4,093	2,247	6,340		
	- Cat 725 Articulated Dumper 25 T	24.00	20.00	90%	3	321	h				24.00	20.00	0	0	0	7,704	4,815	12,519		
													0	0	0	0	0	0		
	Disposal of excavated materials												0	0	0	0	0	0		

Item : (3412)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 1 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 1 30 km / h										0	0	0	0	0	0		
	13 min.										0	0	0	0	0	0		
	Efficacité : 85% 15 min. / trip										0	0	0	0	0	0		
	0.25 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	36 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	432 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Gate shaft L W H										0	0	0	0	0	0		
	3.80 2.50 10.50		2	**200**	**m³**						0	0	0	0	0	0		
	9.50 m²										0	0	0	0	0	0		
	Excavation										0	0	0	0	0	0		
	Number of holes (m)										0	0	0	0	0	0		
	Production 12 252										0	0	0	0	0	0		
	Contour 21 441										0	0	0	0	0	0		
	33 693										0	0	0	0	0	0		
	Cut 3 63										0	0	0	0	0	0		
	36 756										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling 20 m / h 38 h										0	0	0	0	0	0		
	9.0 h / sh. Eff.			5	sh						0	0	0	0	0	0		
	10 h /sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	150	h	24.00					3,600	0	0	0	0	3,600		150
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	1	45	h				19.40	15.00	0	0	0	873	506	1,379		
	- Compressor XAHS 237 (500 cfm) 15.00 29.00	90%	1	45	h				15.00	29.00	0	0	0	675	979	1,654		
											0	0	0	0	0	0		
	- Drilling materials			756	m		1.20				0	907	0	0	0	907		
											0	0	0	0	0	0		
	Blasting 3.50 m / round 198 holes										0	0	0	0	0	0		
	Loading 10 min / hole			33	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	132	h	24.00					3,168	0	0	0	0	3,168		132
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	30	h				5.00	15.00	0	0	0	150	338	488		
	15 rounds										0	0	0	0	0	0		
	- Prima cord Average lent(84 m / round 1,260 m	5%		1,323	m		1.00				0	1,323	0	0	0	1,323		
	- Caps 33 holes / round 495 un	13%		559	un		5.00				0	2,795	0	0	0	2,795		
	- Dynamite 200 m³ Powder fact 1.6			319	kg		5.60				0	1,788	0	0	0	1,788		
											0	0	0	0	0	0		
	- Miscelaneous material			693	m		2.00				0	1,386	0	0	0	1,386		
											0	0	0	0	0	0		
	Mucking **Included in draft tube**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Support L = 21										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Supply										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P (Unit prices)	Cons. Mat. (Unit prices)	Perm. Mat. (Unit prices)	Equip. Op. (Unit prices)	Fuel l / h	Man power (Total costs)	Consumable materials (Total costs)	Permanent Materials (Total costs)	Equipment Operation (Total costs)	Fuel Consumption (Total costs)	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- Rock bolts 3 m 3.0 un / m 63 un Losses	3%		65	un			70.00			0	0	4,550	0	0	4,550		
	189 m drilling										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Wire mesh 12.60 m² / m 265 m²	15%		304	m²			4.60			0	0	1,398	0	0	1,398		
	- Spikes ,7 m 1.25 m c/c 212 un	3%		218	un			4.50			0	0	981	0	0	981		
	- Wire 0.04 $ / m²			265	m²			0.04			0	0	11	0	0	11		
											0	0	0	0	0	0		
	Rock bolts Installation (Operating on platform hooked on a crane)										0	0	0	0	0	0		
	1) Drilling 10 m / h 19 h																	
	7.5 h / sh Eff.			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	90	h	24.00					2,160	0	0	0	0	2,160		90
											0	0	0	0	0	0		
	- Jack leg 2.00	90%	1	27	h				2.00	0.00	0	0	0	54	0	54		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	27	h				37.00	20.00	0	0	0	999	405	1,404		
	- Compressor XAHS 237 (500 cfm) 15.00 29.00	90%	1	27	h				15.00	29.00	0	0	0	405	587	992		
	2) Install with platform down the shaft										0	0	0	0	0	0		
	63 un 0.5 h / un										0	0	0	0	0	0		
	31.5 h										0	0	0	0	0	0		
	7.5 h / sh. Eff.			5	sh						0	0	0	0	0	0		
	10 h /sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	200	h	24.00					4,800	0	0	0	0	4,800		200
											0	0	0	0	0	0		
	- Jack leg 2.00	90%	1	45	h				2.00	0.00	0	0	0	90	0	90		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	45	h				37.00	20.00	0	0	0	1,665	675	2,340		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	- Torque wrench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Production of 175 m² / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	100	h	24.00					2,400	0	0	0	0	2,400		100
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00		0	0	0	666	0	666		
	- Jack leg 2.00	30%	1	6	h				2.00		0	0	0	12	0	12		
	- Compressor XAHS 237 (500 cfm) 15.00 29.00	90%	1	18	h				15.00		0	0	0	270	0	270		
	- Miscellaneous materials Spike drilling 148.4 m			148	m		1.00				0	148	0	0	0	148		
											0	0	0	0	0	0		
	Wire mesh removing										0	0	0	0	0	0		
	Production of 200 m² / sh			1	sh						0	0	0	0	0	0		
	10 h / sh			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	50	h	24.00					1,200	0	0	0	0	1,200		50
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	9	h				37.00	20.00	0	0	0	333	135	468		
	- Boom truck 17 tons 13.65 18.00	90%	1	9	h				13.65	18.00	0	0	0	123	122	245		
											0	0	0	0	0	0		
	Services **Using outside installations for TBM**			**196**	**m**													

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Transformer Chamber Access tunnel 140																	
	Transformer Chamber 56																	
	196 m																	
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			587	h	24.00					14,089	0	0	0	0	14,089		587
											0	0	0	0	0	0		
	- Miscelaneous materials			196	m		10.00				0	1,957	0	0	0	1,957		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Dewatering										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			391	h	24.00					9,393	0	0	0	0	9,393		391
											0	0	0	0	0	0		
	- Miscelaneous materials			196	m		10.00				0	1,957	0	0	0	1,957		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			685	h	24.00					16,437	0	0	0	0	16,437		685
											0	0	0	0	0	0		
	- Miscelaneous materials			196	m		10.00				0	1,957	0	0	0	1,957		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Compressed Air										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			685	h	24.00					16,437	0	0	0	0	16,437		685
											0	0	0	0	0	0		
	- Miscelaneous materials			196	m		24.00				0	4,696	0	0	0	4,696		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			685	h	24.00					16,437	0	0	0	0	16,437		685
											0	0	0	0	0	0		
	- Miscelaneous materials			196	m		24.00				0	4,696	0	0	0	4,696		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3412	**Transformer Chamber and Access**			**21,750**							**236,179**	**314,039**	**87,608**	**82,760**	**64,412**	**784,998**	**36.09**	**9,841**

Item : (3413)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			

3410 Excavation

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3413	**Powerhouse tailrace including Access and Oulet**			65,657	m³													
	Tailrace access (m²) 67.2, L 176			11,827	m³						0	0	0	0	0	0		
											0	0	0	0	0	0		
	As per 7e Surge Chamber Access 0.43 h / m³			11,827	m³	10.22	14.75	6.32	5.01	2.06	120,834	174,407	74,745	59,281	18,278	447,545		5,034

	(m²)	L	Qty	Un.
Tailrace access	67.2	176	11,827	m³
Tailrace tunnel	39.4	1,100	43,340	m³
Collector and Draft tube	39.4	101.5	4,000	m³
Outlet **Dry**			4,690	m³
Wet			1,800	m³
			65,657	m³

Drilling with Boomer E2 C

			Qty	Un.
Tailrace tunnel	39.4	1,100	43,340	m³
Collector and Draft tube	39.4	102	4,000	m³
		1,202	47,340	m³

D Shape 5 x 8,25 — 39.40 m³ — 1,202 m — 47,340 m³

			Area (m²)
Arc	5.80		1.90
Height	8.25		
Wall	7.50		37.50
Width	5.00	37.50	
			39.40

Excavation

Progression	4.66	m		
Number of rounds	258			
Plus 3 widenings	5			
	263			
Number of shifts	368	Prod. Factor 1.4		
Number of holes			(m)	(Feet)
Production	32	55 mm dia.	42,332	138,851
Contour	33	55 mm dia.	43,655	143,190
	65			
Cut	3	109 mm dia.	3,969	13,017
	68			
Drilling depth	5.03	m	89,957	295,057

Durations			(hours)	263 rounds
Drilling	100	m / h	3.42	900 h
Blasting	1.15	min / hole	1.30	343 h
Scaling & W. mesh			2.00	526 h
Mucking	205	m³ / h	0.90	236 h

WBS	DESCRIPTION	%	n	Qty	Un.	M-P (Unit prices)	Cons. Mat. (Unit prices)	Perm. Mat. (Unit prices)	Equip. Op. (Unit prices)	Fuel l / h	Man power (Total costs)	Consumable materials (Total costs)	Permanent Materials (Total costs)	Equipment Operation (Total costs)	Fuel Consumption (Total costs)	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Drilling labour																	
	H-H / Bolting / W. Mesh / Remaining																	
	8 · 29,440 · 4,122 · 3,533 · 21,786																	
	14% · 12%																	
	Drilling · 4.0 · 263 · 1,052 h																	
	9 h / sh · 117 sh																	
	8 men / sh · 10 h / sh · 9,351 h-h																	
	Loading & Blasting · 1.30 · 263 · 343 h																	
	9 h / sh · 38 sh																	
	8 men / sh · 10 h / sh · 3,040 h-h																	
	Remaining for services · 9,394																	
	Drilling			1,169	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	9,351	h	24.00					224,427	0	0	0	0	224,427		9,351
	263 rounds										0	0	0	0	0	0		
	- Jumbo E 2C · 14.00 · 4.5 h			1,184	h				14.00		0	0	0	16,569	0	16,569		
	- Cat GEP 550 - 400KW · 6.50 · 102.40			1,184	h				6.50	102.40	0	0	0	7,693	90,893	98,586		
	- Bits 2"Ø · 282,040 · 1,600			176	un		85.00				0	14,960	0	0	0	14,960		
	- Bits 4"Ø · 13,017 · 1,500			9	un		500.00				0	4,500	0	0	0	4,500		
	- Rod 18' · 295,057 · 7,500			39	un		485.00				0	18,915	0	0	0	18,915		
	- Coupling · 295,057 · 3,700			80	un		50.00				0	4,000	0	0	0	4,000		
	- Shank · 295,057 · 12,500			24	un		300.00				0	7,200	0	0	0	7,200		
	- Misc. Materials · 295,057			295,057	ft		0.04				0	11,802	0	0	0	11,802		
	Loading & Blasting			380	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	3,040	h	24.00					72,960	0	0	0	0	72,960		3,040
											0	0	0	0	0	0		
	- Explosives Truck · 5.00 · 15.00	90%	1	342	h				5.00	15.00	0	0	0	1,710	3,848	5,558		
											0	0	0	0	0	0		
	5.03 m holes · **263 Rounds**										0	0	0	0	0	0		
	Number · Total · Length (m)										0	0	0	0	0	0		
	Contour holes · 33 · 8,679 · 43,655										0	0	0	0	0	0		
	Production holes · 32 · 8,416 · 42,332										0	0	0	0	0	0		
	65 · 17,095										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Prima cord · 5.5 m · 47,735	5%		50,121	m		1.00				0	50,121	0	0	0	50,121		
	- Cap 6m · 17,095	13%		19,317	un		3.50				0	67,610	0	0	0	67,610		
	- Dynamite RXL 438 · 47,340 m³ · Powder fact · 1.6			75,744	kg		5.60				0	424,166	0	0	0	424,166		
	- XACTEX · 8,679 holes · 23,867	5%		25,061	kg		7.50				0	187,958	0	0	0	187,958		
	2.75 kg / hole										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Mucking · 47,340 m³										0	0	0	0	0	0		
	1.5 Loose »»»» · 71,010 m³										0	0	0	0	0	0		
	270 m³ / round										0	0	0	0	0	0		
	Production · 140 m³ / h · 1.93 h										0	0	0	0	0	0		
	263 rounds · 507 h x 10/9 »»			564	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	3,945	h	24.00					94,680	0	0	0	0	94,680		3,945
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator · 19.00 · 29.00	50%	1	282	h				19.00	29.00	0	0	0	5,358	6,134	11,492		
	- Cat 988H Wheel Loader · 39.20 · 48.00	90%	1	507	h				39.20	48.00	0	0	0	19,874	18,252	38,126		
	- Cat D7R II LGP Track-Type Tractor · 38.25 · 28.00	90%	1	507	h				38.25	28.00	0	0	0	19,393	10,647	30,040		
	- Cat 725 Articulated Dumper 25 T · 24.00 · 20.00	90%	1	507	h				24.00	20.00	0	0	0	12,168	7,605	19,773		

Item : (3413)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 1 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 1 30 km / h										0	0	0	0	0	0		
	13 min.										0	0	0	0	0	0		
	Efficacité : 85% 15 min. / trip										0	0	0	0	0	0		
	0.25 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	36 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	432 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
	Rolling Path Length 1,202										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 2,884										0	0	0	0	0	0		
	Production 800 m³ / sh			4	sh						0	0	0	0	0	0		
	10 h / s			40	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
-	Cat 988H Wheel Loader 39.20 48.00	90%	1	36	h				39.20	48.00	0	0	0	1,411	1,296	2,707		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	36	h				38.25	28.00	0	0	0	1,377	756	2,133		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	36	h				24.00	20.00	0	0	0	864	540	1,404		

Rock Support

D Shape **8 x 9,5** **39.40 m³** **1,202 m** — Qty **47,340 m³**

			Area (m²)
Arc	5.80		1.90
Height	8.25		
Wall	7.50		37.50
Width	5.00	37.50	
			39.40

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
	Tunnel																	
	Required — Length — Arch (m)										0	0	0	0	0	0		
	Class 1 — 901.1 — 5.80	75%									0	0	0	0	0	0		
	Class 2 — 180.2 — 5.80	15%									0	0	0	0	0	0		
	Class 3 — 84.1 — 5.80	7.0%									0	0	0	0	0	0		
	Class 4 — 30.0 — 5.80	2.5%									0	0	0	0	0	0		
	Class 5 — 6.0 — 5.80	0.5%									0	0	0	0	0	0		
	1,202	100%									0	0	0	0	0	0		
	Class 1 — Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m — 1 un / m — 901 un										0	0	0	0	0	0		
	Shotcrete 50 mm — 14.80 m² / m — 2,000 m²	15%									0	0	0	0	0	0		
	Wire mesh — 14.80 m² / m — 11,336 m²	85%									0	0	0	0	0	0		
	Class 2										0	0	0	0	0	0		
	Rock bolts 2,5 m — 1.1 un / m — 206 un										0	0	0	0	0	0		
	Shotcrete 50 mm — 14.80 m² / m — 400 m²	15%									0	0	0	0	0	0		

Item : (3413)

WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.75 $			
	Wire mesh	14.80	m² / m	2,267	m²		85%									0	0	0	0	0	0		
	Class 3															0	0	0	0	0	0		
	Rock bolts 3 m	1.5	un / m	122	un											0	0	0	0	0	0		
	Shotcrete 50 mm	14.80	m² / m	622	m²		50%									0	0	0	0	0	0		
	Wire mesh	14.80	m² / m	622	m²		50%									0	0	0	0	0	0		
	Class 4															0	0	0	0	0	0		
	Rock bolts 4 m	2.6	un / m	77	un											0	0	0	0	0	0		
	Shotcrete 50 mm	9.0	m² / m	81	m²		30%									0	0	0	0	0	0		
	Wire mesh	9.0	m² / m	189	m²		70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m² / m	174	m²		100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m² / m	174	m²		100%									0	0	0	0	0	0		
	Steel arch (W 100)	1.5	m c/c	20	un											0	0	0	0	0	0		
		20.8	m / arch	416	m																		
	Class 5															0	0	0	0	0	0		
	Rock bolts 5 m	5.8	un / m	35	un											0	0	0	0	0	0		
	Shotcrete 50 mm	9.0	m² / m	16	m²		30%									0	0	0	0	0	0		
	Wire mesh	9.0	m² / m	38	m²		70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m² / m	35	m²		100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m² / m	35	m²		100%									0	0	0	0	0	0		
	Steel arch (W 150)	0.75	m c/c	8	un											0	0	0	0	0	0		
		20.8	m / arch	166	m											0	0	0	0	0	0		
	Supply			Lenght (m)												0	0	0	0	0	0		
-	Rock bolts 2,5 m	1,107	un	2,768		Losses	3%		1,140	un			60.00			0	0	68,400	0	0	68,400		
-	Rock bolts 3 m	122	un	366		Losses	3%		126	un			70.00			0	0	8,820	0	0	8,820		
-	Rock bolts 4 m	77	un	308		Losses	3%		79	un			80.00			0	0	6,320	0	0	6,320		
-	Rock bolts 5 m	35	un	175		Losses	3%		36	un			105.00			0	0	3,780	0	0	3,780		
		1,341		3,617												0	0	0	0	0	0		
-	Injection tubes	150	m roll				3%		25	rolls			110.00			0	0	2,750	0	0	2,750		
-	Oakum	130	bolts / box				3%		11	box			280.00			0	0	3,080	0	0	3,080		
-	Grease	154	bolts / box				3%		9	box			336.00			0	0	3,024	0	0	3,024		
																0	0	0	0	0	0		
-	Wire mesh	14,453	m²				15%		16,621	m²			4.60			0	0	76,457	0	0	76,457		
-	Reinf. Mesh	209	m²				15%		240	m²			5.60			0	0	1,344	0	0	1,344		
		14,662	m²													0	0	0	0	0	0		
-	Spikes 1,1 m	1.25	m c/c	11,730	un		3%		12,082	un			4.50			0	0	54,369	0	0	54,369		
-	Wire			0.04 $	/ m²				14,662	m²			0.04			0	0	586	0	0	586		
		m²		m³												0	0	0	0	0	0		
	Shotcrete 50 mm	3,120	0.05	156												0	0	0	0	0	0		
	Shotcrete 100 mm	209	0.1	21												0	0	0	0	0	0		
				177												0	0	0	0	0	0		
-	Cement (40 kg Bags)	0.03	m³ / bag			Losses	7.5%		6,340	bags			10.00			0	0	63,400	0	0	63,400		
		33.33	bags / m³	5,897	bags											0	0	0	0	0	0		
-	Sand	1.40 mt / m³		0.11	h / mt				248	mt	2.61	8.08	0.00	2.60	11.98	646	2,001	0	644	2,225	5,516		27
																0	0	0	0	0	0		
-	Monoset (3% of cement)			235,895	kg		3%		7,077	kg			3.40			0	0	24,062	0	0	24,062		
																0	0	0	0	0	0		
-	Steel arch (W 100)	19.0	kg / m	416	m				7,904	kg			4.00			0	0	31,616	0	0	31,616		
-	Steel arch (W 150)	22.0	kg / m	166	m				3,661	kg			5.00			0	0	18,304	0	0	18,304		
	Rock bolts Installation								368	sh						0	0	0	0	0	0		
		3,617 m		10	m / sh																		
		1,341 un		4	un / sh																		
				0.5	h / un. including positionning																		
				2	h / sh				736	h													
1)	Drilling with Jumbo															0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
											0	0	0	0	0	0		
	- Jumbo	90%	1	662	h				102.50		0	0	0	67,855	0	67,855		
	- Cat GEP 550 - 400KW 6.50 102.40			662	h				6.50	102.40	0	0	0	4,303	50,842	55,145		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
	1,341 un 4 un / sh																	
	0.5 h / un incl. Positionning																	
	1.8 h / sh			671	h													
	- M-P		3	2,012	h	24.00					48,276	0	0	0	0	48,276		2,012
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	603	h				37.00	20.00	0	0	0	22,311	9,045	31,356		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	- Torque wrench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			34	sh						0	0	0	0	0	0		
	10 h / sh			340	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	1,360	h	24.00					32,640	0	0	0	0	32,640		1,360
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	306	h				37.00	20.00	0	0	0	11,322	4,590	15,912		
	- Moyno pump 2.00	75%	1	255	h				2.00		0	0	0	510	0	510		
											0	0	0	0	0	0		
	- Cement (bags) 3,617 m	100%		592	bags			10.00			0	0	5,920	0	0	5,920		
	11,862 ft 0.02269801 sf										0	0	0	0	0	0		
	2 in. Dia hole 269 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 296 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 118 kg	1%		120	kg			3.00			0	0	360	0	0	360		
	- Miscellaneous			1,341	un		0.30				0	402	0	0	0	402		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 200 m² / sh 14,662 m²			73	sh						0	0	0	0	0	0		
	10 h / sh			733	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	4,399		24.00					105,566	0	0	0	0	105,566		4,399
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	660	h				37.00	20.00	0	0	0	24,420	9,900	34,320		
	- Jack leg 2.00	30%		220	h				2.00		0	0	0	440	0	440		
	- Miscellaneous materials Spike drilling 12,903 m			12,903	m		1.00				0	12,903	0	0	0	12,903		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**177**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 124 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			17	sh						0	0	0	0	0	0		
	10 h / sh			170	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	850	h	24.00					20,400	0	0	0	0	20,400		850
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	153	h				37.00	20.00	0	0	0	5,661	2,295	7,956		
	- Shotcrete pump 17.00	60%	1	102	h				17.00		0	0	0	1,734	0	1,734		
	- Hoses	25%	1	43	h		35.00				0	1,505	0	0	0	1,505		
	- Nozzle 66 m³ / un			3	un		275.00				0	825	0	0	0	825		
											0	0	0	0	0	0		

Item : (3413)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Arches installation 582 m 21 m / un			**28**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			14	sh						0	0	0	0	0	0		
	10 h / sh			140	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	700	h	24.00					16,800	0	0	0	0	16,800		700
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	126	h				37.00	20.00	0	0	0	4,662	2,520	7,182		
	- Miscellaneous materials			28	un		200.00				0	5,600	0	0	0	5,600		
	Dewatering Duration 6 months			**1,202**	**m**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20,000				0	20,000	0	0	0	20,000		
	- Miscelaneous			1,202	m		15.00				0	18,023	0	0	0	18,023		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			2,403	h	24.00					57,672	0	0	0	0	57,672		2,403
											0	0	0	0	0	0		
	Outside Installation			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	210	h	24.00					5,040	0	0	0	0	5,040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6,000	0	6,000		
											0	0	0	0	0	0		
	Pumping 26 weeks 6 d / w			156	days						0	0	0	0	0	0		
	20 h / day			3,120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	3,120	h	24.00					74,880	0	0	0	0	74,880		3,120
											0	0	0	0	0	0		
	- Miscelaneous			26	weeks		110.00				0	2,860	0	0	0	2,860		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials Duration 6 months										0	0	0	0	0	0		
	- Pumps			2	un		20,000				0	40,000	0	0	0	40,000		
	- Miscelaneous			1,202	m		21.00				0	25,232	0	0	0	25,232		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			2,403	h	24.00					57,672	0	0	0	0	57,672		2,403
											0	0	0	0	0	0		
	Compressed Air Duration 6 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			4,205	h	24.00					100,926	0	0	0	0	100,926		4,205
											0	0	0	0	0	0		
	- Miscelaneous materials			1,202	m		24.00				0	28,836	0	0	0	28,836		
											0	0	0	0	0	0		
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			3,605	h	24.00					86,508	0	0	0	0	86,508		3,605
											0	0	0	0	0	0		
	- Miscelaneous materials			1,202	m		10.00				0	12,015	0	0	0	12,015		
											0	0	0	0	0	0		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			4,205	h	24.00					100,926	0	0	0	0	100,926		4,205
											0	0	0	0	0	0		
	- Miscelaneous materials			1,202	m		22.00				0	26,433	0	0	0	26,433		

Item : (3413)

									UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.75 $			
														0	0	0	0	0	0		
														0	0	0	0	0	0		
	Outside services are included in TBM													0	0	0	0	0	0		
	Outlet **Dry**						**4,690**	**m³**													
	Wet						**1,800**	**m³**													
	Construction roads	**(m)**	**(m² / m)**	**(m³)**										0	0	0	0	0	0		
	Widenning permanent road	**5,000**	**5**	**25,000**										0	0	0	0	0	0		
	From powerhouse access to outlet	**500**	**11**	**5,500**										0	0	0	0	0	0		
		5,500		**30,500**										0	0	0	0	0	0		
	Backfill from excavated materials													0	0	0	0	0	0		
	Foundation						**30,500**	**m³**													
	Production of 1,200 m³ / sh						25	sh						0	0	0	0	0	0		
			10 h / s				250	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
-	M-P					4	1,000	h	24.00					24,000	0	0	0	0	24,000		1,000
														0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	225	h				38.25	28.00	0	0	0	8,606	4,725	13,331		
-	Cat CS76 XT Vibratory Soil Compactor	14.85	20.00		45%	1	113	h				14.85	20.00	0	0	0	1,678	1,695	3,373		
-	Cat 329DL Hydraulic Excavator	19.00	29.00		25%	1	63	h				19.00	29.00	0	0	0	1,197	1,370	2,567		
-	Miscelaneous (culverts, signalisation, etc...)						5,500	m		2.00				0	11,000	0	0	0	11,000		
	Pavement 0.3 x	10		3 m³ / m			**16,500**	**m³**						0	0	0	0	0	0		
	Production of 1,000 m³ / sh						17	sh						0	0	0	0	0	0		
			10 h / s				165	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
-	M-P					10	1,650	h	24.00					39,600	0	0	0	0	39,600		1,650
														0	0	0	0	0	0		
-	Cat D6T LGP Track-Type Tractor	28.40	26.10		90%	1	149	h				28.40	26.10	0	0	0	4,232	2,917	7,149		
-	Cat 725 Articulated Dumper 25 T	24.00	20.00		45%	5	371	h				24.00	20.00	0	0	0	8,904	5,565	14,469		
-	Cat CS76 XT Vibratory Soil Compactor	14.85	20.00		25%	1	41	h				14.85	20.00	0	0	0	609	615	1,224		
-	Cat 14M Motorgrader	16.65	25.75		90%	1	149	h				16.65	25.75	0	0	0	2,481	2,878	5,359		
-	Cat 980H Wheel Loader	29.00	23.45		90%	1	149	h				29.00	23.45	0	0	0	4,321	2,621	6,942		
														0	0	0	0	0	0		
	Hauling distance from crusher	5.00 km												0	0	0	0	0	0		
														0	0	0	0	0	0		
	Loading	4												0	0	0	0	0	0		
	Trip up	9	35 km / h											0	0	0	0	0	0		
	Unloading	4												0	0	0	0	0	0		
	Back trip	9	35 km / h											0	0	0	0	0	0		
		26 min.												0	0	0	0	0	0		
	Efficiency :	85%	31 min. / trip											0	0	0	0	0	0		
			0.51 h / trip											0	0	0	0	0	0		
			9 h / sh											0	0	0	0	0	0		
			18 trips / sh											0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T		12.0 m³											0	0	0	0	0	0		
			216 m³/mach/sh											0	0	0	0	0	0		
	Number of trucks per shift		**5**											0	0	0	0	0	0		
														0	0	0	0	0	0		
-	Pavement material	1.8 mt / m³	0.11 h / mt				29,700	mt	2.61	8.08	0.00	2.60	11.98	77,517	239,976	0	77,220	266,855	661,568		3,267
														0	0	0	0	0	0		
	Rock Excavation - Dry						**4,690**	**m³**						0	0	0	0	0	0		
	Drilling													0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 4,343 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			22	sh						0	0	0	0	0	0		
	2 machines			11	sh						0	0	0	0	0	0		
	10 h / s			110	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	550	h	24.00					13,200	0	0	0	0	13,200		550
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	2	198	h				19.40	15.00	0	0	0	3,841	2,228	6,069		
-	Drilling materials			4,343	m		0.70				0	3,040	0	0	0	3,040		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 8 m										0	0	0	0	0	0		
	Number of holes 543 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Dynamite 1 kg / m³ 4,690 m³ Losses	5%		4,925	kg		5.60				0	27,580	0	0	0	27,580		
-	Caps Losses	5%		570	un		4.50				0	2,565	0	0	0	2,565		
											0	0	0	0	0	0		
-	M-P		4	440	h	24.00					10,560	0	0	0	0	10,560		440
											0	0	0	0	0	0		
-	Explosives Truck 5.00 15.00	90%	1	99	h				5.00	15.00	0	0	0	495	1,114	1,609		
-	Misc. Blasting materials			4,690	m³		0.10				0	469	0	0	0	469		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 426 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 640 m³ / sh			11	sh						0	0	0	0	0	0		
	10 h / s			110	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		7	770	h	24.00					18,480	0	0	0	0	18,480		770
											0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	99	h				38.25	28.00	0	0	0	3,787	2,079	5,866		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	198	h				24.00	20.00	0	0	0	4,752	2,970	7,722		
-	Generator 5 kW (Tower light) 3.50 2.20	90%	1	99	h				3.50	2.20	0	0	0	347	163	510		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	99	h				19.00	29.00	0	0	0	1,881	2,153	4,034		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	552 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
	Rock Excavation - Wet			**1,800**	**m³**						0	0	0	0	0	0		
	Rock plug 1,800										0	0	0	0	0	0		
	Drilling platform 10,000										0	0	0	0	0	0		
	11,800										0	0	0	0	0	0		

Item : (3413)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 10,926 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			55	sh						0	0	0	0	0	0		
	3 machines			18	sh						0	0	0	0	0	0		
	10 h / s			183	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	1,100	h	24.00					26,400	0	0	0	0	26,400		1,100
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	3	495	h				19.40	15.00	0	0	0	9,603	5,569	15,172		
	- Drilling materials			10,926	m		0.70				0	7,648	0	0	0	7,648		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 20 m										0	0	0	0	0	0		
	Number of holes 546 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1.5 kg / m³ 2,700 kg Losses	5%		2,835	kg		5.60				0	15,876	0	0	0	15,876		
	- Caps Losses	5%		574	un		4.50				0	2,583	0	0	0	2,583		
											0	0	0	0	0	0		
	Production 8 min / hole 73 h			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	72	h				5.00	15.00	0	0	0	360	810	1,170		
	- Misc. Blasting materials			1,800	m³		0.10				0	180	0	0	0	180		
											0	0	0	0	0	0		
	Mucking Rock plug 1,800										0	0	0	0	0	0		
	1.5 loose »»»» 2,700										0	0	0	0	0	0		
	Drilling platform 10,000										0	0	0	0	0	0		
	12,700 m³										0	0	0	0	0	0		
	With clamshell and casted on each side										0	0	0	0	0	0		
	Production 425 m³ / sh			30	sh						0	0	0	0	0	0		
	10 h / s			300	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	1,200	h	24.00					28,800	0	0	0	0	28,800		1,200
											0	0	0	0	0	0		
	- Crane 150T - Crawler 50.75 25.00	90%	1	270	h				50.75	25.00	0	0	0	13,703	5,063	18,766		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	45%	1	135	h				38.25	28.00	0	0	0	5,164	2,835	7,999		
	- Miscelaneous			300	h		5.00				0	1,500	0	0	0	1,500		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3413	**Powerhouse tailrace including Access and Oulet**			**65,657**							**1,474,770**	**1,476,471**	**447,337**	**448,741**	**553,891**	**4,401,210**	**67.03**	**61,486**

Item : **(3414)**

3410 Excavation

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
3414	**Cable and Escape Tunnel**			**18 425**	**m³**													
	Drilling with standard hydraulic drilling machine																	
	From transformer chamber 200 m										0	0	0	0	0	0		
	From outside 865 m										0	0	0	0	0	0		
	D Shape 4,5 x 4,2 17.30 m³ 1 065 m			**18 425**	**m³**						0	0	0	0	0	0		
	Area (m²)										0	0	0	0	0	0		
	Arc 5.30 3.80										0	0	0	0	0	0		
	Height 4.20										0	0	0	0	0	0		
	Wall 3.00 13.50										0	0	0	0	0	0		
	Width 4.50										0	0	0	0	0	0		
	17.30										0	0	0	0	0	0		
	Excavation										0	0	0	0	0	0		
	Progression 3.00 m										0	0	0	0	0	0		
	Number of rounds 355										0	0	0	0	0	0		
	Number of shifts 497 Prod. Factor 1.4										0	0	0	0	0	0		
	Number of holes (m) (Feet)										0	0	0	0	0	0		
	Production 14 55 mm dia. 16 749 54 936										0	0	0	0	0	0		
	Contour 18 55 mm dia. 21 534 70 633										0	0	0	0	0	0		
	32										0	0	0	0	0	0		
	Cut 3 109 mm dia. 3 589 11 772										0	0	0	0	0	0		
	35										0	0	0	0	0	0		
	Drilling depth 3.37 m 41 872 137 341										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Durations (hours) 355 rounds										0	0	0	0	0	0		
	Drilling 22 m / h 5.36 1 903 h										0	0	0	0	0	0		
	Blasting 5 min / hole 2.92 1 035 h										0	0	0	0	0	0		
	8.28										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling and Blasting			355	sh						0	0	0	0	0	0		
	10 h / sh			3 550	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	14 200	h	24.00					340 800	0	0	0	0	340 800		14 200
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	1	3 195	h				19.40	15.00	0	0	0	61 983	35 944	97 927		
	- Explosives Truck 5.00 15.00	90%	1	3 195	h				5.00	15.00	0	0	0	15 975	35 944	51 919		
											0	0	0	0	0	0		
	3.37 m holes 355 Rounds										0	0	0	0	0	0		
	Number Total Length (m)										0	0	0	0	0	0		
	Contour holes 18 6 390 21 534										0	0	0	0	0	0		
	Production holes 14 4 970 16 749										0	0	0	0	0	0		
	32 11 360										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Prima cord 3.8 m 24 282	5%		25 496	m		1.00				0	25 496	0	0	0	25 496		
	- Cap 6m 11 360	13%		12 837	un		3.50				0	44 930	0	0	0	44 930		
	- Dynamite RXL 438 18 425 m³ Powder fact 1.6			29 479	kg		5.60				0	165 084	0	0	0	165 084		
	- XACTEX 6 390 holes 17 573	5%		18 451	kg		7.50				0	138 383	0	0	0	138 383		
	2.75 kg / hole										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2,5"Ø 125 569 1 500			84	un		160.00				0	13 440	0	0	0	13 440		

Item : **(3414)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- Bits 3"Ø 11 772 1 500			8	un		200.00				0	1 600	0	0	0	1 600		
	- Rod 18' 137 341 5 000			27	un		500.00				0	13 500	0	0	0	13 500		
	- Shank 137 341 10 000			14	un		300.00				0	4 200	0	0	0	4 200		
	- Misc. Materials 137 341			137 341	ft		0.05				0	6 867	0	0	0	6 867		
											0	0	0	0	0	0		
	Mucking 18 425 m³										0	0	0	0	0	0		
	1.5 Loose »»»» 27 637 m³										0	0	0	0	0	0		
	78 m³ / round										0	0	0	0	0	0		
	Transformer chamber section 200 m										0	0	0	0	0	0		
	Scooptram Average hauling distance : 0.15 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 0.5										0	0	0	0	0	0		
	Going 1.0 8.0 km / h										0	0	0	0	0	0		
	Unloading 3.0										0	0	0	0	0	0		
	Return 1.0 8.8 km / h										0	0	0	0	0	0		
	5.5 min.										0	0	0	0	0	0		
	Efficacité : 85% 6.5 min. / trip										0	0	0	0	0	0		
	0.11 h / trip										0	0	0	0	0	0		
	3.00 m³ / trip										0	0	0	0	0	0		
	2.80 h / round										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Left for Rock Support and services = 6.70 h										0	0	0	0	0	0		
	Trucks										0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 25.88 3 m³ / trip										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 2 30 km / h										0	0	0	0	0	0		
	33 min.										0	0	0	0	0	0		
	Efficacité : 85% 39 min. / trip										0	0	0	0	0	0		
	0.64 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	14 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	168 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2** **(1+1)**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production 78 m³ / round 3.00 h / round										0	0	0	0	0	0		
	355 rounds 1 065 h x 10/9 »»			1 183	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	5 917	h	24.00					142 000	0	0	0	0	142 000		5 917
											0	0	0	0	0	0		
	- R1300 G - Scooptram 20.35 16.00	90%	1	1 065	h				20.35	16.00	0	0	0	21 673	12 780	34 453		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	1 065	h				38.25	28.00	0	0	0	40 736	22 365	63 101		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	2 130	h				24.00	20.00	0	0	0	51 120	31 950	83 070		
											0	0	0	0	0	0		
	Outside section 865 m										0	0	0	0	0	0		
	Scooptram Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 0.5										0	0	0	0	0	0		
	Going 4.0 8.0 km / h										0	0	0	0	0	0		
	Unloading 3.0										0	0	0	0	0	0		
	Return 3.0 8.8 km / h										0	0	0	0	0	0		
	10.5 min.										0	0	0	0	0	0		

Item : **(3414)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	Efficiency : 85% 12.4 min. / trip										0	0	0	0	0	0		
	0.21 h / trip										0	0	0	0	0	0		
	3.00 m³ / trip										0	0	0	0	0	0		
	5.34 h / round										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Left for Rock Support and services = 4.16 h										0	0	0	0	0	0		
	Trucks										0	0	0	0	0	0		
	Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 49.41 3 m³ / trip										0	0	0	0	0	0		
	Going 1 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 1 30 km / h										0	0	0	0	0	0		
	54 min.										0	0	0	0	0	0		
	Efficacité : 85% 64 min. / trip										0	0	0	0	0	0		
	1.07 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	9 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	108 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2** **(1+1)**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production 78 m³ / round 6.00 h / round										0	0	0	0	0	0		
	355 rounds 2 130 h x 10/9 »»			2 367	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	11 833	h	24.00					284 000	0	0	0	0	284 000		11 833
											0	0	0	0	0	0		
	- R1300 G - Scooptram 20.35 16.00	90%	1	2 130	h				20.35	16.00	0	0	0	43 346	25 560	68 906		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	2 130	h				38.25	28.00	0	0	0	81 473	44 730	126 203		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	4 260	h				24.00	20.00	0	0	0	102 240	63 900	166 140		
											0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
											0	0	0	0	0	0		
	D Shape **4,5 x 4,2** **17.30 m³** **1 065 m**										0	0	0	0	0	0		
	Area (m²)										0	0	0	0	0	0		
	Arc 5.30 3.80										0	0	0	0	0	0		
	Height 4.20										0	0	0	0	0	0		
	Wall 3.00 13.50										0	0	0	0	0	0		
	Width 4.50										0	0	0	0	0	0		
	17.30										0	0	0	0	0	0		
	Tunnel										0	0	0	0	0	0		
	Reshuired Length Dia.(m) Arch (m)										0	0	0	0	0	0		
	Class 1 798.8 12.5 11.59	75%									0	0	0	0	0	0		
	Class 2 159.8 12.5 11.59	15%									0	0	0	0	0	0		
	Class 3 74.6 12.5 11.59	7.0%									0	0	0	0	0	0		
	Class 4 26.6 12.5 11.59	2.5%									0	0	0	0	0	0		
	Class 5 5.3 12.5 11.59	0.5%									0	0	0	0	0	0		
	1 065	100%									0	0	0	0	0	0		
	Class 1 Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m 1 un / m 799 un										0	0	0	0	0	0		
	Shotcrete 50 mm 11.59 m² / m 1 389 m²	15%									0	0	0	0	0	0		
	Wire mesh 11.59 m² / m 7 869 m²	85%									0	0	0	0	0	0		
	Class 2										0	0	0	0	0	0		
	Rock bolts 2,5 m 2.3 un / m 366 un										0	0	0	0	0	0		

Item : **(3414)**

WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.75 $			
	Shotcrete 50 mm	11.59	m^2 / m	278	m^2		15%									0	0	0	0	0	0		
	Wire mesh	11.59	m^2 / m	1 574	m^2		85%									0	0	0	0	0	0		
	Class 3															0	0	0	0	0	0		
	Rock bolts 3 m	2.9	un / m	216	un											0	0	0	0	0	0		
	Shotcrete 50 mm	11.59	m^2 / m	432	m^2		50%									0	0	0	0	0	0		
	Wire mesh	11.59	m^2 / m	432	m^2		50%									0	0	0	0	0	0		
	Class 4															0	0	0	0	0	0		
	Rock bolts 4 m	5.2	un / m	137	un											0	0	0	0	0	0		
	Shotcrete 50 mm	0.0	m^2 / m	0	m^2		30%									0	0	0	0	0	0		
	Wire mesh	0.0	m^2 / m	0	m^2		70%									0	0	0	0	0	0		
	Shotcrete 100 mm	11.6	m^2 / m	309	m^2		100%									0	0	0	0	0	0		
	Reinf. Mesh	11.6	m^2 / m	309	m^2		100%									0	0	0	0	0	0		
	Steel arch (W 100)	1.5	m c/c	18	un											0	0	0	0	0	0		
		11.3	m / arch	203	m											0	0	0	0	0	0		
	Class 5															0	0	0	0	0	0		
	Rock bolts 5 m	11.6	un / m	62	un											0	0	0	0	0	0		
	Shotcrete 50 mm	0.0	m^2 / m	0	m^2		30%									0	0	0	0	0	0		
	Wire mesh	0.0	m^2 / m	0	m^2		70%									0	0	0	0	0	0		
	Shotcrete 100 mm	11.6	m^2 / m	62	m^2		100%									0	0	0	0	0	0		
	Reinf. Mesh	11.6	m^2 / m	62	m^2		100%									0	0	0	0	0	0		
	Steel arch (W 150)	0.75	m c/c	7	un											0	0	0	0	0	0		
		11.3	m / arch	79	m											0	0	0	0	0	0		
	Supply			Lenght (m)												0	0	0	0	0	0		
	- Rock bolts 2,5 m	1 165	un	3 000		Losses	3%		1 200	un			60.00			0	0	72 000	0	0	72 000		
	- Rock bolts 3 m	216	un	666		Losses	3%		222	un			70.00			0	0	15 540	0	0	15 540		
	- Rock bolts 4 m	137	un	564		Losses	3%		141	un			80.00			0	0	11 280	0	0	11 280		
	- Rock bolts 5 m	62	un	320		Losses	3%		64	un			105.00			0	0	6 720	0	0	6 720		
		1 580		4 550												0	0	0	0	0	0		
	- Injection tubes	150	m roll				3%		31	rolls			110.00			0	0	3 410	0	0	3 410		
	- Oakum	130	bolts / box				3%		13	box			280.00			0	0	3 640	0	0	3 640		
	- Grease	154	bolts / box				3%		11	box			336.00			0	0	3 696	0	0	3 696		
																0	0	0	0	0	0		
	- Wire mesh	9 875	m^2				15%		11 356	m^2			4.60			0	0	52 238	0	0	52 238		
	- Reinf. Mesh	370	m^2				15%		426	m^2			5.60			0	0	2 386	0	0	2 386		
		10 245	m^2													0	0	0	0	0	0		
	- Spikes 1,1 m	1.25	m c/c	8 196	un		3%		8 442	un			4.50			0	0	37 989	0	0	37 989		
	- Wire			0.04 $	/ m^2				10 245	m^2			0.04			0	0	410	0	0	410		
		m^2		m^3												0	0	0	0	0	0		
	Shotcrete 50 mm	2 098	0.05	105												0	0	0	0	0	0		
	Shotcrete 100 mm	370	0.1	37												0	0	0	0	0	0		
				142												0	0	0	0	0	0		
	- Cement (40 kg Bags)	0.03	m^3 / bag			Losses	7.5%		5 086	bags			10.00			0	0	50 860	0	0	50 860		
		33.33	bags / m^3	4 732	bags											0	0	0	0	0	0		
	- Sand	1.40 mt / m^3	0.11 h / mt						199	mt	2.61	8.08	0.00	2.60	11.98	519	1 606	0	517	1 786	4 428		22
																0	0	0	0	0	0		
	- Monoset (3% of cement)			189 265	kg		3%		5 678	kg			3.40			0	0	19 305	0	0	19 305		
																0	0	0	0	0	0		
	- Steel arch (W 100)	19.0	kg / m	203	m				3 865	kg			4.00			0	0	15 458	0	0	15 458		
	- Steel arch (W 150)	22.0	kg / m	79	m				1 740	kg			5.00			0	0	8 701	0	0	8 701		
																0	0	0	0	0	0		
	Rock bolts Installation															0	0	0	0	0	0		
	1 580 un	0.5	h	790	h											0	0	0	0	0	0		
				7.5	h / sh Eff.				106	sh						0	0	0	0	0	0		
				10	h / sh				1 060	h						0	0	0	0	0	0		
	1) Drilling															0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- M-P		4	4 240	h	24.00					101 760	0	0	0	0	101 760		4 240
											0	0	0	0	0	0		
	- Jumbo	90%	1	954	h				102.50		0	0	0	97 785	0	97 785		
											0	0	0	0	0	0		
	2) Install with 10 T Fork lift										0	0	0	0	0	0		
	1 580 un 4 un / round										0	0	0	0	0	0		
	0.5 h / un 2.2 h / round including positionning										0	0	0	0	0	0		
	3 516 h										0	0	0	0	0	0		
	9.0 h / sh. Eff.			391	sh						0	0	0	0	0	0		
	10 h /sh			3 910	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	11 730	h	24.00					281 520	0	0	0	0	281 520		11 730
											0	0	0	0	0	0		
	- Fork lift 10 T 11.00 7.00	90%	1	3 519	h				11.00	7.00	0	0	0	38 709	18 475	57 184		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1 200.00				0	1 200	0	0	0	1 200		
	- Torque rench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			40	sh						0	0	0	0	0	0		
	10 h /sh			400	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	1 600	h	24.00					38 400	0	0	0	0	38 400		1 600
											0	0	0	0	0	0		
	- Fork lift 10 T 11.00 7.00	90%	1	360	h				11.00	7.00	0	0	0	3 960	1 890	5 850		
	- Moyno pump 2.00	75%	1	300	h				2.00		0	0	0	600	0	600		
											0	0	0	0	0	0		
	- Cement (bags) 4 550 m	100%		744	bags			10.00			0	0	7 440	0	0	7 440		
	14 924 ft 0.02269801 sf										0	0	0	0	0	0		
	2 in. Dia hole 339 cu ft										0	0	0	0	0	0		
	0.91 bag / cu ft 372 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 149 kg	1%		150	kg			3.00			0	0	450	0	0	450		
	- Miscellaneous			1 580	un		0.30				0	474	0	0	0	474		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Production of 200 m^2 / sh 10 245			51	sh						0	0	0	0	0	0		
	10 h / sh			512	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	3 073	h	24.00					73 764	0	0	0	0	73 764		3 073
											0	0	0	0	0	0		
	- Fork lift 10 T 11.00 7.00	90%	1	461	h				11.00	7.00	0	0	0	5 071	2 420	7 491		
	- Jack leg 2.00	30%	1	154	h				2.00		0	0	0	308	0	308		
	- Miscellaneous materials Spike drilling 9015.6 m			9 016	m		1.00				0	9 016	0	0	0	9 016		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**142**	**m^3**						0	0	0	0	0	0		
	Production of 0.7 h / m^3 99 h										0	0	0	0	0	0		
	7.5 h / sh. Eff.			14	sh						0	0	0	0	0	0		
	10 h /sh			140	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	1 260	h	24.00					30 240	0	0	0	0	30 240		1 260
											0	0	0	0	0	0		
	- Fork lift 10 T 11.00 7.00	90%	1	126	h				11.00	7.00	0	0	0	1 386	662	2 048		
	- Shotcrete pump 17.00	60%	1	84	h				17.00		0	0	0	1 428	0	1 428		
	- Hoses	25%	1	35	h		35.00				0	1 225	0	0	0	1 225		

Item : **(3414)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.75 $			
	- Nozzle 66 m³ / un			2	un		275.00				0	550	0	0	0	550		
											0	0	0	0	0	0		
	Arches installation 283 m 11 m / un			**25**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			13	sh						0	0	0	0	0	0		
	10 h /sh			130	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	650	h	24.00					15 600	0	0	0	0	15 600		650
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	117	h				37.00	20.00	0	0	0	4 329	1 755	6 084		
	- Miscellaneous materials			25	un		200.00				0	5 000	0	0	0	5 000		
	Outside services are included in TBM Power tunnel										0	0	0	0	0	0		
	Dewatering Duration 497 sh (days) 26 d / mth			19	mth						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 1.0 h / m			1 065	h	24.00					25 560	0	0	0	0	25 560		1 065
											0	0	0	0	0	0		
	- Miscelaneous			1 065	m		10.00				0	10 650	0	0	0	10 650		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			2 130	h	24.00					51 120	0	0	0	0	51 120		2 130
											0	0	0	0	0	0		
	- Miscelaneous materials			1 065	m		10.00				0	10 650	0	0	0	10 650		
	Compressed Air										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			2 130	h	24.00					51 120	0	0	0	0	51 120		2 130
											0	0	0	0	0	0		
	- Miscelaneous materials			1 065	m		24.00											
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 1.5 h / m			1 598	h	24.00					38 340	0	0	0	0	38 340		1 598
											0	0	0	0	0	0		
	- Miscelaneous materials			1 065	m		10.00											
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			2 130	h	24.00					51 120	0	0	0	0	51 120		2 130
											0	0	0	0	0	0		
	- Miscelaneous materials			1 065	m		24.00				0	25 560	0	0	0	25 560		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3414	**Cable and Escape Tunnel**			**18 425**	**m³**						**1 525 863**	**480 011**	**311 523**	**572 639**	**300 161**	**3 190 197**		**63 578**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3420	**Concrete Works**																	
3421	**Transformer Chamber Concrete**			**1,660**	**m³**													
	Transformer Chamber			**1,660**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concreting 4.50 h / m³			7,470	h	24.00					179,280	0	0	0	0	179,280		7,470
	- Construction materials			1,660	m³		74.00				0	122,840	0	0	0	122,840		
	- Construction equipment			1,660	m³				48.00	38.00	0	0	0	79,680	45,418	125,098		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concrete supply 1,660 2.61 h / m³	2%		1,693	m²	62.54	17.48	155.35	24.23	22.05	105,873	29,587	263,003	41,021	26,881	466,365		4,416
											0	0	0	0	0	0		
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabrication 60 kg / m³ 15.88 h / mt			**100**	**mt**	381.05	217.41	988.17	69.37	39.85	37,953	21,654	98,422	6,909	2,857	167,795		1,581
											0	0	0	0	0	0		
	Installation																	
	- M-P 16.00 h / mt			1,594	h	24.00					38,246	0	0	0	0	38,246		1,594
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	319	h				37.00	20.00	0	0	0	11,803	4,594	16,397		
	- Boom truck 17 tons 13.65 18.00	50%	1	797	h				13.65	18.00	0	0	0	10,879	10,329	21,208		
											0	0	0	0	0	0		
	Concrete transportation from the Batching Plan			**1,693**	**m³**						0	0	0	0	0	0		
	Average production 80 m³ / sh			22	sh						0	0	0	0	0	0		
	10 h / sh			220	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	440	h	24.00					10,560	0	0	0	0	10,560		440
											0	0	0	0	0	0		
	- Readymix 8 m³ 13.60 14.00	90%	1	198	h				13.60	14.00	0	0	0	2,693	1,996	4,689		
											0	0	0	0	0	0		
	Average hauling distance : 5.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 10 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 9 35 km / h										0	0	0	0	0	0		
	44 min.										0	0	0	0	0	0		
	Efficacité : 85% 52 min. / trip										0	0	0	0	0	0		
	0.86 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	11 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	88 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3421	**Transformer Chamber Concrete**			**1,660**	**m³**						**371,912**	**174,081**	**361,425**	**152,985**	**92,075**	**1,152,478**		**15,501**

Item : (3421-3426)

									UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
3422	**Powerhouse - Phase I**						**1,755**	**m³**													
	Powerhouse	1,755												0	0	0	0	0	0		
		1,755												0	0	0	0	0	0		
	Powerhouse						**1,755**	**m²**						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Concreting	5.00 h / m³					8,775	h	24.00					210,600	0	0	0	0	210,600		8,775
	- Construction materials						1,755	m³		74.00				0	129,870	0	0	0	129,870		
	- Construction equipment						1,755	m³				48.00	38.00	0	0	0	84,240	48,017	132,257		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Concrete supply	1,755	2.61 h / m³		2%		1,790	m²	62.54	17.48	155.35	24.23	22.05	111,939	31,282	278,072	43,371	28,421	493,085		4,669
														0	0	0	0	0	0		
	Reinforcing Steel													0	0	0	0	0	0		
	- Supply and Fabrication	60 kg / m³	15.88 h / mt				**105**	**mt**	381.05	217.41	988.17	69.37	39.85	40,125	22,894	104,054	7,304	3,021	177,398		1,672
														0	0	0	0	0	0		
	Installation																				
	- M-P	16.00 h / mt					1,685	h	24.00					40,435	0	0	0	0	40,435		1,685
														0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)		37.00	20.00	20%	1	337	h				37.00	20.00	0	0	0	12,469	4,853	17,322		
	- Boom truck 17 tons		13.65	18.00	50%	1	842	h				13.65	18.00	0	0	0	11,493	10,912	22,405		
														0	0	0	0	0	0		
	Concrete transportation from the Batching Plan						**1,790**	**m³**						0	0	0	0	0	0		
	Average production	50 m³ / sh					36	sh						0	0	0	0	0	0		
				10 h / sh			360	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					2	720	h	24.00					17,280	0	0	0	0	17,280		720
														0	0	0	0	0	0		
	- Readymix 8 m³		13.60	14.00	90%	1	324	h				13.60	14.00	0	0	0	4,406	3,266	7,672		
														0	0	0	0	0	0		
		Average hauling distance :		5.00 km										0	0	0	0	0	0		
														0	0	0	0	0	0		
	Loading	10												0	0	0	0	0	0		
	Going	10		30 km / h										0	0	0	0	0	0		
	Unloading	15												0	0	0	0	0	0		
	Return	9		35 km / h										0	0	0	0	0	0		
		44	min.											0	0	0	0	0	0		
	Efficacité :	85%		52 min. / trip										0	0	0	0	0	0		
				0.86 h / trip										0	0	0	0	0	0		
				9 h / sh										0	0	0	0	0	0		
				11 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³			8 m³										0	0	0	0	0	0		
				88 m³ / truck-sh										0	0	0	0	0	0		
			Number of trucks :	**1**										0	0	0	0	0	0		
														0	0	0	0	0	0		
3422	**Powerhouse - Phase I**						**1,755**							**420,379**	**184,046**	**382,126**	**163,283**	**98,490**	**1,248,324**		**17,520**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3423	**Powerhouse - Phase II**			**1,240**	**m³**													
	Powerhouse 1,240										0	0	0	0	0	0		
	1,240										0	0	0	0	0	0		
	Powerhouse			**1,240**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concreting 5.75 h / m³			7,130	h	24.00					171,120	0	0	0	0	171,120		7,130
	- Construction materials			1,240	m³		74.00				0	91,760	0	0	0	91,760		
	- Construction equipment			1,240	m³				48.00	38.00	0	0	0	59,520	33,926	93,446		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concrete supply 1,240 2.61 h / m³	2%		1,265	m²	62.54	17.48	155.35	24.23	22.05	79,108	22,107	196,514	30,651	20,085	348,465		3,299
											0	0	0	0	0	0		
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabrication 60 kg / m³ 15.88 h / mt			**74**	**mt**	381.05	217.41	988.17	69.37	39.85	28,350	16,175	73,520	5,161	2,134	125,340		1,181
											0	0	0	0	0	0		
	Installation																	
	- M-P 16.00 h / mt			1,190	h	24.00					28,570	0	0	0	0	28,570		1,190
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	238	h				37.00	20.00	0	0	0	8,806	3,427	12,233		
	- Boom truck 17 tons 13.65 18.00	50%	1	595	h				13.65	18.00	0	0	0	8,122	7,711	15,833		
											0	0	0	0	0	0		
	Concrete transportation from the Batching Plan			**1,265**	**m³**						0	0	0	0	0	0		
	Average production 80 m³ / sh			16	sh						0	0	0	0	0	0		
	10 h / sh			160	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
	- Readymix 8 m³ 13.60 14.00	90%	1	144	h				13.60	14.00	0	0	0	1,958	1,452	3,410		
											0	0	0	0	0	0		
	Average hauling distance : 5.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 10 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 9 35 km / h										0	0	0	0	0	0		
	44 min.										0	0	0	0	0	0		
	Efficacité : 85% 52 min. / trip										0	0	0	0	0	0		
	0.86 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	11 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	88 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3423	**Powerhouse - Phase II**			**1,240**							**314,828**	**130,042**	**270,034**	**114,218**	**68,735**	**897,857**		**13,121**

WBS	DESCRIPTION		%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
							UNIT PRICES					TOTAL COSTS							
												24.00 $				0.72 $			
3424	**Penstocs and Manifold**				**650**	**m³**													
	Penstocks and Manifold				**650**	**m³**						0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Concreting	4.50 h / m³			2,925	h	24.00					70,200	0	0	0	0	70,200		2,925
	- Construction materials				650	m³		65.00				0	42,250	0	0	0	42,250		
	- Construction equipment				650	m³				52.00	45.00	0	0	0	33,800	21,060	54,860		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Concrete supply	650 2.61 h / m³	2%		663	m²	62.54	17.48	155.35	24.23	22.05	41,461	11,586	102,995	16,064	10,527	182,633		1,729
												0	0	0	0	0	0		
												0	0	0	0	0	0		
	Concrete transportation from the Batching Plan				**663**	**m³**						0	0	0	0	0	0		
	Average production	45 m³ / sh			15	sh						0	0	0	0	0	0		
		10 h / sh			150	h						0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P			2	300	h	24.00					7,200	0	0	0	0	7,200		300
												0	0	0	0	0	0		
	- Readymix 8 m³	13.60 14.00	90%	1	135	h				13.60	14.00	0	0	0	1,836	1,361	3,197		
												0	0	0	0	0	0		
	Average hauling distance :	5.00 km										0	0	0	0	0	0		
												0	0	0	0	0	0		
	Loading	10										0	0	0	0	0	0		
	Going	10 30 km / h										0	0	0	0	0	0		
	Unloading	15										0	0	0	0	0	0		
	Return	9 35 km / h										0	0	0	0	0	0		
		44 min.										0	0	0	0	0	0		
	Efficacité :	85% 52 min. / trip										0	0	0	0	0	0		
		0.86 h / trip										0	0	0	0	0	0		
		9 h / sh										0	0	0	0	0	0		
		11 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³	8 m³										0	0	0	0	0	0		
		88 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks :	**1**										0	0	0	0	0	0		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
3424	**Penstocs and Manifold**				**650**	**m³**						**118,861**	**53,836**	**102,995**	**51,700**	**32,948**	**360,340**		**4,954**
3425	**Intake Tunnel**				**1,800**	**m³**													
	Intake Tunnel				**1,800**	**m³**						0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Concreting	6.00 h / m³			10,800	h	24.00					259,200	0	0	0	0	259,200		10,800
	- Construction materials				1,800	m³		60.00				0	108,000	0	0	0	108,000		
	- Construction equipment				1,800	m³				48.00	38.00	0	0	0	86,400	49,248	135,648		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Concrete supply	1,800 2.61 h / m³	2%		1,836	m²	62.54	17.48	155.35	24.23	22.05	114,816	32,086	285,218	44,486	29,152	505,758		4,789
												0	0	0	0	0	0		

Item : (3421-3426)

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabrication 60 kg / m³ 15.88 h / mt			**108**	**mt**	381.05	217.41	988.17	69.37	39.85	41,154	23,481	106,722	7,492	3,098	181,947		1,715
											0	0	0	0	0	0		
	Installation																	
	- M-P 16.00 h / mt			1,728	h	24.00					41,472	0	0	0	0	41,472		1,728
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	346	h				37.00	20.00	0	0	0	12,802	4,982	17,784		
	- Boom truck 17 tons 13.65 18.00	50%	1	864	h				13.65	18.00	0	0	0	11,794	11,197	22,991		
											0	0	0	0	0	0		
	Concrete transportation from the Batching Plan			**1,836**	**m³**						0	0	0	0	0	0		
	Average production 50 m³ / sh			37	sh						0	0	0	0	0	0		
	10 h / sh			370	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	740	h	24.00					17,760	0	0	0	0	17,760		740
											0	0	0	0	0	0		
	- Readymix 8 m³ 13.60 14.00	90%	1	333	h				13.60	14.00	0	0	0	4,529	3,357	7,886		
											0	0	0	0	0	0		
	Average hauling distance : 5.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 10 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 9 35 km / h										0	0	0	0	0	0		
	44 min.										0	0	0	0	0	0		
	Efficacité : 85% 52 min. / trip										0	0	0	0	0	0		
	0.86 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	11 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	88 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3425	**Intake Tunnel**			**1,800**							**474,402**	**163,567**	**391,940**	**167,503**	**101,034**	**1,298,446**		**19,771**

3426	**Cable and Escape Tunnel**																	
	Concrete Blocks			**4,500**	**m²**						0	0	0	0	0	0		
	Supply										0	0	0	0	0	0		
	- Concrete blocks Losses	5%		4,725	m²			110.00			0	0	519,750	0	0	519,750		
											0	0	0	0	0	0		
	Production of 30 m² / sh			158	sh						0	0	0	0	0	0		
	10 h /sh			1,575	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	11,025	h	24.00					264,600	0	0	0	0	264,600		11,025
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	1,418	h				13.65	18.00	0	0	0	19,356	18,377	37,733		
											0	0	0	0	0	0		
	- Miscellaneous			1,575	h		6.00		12.00		0	9,450	0	18,900	0	28,350		
											0	0	0	0	0	0		

Item : (3421-3426)

WBS	DESCRIPTION		%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Concrete Footing	Length 1,186										0	0	0	0	0	0		
		Width 0.30										0	0	0	0	0	0		
		Height 0.150										0	0	0	0	0	0		
		Volume 53 m³			53	m³						0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Concreting	5.50 h / m³			294	h	24.00					7,045	0	0	0	0	7,045		294
	- Construction materials				53	m³		74.00				0	3,949	0	0	0	3,949		
	- Construction equipment				53	m³				48.00	38.00	0	0	0	2,562	1,460	4,022		
												0	0	0	0	0	0		
	- Concrete	**2.61** h / mt Losses	2%		54	m³	62.54	17.48	155.35	24.23	22.05	3,377	944	8,389	1,308	2,176	16,194		141
												0	0	0	0	0	0		
												0	0	0	0	0	0		
	Pavement	Length 1,186										0	0	0	0	0	0		
		Width 3.50										0	0	0	0	0	0		
		Thickness 0.150										0	0	0	0	0	0		
		Volume 623 m³										0	0	0	0	0	0		
												0	0	0	0	0	0		
	Production	900 m³ / sh			1	sh						0	0	0	0	0	0		
		10 h / s			10	h						0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P			4	40	h	24.00					960	0	0	0	0	960		40
												0	0	0	0	0	0		
	- Cat 988H Wheel Loader	39.20 48.00	90%	1	9	h				39.20	48.00	0	0	0	353	311	664		
	- Cat D7R II LGP Track-Type Tractor	38.25 28.00	90%	1	9	h				38.25	28.00	0	0	0	344	181	525		
	- Cat 725 Articulated Dumper 25 T	24.00 20.00	90%	1	9	h				24.00	20.00	0	0	0	216	130	346		
												0	0	0	0	0	0		
	- Crushed Stone	1.8 mt / m³ **0.11** h / mt			1,121	mt	2.61	8.08	0.00	2.60	11.98	2,925	9,056	0	2,914	9,667	24,562		1,121
												0	0	0	0	0	0		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
3426	**Cable and Escape Tunnel**											**278,907**	**23,399**	**528,139**	**45,953**	**32,302**	**908,700**		**12,620**

Item : (3430-3470)

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
3430	**Powerhouse crane installation**					**1**	**ls**													
	Including testing																			
						10	sh						0	0	0	0	0	0		
			10 h / sh			100	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				9	900	h	24.00					21,600	0	0	0	0	21,600		900
													0	0	0	0	0	0		
	- Crane - Rough terrain 120 t (L-Bel	45.00	23.00	75%	1	75	h				45.00	23.00	0	0	0	3,375	1,242	4,617		
	- Boom truck 17 tons	13.65	18.00	90%	1	90	h				13.65	18.00	0	0	0	1,229	1,166	2,395		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00	60%	1	60	h				11.50	15.00	0	0	0	690	648	1,338		
													0	0	0	0	0	0		
	- Miscellaneous					100	h		9.00		8.00	12.00	0	900	0	800	864	2,564		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3430	**Powerhouse crane installation**												**21,600**	**900**	**0**	**6,094**	**3,920**	**32,514**		**900**
3440	**Powerhouse overhead roofing**					**45**	**mt**													
	Overhead Roofing					**45**	**mt**						0	0	0	0	0	0		
	Supply and install												0	0	0	0	0	0		
	- Material					45	mt			4,000			0	0	180,000	0	0	180,000		
													0	0	0	0	0	0		
	Production of	8 mt / sh				6	sh													
			10 h / sh			56	h													
	- M-P				6	338	h	24.00					8,100	0	0	0	0	8,100		338
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	51	h				37.00	20.00	0	0	0	1,887	734	2,621		
	- Boom truck 17 tons	13.65	18.00	90%	1	51	h				13.65	18.00	0	0	0	696	661	1,357		
													0	0	0	0	0	0		
	- Miscellaneous					56	h		4.00		8.00	12.00	0	225	0	450	486	1,161		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3440	**Powerhouse overhead roofing**					**45**							**8,100**	**225**	**180,000**	**3,033**	**1,881**	**193,239**		**338**

Item : (3430-3470)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS							
													24.00 $				0.72 $			
3450	**Structural Steel**					**160**	**mt**													
	Steel Structure for service area		75										0	0	0	0	0	0		
	Steel Structure for powerhouse area		85										0	0	0	0	0	0		
			160 mt										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Supply and install					**160**	**mt**						0	0	0	0	0	0		
	- Material					160	mt			3,775			0	0	604,000	0	0	604,000		
													0	0	0	0	0	0		
	Production of	8.0 mt / sh				20	sh						0	0	0	0	0	0		
			10 h / sh			200	h													
													0	0	0	0	0	0		
	- M-P				8	1,600		24.00					38,400	0	0	0	0	38,400		1,600
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	180	h				37.00	20.00	0	0	0	6,660	2,592	9,252		
	- Boom truck 17 tons	13.65	18.00	90%	1	180	h				13.65	18.00	0	0	0	2,457	2,333	4,790		
													0	0	0	0	0	0		
	- Miscellaneous					200	h		4.00		8.00	12.00	0	800	0	1,600	1,728	4,128		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3450	**Structural Steel**					**160**							**38,400**	**800**	**604,000**	**10,717**	**6,653**	**660,570**		**1,600**
3460	**Steel lining - Penstocks and Manifold**					**460**	**mt**													
	Supply and install					**460**	**mt**						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Material					460	mt			3,000			0	0	1,380,000	0	0	1,380,000		
													0	0	0	0	0	0		
	Production of	10.0 mt / sh				46	sh						0	0	0	0	0	0		
			10 h / sh			460	h													
													0	0	0	0	0	0		
	- M-P				##	6,440		24.00					154,560	0	0	0	0	154,560		6,440
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	414	h				37.00	20.00	0	0	0	15,318	5,962	21,280		
	- Boom truck 17 tons	13.65	18.00	90%	1	414	h				13.65	18.00	0	0	0	5,651	5,365	11,016		
	- Welding Machine - 400 A	2.00	6.00	90%	4	1,656	h				2.00	6.00	0	0	0	3,312	7,154	10,466		
	- Miscellaneous					460	h		12.00		24.00	36.00	0	5,520	0	11,040	11,923	28,483		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3460	**Steel lining - Penstocks and Manifold**					**460**							**154,560**	**5,520**	**1,380,000**	**35,321**	**30,404**	**1,605,805**		**6,440**

Item : (3430-3470)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3470	**Concrete Plugs - Tunnels**			**2,790**	**m³**													
	Concrete plugs																	
	Power tunnel access Concrete Plug			**2,790**	**m³**													
	- Concreting 2.75 h / m³			7,673	h	24.00					184,140	0	0	0	0	184,140		7,673
	- Construction materials			2,790	m³		70.00				0	195,300	0	0	0	195,300		
	- Construction equipment			2,790	m³				40.00	48.00	0	0	0	111,600	96,422	208,022		
											0	0	0	0	0	0		
	- Concrete supply 2,790 2.61 h / m³	2%		2,846	m²	62.54	17.48	155.35	24.23	22.05	177,977	49,736	442,118	68,958	45,188	783,977		7,423
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabricat 60 kg / m³ 15.88 h / mt			**167**	**mt**	381.05	217.41	988.17	69.37	39.85	63,788	36,395	165,420	11,612	4,803	282,018		2,658
											0	0	0	0	0	0		
	Installation																	
	- M-P 16.00 h / mt			2,678	h	24.00					64,282	0	0	0	0	64,282		2,678
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	536	h				37.00	20.00	0	0	0	19,832	7,718	27,550		
	- Boom truck 17 tons 13.65 18.00	50%	1	1,339	h				13.65	18.00	0	0	0	18,277	17,353	35,630		
	Concrete transportation from the Batching Plan			**2,790**	**m³**						0	0	0	0	0	0		
	Average production 400 m³ / sh			7	sh						0	0	0	0	0	0		
	10 h / sh			70	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	350	h	24.00					8,400	0	0	0	0	8,400		350
											0	0	0	0	0	0		
	- Readymix 8 m³ 13.60 4.00	90%	4	252					13.60	4.00	0	0	0	3,427	726	4,153		
											0	0	0	0	0	0		
	Average hauling distance : 5.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 10 30 km / h										0	0	0	0	0	0		
	Unloading 8										0	0	0	0	0	0		
	Return 9 35 km / h										0	0	0	0	0	0		
	37 min.										0	0	0	0	0	0		
	Efficacité : 85% 44 min. / trip										0	0	0	0	0	0		
	0.73 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	13 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	104 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **4**										0	0	0	0	0	0		
											0	0	0	0	0	0		
3470	**Concrete Plugs - Tunnels**			**2,790**							**498,587**	**281,431**	**607,538**	**233,706**	**172,210**	**1,793,472**		**20,782**

3500 Civil works related to Power tunnel

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3510	**Power tunnel (including Rock Support)**			224,138	m³													
	TBM - Operation										0	0	0	0	0	0		
	Dia. Area Lenth Volume										0	0	0	0	0	0		
	5.1 20.43 10,972 224,138										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Cutter cost			224,138	m³		14.30				0	3,205,173	0	0	0	3,205,173		
											0	0	0	0	0	0		
	Assembling 7 wks 60 h / wk			420	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Foreman	100%	1	420	h	24.00					10,080	0	0	0	0	10,080		420
	- Mechanic	100%	4	1,680	h	24.00					40,320	0	0	0	0	40,320		1,680
	- Electrician	100%	2	840	h	24.00					20,160	0	0	0	0	20,160		840
	- Iron worker	100%	4	1,680	h	24.00					40,320	0	0	0	0	40,320		1,680
	- Miner	100%	1	420	h	24.00					10,080	0	0	0	0	10,080		420
	- Truck Driver	100%	2	840	h	24.00					20,160	0	0	0	0	20,160		840
	- Crane op.	100%	1	420	h	24.00					10,080	0	0	0	0	10,080		420
	- Crane op.helper	100%	1	420	h	24.00					10,080	0	0	0	0	10,080		420
			16								0	0	0	0	0	0		
	- Crane 150T - Crawler 50.75 25.00	90%	1	378	h				50.75	25.00	0	0	0	19,184	6,804	25,988		
	- Welding Machine - 400 A 2.00 6.00	90%	1	378	h				2.00	6.00	0	0	0	756	1,633	2,389		
	- Tractor truck & Load Carrier - 65 T 11.50 15.00	45%	1	189	h				11.50	15.00	0	0	0	2,174	2,041	4,215		
	Boom truck 17 tons 13.65 18.00	90%	1	378	h				13.65	18.00	0	0	0	5,160	4,899	10,059		
	Labour										0	0	0	0	0	0		
	Average penatration 2.2 m / h										0	0	0	0	0	0		
	Duration																	
	Distance 10,972 m 4,987 h										0	0	0	0	0	0		
	2 m strokes 5,486 strokes										0	0	0	0	0	0		
	5 min / stroke 458 h										0	0	0	0	0	0		
	1 Conveyer belt splicing / 300 m										0	0	0	0	0	0		
	15 h / splice 549 h										0	0	0	0	0	0		
	5,994										0	0	0	0	0	0		
	Efficiency 85% 7,052 h										0	0	0	0	0	0		
	9 h eff. / shift 784 sh										0	0	0	0	0	0		
	12 sh / week 65 weeks										0	0	0	0	0	0		
	15.0 months										0	0	0	0	0	0		
	14 m / sh										0	0	0	0	0	0		
											0	0	0	0	0	0		
	1) Day shift			392	sh						0	0	0	0	0	0		
	10 h / sh			3,920	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Foreman	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
	- TBM Op.	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
	- Rock Support	100%	6	23,520	h	24.00					564,480	0	0	0	0	564,480		23,520
	- Iron worker	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
	- Electrician	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
	- Services	100%	6	23,520	h	24.00					564,480	0	0	0	0	564,480		23,520
			16								0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
											0	0	0	0	0	0		
2)	Night shift			392	sh						0	0	0	0	0	0		
	10 h / sh			3,920	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Foreman	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
-	TBM Op.	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
-	Rock Support	100%	6	23,520	h	24.00					564,480	0	0	0	0	564,480		23,520
-	Iron worker	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
-	Electrician	100%	1	3,920	h	24.00					94,080	0	0	0	0	94,080		3,920
-	Services	100%	6	23,520	h	24.00					564,480	0	0	0	0	564,480		23,520
			16								0	0	0	0	0	0		
											0	0	0	0	0	0		
	Equipment										0	0	0	0	0	0		
-	TBM			4,987	h				80.00		0	0	0	398,982	0	398,982		
-	Conveyers			4,987	h				50.00		0	0	0	249,364	0	249,364		
-	Boom truck 17 tons 13.65 18.00	90%	1	3,528	h				13.65	18.00	0	0	0	48,157	45,723	93,880		
											0	0	0	0	0	0		
-	Miscellaneous			1	ls		1,000,000				0	1,000,000	0	0	0	1,000,000		
											0	0	0	0	0	0		
	Disposal of excavated materials										0	0	0	0	0	0		
	224,138 m³ solid										0	0	0	0	0	0		
	1.6 factor 358,621 loose 457 m³ / sh										0	0	0	0	0	0		
	51 m³ / h										0	0	0	0	0	0		
	0.85 m³ / min										0	0	0	0	0	0		
	Distance moyenne de transport : 3.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	chargement 15										0	0	0	0	0	0		
	aller 5 35 km / h										0	0	0	0	0	0		
	déchargement 3										0	0	0	0	0	0		
	retour 4 45 km / h										0	0	0	0	0	0		
	27 min.										0	0	0	0	0	0		
	Efficacité : 85% 32 min. / trip										0	0	0	0	0	0		
	0.53 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	17 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	204 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
				784	sh						0	0	0	0	0	0		
	10 h / sh			7,840	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	39,200	h	24.00					940,800	0	0	0	0	940,800		39,200
											0	0	0	0	0	0		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	3	21,168	h				24.00	20.00	0	0	0	508,032	304,819	812,851		
-	Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	7,056	h				28.40	26.10	0	0	0	200,390	132,596	332,986		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Dismantling TBM & Conveyers 4 weeks 60 h / w			240	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		16	3,840	h	24.00					92,160	0	0	0	0	92,160		3,840
											0	0	0	0	0	0		
-	Crane 150T - Crawler 50.75 25.00	90%	1	216	h				50.75	25.00	0	0	0	10,962	3,888	14,850		
-	Tractor truck & Load Carrier - 65 T 11.50 15.00	90%	2	432	h				11.50	15.00	0	0	0	4,968	4,666	9,634		

Item : 3510

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Boom truck 17 tons 13.65 18.00	90%	2	432	h				13.65	18.00	0	0	0	5,897	5,599	11,496		
											0	0	0	0	0	0		
	Dewatering Duration 18 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20,000				0	20,000	0	0	0	20,000		
	- Miscelaneous			16,000	m		15.00				0	240,000	0	0	0	240,000		
											0	0	0	0	0	0		
	Outside Installation			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	210	h	24.00					5,040	0	0	0	0	5,040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6,000	0	6,000		
											0	0	0	0	0	0		
	Pumping 78 weeks 6 d / w			468	days						0	0	0	0	0	0		
	20 h / day			9,353	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	9,353	h	24.00					224,467	0	0	0	0	224,467		9,353
											0	0	0	0	0	0		
	- Miscelaneous			78	weeks		110.00				0	8,573	0	0	0	8,573		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials Duration 18 months										0	0	0	0	0	0		
	- Pumps 1 un / km 10 km			10	un		20,000				0	200,000	0	0	0	200,000		
	- Miscelaneous			10,000	m		21.00				0	210,000	0	0	0	210,000		
											0	0	0	0	0	0		
	Enclosed building for Compressors and Generators TBM 1) 13 34 19,50 - 1000										0	0	0	0	0	0		
	- Supply 16 x 50			800	m²		137.00				0	109,600	0	0	0	109,600		
	- Install 0.913 h / m²			730	h	24.00					17,520	0	0	0	0	17,520		730
	- Equipment			800	m²				30.00		0	0	0	24,000	0	24,000		
											0	0	0	0	0	0		
	- Overhead crane - 12 T			1	ls		50,000				0	50,000	0	0	0	50,000		
											0	0	0	0	0	0		
	- Door			1	ls		20,000				0	20,000	0	0	0	20,000		
	13 34 19,50 - 1000										0	0	0	0	0	0		
	- Insulation			800	m²		10.70				0	8,560	0	0	0	8,560		
	- M-P 0.075 h / m²			60	h	24.00					1,440	0	0	0	0	1,440		60
											0	0	0	0	0	0		
	Compressed Air Duration 18 months										0	0	0	0	0	0		
	78 weeks										0	0	0	0	0	0		
	6 days / week		2								0	0	0	0	0	0		
	18 h / day										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Miscellaneous materials			10,000	m		24.00				0	240,000	0	0	0	240,000		
											0	0	0	0	0	0		
	Outside Installation			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	1,080	h	24.00					25,920	0	0	0	0	25,920		1,080
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	108	h				13.65	18.00	0	0	0	1,474	1,400	2,874		
											0	0	0	0	0	0		
	Operation 78 weeks 6 days / week			468	days						0	0	0	0	0	0		
	18 h / d			8,418	h						0	0	0	0	0	0		

Item : 3510

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS					
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- M-P		1	8,418	h	24.00					202,020	0	0	0	0	202,020		8,418
											0	0	0	0	0	0		
	- Compressor - 1050 cfm 16.50 32.00		4	33,670	h				16.50	32.00	0	0	0	555,556	775,759	1,331,315		
											0	0	0	0	0	0		
	Ventilation & Heathing Duration (winter) 39 weeks	50%									0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Miscelaneous (fans, Furnace, Ducks, etc.)			10,000	m		20				0	200,000	0	0	0	200,000		
											0	0	0	0	0	0		
	Operation 7 d / week										0	0	0	0	0	0		
	24 h / day			6,547	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 60 h / week		2	4,676	h	24.00					112,234	0	0	0	0	112,234		4,676
											0	0	0	0	0	0		
	- Furnace - 2 500 000 BTU 2.00 91.00		3	19,641					2.00	91.00	0	0	0	39,282	1,286,870	1,326,152		
											0	0	0	0	0	0		
	Outside Installation and Removing			6	s						0	0	0	0	0	0		
	60 h / s			360	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	2,160	h	24.00					51,840	0	0	0	0	51,840		2,160
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	324	h				13.65	18.00	0	0	0	4,423	4,199	8,622		
											0	0	0	0	0	0		
	Door Operation 13 weeks 6 days / week			78	days						0	0	0	0	0	0		
	18 h / d			1,404	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	1,404	h	24.00					33,696	0	0	0	0	33,696		1,404
											0	0	0	0	0	0		
	Electrical supply										0	0	0	0	0	0		
	Needed capacity TBM 1,500 kW										0	0	0	0	0	0		
	Conveyer 2 x 600 1,200 kW										0	0	0	0	0	0		
	Boosters 2 x 600 1,200 kW										0	0	0	0	0	0		
	3,900										0	0	0	0	0	0		
	0.8 PF **4,875**										0	0	0	0	0	0		
	- Miscelaneous			16,000	m		22.00				0	352,000	0	0	0	352,000		
											0	0	0	0	0	0		
	Outside Installation and dismantling			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	840	h	24.00					20,160	0	0	0	0	20,160		840
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	108	h				13.65	18.00	0	0	0	1,474	1,400	2,874		
											0	0	0	0	0	0		
	Operation 78 weeks										0	0	0	0	0	0		
	6 days / week										0	0	0	0	0	0		
	18 h / day			8,418	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	16,835	h	24.00					404,041	0	0	0	0	404,041		16,835
											0	0	0	0	0	0		
	- Cat GEP 550 - 400KW **400** 6.50 102.40 1,200	50%	3	12,626	h				6.50	102.40	0	0	0	82,069	930,890	1,012,959		
	- Cat GEP 1250 - 1250kW **1,250** 10.50 185.00 3,750	50%	3	12,626	h				10.50	185.00	0	0	0	132,573	1,681,783	1,814,356		
	4,950										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Support (total power tunnel)			**10,972**	**m**						0	0	0	0	0	0		
	Tunnel										0	0	0	0	0	0		

Item : 3510

WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.72 $			
	Required	Length	Dia.(m)	Arch (m)												0	0	0	0	0	0		
	Class 1	8,229.0	5.1	8.01			75%									0	0	0	0	0	0		
	Class 2	1,645.8	5.1	8.01			15%									0	0	0	0	0	0		
	Class 3	768.0	5.1	8.01			7.0%									0	0	0	0	0	0		
	Class 4	274.3	5.1	8.01			2.5%									0	0	0	0	0	0		
	Class 5	54.9	5.1	8.01			0.5%									0	0	0	0	0	0		
		10,972					100%									0	0	0	0	0	0		
	Class 1			Qty												0	0	0	0	0	0		
	Rock bolts 2,5 m	1	un / m	8,229	un											0	0	0	0	0	0		
	Shotcrete 50 mm	1.20	m² / m	9,888	m²											0	0	0	0	0	0		
	Class 2															0	0	0	0	0	0		
	Rock bolts 2,5 m	1.0	un / m	1,646	un											0	0	0	0	0	0		
	Shotcrete 50 mm	1.20	m² / m	1,978	m²											0	0	0	0	0	0		
	Wire mesh	1.2	m² / m	1,978	m²											0	0	0	0	0	0		
	Class 3															0	0	0	0	0	0		
	Rock bolts 2,5 m	1.28	un / m	984	un											0	0	0	0	0	0		
	Shotcrete 50 mm	8.0	m² / m	6,153	m²											0	0	0	0	0	0		
	Wire mesh	1.2	m² / m	923	m²											0	0	0	0	0	0		
	Class 4															0	0	0	0	0	0		
	Rock bolts 3 m	2.0	un / m	549	un											0	0	0	0	0	0		
	Shotcrete 100 mm	8.0	m² / m	2,197	m²											0	0	0	0	0	0		
	Reinf. Mesh	8.0	m² / m	2,197	m²											0	0	0	0	0	0		
	Steel arch (W 100)	2.00	m c/c	137.15	un											0	0	0	0	0	0		
		20.0	m / arch	2,743	m											0	0	0	0	0	0		
	Class 5															0	0	0	0	0	0		
	Rock bolts 4 m	8.0	un / m	439	un											0	0	0	0	0	0		
	Shotcrete 150 mm	8.0	m² / m	439	m²											0	0	0	0	0	0		
	Reinf. Mesh	8.0	m² / m	439	m²											0	0	0	0	0	0		
	Steel arch (W 150)	1.00	m c/c	54.86	un											0	0	0	0	0	0		
		20.0	m / arch	1,097	m											0	0	0	0	0	0		
	Supply			Lenght (m)												0	0	0	0	0	0		
-	Rock bolts 2,5 m	10,859	un	27,963		Losses	3%		11,185	un			60.00			0	0	671,100	0	0	671,100		
-	Rock bolts 3 m	549	un	1,698		Losses	3%		566	un			70.00			0	0	39,620	0	0	39,620		
-	Rock bolts 4 m	439	un	1,808		Losses	3%		452	un			80.00			0	0	36,160	0	0	36,160		
		11,847		31,469												0	0	0	0	0	0		
-	Injection tubes	150	m roll						210	rolls			110.00			0	0	23,077	0	0	23,077		
-	Oakum	130	bolts / box						79	box			280.00			0	0	22,120	0	0	22,120		
-	Grease	154	bolts / box						77	box			336.00			0	0	25,849	0	0	25,849		
																0	0	0	0	0	0		
-	Wire mesh	2,901	m²				15%		3,336	m²			4.60			0	0	15,346	0	0	15,346		
-	Reinf. Mesh	2,637	m²				15%		3,032	m²			5.60			0	0	16,979	0	0	16,979		
		5,538	m²													0	0	0	0	0	0		
-	Spikes 1,1 m	1.25	m c/c	4,430	un				4,430	un			4.50			0	0	19,935	0	0	19,935		
-	Wire			0.04 $	/ m²				5,538	m²			0.04			0	0	222	0	0	222		
		m²	Thickness	m³												0	0	0	0	0	0		
	Shotcrete 50 mm	18,019	0.05	901												0	0	0	0	0	0		
	Shotcrete 100 mm	2,197	0.1	220												0	0	0	0	0	0		
	Shotcrete 150 mm	439	0.15	66												0	0	0	0	0	0		
				1,187												0	0	0	0	0	0		
-	Sand	1.40 mt / m³	0.11 h / mt						1,662	mt	2.61	8.08	0.00	2.60	11.98	4,337	13,427	0	4,321	14,334	36,419		183
-	Cement (40 kg Bags)	0.03	m³ / bag			Losses	7.5%		42,534	bags			10.00			0	0	425,340	0	0	425,340		
		33.33	bags / m³	39,567	bags											0	0	0	0	0	0		
-	Monoset (3% of cement)		1,701,360	kg			3%		51,041	kg			3.40			0	0	173,539	0	0	173,539		

WBS		DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
							UNIT PRICES					TOTAL COSTS							
												24.00 $				0.72 $			
												0	0	0	0	0	0		
	-	Steel arch (W 150) 22.0 kg / m 24,138 kg			24,138	kg			4.00			0	0	96,552	0	0	96,552		
	-	Steel arch (W 100) 19 kg / m 52,117 kg			52,117	kg			4.00			0	0	208,468	0	0	208,468		
												0	0	0	0	0	0		
		Rock bolts Installation			784	sh						0	0	0	0	0	0		
		10 h / sh			7,840	h						0	0	0	0	0	0		
												0	0	0	0	0	0		
	1)	Drilling with TBM Crew										0	0	0	0	0	0		
												0	0	0	0	0	0		
	2)	Install with 50t crane with basket										0	0	0	0	0	0		
		11,847 un 15 un / sh										0	0	0	0	0	0		
	-	M-P		3	23,520	h	24.00					564,480	0	0	0	0	564,480		23,520
												0	0	0	0	0	0		
	-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	7,056	h				37.00		0	0	0	261,072	0	261,072		
												0	0	0	0	0	0		
	-	Impact tool			1	un		300.00				0	300	0	0	0	300		
	-	Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	-	Torque rench			1	un		280.00				0	280	0	0	0	280		
												0	0	0	0	0	0		
	3)	Injection 40 bolts / sh			297	sh						0	0	0	0	0	0		
		10 h / sh			2,970	h						0	0	0	0	0	0		
												0	0	0	0	0	0		
	-	M-P		4	11,880	h	24.00					285,120	0	0	0	0	285,120		11,880
												0	0	0	0	0	0		
	-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	2,673	h				37.00		0	0	0	98,901	0	98,901		
	-	Moyno pump 2.00	90%	1	2,228	h				2.00		0	0	0	4,455	0	4,455		
												0	0	0	0	0	0		
	-	Cement (bags) 31,469 m	100%		5,150	bags			10.00			0	0	51,500	0	0	51,500		
		103,217 ft 0.022698 sf										0	0	0	0	0	0		
		2 in. Dia hole 2,343 cu ft										0	0	0	0	0	0		
		0.91 bag / cu ft 2,575 bags										0	0	0	0	0	0		
	-	Intraplast "N" 0.4 kg / bag 1,030 kg	1%		1,040	kg			3.00			0	0	3,120	0	0	3,120		
	-	Miscellaneous			11,847	un		0.30				0	3,554	0	0	0	3,554		
												0	0	0	0	0	0		
		Wire mesh installation Installation by TBM crew										0	0	0	0	0	0		
		Production of 200 m² / sh 5,538 m²			28	sh						0	0	0	0	0	0		
		10 h / sh			277	h						0	0	0	0	0	0		
		Plus										0	0	0	0	0	0		
	-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	249	h				37.00		0	0	0	9,213	0	9,213		
	-	Jack leg 2.00	30%	1	83	h				2.00		0	0	0	166	0	166		
	-	Miscellaneous materials Spike drillin 4873 m			4,873	m		1.00				0	4,873	0	0	0	4,873		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
		Shotcreting **By the TBM crew**			**1,187**	**m³**						0	0	0	0	0	0		
		Production of 0.7 h / m³ 831 h										0	0	0	0	0	0		
		7.5 h / sh Eff.			111	sh						0	0	0	0	0	0		
		10 h / sh Eff.			1,110	h						0	0	0	0	0	0		
		Plus										0	0	0	0	0	0		
	-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	999	h				37.00		0	0	0	36,963	0	36,963		
	-	Shotcrete pump 17.00	60%	1	666	h				17.00		0	0	0	11,322	0	11,322		
	-	Hoses	25%	1	278	h		35.00				0	9,730	0	0	0	9,730		
	-	Nozzle 66 m³ / un			18	un		275.00				0	4,950	0	0	0	4,950		
												0	0	0	0	0	0		
		Arches installation			**192**	**un**						0	0	0	0	0	0		

Item : 3510

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
	Production of	2 un / sh				96	sh						0	0	0	0	0	0		
			10 h / sh			960	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	4,800	h	24.00					115,200	0	0	0	0	115,200		4,800
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	864	h				37.00		0	0	0	31,968	0	31,968		
	- Miscellaneous materials					192	un		200.00				0	38,400	0	0	0	38,400		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3510	**Power tunnel (including Rock Support)**					**224,138**	**m³**						**6,272,315**	**5,940,620**	**1,828,927**	**2,759,258**	**5,209,303**	**22,010,423**	**98.20**	**261,349**

Item : 3520

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3520	**Power tunnel Access**			**68,265**	**m^3**													
	D Shape 10 x 10 92.5 m^3 738 m			**68,265**	**m^3**						0	0	0	0	0	0		
	Area (m^2)										0	0	0	0	0	0		
	Arc 11.59 17.50										0	0	0	0	0	0		
	Height 10.00										0	0	0	0	0	0		
	Wall 7.50 75.00										0	0	0	0	0	0		
	Width 10.00										0	0	0	0	0	0		
	92.5										0	0	0	0	0	0		
	Excavation										0	0	0	0	0	0		
	Progression 4.66 m										0	0	0	0	0	0		
	Number of rounds 159										0	0	0	0	0	0		
	Number of shifts 223 Prod. Factor 1.4										0	0	0	0	0	0		
	Number of holes (m) (Feet)										0	0	0	0	0	0		
	Production 74 55 mm dia. 59,183 194,120										0	0	0	0	0	0		
	Contour 41 55 mm dia. 32,791 107,553										0	0	0	0	0	0		
	115										0	0	0	0	0	0		
	Cut 3 109 mm dia. 2,399 7,870										0	0	0	0	0	0		
	118										0	0	0	0	0	0		
	Drilling depth 5.03 m 94,373 309,543										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Durations (hours) 159 rounds										0	0	0	0	0	0		
	Drilling 150 m / h 3.96 629 h										0	0	0	0	0	0		
	Blasting 1.15 min / hole 2.26 360 h										0	0	0	0	0	0		
	Scaling & W. mesh 2.00 318 h										0	0	0	0	0	0		
	Mucking 205 m^3 / h 2.10 334 h										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling labour										0	0	0	0	0	0		
	H-H Bolting W. Mesh Remaining										0	0	0	0	0	0		
	8 17,840 2,498 2,141 13,202										0	0	0	0	0	0		
	14% 12%										0	0	0	0	0	0		
	Drilling 4.0 159 636 h										0	0	0	0	0	0		
	9 h / sh 71 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 5,653 h-h										0	0	0	0	0	0		
	Loading & Blasting 2.26 159 360 h										0	0	0	0	0	0		
	9 h / sh 40 sh										0	0	0	0	0	0		
	8 men / sh 10 h / sh 3,200 h-h										0	0	0	0	0	0		
	Remaining for services 4,348										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling			707	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	5,653	h	24.00					135,680	0	0	0	0	135,680		5,653
	159 rounds										0	0	0	0	0	0		
	- Jumbo E 3C 14.00 4.5 h			716	h				14.00		0	0	0	10,017	0	10,017		
	- Cat GEP 550 - 400KW 6.50 102.40		1	716	h				6.50	102.40	0	0	0	4,651	52,752	57,403		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2"Ø 301,673 1,600			189	un		85.00				0	16,065	0	0	0	16,065		
	- Bits 4"Ø 7,870 1,500			5	un		500.00				0	2,500	0	0	0	2,500		
	- Rod 18' 309,543 7,500			41	un		485.00				0	19,885	0	0	0	19,885		
	- Coupling 309,543 3,700			84	un		50.00				0	4,200	0	0	0	4,200		
	- Shank 309,543 12,500			25	un		300.00				0	7,500	0	0	0	7,500		
	- Misc. Materials 309,543			309,543	ft		0.04				0	12,382	0	0	0	12,382		

Item : 3520

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	Loading & Blasting			400	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	3,200	h	24.00					76,800	0	0	0	0	76,800		3,200
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	360	h				5.00	15.00	0	0	0	1,800	3,888	5,688		
											0	0	0	0	0	0		
	5.03 m holes 159 Rounds										0	0	0	0	0	0		
	Number Total Length (m)										0	0	0	0	0	0		
	Contour holes 41 6,519 32,791										0	0	0	0	0	0		
	Production holes 74 11,766 59,183										0	0	0	0	0	0		
	115 18,285										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Prima cord 5.5 m 35,855	5%		37,647	m		1.00				0	37,647	0	0	0	37,647		
	- Cap 6m 18,285	13%		20,662	un		3.50				0	72,317	0	0	0	72,317		
	- Dynamite RXL 438 68,265 m³ Powder fact 1.6			109,224	kg		5.60				0	611,654	0	0	0	611,654		
	- XACTEX 6,519 holes 17,927	5%		18,824	kg		7.50				0	141,180	0	0	0	141,180		
	2.75 kg / hole						5.60				0	0	0	0	0	0		
											0	0	0	0	0	0		
	Mucking 68,265 m³										0	0	0	0	0	0		
	1.5 Loose »»»» 102,398 m³										0	0	0	0	0	0		
	644 m³ / round										0	0	0	0	0	0		
	Production 140 m³ / h 4.60 h										0	0	0	0	0	0		
	159 rounds 731 h x 10/9 »»			813	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	5,689	h	24.00					136,530	0	0	0	0	136,530		5,689
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	50%	1	406	h				19.00	29.00	0	0	0	7,714	8,477	16,191		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	731	h				39.20	48.00	0	0	0	28,655	25,263	53,918		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	731	h				38.25	28.00	0	0	0	27,961	14,737	42,698		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	1,463	h				24.00	20.00	0	0	0	35,112	21,067	56,179		
											0	0	0	0	0	0		
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 1 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 1 30 km / h										0	0	0	0	0	0		
	13 min.										0	0	0	0	0	0		
	Efficacité : 85% 15 min. / trip										0	0	0	0	0	0		
	0.25 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	36 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	432 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
	Rolling Path Length 738										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 1,771										0	0	0	0	0	0		
	Production 900 m³ / sh			2	sh						0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	10 h / s			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	160	h	24.00					3,840	0	0	0	0	3,840		160
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	18	h				39.20	48.00	0	0	0	706	622	1,328		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	18	h				38.25	28.00	0	0	0	689	363	1,052		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	18	h				24.00	20.00	0	0	0	432	259	691		
	Rock Support										0	0	0	0	0	0		
											0	0	0	0	0	0		
	D Shape 10 x 10 92.5 m³ 738 m			**68,265**	**m³**						0	0	0	0	0	0		
	Area (m²)										0	0	0	0	0	0		
	Arc 11.59 17.50										0	0	0	0	0	0		
	Height 10.00										0	0	0	0	0	0		
	Wall 7.50 75.00										0	0	0	0	0	0		
	Width 10.00										0	0	0	0	0	0		
	92.5										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Tunnel										0	0	0	0	0	0		
	Required Length Dia.(m) Arch (m)										0	0	0	0	0	0		
	Class 1 553.5 11.59	75%									0	0	0	0	0	0		
	Class 2 110.7 11.59	15%									0	0	0	0	0	0		
	Class 3 51.7 11.59	7.0%									0	0	0	0	0	0		
	Class 4 18.5 11.59	2.5%									0	0	0	0	0	0		
	Class 5 3.7 11.59	0.5%									0	0	0	0	0	0		
	738	100%									0	0	0	0	0	0		
	Class 1 Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m 1 un / m 554 un										0	0	0	0	0	0		
	Shotcrete 50 mm 20.59 m² / m 1,709 m²	15%									0	0	0	0	0	0		
	Wire mesh 20.59 m² / m 9,687 m²	85%									0	0	0	0	0	0		
	Class 2										0	0	0	0	0	0		
	Rock bolts 2,5 m 2.3 un / m 253 un										0	0	0	0	0	0		
	Shotcrete 50 mm 20.59 m² / m 342 m²	15%									0	0	0	0	0	0		
	Wire mesh 20.59 m² / m 1,937 m²	85%									0	0	0	0	0	0		
	Class 3										0	0	0	0	0	0		
	Rock bolts 3 m 2.9 un / m 150 un										0	0	0	0	0	0		
	Shotcrete 50 mm 20.59 m² / m 532 m²	50%									0	0	0	0	0	0		
	Wire mesh 20.59 m² / m 532 m²	50%									0	0	0	0	0	0		
	Class 4										0	0	0	0	0	0		
	Rock bolts 4 m 5.2 un / m 95 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.0 m² / m 50 m²	30%									0	0	0	0	0	0		
	Wire mesh 9.0 m² / m 116 m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 11.6 m² / m 214 m²	100%									0	0	0	0	0	0		
	Reinf. Mesh 11.6 m² / m 214 m²	100%									0	0	0	0	0	0		
	Steel arch (W 100) 1.5 m c/c 12 un										0	0	0	0	0	0		
	26.6 m / arch 319 m																	
	Class 5										0	0	0	0	0	0		
	Rock bolts 5 m 11.6 un / m 43 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.0 m² / m 10 m²	30%									0	0	0	0	0	0		
	Wire mesh 9.0 m² / m 23 m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 11.6 m² / m 43 m²	100%									0	0	0	0	0	0		
	Reinf. Mesh 11.6 m² / m 43 m²	100%									0	0	0	0	0	0		
	Steel arch (W 150) 0.75 m c/c 5 un										0	0	0	0	0	0		

Item : 3520

WBS		DESCRIPTION						%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												UNIT PRICES					TOTAL COSTS							
																	24.00 $				0.72 $			
			26.6	m / arch	133	m											0	0	0	0	0	0		
		Supply			Lenght (m)												0	0	0	0	0	0		
	-	Rock bolts 2,5 m	807	un	2,018		Losses	3%		831	un			60.00			0	0	49,860	0	0	49,860		
	-	Rock bolts 3 m	150	un	450		Losses	3%		155	un			70.00			0	0	10,850	0	0	10,850		
	-	Rock bolts 4 m	95	un	380		Losses	3%		98	un			80.00			0	0	7,840	0	0	7,840		
	-	Rock bolts 5 m	43	un	215		Losses	3%		44	un			105.00			0	0	4,620	0	0	4,620		
			1,095		3,063												0	0	0	0	0	0		
	-	Injection tubes	150	m roll				3%		21	rolls			110.00			0	0	2,310	0	0	2,310		
	-	Oakum	130	bolts / box				3%		9	box			280.00			0	0	2,520	0	0	2,520		
	-	Grease	154	bolts / box				3%		7	box			336.00			0	0	2,352	0	0	2,352		
																	0	0	0	0	0	0		
	-	Wire mesh	12,296	m²				15%		14,140	m²			4.60			0	0	65,044	0	0	65,044		
	-	Reinf. Mesh	257	m²				15%		295	m²			5.60			0	0	1,652	0	0	1,652		
			12,552	m²													0	0	0	0	0	0		
	-	Spikes 1,1 m	1.25	m c/c	10,042	un		3%		10,343	un			4.50			0	0	46,544	0	0	46,544		
	-	Wire			0.04	$ / m²				12,552	m²			0.04			0	0	502	0	0	502		
			m²		m³												0	0	0	0	0	0		
		Shotcrete 50 mm	2,643	0.05	132												0	0	0	0	0	0		
		Shotcrete 100 mm	257	0.1	26												0	0	0	0	0	0		
					158												0	0	0	0	0	0		
	-	Cement (40 kg Bags)	0.03	m³ / bag			Losses	7.5%		5,655	bags			10.00			0	0	56,550	0	0	56,550		
			33.33	bags / m³	5,260	bags											0	0	0	0	0	0		
	-	Sand	1.40	mt / m³	0.11	h / mt				221	mt	2.61	8.08	0.00	2.60	11.98	577	1,785	0	574	1,906	4,842		24
																	0	0	0	0	0	0		
	-	Monoset (3% of cement)			210,414	kg		3%		6,312	kg			3.40			0	0	21,461	0	0	21,461		
																	0	0	0	0	0	0		
	-	Steel arch (W 100)	19.0	kg / m	319	m				6,063	kg			4.00			0	0	24,250	0	0	24,250		
	-	Steel arch (W 150)	22.0	kg / m	133	m				2,925	kg			5.00			0	0	14,625	0	0	14,625		
		Rock bolts Installation								223	sh						0	0	0	0	0	0		
			3,063	m	14	m / sh																		
			1,095	un	5	un / sh																		
					0.5	h / un. including positionning																		
					3	h / sh				669	h													
	1)	Drilling with Jumbo															0	0	0	0	0	0		
																	0	0	0	0	0	0		
	-	Jumbo						90%	1	602	h				102.50		0	0	0	61,705	0	61,705		
	-	Cat GEP 550 - 400KW	6.50		102.40					602	h				6.50	102.40	0	0	0	3,913	44,384	48,297		
	2)	Install with 50t crane with basket															0	0	0	0	0	0		
			1,095	un	5	un / sh																		
					0.5	h / un incl. Positionning																		
					2.5	h / sh				548	h													
	-	M-P							3	1,643	h	24.00					39,420	0	0	0	0	39,420		1,643
																	0	0	0	0	0	0		
	-	Crane - Rough terrain 50 t (L-Belt)	37.00		20.00			90%	1	493	h				37.00	20.00	0	0	0	18,241	7,099	25,340		
																	0	0	0	0	0	0		
	-	Impact tool								1	un		300.00				0	300	0	0	0	300		
	-	Test rig								1	un		1,200.00				0	1,200	0	0	0	1,200		
	-	Torque wrench								1	un		280.00				0	280	0	0	0	280		
																	0	0	0	0	0	0		
	3)	Injection	40	bolts / sh						28	sh						0	0	0	0	0	0		
					10	h / sh				280	h						0	0	0	0	0	0		

Item : 3520

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- M-P		4	1,120	h	24.00					26,880	0	0	0	0	26,880		1,120
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	252	h				37.00	20.00	0	0	0	9,324	3,629	12,953		
	- Moyno pump 2.00	75%	1	210	h				2.00		0	0	0	420	0	420		
											0	0	0	0	0	0		
	- Cement (bags) 3,063 m	100%		502	bags			10.00			0	0	5,020	0	0	5,020		
	10,045 ft 0.022698 sf										0	0	0	0	0	0		
	2 in. Dia hole 228 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 251 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 100 kg	1%		101	kg			3.00			0	0	303	0	0	303		
	- Miscellaneous			1,095	un		0.30				0	329	0	0	0	329		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Installation by Jumbo team										0	0	0	0	0	0		
	Production of 200 m² / sh 12,552 m²			63	sh						0	0	0	0	0	0		
	10 h / sh			628	h						0	0	0	0	0	0		
	Plus										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	565	h				37.00	20.00	0	0	0	20,905	8,136	29,041		
	- Jack leg 2.00	30%		188	h				2.00		0	0	0	376	0	376		
	- Miscellaneous materials Spike drilling 11,046 m			11,046	m		1.00				0	11,046	0	0	0	11,046		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**158**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 110 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			15	sh						0	0	0	0	0	0		
	10 h / sh			150	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	1,350	h	24.00					32,400	0	0	0	0	32,400		1,350
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	135	h				37.00	20.00	0	0	0	4,995	1,944	6,939		
	- Shotcrete pump 17.00	60%	1	90	h				17.00		0	0	0	1,530	0	1,530		
	- Hoses	25%	1	38	h		35.00				0	1,330	0	0	0	1,330		
	- Nozzle 66 m³ / un			2	un		275.00				0	550	0	0	0	550		
											0	0	0	0	0	0		
	Arches installation 452 m 27 m / un			**17**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			9	sh						0	0	0	0	0	0		
	10 h / sh			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	450	h	24.00					10,800	0	0	0	0	10,800		450
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	81	h				37.00	20.00	0	0	0	2,997	1,620	4,617		
	- Miscellaneous materials			17	un		200.00				0	3,400	0	0	0	3,400		
											0	0	0	0	0	0		
	Dewatering Duration 24 months			**738**	**m**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20,000				0	20,000	0	0	0	20,000		
	- Miscelaneous			738	m		15.00				0	11,070	0	0	0	11,070		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			1,476	h	24.00					35,424	0	0	0	0	35,424		1,476
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Outside Installation			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	210	h	24.00					5,040	0	0	0	0	5,040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6,000	0	6,000		
											0	0	0	0	0	0		
	Pumping 104 weeks 6 d / w			624	days						0	0	0	0	0	0		
	20 h / day			12,480	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	12,480	h	24.00					299,520	0	0	0	0	299,520		12,480
											0	0	0	0	0	0		
	- Miscelaneous			104	weeks		110.00				0	11,440	0	0	0	11,440		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials Duration 24 months										0	0	0	0	0	0		
	- Pumps			2	un		20,000				0	40,000	0	0	0	40,000		
	- Miscelaneous			738	m		21.00				0	15,498	0	0	0	15,498		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			1,476	h	24.00					35,424	0	0	0	0	35,424		1,476
											0	0	0	0	0	0		
	Compressed Air Duration 24 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			2,583	h	24.00					61,992	0	0	0	0	61,992		2,583
											0	0	0	0	0	0		
	- Miscelaneous materials			738	m		24.00				0	17,712	0	0	0	17,712		
											0	0	0	0	0	0		
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			2,214	h	24.00					53,136	0	0	0	0	53,136		2,214
											0	0	0	0	0	0		
	- Miscelaneous materials			738	m		10.00				0	7,380	0	0	0	7,380		
											0	0	0	0	0	0		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			2,583	h	24.00					61,992	0	0	0	0	61,992		2,583
											0	0	0	0	0	0		
	- Miscelaneous materials			738	m		22.00				0	16,236	0	0	0	16,236		
											0	0	0	0	0	0		
	Outside services are included in TBM Power tunnel										0	0	0	0	0	0		
3520	**Power tunnel Access**			**68,265**	**m**						**1,015,455**	**1,084,886**	**316,303**	**248,717**	**196,146**	**2,861,507**	**41.92**	**42,311**

Project : 6g Cost Estimate.xlsx

Item : 3530

3530 Intake excavation

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3530	**Intake excavation**			**15,000**	**m³**													
	Rock Excavation			**15,000**	**m³**						0	0	0	0	0	0		
	Access road and working platform			**5,000**														
				20,000	**m³**													
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 18,519 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			93	sh						0	0	0	0	0	0		
	3 machines			31	sh						0	0	0	0	0	0		
	10 h / s			310	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	1,860	h	24.00					44,640	0	0	0	0	44,640		1,860
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	3	837	h				19.40	15.00	0	0	0	16,238	9,040	25,278		
	- Drilling materials			18,519	m		0.70				0	12,963	0	0	0	12,963		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 8 m										0	0	0	0	0	0		
	Number of holes 2,315 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 15,000 m³ Losses	5%		15,750	kg		5.60				0	88,200	0	0	0	88,200		
	- Caps Losses	5%		2,431	un		4.50				0	10,940	0	0	0	10,940		
											0	0	0	0	0	0		
	- M-P		4	1,240	h	24.00					29,760	0	0	0	0	29,760		1,240
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	279	h				5.00	15.00	0	0	0	1,395	3,013	4,408		
	- Misc. Blasting materials			15,000	m³		0.10				0	1,500	0	0	0	1,500		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 484 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 726 m³ / sh			31	sh						0	0	0	0	0	0		
	10 h / s			310	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		11	3,410	h	24.00					81,840	0	0	0	0	81,840		3,410
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	279	h				38.25	28.00	0	0	0	10,672	5,625	16,297		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	279	h				40.00	60.00	0	0	0	11,160	12,053	23,213		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	558	h				32.00	27.90	0	0	0	17,856	11,209	29,065		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	558	h				3.50	2.20	0	0	0	1,953	884	2,837		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	279	h				19.00	29.00	0	0	0	5,301	5,826	11,127		
	Hauling distance 4.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 10 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 7 35 km / h										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
	25 min.										0	0	0	0	0	0		
	Efficiency : 85% 29 min. / trip										0	0	0	0	0	0		
	0.49 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	19 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	399 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
	Invert at 655										0	0	0	0	0	0		
	Hoist building at 670																	
	Intake L H Area										0	0	0	0	0	0		
	2 sides 40 15 600										0	0	0	0	0	0		
	Face 7 8 57																	
	Hoist platform 2 sides 40 10 400																	
	Face 20 10 200																	
	1,257 m²																	
	Suppply										0	0	0	0	0	0		
	- Rock bolts 6 m 30 m² / un 42 un Losses	3%		43	un		110.00				0	4,730	0	0	0	4,730		
	- Wire mesh 1,257 m² Lapping	15%		1,446	m²		4.60				0	6,652	0	0	0	6,652		
	- Spikes 0,7 m 1.56 m² / un 806 un	3%		830	un		4.50				0	3,735	0	0	0	3,735		
	- Wire			1,257	m²		0.04				0	50	0	0	0	50		
											0	0	0	0	0	0		
	Rock bolts drilling and Installation										0	0	0	0	0	0		
	Production of 100 m / sh			3	sh						0	0	0	0	0	0		
	6 m bolt 252 m 10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	180	h	24.00					4,320	0	0	0	0	4,320		180
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	27	h				37.00	20.00	0	0	0	999	389	1,388		
	- Fork lift 15 T 13.00 9.00	90%	1	27	h				13.00	9.00	0	0	0	351	175	526		
	- Boom truck 17 tons 13.65 18.00	90%	1	27	h				13.65	18.00	0	0	0	369	350	719		
	- Drilling rig (on fork lift)	90%	1	27	h				0.00	0.00	0	0	0	0	0	0		
											0	0	0	0	0	0		
	Wire mesh Installation										0	0	0	0	0	0		
	Production of 100 m² / sh			13	sh						0	0	0	0	0	0		
	10 h / sh			130	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	650	h	24.00					15,600	0	0	0	0	15,600		650
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	117	h				37.00	20.00	0	0	0	4,329	1,685	6,014		
	- Jack leg 2.00	30%	1	39	h				2.00	0.00	0	0	0	78	0	78		
	- Fork lift 15 T 13.00 9.00	90%	1	117	h				13.00	9.00	0	0	0	1,521	758	2,279		
	- Misc. Drilling materials 806 un 0.7 m			564	m		1.00				0	564	0	0	0	564		
											0	0	0	0	0	0		
	Wire mesh removing (For intake concrete structure)										0	0	0	0	0	0		
	L H Area m²										0	0	0	0	0	0		
	45 60 2,700										0	0	0	0	0	0		
	Production of 600 m² / sh			5	sh						0	0	0	0	0	0		
	10 h / sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	250	h	24.00					6,000	0	0	0	0	6,000		250
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	45	h				37.00	20.00	0	0	0	1,665	648	2,313		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
	- Boom truck 17 tons 13.65 18.00	90%	1	45	h				13.65	18.00	0	0	0	614	583	1,197		
											0	0	0	0	0	0		
	Dewatering Duration 2 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20,000				0	20,000	0	0	0	20,000		
	- Miscelaneous			1,000	m		15.00				0	15,000	0	0	0	15,000		
											0	0	0	0	0	0		
	Installation			30	h						0	0	0	0	0	0		
															0			
	- M-P		7	210	h	24.00					5,040	0	0	0	0	5,040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6,000	0	6,000		
											0	0	0	0	0	0		
	Pumping 9 weeks 6 d / w			54	days						0	0	0	0	0	0		
	20 h / day			1,080	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	1,080	h	24.00					25,920	0	0	0	0	25,920		1,080
											0	0	0	0	0	0		
	- Miscelaneous			9	weeks		110.00				0	990	0	0	0	990		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3530	**Intake excavation**			**15,000**							**213,120**	**165,324**	**0**	**80,501**	**52,238**	**511,183**	**34.08**	**8,880**

Item : 3540

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS							
													24.00 $				0.72 $			
3540	**Intake structure**					760	m³													
	Concrete works												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Intake Structure					760	m²						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Concreting	5.00 h / m³				3,800	h	24.00					91,200	0	0	0	0	91,200		3,800
	- Construction materials					760	m³		80.00				0	60,800	0	0	0	60,800		
	- Construction equipment					760	m³				48.00	40.00	0	0	0	36,480	21,888	58,368		
	- Concrete supply	760	4.04 h / m³	2%		775	m²	96.85	5.10	186.47	35.08	13.03	75,057	3,953	144,512	27,186	7,271	257,979		3,133
	Reinforcing Steel												0	0	0	0	0	0		
	- Supply and Fabrication	60 kg / m³	17.27 h / mt			46	mt	414.40	323.08	987.76	79.99	44.86	18,897	14,733	45,042	3,648	1,473	83,793		787
													0	0	0	0	0	0		
	Installation																			
	- M-P	16.00 h / mt				730	h	24.00					17,510	0	0	0	0	17,510		730
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	146	h				37.00	20.00	0	0	0	5,402	2,102	7,504		
	- Boom truck 17 tons	13.65	18.00	50%	1	365	h				13.65	18.00	0	0	0	4,982	4,730	9,712		
	Concrete transportation from the Batching Plan					775	m³						0	0	0	0	0	0		
	Average production	50 m³ / sh				16	sh						0	0	0	0	0	0		
			10 h / sh			160	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				3	480	h	24.00					11,520	0	0	0	0	11,520		480
													0	0	0	0	0	0		
	- Readymix 8 m³	13.60	14.00	90%	2	288	h				13.60	14.00	0	0	0	3,917	2,903	6,820		
													0	0	0	0	0	0		
	Average hauling distance :		1.00 km										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading	10											0	0	0	0	0	0		
	Going	2	30 km / h										0	0	0	0	0	0		
	Unloading	15											0	0	0	0	0	0		
	Return	2	35 km / h										0	0	0	0	0	0		
		29 min.											0	0	0	0	0	0		
	Efficacité :	85%	34 min. / trip										0	0	0	0	0	0		
			0.57 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			16 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³		8 m³										0	0	0	0	0	0		
			128 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks :		**2**	**(1+1)**									0	0	0	0	0	0		
													0	0	0	0	0	0		
3540	**Intake structure**					**760**							**214,184**	**79,486**	**189,554**	**81,615**	**40,367**	**605,206**	**796.32**	**8,930**

Item : **(3611-3614)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			

3600 Dams and Spillway

3610 Diversion Tunnels (including concrete plug)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3611	**Dam 1 - Diversion Tunnel**			**7 125**	**m^3**													
	Overburden excavation										0	0	0	0	0	0		
	Upstream Portal			**520**	**m^3**						0	0	0	0	0	0		
	Downstream Portal			**170**	**m^3**						0	0	0	0	0	0		
				690	**m^3**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m^3 / sh Say			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	60	h	24.00					1 440	0	0	0	0	1 440		60
											0	0	0	0	0	0		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	18	h				40.00	60.00	0	0	0	720	778	1 498		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	18	h				28.40	26.10	0	0	0	511	338	849		
											0	0	0	0	0	0		
	Rock excavation										0	0	0	0	0	0		
	Upstream Portal			**2 135**	**m^3**						0	0	0	0	0	0		
	Downstream Portal			**1 250**	**m^3**						0	0	0	0	0	0		
				3 385	**m^3**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m^2										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 3 134 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			16	sh						0	0	0	0	0	0		
	2 machines			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	400	h	24.00					9 600	0	0	0	0	9 600		400
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	144	h				19.40	15.00	0	0	0	2 794	1 555	4 349		
	- Drilling materials			3 134	m		0.70				0	2 194	0	0	0	2 194		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 313 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m^3 3 385 m^3 Losses	5%		3 554	kg		5.60				0	19 902	0	0	0	19 902		
	- Caps Losses	5%		329	un		4.50				0	1 481	0	0	0	1 481		
											0	0	0	0	0	0		
	- M-P		4	320	h	24.00					7 680	0	0	0	0	7 680		320
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	72	h				5.00	15.00	0	0	0	360	778	1 138		
	- Misc. Blasting materials			3 385	m^3		0.10				0	339	0	0	0	339		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 423 m^3 / sh										0	0	0	0	0	0		
	1.5 loose »»»» 635 m^3 / sh			8	sh						0	0	0	0	0	0		
	Plus 1 sh for overburden			1														
				9	sh													
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	720	h	24.00					17 280	0	0	0	0	17 280		720
											0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	81	h				38.25	28.00	0	0	0	3 098	1 633	4 731		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	81	h				19.00	29.00	0	0	0	1 539	1 691	3 230		
-	Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	4	324	h				32.00	27.90	0	0	0	10 368	6 509	16 877		
-	Generator 5 kW (Tower light) 3.50 2.20	90%	2	162	h				3.50	2.20	0	0	0	567	257	824		
											0	0	0	0	0	0		
	Hauling distance 12.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 21 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 21 35 km / h										0	0	0	0	0	0		
	50 min.										0	0	0	0	0	0		
	Efficiency : 85% 59 min. / trip										0	0	0	0	0	0		
	0.98 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	10 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m^3										0	0	0	0	0	0		
	210 m^3/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **4**										0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
	L H Area										0	0	0	0	0	0		
	2 sides 40 5 200										0	0	0	0	0	0		
	2 ends 10 10 100																	
	300 m^2																	
	Suppply										0	0	0	0	0	0		
-	Rock bolts 6 m 30 m^2 / un 10 un Losses	3%		10	un		110.00				0	1 100	0	0	0	1 100		
-	Wire mesh 200 m^2 Lapping	15%		230	m^2		4.60				0	1 058	0	0	0	1 058		
-	Spikes 0,7 m 1.56 m^2 / un 128 un	3%		132	un		4.50				0	594	0	0	0	594		
-	Wire			200	m^2		0.04				0	8	0	0	0	8		
											0	0	0	0	0	0		
	Rock bolts drilling and Installation										0	0	0	0	0	0		
	Production of 100 m / sh			1	sh						0	0	0	0	0	0		
	6 m bolt 60 m 10 h / sh			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	60	h	24.00					1 440	0	0	0	0	1 440		60
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	9	h				37.00	20.00	0	0	0	333	130	463		
-	Fork lift 15 T 13.00 9.00	90%	1	9	h				13.00	9.00	0	0	0	117	58	175		
-	Boom truck 17 tons 13.65 18.00	90%	1	9	h				13.65	18.00	0	0	0	123	117	240		
-	Drilling rig (on fork lift)	90%	1	9	h				0.00	0.00	0	0	0	0	0	0		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Wire mesh Installation										0	0	0	0	0	0		
	Production of 100 m^2 / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	100	h	24.00					2 400	0	0	0	0	2 400		100
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	259	925		
	- Jack leg 2.00	30%	1	6	h				2.00	0.00	0	0	0	12	0	12		
	- Fork lift 15 T 13.00 9.00	90%	1	18	h				13.00	9.00	0	0	0	234	117	351		
	- Misc. Drilling materials 128 un 0.7	m		90	m		1.00				0	90	0	0	0	90		

Diversion tunnel

Drilling with Boomer E2 C

D Shape **5 x 6** **28.24 m^3** **108 m** **3 050 m^3**

		Area (m^2)
Arc	5.80	4.49
Height	6.00	
Wall	4.75	23.75
Width	5.00	
		28.24

Excavation

Progression	4.66	m		
Number of rounds	24			
	24			
Number of shifts	34	Prod. Factor 1.4		
Number of holes			(m)	(Feet)
Production	23	55 mm dia.	2 777	9 107
Contour	24	55 mm dia.	2 897	9 503
	47			
Cut	3	109 mm dia.	362	1 188
	50			
Drilling depth	5.03	m	6 036	19 798

Durations			(hours)	24 rounds
Drilling	100	m / h	2.52	60 h
Blasting	1.15	min / hole	0.96	23 h
Scaling & W. mesh			2.00	48 h
Mucking	205	m^3 / h	0.64	15 h

Drilling labour

	H-H	Bolting	W. Mesh	Remaining
8	2 720	381	326	2 013
		14%	12%	

Drilling	2.5	24	60 h	
		9 h / sh	7 sh	
8 men / sh		10 h / sh		537 h-h
Loading & Blasting	0.96	24	23 h	
		9 h / sh	3 sh	
8 men / sh		10 h / sh		240 h-h

Item : **(3611-3614)**

										UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION					%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.72 $			
	Remaining for services				1 236																	
	Drilling							67	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	537	h	24.00					12 877	0	0	0	0	12 877		537
					24 rounds										0	0	0	0	0	0		
	- Jumbo E 2C		14.00		4.5 h			108	h				14.00		0	0	0	1 512	0	1 512		
	- Cat GEP 550 - 400KW		6.50	102.40			1	108	h				6.50	102.40	0	0	0	702	7 963	8 665		
		Feet	ft / un												0	0	0	0	0	0		
	- Bits 2"Ø	18 610	1 600					12	un		85.00				0	1 020	0	0	0	1 020		
	- Bits 4"Ø	1 188	1 500					1	un		500.00				0	500	0	0	0	500		
	- Rod 18'	19 798	7 500					3	un		485.00				0	1 455	0	0	0	1 455		
	- Coupling	19 798	3 700					5	un		50.00				0	250	0	0	0	250		
	- Shank	19 798	12 500					2	un		300.00				0	600	0	0	0	600		
	- Misc. Materials	19 798						19 798	ft		0.04				0	792	0	0	0	792		
															0	0	0	0	0	0		
	Loading & Blasting							30	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	240	h	24.00					5 760	0	0	0	0	5 760		240
															0	0	0	0	0	0		
	- Explosives Truck		5.00	15.00		90%	1	27	h				5.00	15.00	0	0	0	135	292	427		
															0	0	0	0	0	0		
	5.03 m holes	**24**	**Rounds**												0	0	0	0	0	0		
		Number	Total	Length (m)											0	0	0	0	0	0		
	Contour holes	24	576	2 897											0	0	0	0	0	0		
	Production holes	23	552	2 777											0	0	0	0	0	0		
		47	1 128												0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Prima cord	5.5 m			3 168	5%		3 326	m		1.00				0	3 326	0	0	0	3 326		
	- Cap 6m				1 128	13%		1 275	un		3.50				0	4 463	0	0	0	4 463		
	- Dynamite RXL 438	3 050 m^3		Powder fact	1.6			4 880	kg		5.60				0	27 328	0	0	0	27 328		
	- XACTEX	576 holes			1 584	5%		1 663	kg		7.50				0	12 473	0	0	0	12 473		
		2.75 kg / hole													0	0	0	0	0	0		
															0	0	0	0	0	0		
	Mucking	3 050 m^3													0	0	0	0	0	0		
	1.5 Loose »»»»	4 575 m^3													0	0	0	0	0	0		
		191 m^3 / round													0	0	0	0	0	0		
	Production	140 m^3 / h		1.36 h											0	0	0	0	0	0		
		24 rounds		33 h x 10/9 »»				36	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						7	254	h	24.00					6 100	0	0	0	0	6 100		254
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		50%	1	18	h				19.00	29.00	0	0	0	342	376	718		
	- Cat 988H Wheel Loader		39.20	48.00		90%	1	33	h				39.20	48.00	0	0	0	1 294	1 140	2 434		
	- Cat D7R II LGP Track-Type Tractor		38.25	28.00		90%	1	33	h				38.25	28.00	0	0	0	1 262	665	1 927		
	- Cat 725 Articulated Dumper 25 T		24.00	20.00		90%	1	33	h				24.00	20.00	0	0	0	792	475	1 267		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 4 30 km / h										0	0	0	0	0	0		
	19 min.										0	0	0	0	0	0		
	Efficacité : 85% 22 min. / trip										0	0	0	0	0	0		
	0.37 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	25 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	300 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
	Rolling Path Length 108										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 259										0	0	0	0	0	0		
	Production 800 m³ / sh			1	sh						0	0	0	0	0	0		
	10 h / s			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	80	h	24.00					1 920	0	0	0	0	1 920		80
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	9	h				39.20	48.00	0	0	0	353	311	664		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	9	h				38.25	28.00	0	0	0	344	181	525		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	9	h				24.00	20.00	0	0	0	216	130	346		
	Rock Support																	
	D Shape 5 x 6 28.24 m³ 108 m			**3 050**	**m³**													
	Area (m²)																	
	Arc 5.80 4.49																	
	Height 6.00																	
	Wall 4.75 23.75																	
	Width 5.00																	
	28.24																	
	Tunnel																	
	Required Length Arch (m)										0	0	0	0	0	0		
	Class 1 81.0 5.80	75%									0	0	0	0	0	0		
	Class 2 16.2 5.80	15%									0	0	0	0	0	0		
	Class 3 7.6 5.80	7.0%									0	0	0	0	0	0		
	Class 4 2.7 5.80	2.5%									0	0	0	0	0	0		
	Class 5 0.5 5.80	0.5%									0	0	0	0	0	0		
	108	100%									0	0	0	0	0	0		
	Class 1 Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m 1 un / m 81 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.30 m² / m 113 m²	15%									0	0	0	0	0	0		
	Wire mesh 9.30 m² / m 640 m²	85%									0	0	0	0	0	0		

Item : **(3611-3614)**

WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.72 $			
	Class 2															0	0	0	0	0	0		
	Rock bolts 2,5 m	1.1	un / m	19	un											0	0	0	0	0	0		
	Shotcrete 50 mm	9.30	m² / m	23	m²		15%									0	0	0	0	0	0		
	Wire mesh	9.30	m² / m	128	m²		85%									0	0	0	0	0	0		
	Class 3															0	0	0	0	0	0		
	Rock bolts 3 m	1.5	un / m	11	un											0	0	0	0	0	0		
	Shotcrete 50 mm	9.30	m² / m	35	m²		50%									0	0	0	0	0	0		
	Wire mesh	9.30	m² / m	35	m²		50%									0	0	0	0	0	0		
	Class 4															0	0	0	0	0	0		
	Rock bolts 4 m	2.6	un / m	7	un											0	0	0	0	0	0		
	Shotcrete 50 mm	3.5	m² / m	3	m²		30%									0	0	0	0	0	0		
	Wire mesh	3.5	m² / m	7	m²		70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m² / m	16	m²		100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m² / m	16	m²		100%									0	0	0	0	0	0		
	Steel arch (W 100)	1.5	m c/c	2	un											0	0	0	0	0	0		
		15.3	m / arch	31	m																		
	Class 5															0	0	0	0	0	0		
	Rock bolts 5 m	5.8	un / m	3	un											0	0	0	0	0	0		
	Shotcrete 50 mm	3.5	m² / m	1	m²		30%									0	0	0	0	0	0		
	Wire mesh	3.5	m² / m	1	m²		70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m² / m	3	m²		100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m² / m	3	m²		100%									0	0	0	0	0	0		
	Steel arch (W 150)	0.75	m c/c	1	un											0	0	0	0	0	0		
		15.3	m / arch	15	m											0	0	0	0	0	0		
	Supply			Lenght (m)												0	0	0	0	0	0		
	- Rock bolts 2,5 m	100	un	250		Losses	3%		103	un			60.00			0	0	6 180	0	0	6 180		
	- Rock bolts 3 m	11	un	33		Losses	3%		11	un			70.00			0	0	770	0	0	770		
	- Rock bolts 4 m	7	un	28		Losses	3%		7	un			80.00			0	0	560	0	0	560		
	- Rock bolts 5 m	3	un	15		Losses	3%		3	un			105.00			0	0	315	0	0	315		
		121		326												0	0	0	0	0	0		
	- Injection tubes	150	m roll				3%		2	rolls			110.00			0	0	220	0	0	220		
	- Oakum	130	bolts / box				3%		1	box			280.00			0	0	280	0	0	280		
	- Grease	154	bolts / box				3%		1	box			336.00			0	0	336	0	0	336		
																0	0	0	0	0	0		
	- Wire mesh	811	m²				15%		933	m²			4.60			0	0	4 292	0	0	4 292		
	- Reinf. Mesh	19	m²				15%		22	m²			5.60			0	0	123	0	0	123		
		830	m²													0	0	0	0	0	0		
	- Spikes 1,1 m	1.25	m c/c	664	un		3%		684	un			4.50			0	0	3 078	0	0	3 078		
	- Wire			0.04 $	/ m²				830	m²			0.04			0	0	33	0	0	33		
		m²		m³												0	0	0	0	0	0		
	Shotcrete 50 mm	174	0.05	9												0	0	0	0	0	0		
	Shotcrete 100 mm	19	0.1	2												0	0	0	0	0	0		
				11												0	0	0	0	0	0		
	- Cement (40 kg Bags)	0.03	m³ / bag			Losses	7.5%		379	bags			10.00			0	0	3 790	0	0	3 790		
		33.33	bags / m³	353	bags											0	0	0	0	0	0		
	- Sand	1.40 mt / m³		0.08	h / mt				15	mt	1.84	1.30	0.00	2.08	3.08	27	19	0	31	33	110		1
																0	0	0	0	0	0		
	- Monoset (3% of cement)			14 116	kg		3%		423	kg			3.40			0	0	1 438	0	0	1 438		
																0	0	0	0	0	0		
	- Steel arch (W 100)	19.0	kg / m	31	m				581	kg			4.00			0	0	2 326	0	0	2 326		
	- Steel arch (W 150)	22.0	kg / m	15	m				337	kg			5.00			0	0	1 683	0	0	1 683		

Item : **(3611-3614)**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Rock bolts Installation			34	sh						0	0	0	0	0	0		
	326 m 10 m / sh																	
	121 un 4 un / sh																	
	0.5 h / un. including positionning																	
	2 h / sh			68	h													
	1) Drilling with Jumbo										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Jumbo	90%	1	61	h				102.50		0	0	0	6 253	0	6 253		
	- Cat GEP 550 - 400KW 6.50 102.40		1	61	h				6.50	102.40	0	0	0	397	4 497	4 894		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
	121 un 4 un / sh																	
	0.5 h / un incl. Positionning																	
	1.8 h / sh			61	h													
	- M-P		3	182	h	24.00					4 356	0	0	0	0	4 356		182
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	54	h				37.00	20.00	0	0	0	1 998	778	2 776		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1 200.00				0	1 200	0	0	0	1 200		
	- Torque wrench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	120	h	24.00					2 880	0	0	0	0	2 880		120
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	27	h				37.00	20.00	0	0	0	999	389	1 388		
	- Moyno pump 2.00	75%	1	23	h				2.00		0	0	0	46	0	46		
											0	0	0	0	0	0		
	- Cement (bags) 326 m	100%		54	bags			10.00			0	0	540	0	0	540		
	1 069 ft 0.022698 sf										0	0	0	0	0	0		
	2 in. Dia hole 24 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 27 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 11 kg	1%		11	kg			3.00			0	0	33	0	0	33		
	- Miscellaneous			121	un		0.30				0	36	0	0	0	36		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Installation by Jumbo team										0	0	0	0	0	0		
	Production of 200 m² / sh 830 m²			4	sh						0	0	0	0	0	0		
	10 h / sh			42	h						0	0	0	0	0	0		
	Plus										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	37	h				37.00	20.00	0	0	0	1 369	533	1 902		
	- Jack leg 2.00	30%		12	h				2.00		0	0	0	24	0	24		
	- Miscellaneous materials Spike drilling 730 m			730	m		1.00				0	730	0	0	0	730		
											0	0	0	0	0	0		
											0	0	0	0	0	0		

Item : **(3611-3614)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Shotcreting			**11**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 7 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			1	sh						0	0	0	0	0	0		
	10 h / sh			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	90	h	24.00					2 160	0	0	0	0	2 160		90
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	9	h				37.00	20.00	0	0	0	333	130	463		
	- Shotcrete pump 17.00	60%	1	6	h				17.00		0	0	0	102	0	102		
	- Hoses	25%	1	3	h		35.00				0	105	0	0	0	105		
	- Nozzle 66 m³ / un			0	un		275.00				0	0	0	0	0	0		
											0	0	0	0	0	0		
	Arches installation 46 m 15 m / un			**3**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	100	h	24.00					2 400	0	0	0	0	2 400		100
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	360	1 026		
	- Miscellaneous materials			3	un		200.00				0	600	0	0	0	600		
	Dewatering Duration 1 months			**108**	**m**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20 000				0	20 000	0	0	0	20 000		
	- Miscelaneous			108	m		15.00				0	1 620	0	0	0	1 620		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			216	h	24.00					5 184	0	0	0	0	5 184		216
											0	0	0	0	0	0		
	Outside Installation			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	210	h	24.00					5 040	0	0	0	0	5 040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6 000	0	6 000		
											0	0	0	0	0	0		
	Pumping 4 weeks 6 d / w			24	days						0	0	0	0	0	0		
	20 h / day			480	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	480	h	24.00					11 520	0	0	0	0	11 520		480
											0	0	0	0	0	0		
	- Miscelaneous			4	weeks		110.00				0	440	0	0	0	440		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials Duration 1 months										0	0	0	0	0	0		
	- Pumps			2	un		20 000				0	40 000	0	0	0	40 000		
	- Miscelaneous			108	m		21.00				0	2 268	0	0	0	2 268		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			216	h	24.00					5 184	0	0	0	0	5 184		216
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Compressed Air Duration 1 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			378	h	24.00					9 072	0	0	0	0	9 072		378
											0	0	0	0	0	0		
	- Miscelaneous materials			108	m		24.00				0	2 592	0	0	0	2 592		
											0	0	0	0	0	0		
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			324	h	24.00					7 776	0	0	0	0	7 776		324
											0	0	0	0	0	0		
	- Miscelaneous materials			108	m		10.00				0	1 080	0	0	0	1 080		
											0	0	0	0	0	0		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			378	h	24.00					9 072	0	0	0	0	9 072		378
											0	0	0	0	0	0		
	- Miscelaneous materials			108	m		22.00				0	2 376	0	0	0	2 376		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3611	**Dam 1 - Diversion Tunnel**			**7 125**							**131 168**	**152 619**	**25 997**	**46 612**	**32 473**	**388 869**	**54.58**	**5 465**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3614	**Dam 4 - Diversion Tunnel**			**5 788**	**m³**													
	Overburden excavation										0	0	0	0	0	0		
	Upstream Portal			**770**	**m³**						0	0	0	0	0	0		
				770	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m³ / sh Say			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	60	h	24.00					1 440	0	0	0	0	1 440		60
											0	0	0	0	0	0		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	18	h				40.00	60.00	0	0	0	720	778	1 498		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	18	h				28.40	26.10	0	0	0	511	338	849		
	Rock excavation																	
	Upstream Portal			**1 310**	**m³**													
	Downstream Portal			**2 200**	**m³**													
				3 510	**m³**													
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 3 250 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			16	sh						0	0	0	0	0	0		
	2 machines			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	400	h	24.00					9 600	0	0	0	0	9 600		400
											0	0	0	0	0	0		

Project : **6g Cost Estimate.xlsx**

Item : **(3611-3614)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	144	h				19.40	15.00	0	0	0	2 794	1 555	4 349		
	- Drilling materials			3 250	m		0.70				0	2 275	0	0	0	2 275		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 325 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 3 510 m³ Losses	5%		3 686	kg		5.60				0	20 642	0	0	0	20 642		
	- Caps Losses	5%		341	un		4.50				0	1 535	0	0	0	1 535		
											0	0	0	0	0	0		
	- M-P		4	320	h	24.00					7 680	0	0	0	0	7 680		320
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	72	h				5.00	15.00	0	0	0	360	778	1 138		
	- Misc. Blasting materials			3 510	m³		0.10				0	351	0	0	0	351		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 275 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 413 m³ / sh			8	sh						0	0	0	0	0	0		
	Plus 1 sh for overburden			1														
				9	sh													
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	540	h	24.00					12 960	0	0	0	0	12 960		540
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	81	h				38.25	28.00	0	0	0	3 098	1 633	4 731		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	81	h				19.00	29.00	0	0	0	1 539	1 691	3 230		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	162	h				32.00	27.90	0	0	0	5 184	3 254	8 438		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	162	h				3.50	2.20	0	0	0	567	257	824		
											0	0	0	0	0	0		
	Hauling distance 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 3 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	693 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2** (1+1)										0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
	L H Area										0	0	0	0	0	0		
	2 sides 100 5 500										0	0	0	0	0	0		
	2 ends 16 7 112																	
	612 m²																	

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Suppply										0	0	0	0	0	0		
	- Rock bolts 6 m 30 m² / un 20 un Losses	3%		21	un		110.00				0	2 310	0	0	0	2 310		
	- Wire mesh 500 m² Lapping	15%		575	m²		4.60				0	2 645	0	0	0	2 645		
	- Spikes 0,7 m 1.56 m² / un 321 un	3%		331	un		4.50				0	1 490	0	0	0	1 490		
	- Wire			500	m²		0.04				0	20	0	0	0	20		
											0	0	0	0	0	0		
	Rock bolts drilling and Installation										0	0	0	0	0	0		
	Production of 100 m / sh			2	sh						0	0	0	0	0	0		
	6 m bolt 120 m 10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	120	h	24.00					2 880	0	0	0	0	2 880		120
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	259	925		
	- Fork lift 15 T 13.00 9.00	90%	1	18	h				13.00	9.00	0	0	0	234	117	351		
	- Boom truck 17 tons 13.65 18.00	90%	1	18	h				13.65	18.00	0	0	0	246	233	479		
	- Drilling rig (on fork lift)	90%	1	18	h				0.00	0.00	0	0	0	0	0	0		
											0	0	0	0	0	0		
	Wire mesh Installation										0	0	0	0	0	0		
	Production of 100 m² / sh			5	sh						0	0	0	0	0	0		
	10 h / sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	250	h	24.00					6 000	0	0	0	0	6 000		250
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	45	h				37.00	20.00	0	0	0	1 665	648	2 313		
	- Jack leg 2.00	30%	1	15	h				2.00	0.00	0	0	0	30	0	30		
	- Fork lift 15 T 13.00 9.00	90%	1	45	h				13.00	9.00	0	0	0	585	292	877		
	- Misc. Drilling materials 321 un 0.7	m		225	m		1.00				0	225	0	0	0	225		

Diversion tunnel

Drilling with Boomer E2 C

D Shape **8 x 7** **51.20 m³** **98 m** **5 018 m³**

		Area (m²)
Arc	5.80	11.20
Height	7.00	
Wall	5.00	40.00
Width	8.00	
		51.20

Excavation

			(m)	(Feet)
Progression	4.66	m		
Number of rounds	21			
	21			
Number of shifts	29	Prod. Factor 1.4		
Number of holes			(m)	(Feet)
Production	41	55 mm dia.	4 331	14 205
Contour	25	55 mm dia.	2 641	8 662
	66			
Cut	3	109 mm dia.	317	1 039
	69			
Drilling depth	5.03	m	7 288	23 906

Item : **(3611-3614)**

Durations			(hours)	21 rounds
Drilling	100	m / h	3.47	73 h
Blasting	1.15	min / hole	1.32	28 h
Scaling & W. mesh			2.00	42 h
Mucking	205	m³ / h	1.16	24 h

Drilling labour

	H-H	Bolting	W. Mesh	Remaining
8	2 320	325	278	1 717
		14%	12%	

Drilling		3.5	21	73 h
		9	h / sh	8 sh
	8 men / sh	10	h / sh	648 h-h
Loading & Blasting		1.32	21	28 h
		9	h / sh	3 sh
	8 men / sh	10	h / sh	240 h-h
Remaining for services				829

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Drilling			81	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	648	h	24.00					15 549	0	0	0	0	15 549		648
	21 rounds										0	0	0	0	0	0		
	- Jumbo E 2C 14.00 4.5 h			95	h				14.00		0	0	0	1 323	0	1 323		
	- Cat GEP 550 - 400KW 6.50 102.40		1	95	h				6.50	102.40	0	0	0	614	6 967	7 581		
	Feet ft / un										0	0	0	0	0	0		
	- Bits 2"Ø 22 867 1 600			14	un		85.00				0	1 190	0	0	0	1 190		
	- Bits 4"Ø 1 039 1 500			1	un		500.00				0	500	0	0	0	500		
	- Rod 18' 23 906 7 500			3	un		485.00				0	1 455	0	0	0	1 455		
	- Coupling 23 906 3 700			6	un		50.00				0	300	0	0	0	300		
	- Shank 23 906 12 500			2	un		300.00				0	600	0	0	0	600		
	- Misc. Materials 23 906			23 906	ft		0.04				0	956	0	0	0	956		
											0	0	0	0	0	0		
	Loading & Blasting			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	240	h	24.00					5 760	0	0	0	0	5 760		240
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	27	h				5.00	15.00	0	0	0	135	292	427		
											0	0	0	0	0	0		
	5.03 m holes 21 Rounds										0	0	0	0	0	0		
	Number Total Length (m)										0	0	0	0	0	0		
	Contour holes 25 525 2 641										0	0	0	0	0	0		
	Production holes 41 861 4 331										0	0	0	0	0	0		
	66 1 386										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Prima cord 5.5 m 2 888	5%		3 032	m		1.00				0	3 032	0	0	0	3 032		
	- Cap 6m 1 386	13%		1 566	un		3.50				0	5 481	0	0	0	5 481		
	- Dynamite RXL 438 5 018 m³ Powder fact 1.6			8 029	kg		5.60				0	44 961	0	0	0	44 961		
	- XACTEX 525 holes 1 444	5%		1 516	kg		7.50				0	11 370	0	0	0	11 370		
	2.75 kg / hole										0	0	0	0	0	0		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Mucking 5 018 m³										0	0	0	0	0	0		
	1.5 Loose »»»» 7 527 m³										0	0	0	0	0	0		
	358 m³ / round										0	0	0	0	0	0		
	Production 140 m³ / h 2.56 h										0	0	0	0	0	0		
	21 rounds 54 h x 10/9 »»			60	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	418	h	24.00					10 036	0	0	0	0	10 036		418
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	50%	1	30	h				19.00	29.00	0	0	0	570	626	1 196		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	54	h				39.20	48.00	0	0	0	2 117	1 866	3 983		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	54	h				38.25	28.00	0	0	0	2 066	1 089	3 155		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	108	h				24.00	20.00	0	0	0	2 592	1 555	4 147		
	Disposal of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 3.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 8										0	0	0	0	0	0		
	Going 6 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 6 30 km / h										0	0	0	0	0	0		
	23 min.										0	0	0	0	0	0		
	Efficacité : 85% 27 min. / trip										0	0	0	0	0	0		
	0.45 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	20 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	240 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
	Rolling Path Length 98										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 235										0	0	0	0	0	0		
	Production 800 m³ / sh			1	sh						0	0	0	0	0	0		
	10 h / s			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	80	h	24.00					1 920	0	0	0	0	1 920		80
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	9	h				39.20	48.00	0	0	0	353	311	664		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	9	h				38.25	28.00	0	0	0	344	181	525		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	9	h				24.00	20.00	0	0	0	216	130	346		

Rock Support

D Shape **8 x 7** **51.20 m³** **98 m**

		Area (m²)
Arc	5.80	11.20
Height	7.00	
Wall	5.00	40.00
Width	8.00	
		51.20

WBS	DESCRIPTION					%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
										UNIT PRICES					TOTAL COSTS							
															24.00 $				0.72 $			
		Tunnel																				
	Required	Length		Arch (m)											0	0	0	0	0	0		
	Class 1	73.5		5.80		75%									0	0	0	0	0	0		
	Class 2	14.7		5.80		15%									0	0	0	0	0	0		
	Class 3	6.9		5.80		7.0%									0	0	0	0	0	0		
	Class 4	2.5		5.80		2.5%									0	0	0	0	0	0		
	Class 5	0.5		5.80		0.5%									0	0	0	0	0	0		
		98				100%									0	0	0	0	0	0		
	Class 1			Qty											0	0	0	0	0	0		
	Rock bolts 2,5 m	1	un / m	74	un										0	0	0	0	0	0		
	Shotcrete 50 mm	9.80	m² / m	108	m²	15%									0	0	0	0	0	0		
	Wire mesh	9.80	m² / m	612	m²	85%									0	0	0	0	0	0		
	Class 2														0	0	0	0	0	0		
	Rock bolts 2,5 m	1.1	un / m	17	un										0	0	0	0	0	0		
	Shotcrete 50 mm	9.80	m² / m	22	m²	15%									0	0	0	0	0	0		
	Wire mesh	9.80	m² / m	122	m²	85%									0	0	0	0	0	0		
	Class 3														0	0	0	0	0	0		
	Rock bolts 3 m	1.5	un / m	10	un										0	0	0	0	0	0		
	Shotcrete 50 mm	9.80	m² / m	34	m²	50%									0	0	0	0	0	0		
	Wire mesh	9.80	m² / m	34	m²	50%									0	0	0	0	0	0		
	Class 4														0	0	0	0	0	0		
	Rock bolts 4 m	2.6	un / m	6	un										0	0	0	0	0	0		
	Shotcrete 50 mm	4.0	m² / m	3	m²	30%									0	0	0	0	0	0		
	Wire mesh	4.0	m² / m	7	m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m² / m	14	m²	100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m² / m	14	m²	100%									0	0	0	0	0	0		
	Steel arch (W 100)	1.5	m c/c	2	un										0	0	0	0	0	0		
		15.8	m / arch	32	m																	
	Class 5														0	0	0	0	0	0		
	Rock bolts 5 m	5.8	un / m	3	un										0	0	0	0	0	0		
	Shotcrete 50 mm	4.0	m² / m	1	m²	30%									0	0	0	0	0	0		
	Wire mesh	4.0	m² / m	1	m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m² / m	3	m²	100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m² / m	3	m²	100%									0	0	0	0	0	0		
	Steel arch (W 150)	0.75	m c/c	1	un										0	0	0	0	0	0		
		15.8	m / arch	16	m										0	0	0	0	0	0		
	Supply			Lenght (m)											0	0	0	0	0	0		
-	Rock bolts 2,5 m	91	un	228	Losses	3%		94	un			60.00			0	0	5 640	0	0	5 640		
-	Rock bolts 3 m	10	un	30	Losses	3%		10	un			70.00			0	0	700	0	0	700		
-	Rock bolts 4 m	6	un	24	Losses	3%		6	un			80.00			0	0	480	0	0	480		
-	Rock bolts 5 m	3	un	15	Losses	3%		3	un			105.00			0	0	315	0	0	315		
		110		297											0	0	0	0	0	0		
-	Injection tubes	150	m roll			3%		2	rolls			110.00			0	0	220	0	0	220		
-	Oakum	130	bolts / box			3%		1	box			280.00			0	0	280	0	0	280		
-	Grease	154	bolts / box			3%		1	box			336.00			0	0	336	0	0	336		
															0	0	0	0	0	0		
-	Wire mesh	777	m²			15%		893	m²			4.60			0	0	4 108	0	0	4 108		
-	Reinf. Mesh	17	m²			15%		20	m²			5.60			0	0	112	0	0	112		
		794	m²												0	0	0	0	0	0		
-	Spikes 1,1 m	1.25	m c/c	635	un	3%		654	un			4.50			0	0	2 943	0	0	2 943		
-	Wire			0.04 $	/ m²			794	m²			0.04			0	0	32	0	0	32		
		m²		m³											0	0	0	0	0	0		

Item : **(3611-3614)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Shotcrete 50 mm 167 0.05 8										0	0	0	0	0	0		
	Shotcrete 100 mm 17 0.1 2										0	0	0	0	0	0		
	10										0	0	0	0	0	0		
	- Cement (40 kg Bags) 0.03 m³ / bag Losses	7.5%		360	bags			10.00			0	0	3 600	0	0	3 600		
	33.33 bags / m³ 335 bags										0	0	0	0	0	0		
	- Sand 1.40 mt / m³ 0.07 h / mt			14	mt	1.80	1.38	0.00	2.03	3.15	25	19	0	29	32	105		1
											0	0	0	0	0	0		
	- Monoset (3% of cement) 13 393 kg	3%		402	kg			3.40			0	0	1 367	0	0	1 367		
											0	0	0	0	0	0		
	- Steel arch (W 100) 19.0 kg / m 32 m			600	kg			4.00			0	0	2 402	0	0	2 402		
	- Steel arch (W 150) 22.0 kg / m 16 m			348	kg			5.00			0	0	1 738	0	0	1 738		
	Rock bolts Installation			29	sh						0	0	0	0	0	0		
	297 m 10 m / sh																	
	110 un 4 un / sh																	
	0.5 h / un. including positionning																	
	2 h / sh			58	h													
	1) Drilling with Jumbo										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Jumbo	90%	1	52	h				102.50		0	0	0	5 330	0	5 330		
	- Cat GEP 550 - 400KW 6.50 102.40		1	52	h				6.50	102.40	0	0	0	338	3 834	4 172		
	2) Install with 50t crane with basket										0	0	0	0	0	0		
	110 un 4 un / sh																	
	0.5 h / un incl. Positionning																	
	1.9 h / sh			55	h													
	- M-P		3	165	h	24.00					3 960	0	0	0	0	3 960		165
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	50	h				37.00	20.00	0	0	0	1 850	720	2 570		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1 200.00				0	1 200	0	0	0	1 200		
	- Torque wrench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	120	h	24.00					2 880	0	0	0	0	2 880		120
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	27	h				37.00	20.00	0	0	0	999	389	1 388		
	- Moyno pump 2.00	75%	1	23	h				2.00		0	0	0	46	0	46		
											0	0	0	0	0	0		
	- Cement (bags) 297 m	100%		48	bags			10.00			0	0	480	0	0	480		
	973 ft 0.022698 sf										0	0	0	0	0	0		
	2 in. Dia hole 22 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 24 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 10 kg	1%		10	kg			3.00			0	0	30	0	0	30		
	- Miscellaneous			110	un		0.30				0	33	0	0	0	33		
											0	0	0	0	0	0		
	Wire mesh installation										0	0	0	0	0	0		
	Installation by Jumbo team										0	0	0	0	0	0		
	Production of 200 m² / sh 794 m²			4	sh						0	0	0	0	0	0		

Item : **(3611-3614)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	10 h / sh			40	h						0	0	0	0	0	0		
	Plus										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	36	h				37.00	20.00	0	0	0	1 332	518	1 850		
	- Jack leg 2.00	30%		12	h				2.00		0	0	0	24	0	24		
	- Miscellaneous materials Spike drilling 699 m			699	m		1.00				0	699	0	0	0	699		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**10**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 7 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			1	sh						0	0	0	0	0	0		
	10 h / sh			10	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	90	h	24.00					2 160	0	0	0	0	2 160		90
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	9	h				37.00	20.00	0	0	0	333	130	463		
	- Shotcrete pump 17.00	60%	1	6	h				17.00		0	0	0	102	0	102		
	- Hoses	25%	1	3	h		35.00				0	105	0	0	0	105		
	- Nozzle 66 m³ / un			0	un		275.00				0	0	0	0	0	0		
											0	0	0	0	0	0		
	Arches installation 47 m 16 m / un			**3**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	100	h	24.00					2 400	0	0	0	0	2 400		100
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	360	1 026		
	- Miscellaneous materials			3	un		200.00				0	600	0	0	0	600		
	Dewatering Duration 1 months			**98**	**m**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20 000				0	20 000	0	0	0	20 000		
	- Miscelaneous			98	m		15.00				0	1 470	0	0	0	1 470		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			196	h	24.00					4 704	0	0	0	0	4 704		196
											0	0	0	0	0	0		
	Outside Installation			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	210	h	24.00					5 040	0	0	0	0	5 040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6 000	0	6 000		
											0	0	0	0	0	0		
	Pumping 4 weeks 6 d / w			24	days						0	0	0	0	0	0		
	20 h / day			480	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	480	h	24.00					11 520	0	0	0	0	11 520		480
											0	0	0	0	0	0		
	- Miscelaneous			4	weeks		110.00				0	440	0	0	0	440		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Purchase of equipment and materials Duration 1 months										0	0	0	0	0	0		
	- Pumps			2	un		20 000				0	40 000	0	0	0	40 000		
	- Miscelaneous			98	m		21.00				0	2 058	0	0	0	2 058		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			196	h	24.00					4 704	0	0	0	0	4 704		196
											0	0	0	0	0	0		
	Compressed Air Duration 1 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			343	h	24.00					8 232	0	0	0	0	8 232		343
											0	0	0	0	0	0		
	- Miscelaneous materials			98	m		24.00				0	2 352	0	0	0	2 352		
											0	0	0	0	0	0		
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			294	h	24.00					7 056	0	0	0	0	7 056		294
											0	0	0	0	0	0		
	- Miscelaneous materials			98	m		10.00				0	980	0	0	0	980		
											0	0	0	0	0	0		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			343	h	24.00					8 232	0	0	0	0	8 232		343
											0	0	0	0	0	0		
	- Miscelaneous materials			98	m		22.00				0	2 156	0	0	0	2 156		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3614	**Dam 4 - Diversion Tunnel**			**5 788**	**m³**						**134 738**	**174 030**	**24 783**	**45 578**	**30 833**	**409 962**	**70.83**	**5 614**

WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.72 $			

3620 Cofferdams

WBS	DESCRIPTION						%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3621	**Dam 1 - Cofferdams**								**14,100**	**m³**													
	Overburden excavation			**22,000**	**m²**																		
	Dumped material			(m³)																			
	Downstream cofferdam			0																			
	Upstream cofferdam	1 A		2,800																			
		3		3,000																			
		3 A		2,700																			
	Diversion tunnel	1 A		200																			
		3		400																			
				9,100	**m²**																		
	Compacted material																						
	Downstream cofferdam			0																			
	Upstream cofferdam	3 D		5,000																			
				5,000	**m²**																		
	Construction roads		(m)	(m² / m)		(m³)																	
	Widenning permanent road		**2,000**	**5**		**10,000**																	
	(From intake channel to Dam 1)																						
			2,000			**10,000**										0	0	0	0	0	0		
	Backfill from excavated materials															0	0	0	0	0	0		
	Foundation								**10,000**	**m³**						0	0	0	0	0	0		
	Production of	1,200 m³ / sh							8	sh						0	0	0	0	0	0		
				10	h / s				80	h						0	0	0	0	0	0		
																0	0	0	0	0	0		
	- M-P							4	320	h	24.00					7,680	0	0	0	0	7,680		320
																0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor		38.25	28.00			90%	1	72	h				38.25		0	0	0	2,754	0	2,754		
	- Cat CS76 XT Vibratory Soil Compactor		14.85	20.00			45%	1	36	h				14.85		0	0	0	535	0	535		
	- Cat 329DL Hydraulic Excavator		19.00	29.00			25%	1	20	h				19.00		0	0	0	380	0	380		
	- Miscelaneous (culverts, signalisation, etc...)								2,000	m		2.00				0	4,000	0	0	0	4,000		
																0	0	0	0	0	0		
	Pavement 0.3	x	10	3	m³ / m				**6,000**	**m³**						0	0	0	0	0	0		
	Production of	1,000 m³ / sh							6	sh						0	0	0	0	0	0		
				10	h / s				60	h						0	0	0	0	0	0		
																0	0	0	0	0	0		
	- M-P							10	600	h	24.00					14,400	0	0	0	0	14,400		600
																0	0	0	0	0	0		
	- Cat D6T LGP Track-Type Tractor		28.40	26.10			90%	1	54	h				28.40		0	0	0	1,534	0	1,534		
	- Cat 725 Articulated Dumper 25 T		24.00	20.00			45%	3	81	h				24.00		0	0	0	1,944	0	1,944		
	- Cat CS76 XT Vibratory Soil Compactor		14.85	20.00			25%	1	15	h				14.85		0	0	0	223	0	223		
	- Cat 14M Motorgrader		16.65	25.75			90%	1	54	h				16.65		0	0	0	899	0	899		
	- Cat 980H Wheel Loader		29.00	23.45			90%	1	54	h				29.00		0	0	0	1,566	0	1,566		
																0	0	0	0	0	0		
	Hauling distance from crusher		2.00 km													0	0	0	0	0	0		
																0	0	0	0	0	0		
	Loading	4														0	0	0	0	0	0		

Item : (3621-3624-3625)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Trip up 3 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	396 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Pavement material 1.8 mt / m³ 0.08 h / mt			10,800	mt	1.84	1.30	0.00	2.08	3.08	19,872	14,040	0	22,464	23,950	80,326		864
											0	0	0	0	0	0		
	Overburden excavation			**22,000**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m² / sh / mach			31	sh						0	0	0	0	0	0		
	2 machines			16	sh						0	0	0	0	0	0		
	10 h / sh			155	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	1,240	h	24.00					29,760	0	0	0	0	29,760		1,240
											0	0	0	0	0	0		
-	Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	279					40.00	60.00	0	0	0	11,160	12,053	23,213		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	140					38.25	28.00	0	0	0	5,355	2,822	8,177		
-	Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	3	419					32.00	27.90	0	0	0	13,408	8,417	21,825		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficacité : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	693 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Dumped material			**9,100**	**m²**						0	0	0	0	0	0		
	Loading on stockpile at 5 km										0	0	0	0	0	0		
	Production of 1,200 m³ / sh			8	sh						0	0	0	0	0	0		
	10 h / sh			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	640		24.00					15,360	0	0	0	0	15,360		640
											0	0	0	0	0	0		
-	Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	4	288	h				32.00	27.90	0	0	0	9,216	5,785	15,001		
-	Cat 988H Wheel Loader 39.20 48.00	90%	1	72	h				39.20	48.00	0	0	0	2,822	2,488	5,310		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	72	h				19.00	29.00	0	0	0	1,368	1,503	2,871		
			6								0	0	0	0	0	0		
	Average hauling distance : 5.00 km										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 10 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 9 35 km / h										0	0	0	0	0	0		
	26 min.										0	0	0	0	0	0		
	Efficacité : 85% 31 min. / trip										0	0	0	0	0	0		
	0.51 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	18 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	378 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **4**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Compacted material			**5,000**	**m³**						0	0	0	0	0	0		
	From stockpile 0										0	0	0	0	0	0		
	From quarry 5,000										0	0	0	0	0	0		
	5,000										0	0	0	0	0	0		
	Quarry exploitation			**3,333**	**m³**													
	Needed 5,000 m³ loose																	
	1.5 3,333 m³ bank																	
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 3,086 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			15	sh						0	0	0	0	0	0		
	3 machines			5	sh						0	0	0	0	0	0		
	10 h / s			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	350	h	24.00					8,400	0	0	0	0	8,400		350
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	3	135	h				19.40	15.00	0	0	0	2,619	1,458	4,077		
	- Drilling materials			3,086	m		0.70				0	2,160	0	0	0	2,160		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 309 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 3,333 m³ Losses	5%		3,500	kg		5.60				0	19,600	0	0	0	19,600		
	- Caps Losses	5%		324	un		4.50				0	1,458	0	0	0	1,458		
											0	0	0	0	0	0		
	- M-P		8	400	h	24.00					9,600	0	0	0	0	9,600		400
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	2	90	h				5.00	15.00	0	0	0	450	972	1,422		
	- Misc. Blasting materials			3,333	m³		0.10				0	333	0	0	0	333		
	Mucking (Hauling to crusher 2 or dam site)										0	0	0	0	0	0		
	Production of 667 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 1,000 m³ / sh			5	sh						0	0	0	0	0	0		
	10 h / s			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	450	h	24.00					10,800	0	0	0	0	10,800		450

Item : (3621-3624-3625)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	2	90	h				38.25	28.00	0	0	0	3,443	1,814	5,257		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	90	h				40.00	60.00	0	0	0	3,600	3,888	7,488		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	90	h				32.00	27.90	0	0	0	2,880	1,808	4,688		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	90	h				3.50	2.20	0	0	0	315	143	458		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	45	h				39.20	48.00	0	0	0	1,764	1,555	3,319		
			9															
	Hauling distance 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 5 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	16 min.										0	0	0	0	0	0		
	Efficiency : 85% 19 min. / trip										0	0	0	0	0	0		
	0.31 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	29 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 21.0 m³										0	0	0	0	0	0		
	609 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
	From crusher			**5,000**	**m³**													
	Production of 1,000 m³ / sh			5	sh						0	0	0	0	0	0		
	10 h / sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	500		24.00					12,000	0	0	0	0	12,000		500
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	45	h				19.00	29.00	0	0	0	855	940	1,795		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	90	h				32.00	27.90	0	0	0	2,880	1,808	4,688		
	- Cat D8T LGP Track-Type Tractor 47.45 38.60	90%	1	45	h				47.45	38.60	0	0	0	2,135	1,251	3,386		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	45	h				39.20	48.00	0	0	0	1,764	1,555	3,319		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	45	h				40.00	60.00	0	0	0	1,800	1,944	3,744		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	90%	1	45	h				14.85	20.00	0	0	0	668	648	1,316		
	Average hauling distance : 2.00 km		7								0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficacité : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	693 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
	Geotextile			**2,200**	**m²**						0	0	0	0	0	0		
	Production of 550 m² / sh			4	sh						0	0	0	0	0	0		
	10 h / sh			40	h						0	0	0	0	0	0		

Item : (3621-3624-3625)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- M-P		8	320		24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	36	h				13.65	18.00	0	0	0	491	467	958		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	36	h				19.00	29.00	0	0	0	684	752	1,436		
											0	0	0	0	0	0		
	Supply 2,200 m²	15%		2,530	m²			7.50			0	0	18,975	0	0	18,975		
											0	0	0	0	0	0		
	Pumping 30 weeks 6 d / w			180	days						0	0	0	0	0	0		
	20 h / day			3,600	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	3,600	h	24.00					86,400	0	0	0	0	86,400		3,600
											0	0	0	0	0	0		
	- Miscelaneous			1	ls		20,000				0	20,000	0	0	0	20,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3621	**Dam 1 - Cofferdams**			**14,100**	**m³**						**221,952**	**61,591**	**18,975**	**101,976**	**78,021**	**482,515**		**9,284**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3624	**Dam 4 - Cofferdams**			**19,450**	**m³**													
	Overburden excavation **18,000 m²**																	
	Dumped material (m³)																	
	Downstream cofferdam 0																	
	Upstream cofferdam 3 1,900																	
	3 A 2,200																	
	3 B 650																	
	Diversion tunnel 1 A 2,000																	
	3 1,700																	
	8,450 m²																	
	Compacted material																	
	Downstream cofferdam 0																	
	Upstream cofferdam 3 D 11,000																	
	11,000 m²																	
	Construction roads (m) (m² / m) (m³)										0	0	0	0	0	0		
	Widenning primary road 500 5 2,500										0	0	0	0	0	0		
	From primary road to Dam 4 area 750 11 8,250										0	0	0	0	0	0		
	1,250 10,750										0	0	0	0	0	0		
	Backfill from excavated materials										0	0	0	0	0	0		
	Foundation			**10,750**	**m³**						0	0	0	0	0	0		
	Production of 1,200 m³ / sh			9	sh						0	0	0	0	0	0		
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	360	h	24.00					8,640	0	0	0	0	8,640		360
											0	0	0	0	0	0		

Item : (3621-3624-3625)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	81	h				38.25	28.00	0	0	0	3,098	1,633	4,731		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	45%	1	41	h				14.85	20.00	0	0	0	609	590	1,199		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	25%	1	23	h				19.00	29.00	0	0	0	437	480	917		
	- Miscelaneous (culverts, signalisation, etc...)			1,250	m		2.00				0	2,500	0	0	0	2,500		
											0	0	0	0	0	0		
	Pavement 0.3 x 10 3 m³ / m			**3,750**	**m³**						0	0	0	0	0	0		
	Production of 1,000 m³ / sh			4	sh						0	0	0	0	0	0		
	10 h / s			38	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	375	h	24.00					9,000	0	0	0	0	9,000		375
											0	0	0	0	0	0		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	34	h				28.40	26.10	0	0	0	966	639	1,605		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	45%	3	51	h				24.00	20.00	0	0	0	1,224	734	1,958		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	25%	1	9	h				14.85	20.00	0	0	0	134	130	264		
	- Cat 14M Motorgrader 16.65 25.75	90%	1	34	h				16.65	25.75	0	0	0	566	630	1,196		
	- Cat 980H Wheel Loader 29.00 23.45	90%	1	34	h				29.00	23.45	0	0	0	986	574	1,560		
											0	0	0	0	0	0		
	Hauling distance from crusher 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 3 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	396 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Pavement material 1.8 mt / m³ 0.07 h / mt			6,750	mt	1.80	1.38	0.00	2.03	3.15	12,150	9,315	0	13,703	15,309	50,477		473
											0	0	0	0	0	0		
	Overburden excavation			**18,000**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m² / sh / mach			26	sh						0	0	0	0	0	0		
	2 machines			13	sh						0	0	0	0	0	0		
	10 h / sh			130	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	1,040	h	24.00					24,960	0	0	0	0	24,960		1,040
											0	0	0	0	0	0		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	234					40.00	60.00	0	0	0	9,360	10,109	19,469		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	117					38.25	28.00	0	0	0	4,475	2,359	6,834		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	3	351					32.00	27.90	0	0	0	11,232	7,051	18,283		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		

Item : (3621-3624-3625)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Efficacité : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	693 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Dumped material			**8,450**	**m²**						0	0	0	0	0	0		
	Loading on stockpile at 1 km										0	0	0	0	0	0		
	Production of 1,200 m³ / sh			7	sh						0	0	0	0	0	0		
	10 h / sh			70	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	420		24.00					10,080	0	0	0	0	10,080		420
											0	0	0	0	0	0		
-	Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	126	h				32.00	27.90	0	0	0	4,032	2,531	6,563		
-	Cat 988H Wheel Loader 39.20 48.00	90%	1	63	h				39.20	48.00	0	0	0	2,470	2,177	4,647		
-	Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	63	h				40.00	60.00	0	0	0	2,520	2,722	5,242		
			4								0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 2 35 km / h										0	0	0	0	0	0		
	11 min.										0	0	0	0	0	0		
	Efficacité : 85% 13 min. / trip										0	0	0	0	0	0		
	0.22 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	42 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	882 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Compacted material			**11,000**	**m³**						0	0	0	0	0	0		
	From Canal 3 excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 800 m³ / sh			14	sh						0	0	0	0	0	0		
	10 h / sh			140	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	700		24.00					16,800	0	0	0	0	16,800		700
-	Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	126	h				40.00	60.00	0	0	0	5,040	5,443	10,483		
-	Cat D8T LGP Track-Type Tractor 47.45 38.60	90%	1	126	h				47.45	38.60	0	0	0	5,979	3,502	9,481		
-	Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	90%	1	126	h				14.85	20.00	0	0	0	1,871	1,814	3,685		
-	Generator 5 kW (Tower light) 3.50 2.20	90%	2	252	h				3.50	2.20								
	Geotextile			**4,700**	**m²**						0	0	0	0	0	0		
	Production of 550 m² / sh			9	sh						0	0	0	0	0	0		
	10 h / sh			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	720		24.00					17,280	0	0	0	0	17,280		720
											0	0	0	0	0	0		
-	Boom truck 17 tons 13.65 18.00	90%	1	81	h				13.65	18.00	0	0	0	1,106	1,050	2,156		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	81	h				19.00	29.00	0	0	0	1,539	1,691	3,230		
											0	0	0	0	0	0		
	Supply 4,700 m²	15%		5,405	m²			7.50			0	0	40,538	0	0	40,538		
											0	0	0	0	0	0		
	Geomembrane			**3,000**	**m²**						0	0	0	0	0	0		
	Production of 400 m² / sh			8	sh						0	0	0	0	0	0		
	10 h / sh			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	640		24.00					15,360	0	0	0	0	15,360		640
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	72	h				13.65	18.00	0	0	0	983	933	1,916		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	72	h				19.00	29.00	0	0	0	1,368	1,503	2,871		
											0	0	0	0	0	0		
	Supply 3,000 m²	15%		3,450	m²			12.00			0	0	41,400	0	0	41,400		
	Pumping 30 weeks 6 d / w			180	days						0	0	0	0	0	0		
	20 h / day			3,600	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	3,600	h	24.00					86,400	0	0	0	0	86,400		3,600
											0	0	0	0	0	0		
	- Miscelaneous			1	ls		20,000				0	20,000	0	0	0	20,000		
											0	0	0	0	0	0		
3624	**Dam 4 - Cofferdams**										**200,670**	**31,815**	**81,938**	**73,698**	**63,604**	**451,725**		**8,328**
3625	**Dam 5 - Cofferdams**			**6,450**	**m³**													
	Overburden excavation **32,000 m²**																	
	Dumped material (m³)																	
	Upstream cofferdam 3 400																	
	3 A 600																	
	3 B 250																	
	Canal 4 cofferdam 3 3,100																	
	3 A 1,400																	
	3 B 700																	
	6,450 m²																	
	Construction roads (m) (m² / m) (m³)										0	0	0	0	0	0		
	Widening primary road **2,000** **5** **10,000**										0	0	0	0	0	0		
	2,000 **10,000**										0	0	0	0	0	0		
	Backfill from excavated materials										0	0	0	0	0	0		
	Foundation			**10,000**	**m³**						0	0	0	0	0	0		
	Production of 1,200 m³ / sh			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	72	h				38.25	28.00	0	0	0	2,754	1,452	4,206		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	45%	1	36	h				14.85	20.00	0	0	0	535	518	1,053		

Item : (3621-3624-3625)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Cat 329DL Hydraulic Excavator 19.00 29.00	25%	1	20	h				19.00	29.00	0	0	0	380	418	798		
	- Miscelaneous (culverts, signalisation, etc...)			2,000	m		2.00				0	4,000	0	0	0	4,000		
											0	0	0	0	0	0		
	Pavement 0.3 x 10 3 m³ / m			**6,000**	**m³**						0	0	0	0	0	0		
	Production of 1,000 m³ / sh			6	sh						0	0	0	0	0	0		
	10 h / s			60	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	600	h	24.00					14,400	0	0	0	0	14,400		600
											0	0	0	0	0	0		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	54	h				28.40	26.10	0	0	0	1,534	1,015	2,549		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	45%	3	81	h				24.00	20.00	0	0	0	1,944	1,166	3,110		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	25%	1	15	h				14.85	20.00	0	0	0	223	216	439		
	- Cat 14M Motorgrader 16.65 25.75	90%	1	54	h				16.65	25.75	0	0	0	899	1,001	1,900		
	- Cat 980H Wheel Loader 29.00 23.45	90%	1	54	h				29.00	23.45	0	0	0	1,566	912	2,478		
											0	0	0	0	0	0		
	Hauling distance from crusher 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 3 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	396 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Pavement material 1.8 mt / m³ 0.07 h / mt			10,800	mt	1.80	1.38	0.00	2.03	3.15	19,440	14,904	0	21,924	24,494	80,762		756
											0	0	0	0	0	0		
	Overburden excavation			**32,000**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m² / sh / mach			46	sh						0	0	0	0	0	0		
	2 machines			23	sh						0	0	0	0	0	0		
	10 h / sh			230	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	1,840	h	24.00					44,160	0	0	0	0	44,160		1,840
											0	0	0	0	0	0		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	414					40.00	60.00	0	0	0	16,560	17,885	34,445		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	207					38.25	28.00	0	0	0	7,918	4,173	12,091		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	3	621					32.00	27.90	0	0	0	19,872	12,475	32,347		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficacité : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	693 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Dumped material			**6,450**	**m²**						0	0	0	0	0	0		
	Loading on stockpile at 2.5 km										0	0	0	0	0	0		
	Production of 1,200 m³ / sh			5	sh						0	0	0	0	0	0		
	10 h / sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	300		24.00					7,200	0	0	0	0	7,200		300
											0	0	0	0	0	0		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	45	h				19.00	29.00	0	0	0	855	940	1,795		
-	Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	90	h				32.00	27.90	0	0	0	2,880	1,808	4,688		
-	Cat 988H Wheel Loader 39.20 48.00	90%	1	45	h				39.20	48.00	0	0	0	1,764	1,555	3,319		
			3								0	0	0	0	0	0		
	Average hauling distance : 2.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 5 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 4 35 km / h										0	0	0	0	0	0		
	16 min.										0	0	0	0	0	0		
	Efficacité : 85% 19 min. / trip										0	0	0	0	0	0		
	0.31 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	29 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	609 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Geotextile			**2,450**	**m²**						0	0	0	0	0	0		
	Production of 550 m² / sh			4	sh						0	0	0	0	0	0		
	10 h / sh			40	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	320		24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
-	Boom truck 17 tons 13.65 18.00	90%	1	36	h				13.65	18.00	0	0	0	491	467	958		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	36	h				19.00	29.00	0	0	0	684	752	1,436		
											0	0	0	0	0	0		
	Supply 2,450 m²	15%		2,818	m²			7.50			0	0	21,135	0	0	21,135		
											0	0	0	0	0	0		
	Geomembrane			**2,950**	**m²**						0	0	0	0	0	0		
	Production of 550 m² / sh			5	sh						0	0	0	0	0	0		
	10 h / sh			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	400		24.00					9,600	0	0	0	0	9,600		400
											0	0	0	0	0	0		
-	Boom truck 17 tons 13.65 18.00	90%	1	45	h				13.65	18.00	0	0	0	614	583	1,197		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	45	h				19.00	29.00	0	0	0	855	940	1,795		
											0	0	0	0	0	0		
	Supply 2,950 m²	15%		3,393	m²			12.00			0	0	40,716	0	0	40,716		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Pumping 30 weeks 6 d / w			180	days						0	0	0	0	0	0		
	20 h / day			3,600	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	3,600	h	24.00					86,400	0	0	0	0	86,400		3,600
											0	0	0	0	0	0		
	- Miscelaneous			1	ls		20,000				0	20,000	0	0	0	20,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3625	**Dam 5 - Cofferdams**										**196,560**	**38,904**	**61,851**	**84,252**	**72,770**	**454,337**		**8,136**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			

3630 Foundation

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3631	**Dam 1 - Foundation**																	
	Rock Excavation			**3,000**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 0,9 0.90 0.90 0.81 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 3,704 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			19	sh						0	0	0	0	0	0		
	2 machines			10	sh						0	0	0	0	0	0		
	10 h / s			95	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	380	h	24.00					9,120	0	0	0	0	9,120		380
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	171	h				19.40	15.00	0	0	0	3,317	1,847	5,164		
	- Drilling materials			3,704	m		0.70				0	2,593	0	0	0	2,593		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 2 m										0	0	0	0	0	0		
	Number of holes 1,852 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 3,000 kg Losses	5%		3,150	kg		5.60				0	17,640	0	0	0	17,640		
	- Caps Losses	5%		1,945	un		4.50				0	8,753	0	0	0	8,753		
											0	0	0	0	0	0		
	- M-P		4	380	h	24.00					9,120	0	0	0	0	9,120		380
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	86	h				5.00	15.00	0	0	0	430	929	1,359		
	- Misc. Blasting materials			3,000	m³		0.10				0	300	0	0	0	300		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 316 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 474 m³ / sh			10	sh						0	0	0	0	0	0		
	10 h / s			95	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	570	h	24.00					13,680	0	0	0	0	13,680		570
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	86	h				38.25	28.00	0	0	0	3,290	1,734	5,024		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	86	h				32.00	27.90	0	0	0	2,752	1,728	4,480		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	171	h				3.50	2.20	0	0	0	599	271	870		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	86	h				19.00	29.00	0	0	0	1,634	1,796	3,430		
			5															
	Hauling distance 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 2 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 2 35 km / h										0	0	0	0	0	0		
	12 min.										0	0	0	0	0	0		

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Efficiency : 85% 14 min. / trip										0	0	0	0	0	0		
	0.24 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	39 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	819 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Foundation preparation 300 x 4			**1,200**	**m²**						0	0	0	0	0	0		
	Production of 50 m² / sh			24	sh						0	0	0	0	0	0		
	10 h / s			240	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	2,400	h	24.00					57,600	0	0	0	0	57,600		2,400
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	216	h				19.00	29.00	0	0	0	4,104	4,510	8,614		
	- Compressor - 750 cfm 14.30 27.00	90%	1	216	h				14.30	27.00	0	0	0	3,089	4,199	7,288		
	- Compressor XAHS 237 (500 cfm) 15.00 29.00	90%	1	216	h				15.00	29.00	0	0	0	3,240	4,510	7,750		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	432	h				3.50	2.20	0	0	0	1,512	684	2,196		
	- Miscelaneous			1,200	m²		3.00				0	3,600	0	0	0	3,600		
	Industrial water supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Marerials			1,000	m		200.00				0	200,000	0	0	0	200,000		
											0	0	0	0	0	0		
	Installation and Dismantling			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
	- M-P		6	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	45%	1	36	h				19.00	20.88	0	0	0	684	752	1,436		
	- Boom truck 17 tons 13.65 18.00	90%	1	72	h				13.65	12.96	0	0	0	983	933	1,916		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	16	h				37.00	14.40	0	0	0	592	230	822		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3631	**Dam 1 - Foundation**										**101,040**	**232,886**	**0**	**26,226**	**24,123**	**384,275**		**4,210**
3632	**Dam 2 - Foundation**																	
	Overburden excavation			**23,000**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 900 m² / sh			26	sh						0	0	0	0	0	0		
	10 h / sh			260	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	1,560	h	24.00					37,440	0	0	0	0	37,440		1,560
											0	0	0	0	0	0		
	- Cat 385CL Hydraulic Excavator 50.00 70.75	90%	1	234	h				50.00	70.75	0	0	0	11,700	11,920	23,620		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	234	h				38.25	28.00	0	0	0	8,951	4,717	13,668		

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	468	h				32.00	27.90	0	0	0	14,976	9,401	24,377		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	468	h				3.50	2.20	0	0	0	1,638	741	2,379		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 2 35 km / h										0	0	0	0	0	0		
	11 min.										0	0	0	0	0	0		
	Efficacité : 85% 13 min. / trip										0	0	0	0	0	0		
	0.22 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	42 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	882 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
	Rock Excavation			**3,825**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 0,9 0.90 0.90 0.81 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 4,722 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			24	sh						0	0	0	0	0	0		
	2 machines			12	sh						0	0	0	0	0	0		
	10 h / s			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	216	h				19.40	15.00	0	0	0	4,190	2,333	6,523		
	- Drilling materials			4,722	m		0.70				0	3,305	0	0	0	3,305		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 2 m										0	0	0	0	0	0		
	Number of holes 2,361 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 3,825 kg Losses	5%		4,016	kg		5.60				0	22,490	0	0	0	22,490		
	- Caps Losses	5%		2,479	un		4.50				0	11,156	0	0	0	11,156		
											0	0	0	0	0	0		
	- M-P		4	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	108	h				5.00	15.00	0	0	0	540	1,166	1,706		
	- Misc. Blasting materials			3,825	m³		0.10				0	383	0	0	0	383		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 319 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 478 m³ / sh			12	sh						0	0	0	0	0	0		
	10 h / s			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	720	h	24.00					17,280	0	0	0	0	17,280		720

Item : (3631 to 3635)

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
													0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	108	h				38.25	28.00	0	0	0	4,131	2,177	6,308		
	- Cat 740 Articulated Dumper 40 T	32.00	27.90	90%	1	108	h				32.00	27.90	0	0	0	3,456	2,170	5,626		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	108	h				19.00	29.00	0	0	0	2,052	2,255	4,307		
	- Generator 5 kW (Tower light)	3.50	2.20	90%	2	216	h				3.50	2.20	0	0	0	756	342	1,098		
	Hauling distance		1.00 km										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading	4											0	0	0	0	0	0		
	Trip up	2	25 km / h										0	0	0	0	0	0		
	Unloading	4											0	0	0	0	0	0		
	Back trip	2	35 km / h										0	0	0	0	0	0		
		12 min.											0	0	0	0	0	0		
	Efficiency :	85%	14 min. / trip										0	0	0	0	0	0		
			0.24 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			39 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T		21.0 m³										0	0	0	0	0	0		
			819 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift		**1**										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Foundation preparation	475	x 4			**1,900**	**m²**						0	0	0	0	0	0		
	Production of	50 m² / sh				38	sh						0	0	0	0	0	0		
			10 h / s			380	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				10	3,800	h	24.00					91,200	0	0	0	0	91,200		3,800
													0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	342	h				19.00	29.00	0	0	0	6,498	7,141	13,639		
	- Compressor - 750 cfm	14.30	27.00	90%	1	342	h				14.30	27.00	0	0	0	4,891	6,648	11,539		
	- Compressor XAHS 237 (500 cfm)	15.00	29.00	90%	1	342	h				15.00	29.00	0	0	0	5,130	7,141	12,271		
	- Generator 5 kW (Tower light)	3.50	2.20	90%	2	684	h				3.50	2.20	0	0	0	2,394	1,083	3,477		
	- Miscelaneous					1,900	m²		3.00				0	5,700	0	0	0	5,700		
	Industrial water supply												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Marerials					1,000	m		200.00				0	200,000	0	0	0	200,000		
													0	0	0	0	0	0		
	Installation and Dismantling					8	sh						0	0	0	0	0	0		
			10 h / s			80	h						0	0	0	0	0	0		
	- M-P				6	480	h	24.00					11,520	0	0	0	0	11,520		480
													0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	45%	1	36	h				19.00	20.88	0	0	0	684	752	1,436		
	- Boom truck 17 tons	13.65	18.00	90%	1	72	h				13.65	12.96	0	0	0	983	933	1,916		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	16	h				37.00	14.40	0	0	0	592	230	822		
													0	0	0	0	0	0		
3632	**Dam 2 - Foundation**												**180,480**	**243,034**	**0**	**73,562**	**61,150**	**558,226**		**7,520**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3633	**Dam 3 - Foundation**																	
	Overburden excavation			**138,000**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 2,000 m² / sh			69	sh						0	0	0	0	0	0		
	10 h / sh			690	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	6,900	h	24.00					165,600	0	0	0	0	165,600		6,900
											0	0	0	0	0	0		
	- Cat 385CL Hydraulic Excavator 50.00 70.75	90%	2	1,242	h				50.00	70.75	0	0	0	62,100	63,267	125,367		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	2	1,242	h				38.25	28.00	0	0	0	47,507	25,039	72,546		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	3	1,863	h				32.00	27.90	0	0	0	59,616	37,424	97,040		
	- Cat 345 Hydraulic Excavator 40.00 60.00	45%	1	311	h				40.00	60.00	0	0	0	12,440	13,435	25,875		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	4	2,484	h				3.50	2.20	0	0	0	8,694	3,935	12,629		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 2 35 km / h										0	0	0	0	0	0		
	11 min.										0	0	0	0	0	0		
	Efficacité : 85% 13 min. / trip										0	0	0	0	0	0		
	0.22 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	42 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21 m³										0	0	0	0	0	0		
	882 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
	Rock Excavation			**3,800**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 0,9 0.90 0.90 0.81 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 4,691 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			23	sh						0	0	0	0	0	0		
	2 machines			12	sh						0	0	0	0	0	0		
	10 h / s			115	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	460	h	24.00					11,040	0	0	0	0	11,040		460
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	207	h				19.40	15.00	0	0	0	4,016	2,236	6,252		
	- Drilling materials			4,691	m		0.70				0	3,284	0	0	0	3,284		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 2 m										0	0	0	0	0	0		
	Number of holes 2,346 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 3,800 kg Losses	5%		3,990	kg		5.60				0	22,344	0	0	0	22,344		

WBS	DESCRIPTION				%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
	- Caps			Losses	5%		2,463	un		4.50				0	11,084	0	0	0	11,084		
														0	0	0	0	0	0		
	- M-P					4	460	h	24.00					11,040	0	0	0	0	11,040		460
														0	0	0	0	0	0		
	- Explosives Truck	5.00	15.00		90%	1	104	h				5.00	15.00	0	0	0	520	1,123	1,643		
	- Misc. Blasting materials						3,800	m³		0.10				0	380	0	0	0	380		
														0	0	0	0	0	0		
	Evacuation of excavated materials													0	0	0	0	0	0		
	Production of	330 m³ / sh												0	0	0	0	0	0		
	1.5 loose »»»»	496 m³ / sh					12	sh						0	0	0	0	0	0		
				10 h / s			115	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					6	690	h	24.00					16,560	0	0	0	0	16,560		690
														0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	104	h				38.25	28.00	0	0	0	3,978	2,097	6,075		
	- Cat 740 Articulated Dumper 40 T	32.00	27.90		90%	1	104	h				32.00	27.90	0	0	0	3,328	2,089	5,417		
	- Generator 5 kW (Tower light)	3.50	2.20		90%	2	207	h				3.50	2.20	0	0	0	725	328	1,053		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	1	104	h				19.00	29.00	0	0	0	1,976	2,172	4,148		
						5															
	Hauling distance	1.00 km												0	0	0	0	0	0		
														0	0	0	0	0	0		
	Loading	4												0	0	0	0	0	0		
	Trip up	2	25 km / h											0	0	0	0	0	0		
	Unloading	4												0	0	0	0	0	0		
	Back trip	2	35 km / h											0	0	0	0	0	0		
		12 min.												0	0	0	0	0	0		
	Efficiency :	85%	14 min. / trip											0	0	0	0	0	0		
			0.24 h / trip											0	0	0	0	0	0		
			9 h / sh											0	0	0	0	0	0		
			39 trips / sh											0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T		21.0 m³											0	0	0	0	0	0		
			819 m³/mach/sh											0	0	0	0	0	0		
	Number of trucks per shift		**1**											0	0	0	0	0	0		
	Foundation preparation	525	x	4			**2,100**	**m²**						0	0	0	0	0	0		
	Production of	50 m² / sh					42	sh						0	0	0	0	0	0		
				10 h / s			420	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					10	4,200	h	24.00					100,800	0	0	0	0	100,800		4,200
														0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	1	378	h				19.00	29.00	0	0	0	7,182	7,893	15,075		
	- Compressor - 750 cfm	14.30	27.00		90%	1	378	h				14.30	27.00	0	0	0	5,405	7,348	12,753		
	- Compressor XAHS 237 (500 cfm)	15.00	29.00		90%	1	378	h				15.00	29.00	0	0	0	5,670	7,893	13,563		
	- Generator 5 kW (Tower light)	3.50	2.20		90%	2	756	h				3.50	2.20	0	0	0	2,646	1,198	3,844		
	- Miscelaneous						2,100	m²		3.00				0	6,300	0	0	0	6,300		
	Industrial water supply													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Marerials						1,000	m		200.00				0	200,000	0	0	0	200,000		
														0	0	0	0	0	0		
	Installation and Dismantling						8	sh						0	0	0	0	0	0		

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
			10 h / s			80	h						0	0	0	0	0	0		
	- M-P				6	480	h	24.00					11,520	0	0	0	0	11,520		480
													0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	45%	1	36	h				19.00	20.88	0	0	0	684	752	1,436		
	- Boom truck 17 tons	13.65	18.00	90%	1	72	h				13.65	12.96	0	0	0	983	933	1,916		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	16	h				37.00	14.40	0	0	0	592	230	822		
													0	0	0	0	0	0		
	Lean Concrete (Rock contact)					**200**	**m^3**						0	0	0	0	0	0		
	Production of	20 m^3 / sh				10	sh						0	0	0	0	0	0		
			10 h / s			100	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	500	h	24.00					12,000	0	0	0	0	12,000		500
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	90%	1	90	h				37.00	14.40	0	0	0	3,330	1,296	4,626		
													0	0	0	0	0	0		
	- Miscellaneous					200	m^3		10.00				0	2,000	0	0	0	2,000		
													0	0	0	0	0	0		
	- Concrete supply	200	1.87 h / m^3	2%		204	m^2	44.80	10.69	308.59	13.56	10.78	9,139	2,180	62,953	2,766	2,199	79,237		382
													0	0	0	0	0	0		
	Concrete transportation from the Batching Plan					**200**	**m^3**						0	0	0	0	0	0		
	Average production	20 m^3 / sh				10	sh						0	0	0	0	0	0		
			10 h / sh			100	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				3	300	h	24.00					7,200	0	0	0	0	7,200		300
													0	0	0	0	0	0		
	- Ready-mix 8 m^3	13.60	14.00	90%	1	90	h				13.60	14.00	0	0	0	1,224	907	2,131		
													0	0	0	0	0	0		
	Average hauling distance :		2.00 km										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading	10											0	0	0	0	0	0		
	Going	4	30 km / h										0	0	0	0	0	0		
	Unloading	15											0	0	0	0	0	0		
	Return	3	35 km / h										0	0	0	0	0	0		
		32 min.											0	0	0	0	0	0		
	Efficacies :	85%	38 min. / trip										0	0	0	0	0	0		
			0.63 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			15 trips / sh										0	0	0	0	0	0		
	Ready-mix 8 m^3		8 m^3										0	0	0	0	0	0		
			120 m^3 / truck-sh										0	0	0	0	0	0		
	Number of trucks :		**1**										0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3633	**Dam 3 - Foundation**												**344,899**	**247,572**	**62,953**	**235,382**	**183,794**	**1,074,600**		**14,372**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3634	**Dam 4 - Foundation**																	
	Rock Excavation			**1,410**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 0,9 0.90 0.90 0.81 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 1,741 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			9	sh						0	0	0	0	0	0		
	2 machines			5	sh						0	0	0	0	0	0		
	10 h / s			45	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	180	h	24.00					4,320	0	0	0	0	4,320		180
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	81	h				19.40	15.00	0	0	0	1,571	875	2,446		
	- Drilling materials			1,741	m		0.70				0	1,219	0	0	0	1,219		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 2 m										0	0	0	0	0	0		
	Number of holes 871 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 1,410 kg Losses	5%		1,481	kg		5.60				0	8,294	0	0	0	8,294		
	- Caps Losses	5%		914	un		4.50				0	4,113	0	0	0	4,113		
											0	0	0	0	0	0		
	- M-P		4	180	h	24.00					4,320	0	0	0	0	4,320		180
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	41	h				5.00	15.00	0	0	0	205	443	648		
	- Misc. Blasting materials			1,410	m³		0.10				0	141	0	0	0	141		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 313 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 470 m³ / sh			5	sh						0	0	0	0	0	0		
	10 h / s			45	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	270	h	24.00					6,480	0	0	0	0	6,480		270
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	41	h				38.25	28.00	0	0	0	1,568	827	2,395		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	41	h				32.00	27.90	0	0	0	1,312	824	2,136		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	81	h				3.50	2.20	0	0	0	284	128	412		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	41	h				19.00	29.00	0	0	0	779	856	1,635		
			5															
	Hauling distance 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 2 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 2 35 km / h										0	0	0	0	0	0		
	12 min.										0	0	0	0	0	0		
	Efficiency : 85% 14 min. / trip										0	0	0	0	0	0		
	0.24 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		

Item : (3631 to 3635)

WBS	DESCRIPTION				%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
		39 trips / sh												0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T	21.0 m³												0	0	0	0	0	0		
		819 m³/mach/sh												0	0	0	0	0	0		
	Number of trucks per shift	1												0	0	0	0	0	0		
														0	0	0	0	0	0		
	Foundation preparation	150	x	4			**600**	**m²**						0	0	0	0	0	0		
	Production of	50 m² / sh					12	sh						0	0	0	0	0	0		
				10 h / s			120	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					10	1,200	h	24.00					28,800	0	0	0	0	28,800		1,200
														0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	1	108	h				19.00	29.00	0	0	0	2,052	2,255	4,307		
	- Compressor - 750 cfm	14.30	27.00		90%	1	108	h				14.30	27.00	0	0	0	1,544	2,100	3,644		
	- Compressor XAHS 237 (500 cfm)	15.00	29.00		90%	1	108	h				15.00	29.00	0	0	0	1,620	2,255	3,875		
	- Generator 5 kW (Tower light)	3.50	2.20		90%	2	216	h				3.50	2.20	0	0	0	756	342	1,098		
	- Miscelaneous						600	m²		3.00				0	1,800	0	0	0	1,800		
	Industrial water supply													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Marerials						1,000	m		200.00				0	200,000	0	0	0	200,000		
														0	0	0	0	0	0		
	Installation and Dismantling						8	sh						0	0	0	0	0	0		
				10 h / s			80	h						0	0	0	0	0	0		
	- M-P					6	480	h	24.00					11,520	0	0	0	0	11,520		480
														0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		45%	1	36	h				19.00	20.88	0	0	0	684	752	1,436		
	- Boom truck 17 tons	13.65	18.00		90%	1	72	h				13.65	12.96	0	0	0	983	933	1,916		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00		20%	1	16	h				37.00	14.40	0	0	0	592	230	822		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
3634	**Dam 4 - Foundation**													**55,440**	**215,567**	**0**	**13,950**	**12,820**	**297,777**		**2,310**
3635	**Dam 5 - Foundation**						**3,000**	**m²**													
	Rock Excavation						**3,000**	**m³**						0	0	0	0	0	0		
	Drilling													0	0	0	0	0	0		
	Drilling grid ,9 x 0,9	0.90	0.90	0.81 m²										0	0	0	0	0	0		
														0	0	0	0	0	0		
	Drilling length			3,704 m										0	0	0	0	0	0		
	Production of	200 m / machine / sh					19	sh						0	0	0	0	0	0		
		2 machines					10	sh						0	0	0	0	0	0		
				10 h / s			95	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					4	380	h	24.00					9,120	0	0	0	0	9,120		380
														0	0	0	0	0	0		
	- Hydraulic Drilling Machine	19.40	15.00		90%	2	171	h				19.40	15.00	0	0	0	3,317	1,847	5,164		
	- Drilling materials						3,704	m		0.70				0	2,593	0	0	0	2,593		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 2 m										0	0	0	0	0	0		
	Number of holes 1,852 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 3,000 kg Losses	5%		3,150	kg		5.60				0	17,640	0	0	0	17,640		
	- Caps Losses	5%		1,945	un		4.50				0	8,753	0	0	0	8,753		
											0	0	0	0	0	0		
	- M-P		4	380	h	24.00					9,120	0	0	0	0	9,120		380
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	86	h				5.00	15.00	0	0	0	430	929	1,359		
	- Misc. Blasting materials			3,000	m³		0.10				0	300	0	0	0	300		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 316 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 474 m³ / sh			10	sh						0	0	0	0	0	0		
	10 h / s			95	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	570	h	24.00					13,680	0	0	0	0	13,680		570
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	86	h				38.25	28.00	0	0	0	3,290	1,734	5,024		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	86	h				32.00	27.90	0	0	0	2,752	1,728	4,480		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	171	h				3.50	2.20	0	0	0	599	271	870		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	86	h				19.00	29.00	0	0	0	1,634	1,796	3,430		
			5															
	Hauling distance 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 2 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 2 35 km / h										0	0	0	0	0	0		
	12 min.										0	0	0	0	0	0		
	Efficiency : 85% 14 min. / trip										0	0	0	0	0	0		
	0.24 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	39 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	819 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Foundation preparation 275 x 4			**1,100**	**m²**						0	0	0	0	0	0		
	Production of 50 m² / sh			22	sh						0	0	0	0	0	0		
	10 h / s			220	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	2,200	h	24.00					52,800	0	0	0	0	52,800		2,200
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	198	h				19.00	29.00	0	0	0	3,762	4,134	7,896		
	- Compressor - 750 cfm 14.30 27.00	90%	1	198	h				14.30	27.00	0	0	0	2,831	3,849	6,680		
	- Compressor XAHS 237 (500 cfm) 15.00 29.00	90%	1	198	h				15.00	29.00	0	0	0	2,970	4,134	7,104		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	396	h				3.50	2.20	0	0	0	1,386	627	2,013		
	- Miscelaneous			1,100	m²		3.00				0	3,300	0	0	0	3,300		

Item : (3631 to 3635)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS							
													24.00 $				0.72 $			
	Industrial water supply												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Marerials					1,000	m		200.00				0	200,000	0	0	0	200,000		
													0	0	0	0	0	0		
	Installation and Dismantling					8	sh						0	0	0	0	0	0		
		10 h / s				80	h						0	0	0	0	0	0		
	- M-P				6	480	h	24.00					11,520	0	0	0	0	11,520		480
													0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	45%	1	36	h				19.00	20.88	0	0	0	684	752	1,436		
	- Boom truck 17 tons	13.65	18.00	90%	1	72	h				13.65	12.96	0	0	0	983	933	1,916		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	16	h				37.00	14.40	0	0	0	592	230	822		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3635	**Dam 5 - Foundation**												**96,240**	**232,586**	**0**	**25,230**	**22,964**	**377,020**		**4,010**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3640	**Impervious core**																	
3641	**Dam 1 - Impervious core**			**14,300**	**m³**													
	Impervious core			**14,300**	**m³**													
	Asphalt core 1,300																	
	2B Crushed stone 13,000																	
	14,300 m³																	
	Concrete Plinth			**750**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concreting 3.05 h / m³			2,288	h	24.00					54,900	0	0	0	0	54,900		2,288
	- Construction materials			750	m³		107.00				0	80,250	0	0	0	80,250		
	- Construction equipment			750	m³				35.00	26.00	0	0	0	26,250	14,040	40,290		
	- Miscellaneous			750	m³		1.50				0	1,125	0	0	0	1,125		
											0	0	0	0	0	0		
	- Concrete supply 750 4.04 h / m³	2%		765	m²	96.85	5.10	186.47	35.08	13.03	74,089	3,902	142,647	26,835	7,177	254,650		3,092
											0	0	0	0	0	0		
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabrication 60 kg / m³ 17.27 h / mt			**45**	**mt**	414.40	323.08	987.76	79.99	44.86	18,648	14,539	44,449	3,600	1,453	82,689		777
											0	0	0	0	0	0		
	Installation																	
	- M-P 16.00 h / mt			720	h	24.00					17,280	0	0	0	0	17,280		720
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	144	h				37.00	20.00	0	0	0	5,328	2,074	7,402		
	- Boom truck 17 tons 13.65 18.00	50%	1	360	h				13.65	18.00	0	0	0	4,914	4,666	9,580		
	Concrete transportation from the Batching Plan			**765**	**m³**						0	0	0	0	0	0		
	Average production 50 m³ / sh			16	sh						0	0	0	0	0	0		
	10 h / sh			160	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Ready-mix 8 m³ 13.60 14.00	90%	1	144	h				13.60	14.00	0	0	0	1,958	1,452	3,410		
											0	0	0	0	0	0		
	Average hauling distance : 13.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 26 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 22 35 km / h										0	0	0	0	0	0		
	73 min.										0	0	0	0	0	0		
	Efficiency : 85% 86 min. / trip										0	0	0	0	0	0		
	1.43 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	7 trips / sh										0	0	0	0	0	0		
	Ready-mix 8 m³ 8 m³										0	0	0	0	0	0		
	56 m³ / truck-sh										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Heating and Injection										0	0	0	0	0	0		
	Defrosting holes 210										0	0	0	0	0	0		
	Injection holes 100										0	0	0	0	0	0		
	310 m										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling 225 m / sh-mach			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		4	80	h	24.00					1,920	0	0	0	0	1,920		80
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	1	18	h				19.40	15.00	0	0	0	349	194	543		
-	Compressor - 750 cfm 14.30 27.00	90%	1	18	h				14.30	27.00	0	0	0	257	350	607		
											0	0	0	0	0	0		
-	Drilling materials			310	m		0.70				0	217	0	0	0	217		
											0	0	0	0	0	0		
	Injection										0	0	0	0	0	0		
	Cement 3,980 kg										0	0	0	0	0	0		
-	Cement 40 kg bags 100	100%		199	un			10.00			0	0	1,990	0	0	1,990		
	Successfull links 100 kg cement / un **40 un**										0	0	0	0	0	0		
	10 un / sh			4	sh						0	0	0	0	0	0		
	10 h / sh			40	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	320	h	24.00					7,680	0	0	0	0	7,680		320
											0	0	0	0	0	0		
-	Compressor - 750 cfm 14.30 27.00	90%	1	36	h				14.30	27.00	0	0	0	515	700	1,215		
-	Injection pump 10.00	90%	1	36	h				10.00	0.00	0	0	0	360	0	360		
											0	0	0	0	0	0		
-	Miscellaneous			40	un		45.00				0	1,800	0	0	0	1,800		
											0	0	0	0	0	0		
	Heathing and defrosting										0	0	0	0	0	0		
	Rock defrosting 4 days	1	w								0	0	0	0	0	0		
	Drilling 2 sh										0	0	0	0	0	0		
	Injection 4 sh										0	0	0	0	0	0		
	6 sh										0	0	0	0	0	0		
	2 sh / day 3 days	1	w								0	0	0	0	0	0		
		2	w															
	2 weeks																	
	Lag time 1 weeks										0	0	0	0	0	0		
	3 weeks 168 h / w			432	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		2	864	h	24.00					20,736	0	0	0	0	20,736		864
-	Boiler - 1500 kW 4.00 90.00	100%	1	432	h				4.00	90.00	0	0	0	1,728	27,994	29,722		
											0	0	0	0	0	0		
-	Miscellaneous (hoses, pipes, etc...) Holes lentgh proportion :	75%		233	m		18.00				0	4,194	0	0	0	4,194		
	Impervious core			**14,300**	**m³**													
	Asphalt core 1,300																	
	2B Crushed stone 13,000																	

Item : (3641 to 3645)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	14,300 m³																	
	Number of passes																	
	Heigth 20 m																	
	Thickness 0.225 m 89 layers																	
	Asphalt 0.090 m³ / m of layer																	
	Total lentgh 14,444 m 162 m / layer																	
	Progression 70 m / h 2.31 h / layer																	
	10 hours shift 4.32 layers / sh	OK																
	Mechanical placement 3 layers / sh			30	sh						0	0	0	0	0	0		
	Testing bench **25 m** **4 layers**			6	sh													
				36	sh													
	10 h / sh			360	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		10	3,600	h	24.00					86,400	0	0	0	0	86,400		3,600
											0	0	0	0	0	0		
-	Paver 50.00 40.00	90%	1	324	h				50.00	40.00	0	0	0	16,200	9,331	25,531		
-	Cat 950H Wheel Loader 18.35 9.05	90%	1	324	h				18.35	9.05	0	0	0	5,945	2,111	8,056		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	324	h				19.00	29.00	0	0	0	6,156	6,765	12,921		
-	10 Wheeler Truck 24.00 20.00	90%	1	324	h				24.00	20.00	0	0	0	7,776	4,666	12,442		
-	Cat CB 225 Compactor 14.85 20.00	90%	2	648	h				14.85	20.00	0	0	0	9,623	9,331	18,954		
-	Plate damper 1T 2.00 1.45	90%	1	324	h				2.00	1.45	0	0	0	648	338	986		
			7								0	0	0	0	0	0		
-	Miscelaneous (propane and accessories, uppers, etc)			14,444	m		3.00				0	43,332	0	0	0	43,332		
	Asphalt Transportation from Batch Plan										0	0	0	0	0	0		
	Production 44 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 30										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	47 min.										0	0	0	0	0	0		
	Efficiency : 85% 55 min. / trip										0	0	0	0	0	0		
	0.92 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	10 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck 8 m³										0	0	0	0	0	0		
	80 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Manual placement 2 h / layer 89 layers										0	0	0	0	0	0		
	178 h 9 h / sh eff.			20	sh						0	0	0	0	0	0		
	10 h / sh			200	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		9	1,800	h	24.00					43,200	0	0	0	0	43,200		1,800
											0	0	0	0	0	0		
-	Cat 950H Wheel Loader 18.35 9.05	45%	1	90	h				18.35	9.05	0	0	0	1,652	586	2,238		
-	Plate damper 1T 2.00 1.45	90%	2	360	h				2.00	1.45	0	0	0	720	376	1,096		
-	Boom truck 17 tons 13.65 18.00	45%	1	90	h				13.65	18.00	0	0	0	1,229	1,166	2,395		
											0	0	0	0	0	0		
-	Miscelaneous materials (formwork, spikes, etc…)			89	lay		75.00				0	6,675	0	0	0	6,675		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Supply (m³) (mt)										0	0	0	0	0	0		
	- Asphalt 1,300 1,950 1.94 h / mt	10%		2,145	mt	46.38	5.53	68.96	21.69	6.36	0	11,860	147,911	46,517	9,830	216,118		4,152
	- 2B Crushed stone 13,000 23,400 0.08 h / mt	5%		24,570	mt	1.84	1.30	0.00	2.08	3.08	45,209	31,941	0	51,106	54,486	182,742		1,966
											0	0	0	0	0	0		
	Filter 2B **Transportation from crusher stockpile**			**13,000**	**m³**						0	0	0	0	0	0		
	Thickness 0.225 m 89 layers																	
	2B 0.810 m³ / m of layer										0	0	0	0	0	0		
	14,444 m 162 m / layer										0	0	0	0	0	0		
	Progression 70 m / h 2.31 h / layer										0	0	0	0	0	0		
	10 hours shift 4.32 layers / sh										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production 394 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 3.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 5										0	0	0	0	0	0		
	Going 6 30 km / h										0	0	0	0	0	0		
	Unloading 5										0	0	0	0	0	0		
	Return 5 35 km / h										0	0	0	0	0	0		
	21 min.										0	0	0	0	0	0		
	Efficiency : 85% 25 min. / trip										0	0	0	0	0	0		
	0.41 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	22 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck 8 m³										0	0	0	0	0	0		
	176 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
				30	sh						0	0	0	0	0	0		
	10 h / sh			300	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	1,500	h	24.00					36,000	0	0	0	0	36,000		1,500
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	270	h				18.35	9.05	0	0	0	4,955	1,759	6,714		
	- 10 Wheeler Truck 24.00 20.00	90%	3	810	h				24.00	20.00	0	0	0	19,440	11,664	31,104		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3641	**Dam 1 - Impervious core**										**417,582**	**199,835**	**336,997**	**244,061**	**172,509**	**1,370,984**		**21,639**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3642	**Dam 2 - Impervious core**			**13,700**	**m³**													
	Impervious core			**13,700**	**m³**													
	Asphalt core 1,200																	
	2B Crushed stone 12,500																	
	13,700 m³																	
	Concrete Plinth			**1,300**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concreting 3.05 h / m³			3,965	h	24.00					95,160	0	0	0	0	95,160		3,965
	- Construction materials			1,300	m³		107.00				0	139,100	0	0	0	139,100		
	- Construction equipment			1,300	m³				35.00	26.00	0	0	0	45,500	24,336	69,836		
	- Miscellaneous			1,300	m³		1.50				0	1,950	0	0	0	1,950		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES					TOTAL COSTS					GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption			
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- Concrete supply 1,300 4.04 h / m^3	2%		1,326	m^2	96.85	5.10	186.47	35.08	13.03	128,420	6,763	247,255	46,514	12,440	441,392		5,360
											0	0	0	0	0	0		
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabrication 60 kg / m^3 17.27 h / mt			**78**	**mt**	414.40	323.08	987.76	79.99	44.86	32,323	25,201	77,045	6,239	2,519	143,327		1,347
											0	0	0	0	0	0		
	Installation																	
	- M-P 16.00 h / mt			1,248	h	24.00					29,952	0	0	0	0	29,952		1,248
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	250	h				37.00	20.00	0	0	0	9,250	3,600	12,850		
	- Boom truck 17 tons 13.65 18.00	50%	1	624	h				13.65	18.00	0	0	0	8,518	8,087	16,605		
	Concrete transportation from the Batching Plan			**1,326**	**m^3**						0	0	0	0	0	0		
	Average production 50 m^3 / sh			27	sh						0	0	0	0	0	0		
	10 h / sh			270	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	810	h	24.00					19,440	0	0	0	0	19,440		810
											0	0	0	0	0	0		
	- Ready-mix 8 m^3 13.60 14.00	90%	1	243	h				13.60	14.00	0	0	0	3,305	2,449	5,754		
											0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	32 min.										0	0	0	0	0	0		
	Efficiency : 85% 38 min. / trip										0	0	0	0	0	0		
	0.63 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	15 trips / sh										0	0	0	0	0	0		
	Ready-mix 8 m^3 8 m^3										0	0	0	0	0	0		
	120 m^3 / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Impervious core			**13,700**	**m^3**													
	Asphalt core 1,200																	
	2B Crushed stone 12,500																	
	13,700 m^3																	
	Number of passes																	
	Heigth 15 m																	
	Thickness 0.225 m 67 layers																	
	Asphalt 0.090 m^3 / m of layer																	
	Total lentgh 13,333 m 199 m / layer																	
	Progression 70 m / h 2.84 h / layer																	
	10 hours shift 3.52 layers / sh OK																	
	Mechanical placement 3 layers / sh			22	sh						0	0	0	0	0	0		
				22	sh													
	10 h / sh			220	h						0	0	0	0	0	0		
											0	0	0	0	0	0		

Item : (3641 to 3645)

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
-	M-P				10	2,200	h	24.00					52,800	0	0	0	0	52,800		2,200
													0	0	0	0	0	0		
-	Paver	50.00	40.00	90%	1	198	h				50.00	40.00	0	0	0	9,900	5,702	15,602		
-	Cat 950H Wheel Loader	18.35	9.05	90%	1	198	h				18.35	9.05	0	0	0	3,633	1,290	4,923		
-	Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	198	h				19.00	29.00	0	0	0	3,762	4,134	7,896		
-	10 Wheeler Truck	24.00	20.00	90%	1	198	h				24.00	20.00	0	0	0	4,752	2,851	7,603		
-	Cat CB 225 Compactor	14.85	20.00	90%	2	396	h				14.85	20.00	0	0	0	5,881	5,702	11,583		
-	Plate damper 1T	2.00	1.45	90%	1	198	h				2.00	1.45	0	0	0	396	207	603		
					7								0	0	0	0	0	0		
-	Miscelaneous (propane and accessories, uppers, etc)					13,333	m		3.00				0	39,999	0	0	0	39,999		
	Asphalt Transportation from Batch Plan												0	0	0	0	0	0		
	Production 54 m³ / sh												0	0	0	0	0	0		
	Average hauling distance : 2.00 km												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading 10												0	0	0	0	0	0		
	Going 4 30 km / h												0	0	0	0	0	0		
	Unloading 30												0	0	0	0	0	0		
	Return 3 35 km / h												0	0	0	0	0	0		
	47 min.												0	0	0	0	0	0		
	Efficiency : 85% 55 min. / trip												0	0	0	0	0	0		
	0.92 h / trip												0	0	0	0	0	0		
	9 h / sh												0	0	0	0	0	0		
	10 trips / sh												0	0	0	0	0	0		
	10 Wheeler Truck 8 m³												0	0	0	0	0	0		
	80 m³ / truck-sh												0	0	0	0	0	0		
	Number of trucks : **1**												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Manual placement 2 h / layer 67 layers												0	0	0	0	0	0		
	134 h 9 h / sh eff.					15	sh						0	0	0	0	0	0		
	10 h / sh					150	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
-	M-P				9	1,350	h	24.00					32,400	0	0	0	0	32,400		1,350
													0	0	0	0	0	0		
-	Cat 950H Wheel Loader	18.35	9.05	45%	1	68	h				18.35	9.05	0	0	0	1,248	443	1,691		
-	Plate damper 1T	2.00	1.45	90%	2	270	h				2.00	1.45	0	0	0	540	282	822		
-	Boom truck 17 tons	13.65	18.00	45%	1	68	h				13.65	18.00	0	0	0	928	881	1,809		
													0	0	0	0	0	0		
-	Miscelaneous materials (formwork, spikes, etc…)					67	lay		75.00				0	5,025	0	0	0	5,025		
													0	0	0	0	0	0		
	Supply (m³) (mt)												0	0	0	0	0	0		
-	Asphalt 1,200 1,800 1.94 h / mt			10%		1,980	mt	46.38	5.53	68.96	21.69	6.36	0	10,948	136,533	42,939	9,074	199,494		3,833
-	2B Crushed stone 12,500 22,500 0.08 h / mt			5%		23,625	mt	1.84	1.30	0.00	2.08	3.08	43,470	30,713	0	49,140	52,391	175,714		1,890
													0	0	0	0	0	0		
	Filter 2B **Transportation from crusher stockpile**					**12,500**	**m³**						0	0	0	0	0	0		
	Thickness 0.225 m 67 layers																			
	2B 0.810 m³ / m of layer												0	0	0	0	0	0		
	13,333 m 199 m / layer												0	0	0	0	0	0		
	Progression 70 m / h 2.84 h / layer												0	0	0	0	0	0		
	10 hours shift 3.52 layers / sh												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Production 484 m³ / sh												0	0	0	0	0	0		
	Average hauling distance : 2.00 km												0	0	0	0	0	0		
													0	0	0	0	0	0		

Item : (3641 to 3645)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
	Loading	5											0	0	0	0	0	0		
	Going	4	30 km / h										0	0	0	0	0	0		
	Unloading	5											0	0	0	0	0	0		
	Return	3	35 km / h										0	0	0	0	0	0		
		17 min.											0	0	0	0	0	0		
	Efficiency :	85%	20 min. / trip										0	0	0	0	0	0		
			0.33 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			27 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck		8 m³										0	0	0	0	0	0		
			216 m³ / truck-sh										0	0	0	0	0	0		
		Number of trucks :	**3**										0	0	0	0	0	0		
						22	sh						0	0	0	0	0	0		
			10 h / sh			220	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	1,100	h	24.00					26,400	0	0	0	0	26,400		1,100
													0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05	90%	1	198	h				18.35	9.05	0	0	0	3,633	1,290	4,923		
	- 10 Wheeler Truck	24.00	20.00	90%	3	594	h				24.00	20.00	0	0	0	14,256	8,554	22,810		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3642	**Dam 2 - Impervious core**												**460,365**	**259,699**	**460,833**	**260,334**	**146,232**	**1,587,463**		**23,102**
3644	**Dam 4 - Impervious core**					**7,300**	**m³**													
	Impervious core					**7,300**	**m³**													
	Asphalt core	700																		
	2B Crushed stone	6,600																		
		7,300 m³																		
	Concrete Plinth					**500**	**m³**						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Concreting	3.05 h / m³				1,525	h	24.00					36,600	0	0	0	0	36,600		1,525
	- Construction materials					500	m³		107.00				0	53,500	0	0	0	53,500		
	- Construction equipment					500	m³				35.00	26.00	0	0	0	17,500	9,360	26,860		
	- Miscellaneous					500	m³		1.50				0	750	0	0	0	750		
													0	0	0	0	0	0		
	- Concrete supply	500	5.23 h / m³	2%		510	m²	125.64	5.45	180.16	49.26	14.09	64,076	2,779	91,881	25,121	5,173	189,030		2,666
													0	0	0	0	0	0		
	Reinforcing Steel												0	0	0	0	0	0		
	- Supply and Fabrication	60 kg / m³	20.00 h / mt			**30**	**mt**	480.00	397.44	987.76	121.86	48.96	14,400	11,923	29,633	3,656	1,057	60,669		600
													0	0	0	0	0	0		
	Installation																			
	- M-P	16.00 h / mt				480	h	24.00					11,520	0	0	0	0	11,520		480
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	96	h				37.00	20.00	0	0	0	3,552	1,382	4,934		
	- Boom truck 17 tons	13.65	18.00	50%	1	240	h				13.65	18.00	0	0	0	3,276	3,110	6,386		

Item : (3641 to 3645)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES					TOTAL COSTS					GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption			
											24.00 $				0.72 $			
	Concrete transportation from the Batching Plan			**510**	**m³**						0	0	0	0	0	0		
	Average production 50 m³ / sh			11	sh						0	0	0	0	0	0		
	10 h / sh			110	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	330	h	24.00					7,920	0	0	0	0	7,920		330
											0	0	0	0	0	0		
	- Ready-mix 8 m³ 13.60 14.00	90%	1	99	h				13.60	14.00	0	0	0	1,346	998	2,344		
											0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	32 min.										0	0	0	0	0	0		
	Efficiency : 85% 38 min. / trip										0	0	0	0	0	0		
	0.63 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	15 trips / sh										0	0	0	0	0	0		
	Ready-mix 8 m³ 8 m³										0	0	0	0	0	0		
	120 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Heating and Injection										0	0	0	0	0	0		
	Defrosting holes 320										0	0	0	0	0	0		
	Injection holes 155										0	0	0	0	0	0		
	475 m										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling 225 m / sh-mach			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	120	h	24.00					2,880	0	0	0	0	2,880		120
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	1	27	h				19.40	15.00	0	0	0	524	292	816		
	- Compressor - 750 cfm 14.30 27.00	90%	1	27	h				14.30	27.00	0	0	0	386	525	911		
											0	0	0	0	0	0		
	- Drilling materials			475	m		0.70				0	333	0	0	0	333		
											0	0	0	0	0	0		
	Injection										0	0	0	0	0	0		
	Cement 6,300 kg										0	0	0	0	0	0		
	- Cement 40 kg bags 158	100%		315	un			10.00			0	0	3,150	0	0	3,150		
	Successfull links 100 kg cement / un **63 un**										0	0	0	0	0	0		
	10 un / sh			6	sh						0	0	0	0	0	0		
	10 h / sh			63	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	504	h	24.00					12,096	0	0	0	0	12,096		504
											0	0	0	0	0	0		
	- Compressor - 750 cfm 14.30 27.00	90%	1	57	h				14.30	27.00	0	0	0	815	1,108	1,923		
	- Injection pump 10.00	90%	1	57	h				10.00	0.00	0	0	0	570	0	570		
											0	0	0	0	0	0		
	- Miscellaneous			63	un		45.00				0	2,835	0	0	0	2,835		

Item : (3641 to 3645)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	Heathing and defrosting										0	0	0	0	0	0		
	Rock defrosting 8 days 1 w										0	0	0	0	0	0		
	Drilling 3 sh										0	0	0	0	0	0		
	Injection 6 sh										0	0	0	0	0	0		
	9 sh										0	0	0	0	0	0		
	2 sh / day 7 days	1	w								0	0	0	0	0	0		
		2	w															
	2 weeks																	
	Lag time 1 weeks										0	0	0	0	0	0		
	3 weeks 168 h / w			528	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		2	1,056	h	24.00					25,344	0	0	0	0	25,344		1,056
-	Boiler - 1500 kW 4.00 90.00	100%	1	528	h				4.00	90.00	0	0	0	2,112	34,214	36,326		
											0	0	0	0	0	0		
-	Miscellaneous (hoses, pipes, etc...) Holes lentgh proportion :	75%		356	m		18.00				0	6,408	0	0	0	6,408		
	Impervious core			**7,300**	**m³**													
	Asphalt core 700																	
	2B Crushed stone 6,600																	
	7,300 m³																	
	Number of passes																	
	Heigth 30 m																	
	Thickness 0.225 m 133 layers																	
	Asphalt 0.090 m³ / m of layer																	
	Total lentgh 7,778 m 58 m / layer																	
	Progression 50 m / h 1.16 h / layer																	
	10 hours shift 8.62 layers / sh	OK																
	Mechanical placement 3 layers / sh			44	sh						0	0	0	0	0	0		
				44	sh													
	10 h / sh			440	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		10	4,400	h	24.00					105,600	0	0	0	0	105,600		4,400
											0	0	0	0	0	0		
-	Paver 50.00 40.00	90%	1	396	h				50.00	40.00	0	0	0	19,800	11,405	31,205		
-	Cat 950H Wheel Loader 18.35 9.05	90%	1	396	h				18.35	9.05	0	0	0	7,267	2,580	9,847		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	396	h				19.00	29.00	0	0	0	7,524	8,268	15,792		
-	10 Wheeler Truck 24.00 20.00	90%	1	396	h				24.00	20.00	0	0	0	9,504	5,702	15,206		
-	Cat CB 225 Compactor 14.85 20.00	90%	2	792	h				14.85	20.00	0	0	0	11,761	11,405	23,166		
-	Plate damper 1T 2.00 1.45	90%	1	396	h				2.00	1.45	0	0	0	792	413	1,205		
			7								0	0	0	0	0	0		
-	Miscelaneous (propane and accessories, uppers, etc)			7,778	m		3.00				0	23,334	0	0	0	23,334		
	Asphalt Transportation from Batch Plan										0	0	0	0	0	0		
	Production 16 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 30										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		

Item : (3641 to 3645)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	47 min.										0	0	0	0	0	0		
	Efficiency : 85% 55 min. / trip										0	0	0	0	0	0		
	0.92 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	10 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck 8 m³										0	0	0	0	0	0		
	80 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Manual placement 2 h / layer 133 layers										0	0	0	0	0	0		
	266 h 9 h / sh eff.			30	sh						0	0	0	0	0	0		
	10 h / sh			300	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	2,700	h	24.00					64,800	0	0	0	0	64,800		2,700
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	45%	1	135	h				18.35	9.05	0	0	0	2,477	880	3,357		
	- Plate damper 1T 2.00 1.45	90%	2	540	h				2.00	1.45	0	0	0	1,080	564	1,644		
	- Boom truck 17 tons 13.65 18.00	45%	1	135	h				13.65	18.00	0	0	0	1,843	1,750	3,593		
											0	0	0	0	0	0		
	- Miscellaneous materials (formwork, spikes, etc…)			133	lay		75.00				0	9,975	0	0	0	9,975		
											0	0	0	0	0	0		
	Supply (m³) (mt)										0	0	0	0	0	0		
	- Asphalt 700 1,050 1.87 h / mt	10%		1,155	mt	44.95	6.19	69.06	21.95	6.14	0	7,148	79,767	25,349	5,107	117,371		2,158
	- 2B Crushed stone 6,600 11,880 0.07 h / mt	5%		12,474	mt	1.80	1.38	0.00	2.03	3.15	22,453	17,214	0	25,322	28,291	93,280		873
											0	0	0	0	0	0		
	Filter 2B **Transportation from crusher stockpile**			**6,600**	**m³**						0	0	0	0	0	0		
	Thickness 0.225 m 133 layers																	
	2B 0.810 m³ / m of layer										0	0	0	0	0	0		
	7,778 m 58 m / layer										0	0	0	0	0	0		
	Progression 50 m / h 1.16 h / layer										0	0	0	0	0	0		
	10 hours shift 8.62 layers / sh										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production 141 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 5										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 5										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	17 min.										0	0	0	0	0	0		
	Efficiency : 85% 20 min. / trip										0	0	0	0	0	0		
	0.33 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	27 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck 8 m³										0	0	0	0	0	0		
	216 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
				44	sh						0	0	0	0	0	0		
	10 h / sh			440	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	2,200	h	24.00					52,800	0	0	0	0	52,800		2,200
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	396	h				18.35	9.05	0	0	0	7,267	2,580	9,847		
	- 10 Wheeler Truck 24.00 20.00	90%	1	396	h				24.00	20.00	0	0	0	9,504	5,702	15,206		

Item : (3641 to 3645)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
3644	**Dam 4 - Impervious core**					**7,300**							**420,489**	**136,199**	**204,431**	**188,348**	**141,866**	**1,091,333**		**19,612**
3645	**Dam 5 - Impervious core**					**16,500**	**m³**													
	Concrete Plinth					**750**	**m³**						0	0	0	0	0	0		
													0	0	0	0	0	0		
	Rock Heating and Injection																			
	Defrosting holes		360																	
	Injection holes		170																	
			530 m			**530**	**m**													
	Impervious core					**16,500**	**m³**													
	Asphalt core	1,500																		
	2B Crushed stone	15,000																		
		16,500																		
	Concrete Plinth					**750**	**m³**						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Concreting	3.05 h / m³				2,288	h	24.00					54,900	0	0	0	0	54,900		2,288
	- Construction materials					750	m³		107.00				0	80,250	0	0	0	80,250		
	- Construction equipment					750	m³				35.00	26.00	0	0	0	26,250	14,040	40,290		
	- Miscellaneous					750	m³		1.50				0	1,125	0	0	0	1,125		
													0	0	0	0	0	0		
	- Concrete supply	750	5.23 h / m³	2%		765	m²	125.64	5.45	180.16	49.26	14.09	96,115	4,169	137,822	37,682	7,760	283,548		3,999
													0	0	0	0	0	0		
	Reinforcing Steel												0	0	0	0	0	0		
	- Supply and Fabrication	60 kg / m³	20.00 h / mt			**45**	**mt**	480.00	397.44	987.76	121.86	48.96	21,600	17,885	44,449	5,484	1,586	91,004		900
													0	0	0	0	0	0		
	Installation												0	0	0	0	0	0		
	- M-P	16.00 h / mt				720	h	24.00					17,280	0	0	0	0	17,280		720
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	144	h				37.00	20.00	0	0	0	5,328	2,074	7,402		
	- Boom truck 17 tons	13.65	18.00	50%	1	360	h				13.65	18.00	0	0	0	4,914	4,666	9,580		
													0	0	0	0	0	0		
	Concrete transportation from the Batching Plan					**765**	**m³**						0	0	0	0	0	0		
	Average production	50 m³ / sh				16	sh						0	0	0	0	0	0		
			10 h / sh			160	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				3	480	h	24.00					11,520	0	0	0	0	11,520		480
													0	0	0	0	0	0		
	- Ready-mix 8 m³	13.60	14.00	90%	1	144	h				13.60	14.00	0	0	0	1,958	1,452	3,410		
													0	0	0	0	0	0		
	Average hauling distance :		2.00 km										0	0	0	0	0	0		
													0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Loading 10										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	32 min.										0	0	0	0	0	0		
	Efficiency : 85% 38 min. / trip										0	0	0	0	0	0		
	0.63 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	15 trips / sh										0	0	0	0	0	0		
	Ready-mix 8 m³ 8 m³										0	0	0	0	0	0		
	120 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Heating and Injection										0	0	0	0	0	0		
	Defrosting holes 360										0	0	0	0	0	0		
	Injection holes 170										0	0	0	0	0	0		
	530 m										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling 225 m / sh-mach			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	80	h	24.00					1,920	0	0	0	0	1,920		80
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	1	18	h				19.40	15.00	0	0	0	349	194	543		
	- Compressor - 750 cfm 14.30 27.00	90%	1	18	h				14.30	27.00	0	0	0	257	350	607		
											0	0	0	0	0	0		
	- Drilling materials			530	m		0.70				0	371	0	0	0	371		
											0	0	0	0	0	0		
	Injection										0	0	0	0	0	0		
	Cement 7,080 kg										0	0	0	0	0	0		
	- Cement 40 kg bags 177	100%		354	un			10.00			0	0	3,540	0	0	3,540		
	Successfull links 100 kg cement / un **71 un**										0	0	0	0	0	0		
	10 un / sh			7	sh						0	0	0	0	0	0		
	10 h / sh			71	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	568	h	24.00					13,632	0	0	0	0	13,632		568
											0	0	0	0	0	0		
	- Compressor - 750 cfm 14.30 27.00	90%	1	64	h				14.30	27.00	0	0	0	915	1,244	2,159		
	- Injection pump 10.00	90%	1	64	h				10.00	0.00	0	0	0	640	0	640		
											0	0	0	0	0	0		
	- Miscellaneous			71	un		45.00				0	3,195	0	0	0	3,195		
											0	0	0	0	0	0		
	Heathing and defrosting										0	0	0	0	0	0		
	Rock defrosting 8 days	1	w								0	0	0	0	0	0		
	Drilling 2 sh										0	0	0	0	0	0		
	Injection 7 sh										0	0	0	0	0	0		
	9 sh										0	0	0	0	0	0		
	2 sh / day 5 days	1	w								0	0	0	0	0	0		
		2	w															
	2 weeks																	
	Lag time 1 weeks										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	3 weeks 168 h / w			528	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		2	1,056	h	24.00					25,344	0	0	0	0	25,344		1,056
-	Boiler - 1500 kW 4.00 90.00	100%	1	528	h				4.00	90.00	0	0	0	2,112	34,214	36,326		
											0	0	0	0	0	0		
-	Miscellaneous (hoses, pipes, etc...) Holes lentgh proportion :	75%		398	m		18.00				0	7,164	0	0	0	7,164		
											0	0	0	0	0	0		
	Impervious core			**16,500**	**m³**						0	0	0	0	0	0		
	Asphalt core 1,500										0	0	0	0	0	0		
	2B Crushed stone 15,000										0	0	0	0	0	0		
	16,500 m³										0	0	0	0	0	0		
	Number of passes										0	0	0	0	0	0		
	Heigth 30 m										0	0	0	0	0	0		
	Thickness 0.225 m 133 layers										0	0	0	0	0	0		
	Asphalt 0.090 m³ / m of layer										0	0	0	0	0	0		
	Total lentgh 16,667 m 125 m / layer										0	0	0	0	0	0		
	Progression 70 m / h 1.79 h / layer										0	0	0	0	0	0		
	10 hours shift 5.60 layers / sh	**OK**									0	0	0	0	0	0		
											0	0	0	0	0	0		
	Mechanical placement 3 layers / sh			44	sh						0	0	0	0	0	0		
	Testing bench 25 m 4 layers			6	sh													
				50	sh													
	10 h / sh			500	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		10	5,000	h	24.00					120,000	0	0	0	0	120,000		5,000
											0	0	0	0	0	0		
-	Paver 50.00 40.00	90%	1	450	h				50.00	40.00	0	0	0	22,500	12,960	35,460		
-	Cat 950H Wheel Loader 18.35 9.05	90%	1	450	h				18.35	9.05	0	0	0	8,258	2,932	11,190		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	450	h				19.00	29.00	0	0	0	8,550	9,396	17,946		
-	10 Wheeler Truck 24.00 20.00	90%	1	450	h				24.00	20.00	0	0	0	10,800	6,480	17,280		
-	Cat CB 225 Compactor 14.85 20.00	90%	2	900	h				14.85	20.00	0	0	0	13,365	12,960	26,325		
-	Plate damper 1T 2.00 1.45	90%	1	450	h				2.00	1.45	0	0	0	900	470	1,370		
			7								0	0	0	0	0	0		
-	Miscelaneous (propane and accessories, uppers, etc)			16,667	m		3.00				0	50,001	0	0	0	50,001		
											0	0	0	0	0	0		
	Asphalt Transportation from Batch Plan										0	0	0	0	0	0		
	Production 34 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 1.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 3 30 km / h										0	0	0	0	0	0		
	Unloading 30										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	46 min.										0	0	0	0	0	0		
	Efficiency : 85% 54 min. / trip										0	0	0	0	0	0		
	0.90 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	10 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck 8 m³										0	0	0	0	0	0		
	80 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Manual placement 2 h / layer 200 layers (total for 1 depression)										0	0	0	0	0	0		

Item : (3641 to 3645)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	399 h 9 h / sh eff.			44	sh						0	0	0	0	0	0		
	10 h / sh			440	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	3,960	h	24.00					95,040	0	0	0	0	95,040		3,960
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	45%	1	198	h				18.35	9.05	0	0	0	3,633	1,290	4,923		
	- Plate damper 1T 2.00 1.45	90%	2	792	h				2.00	1.45	0	0	0	1,584	827	2,411		
	- Boom truck 17 tons 13.65 18.00	45%	1	198	h				13.65	18.00	0	0	0	2,703	2,566	5,269		
											0	0	0	0	0	0		
	- Miscelaneous materials (formwork, spikes, etc…)			200	lay		75.00				0	14,963	0	0	0	14,963		
											0	0	0	0	0	0		
	Supply (m³) (mt)										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Asphalt 1,500 2,250 1.87 h / mt	10%		2,475	mt	44.95	6.19	69.06	21.95	6.14	0	15,317	170,930	54,320	10,944	251,511		4,623
	- 2B Crushed stone 15,000 27,000 0.07 h / mt	5%		28,350	mt	1.80	1.38	0.00	2.03	3.15	51,030	39,123	0	57,551	64,298	212,002		1,985
											0	0	0	0	0	0		
	Filter 2B **Transportation from crusher stockpile**			**15,000**	**m³**						0	0	0	0	0	0		
	Thickness 0.225 m 133 layers																	
	2B 0.810 m³ / m of layer										0	0	0	0	0	0		
	16,667 m 125 m / layer										0	0	0	0	0	0		
	Progression 70 m / h 1.79 h / layer										0	0	0	0	0	0		
	10 hours shift 5.60 layers / sh										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production 304 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 1.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 5										0	0	0	0	0	0		
	Going 3 30 km / h										0	0	0	0	0	0		
	Unloading 5										0	0	0	0	0	0		
	Return 3 35 km / h										0	0	0	0	0	0		
	16 min.										0	0	0	0	0	0		
	Efficiency : 85% 19 min. / trip										0	0	0	0	0	0		
	0.31 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	29 trips / sh										0	0	0	0	0	0		
	10 Wheeler Truck 8 m³										0	0	0	0	0	0		
	232 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
				44	sh						0	0	0	0	0	0		
	10 h / sh			440	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	2,200	h	24.00					52,800	0	0	0	0	52,800		2,200
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	396	h				18.35	9.05	0	0	0	7,267	2,580	9,847		
	- 10 Wheeler Truck 24.00 20.00	90%	2	792	h				24.00	20.00	0	0	0	19,008	11,405	30,413		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3645	**Dam 5 - Impervious core**										**561,181**	**233,563**	**356,741**	**296,328**	**206,688**	**1,654,501**		**27,858**

Item : (3651 to 3655)

							UNIT PRICES					TOTAL COSTS						
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			

3650 Rockfill

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3651	**Dam 1 - Rockfill**			**82,950**	**m³**													
	3D 0-900 Rockfill 51,000										0	0	0	0	0	0		
	3E 0-225 Crushed stone 23,000										0	0	0	0	0	0		
	3F 0-450 Rockfill 1,450																	
	4 400-600 Riprap 7,500										0	0	0	0	0	0		
	82,950 m³																	
	3D 0-900 Rockfill			**51,000**														
	3F 0-450 Rockfill			**1,450**														
				52,450	**m³**													
	Quarry exploitation			**60,300**	**m³**													
	Needed 82,950 m³ loose																	
	7,500 (Rip rap)																	
	90,450																	
	1.5 60,300 m³ bank																	
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 55,833 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			279	sh						0	0	0	0	0	0		
	6 machines			47	sh						0	0	0	0	0	0		
	10 h / s			465	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		11	5,115	h	24.00					122,760	0	0	0	0	122,760		5,115
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	6	2,511	h				19.40	15.00	0	0	0	48,713	27,119	75,832		
	- Drilling materials			55,833	m		0.70				0	39,083	0	0	0	39,083		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 5,583 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 60,300 m³ Losses	5%		63,315	kg		5.60				0	354,564	0	0	0	354,564		
	- Caps Losses	5%		5,862	un		4.50				0	26,379	0	0	0	26,379		
											0	0	0	0	0	0		
	- M-P		8	3,720	h	24.00					89,280	0	0	0	0	89,280		3,720
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	2	837	h				5.00	15.00	0	0	0	4,185	9,040	13,225		
	- Misc. Blasting materials			60,300	m³		0.10				0	6,030	0	0	0	6,030		
	Mucking (Hauling to crusher 2 or dam site)										0	0	0	0	0	0		
	Production of 1,297 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 1,945 m³ / sh			47	sh						0	0	0	0	0	0		
	10 h / s			465	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		12	5,580	h	24.00					133,920	0	0	0	0	133,920		5,580
											0	0	0	0	0	0		

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS							
													24.00 $				0.72 $			
-	Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	2	837	h				38.25	28.00	0	0	0	32,015	16,874	48,889		
-	Cat 345 Hydraulic Excavator	40.00	60.00	90%	2	837	h				40.00	60.00	0	0	0	33,480	36,158	69,638		
-	Cat 740 Articulated Dumper 40 T	32.00	27.90	90%	4	1,674	h				32.00	27.90	0	0	0	53,568	33,627	87,195		
-	Generator 5 kW (Tower light)	3.50	2.20	90%	2	837	h				3.50	2.20	0	0	0	2,930	1,326	4,256		
-	Cat 988H Wheel Loader	39.20	48.00	90%	1	419	h				39.20	48.00	0	0	0	16,425	14,481	30,906		
					11															
	Hauling distance	2.00 km											0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading	4											0	0	0	0	0	0		
	Trip up	5	25 km / h										0	0	0	0	0	0		
	Unloading	4											0	0	0	0	0	0		
	Back trip	3	35 km / h										0	0	0	0	0	0		
		16 min.											0	0	0	0	0	0		
	Efficiency :	85%	19 min. / trip										0	0	0	0	0	0		
			0.31 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			29 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T		21.0 m³										0	0	0	0	0	0		
			609 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift	4											0	0	0	0	0	0		
3D	**0-900 Rockfill**					**51,000**														
3F	**0-450 Rockfill**					**1,450**														
						52,450	**m³**													
	Transport included in Quarry excavation																			
	Production of	1,200 m³ / sh				44	sh						0	0	0	0	0	0		
			10 h / s			440	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
-	M-P				9	3,960	h	24.00					95,040	0	0	0	0	95,040		3,960
													0	0	0	0	0	0		
-	Generator 5 kW (Tower light)	3.50	2.20	90%	4	1,584	h				3.50	2.20	0	0	0	5,544	2,509	8,053		
-	Cat D8T LGP Track-Type Tractor	47.45	38.60	90%	1	396	h				47.45	38.60	0	0	0	18,790	11,006	29,796		
-	Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	396	h				38.25	28.00	0	0	0	15,147	7,983	23,130		
-	Cat 329DL Hydraulic Excavator	19.00	29.00	90%	2	792	h				19.00	29.00	0	0	0	15,048	16,537	31,585		
-	Cat CS76 XT Vibratory Soil Compactor	14.85	20.00	90%	2	792	h				14.85	20.00	0	0	0	11,761	11,405	23,166		
													0	0	0	0	0	0		
-	Miscelaneous					52,450	m³		0.10				0	5,245	0	0	0	5,245		
3E	**0-225 Crushed stone**					**23,000**	**m³**													
	Transport from crusher												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Production of	900 m³ / sh				26	sh						0	0	0	0	0	0		
			10 h / s			260	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
-	M-P				12	3,120	h	24.00					74,880	0	0	0	0	74,880		3,120
													0	0	0	0	0	0		
-	Cat 988H Wheel Loader	39.20	48.00	90%	1	234	h				39.20	48.00	0	0	0	9,173	8,087	17,260		
-	Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	234	h				38.25	28.00	0	0	0	8,951	4,717	13,668		
-	Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	234	h				19.00	29.00	0	0	0	4,446	4,886	9,332		
-	Cat CS76 XT Vibratory Soil Compactor	14.85	20.00	90%	1	234	h				14.85	20.00	0	0	0	3,475	3,370	6,845		
-	Cat 725 Articulated Dumper 25 T	24.00	20.00	90%	2	468	h				24.00	20.00	0	0	0	11,232	6,739	17,971		
					6								0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Hauling distance 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 2 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 2 35 km / h										0	0	0	0	0	0		
	12 min.										0	0	0	0	0	0		
	Efficiency : 85% 14 min. / trip										0	0	0	0	0	0		
	0.24 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	39 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	468 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Supply From crusher 1.8 0.08 h / mt 41,400	5%		43,470	mt	1.84	1.30	0.00	2.08	3.08	79,985	56,511	0	90,418	96,399	323,313		3,478
											0	0	0	0	0	0		
	4 400-600 Riprap			**7,500**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Selection in Quarry excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 400 m³ / sh			19	sh						0	0	0	0	0	0		
	10 h / s			190	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	950	h	24.00					22,800	0	0	0	0	22,800		950
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	171	h				19.00	29.00	0	0	0	3,249	3,570	6,819		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	171	h				40.00	60.00	0	0	0	6,840	7,387	14,227		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	171	h				38.25	28.00	0	0	0	6,541	3,447	9,988		
											0	0	0	0	0	0		
	- Miscelaneous			7,500	m³		0.30				0	2,250	0	0	0	2,250		
											0	0	0	0	0	0		
3651	**Dam 1 - Rockfill**			**82,950**	**m³**						**618,665**	**490,062**	**0**	**401,931**	**326,667**	**1,837,325**		**25,923**

WBS	DESCRIPTION	Qty	Un.
3652	**Dam 2 - Rockfill**	**64,700**	**m³**

3D	**0-900**	**Rockfill**	**29,000**	
3E	**0-225**	**Crushed stone**	**23,500**	
3F	**0-450**	**Rockfill**	**2,200**	
4	**400-600**	**Riprap**	**10,000**	
			64,700	**m³**

DESCRIPTION	Qty	Un.
3D 0-900 Rockfill	**29,000**	
3F 0-450 Rockfill	**2,200**	
	31,200	**m³**
Quarry exploitation	**49,800**	**m³**
Needed 64,700 m³ loose		
10,000 (rip rap)		
74,700		
1.5 49,800 m³ bank		

Item : (3651 to 3655)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 46,111 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			231	sh						0	0	0	0	0	0		
	6 machines			39	sh						0	0	0	0	0	0		
	10 h / s			385	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		11	4,235	h	24.00					101,640	0	0	0	0	101,640		4,235
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	6	2,079	h				19.40	15.00	0	0	0	40,333	22,453	62,786		
-	Drilling materials			46,111	m		0.70				0	32,278	0	0	0	32,278		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 4,611 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Dynamite 1 kg / m³ 49,800 m³ Losses	5%		52,290	kg		5.60				0	292,824	0	0	0	292,824		
-	Caps Losses	5%		4,842	un		4.50				0	21,789	0	0	0	21,789		
											0	0	0	0	0	0		
-	M-P		8	3,080	h	24.00					73,920	0	0	0	0	73,920		3,080
											0	0	0	0	0	0		
-	Explosives Truck 5.00 15.00	90%	2	693	h				5.00	15.00	0	0	0	3,465	7,484	10,949		
-	Misc. Blasting materials			49,800	m³		0.10				0	4,980	0	0	0	4,980		
	Mucking (Hauling to crusher 2 or dam site)										0	0	0	0	0	0		
	Production of 1,294 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 1,940 m³ / sh			39	sh						0	0	0	0	0	0		
	10 h / s			385	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		11	4,235	h	24.00					101,640	0	0	0	0	101,640		4,235
											0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	2	693	h				38.25	28.00	0	0	0	26,507	13,971	40,478		
-	Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	693	h				40.00	60.00	0	0	0	27,720	29,938	57,658		
-	Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	4	1,386	h				32.00	27.90	0	0	0	44,352	27,842	72,194		
-	Generator 5 kW (Tower light) 3.50 2.20	90%	2	693	h				3.50	2.20	0	0	0	2,426	1,098	3,524		
-	Cat 988H Wheel Loader 39.20 48.00	90%	1	347	h				39.20	48.00	0	0	0	13,602	11,992	25,594		
			11															
	Hauling distance 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 5 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	16 min.										0	0	0	0	0	0		
	Efficiency : 85% 19 min. / trip										0	0	0	0	0	0		
	0.31 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	29 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	609 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **4**										0	0	0	0	0	0		
3D	**0-900 Rockfill**			**29,000**														
3F	**0-450 Rockfill**			**2,200**														

Item : (3651 to 3655)

									UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
							31,200	**m^3**													
	Transport included in Quarry excavation																				
	Production of	1,200 m^3 / sh					26	sh						0	0	0	0	0	0		
			10 h / s				260	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					9	2,340	h	24.00					56,160	0	0	0	0	56,160		2,340
														0	0	0	0	0	0		
	- Generator 5 kW (Tower light)	3.50	2.20		90%	4	936	h				3.50	2.20	0	0	0	3,276	1,483	4,759		
	- Cat D8T LGP Track-Type Tractor	47.45	38.60		90%	1	234	h				47.45	38.60	0	0	0	11,103	6,503	17,606		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	234	h				38.25	28.00	0	0	0	8,951	4,717	13,668		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	2	468	h				19.00	29.00	0	0	0	8,892	9,772	18,664		
	- Cat CS76 XT Vibratory Soil Compactor	14.85	20.00		90%	2	468	h				14.85	20.00	0	0	0	6,950	6,739	13,689		
						6								0	0	0	0	0	0		
	- Miscelaneous						31,200	m^3		0.10				0	3,120	0	0	0	3,120		
3E	**0-225 Crushed stone**						**23,500**	**m^3**													
	Transport from crusher													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Production of	900 m^3 / sh					26	sh						0	0	0	0	0	0		
			10 h / s				260	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					9	2,340	h	24.00					56,160	0	0	0	0	56,160		2,340
														0	0	0	0	0	0		
	- Cat 988H Wheel Loader	39.20	48.00		90%	1	234	h				39.20	48.00	0	0	0	9,173	8,087	17,260		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	234	h				38.25	28.00	0	0	0	8,951	4,717	13,668		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	1	234	h				19.00	29.00	0	0	0	4,446	4,886	9,332		
	- Cat CS76 XT Vibratory Soil Compactor	14.85	20.00		90%	1	234	h				14.85	20.00	0	0	0	3,475	3,370	6,845		
	- Cat 725 Articulated Dumper 25 T	24.00	20.00		90%	2	468	h				24.00	20.00	0	0	0	11,232	6,739	17,971		
						6								0	0	0	0	0	0		
	Hauling distance		1.00 km											0	0	0	0	0	0		
														0	0	0	0	0	0		
	Loading	4												0	0	0	0	0	0		
	Trip up	2	25 km / h											0	0	0	0	0	0		
	Unloading	4												0	0	0	0	0	0		
	Back trip	2	35 km / h											0	0	0	0	0	0		
		12 min.												0	0	0	0	0	0		
	Efficiency :	85%	14 min. / trip											0	0	0	0	0	0		
			0.24 h / trip											0	0	0	0	0	0		
			9 h / sh											0	0	0	0	0	0		
			39 trips / sh											0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T		12.0 m^3											0	0	0	0	0	0		
			468 m^3/mach/sh											0	0	0	0	0	0		
		Number of trucks per shift	**2**											0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Supply From crusher	1.8	0.08 h / mt	42,300	5%		44,415	mt	1.84	1.30	0.00	2.08	3.08	81,724	57,740	0	92,383	98,495	330,342		3,553
														0	0	0	0	0	0		
4	**400-600 Riprap**						**10,000**	**m^2**						0	0	0	0	0	0		
														0	0	0	0	0	0		
	Selection in Quarry excavation													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Production of	400 m^3 / sh					25	sh						0	0	0	0	0	0		
			10 h / s				250	h						0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- M-P		5	1,250	h	24.00					30,000	0	0	0	0	30,000		1,250
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	225	h				19.00	29.00	0	0	0	4,275	4,698	8,973		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	225	h				40.00	60.00	0	0	0	9,000	9,720	18,720		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	225	h				38.25	28.00	0	0	0	8,606	4,536	13,142		
											0	0	0	0	0	0		
	- Miscelaneous			10,000	m³		0.30				0	3,000	0	0	0	3,000		
											0	0	0	0	0	0		
3652	**Dam 2 - Rockfill**			**64,700**							**501,244**	**415,731**	**0**	**349,118**	**289,240**	**1,555,333**		**21,033**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3653	**Dam 3 - Rockfill**			**160,000**	**m³**													
	3C 0-20 Crushed stone 13,500																	
	3D 0-900 Rockfill 77,000										0	0	0	0	0	0		
	3E 0-225 Crushed stone 20,000										0	0	0	0	0	0		
	Random Fill 40,000										0	0	0	0	0	0		
	4 400-600 Riprap 9,500										0	0	0	0	0	0		
	160,000 m³										0	0	0	0	0	0		
											0	0	0	0	0	0		
	3D 0-900 Rockfill			**77,000**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Transport included in Quarry excavation										0	0	0	0	0	0		
	Quarry exploitation			**57,667**	**m³**													
	Needed 77,000 m³ loose																	
	9,500 (Rip rap)																	
	86,500																	
	1.5 57,667 m³ bank																	
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 53,395 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			267	sh						0	0	0	0	0	0		
	6 machines			45	sh						0	0	0	0	0	0		
	10 h / s			445	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		11	4,895	h	24.00					117,480	0	0	0	0	117,480		4,895
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	6	2,403	h				19.40	15.00	0	0	0	46,618	25,952	72,570		
	- Drilling materials			53,395	m		0.70				0	37,377	0	0	0	37,377		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 5,340 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 57,667 m³ Losses	5%		60,550	kg		5.60				0	339,080	0	0	0	339,080		
	- Caps Losses	5%		5,606	un		4.50				0	25,227	0	0	0	25,227		
											0	0	0	0	0	0		
	- M-P		8	3,560	h	24.00					85,440	0	0	0	0	85,440		3,560
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	2	801	h				5.00	15.00	0	0	0	4,005	8,651	12,656		

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
-	Misc. Blasting materials					57,667	m³		0.10				0	5,767	0	0	0	5,767		
	Mucking to Dam 3												0	0	0	0	0	0		
	Production of 1,296 m³ / sh												0	0	0	0	0	0		
	1.5 loose »»»» 1,944 m³ / sh					45	sh						0	0	0	0	0	0		
	10 h / s					445	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
-	M-P				11	4,895	h	24.00					117,480	0	0	0	0	117,480		4,895
													0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	2	801	h				38.25	28.00	0	0	0	30,638	16,148	46,786		
-	Cat 345 Hydraulic Excavator	40.00	60.00	90%	2	801	h				40.00	60.00	0	0	0	32,040	34,603	66,643		
-	Cat 740 Articulated Dumper 40 T	32.00	27.90	90%	4	1,602	h				32.00	27.90	0	0	0	51,264	32,181	83,445		
-	Generator 5 kW (Tower light)	3.50	2.20	90%	2	801	h				3.50	2.20	0	0	0	2,804	1,269	4,073		
-	Cat 988H Wheel Loader	39.20	48.00	90%	1	401	h				39.20	48.00	0	0	0	15,719	13,859	29,578		
					11															
	Hauling distance 2.00 km												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading 4												0	0	0	0	0	0		
	Trip up 5 — 25 km / h												0	0	0	0	0	0		
	Unloading 4												0	0	0	0	0	0		
	Back trip 3 — 35 km / h												0	0	0	0	0	0		
	16 min.												0	0	0	0	0	0		
	Efficiency : 85% — 19 min. / trip												0	0	0	0	0	0		
	0.31 h / trip												0	0	0	0	0	0		
	9 h / sh												0	0	0	0	0	0		
	29 trips / sh												0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T — 21.0 m³												0	0	0	0	0	0		
	609 m³/mach/sh												0	0	0	0	0	0		
	Number of trucks per shift **4**												0	0	0	0	0	0		
3D	**0-900 Rockfill**					**77,000**	**m³**													
	Transport included in Quarry excavation																			
	Production of 1,200 m³ / sh					64	sh						0	0	0	0	0	0		
	10 h / s					640	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
-	M-P				9	5,760	h	24.00					138,240	0	0	0	0	138,240		5,760
													0	0	0	0	0	0		
-	Generator 5 kW (Tower light)	3.50	2.20	90%	4	2,304	h				3.50	2.20	0	0	0	8,064	3,650	11,714		
-	Cat D8T LGP Track-Type Tractor	47.45	38.60	90%	1	576	h				47.45	38.60	0	0	0	27,331	16,008	43,339		
-	Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	576	h				38.25	28.00	0	0	0	22,032	11,612	33,644		
-	Cat 329DL Hydraulic Excavator	19.00	29.00	90%	2	1,152	h				19.00	29.00	0	0	0	21,888	24,054	45,942		
-	Cat CS76 XT Vibratory Soil Compactor	14.85	20.00	90%	2	1,152	h				14.85	20.00	0	0	0	17,107	16,589	33,696		
					6								0	0	0	0	0	0		
-	Miscellaneous					77,000	m³		0.10				0	7,700	0	0	0	7,700		
3E	**0-225 Crushed stone**					**20,000**	**m³**													
3C	**0-20 Crushed stone**					**13,500**	**m³**													
						33,500	**m³**													
	Transport from crusher												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Production of 500 m³ / sh					67	sh						0	0	0	0	0	0		
	10 h / s					670	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
-	M-P				10	6,700	h	24.00					160,800	0	0	0	0	160,800		6,700

Item : (3651 to 3655)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	603	h				39.20	48.00	0	0	0	23,638	20,840	44,478		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	603	h				38.25	28.00	0	0	0	23,065	12,156	35,221		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	603	h				19.00	29.00	0	0	0	11,457	12,591	24,048		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	90%	1	603	h				14.85	20.00	0	0	0	8,955	8,683	17,638		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	1,206	h				24.00	20.00	0	0	0	28,944	17,366	46,310		
			6								0	0	0	0	0	0		
	Hauling distance 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 5 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	16 min.										0	0	0	0	0	0		
	Efficiency : 85% 19 min. / trip										0	0	0	0	0	0		
	0.31 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	29 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m^3										0	0	0	0	0	0		
	348 m^3/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Supply From crusher 1.8 0.08 h / mt 60,300	5%		63,315	mt	1.84	1.97	0.00	2.04	3.90	116,500	124,731	0	129,163	177,789	548,183		5,065
											0	0	0	0	0	0		
	4 400-600 Riprap			**9,500**	**m^2**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Selection in Quarry excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 400 m^3 / sh			24	sh						0	0	0	0	0	0		
	10 h / s			240	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	1,200	h	24.00					28,800	0	0	0	0	28,800		1,200
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	216	h				19.00	29.00	0	0	0	4,104	4,510	8,614		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	216	h				40.00	60.00	0	0	0	8,640	9,331	17,971		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	216	h				38.25	28.00	0	0	0	8,262	4,355	12,617		
											0	0	0	0	0	0		
	- Miscelaneous			9,500	m^3		0.30				0	2,850	0	0	0	2,850		
											0	0	0	0	0	0		
	Geotextile			**20,000**	**m^2**						0	0	0	0	0	0		
	Production of 550 m^2 / sh			36	sh						0	0	0	0	0	0		
	10 h / sh			360	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	2,880		24.00					69,120	0	0	0	0	69,120		2,880
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	324	h				13.65	18.00	0	0	0	4,423	4,199	8,622		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	324	h				19.00	29.00	0	0	0	6,156	6,765	12,921		
											0	0	0	0	0	0		
	Supply 20,000 m^2	15%		23,000	m^2			7.50			0	0	172,500	0	0	172,500		
											0	0	0	0	0	0		
	Geomembrane			**9,500**	**m^2**						0	0	0	0	0	0		
	Production of 400 m^2 / sh			24	sh						0	0	0	0	0	0		
	10 h / sh			240	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	1,920		24.00					46,080	0	0	0	0	46,080		1,920

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
													0	0	0	0	0	0		
	- Boom truck 17 tons	13.65	18.00	90%	1	216	h				13.65	18.00	0	0	0	2,948	2,799	5,747		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	216	h				19.00	29.00	0	0	0	4,104	4,510	8,614		
													0	0	0	0	0	0		
	Supply	9,500 m²		15%		10,925	m²			12.00			0	0	131,100	0	0	131,100		
	Lean Concrete and Membrane anchorage												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Supply												0	0	0	0	0	0		
	- Concrete	1.87 h / m³				200	m³	44.80	10.69	308.59	13.56	10.78	8,960	2,138	61,718	2,711	1,552	77,079		200
													0	0	0	0	0	0		
	- Anchors					575	m			20.00			0	0	11,500	0	0	11,500		
													0	0	0	0	0	0		
	Installation	50 m³ / sh				4	sh						0	0	0	0	0	0		
			10 h / s			40	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				7	280	h	24.00					6,720	0	0	0	0	6,720		280
													0	0	0	0	0	0		
	- Boom truck 17 tons	13.65	18.00	90%	1	36	h				13.65	18.00	0	0	0	491	467	958		
	- Readymix 8 m³	13.60	14.00	90%	1	36	h				13.60	14.00	0	0	0	490	363	853		
													0	0	0	0	0	0		
	- Miscellaneous					575	m		3.00				0	1,725	0	0	0	1,725		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
	Random Fill					**40,000**	**m³**						0	0	0	0	0	0		
	From Overburden stock Pile												0	0	0	0	0	0		
	Production of	700 m³ / sh				16	sh						0	0	0	0	0	0		
			10 h / s			160	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				8	1,280	h	24.00					30,720	0	0	0	0	30,720		1,280
													0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	2	288	h				19.00	29.00	0	0	0	5,472	6,013	11,485		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	144	h				38.25	28.00	0	0	0	5,508	2,903	8,411		
	- Cat 725 Articulated Dumper 25 T	24.00	20.00	90%	3	432	h				24.00	20.00	0	0	0	10,368	6,221	16,589		
	Hauling distance	2.00 km																		
	Loading	4																		
	Trip up	5	25 km / h																	
	Unloading	4																		
	Back trip	3	35 km / h																	
		16 min.																		
	Efficiency :	85%	19 min. / trip																	
			0.31 h / trip																	
			9 h / sh																	
			29 trips / sh																	
	Cat 725 Articulated Dumper 25 T		12.0 m³																	
			348 m³/mach/sh																	
	Number of trucks per shift		**3**																	
													0	0	0	0	0	0		
3653	**Dam 3 - Rockfill**					**160,000**							**926,340**	**546,595**	**376,818**	**568,409**	**507,989**	**2,926,151**		**38,635**

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
3654	**Dam 4 - Rockfill**					**32,900**	**m³**													
	3D 0-900 Rockfill		**21,000**										0	0	0	0	0	0		
	3E 0-225 Crushed stone		**10,500**										0	0	0	0	0	0		
	4 400-600 Riprap		**1,400**										0	0	0	0	0	0		
			32,900 m³										0	0	0	0	0	0		
													0	0	0	0	0	0		
	3D 0-900 Rockfill					**21,000**	**m³**						0	0	0	0	0	0		
	Transport included in Canal 3 excavation												0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
	Production of	1,200 m³ / sh				18	sh						0	0	0	0	0	0		
			10 h / s			180	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				9	1,620	h	24.00					38,880	0	0	0	0	38,880		1,620
													0	0	0	0	0	0		
	- Generator 5 kW (Tower light)	3.50	2.20	90%	4	648	h				3.50	2.20	0	0	0	2,268	1,026	3,294		
	- Cat D8T LGP Track-Type Tractor	47.45	38.60	90%	1	162	h				47.45	38.60	0	0	0	7,687	4,502	12,189		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	162	h				38.25	28.00	0	0	0	6,197	3,266	9,463		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	2	324	h				19.00	29.00	0	0	0	6,156	6,765	12,921		
	- Cat CS76 XT Vibratory Soil Compactor	14.85	20.00	90%	2	324	h				14.85	20.00	0	0	0	4,811	4,666	9,477		
													0	0	0	0	0	0		
	- Miscellaneous					21,000	m³		0.10				0	2,100	0	0	0	2,100		
	3E 0-225 Crushed stone					**10,500**	**m³**													
	Transport from crusher												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Production of	900 m³ / sh				12	sh						0	0	0	0	0	0		
			10 h / s			120	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				8	960	h	24.00					23,040	0	0	0	0	23,040		960
													0	0	0	0	0	0		
	- Cat 988H Wheel Loader	39.20	48.00	90%	1	108	h				39.20	48.00	0	0	0	4,234	3,732	7,966		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	108	h				38.25	28.00	0	0	0	4,131	2,177	6,308		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	108	h				19.00	29.00	0	0	0	2,052	2,255	4,307		
	- Cat CS76 XT Vibratory Soil Compactor	14.85	20.00	90%	1	108	h				14.85	20.00	0	0	0	1,604	1,555	3,159		
	- Cat 725 Articulated Dumper 25 T	24.00	20.00	90%	2	216	h				24.00	20.00	0	0	0	5,184	3,110	8,294		
					6								0	0	0	0	0	0		
	Hauling distance		1.00 km										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading	4											0	0	0	0	0	0		
	Trip up	2	25 km / h										0	0	0	0	0	0		
	Unloading	4											0	0	0	0	0	0		
	Back trip	2	35 km / h										0	0	0	0	0	0		
		12 min.											0	0	0	0	0	0		
	Efficiency :	85%	14 min. / trip										0	0	0	0	0	0		
			0.24 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			39 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T		12.0 m³										0	0	0	0	0	0		
			468 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift		**2**										0	0	0	0	0	0		

WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
														0	0	0	0	0	0		
	- Supply From crusher	1.8	0.07 h / mt	18,900	5%		19,845	mt	1.80	1.38	0.00	2.03	3.15	35,721	27,386	0	40,285	45,008	148,400		1,389
														0	0	0	0	0	0		
	4 400-600 Riprap						**1,400**	**m³**						0	0	0	0	0	0		
														0	0	0	0	0	0		
	Selection in Canal excavation													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Production of	400 m³ / sh					4	sh						0	0	0	0	0	0		
			10 h / s				40	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					5	200	h	24.00					4,800	0	0	0	0	4,800		200
														0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	1	36	h				19.00	29.00	0	0	0	684	752	1,436		
	- Cat 345 Hydraulic Excavator	40.00	60.00		90%	1	36	h				40.00	60.00	0	0	0	1,440	1,555	2,995		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	36	h				38.25	28.00	0	0	0	1,377	726	2,103		
														0	0	0	0	0	0		
	- Miscellaneous						1,400	m³		0.30				0	420	0	0	0	420		
														0	0	0	0	0	0		
3654	**Dam 4 - Rockfill**						**32,900**							**102,441**	**29,906**	**0**	**88,110**	**81,095**	**301,552**		**4,169**
3655	**Dam 5 - Rockfill**						**105,200**	**m³**													
	3D 0-900 Rockfill		**77,000**																		
	3E 0-225 Crushed stone		**23,000**																		
	4 400-600 Riprap		**5,200**																		
			105,200 m³																		
	3D 0-900 Rockfill						**77,000**	**m³**						0	0	0	0	0	0		
	Transport included in Canal 3 excavation													0	0	0	0	0	0		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
	Production of	1,200 m³ / sh					64	sh						0	0	0	0	0	0		
			10 h / s				640	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					9	5,760	h	24.00					138,240	0	0	0	0	138,240		5,760
														0	0	0	0	0	0		
	- Generator 5 kW (Tower light)	3.50	2.20		90%	4	2,304	h				3.50	2.20	0	0	0	8,064	3,650	11,714		
	- Cat D8T LGP Track-Type Tractor	47.45	38.60		90%	1	576	h				47.45	38.60	0	0	0	27,331	16,008	43,339		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	576	h				38.25	28.00	0	0	0	22,032	11,612	33,644		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	2	1,152	h				19.00	29.00	0	0	0	21,888	24,054	45,942		
	- Cat CS76 XT Vibratory Soil Compactor	14.85	20.00		90%	2	1,152	h				14.85	20.00	0	0	0	17,107	16,589	33,696		
														0	0	0	0	0	0		
	- Miscellaneous						77,000	m³		0.10				0	7,700	0	0	0	7,700		
	3E 0-225 Crushed stone						**23,000**	**m³**													
	Transport from crusher													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Production of	900 m³ / sh					26	sh						0	0	0	0	0	0		
			10 h / s				260	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					8	2,080	h	24.00					49,920	0	0	0	0	49,920		2,080

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	234	h				39.20	48.00	0	0	0	9,173	8,087	17,260		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	234	h				38.25	28.00	0	0	0	8,951	4,717	13,668		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	234	h				19.00	29.00	0	0	0	4,446	4,886	9,332		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	90%	1	234	h				14.85	20.00	0	0	0	3,475	3,370	6,845		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	468	h				24.00	20.00	0	0	0	11,232	6,739	17,971		
			6								0	0	0	0	0	0		
	Hauling distance 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 2 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 2 35 km / h										0	0	0	0	0	0		
	12 min.										0	0	0	0	0	0		
	Efficiency : 85% 14 min. / trip										0	0	0	0	0	0		
	0.24 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	39 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	468 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Supply From crusher 1.8 0.07 h / mt 41,400	5%		43,470	mt	1.80	1.38	0.00	2.03	3.15	78,246	59,989	0	88,244	98,590	325,069		3,043
											0	0	0	0	0	0		
	4 400-600 Riprap			**5,200**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Selection in Canal excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 400 m³ / sh			13	sh						0	0	0	0	0	0		
	10 h / s			130	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	650	h	24.00					15,600	0	0	0	0	15,600		650
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	117	h				19.00	29.00	0	0	0	2,223	2,443	4,666		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	117	h				40.00	60.00	0	0	0	4,680	5,054	9,734		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	117	h				38.25	28.00	0	0	0	4,475	2,359	6,834		
	- Miscellaneous			5,200	m³		0.30				0	1,560	0	0	0	1,560		
											0	0	0	0	0	0		
3655	**Dam 5 - Rockfill**			**105,200**							**282,006**	**69,249**	**0**	**233,321**	**208,158**	**792,734**		**11,533**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3660	**Spillways**																	
3661	**Spillway 1**																	
	Overburden excavation			**2,000**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m³ / sh			3	sh						0	0	0	0	0	0		
	Mobilisation			1	sh													
				4	sh													
	10 h / sh			40	h						0	0	0	0	0	0		
	- M-P		9	360	h	24.00					8,640	0	0	0	0	8,640		360
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	36	h				19.00	29.00	0	0	0	684	752	1,436		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	36	h				28.40	26.10	0	0	0	1,022	677	1,699		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	1	36	h				3.50	2.20	0	0	0	126	57	183		
	- Tractor truck & Load Carrier - 65 T 11.50 15.00	90%	1	36	h				11.50	15.00	0	0	0	414	389	803		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	4	144	h				24.00	20.00	0	0	0	3,456	2,074	5,530		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Excavation			**280**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 259 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			2	sh						0	0	0	0	0	0		
	10 h / s			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	60	h	24.00					1,440	0	0	0	0	1,440		60
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	1	18	h				19.40	15.00	0	0	0	349	194	543		
	- Drilling materials			259	m		0.70				0	181	0	0	0	181		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 6 m										0	0	0	0	0	0		
	Number of holes 43 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 280 m³ Losses	5%		294	kg		5.60				0	1,646	0	0	0	1,646		
	- Caps Losses	5%		45	un		4.50				0	203	0	0	0	203		
											0	0	0	0	0	0		
	- M-P		8	160	h	24.00					3,840	0	0	0	0	3,840		160
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	2	36	h				5.00	15.00	0	0	0	180	389	569		
	- Misc. Blasting materials			280	m³		0.10				0	28	0	0	0	28		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 140 m³ / sh										0	0	0	0	0	0		

Item : (3661-3662)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	1.5 loose »»»» 210 m³ / sh			2	sh						0	0	0	0	0	0		
	10 h / s			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	200	h	24.00					4,800	0	0	0	0	4,800		200
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	18	h				38.25	28.00	0	0	0	689	363	1,052		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	18	h				32.00	27.90	0	0	0	576	362	938		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	2	36	h				19.00	29.00	0	0	0	684	752	1,436		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	966 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **1**										0	0	0	0	0	0		
	Concrete Weir			**750**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Foundation preparation 300 m²										0	0	0	0	0	0		
	Production of 100 m² / sh			3	sh						0	0	0	0	0	0		
	10 h / sh			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	150	h	24.00					3,600	0	0	0	0	3,600		150
											0	0	0	0	0	0		
	- Compressor - 750 cfm 14.30 27.00	90%	1	27	h				14.30	27.00	0	0	0	386	525	911		
	- Generator 5 kW (Tower light) 3.50 2.20	30%	1	9	h				3.50	2.20	0	0	0	32	14	46		
											0	0	0	0	0	0		
	- Miscelaneous			300	m²		0.50				0	150	0	0	0	150		
											0	0	0	0	0	0		
	Concrete			**750**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concreting 5.00 h / m³			3,750	h	24.00					90,000	0	0	0	0	90,000		3,750
	- Construction materials			750	m³		80.00				0	60,000	0	0	0	60,000		
	- Construction equipment			750	m³				38.00	26.00	0	0	0	28,500	14,040	42,540		
	- Concrete supply 750 4.04 h / m³	2%		765	m²	96.85	5.10	186.47	35.08	13.03	74,089	3,902	142,647	26,835	7,177	254,650		3,092
											0	0	0	0	0	0		
	Reinforcing Steel										0	0	0	0	0	0		
	- Supply and Fabrication 60 kg / m³ 17.27 h / mt			**45**	**mt**	414.40	323.08	987.76	79.99	44.86	18,648	14,539	44,449	3,600	1,453	82,689		777
											0	0	0	0	0	0		
	Installation																	

Item : (3661-3662)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- M-P 16.00 h / mt			720	h	24.00					17,280	0	0	0	0	17,280		720
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	20%	1	144	h				37.00	20.00	0	0	0	5,328	2,074	7,402		
	- Boom truck 17 tons 13.65 18.00	50%	1	360	h				13.65	18.00	0	0	0	4,914	4,666	9,580		
	Concrete transportation from the Batching Plan			**765**	**m^3**						0	0	0	0	0	0		
	Average production 80 m^3 / sh			10	sh						0	0	0	0	0	0		
	10 h / sh			100	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	400	h	24.00					9,600	0	0	0	0	9,600		400
											0	0	0	0	0	0		
	- Readymix 8 m^3 13.60 14.00	90%	3	270	h				13.60	14.00	0	0	0	3,672	2,722	6,394		
											0	0	0	0	0	0		
	Average hauling distance : 13.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 26 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 22 35 km / h										0	0	0	0	0	0		
	73 min.										0	0	0	0	0	0		
	Efficacité : 85% 86 min. / trip										0	0	0	0	0	0		
	1.43 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	7 trips / sh										0	0	0	0	0	0		
	Readymix 8 m^3 8 m^3										0	0	0	0	0	0		
	56 m^3 / truck-sh										0	0	0	0	0	0		
	Number of trucks : **2**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3661	**Spillway 1**			**0**							**231,937**	**80,649**	**187,096**	**81,447**	**38,680**	**619,809**		**9,669**

Item : (3661-3662)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3662	**Spillway 2**																	
	Overburden excavation			**2,310**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 700 m³ / sh			4	sh						0	0	0	0	0	0		
				4	sh													
	10 h / sh			40	h						0	0	0	0	0	0		
	- M-P		9	360	h	24.00					8,640	0	0	0	0	8,640		360
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	36	h				19.00	29.00	0	0	0	684	752	1,436		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	36	h				28.40	26.10	0	0	0	1,022	677	1,699		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	1	36	h				3.50	2.20	0	0	0	126	57	183		
	- Tractor truck & Load Carrier - 65 T 11.50 15.00	90%	1	36	h				11.50	15.00	0	0	0	414	389	803		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	72	h				24.00	20.00	0	0	0	1,728	1,037	2,765		
											0	0	0	0	0	0		
	Rock Excavation (m³)			**500**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 463 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			3	sh						0	0	0	0	0	0		
	10 h / s			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	90	h	24.00					2,160	0	0	0	0	2,160		90
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	1	27	h				19.40	15.00	0	0	0	524	292	816		
	- Drilling materials			463	m		0.70				0	324	0	0	0	324		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 6 m										0	0	0	0	0	0		
	Number of holes 77 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 500 m³ Losses	5%		525	kg		5.60				0	2,940	0	0	0	2,940		
	- Caps Losses	5%		81	un		4.50				0	365	0	0	0	365		
											0	0	0	0	0	0		
	- M-P		8	240	h	24.00					5,760	0	0	0	0	5,760		240
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	2	54	h				5.00	15.00	0	0	0	270	583	853		
	- Misc. Blasting materials			500	m³		0.10				0	50	0	0	0	50		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 167 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 250 m³ / sh			3	sh						0	0	0	0	0	0		
	10 h / s			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	300	h	24.00					7,200	0	0	0	0	7,200		300
											0	0	0	0	0	0		

Item : (3661-3662)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS							
													24.00 $				0.72 $			
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	27	h				38.25	28.00	0	0	0	1,033	544	1,577		
	- Cat 740 Articulated Dumper 40 T	32.00	27.90	90%	1	27	h				32.00	27.90	0	0	0	864	542	1,406		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	2	54	h				19.00	29.00	0	0	0	1,026	1,128	2,154		
	Hauling distance	2.00 km											0	0	0	0	0	0		
													0	0	0	0	0	0		
	Loading	4											0	0	0	0	0	0		
	Trip up	5	25 km / h										0	0	0	0	0	0		
	Unloading	4											0	0	0	0	0	0		
	Back trip	3	35 km / h										0	0	0	0	0	0		
		16 min.											0	0	0	0	0	0		
	Efficiency :	85%	19 min. / trip										0	0	0	0	0	0		
			0.31 h / trip										0	0	0	0	0	0		
			9 h / sh										0	0	0	0	0	0		
			29 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T		21.0 m³										0	0	0	0	0	0		
			609 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift	**1**											0	0	0	0	0	0		
	Concrete Weir					**1,065**	**m³**						0	0	0	0	0	0		
													0	0	0	0	0	0		
	Foundation preparation	300 m²											0	0	0	0	0	0		
	Production of	100 m² / sh				3	sh						0	0	0	0	0	0		
			10 h / sh			30	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	150	h	24.00					3,600	0	0	0	0	3,600		150
													0	0	0	0	0	0		
	- Compressor - 750 cfm	14.30	27.00	90%	1	27	h				14.30	27.00	0	0	0	386	525	911		
	- Generator 5 kW (Tower light)	3.50	2.20	30%	1	9	h				3.50	2.20	0	0	0	32	14	46		
													0	0	0	0	0	0		
	- Miscelaneous					300	m²		0.50				0	150	0	0	0	150		
													0	0	0	0	0	0		
	Concrete					**1,065**	**m³**						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Concreting	5.00 h / m³				5,325	h	24.00					127,800	0	0	0	0	127,800		5,325
	- Construction materials					1,065	m³		80.00				0	85,200	0	0	0	85,200		
	- Construction equipment					1,065	m³				38.00	26.00	0	0	0	40,470	19,937	60,407		
	- Concrete supply	1,065	5.23 h / m³	2%		1,086	m²	125.64	5.45	180.16	49.26	14.09	136,445	5,918	195,653	53,493	11,016	402,525		5,677
													0	0	0	0	0	0		
	Reinforcing Steel												0	0	0	0	0	0		
	- Supply and Fabrication	60 kg / m³	20.00 h / mt			**64**	**mt**	480.00	397.44	987.76	121.86	48.96	30,672	25,397	63,118	7,787	2,252	129,226		1,278
													0	0	0	0	0	0		
	Installation																			
	- M-P	16.00 h / mt				1,022	h	24.00					24,538	0	0	0	0	24,538		1,022
													0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	20%	1	204	h				37.00	20.00	0	0	0	7,548	2,938	10,486		
	- Boom truck 17 tons	13.65	18.00	50%	1	511	h				13.65	18.00	0	0	0	6,975	6,623	13,598		

Item : (3661-3662)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Concrete transportation from the Batching Plan			**1,086**	**m³**						0	0	0	0	0	0		
	Average production 80 m³ / sh			14	sh						0	0	0	0	0	0		
	10 h / sh			140	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		3	420	h	24.00					10,080	0	0	0	0	10,080		420
											0	0	0	0	0	0		
	- Readymix 8 m³ 13.60 14.00	90%	1	126	h				13.60	14.00	0	0	0	1,714	1,270	2,984		
											0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 2 35 km / h										0	0	0	0	0	0		
	29 min.										0	0	0	0	0	0		
	Efficacité : 85% 34 min. / trip										0	0	0	0	0	0		
	0.57 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	16 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	128 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3662	**Spillway 2**			**0**							**356,895**	**120,344**	**258,771**	**126,096**	**50,576**	**912,682**		**14,862**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3670	**Transfer Tunnels**																	
3671	**Tunnel T1 Excavation**																	
	Rock excavation Dry										0	0	0	0	0	0		
	Upstream Portal			**57,050**	**m³**						0	0	0	0	0	0		
	Intake structure 5,250																	
	Hoist Acces road 3,000																	
	Invert Access road 45,000																	
	53,250																	
	Downstream Portal																	
	Portal 1,800																	
	Invert Access road 2,000																	
	3,800																	
	Rock excavation Wet			**6,880**	**m³**													
	Upstream Portal																	
	Rock Plug 1,700																	
	Intake channel 3,354																	
	5,054																	
	Downstream Portal																	
	Rock Plug 660																	
	Tailrace channel 1,166																	
	1,826																	
	Loose Material Excavation - Wet																	
	Upstream Portal Loose factor 1.4																	
	Rock 5,054 7,076																	
	Working platform 32,500																	
	39,577 m³																	
	Downstream Portal																	
	Rock 1,826 2,556																	
	Working platform 3,000																	
	5,556 m²																	
	Underground Excavation																	
	D Shape 5 x 6 29.40 m³ 1,690 m			**49,686**	**m³**													
	Downstream Portal - Dry																	
	Portal 1,800																	
	Invert Access road 2,000																	
	3,800			**3,800**	**m³**													
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 3,519 m										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Production of 200 m / machine / sh			18	sh						0	0	0	0	0	0		
	2 machines			9	sh						0	0	0	0	0	0		
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	450	h	24.00					10,800	0	0	0	0	10,800		450
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	2	162	h				19.40	15.00	0	0	0	3,143	1,750	4,893		
-	Drilling materials			3,519	m		0.70				0	2,463	0	0	0	2,463		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 8 m										0	0	0	0	0	0		
	Number of holes 440 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Dynamite 1 kg / m³ 3,800 m³ Losses	5%		3,990	kg		5.60				0	22,344	0	0	0	22,344		
-	Caps Losses	5%		462	un		4.50				0	2,079	0	0	0	2,079		
											0	0	0	0	0	0		
-	M-P		4	360	h	24.00					8,640	0	0	0	0	8,640		360
											0	0	0	0	0	0		
-	Explosives Truck 5.00 15.00	90%	1	81	h				5.00	15.00	0	0	0	405	875	1,280		
-	Misc. Blasting materials			3,800	m³		0.10				0	380	0	0	0	380		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 422 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 633 m³ / sh			9	sh						0	0	0	0	0	0		
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	540	h	24.00					12,960	0	0	0	0	12,960		540
											0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	81	h				38.25	28.00	0	0	0	3,098	1,633	4,731		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	81	h				19.00	29.00	0	0	0	1,539	1,691	3,230		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	2	162	h				24.00	20.00	0	0	0	3,888	2,333	6,221		
-	Generator 5 kW (Tower light) 3.50 2.20	90%	1	81	h				3.50	2.20	0	0	0	284	128	412		
											0	0	0	0	0	0		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	552 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
	Invert at 660										0	0	0	0	0	0		
	Top at 680																	
	Intake L H Area										0	0	0	0	0	0		
	2 sides 60 8 480										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Face 10 12 120																	
	600 m²																	
	Suppply										0	0	0	0	0	0		
-	Rock bolts 6 m 30 m² / un 20 un Losses	3%		21	un		110.00				0	2,310	0	0	0	2,310		
-	Wire mesh 600 m² Lapping	15%		690	m²		4.60				0	3,174	0	0	0	3,174		
-	Spikes 0,7 m 1.56 m² / un 385 un	3%		397	un		4.50				0	1,787	0	0	0	1,787		
-	Wire			600	m²		0.04				0	24	0	0	0	24		
											0	0	0	0	0	0		
	Rock bolts drilling and Installation										0	0	0	0	0	0		
	Production of 100 m / sh			2	sh						0	0	0	0	0	0		
	6 m bolt 120 m 10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	120	h	24.00					2,880	0	0	0	0	2,880		120
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	259	925		
-	Fork lift 15 T 13.00 9.00	90%	1	18	h				13.00	9.00	0	0	0	234	117	351		
-	Boom truck 17 tons 13.65 18.00	90%	1	18	h				13.65	18.00	0	0	0	246	233	479		
-	Drilling rig (on fork lift)	90%	1	18	h				0.00	0.00	0	0	0	0	0	0		
											0	0	0	0	0	0		
	Wire mesh Installation										0	0	0	0	0	0		
	Production of 100 m² / sh			6	sh						0	0	0	0	0	0		
	10 h / sh			60	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	300	h	24.00					7,200	0	0	0	0	7,200		300
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	54	h				37.00	20.00	0	0	0	1,998	778	2,776		
-	Jack leg 2.00	30%	1	18	h				2.00	0.00	0	0	0	36	0	36		
-	Fork lift 15 T 13.00 9.00	90%	1	54	h				13.00	9.00	0	0	0	702	350	1,052		
-	Misc. Drilling materials 385 un 0.7 m			270	m		1.00				0	270	0	0	0	270		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Downstream Portal - Wet										0	0	0	0	0	0		
	Drilling trough working platform										0	0	0	0	0	0		
	Working platform is included in rock excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling area 50 10 500 m²																	
	Depth 6 m																	
	Over drilling 2.44 m																	
	Total drilling 8.44 m Volume to blast 4,220 m³																	
	Drilling										0	0	0	0	0	0		
	Drilling grid 3,9 x 3,9 3.90 3.90 15.21 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 277 m										0	0	0	0	0	0		
	Production of 50 m / machine / sh			6	sh						0	0	0	0	0	0		
	10 h / s			60	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		2	120	h	24.00					2,880	0	0	0	0	2,880		120
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	1	54	h				19.40	15.00	0	0	0	1,048	583	1,631		
-	Drilling materials (plastic casing, bits, etc...)			277	m		5.00				0	1,387	0	0	0	1,387		

Item : (3671-3672)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 8.44 m										0	0	0	0	0	0		
	Number of holes 33 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1.30 kg / m³ 5,486 kg Losses	5%		5,760	kg		5.60				0	32,256	0	0	0	32,256		
	- Caps Losses	5%		35	un		4.50				0	158	0	0	0	158		
											0	0	0	0	0	0		
	0.5 h / hole			16	h													
	- M-P		4	66	h	24.00					1,578	0	0	0	0	1,578		66
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	15	h				5.00	15.00	0	0	0	74	160	234		
	- Misc. Blasting materials			5,486	m³		0.30				0	1,646	0	0	0	1,646		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Volume of material to excavate including sides slopes 8,440			**8,440**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 900 m² / sh			9	sh						0	0	0	0	0	0		
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	540	h	24.00					12,960	0	0	0	0	12,960		540
											0	0	0	0	0	0		
	- Cat 385CL Hydraulic Excavator 50.00 70.75	90%	1	81	h				50.00	70.75	0	0	0	4,050	4,126	8,176		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	81	h				38.25	28.00	0	0	0	3,098	1,633	4,731		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	81	h				32.00	27.90	0	0	0	2,592	1,627	4,219		
											0	0	0	0	0	0		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	966 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Upstream Portal - Dry																	
	Intake structure 5,250																	
	Hoist Acces road 3,000																	
	Invert Access road 45,000			**53,250**	**m³**													
	53,250																	
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		

Item : (3671-3672)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Drilling length 49,306 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			247	sh						0	0	0	0	0	0		
	4 machines			62	sh						0	0	0	0	0	0		
	10 h / s			618	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	4,940	h	24.00					118,560	0	0	0	0	118,560		4,940
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	4	2,223	h				19.40	15.00	0	0	0	43,126	24,008	67,134		
-	Drilling materials			49,306	m		0.70				0	34,514	0	0	0	34,514		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 4,931 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Dynamite 1 kg / m^3 53,250 m^3 Losses	5%		55,913	kg		5.60				0	313,113	0	0	0	313,113		
-	Caps Losses	5%		5,177	un		4.50				0	23,297	0	0	0	23,297		
											0	0	0	0	0	0		
-	M-P		4	2,470	h	24.00					59,280	0	0	0	0	59,280		2,470
											0	0	0	0	0	0		
-	Explosives Truck 5.00 15.00	90%	1	556	h				5.00	15.00	0	0	0	2,780	6,005	8,785		
-	Misc. Blasting materials			53,250	m^3		0.10				0	5,325	0	0	0	5,325		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 862 m^3 / sh										0	0	0	0	0	0		
	1.5 loose »»»» 1,294 m^3 / sh			62	sh						0	0	0	0	0	0		
	10 h / s			618	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		9	5,558	h	24.00					133,380	0	0	0	0	133,380		5,558
											0	0	0	0	0	0		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	556	h				38.25	28.00	0	0	0	21,267	11,209	32,476		
-	Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	556	h				40.00	60.00	0	0	0	22,240	24,019	46,259		
-	Cat 988H Wheel Loader 39.20 48.00	90%	1	556	h				39.20	48.00	0	0	0	21,795	19,215	41,010		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	3	1,667	h				24.00	20.00	0	0	0	40,008	24,005	64,013		
-	Generator 5 kW (Tower light) 3.50 2.20	90%	1	556	h				3.50	2.20	0	0	0	1,946	881	2,827		
											0	0	0	0	0	0		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m^3										0	0	0	0	0	0		
	552 m^3/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **3**										0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
	Invert at 660										0	0	0	0	0	0		
	Top at 690																	

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Intake L H Area										0	0	0	0	0	0		
	2 sides 60 24 1,440										0	0	0	0	0	0		
	Face 10 25 250																	
	1,690 m²																	
	Suppply										0	0	0	0	0	0		
-	Rock bolts 6 m 30 m² / un 56 un Losses	3%		58	un		110.00				0	6,380	0	0	0	6,380		
-	Wire mesh 1,690 m² Lapping	15%		1,944	m²		4.60				0	8,942	0	0	0	8,942		
-	Spikes 0,7 m 1.56 m² / un 1,083 un	3%		1,115	un		4.50				0	5,018	0	0	0	5,018		
-	Wire			1,690	m²		0.04				0	68	0	0	0	68		
											0	0	0	0	0	0		
	Rock bolts drilling and Installation										0	0	0	0	0	0		
	Production of 100 m / sh			4	sh						0	0	0	0	0	0		
	6 m bolt 336 m 10 h / sh			40	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	240	h	24.00					5,760	0	0	0	0	5,760		240
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	36	h				37.00	20.00	0	0	0	1,332	518	1,850		
-	Fork lift 15 T 13.00 9.00	90%	1	36	h				13.00	9.00	0	0	0	468	233	701		
-	Boom truck 17 tons 13.65 18.00	90%	1	36	h				13.65	18.00	0	0	0	491	467	958		
-	Drilling rig (on fork lift)	90%	1	36	h				0.00	0.00	0	0	0	0	0	0		
											0	0	0	0	0	0		
	Wire mesh Installation										0	0	0	0	0	0		
	Production of 100 m² / sh			17	sh						0	0	0	0	0	0		
	10 h / sh			170	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	850	h	24.00					20,400	0	0	0	0	20,400		850
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	153	h				37.00	20.00	0	0	0	5,661	2,203	7,864		
-	Jack leg 2.00	30%	1	51	h				2.00	0.00	0	0	0	102	0	102		
-	Fork lift 15 T 13.00 9.00	90%	1	153	h				13.00	9.00	0	0	0	1,989	991	2,980		
-	Misc. Drilling materials 1,083 un 0.7 m			758	m		1.00				0	758	0	0	0	758		
											0	0	0	0	0	0		
	Wire mesh removing (For intake concrete structure)										0	0	0	0	0	0		
	L H Area m²										0	0	0	0	0	0		
	25 30 750										0	0	0	0	0	0		
	Production of 600 m² / sh			2	sh						0	0	0	0	0	0		
	10 h / sh			20	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	100	h	24.00					2,400	0	0	0	0	2,400		100
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	18	h				37.00	20.00	0	0	0	666	259	925		
-	Boom truck 17 tons 13.65 18.00	90%	1	18	h				13.65	18.00	0	0	0	246	233	479		
	Upstream Portal - Wet										0	0	0	0	0	0		
	Drilling trough working platform										0	0	0	0	0	0		
	Working platform is included in rock excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling area 60 10 600 m²																	
	Depth 24 m																	
	Over drilling 2.44 m																	
	Total drilling 26.44 m Volume to blast 15,864 m³																	

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Drilling										0	0	0	0	0	0		
	Drilling grid 3,9 x 3,9 3.90 3.90 15.21 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 1,043 m										0	0	0	0	0	0		
	Production of 50 m / machine / sh			21	sh						0	0	0	0	0	0		
	10 h / s			210	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		5	1,050	h	24.00					25,200	0	0	0	0	25,200		1,050
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	2	378	h				19.40	15.00	0	0	0	7,333	4,082	11,415		
-	Drilling materials (plastic casing, bits, etc...)			1,043	m		5.00				0	5,215	0	0	0	5,215		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 26.44 m										0	0	0	0	0	0		
	Number of holes 39 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Dynamite 1.30 kg / m³ 20,623 m³ Losses	5%		21,654	kg		5.60				0	121,262	0	0	0	121,262		
-	Caps Losses	5%		41	un		4.50				0	185	0	0	0	185		
											0	0	0	0	0	0		
	0.5 h / hole			20	h													
-	M-P		4	840	h	24.00					20,160	0	0	0	0	20,160		840
											0	0	0	0	0	0		
-	Explosives Truck 5.00 15.00	90%	1	18	h				5.00	15.00	0	0	0	89	192	281		
-	Misc. Blasting materials			20,623	m³		0.30				0	6,187	0	0	0	6,187		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Volume of material to excavate including sides slopes 31,728			**31,728**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Barge mounted clamshell																	
	Excavated materials casted on sides																	
	Production of 360 m² / sh			88	sh						0	0	0	0	0	0		
	10 h / s			880	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	5,280	h	24.00					126,720	0	0	0	0	126,720		5,280
											0	0	0	0	0	0		
-	Crane 150T - Crawler 50.75 25.00	90%	1	792	h				50.75	25.00	0	0	0	40,194	14,256	54,450		
-	Miscelaneous			880	h		10.00				0	8,800	0	0	0	8,800		
											0	0	0	0	0	0		
	Duration 6 month (including mob/demob)																	
	L (ft) W (ft) H (ft) V (cu ft)										0	0	0	0	0	0		
-	Working barge 50.0 12.0 6.5 3,900		1	6	mth - un		4,800				0	28,800	0	0	0	28,800		
-	Tug		1	6	mth - un		6,500				0	39,000	0	0	0	39,000		
-	Miscelaneous (winches, anchors, generators, etc..)		1	6	mth - un		6,000				0	36,000	0	0	0	36,000		
	Marine Equipment preparation and transportation										0	0	0	0	0	0		
	8 trips 1 trip / day			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	480	h	24.00					11,520	0	0	0	0	11,520		480

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	50%	1	40	h				37.00	20.00	0	0	0	1,480	576	2,056		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	20%	1	16	h				28.40	26.10	0	0	0	454	301	755		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	20%	1	16	h				19.00	29.00	0	0	0	304	334	638		
	- Tractor truck & Load Carrier - 65 T 11.50 15.00	90%	1	72	h				11.50	15.00	0	0	0	828	778	1,606		
											0	0	0	0	0	0		
	Tunnel excavation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling with Boomer E2 C										0	0	0	0	0	0		
											0	0	0	0	0	0		
	D Shape 5 x 6 29.40 m³ 1,690 m			**49,686**	**m³**						0	0	0	0	0	0		
	Area (m²)										0	0	0	0	0	0		
	Arc 5.80 4.40										0	0	0	0	0	0		
	Height 6.25																	
	Wall 5.00 25.00																	
	Width 5.00																	
	29.40																	
	Excavation																	
	Progression 4.66 m																	
	Number of rounds 363																	
	363																	
	Number of shifts 508 Prod. Factor 1.4																	
	Number of holes (m) (Feet)																	
	Production 24 55 mm dia. 43,821 143,734																	
	Contour 25 55 mm dia. 45,647 149,723																	
	49																	
	Cut 3 109 mm dia. 5,478 17,967																	
	52																	
	Drilling depth 5.03 m 94,946 311,424																	
	Durations (hours) 363 rounds																	
	Drilling 100 m / h 2.62 949 h																	
	Blasting 1.15 min / hole 1.00 362 h																	
	Scaling & W. mesh 2.00 726 h																	
	Mucking 205 m³ / h 0.67 243 h																	
	Drilling labour																	
	H-H Bolting W. Mesh Remaining																	
	8 40,640 5,690 4,877 30,074																	
	14% 12%																	
	Drilling 2.62 363 949 h																	
	9 h / sh 105 sh																	
	8 men / sh 10 h / sh 8,440 h-h																	
	Loading & Blasting 1.00 363 362 h																	
	9 h / sh 40 sh																	
	8 men / sh 10 h / sh 3,200 h-h																	
	Remaining for services 18,434																	
	Drilling			1,055	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	8,440	h	24.00					202,552	0	0	0	0	202,552		8,440
	363 rounds										0	0	0	0	0	0		

WBS	DESCRIPTION					%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.72 $			
	- Jumbo E 2C		14.00		4.5 h			1,634	h				14.00		0	0	0	22,869	0	22,869		
	- Cat GEP 550 - 400KW		6.50	102.40	12 h / r			4,356	h				6.50	102.40	0	0	0	28,314	321,159	349,473		
															0	0	0	0	0	0		
		Feet	ft / un												0	0	0	0	0	0		
	- Bits 2"Ø	293,457	1,600					183	un		85.00				0	15,555	0	0	0	15,555		
	- Bits 4"Ø	17,967	1,500					12	un		500.00				0	6,000	0	0	0	6,000		
	- Rod 18'	311,424	7,500					42	un		485.00				0	20,370	0	0	0	20,370		
	- Coupling	311,424	3,700					84	un		50.00				0	4,200	0	0	0	4,200		
	- Shank	311,424	12,500					25	un		300.00				0	7,500	0	0	0	7,500		
	- Misc. Materials	311,424						311,424	ft		0.04				0	12,457	0	0	0	12,457		
															0	0	0	0	0	0		
	Loading & Blasting							400	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	3,200	h	24.00					76,800	0	0	0	0	76,800		3,200
															0	0	0	0	0	0		
	- Explosives Truck		5.00	15.00		90%	1	360	h				5.00	15.00	0	0	0	1,800	3,888	5,688		
															0	0	0	0	0	0		
	5.03 m holes	**363 Rounds**													0	0	0	0	0	0		
		Number	Total	Length (m)											0	0	0	0	0	0		
	Contour holes	25	9,075	45,647											0	0	0	0	0	0		
	Production holes	24	8,712	43,821											0	0	0	0	0	0		
		49	17,787												0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Prima cord	5.5 m			49,913	5%		52,408	m		1.00				0	52,408	0	0	0	52,408		
	- Cap 6m				17,787	13%		20,099	un		3.50				0	70,347	0	0	0	70,347		
	- Dynamite RXL 438	49,686 m³		Powder fact	1.6			79,498	kg		5.60				0	445,187	0	0	0	445,187		
	- XACTEX	9,075 holes			24,956	5%		26,204	kg		7.50				0	196,530	0	0	0	196,530		
		2.75 kg / hole													0	0	0	0	0	0		
															0	0	0	0	0	0		
	Mucking	49,686 m³													0	0	0	0	0	0		
	1.5 Loose »»»»	74,529 m³													0	0	0	0	0	0		
		205 m³ / round													0	0	0	0	0	0		
	Production	140 m³ / h			1.47 h										0	0	0	0	0	0		
		363 rounds			532 h x 10/9 »»			592	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						7	4,141	h	24.00					99,372	0	0	0	0	99,372		4,141
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		50%	1	296	h				19.00	29.00	0	0	0	5,624	6,180	11,804		
	- Cat 988H Wheel Loader		39.20	48.00		90%	1	532	h				39.20	48.00	0	0	0	20,854	18,386	39,240		
	- Cat D7R II LGP Track-Type Tractor		38.25	28.00		90%	1	532	h				38.25	28.00	0	0	0	20,349	10,725	31,074		
	- Cat 725 Articulated Dumper 25 T		24.00	20.00		90%	2	1,065	h				24.00	20.00	0	0	0	25,560	15,336	40,896		
	Disposal of excavated materials														0	0	0	0	0	0		
	Average hauling distance :			2.00 km											0	0	0	0	0	0		
															0	0	0	0	0	0		
	Loading		8												0	0	0	0	0	0		
	Going		4	30 km / h											0	0	0	0	0	0		
	Unloading		3												0	0	0	0	0	0		
	Return		4	30 km / h											0	0	0	0	0	0		
			19	min.											0	0	0	0	0	0		
	Efficacité :		85%	22 min. / trip											0	0	0	0	0	0		
				0.37 h / trip											0	0	0	0	0	0		
				9 h / sh											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	25 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	300 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : 2	(1+1)									0	0	0	0	0	0		
	Rolling Path Length 1,690										0	0	0	0	0	0		
	Width 8.00										0	0	0	0	0	0		
	Thickness 0.30										0	0	0	0	0	0		
	Volume 4,056										0	0	0	0	0	0		
	Production 800 m³ / sh			5	sh						0	0	0	0	0	0		
	10 h / s			50	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	400	h	24.00					9,600	0	0	0	0	9,600		400
											0	0	0	0	0	0		
	- Cat 988H Wheel Loader 39.20 48.00	90%	1	45	h				39.20	48.00	0	0	0	1,764	1,555	3,319		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	45	h				38.25	28.00	0	0	0	1,721	907	2,628		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	1	45	h				24.00	20.00	0	0	0	1,080	648	1,728		
	Rock Support																	
	D Shape 5 x 6 29.40 m³ 1,690 m			**49,686**	**m³**													
	Area (m²)																	
	Arc 5.80 4.40																	
	Height 6.25																	
	Wall 5.00 25.00																	
	Width 5.00																	
	29.40																	
	Tunnel																	
	Required Length Arch (m)										0	0	0	0	0	0		
	Class 1 1,267.5 5.80	75%									0	0	0	0	0	0		
	Class 2 253.5 5.80	15%									0	0	0	0	0	0		
	Class 3 118.3 5.80	7.0%									0	0	0	0	0	0		
	Class 4 42.3 5.80	2.5%									0	0	0	0	0	0		
	Class 5 8.5 5.80	0.5%									0	0	0	0	0	0		
	1,690	100%									0	0	0	0	0	0		
	Class 1 Qty										0	0	0	0	0	0		
	Rock bolts 2,5 m 1 un / m 1,268 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.80 m² / m 1,863 m²	15%									0	0	0	0	0	0		
	Wire mesh 9.80 m² / m 10,558 m²	85%									0	0	0	0	0	0		
	Class 2										0	0	0	0	0	0		
	Rock bolts 2,5 m 1.1 un / m 290 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.80 m² / m 373 m²	15%									0	0	0	0	0	0		
	Wire mesh 9.80 m² / m 2,112 m²	85%									0	0	0	0	0	0		
	Class 3										0	0	0	0	0	0		
	Rock bolts 3 m 1.5 un / m 172 un										0	0	0	0	0	0		
	Shotcrete 50 mm 9.80 m² / m 580 m²	50%									0	0	0	0	0	0		
	Wire mesh 9.80 m² / m 580 m²	50%									0	0	0	0	0	0		
	Class 4										0	0	0	0	0	0		
	Rock bolts 4 m 2.6 un / m 109 un										0	0	0	0	0	0		
	Shotcrete 50 mm 4.0 m² / m 51 m²	30%									0	0	0	0	0	0		
	Wire mesh 4.0 m² / m 118 m²	70%									0	0	0	0	0	0		
	Shotcrete 100 mm 5.8 m² / m 245 m²	100%									0	0	0	0	0	0		

Item : (3671-3672)

WBS	DESCRIPTION					%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.72 $			
	Reinf. Mesh	5.8	m^2 / m	245	m^2	100%									0	0	0	0	0	0		
	Steel arch (W 100)	1.5	m c/c	28	un										0	0	0	0	0	0		
		15.8	m / arch	442	m																	
	Class 5														0	0	0	0	0	0		
	Rock bolts 5 m	5.8	un / m	49	un										0	0	0	0	0	0		
	Shotcrete 50 mm	4.0	m^2 / m	10	m^2	30%									0	0	0	0	0	0		
	Wire mesh	4.0	m^2 / m	24	m^2	70%									0	0	0	0	0	0		
	Shotcrete 100 mm	5.8	m^2 / m	49	m^2	100%									0	0	0	0	0	0		
	Reinf. Mesh	5.8	m^2 / m	49	m^2	100%									0	0	0	0	0	0		
	Steel arch (W 150)	0.75	m c/c	11	un										0	0	0	0	0	0		
		15.8	m / arch	174	m										0	0	0	0	0	0		
	Supply			Lenght (m)											0	0	0	0	0	0		
	- Rock bolts 2,5 m	1,558	un	3,895	Losses	3%		1,605	un			60.00			0	0	96,300	0	0	96,300		
	- Rock bolts 3 m	172	un	516	Losses	3%		177	un			70.00			0	0	12,390	0	0	12,390		
	- Rock bolts 4 m	109	un	436	Losses	3%		112	un			80.00			0	0	8,960	0	0	8,960		
	- Rock bolts 5 m	49	un	245	Losses	3%		50	un			105.00			0	0	5,250	0	0	5,250		
		1,888		5,092											0	0	0	0	0	0		
	- Injection tubes	150	m roll			3%		35	rolls			110.00			0	0	3,850	0	0	3,850		
	- Oakum	130	bolts / box			3%		15	box			280.00			0	0	4,200	0	0	4,200		
	- Grease	154	bolts / box			3%		13	box			336.00			0	0	4,368	0	0	4,368		
															0	0	0	0	0	0		
	- Wire mesh	13,392	m^2			15%		15,400	m^2			4.60			0	0	70,840	0	0	70,840		
	- Reinf. Mesh	294	m^2			15%		338	m^2			5.60			0	0	1,893	0	0	1,893		
		13,686	m^2												0	0	0	0	0	0		
	- Spikes 1,1 m	1.25	m c/c	10,948	un	3%		11,276	un			4.50			0	0	50,742	0	0	50,742		
	- Wire			0.04 $	/ m^2			13,686	m^2			0.04			0	0	547	0	0	547		
		m^2		m^3											0	0	0	0	0	0		
	Shotcrete 50 mm	2,876	0.05	144											0	0	0	0	0	0		
	Shotcrete 100 mm	294	0.1	29											0	0	0	0	0	0		
				173											0	0	0	0	0	0		
	- Cement (40 kg Bags)	0.03	m^3 / bag		Losses	7.5%		6,207	bags			10.00			0	0	62,070	0	0	62,070		
		33.33	bags / m^3	5,774	bags										0	0	0	0	0	0		
	- Sand	1.40	mt / m^3	0.08	h / mt			243	mt	1.84	1.97	0.00	2.04	3.90	446	478	0	495	681	2,100		19
															0	0	0	0	0	0		
	- Monoset (3% of cement)			230,967	kg	3%		6,929	kg			3.40			0	0	23,559	0	0	23,559		
															0	0	0	0	0	0		
	- Steel arch (W 100)	19.0	kg / m	442	m			8,406	kg			4.00			0	0	33,622	0	0	33,622		
	- Steel arch (W 150)	22.0	kg / m	174	m			3,824	kg			5.00			0	0	19,118	0	0	19,118		
	Rock bolts Installation							508	sh						0	0	0	0	0	0		
		5,092	m	10	m / sh																	
		1,888	un	4	un / sh																	
				0.5	h / un. including positionning																	
				2	h / sh			1,016	h													
	1) Drilling with Jumbo														0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Jumbo					90%	1	914	h				102.50		0	0	0	93,685	0	93,685		
															0	0	0	0	0	0		
	2) Install with 50t crane with basket														0	0	0	0	0	0		
		1,888	un	4	un / sh																	
				0.5	h / un incl. Positionning																	
				1.9	h / sh			944	h													

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- M-P		3	2,832	h	24.00					67,968	0	0	0	0	67,968		2,832
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	850	h				37.00	20.00	0	0	0	31,450	12,240	43,690		
											0	0	0	0	0	0		
	- Impact tool			1	un		300.00				0	300	0	0	0	300		
	- Test rig			1	un		1,200.00				0	1,200	0	0	0	1,200		
	- Torque wrench			1	un		280.00				0	280	0	0	0	280		
											0	0	0	0	0	0		
	3) Injection 40 bolts / sh			48	sh						0	0	0	0	0	0		
	10 h / sh			480	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	1,920	h	24.00					46,080	0	0	0	0	46,080		1,920
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	432	h				37.00	20.00	0	0	0	15,984	6,221	22,205		
	- Moyno pump 2.00	75%	1	360	h				2.00		0	0	0	720	0	720		
											0	0	0	0	0	0		
	- Cement (bags) 5,092 m	100%		834	bags			10.00			0	0	8,340	0	0	8,340		
	16,702 ft 0.022698 sf										0	0	0	0	0	0		
	2 in. Dia hole 379 cu ft										0	0	0	0	0	0		
	0.91 cu ft / bag 417 bags										0	0	0	0	0	0		
	- Intraplast "N" 0.4 kg / bag 167 kg	1%		168	kg			3.00			0	0	504	0	0	504		
	- Miscellaneous			1,888	un		0.30				0	566	0	0	0	566		
	Wire mesh installation										0	0	0	0	0	0		
	Installation by Jumbo team										0	0	0	0	0	0		
	Production of 200 m² / sh 13,686 m²			68	sh						0	0	0	0	0	0		
	10 h / sh			684	h						0	0	0	0	0	0		
	Plus										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	616	h				37.00	20.00	0	0	0	22,792	8,870	31,662		
	- Jack leg 2.00	30%		205	h				2.00		0	0	0	410	0	410		
	- Miscellaneous materials Spike drilling 12,043 m			12,043	m		1.00				0	12,043	0	0	0	12,043		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Shotcreting			**173**	**m³**						0	0	0	0	0	0		
	Production of 0.7 h / m³ 121 h										0	0	0	0	0	0		
	7.5 h / sh Eff.			17	sh						0	0	0	0	0	0		
	10 h / sh			170	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	1,530	h	24.00					36,720	0	0	0	0	36,720		1,530
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	153	h				37.00	20.00	0	0	0	5,661	2,203	7,864		
	- Shotcrete pump 17.00	60%	1	102	h				17.00		0	0	0	1,734	0	1,734		
	- Hoses	25%	1	43	h		35.00				0	1,505	0	0	0	1,505		
	- Nozzle 66 m³ / un			3	un		275.00				0	825	0	0	0	825		
											0	0	0	0	0	0		
	Arches installation 616 m 16 m / un			**39**	**un**						0	0	0	0	0	0		
	Production of 2 un / sh			20	sh						0	0	0	0	0	0		
	10 h / sh			200	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	1,000	h	24.00					24,000	0	0	0	0	24,000		1,000
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	180	h				37.00	20.00	0	0	0	6,660	3,600	10,260		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Miscellaneous materials			39	un		200.00				0	7,800	0	0	0	7,800		
	Dewatering Duration 12 months			**1,690**	**m**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20,000				0	20,000	0	0	0	20,000		
	- Miscelaneous			1,690	m		15.00				0	25,350	0	0	0	25,350		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			3,380	h	24.00					81,120	0	0	0	0	81,120		3,380
											0	0	0	0	0	0		
	Outside Installation			60	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	420	h	24.00					10,080	0	0	0	0	10,080		420
											0	0	0	0	0	0		
	- Equipment			60	h				200.00		0	0	0	12,000	0	12,000		
											0	0	0	0	0	0		
	Pumping 52 weeks 6 d / w			312	days						0	0	0	0	0	0		
	20 h / day			6,240	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	6,240	h	24.00					149,760	0	0	0	0	149,760		6,240
											0	0	0	0	0	0		
	- Miscelaneous			52	weeks		110.00				0	5,720	0	0	0	5,720		
											0	0	0	0	0	0		
	Industrial Water Supply										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials Duration 12 months										0	0	0	0	0	0		
	- Pumps			2	un		20,000				0	40,000	0	0	0	40,000		
	- Miscelaneous			1,690	m		21.00				0	35,490	0	0	0	35,490		
											0	0	0	0	0	0		
	- M-P 2.0 h / m			3,380	h	24.00					81,120	0	0	0	0	81,120		3,380
											0	0	0	0	0	0		
	Compressed Air Duration 12 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			5,915	h	24.00					141,960	0	0	0	0	141,960		5,915
											0	0	0	0	0	0		
	- Miscelaneous materials			1,690	m		24.00				0	40,560	0	0	0	40,560		
											0	0	0	0	0	0		
	Ventilation & Heathing										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.0 h / m			5,070	h	24.00					121,680	0	0	0	0	121,680		5,070
											0	0	0	0	0	0		
	- Miscelaneous materials			1,690	m		10.00				0	16,900	0	0	0	16,900		
	- Furnace - 2 500 000 BTU 2.00 91.00			5,070	h				2.00	91.00	0	0	0	10,140	461,370	471,510		
	Electrical services										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3.5 h / m			5,915	h	24.00					141,960	0	0	0	0	141,960		5,915
											0	0	0	0	0	0		
	- Miscelaneous materials			1,690	m		22.00				0	37,180	0	0	0	37,180		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3671	**Tunnel T1 Excavation**			**0**							**1,874,496**	**1,789,893**	**406,553**	**573,566**	**1,027,010**	**5,671,518**		**78,105**

Item : (3671-3672)

WBS	DESCRIPTION				%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
3672	**Tunnel T1 Intake structure**						**900**	**m³**													
	Concrete works													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Intake Structure						**900**	**m²**						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Concreting	5.00 h / m³					4,500	h	24.00					108,000	0	0	0	0	108,000		4,500
	- Construction materials						900	m³		80.00				0	72,000	0	0	0	72,000		
	- Construction equipment						900	m³				48.00	40.00	0	0	0	43,200	25,920	69,120		
	- Concrete supply	900	1.87 h / m³		2%		918	m²	44.80	10.69	308.59	13.56	10.78	41,124	9,812	283,288	12,445	7,124	353,793		1,719
	Reinforcing Steel													0	0	0	0	0	0		
	- Supply and Fabrication	60 kg / m³	20.71	h / mt			**54**	**mt**	497.14	737.38	985.52	102.06	54.07	26,846	39,819	53,218	5,511	2,102	127,496		1,119
														0	0	0	0	0	0		
	Installation																				
	- M-P	16.00 h / mt					864	h	24.00					20,736	0	0	0	0	20,736		864
														0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00		20%	1	173	h				37.00	20.00	0	0	0	6,401	2,491	8,892		
	- Boom truck 17 tons	13.65	18.00		50%	1	432	h				13.65	18.00	0	0	0	5,897	5,599	11,496		
	Concrete transportation from the Batching Plan						**918**	**m³**						0	0	0	0	0	0		
	Average production	50 m³ / sh					19	sh						0	0	0	0	0	0		
			10 h / sh				190	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					3	570	h	24.00					13,680	0	0	0	0	13,680		570
														0	0	0	0	0	0		
	- Readymix 8 m³	13.60	14.00		90%	2	342	h				13.60	14.00	0	0	0	4,651	3,447	8,098		
														0	0	0	0	0	0		
	Average hauling distance :		1.00 km											0	0	0	0	0	0		
														0	0	0	0	0	0		
	Loading	10												0	0	0	0	0	0		
	Going	2	30 km / h											0	0	0	0	0	0		
	Unloading	15												0	0	0	0	0	0		
	Return	2	35 km / h											0	0	0	0	0	0		
		29 min.												0	0	0	0	0	0		
	Efficacité :	85%	34 min. / trip											0	0	0	0	0	0		
			0.57 h / trip											0	0	0	0	0	0		
			9 h / sh											0	0	0	0	0	0		
			16 trips / sh											0	0	0	0	0	0		
	Readymix 8 m³		8 m³											0	0	0	0	0	0		
			128 m³ / truck-sh											0	0	0	0	0	0		
		Number of trucks :	2	(1+1)										0	0	0	0	0	0		
														0	0	0	0	0	0		
3672	**Tunnel T1 Intake structure**						**900**	**m³**						**210,386**	**121,631**	**336,506**	**78,105**	**46,683**	**793,311**	**881.46**	**8,772**

WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
									UNIT PRICES					TOTAL COSTS							
														24.00 $				0.72 $			
3680	**Canals**																				
3681	**Canals 1 and 2**						**20,000**	**m³**													
		Dry	**Wet**	**Total**										0	0	0	0	0	0		
		60%	40%																		
	Overburden excavation	6,600	4,400	**11,000**										0	0	0	0	0	0		
	Rock excavation	5,400	3,600	**9,000**										0	0	0	0	0	0		
		12,000	8,000											0	0	0	0	0	0		
														0	0	0	0	0	0		
	Overburden excavation - Dry						**6,600**	**m³**						0	0	0	0	0	0		
	Production of 900 m³ / sh						7	sh													
	10 h / sh						70	h													
	- M-P					6	420	h	24.00					10,080	0	0	0	0	10,080		420
														0	0	0	0	0	0		
	- Cat 345 Hydraulic Excavator	40.00	60.00		90%	1	63	h				40.00	60.00	0	0	0	2,520	2,722	5,242		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	63	h				38.25	28.00	0	0	0	2,410	1,270	3,680		
	- Cat 740 Articulated Dumper 40 T	32.00	27.90		90%	2	126	h				32.00	27.90	0	0	0	4,032	2,531	6,563		
														0	0	0	0	0	0		
	Evacuation of excavated materials													0	0	0	0	0	0		
	Production of 900 m³ / sh													0	0	0	0	0	0		
	1.5 loose »»»» 1,350 m³ / sh													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Average hauling distance : 0.50 km													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Loading	4																			
	Going	1		30 km / h																	
	Unloading	3																			
	Return	1		35 km / h																	
		9	min.																		
	Efficacité :	85%		11 min. / trip																	
				0.18 h / trip																	
				9 h / sh																	
				51 trips / sh																	
	Cat 740 Articulated Dumper 40 T			21 m³																	
				1,071 m³ / truck-sh																	
			Number of trucks :	**2**																	
	Construction roads	**(m)**	**(m² / m)**	**(m³)**										0	0	0	0	0	0		
	Access road to canal 1	**500**	**6**	**3,000**										0	0	0	0	0	0		
	Access road to canal 2	**500**	**6**	**3,000**										0	0	0	0	0	0		
		1,000		**6,000**										0	0	0	0	0	0		
	Backfill from excavated materials													0	0	0	0	0	0		
	Foundation						**6,000**	**m³**													
	Production of 1,200 m³ / sh						5	sh						0	0	0	0	0	0		
				10 h / s			50	h						0	0	0	0	0	0		

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- M-P		4	200	h	24.00					4,800	0	0	0	0	4,800		200
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	45	h				38.25	28.00	0	0	0	1,721	907	2,628		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	45%	1	23	h				14.85	20.00	0	0	0	342	331	673		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	25%	1	13	h				19.00	29.00	0	0	0	247	271	518		
	Pavement 0.3 x 10 3 m³ / m			**3,000**	**m³**						0	0	0	0	0	0		
	Production of 800 m³ / sh			4	sh						0	0	0	0	0	0		
	10 h / s			38	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		##	375	h	24.00					9,000	0	0	0	0	9,000		375
											0	0	0	0	0	0		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	34	h				28.40	26.10	0	0	0	966	639	1,605		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	45%	3	51	h				24.00	20.00	0	0	0	1,224	734	1,958		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	25%	1	9	h				14.85	20.00	0	0	0	134	130	264		
	- Cat 14M Motorgrader 16.65 25.75	90%	1	34	h				16.65	25.75	0	0	0	566	630	1,196		
	- Cat 980H Wheel Loader 29.00 23.45	90%	1	34	h				29.00	23.45	0	0	0	986	574	1,560		
											0	0	0	0	0	0		
	Hauling distance from crusher 3.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 6 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 6 35 km / h										0	0	0	0	0	0		
	20 min.										0	0	0	0	0	0		
	Efficiency : 85% 24 min. / trip										0	0	0	0	0	0		
	0.39 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	23 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	276 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Pavement material 1.8 mt / m³ 0.08 h / mt	5%		5,670	mt	1.84	1.97	0.00	2.04	3.90	10,433	11,170	0	11,567	15,921	49,091		454
	Rock excavation - Dry			**5,400**	**m³**													
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 5,000 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			25	sh						0	0	0	0	0	0		
	4 machines			6	sh						0	0	0	0	0	0		
	10 h / s			63	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	500	h	24.00					12,000	0	0	0	0	12,000		500
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	4	225	h				19.40	15.00	0	0	0	4,365	2,430	6,795		
	- Drilling materials			5,000	m		0.70				0	3,500	0	0	0	3,500		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		

						UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 500 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 5,400 m³ Losses	5%		5,670	kg		5.60				0	31,752	0	0	0	31,752		
	- Caps Losses	5%		525	un		4.50				0	2,363	0	0	0	2,363		
											0	0	0	0	0	0		
	- M-P		4	250	h	24.00					6,000	0	0	0	0	6,000		250
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	56	h				5.00	15.00	0	0	0	280	605	885		
	- Misc. Blasting materials			5,400	m³		0.10				0	540	0	0	0	540		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 864 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 1,296 m³ / sh			6	sh						0	0	0	0	0	0		
	10 h / s			63	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	375	h	24.00					9,000	0	0	0	0	9,000		375
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	56	h				38.25	28.00	0	0	0	2,142	1,129	3,271		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	56	h				40.00	60.00	0	0	0	2,240	2,419	4,659		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	2	113	h				32.00	27.90	0	0	0	3,616	2,270	5,886		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	113	h				3.50	2.20	0	0	0	396	179	575		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	966 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **2**										0	0	0	0	0	0		
	Overburden and Rock excavation - Wet			**8,000**	**m³**													
	(Including working platform)																	
	Drilling area 150 20 3,000 m²																	
	Depth 5 m																	
	Over drilling 2.44 m																	
	Total drilling 7.44 m Volume to blast 22,320 m³																	
	Drilling										0	0	0	0	0	0		
	Drilling grid 3,9 x 3,9 3.90 3.90 15.21 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 1,467 m										0	0	0	0	0	0		
	Production of 50 m / machine / sh			29	sh						0	0	0	0	0	0		
	2 mach			15	sh													

Item : (3681 to 3684)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	10 h / s			150	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	750	h	24.00					18,000	0	0	0	0	18,000		750
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	270	h				19.40	15.00	0	0	0	5,238	2,916	8,154		
	- Drilling materials (plastic casing, bits, etc...)			1,467	m		5.00				0	7,337	0	0	0	7,337		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 7.44 m										0	0	0	0	0	0		
	Number of holes 197 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1.30 kg / m³ 29,016 kg Losses	5%		30,467	kg		5.60				0	170,615	0	0	0	170,615		
	- Caps Losses	5%		207	un		4.50				0	932	0	0	0	932		
											0	0	0	0	0	0		
	0.5 h / hole			99	h													
	- M-P		4	394	h	24.00					9,467	0	0	0	0	9,467		394
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	89	h				5.00	15.00	0	0	0	444	959	1,403		
	- Misc. Blasting materials			29,016	m³		0.30				0	8,705	0	0	0	8,705		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Volume of material to excavate including sides slopes 44,640			**44,640**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 900 m³ / sh			50	sh						0	0	0	0	0	0		
	10 h / s			500	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		5	2,500	h	24.00					60,000	0	0	0	0	60,000		2,500
											0	0	0	0	0	0		
	- Cat 385CL Hydraulic Excavator 50.00 70.75	90%	1	450	h				50.00	70.75	0	0	0	22,500	22,923	45,423		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	450	h				38.25	28.00	0	0	0	17,213	9,072	26,285		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	450	h				32.00	27.90	0	0	0	14,400	9,040	23,440		
											0	0	0	0	0	0		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	966 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
3681	**Canals 1 and 2**			**20,000**	**m³**						**148,780**	**236,914**	**0**	**99,549**	**80,602**	**565,845**	**28.29**	**6,218**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3683	**Canal 3**			**92,000**	**m³**													
	Overburden excavation			**60,000**	**m³**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 900 m² / sh / mach			67	sh						0	0	0	0	0	0		
	2 machines			34	sh						0	0	0	0	0	0		
	10 h / sh			335	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		9	3,015	h	24.00					72,360	0	0	0	0	72,360		3,015
											0	0	0	0	0	0		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	603	h				40.00	60.00	0	0	0	24,120	26,050	50,170		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	302	h				38.25	28.00	0	0	0	11,552	6,088	17,640		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	4	1,206	h				32.00	27.90	0	0	0	38,592	24,226	62,818		
											0	0	0	0	0	0		
	Evacuation of excavated materials										0	0	0	0	0	0		
	Production of 1,800 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 2,700 m³ / sh										0	0	0	0	0	0		
	Average hauling distance : 1.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Going 2 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 2 35 km / h																	
	11 min.																	
	Efficacité : 85% 13 min. / trip																	
	0.22 h / trip																	
	9 h / sh																	
	42 trips / sh																	
	Cat 740 Articulated Dumper 40 T 21 m³																	
	882 m³ / truck-sh																	
	Number of trucks : **4**																	
	Construction roads (m) (m² / m) (m³)										0	0	0	0	0	0		
	1,000 **11** **11,000**										0	0	0	0	0	0		
	1,000 **11,000**										0	0	0	0	0	0		
	Backfill from excavated materials										0	0	0	0	0	0		
	Foundation			**11,000**	**m³**													
	Production of 1,200 m³ / sh			9	sh						0	0	0	0	0	0		
	10 h / s			90	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	360	h	24.00					8,640	0	0	0	0	8,640		360
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	81	h				38.25	28.00	0	0	0	3,098	1,633	4,731		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	45%	1	41	h				14.85	20.00	0	0	0	609	590	1,199		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	25%	1	23	h				19.00	29.00	0	0	0	437	480	917		
	- Miscelaneous (culverts, signalisation, etc...)			1,000	m		2.00				0	2,000	0	0	0	2,000		
	Pavement 0.3 x 10 3 m³ / m			**3,000**	**m³**						0	0	0	0	0	0		

Item : (3681 to 3684)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Production of 1,000 m^3 / sh			3	sh						0	0	0	0	0	0		
	10 h / s			30	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		##	300	h	24.00					7,200	0	0	0	0	7,200		300
											0	0	0	0	0	0		
-	Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	27	h				28.40	26.10	0	0	0	767	507	1,274		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	45%	3	41	h				24.00	20.00	0	0	0	984	590	1,574		
-	Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	25%	1	8	h				14.85	20.00	0	0	0	119	115	234		
-	Cat 14M Motorgrader 16.65 25.75	90%	1	27	h				16.65	25.75	0	0	0	450	501	951		
-	Cat 980H Wheel Loader 29.00 23.45	90%	1	27	h				29.00	23.45	0	0	0	783	456	1,239		
											0	0	0	0	0	0		
	Hauling distance from crusher 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 3 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m^3										0	0	0	0	0	0		
	396 m^3/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Pavement material 1.8 mt / m^3 0.07 h / mt			5,400	mt	1.80	1.38	0.00	2.03	3.15	9,720	7,452	0	10,962	12,247	40,381		378
	Rock Excavation			**32,000**	**m^3**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m^2										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 29,630 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			148	sh						0	0	0	0	0	0		
	6 machines			25	sh						0	0	0	0	0	0		
	10 h / s			247	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		##	2,467	h	24.00					59,200	0	0	0	0	59,200		2,467
											0	0	0	0	0	0		
-	Hydraulic Drilling Machine 19.40 15.00	90%	6	1,332	h				19.40	15.00	0	0	0	25,841	14,386	40,227		
-	Drilling materials			29,630	m		0.70				0	20,741	0	0	0	20,741		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 2,963 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
-	Dynamite 1 kg / m^3 32,000 m^3 Losses	5%		33,600	kg		5.60				0	188,160	0	0	0	188,160		
-	Caps Losses	5%		3,111	un		4.50				0	14,000	0	0	0	14,000		
											0	0	0	0	0	0		
-	M-P		4	987	h	24.00					23,680	0	0	0	0	23,680		987
											0	0	0	0	0	0		
-	Explosives Truck 5.00 15.00	90%	1	222	h				5.00	15.00	0	0	0	1,110	2,398	3,508		

Item : (3681 to 3684)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Misc. Blasting materials			32,000	m³		0.10				0	3,200	0	0	0	3,200		
											0	0	0	0	0	0		
	Mucking										0	0	0	0	0	0		
	Production of 1,297 m³ / sh										0	0	0	0	0	0		
	1.5 loose »»»» 1,946 m³ / sh			25	sh						0	0	0	0	0	0		
	10 h / s			247	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		##	3,207	h	24.00					76,960	0	0	0	0	76,960		3,207
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	2	444	h				38.25	28.00	0	0	0	16,983	8,951	25,934		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	2	444	h				40.00	60.00	0	0	0	17,760	19,181	36,941		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	4	888	h				32.00	27.90	0	0	0	28,416	17,838	46,254		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	444	h				3.50	2.20	0	0	0	1,554	703	2,257		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	222	h				19.00	29.00	0	0	0	4,218	4,635	8,853		
	Hauling distance 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 5 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 3 35 km / h										0	0	0	0	0	0		
	16 min.										0	0	0	0	0	0		
	Efficiency : 85% 19 min. / trip										0	0	0	0	0	0		
	0.31 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	29 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m³										0	0	0	0	0	0		
	609 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **4**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Support										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Suppply										0	0	0	0	0	0		
	- Rock bolts 6 m 200 un Losses	3%		206	un		110.00				0	22,660	0	0	0	22,660		
											0	0	0	0	0	0		
	Rock bolts drilling and Installation										0	0	0	0	0	0		
	Production of 100 m / sh			12	sh						0	0	0	0	0	0		
	6 m bolt 1,200 m 10 h / sh			120	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	840	h	24.00					20,160	0	0	0	0	20,160		840
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	108	h				37.00	20.00	0	0	0	3,996	1,555	5,551		
	- Fork lift 15 T 13.00 9.00	90%	1	108	h				13.00	9.00	0	0	0	1,404	700	2,104		
	- Boom truck 17 tons 13.65 18.00	90%	1	108	h				13.65	18.00	0	0	0	1,474	1,400	2,874		
	- Drilling rig (on fork lift)	90%	1	108	h				0.00	0.00	0	0	0	0	0	0		
	Dewatering Duration 2 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase of equipment and materials										0	0	0	0	0	0		
	- Pumps			1	ls		20,000				0	20,000	0	0	0	20,000		
	- Miscelaneous			1,000	m		15.00				0	15,000	0	0	0	15,000		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Installation			30	h						0	0	0	0	0	0		
															0			
	- M-P		7	210	h	24.00					5,040	0	0	0	0	5,040		210
											0	0	0	0	0	0		
	- Equipment			30	h				200.00		0	0	0	6,000	0	6,000		
											0	0	0	0	0	0		
	Pumping 9 weeks 6 d / w			54	days						0	0	0	0	0	0		
	20 h / day			1,080	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	1,080	h	24.00					25,920	0	0	0	0	25,920		1,080
											0	0	0	0	0	0		
	- Miscelaneous			9	weeks		110.00				0	990	0	0	0	990		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3683	**Canal 3**			**92,000**							**308,880**	**294,203**	**0**	**201,229**	**145,230**	**949,542**		**12,843**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3684	**Canal 4**			**4,500**	**m³**													
	Overburden and rock excavation			**4,500**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	All frozen and considered as rock										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Rock Excavation - Dry			**4,500**	**m³**						0	0	0	0	0	0		
	Drilling										0	0	0	0	0	0		
	Drilling grid ,9 x 1,2 0.90 1.20 1.08 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Drilling length 4,167 m										0	0	0	0	0	0		
	Production of 200 m / machine / sh			21	sh						0	0	0	0	0	0		
	2 machines			11	sh						0	0	0	0	0	0		
	10 h / s			105	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	420	h	24.00					10,080	0	0	0	0	10,080		420
											0	0	0	0	0	0		
	- Hydraulic Drilling Machine 19.40 15.00	90%	2	189	h				19.40	15.00	0	0	0	3,667	2,041	5,708		
	- Drilling materials			4,167	m		0.70				0	2,917	0	0	0	2,917		
											0	0	0	0	0	0		
	Blasting										0	0	0	0	0	0		
	Average depth of holes 10 m										0	0	0	0	0	0		
	Number of holes 417 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Dynamite 1 kg / m³ 4,500 m³ Losses	5%		4,725	kg		5.60				0	26,460	0	0	0	26,460		
	- Caps Losses	5%		438	un		4.50				0	1,971	0	0	0	1,971		
											0	0	0	0	0	0		
	- M-P		4	420	h	24.00					10,080	0	0	0	0	10,080		420
											0	0	0	0	0	0		
	- Explosives Truck 5.00 15.00	90%	1	95	h				5.00	15.00	0	0	0	475	1,026	1,501		
	- Misc. Blasting materials			4,500	m³		0.10				0	450	0	0	0	450		
											0	0	0	0	0	0		

Item : (3681 to 3684)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Mucking										0	0	0	0	0	0		
	Production of 429 m^3 / sh										0	0	0	0	0	0		
	1.5 loose »»»» 643 m^3 / sh			11	sh						0	0	0	0	0	0		
	10 h / s			105	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	630	h	24.00					15,120	0	0	0	0	15,120		630
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	95	h				38.25	28.00	0	0	0	3,634	1,915	5,549		
	- Cat 345 Hydraulic Excavator 40.00 60.00	90%	1	95	h				40.00	60.00	0	0	0	3,800	4,104	7,904		
	- Cat 740 Articulated Dumper 40 T 32.00 27.90	90%	1	95	h				32.00	27.90	0	0	0	3,040	1,908	4,948		
	- Generator 5 kW (Tower light) 3.50 2.20	90%	2	189	h				3.50	2.20	0	0	0	662	299	961		
	Hauling distance 0.50 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 1 25 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 1 35 km / h										0	0	0	0	0	0		
	10 min.										0	0	0	0	0	0		
	Efficiency : 85% 12 min. / trip										0	0	0	0	0	0		
	0.20 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	46 trips / sh										0	0	0	0	0	0		
	Cat 740 Articulated Dumper 40 T 21.0 m^3										0	0	0	0	0	0		
	966 m^3/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
3684	**Canal 4**			**4,500**							**35,280**	**31,798**	**0**	**15,278**	**11,293**	**93,649**		**1,470**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3700	**Electrical Works**																	
3710	**Supply and Installation of Transformers and Power cables**			**0**	**0**													
	Power transformers																	
	Purchase																	
	- Power transformer (oil)			2	un			1 500 000			0	0	3 000 000	0	0	3 000 000		
											0	0	0	0	0	0		
	Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 3 000 h / un		2	6 000	h	24.00					144 000	0	0	0	0	144 000		6 000
											0	0	0	0	0	0		
	- Miscelaneous			2	un		5 000.00		70 000.00		0	10 000	0	140 000	0	150 000		
											0	0	0	0	0	0		
	Secondary transformers (oil)										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase										0	0	0	0	0	0		
	- S1 & S2			2	un			250 000			0	0	500 000	0	0	500 000		
											0	0	0	0	0	0		
	Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 200 h / un		2	400	h	24.00					9 600	0	0	0	0	9 600		400
											0	0	0	0	0	0		
	- Miscelaneous			2	un		500.00		4 500.00		0	1 000	0	9 000	0	10 000		
											0	0	0	0	0	0		
	Secondary transformers (dry)										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Purchase and Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- S 3			1	un			200 000			0	0	200 000	0	0	200 000		
	- S 4										0	0	300 000	0	0	300 000		
	- M-P 200 h / un		2	400	h	24.00					9 600	0	0	0	0	9 600		400
											0	0	0	0	0	0		
	- Miscelaneous			2	un		200.00		2 000.00		0	400	0	4 000	0	4 400		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3710	**Supply and Installation of Transformers and Power cables**										**163 200**	**11 400**	**4 000 000**	**153 000**	**0**	**4 327 600**		**6 800**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3720	**Supply and Installation of High voltage distribution plant**																	
	Purchase and Installation										0	0	0	0	0	0		
	12 kV Distribution center										0	0	0	0	0	0		
	- PSG 1			1	un			275 000			0	0	275 000	0	0	275 000		
	- PSG 2			1	un			275 000			0	0	275 000	0	0	275 000		
	- PSG 3			1	un			175 000			0	0	175 000	0	0	175 000		
											0	0	0	0	0	0		
	- M-P 700 h / un		3	2 100	h	24.00					50 400	0	0	0	0	50 400		2 100
											0	0	0	0	0	0		
	- Miscelaneous			3	un		500.00		2 000.00		0	1 500	0	6 000	0	7 500		
											0	0	0	0	0	0		
	400 V Principal distribution center										0	0	0	0	0	0		
	- SG 1			1	un			155 000			0	0	155 000	0	0	155 000		
	- SG 2			1	un			155 000			0	0	155 000	0	0	155 000		
											0	0	0	0	0	0		
	- M-P 600 h / un		2	1 200	h	24.00					28 800	0	0	0	0	28 800		1 200
											0	0	0	0	0	0		
	- Miscelaneous			2	un		1 000.00		18 000.00		0	2 000	0	36 000	0	38 000		
											0	0	0	0	0	0		
	400 V Secondary group distribution										0	0	0	0	0	0		
	- SG 11			1	un			75 000			0	0	75 000	0	0	75 000		
	- SG 12			1	un			75 000			0	0	75 000	0	0	75 000		
											0	0	0	0	0	0		
	- M-P 600 h / un		2	1 200	h	24.00					28 800	0	0	0	0	28 800		1 200
											0	0	0	0	0	0		
	- Miscelaneous			2	un		1 000.00		10 000.00		0	2 000	0	20 000	0	22 000		
															0			
	400 V Secondary distribution center										0	0	0	0	0	0		
	- SG 21			1	un			80 000			0	0	80 000	0	0	80 000		
	- SG 22			1	un			80 000			0	0	80 000	0	0	80 000		
	- SG 23			1	un			85 000			0	0	85 000	0	0	85 000		
	- SG 24			1	un			85 000			0	0	85 000	0	0	85 000		
															0			
	- M-P 600 h / un		4	2 400	h	24.00					57 600	0	0	0	0	57 600		2 400
											0	0	0	0	0	0		
	- Miscelaneous			4	un		800.00		10 000.00		0	3 200	0	40 000	0	43 200		
											0	0	0	0	0	0		
	«Barres sous gaine»										0	0	0	0	0	0		
	- BSG 1			1	un			100 000			0	0	100 000	0	0	100 000		
	- BSG 2			1	un			100 000			0	0	100 000	0	0	100 000		
											0	0	0	0	0	0		
	- M-P 750 h / un		2	1 500	h	24.00					36 000	0	0	0	0	36 000		1 500
											0	0	0	0	0	0		
	- Miscelaneous			2	un		1 000.00		16 000.00		0	2 000	0	32 000	0	34 000		
											0	0	0	0	0	0		
	Bus Bars										0	0	0	0	0	0		
	- BB 1			1	un						0	0	0	0	0	0		
	- BB 2			1	un						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 8 000 h / un		2	16 000	h	24.00					384 000	0	0	0	0	384 000		16 000
											0	0	0	0	0	0		

Item : **(3710 to 3790)**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Miscelaneous			2	un		10 000.00		45 000.00		0	20 000	0	90 000	0	110 000		
											0	0	0	0	0	0		
	Cable 22 to 200 m outside tunnel										0	0	0	0	0	0		
	- C1A			1.2	km			350 000			0	0	420 000	0	0	420 000		
	- C1B			1.2	km			350 000			0	0	420 000	0	0	420 000		
	- C1C			1.2	km			350 000			0	0	420 000	0	0	420 000		
	- C2A			1.2	km			350 000			0	0	420 000	0	0	420 000		
	- C2B			1.2	km			350 000			0	0	420 000	0	0	420 000		
	- C2C			1.2	km			350 000			0	0	420 000	0	0	420 000		
											0	0	0	0	0	0		
	- M-P 7.2 km 3000 h / km			21 600	h	24.00					518 400	0	0	0	0	518 400		21 600
											0	0	0	0	0	0		
	- Miscelaneous			7.2	km		2 000.00		17 000.00		0	14 400	0	122 400	0	136 800		
											0	0	0	0	0	0		
	Cable heads 220 kV - Accessories										0	0	0	0	0	0		
	- TDC			6	un			25 000			0	0	150 000	0	0	150 000		
	- TDCGIS			6	un			50 000			0	0	300 000	0	0	300 000		
	- RSC - Splice cables (600 m)			6	un			35 000			0	0	210 000	0	0	210 000		
	- GIS Between transfo and 200 kV cable			6	un			50 000			0	0	300 000	0	0	300 000		
											0	0	0	0	0	0		
	- M-P 150 h / un		24	3 600	h	24.00					86 400	0	0	0	0	86 400		3 600
											0	0	0	0	0	0		
	- Miscelaneous			24	un		500.00		3 500.00		0	12 000	0	84 000	0	96 000		
											0	0	0	0	0	0		
	Battery System										0	0	0	0	0	0		
	- 125 V battery Protect. A			1	un			40 000			0	0	40 000	0	0	40 000		
	- 125 V battery Protect. B			1	un			40 000										
	- 125 V battery Primer			1	un			15 000			0	0	15 000	0	0	15 000		
	- Batery charger 300 A			2	un			65 000			0	0	130 000	0	0	130 000		
	- Batery charger 50 A			1	un			25 000			0	0	25 000	0	0	25 000		
	- 120 V «Onduleur» 10 kVA			1	un			40 000			0	0	40 000	0	0	40 000		
											0	0	0	0	0	0		
	- M-P 120 h / un		7	840.0	h	24.00					20 160	0	0	0	0	20 160		840
											0	0	0	0	0	0		
	- Miscelaneous			7	un		100.00		600.00		0	700	0	4 200	0	4 900		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3720	**Supply and Installation of High voltage distribution plant**										**1 210 560**	**57 800**	**5 445 000**	**434 600**	**0**	**7 147 960**		**50 440**

3730 Permanent camp Utilities Substation

WBS	DESCRIPTION	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3731	**Water treatment Area Substation**	**0**	**0**													
	Included in Underground utilities															
									0	0	0	0	0	0		
									0	0	0	0	0	0		
									0	0	0	0	0	0		
									0	0	0	0	0	0		
									0	0	0	0	0	0		
3731	**Water treatment Area Substation**								**0**	**0**	**0**	**0**	**0**	**0**		**0**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
3732	**Administration Building Area Substation**			0	0													
	Included in Underground utilities																	
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3732	**Administration Building Area Substation**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3733	**Sewage Treatment Area Substation**			0	0													
	Included in Underground utilities																	
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3733	**Sewage Treatment Area Substation**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3734	**Fire & Process Water Area Pumping Station Substation**			0	0													
	Included in Underground utilities																	
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3734	**Fire & Process Water Area Pumping Station Substation**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3735	**Maintenance Shop and Warehouse Area Substation**			0	0													
	Included in Underground utilities																	
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3735	**Maintenance Shop and Warehouse Area Substation**										**0**	**0**	**0**	**0**	**0**	**0**		**0**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel l / h	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3736	**Port Facility Substation**			**0**	**0**													
	Included in 3210 - Warf facilities																	
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3736	**Port Facility Substation**										**0**	**0**	**0**	**0**	**0**	**0**		**0**
3740	**Emergency Generator**			**0**	**0**													
	Purchase and Installation										0	0	0	0	0	0		
	- Generator and Fuel tank			1	un			170 000			0	0	170 000	0	0	170 000		
											0	0	0	0	0	0		
	- M-P		1	100.0	h	24.00					2 400	0	0	0	0	2 400		100
											0	0	0	0	0	0		
	- Miscelaneous			1	un		1 000		1 500		0	1 000	0	1 500	0	2 500		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3740	**Emergency Generator**										**2 400**	**1 000**	**170 000**	**1 500**	**0**	**174 900**		**100**
3750	**Plant Communications**			**0**	**0**													
	Purchase and Installation										0	0	0	0	0	0		
	- Communications			1	ls			280 000			0	0	280 000	0	0	280 000		
	- Fire detection			1	ls			500 000			0	0	500 000	0	0	500 000		
															0			
															0			
	- M-P			6 500	h	24.00					156 000	0	0	0	0	156 000		6 500
											0	0	0	0	0	0		
	- Miscelaneous			1	un		25 000.0		100 000		0	25 000	0	100 000	0	125 000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3750	**Plant Communications**										**156 000**	**25 000**	**780 000**	**100 000**	**0**	**1 061 000**		**6 500**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3760	**Power plant Command Circuitry**																	
	Purchase and Installation										0	0	0	0	0	0		
	- Command cables			1	ls			700 000			0	0	700 000	0	0	700 000		
	- Supply cables			1	ls			1 200 000			0	0	1 200 000	0	0	1 200 000		
	- Cable Trays			1	ls			1 200 000			0	0	1 200 000	0	0	1 200 000		
	- Control pannels			1	ls			700 000			0	0	700 000	0	0	700 000		
	- Malt			1	ls			300 000			0	0	300 000	0	0	300 000		
											0	0	0	0	0	0		
	- M-P			50 000	h	24.00					1 200 000	0	0	0	0	1 200 000		50 000
											0	0	0	0	0	0		
	- Miscelaneous			1	ls		300 000		700 000		0	300 000	0	700 000	0	1 000 000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3760	**Power plant Command Circuitry**										**1 200 000**	**300 000**	**4 100 000**	**700 000**	**0**	**6 300 000**		**50 000**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3770	**Switch yard Site**																	
	Backfll included in excavation materials from tunnels										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Pavement 200 x 150 200 150			**30 000**	**m²**						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Say 0.5 m of crushed stone			15 000	m³						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Production of 1 200 m³ / sh			13	sh						0	0	0	0	0	0		
	10 h / sh			130	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		10	1 300	h	24.00					31 200	0	0	0	0	31 200		1 300
											0	0	0	0	0	0		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	90%	1	117	h				28.40	26.10	0	0	0	3 323	2 199	5 522		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	45%	6	351	h				24.00	20.00	0	0	0	8 424	5 054	13 478		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	25%	1	33	h				14.85	20.00	0	0	0	490	475	965		
	- Cat 14M Motorgrader 16.65 25.75	90%	1	117	h				16.65	25.75	0	0	0	1 948	2 169	4 117		
	- Cat 980H Wheel Loader 29.00 23.45	90%	1	117	h				29.00	23.45	0	0	0	3 393	1 975	5 368		
											0	0	0	0	0	0		
	Hauling distance from crusher 5.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 4										0	0	0	0	0	0		
	Trip up 9 35 km / h										0	0	0	0	0	0		
	Unloading 4										0	0	0	0	0	0		
	Back trip 9 35 km / h										0	0	0	0	0	0		
	26 min.										0	0	0	0	0	0		
	Efficiency : 85% 31 min. / trip										0	0	0	0	0	0		
	0.51 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	18 trips / sh										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12.0 m³										0	0	0	0	0	0		
	216 m³/mach/sh										0	0	0	0	0	0		
	Number of trucks per shift **6**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Pavement material 1.8 mt / m³ 0.11 h / mt			27 000	mt	2.61	8.08	0.00	2.60	11.98	70 470	218 160	0	70 200	232 891	591 721		2 970
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3770	**Switch yard Site**										**101 670**	**218 160**	**0**	**87 778**	**244 763**	**652 371**		**4 270**
3780	**Supply Line to Power Tunnel Intake**			**19**	**km**													
	Supply			19 000	m			123.15			0	0	2 339 850	0	0	2 339 850		
	- Conductor										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concrete cover from 1 0.09 m³ / m 2.6082 h / m³			855	m³	62.54	17.48	155.35	24.23	22.05	53 468	14 942	132 822	20 716	13 576	235 524		2 230
	- Concrete cover from 2 0.09 m³ / m 4.0420 h / m³			855	m³	96.85	5.10	186.47	35.08	13.03	82 805	4 361	159 429	29 992	8 022	284 609		3 456
	- Miscellaneous (transfo, switch, etc.)			1	ls			200 000			0	0	200 000	0	0	200 000		
											0	0	0	0	0	0		
	Install			**19 000**	**m**						0	0	0	0	0	0		
	Produuction of 175 m / sh			109	sh						0	0	0	0	0	0		
	16 m³ 10 h / sh			1 086	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	6 514		24.00					156 343	0	0	0	0	156 343		6 514
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	977	h				19.00	29.00	0	0	0	18 563	20 400	38 963		
	- Readymix 8 m³ 13.60 14.00	90%	1	977	h				13.60	14.00	0	0	0	13 287	9 848	23 135		
	- Boom truck 17 tons 13.65 18.00	25%	1	271	h				13.65	18.00	0	0	0	3 699	3 512	7 211		
											0	0	0	0	0	0		
	- Miscelaneous			19 000	m		5.00				0	95 000	0	0	0	95 000		
											0	0	0	0	0	0		
	Concrete transportation from the Batching Plans			**1 710**	**m³**						0	0	0	0	0	0		
	Average production 16 m³ / sh			109	sh						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Average hauling distance : 8.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 16 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 14 35 km / h										0	0	0	0	0	0		
	55 min.										0	0	0	0	0	0		
	Efficacité : 85% 65 min. / trip										0	0	0	0	0	0		
	1.08 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	9 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	72 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		

Item : **(3710 to 3790)**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3780	**Supply Line to Power Tunnel Intake**										**292 616**	**114 303**	**2 832 101**	**86 257**	**55 358**	**3 380 635**		**12 200**
3790	**Supply Line to Tunnel 1 Intake**			**20**	**km**													
	Supply			20 000	m			123.15			0	0	2 463 000	0	0	2 463 000		
	- Conductor										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Concrete cover from 2 0.09 m³ / m 4.0420 h / m³			900	m³	96.85	5.10	186.47	35.08	13.03	87 163	4 590	167 820	31 570	8 444	299 587		3 638
	- Concrete cover from 3 0.09 m³ / m 1.8726 h / m³			900	m³	44.80	10.69	308.59	13.56	10.78	40 318	9 620	277 733	12 201	6 984	346 856		1 685
	- Miscellaneous (transfo, switch, etc.)			1	ls			200 000			0	0	200 000	0	0	200 000		
											0	0	0	0	0	0		
	Install			**20 000**	**m**						0	0	0	0	0	0		
	Produuction of 175 m / sh			114	sh						0	0	0	0	0	0		
	16 m³ 10 h / sh			1 143	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	6 857		24.00					164 571	0	0	0	0	164 571		6 857
											0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	1 029	h				19.00	29.00	0	0	0	19 551	21 486	41 037		
	- Readymix 8 m³ 13.60 14.00	90%	1	1 029	h				13.60	14.00	0	0	0	13 994	10 372	24 366		
	- Boom truck 17 tons 13.65 18.00	25%	1	286	h				13.65	18.00	0	0	0	3 904	3 707	7 611		
											0	0	0	0	0	0		
	- Miscelaneous			20 000	m		5.00				0	100 000	0	0	0	100 000		
											0	0	0	0	0	0		
	Concrete transportation from the Batching Plans			**1 800**	**m³**						0	0	0	0	0	0		
	Average production 16 m³ / sh			114	sh						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Average hauling distance : 8.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 10										0	0	0	0	0	0		
	Going 16 30 km / h										0	0	0	0	0	0		
	Unloading 15										0	0	0	0	0	0		
	Return 14 35 km / h										0	0	0	0	0	0		
	55 min.										0	0	0	0	0	0		
	Efficacité : 85% 65 min. / trip										0	0	0	0	0	0		
	1.08 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	9 trips / sh										0	0	0	0	0	0		
	Readymix 8 m³ 8 m³										0	0	0	0	0	0		
	72 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **1**										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3790	**Supply Line to Tunnel 1 Intake**										**292 052**	**114 210**	**3 108 553**	**81 220**	**50 993**	**3 647 028**		**12 180**

WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
										UNIT PRICES				TOTAL COSTS							
										USD »»	0.90			35.00 $				0.72 $			
3800	**Mechanical + Electrical Works**																				
3810	**Supply and Installation of Turbine/Generators assemblies**																				
	Supply													0	0	0	0	0	0		
	- Turbine		2	Sets			1	ls			5,582,315			0	0	5,582,315	0	0	5,582,315		
	- Governor		2	Sets			1	ls			315,064			0	0	315,064	0	0	315,064		
	- Spherical		2	Sets			1	ls			693,767			0	0	693,767	0	0	693,767		
	- Cooling		Prop	Set			1	ls			580,153			0	0	580,153	0	0	580,153		
	- Compressed		Prop	Sets			1	ls			36,705			0	0	36,705	0	0	36,705		
														0	0	0	0	0	0		
	- Instrumentation		1	set			1	ls			594,311			0	0	594,311	0	0	594,311		
														0	0	0	0	0	0		
	- Generator		2	Sets			1	ls			6,394,980			0	0	6,394,980	0	0	6,394,980		
	- Excitation		2	Sets			1	ls			505,391			0	0	505,391	0	0	505,391		
														0	0	0	0	0	0		
	- DCS/SCADASystem/MMI		1	Set			1	ls			1,692,631			0	0	1,692,631	0	0	1,692,631		
	- 11kVBusDuct		2	Sets			1	ls			985,130			0	0	985,130	0	0	985,130		
	- FireProtection		Prop	Sets			1	ls			86,777			0	0	86,777	0	0	86,777		
	- ProtectionMetering		Prop	Sets			1	ls			495,728			0	0	495,728	0	0	495,728		
	- UAT's+SST		Prop	Sets			1	ls			207,377			0	0	207,377	0	0	207,377		
	- UAB's+SSB		Prop	Sets			1	ls			256,953			0	0	256,953	0	0	256,953		
	- DCSystem		Prop	Sets			1	ls			414,472			0	0	414,472	0	0	414,472		
	- CablesAccessories		Prop	Sets			1	ls			799,625			0	0	799,625	0	0	799,625		
														0	0	0	0	0	0		
	- Spares (4 runners)		Special	set			1	ls			3,843,131			0	0	3,843,131	0	0	3,843,131		
														0	0	0	0	0	0		
	- FirstFill+Tools		Prop	Set			1	ls			156,330			0	0	156,330	0	0	156,330		
														0	0	0	0	0	0		
	- OptionalModelTesting		1	Set			1	ls			407,081			0	0	407,081	0	0	407,081		
											24,047,921			0	0	0	0	0	0		
	Erection and Commissioning													0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P		81,000	h / gr		2	162,000	h	35.00					5,670,000	0	0	0	0	5,670,000		162,000
														0	0	0	0	0	0		
	- Miscelaneous	6,199,693 $			10%		1	ls		619,969		309,985		0	619,969	0	309,985	0	929,954		
					5%									0	0	0	0	0	0		
														0	0	0	0	0	0		
3810	**Supply and Installation of Turbine/Generators assemblies**													**5,670,000**	**619,969**	**24,047,921**	**309,985**	**0**	**30,647,875**		**162,000**
3820	**Supply and installation of Power tunnel intake Gates and Valves**																				
	Supply and Installation													0	0	0	0	0	0		
	Intake																				
		(kg)												0	0	0	0	0	0		
	Trash Rack	22,000					22,000	kg			9.00			0	0	198,000	0	0	198,000		
	Stop logs	9,000					9,000	kg			12.00			0	0	108,000	0	0	108,000		
	Embedded parts	24,000					24,000	kg			9.00			0	0	216,000	0	0	216,000		
	Gates	8,000					8,000	kg			14.00			0	0	112,000	0	0	112,000		

WBS	DESCRIPTION		%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES				TOTAL COSTS							
								USD »»	0.90			35.00 $				0.72 $			
	Spreader	3,500			3,500	kg			12.00			0	0	42,000	0	0	42,000		
	Winches	7,000			7,000	kg			14.00			0	0	98,000	0	0	98,000		
	Lining	8,000			8,000	kg			8.00			0	0	64,000	0	0	64,000		
		81,500										0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P	0.20 h / kg			16,300	h	35.00					570,500	0	0	0	0	570,500		16,300
												0	0	0	0	0	0		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
3820	**Supply and installation of Power tunnel intake Gates and Valves**											**570,500**	**0**	**838,000**	**0**	**0**	**1,408,500**		**16,300**
3830	**Supply and installation of Tunnel 1 Regulating gates**																		
	Supply and Installation											0	0	0	0	0	0		
	Intake																		
		(kg)										0	0	0	0	0	0		
	Upstream Stop logs	5,000			5,000	kg			12.00			0	0	60,000	0	0	60,000		
	Stoplogs Embedded parts	19,000			19,000	kg			9.00			0	0	171,000	0	0	171,000		
	Gates	17,000			17,000	kg			14.00			0	0	238,000	0	0	238,000		
	Gates Embedded parts	22,000			22,000	kg			9.00			0	0	198,000	0	0	198,000		
	Stoplogs Lifting Beam	1,000			1,000	kg			12.00			0	0	12,000	0	0	12,000		
	Actuator	3,000			3,000	kg			14.00			0	0	42,000	0	0	42,000		
	Downstream Stop logs	5,000			5,000	kg			12.00			0	0	60,000	0	0	60,000		
	Downstream Stop logs Lifting Beam	1,000			1,000	kg			12.00			0	0	12,000	0	0	12,000		
	Monorail	4,000			4,000	kg			8.00			0	0	32,000	0	0	32,000		
		77,000										0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P	0.20 h / kg			15,400	h	35.00					539,000	0	0	0	0	539,000		15,400
												0	0	0	0	0	0		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
3830	**Supply and installation of Tunnel 1 Regulating gates**											**539,000**	**0**	**825,000**	**0**	**0**	**1,364,000**		**15,400**
3840	**Supply and installation of Draft tube Gates**																		
	Gates	2,500 kg / un 5,000		2	5,000	kg			14.00			0	0	70,000	0	0	70,000		
	Embedded parts	5,000 kg / un 10,000		2	10,000	kg			9.00			0	0	90,000	0	0	90,000		
	Gantry crane	5000			5,000	kg			14.00			0	0	70,000	0	0	70,000		
		20,000										0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P	0.20 h / kg			4,000	h	35.00					140,000	0	0	0	0	140,000		4,000
0	**0**											**140,000**	**0**	**230,000**	**0**	**0**	**370,000**		**4,000**
3850	**Supply the overhead crane**				**1**	**ls**													
	Supply											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat. (UNIT PRICES)	Perm. Mat. (UNIT PRICES)	Equip. Op. (UNIT PRICES)	Fuel l / h (UNIT PRICES)	Man power (TOTAL COSTS)	Consumable materials (TOTAL COSTS)	Permanent Materials (TOTAL COSTS)	Equipment Operation (TOTAL COSTS)	Fuel Consumption (TOTAL COSTS)	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
							USD »»	0.90			35.00 $				0.72 $			
	- 265 / 25 mt Over head crane 1,750,000 CDN			1	un			1,575,000			0	0	1,575,000	0	0	1,575,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3850	**Supply the overhead crane**										**0**	**0**	**1,575,000**	**0**	**0**	**1,575,000**		**0**

3860 Underground Utilities

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3861	**Fire water System**			**0**	**0**													
	Supply and Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Protection incendie 539,000 $	75%		1	ls			404,250			0	0	404,250	0	0	404,250		
											0	0	0	0	0	0		
	- M-P			2,500	h	35.00					87,500	0	0	0	0	87,500		2,500
											0	0	0	0	0	0		
	- Miscelaneous Equipment and Materials	2%		1	ls		10,780		26,950		0	10,780	0	26,950	0	37,730		
		5%									0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3861	**Fire water System**										**87,500**	**10,780**	**404,250**	**26,950**	**0**	**529,480**		**2,500**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3862	**Potable Water System**			**0**	**0**													
	Supply and Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Potable Water 796,000 $	75%		1	ls			597,000			0	0	597,000	0	0	597,000		
											0	0	0	0	0	0		
	- M-P			3,200	h	35.00					112,000	0	0	0	0	112,000		3,200
											0	0	0	0	0	0		
	- Miscelaneous Equipment and Materials	2%		1	ls		15,920		39,800		0	15,920	0	39,800	0	55,720		
		5%									0	0	0	0	0	0		
											0	0	0	0	0	0		
3862	**Potable Water System**										**112,000**	**15,920**	**597,000**	**39,800**	**0**	**764,720**		**3,200**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3863	**Sewage and Sanitary System**																	
	Supply and Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
							UNIT PRICES				TOTAL COSTS							
							USD »»	0.90			35.00 $				0.72 $			
	Drainage des eaux claires 835,000 $										0	0	0	0	0	0		
	Drainage des eaux usées 730,000 $										0	0	0	0	0	0		
	Drainage des eaux huileuses 361,000 $														0			
	Manutention des huiles 470,000 $														0			
	2,396,000 $	80%		1	ls			1,916,800			0	0	1,916,800	0	0	1,916,800		
											0	0	0	0	0	0		
	- M-P			6,900	h	35.00					241,500	0	0	0	0	241,500		6,900
											0	0	0	0	0	0		
	- Miscelaneous Equipment and Materials	2%		1	ls		47,920		119,800		0	47,920	0	119,800	0	167,720		
		5%									0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3863	**Sewage and Sanitary System**										**241,500**	**47,920**	**1,916,800**	**119,800**	**0**	**2,326,020**		**6,900**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3864	**Compressed Air System**																	
	Supply and Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Air comprimé basse pression (air de service) 608,000 $	80%		1	ls			486,400			0	0	486,400	0	0	486,400		
											0	0	0	0	0	0		
															0			
	- M-P			1,750	h	35.00					61,250	0	0	0	0	61,250		1,750
											0	0	0	0	0	0		
	- Miscelaneous Equipment and Materials	2%		1	ls		12,160		30,400		0	12,160	0	30,400	0	42,560		
		5%									0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3864	**Compressed Air System**										**61,250**	**12,160**	**486,400**	**30,400**	**0**	**590,210**		**1,750**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3865	**Process Water System**																	
	Supply and Installation										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Eau de service 586,000 $														0			
	Limnimètres et piézomètres 94,000 $										0	0	0	0	0	0		
	680,000 $	80%		1	ls			544,000			0	0	544,000	0	0	544,000		
															0			
	- M-P			2,000	h	35.00					70,000	0	0	0	0	70,000		2,000
											0	0	0	0	0	0		
	- Miscelaneous Equipment and Materials	2%		1	ls		13,600		34,000		0	13,600	0	34,000	0	47,600		
		5%									0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3865	**Process Water System**										**70,000**	**13,600**	**544,000**	**34,000**	**0**	**661,600**		**2,000**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
3866	**CVAC**																	

WBS	DESCRIPTION		%	n	Qty	Un.	M-P	UNIT PRICES Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								USD »»	0.90			35.00 $				0.72 $			
	Supply and Installation											0	0	0	0	0	0		
												0	0	0	0	0	0		
	Ventilation des bureaux informatique	200,000 $										0	0	0	0	0	0		
	Ventilation des bureaux	225,000 $										0	0	0	0	0	0		
	Ventilation - Plancher alternateurs	600,000 $										0	0	0	0	0	0		
	Ventilation - Bâches et conduites forcées	300,000 $										0	0	0	0	0	0		
	Ventilation - Salle des compresseurs	10,000 $										0	0	0	0	0	0		
	Ventilation - Salle mécanique	90,000 $										0	0	0	0	0	0		
	Ventilation - Galerie des transformateurs	250,000 $										0	0	0	0	0	0		
	Alimentation d'air extérieur - Centrale	1,000,000 $										0	0	0	0	0	0		
	Ventilation - Salle des batteries	50,000 $										0	0	0	0	0	0		
	Ventilation - Salle des huiles et salle des hydrocarbures	75,000 $										0	0	0	0	0	0		
	Ventilation - Hotte de soudure mobile	70,000 $										0	0	0	0	0	0		
	Ventilation - Hotte de soudure des bâches	125,000 $										0	0	0	0	0	0		
	Ventilation - Galerie d'accès permanent	90,000 $										0	0	0	0	0	0		
	Ventilation et chauffage - Salle de traitement des eaux usées	125,000 $										0	0	0	0	0	0		
	Ventilation - Atelier mécanique	70,000 $										0	0	0	0	0	0		
	Ventilation - Atelier électrique	60,000 $										0	0	0	0	0	0		
	Pressurisation des escaliers	80,000 $										0	0	0	0	0	0		
	Ventilation - Salle de traitement d'eau potable	50,000 $										0	0	0	0	0	0		
	Ventilation - Salle de mécanique de l'ascenseur	20,000 $										0	0	0	0	0	0		
	Ventilation - Salle des pompes	20,000 $										0	0	0	0	0	0		
	Ventilation - Gaz délétères	150,000 $										0	0	0	0	0	0		
	Ventilation et chauffage - Prise d'eau	125,000 $										0	0	0	0	0	0		
	Ventilation - Toilettes	10,000 $										0	0	0	0	0	0		
	Ventilation - Entrepôt des pièces de rechange	25,000 $										0	0	0	0	0	0		
	Ventilation - Salle électrique	60,000 $										0	0	0	0	0	0		
	Système de supervision SCADA	20,000 $										0	0	0	0	0	0		
	Système de supervision SCADA	20,000 $										0	0	0	0	0	0		
	Système de supervision SCADA	20,000 $										0	0	0	0	0	0		
	Système de supervision SCADA	20,000 $										0	0	0	0	0	0		
		3,960,000 $	80%		1	ls			3,168,000			0	0	3,168,000	0	0	3,168,000		
	- M-P				11,500	h	35.00					402,500	0	0	0	0	402,500		11,500
	- Miscelaneous Equipment and Materials		2%		1	ls		79,200		198,000		0	79,200	0	198,000	0	277,200		
			5%									0	0	0	0	0	0		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
3866	**CVAC**											**402,500**	**79,200**	**3,168,000**	**198,000**	**0**	**3,847,700**		**11,500**

Item : (3910)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
3910	**Service Building**																	
	Supply and install										0	0	0	0	0	0		
	L W H Volume										0	0	0	0	0	0		
	- Service building 68 30 7 14280			14,280	m³			385.00			0	0	5,497,800	0	0	5,497,800		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
3910	**Service Building**										**0**	**0**	**5,497,800**	**0**	**0**	**5,497,800**		**0**

6100 Temporary Construction Facilities

6110 Work Areas, including Buildings

6113 Work Areas, including Buildings - Hydro Site 6g

DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES					TOTAL COSTS							
													24.00 $				0.72 $			
Site preparation																				
Main camp area	30 000 (300 x 100)												0	0	0	0	0	0		
Dam site area	20 000 (200 x 100)												0	0	0	0	0	0		
Roads	12 000 (3000 x 4)																0			
T-Line area - Site 1	15 600 (120 x1 30)																			
T-Line area - Site 2	15 600 (120 x1 30)																			
	93 200 m²	3 000 m² / sh				32	sh						0	0	0	0	0	0		
		10 h / sh				320	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
- M-P					6	1 920	h	24.00					46 080	0	0	0	0	46 080		1 920
													0	0	0	0	0	0		
- Cat D7R II LGP Track-Type Tractor	38.25	28.00		90%	1	288	h				38.25	28.00	0	0	0	11 016	5 806	16 822		
- Cat 725 Articulated Dumper 25 T	24.00	20.00		90%	3	864	h				24.00	20.00	0	0	0	20 736	12 442	33 178		
- Cat 329DL Hydraulic Excavator	19.00	29.00		90%	1	288	h				19.00	29.00	0	0	0	5 472	6 013	11 485		
													0	0	0	0	0	0		
- Misc. (Dust control, accessories, etc..)						1	ls		10 000				0	10 000	0	0	0	10 000		
													0	0	0	0	0	0		
Buildings					Cnt			L	W	H	Tansp. Vol. (cu-ft)	(m³)	Months							
Site 1 Area																				
- Office					8	2 560	sf	40	8	8	20 480	580	60							
- Garage	Fold-Away	100	60		14	4 480	sf	32	10	4	17 920	508	60							
- Trade shop	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Warehouse	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Dry House	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Wash Room					2	480	sf	30	8	8	3 840	109	60							
- Foremen Office					2	640	sf	40	8	8	5 120	145	60							
Site 2 Area																				
- Office					4	1 280	sf	40	8	8	10 240	290	60							
- Garage	Fold-Away	100	60		14	4 480	sf	32	10	4	17 920	508	60							
- Trade shop	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Warehouse	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Dry House	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Wash Room					2	480	sf	30	8	8	3 840	109	60							
- Foremen Office					2	640	sf	40	8	8	5 120	145	60							
Site 3 Area																				
- Office					4	1 280	sf	40	8	8	10 240	290	60							
- Garage	Fold-Away	100	60		14	4 480	sf	32	10	4	17 920	508	60							
- Trade shop	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Warehouse	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Dry House	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Wash Room					2	480	sf	30	8	8	3 840	109	60							
- Foremen Office					2	640	sf	40	8	8	5 120	145	60							
Site 4 Area																				
- Office					4	1 280	sf	40	8	8	10 240	290	60							
- Garage	Fold-Away	100	60		14	4 480	sf	32	10	4	17 920	508	60							
- Trade shop	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Warehouse	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Dry House	Fold-Away	80	40		12	2 640	sf	22	10	4	10 560	299	60							
- Wash Room					2	480	sf	30	8	8	3 840	109	60							
- Foremen Office					2	640	sf	40	8	8	5 120	145	60							

Item : **(6113-6143)**

WBS	DESCRIPTION					%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
										UNIT PRICES					TOTAL COSTS							
															24.00 $				0.72 $			
	Purchase																					
	- Office							6 400	sf		95.00				0	608 000	0	0		608 000		
	- Garage							17 920	sf		15.00				0	268 800	0	0		268 800		
	- Trade shop							10 560	sf		15.00				0	158 400	0	0		158 400		
	- Warehouse							10 560	sf		15.00				0	158 400	0	0		158 400		
	- Dry House							10 560	sf		15.00				0	158 400	0	0		158 400		
	- Wash Room							1 920	sf		60.00				0	115 200	0	0		115 200		
	- Foremen Office							2 560	sf		47.00				0	120 320	0	0		120 320		
	- Containers 8' x 20'							40	un		6 400				0	256 000	0	0		256 000		
															0	0	0	0		0		
															0	0	0	0		0		
	Installation and dismantling		20 sh / site					80	sh						0	0	0	0		0		
				10 h / sh				800	h						0	0	0	0		0		
															0	0	0	0		0		
	- M-O						20	16 000	h	24.00					384 000	0	0	0	0	384 000		16 000
															0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00			90%	1	720	h				37.00	14.40	0	0	0	26 640	7 465	34 105		
	- Cat 329DL Hydraulic Excavator	19.00	29.00			90%	1	720	h				19.00	20.88	0	0	0	13 680	10 824	24 504		
	- Boom truck 17 tons	13.65	18.00			90%	1	720	h				13.65	12.96	0	0	0	9 828	6 718	16 546		
																			0			
	Materials	Building total ±	#########																0			
	- Wood					20%		1	ls		400 000				0	400 000	0	0	0	400 000		
	- Electrical					10%		1	ls		200 000				0	200 000	0	0	0	200 000		
	- Plumbing					15%		1	ls		300 000				0	300 000	0	0	0	300 000		
	- Dry-House					6%		1	ls		120 000				0	120 000	0	0	0	120 000		
	- Concrete					15%		1	ls		300 000				0	300 000	0	0	0	300 000		
																			0			
	Shops Equipment **Site**	**1**	**2**	**3**	**4**			1	ls		975 000				0	975 000	0	0	0	975 000		
																			0			
	- Wood shop	75 000	50 000	50 000	50 000										0	0	0	0	0	0		
	- Garage	50 000	50 000	50 000	50 000										0	0	0	0	0	0		
	- Electrical	75 000	50 000	50 000	50 000										0	0	0	0	0	0		
	- Plumbing	75 000	50 000	50 000	50 000										0	0	0	0	0	0		
	- Miscelaneous	25 000	25 000	25 000	25 000										0	0	0	0	0	0		
		300 000	225 000	225 000	225 000										0	0	0	0	0	0		
																			0			
	Concrete Batch Plan (1 unit for each site)														0	0	0	0	0	0		
															0	0	0	0	0	0		
	Installation	(Including heating of aggregates)													0	0	0	0	0	0		
	Duration		3 weeks / site					12	wk						0	0	0	0	0	0		
					60 h / wk			720	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						12	8 640	h	24.00					207 360	0	0	0	0	207 360		8 640
															0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05			75%	1	540	h				18.35	9.05	0	0	0	9 909	3 519	13 428		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00			40%	1	288	h				38.25	28.00	0	0	0	11 016	5 806	16 822		
	- Cat 329DL Hydraulic Excavator	19.00	29.00			30%	1	216	h				19.00	29.00	0	0	0	4 104	4 510	8 614		
	- Welding Machine - 400 A	2.00	6.00			60%	1	432	h				2.00	6.00	0	0	0	864	1 866	2 730		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00			30%	1	216	h				37.00	20.00	0	0	0	7 992	3 110	11 102		
	- Concrete	50 m³					1	50	m³		200.00				0	10 000	0	0	0	10 000		
															0	0	0	0	0	0		
	- Miscellaneous materials (Electrical, plumbing, mechanical, aggregates shelter, etc)							1	ls		75 000				0	75 000	0	0	0	75 000		
															0	0	0	0	0	0		
	Dismantling		90 h / site				1	360	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						8	2 880	h	24.00					69 120	0	0	0	0	69 120		2 880
															0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05			33%	1	119	h				18.35	9.05	0	0	0	2 184	775	2 959		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00			33%	1	119	h				38.25	28.00	0	0	0	4 552	2 399	6 951		
															0	0	0	0	0	0		
	Transportation to each site and back to harbour																					
		Trips	h / trip	Total											0	0	0	0	0	0		
	Site 2	6	10	60				60	h						0	0	0	0	0	0		

Item : **(6113-6143)**

WBS	DESCRIPTION				%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
														0	0	0	0	0	0		
	- M-P (Including loading and unloading)					4	240	h	24.00					5 760	0	0	0	0	5 760		240
														0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00		90%	1	54	h				11.50	15.00	0	0	0	621	583	1 204		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00		40%	1	24	h				33.00	18.00	0	0	0	792	311	1 103		
														0	0	0	0	0	0		
	- Miscellaneous						60	h		5.00				0	300	0	0	0	300		
														0	0	0	0	0	0		
	Site 3	6	20	120			120	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P (Including loading and unloading)					4	480	h	24.00					11 520	0	0	0	0	11 520		480
														0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00		90%	1	108	h				11.50	15.00	0	0	0	1 242	1 166	2 408		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00		20%	1	24	h				33.00	18.00	0	0	0	792	311	1 103		
														0	0	0	0	0	0		
	- Miscellaneous						120	h		5.00				0	600	0	0	0	600		
														0	0	0	0	0	0		
	Site 4	6	30	180			180	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P (Including loading and unloading)					4	720	h	24.00					17 280	0	0	0	0	17 280		720
														0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00		90%	1	162	h				11.50	15.00	0	0	0	1 863	1 750	3 613		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00		20%	1	36	h				33.00	18.00	0	0	0	1 188	467	1 655		
														0	0	0	0	0	0		
	- Miscellaneous						180	h		5.00				0	900	0	0	0	900		
														0	0	0	0	0	0		
	Crusher Plan System													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Installation and dismantling			5 sh / site			20	sh						0	0	0	0	0	0		
	- Crusher (300 t / h) (Included in 6300)			10 h / sh			200	h						0	0	0	0	0	0		
							0							0	0	0	0	0	0		
	- M-P					7	1 400	h	24.00					33 600	0	0	0	0	33 600		1 400
														0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05		75%	1	150	h				18.35	9.05	0	0	0	2 753	977	3 730		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		40%	1	80	h				38.25	28.00	0	0	0	3 060	1 613	4 673		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		30%	1	60	h				19.00	29.00	0	0	0	1 140	1 253	2 393		
														0	0	0	0	0	0		
	Transportation to each site and back to harbour																				
		Trips	h / trip	Total										0	0	0	0	0	0		
	Site 2	8	10	80			80	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P (Including loading and unloading)					4	320	h	24.00					7 680	0	0	0	0	7 680		320
														0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00		90%	1	72	h				11.50	15.00	0	0	0	828	778	1 606		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00		40%	1	32	h				33.00	18.00	0	0	0	1 056	415	1 471		
														0	0	0	0	0	0		
	- Miscellaneous						80	h		5.00				0	400	0	0	0	400		
														0	0	0	0	0	0		
	Site 3	8	20	160			160	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P (Including loading and unloading)					4	640	h	24.00					15 360	0	0	0	0	15 360		640
														0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00		90%	1	144	h				11.50	15.00	0	0	0	1 656	1 555	3 211		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00		20%	1	32	h				33.00	18.00	0	0	0	1 056	415	1 471		
														0	0	0	0	0	0		
	- Miscellaneous						160	h		5.00				0	800	0	0	0	800		
														0	0	0	0	0	0		
	Site 4	8	30	240			240	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P (Including loading and unloading)					4	960	h	24.00					23 040	0	0	0	0	23 040		960
														0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00		90%	1	216	h				11.50	15.00	0	0	0	2 484	2 333	4 817		

Item : **(6113-6143)**

WBS	DESCRIPTION			%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00	20%	1	48	h				33.00	18.00	0	0	0	1 584	622	2 206		
													0	0	0	0	0	0		
	- Miscellaneous					240	h		5.00				0	1 200	0	0	0	1 200		
	Asphalt plan												0	0	0	0	0	0		
													0	0	0	0	0	0		
	- Bitumen batching plant "drum mix" (400 t / h)		(Included in 6300)										0	0	0	0	0	0		
													0	0	0	0	0	0		
	Installation at the dam areas		5 sh / site			10	sh						0	0	0	0	0	0		
			10 h / sh			100	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				7	700	h	24.00					16 800	0	0	0	0	16 800		700
													0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05	20%	1	20	h				18.35	9.05	0	0	0	367	130	497		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	20%	1	20	h				38.25	28.00	0	0	0	765	403	1 168		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	20%	1	20	h				19.00	29.00	0	0	0	380	418	798		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	50%	1	50	h				37.00	20.00	0	0	0	1 850	720	2 570		
													0	0	0	0	0	0		
	- Miscelaneous					100	h		200.00				0	20 000	0	0	0	20 000		
													0	0	0	0	0	0		
	Transportation to each site and back to harbour																			
		Trips	h / trip	Total hours									0	0	0	0	0	0		
	Site 2	8	10	80		80	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P (Including loading and unloading)				4	320	h	24.00					7 680	0	0	0	0	7 680		320
													0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00	90%	1	72	h				11.50	15.00	0	0	0	828	778	1 606		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00	40%	1	32	h				33.00	18.00	0	0	0	1 056	415	1 471		
													0	0	0	0	0	0		
	- Miscellaneous					80	h		5.00				0	400	0	0	0	400		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
	Site 4	8	30	240		240	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P (Including loading and unloading)				4	960	h	24.00					23 040	0	0	0	0	23 040		960
													0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T	11.50	15.00	90%	1	216	h				11.50	15.00	0	0	0	2 484	2 333	4 817		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00	20%	1	48	h				33.00	18.00	0	0	0	1 584	622	2 206		
													0	0	0	0	0	0		
	- Miscellaneous					240	h		5.00				0	1 200	0	0	0	1 200		
	Explosives depots												0	0	0	0	0	0		
													0	0	0	0	0	0		
	Main camp area	10 000	(100 x 100)										0	0	0	0	0	0		
	Site 2 area	6 400	(80 x 80)										0	0	0	0	0	0		
	Site 3 area	6 400	(80 x 80)																	
	Site 4 area	6 400	(80 x 80)																	
	Roads	16 000	(4000 x 4)										0	0	0	0	0	0		
		45 200																		
	Access road and site preparation		45 200 m²										0	0	0	0	0	0		
			3 000 m² / sh			15	sh						0	0	0	0	0	0		
			10 h / sh			151	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				6	904	h	24.00					21 696	0	0	0	0	21 696		904
													0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	136	h				38.25	28.00	0	0	0	5 202	2 742	7 944		
	- Cat 725 Articulated Dumper 25 T	24.00	20.00	90%	3	407	h				24.00	20.00	0	0	0	9 768	5 861	15 629		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	136	h				19.00	29.00	0	0	0	2 584	2 840	5 424		
													0	0	0	0	0	0		
	Pavement	150 mm	6 780 m³										0	0	0	0	0	0		
	- Crushed Stone	1.8 mt / m³	**0.08 h / mt**			12 204	mt	1.94	0.00	0.00	2.27	1.58	23 676	0	0	27 703	13 883	65 262		976

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
													0	0	0	0	0	0		
	Fencing and gates												0	0	0	0	0	0		
	Main camp area	400 m											0	0	0	0	0	0		
	Site 2 area	320 m											0	0	0	0	0	0		
	Site 3 area	320 m											0	0	0	0	0	0		
	Site 4 area	320 m																		
		1 360 m																		
	- Gates		1 un / site			4	un		1 500				0	6 000	0	0	0	6 000		
	- Chain link					1 360	m		80.00				0	108 800	0	0	0	108 800		
			75 m / sh			18	sh						0	0	0	0	0	0		
			10 h / sh			180	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				5	900	h	24.00					21 600	0	0	0	0	21 600		900
																	0			
	- Boom truck 17 tons	13.65	18.00	90%	1	162	h				13.65	18.00	0	0	0	2 211	2 100	4 311		
	- Fence post auger	1.00	2.00	90%	1	162	h				1.00	2.00	0	0	0	162	233	395		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
6113	**Work Areas, including Buildings**												**936 972**	**4 374 120**	**0**	**207 052**	**119 280**	**5 635 744**		**38 960**

6120 Roads , Walkways, Parking Lots

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6123	**Roads , Walkways, Parking Lots - Hydro Site 6g**																			
	Main Camp site area	20 000											0	0	0	0	0	0		
	Site 2 area	20 000											0	0	0	0	0	0		
	Site 3 area	20 000																		
	Site 4 area	20 000																		
		80 000	3 000 m² / sh			27	sh													
			10 h / sh			270	h						0	0	0	0	0	0		
													0	0	0	0	0	0		
	- M-P				6	1 620	h	24.00					38 880	0	0	0	0	38 880		1 620
													0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	90%	1	243	h				38.25	28.00	0	0	0	9 295	4 899	14 194		
	- Cat 725 Articulated Dumper 25 T	24.00	20.00	90%	3	729	h				24.00	20.00	0	0	0	17 496	10 498	27 994		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	90%	1	243	h				19.00	29.00	0	0	0	4 617	5 074	9 691		
													0	0	0	0	0	0		
	- Misc. (Dust control, etc..)					1	ls		10 000				0	10 000	0	0	0	10 000		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
													0	0	0	0	0	0		
6123	**Roads , Walkways, Parking Lots**												**38 880**	**10 000**	**0**	**31 408**	**20 471**	**100 759**		**1 620**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
6130	**Utilities**																	
6133	**Utilities - Hydro Site 6g**																	
	Industrial Water installation										0	0	0	0	0	0		
	A) Main Camp area										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- High pressure pump 6" 2 un										0	0	0	0	0	0		
	- Support and shelter 1 un														0			
	- 4" isolated pipe 2 000 m														0			
	- Heathing cable 2 000 m										0	0	0	0	0	0		
	- Electrical line Including transfo, switches, etc… 2 000 m										0	0	0	0	0	0		
	- Culvert pipe 36" 20 m										0	0	0	0	0	0		
	- Coupplings 4" 409 un										0	0	0	0	0	0		
	- Fittings 32 un										0	0	0	0	0	0		
	- Valve 4" 6 un										0	0	0	0	0	0		
											0	0	0	0	0	0		
	B) Site 2 area										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- High pressure pump 6" 2 un										0	0	0	0	0	0		
	- Support and shelter 1 un														0			
	- 4" isolated pipe 1 000 m														0			
	- Heathing cable 1 000 m														0			
	- Electrical line Including transfo, switches, etc… 1 000 m														0			
	- Culvert pipe 36" 20 m														0			
	- Coupplings 4" 207 un														0			
	- Fittings 16 un														0			
	- Valve 4" 4 un														0			
															0			
	C) Site 3 area																	
	- High pressure pump 6" 2 un																	
	- Support and shelter 1 un																	
	- 4" isolated pipe 1 000 m																	
	- Heathing cable 1 000 m																	
	- Electrical line Including transfo, switches, etc… 1 000 m																	
	- Culvert pipe 36" 20 m																	
	- Coupplings 4" 207 un																	
	- Fittings 16 un																	
	- Valve 4" 4 un																	
	B) Site 4 area																	
	- High pressure pump 6" 2 un																	
	- Support and shelter 1 un																	
	- 4" isolated pipe 1 000 m																	
	- Heathing cable 1 000 m																	
	- Electrical line Including transfo, switches, etc… 1 000 m																	
	- Culvert pipe 36" 20 m																	
	- Coupplings 4" 207 un																	
	- Fittings 16 un																	
	- Valve 4" 4 un																	
	Marerials														0			
	- High pressure pump 6"			8	un		6 000				0	48 000	0	0	0	48 000		
	- Support and shelter			4	un		3 000				0	12 000	0	0	0	12 000		
	- 4" isolated pipe			5 000	m		75.00				0	375 000	0	0	0	375 000		
	- Heathing cable			5 000	m		6.00				0	30 000	0	0	0	30 000		
	- 600 v Electrical line Including transfo, switches, etc…			5 000	m		80.00				0	400 000	0	0	0	400 000		
	- Culvert pipe 36"			80	m		110.00				0	8 800	0	0	0	8 800		
	- Coupplings 4"			1 029	un		30.50				0	31 395	0	0	0	31 395		

WBS	DESCRIPTION					%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
										UNIT PRICES					TOTAL COSTS							
															24.00 $				0.72 $			
	- Fittings							80	un		60.00				0	4 800	0	0	0	4 800		
	- Valve 4"							18	un		275.00				0	4 950	0	0	0	4 950		
	- Pipe supports	5 m c/c						1 000	un		20.00				0	20 000	0	0	0	20 000		
	- Fire stations	10 un / site						40	un		350				0	14 000	0	0	0	14 000		
	- Misc.							1	ls		30 000				0	30 000	0	0	0	30 000		
															0	0	0	0	0	0		
	Installation & Dismantling		Duration												0	0	0	0	0	0		
															0	0	0	0	0	0		
	Main Camp area		30 sh												0	0	0	0	0	0		
	Site 2 area		16 sh												0	0	0	0	0	0		
	Site 3 area		16 sh																			
	Site 4 area		16 sh																			
			78 sh					78	sh													
			10 h / sh					780	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						6	4 680	h	24.00					112 320	0	0	0	0	112 320		4 680
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		45%	1	351	h				19.00	20.88	0	0	0	6 669	7 329	13 998		
	- Boom truck 17 tons		13.65	18.00		90%	1	702	h				13.65	12.96	0	0	0	9 582	9 098	18 680		
	- Crane - Rough terrain 50 t (L-Belt)		37.00	20.00		20%	1	156	h				37.00	14.40	0	0	0	5 772	2 246	8 018		
															0	0	0	0	0	0		
	Sewage														0	0	0	0	0	0		
	Linked to camp site system														0	0	0	0	0	0		
															0	0	0	0	0	0		
	- Miscelaneous materials	500 m / site						2 000	m		170.00				0	340 000	0	0	0	340 000		
															0	0	0	0	0	0		
	Installation & Dismantling	8 sh / site						32	sh						0	0	0	0	0	0		
					10 h / sh			320	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						6	1 920		24.00					46 080	0	0	0	0	46 080		1 920
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		25%	1	80	h				19.00	20.88	0	0	0	1 520	1 670	3 190		
	- Boom truck 17 tons		13.65	18.00		90%	1	288	h				13.65	12.96	0	0	0	3 931	3 732	7 663		
															0	0	0	0	0	0		
	Electrical supply														0	0	0	0	0	0		
	Supply	Site 1	Site 2	Site 3	Site 4										0	0	0	0	0	0		
	- 600 v Electrical line	1 000	500	500	500			2 500	m		80.00				0	200 000	0	0	0	200 000		
	- Misc.							2 500	m		50				0	125 000	0	0	0	125 000		
	- Enclosed building		6	x	10		4	240	m²		500.00				0	120 000	0	0	0	120 000		
																			0			
	Installation & Dismantling		Duration												0	0	0	0	0	0		
	Main Camp area		20 sh												0	0	0	0	0	0		
	Site 2 area		15 sh												0	0	0	0	0	0		
	Site 3 area		15 sh												0	0	0	0	0	0		
	Site 4 area		15 sh																			
			65 sh					65	sh													
			10 h / sh					650	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	- M-P						7	4 550	h	24.00					109 200	0	0	0	0	109 200		4 550
															0	0	0	0	0	0		
	- Cat 329DL Hydraulic Excavator		19.00	29.00		45%	1	293	h				19.00	20.88	0	0	0	5 567	6 118	11 685		
	- Boom truck 17 tons		13.65	18.00		90%	2	585	h				13.65	12.96	0	0	0	7 985	7 582	15 567		
															0	0	0	0	0	0		
	Generators Operation														0	0	0	0	0	0		
		Months	Years	Weeks											0	0	0	0	0	0		
	Main Camp area	48	4	208											0	0	0	0	0	0		
	Site 2 area	30	2.5	130											0	0	0	0	0	0		
	Site 3 area	18	1.5	78																		
	Site 4 area	18	1.5	78																		
		114 months		**494** **weeks**											0	0	0	0	0	0		
		7 d / w		24 h / day				82 992	h										0			
																			0			

Item : **(6113-6143)**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Cat GEP 150 - 100KW 4.50 30.70		4	331 968	h				4.50	22.10	0	0	0	1 493 856	7 337 821	8 831 677		
											0	0	0	0	0	0		
	- M-P 2 h / w 988 h		2	1 976	h	24.00					47 424	0	0	0	0	47 424		1 976
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6133	**Utilities**										**315 024**	**1 763 945**	**0**	**1 534 882**	**7 375 596**	**10 989 447**		**13 126**

6140 Weather Protection

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel L /h	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6143	**Weather Protection - Hydro Site 6g**																	
	Special weather protection is Included in appropriate items																	
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6143	**Weather Protection**										**0**	**0**	**0**	**0**	**0**	**0**		**0**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			

6200 Construction Services

6210 General Site Operation

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6213	**General Site Operation - Hydro Site 6g**																	
	Maintenance of buildings										0	0	0	0	0	0		
	Duration										0	0	0	0	0	0		
	Site 1 48														0			
	Site 2 30														0			
	Site 3 18																	
	Site 4 18																	
	78 mth														0			
															0			
	- Carpenter 15 h / mth			1,170	h	24.00					28,080	0	0	0	0	28,080		1,170
	- Electrician 20 h / mth			1,560	h	24.00					37,440	0	0	0	0	37,440		1,560
	- Plumber 5 h / mth			390	h	24.00					9,360	0	0	0	0	9,360		390
	- Labourer 15 h / mth			1,170	h	24.00					28,080	0	0	0	0	28,080		1,170
											0	0	0	0	0	0		
	Compressors operation										0	0	0	0	0	0		
	Generators operation — **Included in corresponding TBM and D+B activities**										0	0	0	0	0	0		
	Heathing operation										0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Vehicules										0	0	0	0	0	0		
	Site 1 48 mth 4 weeks / mth			192	w						0	0	0	0	0	0		
											0	0	0	0	0	0		
	1) Fuel truck 60 h / w			11,520	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	11,520	h	24.00					276,480	0	0	0	0	276,480		11,520
	- Fuel Truck 60 h / w 6.40 16.00	90%	1	10,368	h				6.40	11.52	0	0	0	66,355	85,996	152,351		
											0	0	0	0	0	0		
	2) Mechanics truck 30 h / w			5,760	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Mechanics truck 6.40 12.00	90%	1	5,184	h				6.40	8.64	0	0	0	33,178	32,249	65,427		
											0	0	0	0	0	0		
	3) Welding truck 45 h / w			8,640	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Welding truck 6.40 12.00	90%	1	7,776	h				6.40	8.64	0	0	0	49,766	48,373	98,139		
											0	0	0	0	0	0		
	4) Light vehicules										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Pick-up 30 l / day 780 l / mth			896	un-mth					780	0	0	0	0	503,194	503,194		
	- Crew cab 40 l / day 1040 l / mth			516	un-mth					1,040	0	0	0	0	386,381	386,381		
	- VUS 28 l / day 728 l / mth			241	un-mth					728	0	0	0	0	126,323	126,323		
	- Ambulance 16 l / day 80 l / mth			48	un-mth					80	0	0	0	0	2,765	2,765		
															0			
	Site 2 30 mth 4 weeks / mth			120	w						0	0	0	0	0	0		
											0	0	0	0	0	0		
	1) Fuel truck 60 h / w			7,200	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		1	7,200	h	24.00					172,800	0	0	0	0	172,800		7,200
	- Fuel Truck 60 h / w 6.40 16.00	90%	1	6,480	h				6.40	16.00	0	0	0	41,472	74,650	116,122		
											0	0	0	0	0	0		
	2) Mechanics truck 30 h / w			3,600	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Mechanics truck 6.40 12.00	90%	2	6,480	h				6.40	12.00	0	0	0	41,472	55,987	97,459		
											0	0	0	0	0	0		
	3) Welding truck 45 h / w			5,400	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Welding truck 6.40 12.00	90%	2	9,720	h				6.40	12.00	0	0	0	62,208	83,981	146,189		
											0	0	0	0	0	0		

WBS		DESCRIPTION				%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.72 $			
	4)	**Light vehicules**			26 d / month										0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	Pick-up	30 l / day		780 l / mth			295	un-mth					780	0	0	0	0	165,672	165,672		
	-	Crew cab	40 l / day		1040 l / mth			272	un-mth					1,040	0	0	0	0	203,674	203,674		
	-	VUS	28 l / day		728 l / mth			27	un-mth					728	0	0	0	0	14,152	14,152		
	-	Ambulance	16 l / day		80 l / mth			30	un-mth					80	0	0	0	0	1,728	1,728		
															0	0	0	0	0	0		
		Site 3	18 mth		4 weeks / mth			72	w						0	0	0	0	0	0		
															0	0	0	0	0	0		
	1)	**Fuel truck**		60 h / w				4,320	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	M-P					1	4,320	h	24.00					103,680	0	0	0	0	103,680		4,320
	-	Fuel Truck	60 h / w	6.40	16.00	90%	1	3,888	h				6.40	16.00	0	0	0	24,883	44,790	69,673		
															0	0	0	0	0	0		
	2)	**Mechanics truck**		30 h / w				2,160	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	Mechanics truck		6.40	12.00	90%	2	3,888	h				6.40	12.00	0	0	0	24,883	33,592	58,475		
															0	0	0	0	0	0		
	3)	**Welding truck**		45 h / w				3,240	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	Welding truck		6.40	12.00	90%	2	5,832	h				6.40	12.00	0	0	0	37,325	50,388	87,713		
															0	0	0	0	0	0		
	4)	**Light vehicules**													0	0	0	0	0	0		
					26 d / month										0	0	0	0	0	0		
	-	Pick-up	30 l / day		780 l / mth			142	un-mth					780	0	0	0	0	79,747	79,747		
	-	Crew cab	40 l / day		1040 l / mth			139	un-mth					1,040	0	0	0	0	104,083	104,083		
	-	VUS	28 l / day		728 l / mth			0	un-mth					728	0	0	0	0	0	0		
	-	Ambulance	16 l / day		80 l / mth			18	un-mth					80	0	0	0	0	1,037	1,037		
		Site 4	18 mth		4 weeks / mth			72	w						0	0	0	0	0	0		
															0	0	0	0	0	0		
	1)	**Fuel truck**		60 h / w				4,320	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	M-P					1	4,320	h	24.00					103,680	0	0	0	0	103,680		4,320
	-	Fuel Truck	60 h / w	6.40	16.00	90%	1	3,888	h				6.40	16.00	0	0	0	24,883	44,790	69,673		
															0	0	0	0	0	0		
	2)	**Mechanics truck**		30 h / w				2,160	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	Mechanics truck		6.40	12.00	90%	2	3,888	h				6.40	12.00	0	0	0	24,883	33,592	58,475		
															0	0	0	0	0	0		
	3)	**Welding truck**		45 h / w				3,240	h						0	0	0	0	0	0		
															0	0	0	0	0	0		
	-	Welding truck		6.40	12.00	90%	2	5,832	h				6.40	12.00	0	0	0	37,325	50,388	87,713		
															0	0	0	0	0	0		
	4)	**Light vehicules**													0	0	0	0	0	0		
					26 d / month										0	0	0	0	0	0		
	-	Pick-up	30 l / day		780 l / mth			181	un-mth					780	0	0	0	0	101,650	101,650		
	-	Crew cab	40 l / day		1040 l / mth			169	un-mth					1,040	0	0	0	0	126,547	126,547		
	-	VUS	28 l / day		728 l / mth			0	un-mth					728	0	0	0	0	0	0		
	-	Ambulance	16 l / day		80 l / mth			18	un-mth					80	0	0	0	0	1,037	1,037		
		Shop operation						312	w						0	0	0	0	0	0		
		Directs		1,591,019 m - hours											0	0	0	0	0	0		
		Indirects		456,380 m - hours											0	0	0	0	0	0		
		Miscelaneous		250,000 m - hours															0			
				2,297,399 m - hours											0	0	0	0	0	0		
	-	Small tools						2,297,399	h		0.30				0	689,220	0	0	0	689,220		
															0	0	0	0	0	0		
	-	Miscelaneous supplies						2,297,399	h		0.10				0	229,740	0	0	0	229,740		
															0	0	0	0	0	0		
		Roads Maintenance	mth	km																		
		Site 1	48	10																		
		Site 2	30	20																		
		Site 3	18	20																		

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Site 4 18 5																	
	78 **55** 338 weeks																	
	3 d / w 1,013 d										0	0	0	0	0	0		
	10 h / d			10,132	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		3	30,397	h	24.00					729,518	0	0	0	0	729,518		30,397
											0	0	0	0	0	0		
-	Cat 14M Motorgrader 16.65 25.75	90%	1	9,119	h				16.65	26	0	0	0	151,831	169,066	320,897		
-	10W - Truck 13.60 14.00	10%	1	1,013	h				13.60	14	0	0	0	13,777	10,211	23,988		
-	Cat 950H Wheel Loader 18.35 9.05	10%	1	1,013	h				18.35	9	0	0	0	18,589	6,601	25,190		
											0	0	0	0	0	0		
-	Miscelaneous			10,132	h		1.50				0	15,198	0	0	0	15,198		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	Communications Site 1 Site 2 Site 3 Site 4										0	0	0	0	0	0		
	Port. Radio 2,589 769 356 431			4,145	un-mth		50.00				0	207,250	0	0	0	207,250		
	Cell. 1,510 663 330 414			2,917	un-mth		120.00				0	350,040	0	0	0	350,040		
											0	0	0	0	0	0		
	Base 1 un / site			78	un-mth		120.00				0	9,360	0	0	0	9,360		
											0	0	0	0	0	0		
-	Repairs			78	mth		5,000				0	390,000	0	0	0	390,000		
											0	0	0	0	0	0		
-	Underground phone			1	ls		6,000				0	6,000	0	0	0	6,000		
											0	0	0	0	0	0		
-	Radio towers 1 un / site			4	un		26,000		1,000		0	104,000	0	4,000	0	108,000		
											0	0	0	0	0	0		
	Water Route																	
	Duration 18 month (including mob/demob)																	
	L (ft) W (ft) H (ft) V (cu ft)										0	0	0	0	0	0		
-	Landding barge (Unifloat) 18 8 6 17,280		20	360	mth - un		800				0	288,000	0	0	0	288,000		
-	Noze end 432 5,184		12	216	mth - un		250				0	54,000	0	0	0	54,000		
-	Service barge 50 12 6.5 7,800		2	36	mth - un		4,800				0	172,800	0	0	0	172,800		
-	Tug		2	36	mth - un		6,500				0	234,000	0	0	0	234,000		
-	Work boat		2	36	mth - un		3,000				0	108,000	0	0	0	108,000		
			38															
-	Miscelaneous (winches, anchors, generators, etc..) 856,800 $	10%		1	ls		85,680				0	85,680	0	0	0	85,680		
	Marine Equipment preparation and transportation										0	0	0	0	0	0		
	38 trips 20 h / trip (back and forth)			760	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		8	6,080	h	24.00					145,920	0	0	0	0	145,920		6,080
											0	0	0	0	0	0		
-	Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	50%	1	380	h				37.00	20.00	0	0	0	14,060	5,472	19,532		
-	Cat D6T LGP Track-Type Tractor 28.40 26.10	20%	1	152	h				28.40	26.10	0	0	0	4,317	2,856	7,173		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	20%	1	152	h				19.00	29.00	0	0	0	2,888	3,174	6,062		
-	Tractor truck & Load Carrier - 65 T 11.50 15.00	90%	1	684	h				11.50	15.00	0	0	0	7,866	7,387	15,253		
											0	0	0	0	0	0		
	Operation Barge Ice bridge										0	0	0	0	0	0		
	Duration 2,013 4 2										0	0	0	0	0	0		
	2,014 6 3										0	0	0	0	0	0		
	10 5										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Barge 26 d / mth 10 h / d			2,600	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	15,600	h	24.00					374,400	0	0	0	0	374,400		15,600
											0	0	0	0	0	0		
-	Miscellaneous			1	ls		50,000				0	50,000	0	0	0	50,000		
											0	0	0	0	0	0		
	Ice bridge 26 d / mth 10 h / d			1,300	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		6	7,800	h	24.00					187,200	0	0	0	0	187,200		7,800
											0	0	0	0	0	0		
-	Cat 14M Motorgrader 16.65 25.75	90%	1	1,170	h				16.65	25.75	0	0	0	19,481	21,692	41,173		
-	Cat 329DL Hydraulic Excavator 19.00 29.00	20%	1	260	h				19.00	29.00	0	0	0	4,940	5,429	10,369		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	- Cat 950H Wheel Loader 18.35 9.05	20%	1	260	h				18.35	9.05	0	0	0	4,771	1,694	6,465		
											0	0	0	0	0	0		
	- Miscellaneous			1	ls		5,000				0	5,000	0	0	0	5,000		
											0	0	0	0	0	0		
6213	**General Site Operation**										**2,196,638**	**2,998,288**	**0**	**715,153**	**2,690,348**	**8,600,427**		**91,527**

WBS	DESCRIPTION				%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
6220	**Final Clean Up**																				
6223	**Final Clean Up - Hydro Site 6g**																				
	Final clean up													0	0	0	0	0	0		
	Site 1	300												0	0	0	0	0	0		
	Site 2	200																			
	Site 3	200																			
	Site 4	200																			
		900 h					900	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					13	11,700	h	24.00					280,800	0	0	0	0	280,800		11,700
														0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt)		37.00	20.00	75%	1	675	h				37.00	20.00	0	0	0	24,975	9,720	34,695		
	- Cat 988H Wheel Loader		39.20	48.00	20%	1	180	h				39.20	48.00	0	0	0	7,056	6,221	13,277		
	- Cat 329DL Hydraulic Excavator		19.00	29.00	20%	1	180	h				19.00	29.00	0	0	0	3,420	3,758	7,178		
	- Cat 14M Motor grader		16.65	25.75	15%	1	135	h				16.65	25.75	0	0	0	2,248	2,503	4,751		
	- Cat D7R II LGP Track-Type Tractor		38.25	28.00	25%	1	225	h				38.25	28.00	0	0	0	8,606	4,536	13,142		
	- 10W - Truck		13.60	14.00	90%	1	810	h				13.60	14.00	0	0	0	11,016	8,165	19,181		
														0	0	0	0	0	0		
	- Miscellaneous						1	ls		10,000				0	10,000	0	0	0	10,000		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
6223	**Final Clean Up**													**280,800**	**10,000**	**0**	**57,321**	**34,903**	**383,024**		**11,700**

6230 Material Handling & Warehousing

6233 Material Handling & Warehousing - Hydro Site 6g

Durations

	Site 1	Site 2	Site 3	Site 4
2,011	30	0	0	0
2,012	50	26	0	0
2,013	50	50	26	20
2,014	50	50	50	50
2,015	8	8	0	0
Weeks	188	134	76	70

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Construction materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	General hauling and transportation on project										0	0	0	0	0	0		
											0	0	0	0	0	0		
	1) Boom Truck														0			
	Weeks										0	0	0	0	0	0		
	Site 1 188																	
	Site 2 134 2 un / site																	
	Site 3 76																	
	Site 4 70																	
	468 60 h / w			56,160	h													
	Less hours in direct costs		±	(18,672)	h													
				37,488	h													
	- M-P	100%	1	37,488	h	24.00					899,712	0	0	0	0	899,712		37,488
	- Boom truck 17 tons 13.65 18.00	90%	1	33,739	h				13.65	12.96	0	0	0	460,537	314,825	775,362		
	2) Tractor & carrier										0	0	0	0	0	0		
	Day Weeks										0	0	0	0	0	0		
	Site 1 188																	
	Site 2 134 1 un / site																	
	Site 3 76																	
	Site 4 70																	
	468 30 h / w			14,040	h													
	Less																	
	Included transportation in direct costs																	
	Cement 5,355 mt 40 mt / trip																	
	Rebar 960 mt 158 trip																	
	6,315 mt 1 trip / day																	
	10 h / day																	
	1,580 h			(1,580)														
				12,460	h													
	- Truck driver		1	12,460	h	24.00					299,040	0	0	0	0	299,040		12,460
											0	0	0	0	0	0		
	- Tractor truck & Load Carrier - 65 T 11.50 15.00	70%	1	8,722	h				11.50	10.80	0	0	0	100,303	67,822	168,125		
	- Tractor & Trailer 11.50 15.00	30%	1	3,738	h				11.50	10.80	0	0	0	42,987	29,067	72,054		
											0	0	0	0	0	0		
	3) Bus																	
	Day Weeks																	
	Site 1 188																	
	Site 2 134 2 un / site																	
	Site 3 76																	
	Site 4 70																	
	468 20 h / w			9,360	h													
	- Driver		2	18,720	h	24.00					449,280	0	0	0	0	449,280		18,720
	- Bus 5.30 16.00		2	18,720	h				5.30	11.52	0	0	0	99,216	155,271	254,487		

Item : (6233)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	4) Service crane										0	0	0	0	0	0		
	Day Weeks										0	0	0	0	0	0		
	Site 1 188										0	0	0	0	0	0		
	Site 2 134 1.5 un / site										0	0	0	0	0	0		
	Site 3 76																	
	Site 4 70																	
	468 60 h / w			42,120	h													
	Less hours in direct costs		±	(26,000)	h													
				16,120	h													
	- M-P		1	16,120	h	24.00					386,880	0	0	0	0	386,880		16,120
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	90%	1	37,908	h				37.00	20.00	0	0	0	1,402,596	545,875	1,948,471		
											0	0	0	0	0	0		
	4) Receiving and returning goods material			468	w		500				0	234,000	0	0	0	234,000		
											0	0	0	0	0	0		
	5) Yard crew 1 un / site														0			
	468 weeks 60 h / w			28,080	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		4	112,320		24.00					2,695,680	0	0	0	0	2,695,680		112,320
											0	0	0	0	0	0		
	- Miscelaneous			28,080	h		5.00				0	140,400	0	0	0	140,400		
											0	0	0	0	0	0		
	6) Fuel tanker 75 kL Trips h / trip										0	0	0	0	0	0		
	Needed capacity for Site 2 24,000 kL 320 10			3,200	h						0	0	0	0	0	0		
	Needed capacity for Site 3 6,000 kL 80 15			1,200	h													
	Needed capacity for Site 4 24,000 kL 320 35			11,200	h													
				15,600	h													
											0	0	0	0	0	0		
	- M-P		1	15,600	h	24.00					374,400	0	0	0	0	374,400		15,600
											0	0	0	0	0	0		
	- Fuel Tanker 11.50 15.00	90%	1	14,040	h				11.50	15.00	0	0	0	161,460	151,632	313,092		
											0	0	0	0	0	0		
	Fuel depots										0	0	0	0	0	0		
	Total fuel consumption on project Directs 16,492,135 liters										0	0	0	0	0	0		
	Indirects 39,731,068										0	0	0	0	0	0		
	56,223,203 liters										0	0	0	0	0	0		
	60,000,000 Say 60,000,000 total										0	0	0	0	0	0		
	Weeks kL / w																	
	Site 1 6,000,000 188 32	10%																
	Site 2 24,000,000 134 179	40%																
	Site 3 6,000,000 76 79	10%																
	Site 4 24,000,000 70 343	40%																
	60,000,000	100%									0	0	0	0	0	0		
	Needs Liters Months L/ month kL / week										0	0	0	0	0	0		
	2,011 10,000 6 1,667 0.4										0	0	0	0	0	0		
	2,012 2,500,000 12 208,400 48.1										0	0	0	0	0	0		
	2,013 28,890,000 12 2,407,500 556.0										0	0	0	0	0	0		
	2,014 28,590,000 12 2,382,500 550.2										0	0	0	0	0	0		
	2,015 10,000 1 10,000 2.3										0	0	0	0	0	0		
	60,000,000 43										0	0	0	0	0	0		
	kL / week For 2 months For 6 months																	
	Site 1 32 277 **Use of harbour depot**																	
	Site 2 179 1550										0	0	0	0	0	0		
	Site 3 79 684																	
	Site 4 343 2970 8,911																	

Project : 6g Cost Estimate.xlsx

Item : (6233)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES					TOTAL COSTS					GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption			
											24.00 $				0.72 $			
	Supply																	
	Site 2																	
	- Fuel tank 795 kL 154,000 $			2	un		154,000				0	308,000	0	0	0	308,000		
											0	0	0	0	0	0		
	- Miscelaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		30,800				0	30,800	0	0	0	30,800		
											0	0	0	0	0	0		
	Site 3																	
	- Fuel tank 795 kL 154,000 $			1	un		154,000				0	154,000	0	0	0	154,000		
											0	0	0	0	0	0		
	- Miscelaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		30,800				0	30,800	0	0	0	30,800		
											0	0	0	0	0	0		
	Site 4																	
	- Fuel tank 8,745 kL 578,000 $			1	un		578,000				0	578,000	0	0	0	578,000		
											0	0	0	0	0	0		
	- Miscelaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		115,600				0	115,600	0	0	0	115,600		
											0	0	0	0	0	0		
	Installation and removal 8 sh / un			24	sh						0	0	0	0	0	0		
	10 h / sh			240	sh						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		8	1,920	h	24.00					46,080	0	0	0	0	46,080		1,920
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	216	h				13.65	18.00	0	0	0	2,948	2,799	5,747		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	45%	1	108	h				19.00	29.00	0	0	0	2,052	2,255	4,307		
	- Cat D6T LGP Track-Type Tractor 28.40 26.10	45%	1	108	h				28.40	26.10	0	0	0	3,067	2,030	5,097		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	45%	1	108	h				37.00	20.00	0	0	0	3,996	1,555	5,551		
											0	0	0	0	0	0		
	- Miscelaneous			240	h		5.00				0	1,200	0	0	0	1,200		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6233	**Material Handling & Warehousing**										**5,151,072**	**1,592,800**	**0**	**2,279,162**	**1,273,131**	**10,296,165**		**214,628**

Item : (6243-6273)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
6240	**NDE & QA/QC Testing Services**																	
6243	**NDE & QA/QC Testing Services - Hydro Site 6g**																	
	- General Laboratory Shop and Field services			1	ls						0	0	0	0	0	2,000,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6243	**NDE & QA/QC Testing Services**										**0**	**0**	**0**	**0**	**0**	**2,000,000**		**0**
6250	**Surveying**																	
6253	**Surveying - Hydro Site 6g**																	
	Man Power is included in Item 8120																	
	Surveying Equipment										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Instruments Rental			78	mth		1,500.00				0	117,000	0	0	0	117,000		
											0	0	0	0	0	0		
	- Miscelaneous			78	mth		500.00				0	39,000	0	0	0	39,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6253	**Surveying**										**0**	**156,000**	**0**	**0**	**0**	**156,000**		**0**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Construction materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			

6260 Site Security

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6263	**Site Security - Hydro Site 6g**																	
	Man Power is included in Item 8120																	
	Safety Equipment and Materials										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Directs 1,591,019										0	0	0	0	0	0		
	Indirects 456,380										0	0	0	0	0	0		
	Miscelaneous 250,000										0	0	0	0	0	0		
	2,297,399 m - hours 100 months										0	0	0	0	0	0		
											0	0	0	0	0	0		
	1) First Aid										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- First aid material and medic care			########	h		0.048				0	110,275	0	0	0	110,275		
											0	0	0	0	0	0		
	- Security Equipment and Accessories			########	h		0.038				0	87,301	0	0	0	87,301		
											0	0	0	0	0	0		
	- Miscelaneous			########	h		0.091				0	209,063	0	0	0	209,063		
											0	0	0	0	0	0		
	2) Fire Protection			1	ls		160,000				0	160,000	0	0	0	160,000		
											0	0	0	0	0	0		
	3) Signalisation			1	ls		20,000.00				0	20,000	0	0	0	20,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6263	**Site Security**										**0**	**586,639**	**0**	**0**	**0**	**586,639**		**0**

6270 Man Power Transportation

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6273	**Man Power Transportation - Hydro Site 6g**																	
	Houly labour																	
	Directs 1,591,019 m - hours										0	0	0	0	0	0		
	Indirects 456,380 m - hours										0	0	0	0	0	0		
	Catering and maintenance 275,688 12% Total m_hours																	
	Miscelaneous 250,000 m - hours										0	0	0	0	0	0		
	2,573,086 m - hours										0	0	0	0	0	0		
	Say a trip at 40 days 400 h										0	0	0	0	0	0		
	6,433 trips										0	0	0	0	0	0		
	Helicopter flight 2 hours 903.00 $ 12 Passengers										0	0	0	0	0	0		
	Air fare 1,200.00 $										0	0	0	0	0	0		
	- Personal transportation 2,103.00 $			6,433	trips		2,103				0	13,528,599	0	0	0	13,528,599		
											0	0	0	0	0	0		
	Staff 4,602 m-month										0	0	0	0	0	0		
	Say a trip at 1 month 4,602 trips										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Helicopter flight 2 hours 903.00 $ 12 Passengers										0	0	0	0	0	0		
	Air fare 1,650.00 $										0	0	0	0	0	0		
	- Staff transportation 2,553.00 $			4,602	trips		2,553.00				0	11,748,906	0	0	0	11,748,906		
											0	0	0	0	0	0		
	- Home office personnal Average 4 trips / mth 48 mth			192	trips		2,553.00				0	490,176	0	0	0	490,176		
											0	0	0	0	0	0		
6273	**Man Power Transportation**										**0**	**25,767,681**	**0**	**0**	**0**	**25,767,681**		**0**

Item : (6283)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
6280	**General Expenses**																	
6283	**General Expenses - Hydro Site 6g**																	
	Duration										0	0	0	0	0	0		
	Site 1 48										0	0	0	0	0	0		
	Site 2 30										0	0	0	0	0	0		
	Site 3 18										0	0	0	0	0	0		
	Site 4 18										0	0	0	0	0	0		
	78 mth																	
	Office Costs										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Furniture			1	ls		50,000				0	50,000	0	0	0	50,000		
	- Equipment			1	ls		60,000				0	60,000	0	0	0	60,000		
											0	0	0	0	0	0		
	- Office supplies			78	mth		1,200				0	93,600	0	0	0	93,600		
	- Telephone and internet costs			78	mth		1,500				0	117,000	0	0	0	117,000		
											0	0	0	0	0	0		
	- Computers Site 1 53										0	0	0	0	0	0		
	Site 2 31										0	0	0	0	0	0		
	Site 3 25										0	0	0	0	0	0		
	Site 4 22										0	0	0	0	0	0		
	131			131	un		2,000				0	262,000	0	0	0	262,000		
											0	0	0	0	0	0		
	- Software and Repairs			1	ls		150,000				0	150,000	0	0	0	150,000		
											0	0	0	0	0	0		
	- Mail			78	mth		400				0	31,200	0	0	0	31,200		
											0	0	0	0	0	0		
	Engineering										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Drafting equipment and material			1	ls		50,000				0	50,000	0	0	0	50,000		
											0	0	0	0	0	0		
	- Drawing reproduction			10,000	m^2		2.50				0	25,000	0	0	0	25,000		
											0	0	0	0	0	0		
	- Photography			78	mth		50				0	3,900	0	0	0	3,900		
											0	0	0	0	0	0		
	- Construction Program			1	ls		10,000				0	10,000	0	0	0	10,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6283	**General Expenses - Hydro Site 6g**										**0**	**852,700**	**0**	**0**	**0**	**852,700**		**0**

WBS	DESCRIPTION	%	n	Qty	Un.	Cons. Mat.	Freight in/out	Depr.	Purchase	Construction materials	Freight	Depreciation	Purchase	GLOBAL PRICES
							250							
							125							

6300 Construction Equipment, Tools & Supplies

WBS	DESCRIPTION	%	n	Qty	Un.	Cons. Mat.	Freight in/out	Depr.	Purchase	Construction materials	Freight	Depreciation	Purchase	GLOBAL PRICES
6330	**Construction Equipment, Tools & Supplies - Hydro Site 6g**													
	TBM - Purchase												0	0
	- HP TBM 5,1 m dia with backup 11,900,000												0	0
	- Rock support system 1,200,000												0	0
	- 12 km Conveyer 4,200,000												0	0
	- Spare parts 1,200,000												0	0
	18,500,000									0	0	0	0	0
	Depreciation 11,100,000	60%	1						18,500,000	0	0	11,100,000	18,500,000	11,100,000
	Transportation to site												0	0
	- TBM			462	m^3		250.00				115,500		0	0
	- Tailing gear			520	m^3		250.00				130,000			
	22 cont. 20' 38			847	m^3		250.00				211,675			
	5 cont. 40' 77			385	m^3		250.00			0	96,295	0	0	0
	- Conveyer 70 cont. 40' 77			5,393	m^3		250.00				1,348,129			
	1 cont. 20' 38			38	m^3		250.00			0	9,622	0	0	0
													0	0
	- Crane - Rough terrain 50 t (L-Belt) 194 m^3	40%	6	1,164	m^3		250.00		600,000	0	291,000	1,440,000	3,600,000	1,440,000
	- Crane - Rough terrain 120 t (L-Belt) 169 m^3	40%	1	169	m^3		250.00		890,000	0	42,250	356,000	890,000	356,000
	- Crane 150T - Crawler 10 77 770 m^3	40%	3	2,310	m^3		250.00		1,300,000	0	577,500	1,560,000	3,900,000	1,560,000
	- Fuel Truck 110 m^3	40%	4	440	m^3		250.00		125,000	0	110,000	200,000	500,000	200,000
	- Boom truck 17 tons 110 m^3	40%	12	1,320	m^3		250.00		226,600	0	330,000	1,087,680	2,719,200	1,087,680
	- Readymix 8 m^3 90 m^3	40%	6	540	m^3		250.00		200,000	0	135,000	480,000	1,200,000	480,000
	- Explosives Truck 60 m^3	40%	5	300	m^3		250.00		120,000	0	75,000	240,000	600,000	240,000
	- Welding or Mechanic Truck 60 m^3	40%	6	360	m^3		250.00			0				
	- Asplalt tanker (12 000 USgallon) 110 m^3	40%	2	220	m^3		250.00		125,000		55,000	100,000	250,000	100,000
	- Concrete pump 45 m on truck 220 m^3	40%	2	440	m^3		250.00		800,000	0	110,000	640,000	1,600,000	640,000
	- Cat 950H Wheel Loader 80 m^3 / un	40%	8	640	m^3		250.00		284,730		160,000	911,136	2,277,840	911,136
	- Cat 980H Wheel Loader 118 m^3 / un	40%	4	472	m^3		250.00		501,080		118,000	801,728	2,004,320	801,728
	- Cat 988H Wheel Loader 181 m^3 / un	40%	6	1,086	m^3		250.00		806,225		271,500	1,934,940	4,837,350	1,934,940
											0	0	0	0
	- Cat 329DL Hydraulic Excavator 112 m^3 / un	40%	10	1,120	m^3		250.00		314,325		280,000	1,257,300	3,143,250	1,257,300
	- Cat 345 Hydraulic Excavator 290 m^3 / un	40%	3	870	m^3		250.00		800,000		217,500	960,000	2,400,000	960,000
	- Cat 385CL Hydraulic Excavator 323 m^3 / un	40%	2	646	m^3		250.00		986,860		161,500	789,488	1,973,720	789,488
	- Cat 311C U 48 m^3 / un	40%	4	192	m^3		250.00		150,000		48,000	240,000	600,000	240,000
	- Cat 14M Motorgrader 93 m^3 / un	40%	2	186	m^3		250.00		537,823		46,500	430,258	1,075,646	430,258
	- Cat D8T LGP Track-Type Tractor 69 m^3 / un	40%	6	414	m^3		250.00		765,404		103,500	1,836,970	4,592,424	1,836,970
	- Cat D7R II LGP Track-Type Tractor 68 m^3 / un	40%	6	408	m^3		250.00		370,865		102,000	890,076	2,225,190	890,076
	- Cat D6T LGP Track-Type Tractor 61 m^3 / un	40%	4	244	m^3		250.00		538,844		61,000	862,150	2,155,376	862,150
	- Cat 442E 2WS Backhoe Loader 55 m^3 / un	40%	2	110	m^3		250.00		105,115		27,500	84,092	210,230	84,092
	- Cat 740 Articulated Dumper 40 T 156 m^3 / un	40%	14	2,184	m^3		250.00		561,300		546,000	3,143,280	7,858,200	3,143,280
	- Cat 725 Articulated Dumper 25 T 98 m^3 / un	40%	7	686	m^3		250.00		427,450		171,500	1,196,860	2,992,150	1,196,860
	- 10 Wheeler Truck 90 m^3 / un	40%	18	1,620	m^3		250.00		220,125		405,000	1,584,900	3,962,250	1,584,900
	- Cat CS76 XT Vibratory Soil Compactor 45 m^3 / un	40%	12	540	m^3		250.00		155,125		135,000	744,600	1,861,500	744,600
	Construction **Site 1** **Site 2** **Site 3** **Site 4**													
	Cat GEP 150 - 100KW 2 1 1 2		6											

WBS	DESCRIPTION	%	n	Qty	Un.	Cons. Mat.	Freight in/out	Depr.	Purchase	Construction materials	Freight	Depreciation	Purchase	GLOBAL PRICES
							250							
	Cat GEP 550 - 400KW 9 2 2		13											
	Cat GEP 910 - 910kW		0											
	Cat GEP 1250 - 1250kW 4		4											
	Camps													
	Cat GEP 550 - 400KW 3 2 2		7											
	Cat GEP 910 - 910kW 7 3 3 3		16											
	Cat GEP 1250 - 1250kW													
	Generators													
	- Cat GEP 88 - 50KW 6 m^3 / un	40%	4	24	m^3		250.00		21,635		6,000	34,616	86,540	34,616
	- Cat GEP 150 - 100KW 9 m^3 / un	40%	6	54	m^3		250.00		26,300		13,500	63,120	157,800	63,120
	- Cat GEP 550 - 400KW 20 m^3 / un	40%	20	400	m^3		250.00		84,100		100,000	672,800	1,682,000	672,800
	- Cat GEP 910 - 910kW 24 m^3 / un	40%	16	384	m^3		250.00		339,250		96,000	2,171,200	5,428,000	2,171,200
	- Cat GEP 1250 - 1250kW 24 m^3 / un	40%	4	96	m^3		250.00		500,000		24,000	800,000	2,000,000	800,000
	- Generator 5 kW (Tower light) 5 m^3 / un	40%	26	130	m^3		250.00		5,100		32,500	53,040	132,600	53,040
											0	0	0	0
	- R1300 G - Scooptram 42 m^3 / un	40%	2	84	m^3		250.00		307,850		21,000	246,280	615,700	246,280
											0	0	0	0
	- Pick-up Ford F-150 (4x4) 23 m^3 / un	100%	86	1,978	m^3		250.00		17,345		494,500	1,491,670	1,491,670	1,491,670
	- Crew-cab Ford F-150 (4x4) 26 m^3 / un	100%	94	2,444	m^3		250.00		26,884		611,000	2,527,096	2,527,096	2,527,096
	- Escape (4x4) 16 m^3 / un	100%	7	112	m^3		250.00		16,850		28,000	117,950	117,950	117,950
											0	0	0	0
	- Tractor truck 90 m^3 / un	60%	4	360	m^3		250.00		138,900		90,000	333,360	555,600	333,360
	- Load Carrier - 65 T 60 m^3 / un	60%	2	120			250.00		51,400			61,680	102,800	61,680
	- Trailer 60 m^3 / un	60%	4	240	m^3		250.00		40,000		60,000	96,000	160,000	96,000
	- Fuel Trailor 170 m^3 / un	60%	2	340	m^3		250.00		125,000		85,000	150,000	250,000	150,000
	- Welding Machine - 400 A 3 m^3 / un	60%	123	369	m^3		250.00		15,000		92,250	1,107,000	1,845,000	1,107,000
	- Moyno pump m^3 / un	60%											0	0
	- Jack leg m^3 / un	60%	2	77	m^3		250.00				38,500		0	0
	- Injection pump m^3 / un	60%											0	0
	- Shotcrete pump m^3 / un	60%											0	0
	- Fork lift 10 T 10 m^3 / un	60%	2	20	m^3		250.00		15,000		5,000	18,000	30,000	18,000
	- Fork lift 15 T 15 m^3 / un	60%	3	45	m^3		250.00		30,000		11,250	54,000	90,000	54,000
	- Furukawa HCR9-ES 25 m^3 / un	60%	12	300	m^3		250.00		75,000		75,000	540,000	900,000	540,000
	- Hydraulic Drilling Machine 35 m^3 / un	60%	14	490	m^3		250.00		100,000		122,500	840,000	1,400,000	840,000
											0	0	0	0
	- Bus - 32 Passengers 60 m^3 / un	80%	8	480	m^3		250.00		55,000		120,000	352,000	440,000	352,000
											0	0	0	0
	- Compressor - 1050 cfm (XRHS1100CD6) 21 m^3 / un	60%	4	84	m^3		250.00		160,175		21,000	384,420	640,700	384,420
	- Compressor - 750 cfm 21 m^3 / un	60%	12	252	m^3		250.00		111,110		63,000	799,992	1,333,320	799,992
	- Compressor XAHS 237 (500 cfm) 23 m^3 / un	60%	17	391	m^3		250.00		90,000		97,750	918,000	1,530,000	918,000
											0	0	0	0
	- Furnace - 2 500 000 BTU 3 m^3 / un	100%	3	9	m^3		250.00		16,000		2,250	48,000	48,000	48,000
	- Furnace - 1 000 000 BTU 3 m^3 / un	100%	10	30	m^3		250.00		12,000		7,500	120,000	120,000	120,000
											0	0	0	0
	- Asphalt Paver 39 m^3 / un	60%	4	156	m^3		250.00		225,000	0	39,000	540,000	900,000	540,000
	- Bomag Twin Roller 3 m^3 / un	60%	8	24	m^3		250.00		20,000	0	6,000	96,000	160,000	96,000
	- Plate damper 1 m^3 / un	60%	20	20	m^3		250.00		6,500	0	5,000	78,000	130,000	78,000
										0	0	0	0	0
	TUNNELS									0	0	0	0	0
	- Rocket Boomer E3 C Base 1,300,000 $ 0.9 1,170,000 USD									0	0	0	0	0
	Tailrace access and Caverns 118 m^3 / un	40%	1	118	m^3		250.00		1,170,000	0	29,500	468,000	1,170,000	468,000
	Powerhouse and Power tunnel Access 118 m^3 / un	40%	1	118	m^3		250.00		1,170,000	0	29,500	468,000	1,170,000	468,000

Item : (6330)

WBS	DESCRIPTION	%	n	Qty	Un.	Cons. Mat.	Freight in/out	Depr.	Purchase	Construction materials	Freight	Depreciation	Purchase	GLOBAL PRICES
							250							
													0	
-	**Rocket Boomer E2 C** Base 1,330,719 $ 0.9 1,197,647 USD													
	Tailrace 94 m³ / un	40%	1	94	m³		250.00		1,197,647	0	23,500	479,059	1,197,647	479,059
	Tunnel 1 94 m³ / un	40%	1	94	m³		250.00		1,197,647	0	23,500	479,059	1,197,647	479,059
	Generators (Included in TBM)												0	
													0	
										0	0	0	0	0
	Portable concrete batch Plan									0	0	0	0	0
-	Batch Plan 3 cnt / site 77 m³ / cnt	60%	4	924	m³		250.00		125,000	0	231,000	300,000	500,000	300,000
										0	0	0	0	0
-	Boiler 1 un / site 77 m³ / un	60%	4	308	m³		250.00		30,000	0	77,000	72,000	120,000	72,000
										0	0	0	0	0
										0	0	0	0	0
-	Building (Plan & Cement storage) 8 cnt / site 77 m³ / cnt	60%	4	2,464	m³		250.00		50,000	0	616,000	120,000	200,000	120,000
										0	0	0	0	0
										0	0	0	0	0
-	Control module 2 cnt / site 77 m³ / cnt	60%	4	616	m³		250.00		50,000.00	0	154,000	120,000	200,000	120,000
										0	0	0	0	0
										0	0	0	0	0
-	Miscelaneous (cement storage, water tank, etc.) 77 m³ / site	90%	4	308	m³		250.00		35,000.00	0	77,000	126,000	140,000	126,000
										0	0	0	0	0
											0	0	0	0
	Bitumen batching plant									0	0	0	0	0
	1 unit needed in sites 2 and 4									0	0	0	0	0
										0	0	0	0	0
-	Bitumen batching plant "drum mix" (400 t / h)	60%	2	600	m³		250.00		2,500,000	0	150,000	3,000,000	5,000,000	3,000,000
										0	0	0	0	0
	Crusher 1 unit needed at each site									0	0	0	0	0
										0	0	0	0	0
-	Crusher (300 t / h) 600 m³ / unit	60%	4	1,200	m³		250.00		1,500,000	0	300,000	3,600,000	6,000,000	3,600,000
										0	0	0	0	0
	Electrical components									0	0	0	0	0
	(kg) L W H Vol.										0	0	0	0
-	PSG 1 1,700 1,300 1,340 2,675 5.0		2	10	m³					0	0	0	0	0
	2,550 1,950 1,340 2,675 7.0		3	21	m³						0	0	0	0
-	PSG 2 1,700 1,300 1,340 2,675 5.0		2	10	m³					0	0	0	0	0
	2,550 1,950 1,340 2,675 7.0		3	21	m³						0	0	0	0
-	PSG 3 2,550 650 1,340 2,675 2.0		3	6	m³					0	0	0	0	0
	2,550 1,950 1,340 2,675 7.0		3	21	m³					0	0	0	0	0
	0.0									0	0	0	0	0
-	SG 1 1,700 1,300 1,778 2,596 6.0		4	24	m³					0	0	0	0	0
-	SG 2 1,700 1,300 1,778 2,596 6.0		4	24	m³					0	0	0	0	0
	0.0									0	0	0	0	0
-	SG 11 1,000 1,524 508 2,300 2.0		2	4	m³					0	0	0	0	0
	1,550 2,032 508 2,300 2.0		4	8	m³						0	0	0	0
-	SG 12 1,000 1,524 508 2,300 2.0		2	4	m³					0	0	0	0	0
	1,550 2,032 508 2,300 2.0		4	8	m³						0	0	0	0
										0	0	0	0	0
-	SG 21 1,000 1,524 508 2,300 2.0		2	4	m³					0	0	0	0	0
	1,550 2,032 508 2,300 2.0		4	8	m³						0	0	0	0
	1,200 1,524 508 2,300 2.0		3	6	m³						0	0	0	0
-	SG 22 1,000 1,524 508 2,300 2.0		2	4	m³					0	0	0	0	0
	1,550 2,032 508 2,300 2.0		4	8	m³						0	0	0	0
	1,200 1,524 508 2,300 2.0		3	6	m³						0	0	0	0

WBS	DESCRIPTION						%	n	Qty	Un.	Cons. Mat.	Freight in/out	Depr.	Purchase	Construction materials	Freight	Depreciation	Purchase	GLOBAL PRICES
												250							
	- SG 23	1,500	2,286	508	2,300	3.0		3	9	m³					0	0	0	0	0
		1,200	1,524	508	2,300	2.0		3	6	m³						0	0	0	0
		1,200	1,524	508	2,300	2.0		3	6	m³						0	0	0	0
	- SG 24	1,500	2,286	508	2,300	3.0		3	9	m³					0	0	0	0	0
		1,200	1,524	508	2,300	2.0		3	6	m³					0	0	0	0	0
		1,200	1,524	508	2,300	2.0		3	6	m³					0	0	0	0	0
															0	0	0	0	0
	- T 1	82,000	7,800	3,500	4,300	117.0		1	117	m³					0	0	0	0	0
	- T 2	82,000	7,800	3,500	4,300	117.0		1	117	m³					0	0	0	0	0
	- T 3	82,000	7,800	3,500	4,300	117.0		1	117	m³					0	0	0	0	0
	- T 4	82,000	7,800	3,500	4,300	117.0		1	117	m³					0	0	0	0	0
	- T 1	82,000	7,800	3,500	4,300	117.0		1	117	m³					0	0	0	0	0
															0	0	0	0	0
	- S 1	11,825	3,700	2,500	2,360	22.0		1	22	m³					0	0	0	0	0
	- S 2	11,825	3,700	2,500	2,360	22.0		1	22	m³					0	0	0	0	0
	- S 3	5,000	3,000	2,000	2,800	17.0		1	17	m³					0	0	0	0	0
									885	**m³**		125.00			0	110,625	0	0	0
																0	0	0	0
	- 220 kV Cable		18,000 m		10.7 kg / m				193	mt		250.00			0	48,250	0	0	0
															0	0	0	0	0
	- Miscelaneous		5 mt / gr					5	25	mt		250.00			0	6,250	0	0	0
															0	0	0	0	0
	GENERATING UNITS														0	0	0	0	0
		(kg)	L	W	T	Vol.									0	0	0	0	0
	- Runner	10,000	3	3	1	61		3	184	m³		125.00			0	23,000	0	0	0
	- shafts	14,000				0		2	28	mt		250.00			0	7,000	0	0	0
	- Spiral 1/3	28,000	10	4	2	349		2	698	m³		125.00			0	87,250	0	0	0
	- spiral 2/3	16,000	10	3	2	233		2	466	m³		125.00			0	58,250	0	0	0
	- Spiral 3/3	10,000	8	4	1	189		2	378	m³		125.00			0	47,250	0	0	0
	- Nozzles	4,500	3	2	2	198		13	2,569	m³		125.00			0	321,125	0	0	0
	- Gratings and rails	4,000	5	1	1	63		2	95	m³		125.00			0	11,875	0	0	0
	- Pit walls	9,000	6	2	3	486		2	729	m³		125.00			0	91,125	0	0	0
	- Deflector SM	2,500	1	1	1	1		2	3	m³		125.00			0	375	0	0	0
	- Pit c. & G.sole plates	12,000	6	4	2	540		2	810	m³		125.00			0	101,250	0	0	0
	- Turb. Bearing	2,500	2	2	2	30		2	60	m³		125.00			0	7,500	0	0	0
	- Piping	5,000	6	1	1	30		2	60	m³		125.00			0	7,500	0	0	0
	- Anchors	10,000	6	1	1	30		2	60	m³		125.00			0	7,500	0	0	0
	- Pressure tank	5,000	1	1	3	12		2	24	m³		125.00			0	3,000	0	0	0
	- Sump tank	2,000	2	2	2	23		2	45	m³		125.00			0	5,625	0	0	0
	- Governor	400	2	1	1	15		2	30	m³		125.00			0	3,750	0	0	0
	- Sph. Valve	55,000	2	3	3	86		2	172	m³		125.00			0	21,500	0	0	0
	- Counterweights	22,000	3	2	1	37		4	88	mt		250.00			0	22,000	0	0	0
	- SM, By pass	14,000	6	2	2	94		2	188	m³		125.00			0	23,500	0	0	0
	- Dismantl. Pipe	9,000	2	2	2	36		2	72	m³		125.00			0	9,000	0	0	0
	- Compressed air	4,000	5	3	2	30		1	30	m³		125.00			0	3,750	0	0	0
	- Cooling water syst.	5,000	6	3	2	216		2	432	m³		125.00			0	54,000	0	0	0
	- Half stator frames	12,833	7	5	4	1,250		4	5,001	m³		125.00			0	625,125	0	0	0
	- stator laminations	3,500	1	1	1	86		48	4,147	m³		125.00			0	518,375	0	0	0
	- stator winding	3,000	5	2	2	761		48	36,547	m³		125.00			0	4,568,375	0	0	0
	- Bracket	7,000	8	4	1	403		4	1,614	m³		125.00			0	201,750	0	0	0
	- Rotor laminations	9,000	2	1	1	121		24	216	mt		250.00			0	54,000	0	0	0
	- Poles	4,000	2	1	1	90		28	2,509	m³		125.00			0	313,625	0	0	0
	- Rotor spider & shaft	50,000	7	2	2	185		2	100	mt		250.00			0	25,000	0	0	0
	- Bearing & ThrustB.	5,000	3	3	2	68		2	135	m³		125.00			0	16,875	0	0	0
	- Brakes and segments	10,000	6	2	1	36		1	43	m³		125.00			0	5,375	0	0	0

WBS	DESCRIPTION						%	n	Qty	Un.	Cons. Mat.	Freight in/out	Depr.	Purchase	Construction materials	Freight	Depreciation	Purchase	GLOBAL PRICES
												250							
	- Exciter cubicles	750	2	2	3	150		8	1,200	m^3		125.00			0	150,000	0	0	0
	- Exciter cubicles	1,000	1	2	3	19		2	38	m^3		125.00			0	4,750	0	0	0
	- Exciter transformer	4,000	3	2	3	47		2	94	m^3		125.00			0	11,750	0	0	0
	- Control and protection	1,400	2	2	3	113		6	675	m^3		125.00			0	84,375	0	0	0
	- Station transformer	9,000	3	3	3	23		1	23	m^3		125.00			0	2,875	0	0	0
	- Battery Charger/Inverter	750	2	2	2	6		1	6	m^3		125.00			0	750	0	0	0
	- Battery	6,000	2	2	2	12		2	12	mt		250.00			0	3,000	0	0	0
															0	0	0	0	0
	Overhead Crane	100,150 kg							1,002	mt		250.00			0	250,500	0	0	0
															0	0	0	0	0
	Piping								18	mt		250.00			0	4,500	0	0	0
															0	0	0	0	0
	CVAC				77 m^3 Cnt			5	385	m^3		125.00			0	48,125	0	0	0
															0	0	0	0	0
	Mechanical																		
	Intake			(kg)											0	0	0	0	0
	Trash Rack			22,000					22	mt		250.00			0	5,500	0	0	0
	Stop logs			9,000					9	mt		250.00			0	2,250	0	0	0
	Embedded parts			24,000					24	mt		250.00			0	6,000	0	0	0
	Gates			8,000					8	mt		250.00			0	2,000	0	0	0
	Spreader			3,500					4	mt		250.00			0	875	0	0	0
	Winches			7,000					7	mt		250.00			0	1,750	0	0	0
	Lining			8,000											0	0	0	0	0
															0	0	0	0	0
	Tunnel 1			(kg)											0	0	0	0	0
	Upstream Stop logs			5,000					5	mt		250.00			0	1,250	0	0	0
	Stoplogs Embedded parts			19,000					19	mt		250.00			0	4,750	0	0	0
	Gates			17,000					17	mt		250.00			0	4,250	0	0	0
	Gates Embedded parts			22,000					22	mt		250.00			0	5,500	0	0	0
	Stoplogs Lifting Beam			1,000					1	mt		250.00			0	250	0	0	0
	Actuator			3,000					3	mt		250.00			0	750	0	0	0
	Downstream Stop logs			5,000					5	mt		250.00			0	1,250	0	0	0
	Downstream Stop logs Lifting Beam			1,000					1	mt		250.00			0	250	0	0	0
	Monorail			4,000					4	mt		250.00			0	1,000	0	0	0
				77,000												0	0	0	0
															0	0	0	0	0
	MARINE EQUIPMENT														0	0	0	0	0
															0	0	0	0	0
	Water route		L (ft)	W (ft)	H (ft)	V (cu ft)									0	0	0	0	0
	- Landding barge (Unifloat)		18	8	6.0	864		20	489	m^3		250.00			0	122,333	0	0	0
	- Noze end					432		12	147	m^3		250.00			0	36,700	0	0	0
															0	0	0	0	0
	- Service barge		50	12	6.5	3,900		2	221	m^3		250.00			0	55,220	0	0	0
															0	0	0	0	0
	- Tug		12	6	8.0	576		1	16	m^3		250.00			0	4,078	0	0	0
	- Work boat		8	4	6.0	192		2	11	m^3		250.00			0	2,719	0	0	0
	- Miscelaneous (winches, anchors, generators, etc..)														0	0	0	0	0
															0	0	0	0	0
	Tunnel 1														0	0	0	0	0
	- Noze end					432		6	73	m^3		250.00			0	18,350	0	0	0
	- Working barge		50	12	7	3,900		6	663	m^3		250.00			0	165,660	0	0	0
	- Tug		12	6	8	576		3	49	m^3		250.00			0	12,233	0	0	0
	- Miscelaneous (winches, anchors, generators, etc..)				1,669 m^3		10%		167	m^3		250.00			0	41,750	0	0	0
															0	0	0	0	0
6330	**Construction Equipment, Tools & Supplies - Hydro Site 6g**														**0**	**19,038,014**		**119,698,716**	**58,817,800**

Project : **6g Cost Estimate.xlsx**

Item : **(6430)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Freight	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Construction materials	TOTAL COSTS Freight	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								250			24.00 $				0.72 $			
								125										

6400 Material Transportation

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Freight	Equip. Op.	Fuel	Man power	Construction materials	Freight	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6430	**Material Transportation - Hydro Site 6g**																	
	Freight										0	0	0	0	0	0		
	Construction Materials										0	0	0	0	0	0		
	Full Load 2 Shipments 20 000 m³			40 000	m³			250.00			0	0	10 000 000	0	0	10 000 000		
	Partial load shipments			26 000	m³			250.00			0	0	6 500 000	0	0	6 500 000		
											0	0	0	0	0	0		
	Insurance **Other then Commodities**										0	0	0	0	0			
											0	0	0	0	0			
	Construction Materials 27 384 511 $ 0.25 $ / 100$										0	0	0	0	0	68 461		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6430	**Material Transportation - Hydro Site 6g**										**0**	**0**	**16 500 000**	**0**	**0**	**16 568 461**		**0**

Printed on : 2009-12-03
Revised on :

Item : (6513-6553)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Construction materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			

6500 Construction Camp

6510 Site Preparation - Hydro Site 6g

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
6513	**Site Preparation - Hydro Site 6g**			**212,600**	**m²**													
	Site 1 250 x 250 62,500 m²										0	0	0	0	0	0		
	Site 2 250 x 250 62,500 m²										0	0	0	0	0	0		
	Site 3 240 x 240 57,600 m²										0	0	0	0	0	0		
	Site 4 100 x 300 30,000 m²										0	0	0	0	0	0		
	212,600 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	3,000 m² / sh			71	sh						0	0	0	0	0	0		
	10 h / sh			710	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	4,970	h	24.00					119,280	0	0	0	0	119,280		4,970
											0	0	0	0	0	0		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	90%	1	639	h				38.25	28.00	0	0	0	24,442	0	24,442		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	90%	3	1,917	h				24.00	20.00	0	0	0	46,008	0	46,008		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	90%	1	639	h				19.00	29.00	0	0	0	12,141	0	12,141		
	- Cat CS76 XT Vibratory Soil Compactor 14.85 20.00	45%	1	320	h				14.85	20.00	0	0	0	4,745	0	4,745		
	- Cat 14M Motor grader 16.65 25.75	45%	1	320	h				16.65	25.75	0	0	0	5,320	0	5,320		
											0	0	0	0	0	0		
	- Misc. (Dust control, accessories, etc..)			1	ls		10,000				0	10,000	0	0	0	10,000		
											0	0	0	0	0	0		
	Pavement (roads, parking lot, etc..) 150 mm of crushed stone										0	0	0	0	0	0		
	on 50% of the total ara																	
	m² m³ mt																	
	Site 1 62,500 50% 4,688 8,438																	
	Site 2 62,500 50% 4,688 8,438																	
	Site 3 57,600 50% 4,320 7,776																	
	Site 4 30,000 50% 2,250 4,050																	
	Supply																	
	- Crushed stone - Site 1 0.11 h / mt			8,438	mt	2.61	8.08	0.00	2.60	11.98								928
	- Crushed stone - Site 2 0.08 h / mt			8,438	mt	1.84	1.30	0.00	2.08	3.08								675
	- Crushed stone - Site 3 0.08 h / mt			7,776	mt	1.84	1.97	0.00	2.04	3.90								622
	- Crushed stone - Site 4 0.07 h / mt			4,050	mt	1.80	1.38	0.00	2.03	3.15								284
											0	0	0	0	0	0		
6513	**Site Preparation - Hydro Site 6g**			**212,600**	**m²**						**119,280**	**10,000**	**0**	**92,656**	**0**	**221,936**	**1.04**	**7,479**

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
6520	**Infrastructure**																	
6523	**Infrastructure - Hydro Site 6g**																	
	Installation and removal (Generators, sewers, water supply, communications, etc...)																	
	20 sh / site			80	sh													
	10 h / sh			800	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-O		26	20,800	h	24.00					499,200	0	0	0	0	499,200		20,800
											0	0	0	0	0	0		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	25%	1	200	h				37.00	14.40	0	0	0	7,400	2,074	9,474		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	25%	1	200	h				19.00	20.88	0	0	0	3,800	3,007	6,807		
	- Boom truck 17 tons 13.65 18.00	50%	1	400	h				13.65	12.96	0	0	0	5,460	3,732	9,192		
	Power Station (diesel generators)																	
	Site 1																	
	Needed 8 kW / p-d (Reserve) Total																	
	Workers (Including T-Line) 306 0 306	0%																
	Staff 102 0 102	0%																
	408																	
	Needed capacity **4.1 mW**										0	0	0	0	0	0		
	48 months																	
	1,440 days 24 h / d			34,560	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Transformers 1.75 un / mW			7	un		3,330	103,330			0	23,310	723,310	0	0	746,620		
	- Building Isolated steel building **700**			700	m²		290	830			0	203,000	581,000	0	0	784,000		
	- Electrical mains			1,700	m		110	480			0	187,000	816,000	0	0	1,003,000		
	- Outdoor lighting On poles			6	un		420	1,830			0	2,520	10,980	0	0	13,500		
	- Reefer hotlines			22	un		300	2,000			0	6,600	44,000	0	0	50,600		
	Site 2																	
	Needed 8 kW / p-d (Reserve) Total																	
	Workers (Including T-Line) 162 0 162	0%																
	Staff 54 0 54	0%																
	216																	
	Needed capacity **2.2 mW**										0	0	0	0	0	0		
	36 months																	
	1,080 days 24 h / d			25,920	h						0	0	0	0	0	0		
	- Transformers 1.75 un / mW			4	un		3,330	103,330			0	13,320	413,320	0	0	426,640		
	- Building Isolated steel building **600**			600	m²		290	830			0	174,000	498,000	0	0	672,000		
	- Electrical mains			1,700	m		110	480			0	187,000	816,000	0	0	1,003,000		
	- Outdoor lighting On poles			6	un		420	1,830			0	2,520	10,980	0	0	13,500		
	- Reefer hotlines			22	un		300	2,000			0	6,600	44,000	0	0	50,600		
	Site 3																	
	Needed 8 kW / p-d (Reserve) Total																	
	Workers (Including T-Line) 111 0 111	0%																
	Staff 37 0 37	0%																
	148																	
	Needed capacity **1.5 mW**										0	0	0	0	0	0		
	24 months																	
	720 days 24 h / d			17,280	h						0	0	0	0	0	0		
	- Transformers 1.75 un / mW			3	un		3,330	103,330			0	9,990	309,990	0	0	319,980		
	- Building Isolated steel building **400**			400	m²		290	830			0	116,000	332,000	0	0	448,000		
	- Electrical mains			1,700	m		110	480			0	187,000	816,000	0	0	1,003,000		
	- Outdoor lighting On poles			6	un		420	1,830			0	2,520	10,980	0	0	13,500		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Reefer hotlines			22	un		300	2,000			0	6,600	44,000	0	0	50,600		
	Site 4																	
	Needed 8 kW / p-d (Reserve) Total																	
	Workers (Including T-Line) 132 0 132	0%																
	Staff 44 0 44	0%																
	176																	
	Needed capacity **1.8 mW**										0	0	0	0	0	0		
	24 months																	
	720 days 24 h / d			17,280	h						0	0	0	0	0	0		
	- Transformers 1.75 un / mW			3	un		3,330	103,330			0	9,990	309,990	0	0	319,980		
	- Building Isolated steel building **500**			500	m²		290	830			0	145,000	415,000	0	0	560,000		
	- Electrical mains			1,700	m		110	480			0	187,000	816,000	0	0	1,003,000		
	- Outdoor lighting On poles			6	un		420	1,830			0	2,520	10,980	0	0	13,500		
	- Reefer hotlines			22	un		300	2,000			0	6,600	44,000	0	0	50,600		
											0	0	0	0	0	0		
	Water Supply Plan										0	0	0	0	0	0		
	Site 1 200 L / p-d **408** persons										0	0	0	0	0	0		
	82 kL / d 571 kL / week										0	0	0	0	0	0		
	2,448 kL / month																	
	- Treatment			1	un		3,000	103,330			0	3,000	103,330	0	0	106,330		
											0	0	0	0	0	0		
	- Storage tank Isolated steel tank 1 month capacity			2,448	kL		390	480			0	954,720	1,175,040	0	0	2,129,760		
											0	0	0	0	0	0		
	- Water mains Isolated pipes on ground			2,800	m		50	162			0	140,000	453,600	0	0	593,600		
											0	0	0	0	0	0		
	- Raw water pipeline			500	m		50	162			0	25,000	81,000	0	0	106,000		
											0	0	0	0	0	0		
	- Miscellaneous (pumping station, pumps, heating, etc..)			1	ls		75,000				0	75,000	0	0	0	75,000		
											0	0	0	0	0	0		
	Supply **48 months**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 10 h / mth		2	960	h	24.00					23,040	0	0	0	0	23,040		960
											0	0	0	0	0	0		
	- Filtration unit			1	ls		3,000	25,000			0	3,000	25,000	0	0	28,000		
	Site 2 200 L / p-d **216** persons										0	0	0	0	0	0		
	43 kL / d 302 kL / week										0	0	0	0	0	0		
	1,296 kL / month																	
	- Treatment			1	un		3,000	103,330			0	3,000	103,330	0	0	106,330		
											0	0	0	0	0	0		
	- Storage tank Isolated steel tank 1 month capacity			1,296	kL		390	480			0	505,440	622,080	0	0	1,127,520		
											0	0	0	0	0	0		
	- Water mains Isolated pipes on ground			2,300	m		50	162			0	115,000	372,600	0	0	487,600		
											0	0	0	0	0	0		
	- Raw water pipeline			250	m		50	162			0	12,500	40,500	0	0	53,000		
											0	0	0	0	0	0		
	- Miscellaneous (pumping station, pumps, heating, etc..)			1	ls		75,000				0	75,000	0	0	0	75,000		
											0	0	0	0	0	0		
	Supply **36 months**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 10 h / mth		2	720	h	24.00					17,280	0	0	0	0	17,280		720
											0	0	0	0	0	0		
	- Filtration unit			1	ls		3,000	25,000			0	3,000	25,000	0	0	28,000		
	Site 3 200 L / p-d **148** persons										0	0	0	0	0	0		
	30 kL / d 207 kL / week										0	0	0	0	0	0		
	888 kL / month																	

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Treatment			1	un		3,000	103,330			0	3,000	103,330	0	0	106,330		
											0	0	0	0	0	0		
	- Storage tank Isolated steel tank 1 month capacity			888	kL		390	480			0	346,320	426,240	0	0	772,560		
											0	0	0	0	0	0		
	- Water mains Isolated pipes on ground			1,000	m		50	162			0	50,000	162,000	0	0	212,000		
											0	0	0	0	0	0		
	- Raw water pipeline			250	m		50	162			0	12,500	40,500	0	0	53,000		
											0	0	0	0	0	0		
	- Miscellaneous (pumping station, pumps, heating, etc..)			1	ls		75,000				0	75,000	0	0	0	75,000		
											0	0	0	0	0	0		
	Supply **24 months**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 10 h / mth		2	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Filtration unit			1	ls		3,000	25,000			0	3,000	25,000	0	0	28,000		
	Site 4 200 L / p-d **176** persons										0	0	0	0	0	0		
	35 kL / d 246 kL / week										0	0	0	0	0	0		
	1,056 kL / month																	
	- Treatment			1	un		3,000	103,330			0	3,000	103,330	0	0	106,330		
											0	0	0	0	0	0		
	- Storage tank Isolated steel tank 1 month capacity			1,056	kL		390	480			0	411,840	506,880	0	0	918,720		
											0	0	0	0	0	0		
	- Water mains Isolated pipes on ground			1,500	m		50	162			0	75,000	243,000	0	0	318,000		
											0	0	0	0	0	0		
	- Raw water pipeline			250	m		50	162			0	12,500	40,500	0	0	53,000		
											0	0	0	0	0	0		
	- Miscellaneous (pumping station, pumps, heating, etc..)			1	ls		75,000				0	75,000	0	0	0	75,000		
											0	0	0	0	0	0		
	Supply **24 months**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 10 h / mth		2	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Filtration unit			1	ls		3,000	25,000			0	3,000	25,000	0	0	28,000		
											0	0	0	0	0	0		
	Sewer plan										0	0	0	0	0	0		
	Site 1										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Treatment plan SBR process tank and UV-Disinfect 200 m^3 / d			1	un		300,000	500,000			0	300,000	500,000	0	0	800,000		
											0	0	0	0	0	0		
	- Sewer mains			1,000	m		240	478			0	240,000	478,000	0	0	718,000		
											0	0	0	0	0	0		
	Site 2										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Treatment plan SBR process tank and UV-Disinfect 200 m^3 / d			1	un		300,000	500,000			0	300,000	500,000	0	0	800,000		
											0	0	0	0	0	0		
	- Sewer mains			1,000	m		240	478			0	240,000	478,000	0	0	718,000		
											0	0	0	0	0	0		
	Site 3										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Treatment plan SBR process tank and UV-Disinfect 200 m^3 / d			1	un		300,000	500,000			0	300,000	500,000	0	0	800,000		
											0	0	0	0	0	0		
	- Sewer mains			1,000	m		240	478			0	240,000	478,000	0	0	718,000		
											0	0	0	0	0	0		
	Site 4										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Treatment plan SBR process tank and UV-Disinfect 200 m^3 / d			1	un		300,000	500,000			0	300,000	500,000	0	0	800,000		
											0	0	0	0	0	0		
	- Sewer mains			1,000	m		240	478			0	240,000	478,000	0	0	718,000		
											0	0	0	0	0	0		

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											UNIT PRICES					TOTAL COSTS					
WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
	Incinerator													0	0	0	0	0	0		
	Site 1	**Duration**		**48 months**										0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Supply and install						1	ls		500,000				0	500,000	0	0	0	500,000		
														0	0	0	0	0	0		
		26 d / mth		1,248 days										0	0	0	0	0	0		
			10 h / d				12,480	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					2	24,960	h	24.00					599,040	0	0	0	0	599,040		24,960
														0	0	0	0	0	0		
	- Garbage truck	13.60		14.00	45%	1	5,616	h				13.60	14.00	0	0	0	76,378	56,609	132,987		
	- Cat 950H Wheel Loader	18.35		9.05	90%	1	11,232	h				18.35	9.05	0	0	0	206,107	73,188	279,295		
	- Incinerator	15.00		20.00	90%	1	11,232	h				3.00	6.00	0	0	0	33,696	48,522	82,218		
														0	0	0	0	0	0		
	Site 2	**Duration**		**36 months**										0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Supply and install						1	ls		500,000				0	500,000	0	0	0	500,000		
														0	0	0	0	0	0		
		26 d / mth		936 days										0	0	0	0	0	0		
			10 h / d				9,360	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					2	18,720	h	24.00					449,280	0	0	0	0	449,280		18,720
														0	0	0	0	0	0		
	- Garbage truck	13.60		14.00	45%	1	4,212	h				13.60	14.00	0	0	0	57,283	42,457	99,740		
	- Cat 950H Wheel Loader	18.35		9.05	90%	1	8,424	h				18.35	9.05	0	0	0	154,580	54,891	209,471		
	- Incinerator	15.00		20.00	90%	1	8,424	h				3.00	6.00	0	0	0	25,272	36,392	61,664		
														0	0	0	0	0	0		
	Site 3	**Duration**		**24 months**										0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Supply and install						1	ls		500,000				0	500,000	0	0	0	500,000		
														0	0	0	0	0	0		
		26 d / mth		624 days										0	0	0	0	0	0		
			10 h / d				6,240	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					2	12,480	h	24.00					299,520	0	0	0	0	299,520		12,480
														0	0	0	0	0	0		
	- Garbage truck	13.60		14.00	45%	1	2,808	h				13.60	14.00	0	0	0	38,189	28,305	66,494		
	- Cat 950H Wheel Loader	18.35		9.05	90%	1	5,616	h				18.35	9.05	0	0	0	103,054	36,594	139,648		
	- Incinerator	15.00		20.00	90%	1	5,616	h				3.00	6.00	0	0	0	16,848	24,261	41,109		
														0	0	0	0	0	0		
	Site 4	**Duration**		**24 months**										0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Supply and install						1	ls		500,000				0	500,000	0	0	0	500,000		
														0	0	0	0	0	0		
		26 d / mth		624 days										0	0	0	0	0	0		
			10 h / d				6,240	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					2	12,480	h	24.00					299,520	0	0	0	0	299,520		12,480
														0	0	0	0	0	0		
	- Garbage truck	13.60		14.00	45%	1	2,808	h				13.60	14.00	0	0	0	38,189	28,305	66,494		
	- Cat 950H Wheel Loader	18.35		9.05	90%	1	5,616	h				18.35	9.05	0	0	0	103,054	36,594	139,648		
	- Incinerator	15.00		20.00	90%	1	5,616	h				3.00	6.00	0	0	0	16,848	24,261	41,109		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
	Telecommunications													0	0	0	0	0	0		
	Site 1													0	0	0	0	0	0		
														0	0	0	0	0	0		
	- Communication mast						1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
														0	0	0	0	0	0		
	- Brodcast of Radio and W-Fi	Terminal equipment					1	ls		20,000	108,000			0	20,000	108,000	0	0	128,000		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
											0	0	0	0	0	0		
	- Cable for TV and Internet			1,500	m		18	14			0	27,000	21,000	0	0	48,000		
											0	0	0	0	0	0		
	Site 2										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Communication mast			1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
											0	0	0	0	0	0		
	- brodcast of Radio and W-Fi Terminal equipment			1	ls		20,000	108,000			0	20,000	108,000	0	0	128,000		
											0	0	0	0	0	0		
	- Cable for TV and Internet			1,500	m		18	14			0	27,000	21,000	0	0	48,000		
	- Repeater Tower mast			1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
											0	0	0	0	0	0		
	Site 3										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Communication mast			1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
											0	0	0	0	0	0		
	- brodcast of Radio and W-Fi Terminal equipment			1	ls		20,000	108,000			0	20,000	108,000	0	0	128,000		
											0	0	0	0	0	0		
	- Cable for TV and Internet			1,500	m		18	14			0	27,000	21,000	0	0	48,000		
	- Repeater Tower mast			1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
											0	0	0	0	0	0		
	Site 4										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Communication mast			1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
											0	0	0	0	0	0		
	- brodcast of Radio and W-Fi Terminal equipment			1	ls		20,000	108,000			0	20,000	108,000	0	0	128,000		
											0	0	0	0	0	0		
	- Cable for TV and Internet			1,500	m		18	14			0	27,000	21,000	0	0	48,000		
	- Repeater Tower mast			1	un		13,000	63,000			0	13,000	63,000	0	0	76,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6523	**Infrastructure - Hydro Site 6g**										**1,710,720**	**7,774,930**	**11,142,230**	**869,498**	**490,379**	**21,987,757**		**71,280**

WBS	DESCRIPTION						%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											UNIT PRICES					24.00 $	TOTAL COSTS			0.72 $			
6530	**Camps**																						
6533	**Camps - Hydro Site 6g**																						
	Buildings															0	0	0	0	0	0		
	Site 1																						
	Needed	8	kW / p-d		(Reserve)	Total																	
	Workers (Including T-Line)			306	0	306	0%																
	Staff			102	0	102	0%																
						408																	
	Accommodations (including common rooms)																						
		men / mod.	Living Mod.	Common	Total Mod											0	0	0	0	0	0		
				Mod.		**24.36**	**m² / mod**									0	0	0	0	0	0		
	Workers	4	77	31	108	**2,619**										0	0	0	0	0	0		
	Staff	2	51	20	71	**1,730**										0	0	0	0	0	0		
					179	**4,349**	m²									0	0	0	0	0	0		
	Supply and install															0	0	0	0	0	0		
	- Workers								2,619	m²		240	1,320			0	628,560	3,457,080	0	0	4,085,640		
	- Staff								1,730	m²		270	1,450			0	467,100	2,508,500	0	0	2,975,600		
					Mod	**m²**										0	0	0	0	0	0		
	Service building															0	0	0	0	0	0		
	- Offices	0.0284	mod / men		12	**292**			292	m²		270	1,320			0	78,840	385,440	0	0	464,280		
	- Dining	20	seats / mod						341	m²		270	1,470			0	92,070	501,270	0	0	593,340		
		1.2	m² / p													0	0	0	0	0	0		
		285.6	seats		14	**341**										0	0	0	0	0	0		
	- Kitchen (incl. Day storage)			50% of dining	7	**171**			171	m²		590	1,770			0	100,890	302,670	0	0	403,560		
	- Laundry	1	mod / 200 p		3	**73**			73	m²		590	1,770			0	43,070	129,210	0	0	172,280		
	- Recreation Hall	1.5	m² / p (70 %)	428	18	**428**			428	m²		250	1,240			0	107,000	530,720	0	0	637,720		
																0	0	0	0	0	0		
	- Infirmary	100	p / bed						49	m²		680	2,020			0	33,320	98,980	0	0	132,300		
		4	beds													0	0	0	0	0	0		
		2	beds / mod		2	**49**										0	0	0	0	0	0		
					56																		
					234																		
	Workshops															0	0	0	0	0	0		
	- Mechanical		Isolated steel building			**200**			200	m²		280	1,250			0	56,000	250,000	0	0	306,000		
	- Electrical		Isolated steel building			**200**			200	m²		280	1,250			0	56,000	250,000	0	0	306,000		
	- Carpenter		Isolated steel building			**200**			200	m²		280	1,250			0	56,000	250,000	0	0	306,000		
	- Garage and Fire Fighting		Isolated steel building			**400**			400	m²		290	830			0	116,000	332,000	0	0	448,000		
						1,000																	
	- Fire fighting Equipment		Isolated steel building			**150**			1	ls		330	366,670			0	330	366,670	0	0	367,000		
																0	0	0	0	0	0		
	Site 2																						
	Needed	8	kW / p-d		(Reserve)	Total																	
	Workers (Including T-Line)			162	0	162	0%																
	Staff			54	0	54	0%																
						216																	
	Accommodations (including common rooms)																						
		men / mod.	Living Mod.	Common	Total Mod											0	0	0	0	0	0		
				Mod.		**24.36**	**m² / mod**									0	0	0	0	0	0		
	Workers	4	41	16	57	**1,376**										0	0	0	0	0	0		
	Staff	2	27	11	38	**926**										0	0	0	0	0	0		
					95	**2,302**	m²									0	0	0	0	0	0		
	Supply and install															0	0	0	0	0	0		
	- Workers								1,376	m²		240	1,320			0	330,240	1,816,320	0	0	2,146,560		
	- Staff								926	m²		270	1,450			0	250,020	1,342,700	0	0	1,592,720		
					Mod	**m²**										0	0	0	0	0	0		

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WBS	DESCRIPTION						%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.72 $			
	Service building															0	0	0	0	0	0		
	- Offices	0.0284 mod / men			6	**146**			146	m²		270	1,320			0	39,420	192,720	0	0	232,140		
	- Dining	20 seats / mod							195	m²		270	1,470			0	52,650	286,650	0	0	339,300		
		1.2 m² / p														0	0	0	0	0	0		
		151.2 seats			8	**195**										0	0	0	0	0	0		
	- Kitchen (incl. Day storage)		50% of dining		4	**97**			97	m²		590	1,770			0	57,230	171,690	0	0	228,920		
	- Laundry	1 mod / 200 p			2	**49**			49	m²		590	1,770			0	28,910	86,730	0	0	115,640		
	- Recreation Hall	1.5 m² / p (70 %)		227	9	**227**			227	m²		250	1,240			0	56,750	281,480	0	0	338,230		
																0	0	0	0	0	0		
	- Infirmary	100 p / bed							24	m²		680	2,020			0	16,320	48,480	0	0	64,800		
		2 beds														0	0	0	0	0	0		
		2 beds / mod			1	**24**										0	0	0	0	0	0		
					30																		
					125																		
	Workshops															0	0	0	0	0	0		
	- Mechanical		Isolated steel building			**150**			150	m²		280	1,250			0	42,000	187,500	0	0	229,500		
	- Electrical		Isolated steel building			**150**			150	m²		280	1,250			0	42,000	187,500	0	0	229,500		
	- Carpenter		Isolated steel building			**150**			150	m²		280	1,250			0	42,000	187,500	0	0	229,500		
	- Garage and Fire Fighting		Isolated steel building			**300**			300	m²		290	830			0	87,000	249,000	0	0	336,000		
						750																	
	- Fire fighting Equipment		Isolated steel building			**150**			1	ls		330	366,670			0	330	366,670	0	0	367,000		
																0	0	0	0	0	0		
	Site 3																						
	Needed	8 kW / p-d			(Reserve)	Total																	
	Workers (Including T-Line)			111	0	111	0%																
	Staff			37	0	37	0%																
						148																	
	Accommodations (including common rooms)																						
		men / mod.	Living Mod.	Common	Total Mod											0	0	0	0	0	0		
				Mod.		**24.36**	**m² / mod**									0	0	0	0	0	0		
	Workers	4	28	11	39	**944**										0	0	0	0	0	0		
	Staff	2	19	7	26	**621**										0	0	0	0	0	0		
					64	**1,565**	m²									0	0	0	0	0	0		
	Supply and install															0	0	0	0	0	0		
	- Workers								944	m²		240	1,320			0	226,560	1,246,080	0	0	1,472,640		
	- Staff								621	m²		270	1,450			0	167,670	900,450	0	0	1,068,120		
					Mod	**m²**										0	0	0	0	0	0		
	Service building															0	0	0	0	0	0		
	- Offices	0.0284 mod / men			4	**97**			97	m²		270	1,320			0	26,190	128,040	0	0	154,230		
	- Dining	20 seats / mod							122	m²		270	1,470			0	32,940	179,340	0	0	212,280		
		1.2 m² / p														0	0	0	0	0	0		
		103.6 seats			5	**122**										0	0	0	0	0	0		
	- Kitchen (incl. Day storage)		50% of dining		3	**61**			61	m²		590	1,770			0	35,990	107,970	0	0	143,960		
	- Laundry	1 mod / 200 p			1	**24**			24	m²		590	1,770			0	14,160	42,480	0	0	56,640		
	- Recreation Hall	1.5 m² / p (70 %)		155	6	**155**			155	m²		250	1,240			0	38,750	192,200	0	0	230,950		
																0	0	0	0	0	0		
	- Infirmary	100 p / bed							12	m²		680	2,020			0	8,160	24,240	0	0	32,400		
		1 beds														0	0	0	0	0	0		
		2 beds / mod			1	**12**										0	0	0	0	0	0		
					19																		
					84																		
	Workshops															0	0	0	0	0	0		
	- Mechanical		Isolated steel building			**100**			100	m²		280	1,250			0	28,000	125,000	0	0	153,000		
	- Electrical		Isolated steel building			**100**			100	m²		280	1,250			0	28,000	125,000	0	0	153,000		
	- Carpenter		Isolated steel building			**100**			100	m²		280	1,250			0	28,000	125,000	0	0	153,000		
	- Garage and Fire Fighting		Isolated steel building			**150**			150	m²		290	830			0	43,500	124,500	0	0	168,000		
						450																	
	- Fire fighting Equipment		Isolated steel building			**150**			1	ls		330	366,670			0	330	366,670	0	0	367,000		
																0	0	0	0	0	0		
	Site 4																						

WBS	DESCRIPTION						%	Qty	Un.	M-P (UNIT PRICES)	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power (TOTAL COSTS)	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
															24.00 $				0.72 $			
	Needed	8	kW / p-d		(Reserve)	Total																
	Workers (Including T-Line)			132	0	132	0%															
	Staff			44	0	44	0%															
						176																
	Accommodations (including common rooms)																					
		men / mod.	Living Mod.	Common	Total Mod										0	0	0	0	0	0		
				Mod.		**24.36**	**m² / mod**								0	0	0	0	0	0		
	Workers	4	33	13	46	**1,121**									0	0	0	0	0	0		
	Staff	2	22	9	31	**755**									0	0	0	0	0	0		
					77	**1,876**	m²								0	0	0	0	0	0		
	Supply and install														0	0	0	0	0	0		
	- Workers							1,121	m²		240	1,320			0	269,040	1,479,720	0	0	1,748,760		
	- Staff							755	m²		270	1,450			0	203,850	1,094,750	0	0	1,298,600		
					Mod	**m²**									0	0	0	0	0	0		
	Service building														0	0	0	0	0	0		
	- Offices	0.0284	mod / men		5	**122**		122	m²		270	1,320			0	32,940	161,040	0	0	193,980		
	- Dining	20	seats / mod					146	m²		270	1,470			0	39,420	214,620	0	0	254,040		
		1.2	m² / p												0	0	0	0	0	0		
		123.2	seats		6	**146**									0	0	0	0	0	0		
	- Kitchen (incl. Day storage)			50% of dining	3	**73**		73	m²		590	1,770			0	43,070	129,210	0	0	172,280		
	- Laundry	1	mod / 200 p		1	**24**		24	m²		590	1,770			0	14,160	42,480	0	0	56,640		
	- Recreation Hall	1.5	m² / p (70 %)	185	8	**185**		185	m²		250	1,240			0	46,250	229,400	0	0	275,650		
															0	0	0	0	0	0		
	- Infirmary	100	p / bed					24	m²		680	2,020			0	16,320	48,480	0	0	64,800		
		2	beds												0	0	0	0	0	0		
		2	beds / mod		1	**24**									0	0	0	0	0	0		
					24																	
					101																	
	Workshops														0	0	0	0	0	0		
	- Mechanical		Isolated steel building			**100**		100	m²		280	1,250			0	28,000	125,000	0	0	153,000		
	- Electrical		Isolated steel building			**100**		100	m²		280	1,250			0	28,000	125,000	0	0	153,000		
	- Carpenter		Isolated steel building			**100**		100	m²		280	1,250			0	28,000	125,000	0	0	153,000		
	- Garage and Fire Fighting		Isolated steel building			**200**		200	m²		290	830			0	58,000	166,000	0	0	224,000		
						500																
	- Fire fighting Equipment		Isolated steel building			**150**		1	ls		330	366,670			0	330	366,670	0	0	367,000		
															0	0	0	0	0	0		
															0	0	0	0	0	0		
	Storage buildings		Capacity	1.50	m² / p / w										0	0	0	0	0	0		
	Needed for Site 1		408	612	m² / week																	
	Needed for Site 2		216	324	m² / week																	
	Needed for Site 3		148	222	m² / week																	
	Needed for Site 4		176	264	m² / week																	
	Needed for Site 1			612	m² / week																	
		48	months	2,650	m² / month	127,198	m³ total															
				31,800	m² / year																	
	For	6	months	15,900	m²																	
	Reserve	2	months	2,650	m²																	
				18,550	m² »»»»»»»»»																	
	Needed for Site 2			324	m² / week																	
		36	months	1,403	m² / month	50,505	m³ total								0	0	0	0	0	0		
				16,835	m² / year										0	0	0	0	0	0		
	For	6	months	8,418	m²										0	0	0	0	0	0		
	Reserve	2	months	1,403	m²										0	0	0	0	0	0		
				9,820	m² »»»»»»»»»										0	0	0	0	0	0		
	Needed for Site 3			222	m² / week																	
		24	months	961	m² / month	23,070	m³ total															
				11,535	m² / year																	

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Construction materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	For 6 months 5,768 m²																	
	Reserve 2 months 961 m²																	
	6,729 m² »»»»»»»»»																	
	Needed for Site 4 264 m² / week																	
	24 months 1,143 m² / month 27,435 m³ total																	
	13,717 m² / year																	
	For 6 months 6,859 m²																	
	Reserve 3 months 1,143 m²																	
	8,002 m² »»»»»»»»»																	
	Total supply 228,208 m² »»»»» ± **593,342 m³ of food**																	
	Site 1 Site 1 18,550 m²																	
	Site 2 9,820 m²																	
	Site 3 6,729 m²																	
	Site 4 8,002 m²																	
	43,101 m²																	
	Food storage Depot (m²) (m³)										0	0	0	0	0	0		
-	Frozen Isolated steel building 10,344 26,895	24%		10,344	m²		150	920			0	1,551,630	9,516,661	0	0	11,068,291		
-	Cold (refrigerated) Isolated steel building 10,344 26,895	24%		10,344	m²		120	750			0	1,241,304	7,758,148	0	0	8,999,452		
-	Dry (non perishable) Isolated steel building 22,412 58,272	52%		22,412	m²		130	870			0	2,913,615	19,498,811	0	0	22,412,426		
	43,101 112,062	100%		43,101	m²						0	0	0	0	0	0		
	Site 2 9,820 m²																	
	Food storage Depot (m²) (m³)										0	0	0	0	0	0		
-	Frozen Isolated steel building 2,357 6,128	24%		2,357	m²		150	920			0	353,536	2,168,353	0	0	2,521,889		
-	Cold (refrigerated) Isolated steel building 2,357 6,128	24%		2,357	m²		120	750			0	282,829	1,767,679	0	0	2,050,508		
-	Dry (non perishable) Isolated steel building 5,107 13,277	52%		5,107	m²		130	870			0	663,862	4,442,767	0	0	5,106,629		
	9,820 25,533	100%		9,820	m²						0	0	0	0	0	0		
	Site 3 6,729 m²																	
	Food storage Depot (m²) (m³)										0	0	0	0	0	0		
-	Frozen Isolated steel building 1,615 4,199	24%		1,615	m²		150	920			0	242,238	1,485,723	0	0	1,727,961		
-	Cold (refrigerated) Isolated steel building 1,615 4,199	24%		1,615	m²		120	750			0	193,790	1,211,188	0	0	1,404,978		
-	Dry (non perishable) Isolated steel building 3,499 9,097	52%		3,499	m²		130	870			0	454,868	3,044,118	0	0	3,498,986		
	6,729 17,495	100%		6,729	m²						0	0	0	0	0	0		
	Site 3 8,002 m²																	
	Food storage Depot (m²) (m³)										0	0	0	0	0	0		
-	Frozen Isolated steel building 1,920 4,993	24%		1,920	m²		150	920			0	288,066	1,766,806	0	0	2,054,872		
-	Cold (refrigerated) Isolated steel building 1,920 4,993	24%		1,920	m²		120	750			0	230,453	1,440,331	0	0	1,670,784		
-	Dry (non perishable) Isolated steel building 4,161 10,818	52%		4,161	m²		130	870			0	540,924	3,620,032	0	0	4,160,956		
	8,002 20,804	100%		8,002	m²						0	0	0	0	0	0		
	Starter Camp																	
	Needed Total																	
	Workers 60																	
	Staff 10																	
	Accommodations (including common rooms) 70																	
	men / mod. Living Mod. Common Mod. Total Mod **24.36 m² / mod**																	
	Workers 4 15 6 21 **512**																	
	Staff 2 5 2 7 **171**																	
	28 **683** m²																	
	Supply and install										0	0	0	0	0	0		
-	Workers			512	m²		240	1,320			0	122,880	675,840	0	0	798,720		
-	Staff			171	m²		270	1,450			0	46,170	247,950	0	0	294,120		

WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
									UNIT PRICES					TOTAL COSTS							
														24.00 $				0.72 $			
	- Dining	20 seats / mod					49	m²		270	1,470			0	13,230	72,030	0	0	85,260		
		1.2 m² / p												0	0	0	0	0	0		
		49.0 seats	2	**49**										0	0	0	0	0	0		
	- Kitchen (incl. Day storage)	50% of dining	1	**24**			24	m²		590	1,770			0	14,160	42,480	0	0	56,640		
	- Laundry	1 mod / 200 p	1	**24**			24	m²		590	1,770			0	14,160	42,480	0	0	56,640		
	- Recreation Hall	1.5 m² / p (70 %) 63	1	**22**			22	m²		250	1,240			0	5,500	27,280	0	0	32,780		
														0	0	0	0	0	0		
	- Infirmary	100 p / bed					12	m²		680	2,020			0	8,160	24,240	0	0	32,400		
		1 beds												0	0	0	0	0	0		
		2 beds / mod	1	**12**										0	0	0	0	0	0		
			33											0	0	0	0	0	0		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
6533	**Camps - Hydro Site 6g**													**0**	**13,547,055**	**81,614,737**	**0**	**0**	**95,161,792**		**0**

6540 Catering

6543 Catering - Hydro Site 6g

Total Site 1 to 4

	m-hours	p-d	p-month	
Staff		138,060	4,602	
Workers	m-h / d»»»	10		
Directs	1,591,019	159,102	5,303	
Indirects	456,380	45,638	1,521	
Catering (including Camp Operation)		22,974	766	12%
Miscellaneous	250,000	25,000	833	
		252,714	8,424	
		390,774	13,026	

Based on different sources, Total cost is estimated at 80.00 USD / m-d

This is including Catering and Operation of the camps

Catering	38%	38%
Operation		62%
Security and infirmary	8%	
Maintenance	5%	
Power station	49%	
	100%	100%

WBS	DESCRIPTION		%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												0	0	0	0	0	0		
												0	0	0	0	0	0		
		80.00 USD / p-d																	
	- Catering	2,433.33 USD / p-month	38%		13,026	p-mth		924.67				0	12,044,518	0	0	0	12,044,518		
												0	0	0	0	0	0		
6543	**Catering - Hydro Site 6g**											**0**	**12,044,518**	**0**	**0**	**0**	**12,044,518**		**0**

6550 Operation

6553 Operation - Hydro Site 6g

Total Site 1 to 4

	m-hours	p-d	p-month
Staff		138,060	4,602
Workers	m-h / d»»»	10	
Directs	1,591,019	159,102	5,303
Indirects	456,380	45,638	1,521
Catering (including Camp Operation)		22,974	766
Miscellaneous	250,000	25,000	833
		252,714	8,424
		390,774	13,026

Based on different sources, Total cost is estimated at 40.00 USD / m-d

This is including Catering and Operation of the camps

Catering	75%	100%
Security and infirmary	10%	
Maintenance	15%	

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
											0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Operation 40.00 USD / m-d; 1,216.67 USD / m-	0%		13,026	m-month		0.00				0	0	0	0	0	0		
	Power Station (diesel generators) **(Purchase of generators is included in 6330)**																	
	Site 1										0	0	0	0	0	0		
	Needed 8 kW / p-d (Reserve) Total										0	0	0	0	0	0		
	Workers (Including T-Line) 306 0 306	0%																
	Staff 102 0 102	0%																
	408										0	0	0	0	0	0		
	Needed capacity **4.1 mW**										0	0	0	0	0	0		
	48 months (First 2 months on pioneer camp)																	
	1,460 days 24 h / d			35,040	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Spare Installed										0	0	0	0	0	0		
	5 Cat GEP 910 - 910kW 1 8.50 130.80 3,640	50%	4	70,080	h				8.50	130.80	0	0	0	595,680	6,599,854	7,195,534		
	3 Cat GEP 550 - 400KW 1 6.50 102.40 800	50%	2	35,040	h				6.50	102.40	0	0	0	227,760	2,583,429	2,811,189		
	4,440.0										0	0	0	0	0	0		
	Fuel Storage										0	0	0	0	0	0		
	Total fuel consumption 12,755 kL										0	0	0	0	0	0		
	266 kL / month										0	0	0	0	0	0		
	Transportation from harbor 75 kL / trip										0	0	0	0	0	0		
	3.5 trips / mth										0	0	0	0	0	0		
	170 trips 5 h / trip			850	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	1,700	h	24.00					40,800	0	0	0	0	40,800		1,700
											0	0	0	0	0	0		
	- Fuel Tanker 75 kL 11.50 15.00	90%	1	765	h				12	15.00	0	0	0	8,798	8,262	17,060		
											0	0	0	0	0	0		
	Fuel Tank No reserve needed										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Fuel tank 189 kL 49,700 $			1	un		49,700				0	49,700	0	0	0	49,700		
											0	0	0	0	0	0		

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	- Miscellaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		9,940				0	9,940	0	0	0	9,940		
	Site 2										0	0	0	0	0	0		
	Needed 8 kW / p-d (Reserve) Total										0	0	0	0	0	0		
	Workers (Including T-Line) 162 0 162	0%																
	Staff 54 0 54	0%																
	216										0	0	0	0	0	0		
	Needed capacity **2.2 mW**										0	0	0	0	0	0		
	36 months (First 2 months on pioneer camp)																	
	1,095 days 24 h / d			26,280	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Spare Installed										0	0	0	0	0	0		
	3 Cat GEP 910 - 910kW 1 8.50 130.80 1,820	50%	2	26,280	h				8.50	130.80	0	0	0	223,380	2,474,945	2,698,325		
	2 Cat GEP 550 - 400KW 1 6.50 102.40 400	50%	1	13,140	h				6.50	102.40	0	0	0	85,410	968,786	1,054,196		
	2,220.0										0	0	0	0	0	0		
	Fuel Storage										0	0	0	0	0	0		
	Total fuel consumption 4,783 kL										0	0	0	0	0	0		
	133 kL / month										0	0	0	0	0	0		
	Transportation from harbor 75 kL / trip										0	0	0	0	0	0		
	1.8 trips / mth										0	0	0	0	0	0		
	64 trips 10 h / trip			640	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	1,280	h	24.00					30,720	0	0	0	0	30,720		1,280
											0	0	0	0	0	0		
	- Fuel Tanker 75 kL 11.50 15.00	90%	1	576	h				12	15.00	0	0	0	6,624	6,221	12,845		
											0	0	0	0	0	0		
	Fuel Tank Reserve for 1 month 266 kL										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Fuel tank 795 kL 154,500 $			1	un		154,500				0	154,500	0	0	0	154,500		
											0	0	0	0	0	0		
	- Miscellaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		30,900				0	30,900	0	0	0	30,900		
	Site 3										0	0	0	0	0	0		
	Needed 8 kW / p-d (Reserve) Total										0	0	0	0	0	0		
	Workers (Including T-Line) 111 0 111	0%																
	Staff 37 0 37	0%																
	148										0	0	0	0	0	0		
	Needed capacity **1.5 mW**										0	0	0	0	0	0		
	24 months (First 2 months on pioneer camp)																	
	730 days 24 h / d			17,520	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Spare Installed										0	0	0	0	0	0		
	3 Cat GEP 910 - 910kW 1 8.50 130.80 1,820	50%	2	17,520	h				8.50	130.80	0	0	0	148,920	1,649,964	1,798,884		
	1,820.0										0	0	0	0	0	0		
	Fuel Storage										0	0	0	0	0	0		
	Total fuel consumption 2,292 kL										0	0	0	0	0	0		
	95 kL / month										0	0	0	0	0	0		
	Transportation from harbor 75 kL / trip										0	0	0	0	0	0		
	1.3 trips / mth										0	0	0	0	0	0		
	31 trips 15 h / trip			465	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	930	h	24.00					22,320	0	0	0	0	22,320		930
											0	0	0	0	0	0		
	- Fuel Tanker 75 kL 11.50 15.00	90%	1	419	h				12	15.00	0	0	0	4,819	4,525	9,344		
											0	0	0	0	0	0		
	Fuel Tank Reserve for 1 month 191 kL										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Fuel tank 189 kL 49,700 $			1	un		49,700				0	49,700	0	0	0	49,700		
											0	0	0	0	0	0		
	- Miscellaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		9,940				0	9,940	0	0	0	9,940		

Item : (6513-6553)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Site 4										0	0	0	0	0	0		
	Needed 8 kW / p-d (Reserve) Total										0	0	0	0	0	0		
	Workers (Including T-Line) 132 0 132	0%																
	Staff 44 0 44	0%																
	176										0	0	0	0	0	0		
	Needed capacity **1.8 mW**										0	0	0	0	0	0		
	24 months (First 2 months on pioneer camp)																	
	730 days 24 h / d			17,520	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Spare Installed										0	0	0	0	0	0		
	3 Cat GEP 910 - 910kW 1 8.50 130.80 1,820	50%	2	17,520	h				8.50	130.80	0	0	0	148,920	1,649,964	1,798,884		
	2 Cat GEP 550 - 400KW 1 6.50 102.40 400	50%	1	8,760	h				6.50	102.40	0	0	0	56,940	645,857	702,797		
	2,220.0										0	0	0	0	0	0		
	Fuel Storage										0	0	0	0	0	0		
	Total fuel consumption 3,189 kL										0	0	0	0	0	0		
	133 kL / month										0	0	0	0	0	0		
	Transportation from harbor 75 kL / trip										0	0	0	0	0	0		
	1.8 trips / mth										0	0	0	0	0	0		
	43 trips 25 h / trip			1,075	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		2	2,150	h	24.00					51,600	0	0	0	0	51,600		2,150
											0	0	0	0	0	0		
	- Fuel Tanker 75 kL 11.50 15.00	90%	1	968	h				12	15.00	0	0	0	11,132	10,454	21,586		
											0	0	0	0	0	0		
	Fuel Tank Reserve for 3 months 531 kL										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Fuel tank 795 kL 154,500 $ 4 months reserve			2	un		154,500				0	309,000	0	0	0	309,000		
											0	0	0	0	0	0		
	- Miscellaneous (Storage pond, membrane, piping, etc...)	20%		1	ls		30,900				0	30,900	0	0	0	30,900		
	Starter Camp										0	0	0	0	0	0		
	Needed 8 kW / p-d Total										0	0	0	0	0	0		
	Workers 60										0	0	0	0	0	0		
	Staff 10										0	0	0	0	0	0		
	70										0	0	0	0	0	0		
	Needed capacity **0.7 mW** **2 months**										0	0	0	0	0	0		
	61 days 24 h / d			1,464	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	Spare Installed										0	0	0	0	0	0		
	2 Cat GEP 910 - 910kW 1 8.50 130.80 910	50%	1	732	h			8.50	130.80		0	0	6,222	95,746	0	101,968		
	910										0	0	0	0	0	0		
	- M-P (Included in Camp Operation)										0	0	0	0	0	0		
											0	0	0	0	0	0		
	- Miscellaneous (fueling, temp. Install., etc)			1	ls		200,000				0	200,000	0	0	0	200,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6553	**Operation - Hydro Site 6g**										**145,440**	**844,580**	**6,222**	**1,614,129**	**16,602,261**	**19,212,632**		**6,060**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Construction materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
6600	**Insurance, Taxes, Permits, Fees**																	
6630	**Insurance, Taxes, Permits, Fees - Hydro Site 6g**																	
	Insurances ± 700,000,000 $										0	0	0	0	0	0		
	- Responsibility	2.02%		1	ls				14,140,000		0	0	0	14,140,000	0	14,140,000		
											0	0	0	0	0	0		
	- Risk	0.62%		1	ls				4,340,000		0	0	0	4,340,000	0	4,340,000		
											0	0	0	0	0	0		
	- Execution Bund 0.0069 $			1	ls				4,830,000		0	0	0	4,830,000	0	4,830,000		
											0	0	0	0	0	0		
	- Equipment 119,698,716 $	0.5%		1	ls				598,494		0	0	0	598,494	0	598,494		
											0	0	0	0	0	0		
	- Miscellaneous			1	ls				1,000,000		0	0	0	1,000,000	0	1,000,000		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
6630	**Insurance, Taxes, Permits, Fees - Hydro Site 6g**										**0**	**0**	**0**	**24,908,494**	**0**	**24,908,494**		**0**

WBS	DESCRIPTION						n	Qty	Un.	Cons. Mat. (UNIT PRICES)	Freight in/out (UNIT PRICES)	Equip. M.perm. (UNIT PRICES)	Fuel (UNIT PRICES)	Man power (TOTAL COSTS)	Construction materials (TOTAL COSTS)	Freight (TOTAL COSTS)	Equipment Operation (TOTAL COSTS)	Fuel Consumption (TOTAL COSTS)	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
		0.9000 $ CDN / USD									250			24.00 $				0.72 $			
											125										
6700	**Miscellaneous**																				
6730	**Freight - Hydro Site 6g**																				
	Freight													0	0	0	0	0	0		
	Equipment	19,038,014 $												0	0	0	0	0	19,038,014		
														0	0	0	0	0	0		
	Camps																				
	Site 1	234																			
	Site 2	125																			
	Site 3	84																			
	Site 4	101																			
	Starter	33																			
		577		24.36 m³ / mod				14,056	m³		250.00			0	0	3,513,930	0	0	3,513,930		
														0	0	0	0	0	0		
	Generators	**1**	**2**	**3**	**4**									0	0	0	0	0	0		
	- Cat GEP 910 - 910kW	5	3	3	3	24 m³ / un	14	336	m³		250.00			0	0	84,000	0	0	84,000		
	- Cat GEP 550 - 400KW	3	2	0	2	20 m³ / un	7	140	m³		250.00			0	0	35,000	0	0	35,000		
														0	0	0	0	0	0		
	- Building	400	600	400	500			1,900	m³		250.00			0	0	475,000	0	0	475,000		
	- Fuel Tank	189	795	189	1590			2,763	m³		250.00			0	0	690,750	0	0	690,750		
	- Transformers	50	40	20	30			140	m³		250.00			0	0	35,000	0	0	35,000		
	- Miscellaneous	700	600	300	400			2,000	m³		250.00			0	0	500,000	0	0	500,000		
														0	0	0	0	0	0		
	Workshops	1000	750	450	500			2,700	m³		250.00			0	0	675,000	0	0	675,000		
														0	0	0	0	0	0		
	Storage buildings	43,101	9,820	6,729	8,002			67,652	m³		250.00			0	0	16,913,000	0	0	16,913,000		
														0	0	0	0	0	0		
	Fire Fighter Equipment	150	150	150	150			600	m³		250.00			0	0	150,000	0	0	150,000		
														0	0	0	0	0	0		
	Water Supply													0	0	0	0	0	0		
	- Storage tank	4000	4,000	2,000	3000			13,000	m³		250.00			0	0	3,250,000	0	0	3,250,000		
	- Mains Lines	2800	2300	1000	1500	0.0225 m³ / m		171	m³		250.00			0	0	42,750	0	0	42,750		
	- Raw water lines	500	250	250	250	0.0225 m³ / m		28	m³		250.00			0	0	7,031	0	0	7,031		
	- Treatment plan	14	14	14	14			56	m³		250.00			0	0	14,000	0	0	14,000		
														0	0	0	0	0	0		
	Sewer Plan													0	0	0	0	0	0		
	- Treatment plan	260	260	260	260			1,040	m³		250.00			0	0	260,000	0	0	260,000		
	- Sewer mains	1000	1000	1000	1000	0.0225 m³ / m		90	m³		250.00			0	0	22,500	0	0	22,500		
														0	0	0	0	0	0		
	Incinerators					16 m³ / un	2	32	m³		250.00			0	0	8,000	0	0	8,000		
														0	0	0	0	0	0		
	Telecommunications	30	30	30	30			120	m³		250.00			0	0	30,000	0	0	30,000		
														0	0	0	0	0	0		
	Catering		(Included in 6543)											0	0	0	0	0	0		
	Insurance													0	0	0	0	0	0		
														0	0	0	0	0	0		
	Camps			81,614,737 $		0.25 $ / 100$								0	0	0	0	0	204,037		
	Equipment			119,698,716 $		0.25 $ / 100$								0	0	0	0	0	299,247		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
6730	**Freight - Hydro Site 6g**													**0**	**0**	**26,705,961**	**0**	**0**	**46,247,259**		

Item : (7130)

WBS	DESCRIPTION	%	n	Qty	Un.	TOTAL COSTS Man power	65	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						25.60 $				0.72 $			
7000	**EPCM Home Office**												
7100	**EPCM Home Office - FEL 1 & 2**												
7130	**EPCM Home Office - FEL 1 & 2 - Hydro Site 6g**												
	Contractor **Percentage of direct costs** 191,167,128 $	2%									3,823,343		
	General Managing										2,000,000		
7130	**EPCM Home Office - FEL 1 & 2 - Hydro Site 6g**										**5,823,343**		

Item : (8130)

Art.	DESCRIPTION	%	n	Qty	Un.	COÛT UNITAIRE M-P Monthly	COÛT UNITAIRE M-P Hourly	TOTAL COSTS Men Power Monthly	TOTAL COSTS Men Power Hourly	GLOBAL PRICES	Men-hours
8000	**EPCM Field Office**										
8100	**EPCM Field Office - FEL 1 & 2**										
8130	**EPCM Field Office - FEL 1 & 2 - Hydro Site 6g**										
	Contractor Staff										
	Site 1 1,876										
	Site 2 545										
	Site 3 248										
	Site 4 296										
	2,965 P-Months										
	General Managing Staff										
	Site 1 1,092										
	Site 2 257										
	Site 3 121										
	Site 4 149										
	1,619 P-Months										
	4,584										
	- Average 10,000 $ / month			4,584		10,000.00		45,840,000		45,840,000	
8130	**EPCM Field Office - FEL 1 & 2 - Hydro Site 6g**									**45,840,000**	

Item : (9002)

WBS	DESCRIPTION	%	%	n	Qty	Un.	M-P (UNIT PRICES)	Cons. Mat. (UNIT PRICES)	Perm. Mat. (UNIT PRICES)	Equip. Op. (UNIT PRICES)	Fuel (UNIT PRICES)	Man power (TOTAL COSTS)	Construction materials (TOTAL COSTS)	Permanent Materials (TOTAL COSTS)	Equipment Operation (TOTAL COSTS)	Fuel Consumption (TOTAL COSTS)	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
9000	**Contingency**																		
9003	**Hydro Site 6g - Contingency**																		
	Direct Costs																		
	Harbor site preparation	**474,981**	15%														71,247		
																	0		
	Port Facility	**5,233,722**	15%														785,058		
																	0		
	Primary roads construction	**32,358,790**	25%														8,089,698		
																	0		
	Civil works related to Powerhouse, Tailrace tunnel and Surge tunnel																0		
																	0		
	Excavation	**13,082,134**	15%														1,962,320		
	Concrete Works	**10,151,745**	15%														1,522,762		
																	0		
	Civil works related to Power tunnel																0		
	Power tunnel (including Rock Support)	**22,010,423**	15%														3,301,563		
	Power tunnel Access and addit	**2,861,507**	15%														429,226		
	Intake excavation	**511,183**	15%														76,677		
	Intake structure	**605,206**	15%														90,781		
																	0		
	Dams and Spillway																0		
	Diversion Tunnels (including concrete plug and Portal Structure)	**798,831**	15%														119,825		
																	0		
	Cofferdams	**1,388,577**	15%														208,287		
	Foundation	**2,691,898**	15%														403,785		
	Impervious core	**5,704,281**	10%														570,428		
	Rock fill	**7,413,095**	15%														1,111,964		
	Spillway	**1,532,491**	15%														229,874		
	Transfer Tunnels	**6,464,829**	15%														969,724		
	Canals	**1,609,036**	15%														241,355		
	Supply and Installation of Transformers and Power cables	**4,327,600**	15%														649,140		
																	0		
																	0		
	Supply and Installation of High voltage distribution plant	**7,147,960**	15%														1,072,194		
																	0		
																	0		
	Emergency Generator	**174,900**	15%														26,235		
	Plant Communications	**1,061,000**	15%														159,150		
	Power plant Command Circuitry	**6,300,000**	15%														945,000		
	Switch yard Site	**652,371**	15%														97,856		
	Supply Line to Tunnel Intake	**3,380,635**	15%														507,095		
	Supply Line to Tunnel 1 Intake	**3,647,028**	15%														547,054		
	Mechanical + Electrical Works																0		
	Supply and Installation of Turbine/Generators assemblies	**30,647,875**	15%														4,597,181		
																	0		
	Supply and installation of Power tunnel and Diversion intake Gates	**1,408,500**	15%														211,275		
																	0		
	Supply and installation of Tunnel 1 Regulating gates	**1,364,000**	15%																
	Supply and installation of Draft tube Gates	**370,000**	15%														55,500		
	Supply the overhead crane	**1,575,000**	15%														236,250		

										UNIT PRICES					TOTAL COSTS					
WBS	DESCRIPTION		%	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Construction materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
													24.00 $				0.72 $			
																		0		
	Underground Utilities																	0		
	Fire water System	**529,480**		15%														79,422		
	Potable Water System	**764,720**		15%														114,708		
	Sewage and Sanitary System	**2,326,020**		15%														348,903		
	Compressed Air System	**590,210**		15%														88,532		
	Process Water System	**661,600**		15%														99,240		
	CVAC	**3,847,700**		15%														577,155		
																		0		
	Service building	**5,497,800**		15%														824,670		
																		0		
		191,167,128																0		
																		0		
	Indirect Costs																	0		
	Temporary Construction Facilities																	0		
	Work Areas, including Buildings	**5,635,744**		10%														563,574		
	Roads , Walkways, Parking Lots	**100,759**		15%														15,114		
	Utilities	**10,989,447**		15%														1,648,417		
																		0		
	Construction Services																	0		
	General Site Operation	**8,600,427**		10%														860,043		
	Final Clean Up	**383,024**		20%														76,605		
	Material Handling & Warehousing	**10,296,165**		15%														1,544,425		
	NDE & QA/QC Testing Services	**2,000,000**		10%														200,000		
	Surveying	**156,000**		20%														31,200		
	Site Security	**586,639**		20%														117,328		
	Man Power Transportation	**25,767,681**		15%														3,865,152		
	General Expenses	**852,700**		15%														127,905		
																		0		
	Construction Equipment, Tools & Supplies	**58,817,800**		15%														8,822,670		
																		0		
	Material Transportation	**16,568,461**		15%														2,485,269		
																		0		
	Construction Camp																	0		
	Site Preparation	**221,936**		10%														22,194		
	Infrastructure	**21,987,757**		10%														2,198,776		
	Camps	**95,161,792**		10%														9,516,179		
	Catering	**12,044,518**		10%														1,204,452		
	Operation	**19,212,632**		15%														2,881,895		
																		0		
	Insurance, Taxes, Permits, Fees	**24,908,494**		10%														2,490,849		
																		0		
	Miscellaneous Freight	**46,247,259**		10%														4,624,726		
																		0		
	EPCM Home Office - FEL 1 & 2	**5,823,343**		10%														582,334		
																		0		
	EPCM Field Office - FEL 1 & 2	**45,840,000**		10%														4,584,000		
																		0		
																		0		
9003	**Hydro Site 6g - Contingency**												**0**	**0**	**0**	**0**	**0**	**79,884,241**		**0**

Item : Asphalt (2)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Asphalt 2			3,750	mt														
	Asphalt Plan (m³) (mt)											0	0	0	0	0	0		
	Mix Needs 1.5 mt / m³																		
	Dam 1 1,300 1,950											0	0	0	0	0	0		
	Dam 2 1,200 1,800																		
	2,500 3,750																		
	(mt) months monthly Days																		
	2,013 2,000 3 667 78																		
	2,014 1,750 5 350 130																		
	3,750 208																		
	- Bitumen batching plant "drum mix" (400 t / h) (Included in 6300)			1	un							0	0	0	0	0	0		
												0	0	0	0	0	0		
	Purchase											0	0	0	0	0	0		
	Bitumen											0	0	0	0	0	0		
	- 7.5% of the mix 281 mt Losses 5%			295	mt			625.00				0	0	184,375	0	0	184,375		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			295	mt			250.00				0	0	73,750	0	0	73,750		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			295	mt			1.563				0	0	461	0	0	461		
												0	0	0	0	0	0		
	- Aggregates 3,469 mt Losses 5%			3,642	mt	1.84	1.30	0.00	2.08	3.08	0.08	6,701	4,735	0	7,575	8,076	27,087		291
												0	0	0	0	0	0		
	Mixing 10 h / d			2,080	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	6,240	h	24.00						149,760	0	0	0	0	149,760		6,240
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05		1	2,080	h				18.35	9.05		0	0	0	38,168	13,553	51,721		
	- Bitumen batching plant "drum mix" (400 t / h)		1	2,080	h				15.00			0	0	0	31,200	0	31,200		
												0	0	0	0	0	0		
	Bitument transportation Distance 18 km											0	0	0	0	0	0		
	295 mt											0	0	0	0	0	0		
	40 mt / trip 7 trips 6 h / trip			42	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		4	168	h	24.00						4,032	0	0	0	0	4,032		168
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	38	h				11.50	15.00		0	0	0	437	410	847		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	38	h				33.00	18.00		0	0	0	1,254	492	1,746		
												0	0	0	0	0	0		
	Asphalt Plan Installation and remove			8	sh							0	0	0	0	0	0		
	10 h / sh			80	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		7	560	h	24.00						13,440	0	0	0	0	13,440		560
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	20%	1	16	h				18.35	9.05		0	0	0	294	104	398		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	20%	1	16	h				38.25	28.00		0	0	0	612	323	935		

Item : Asphalt (2)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
							UNIT PRICES					TOTAL COSTS							
												24.00 $				0.72 $			
	- Cat 329DL Hydraulic Excavator 19.00 29.00	20%	1	16	h				19.00	29.00		0	0	0	304	334	638		
	- Crane - Rough terrain 50 t (L-Belt) 37.00 20.00	50%	1	40	h				37.00	20.00		0	0	0	1,480	576	2,056		
												0	0	0	0	0	0		
	- Miscelaneous			80	h		200.00					0	16,000	0	0	0	16,000		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
0	**Asphalt 2**			**3,750**	**mt**							**173,933**	**20,735**	**258,586**	**81,324**	**23,868**	**558,446**		**7,259**
	Unit costs				**mt**							**46.38**	**5.53**	**68.96**	**21.69**	**6.36**			**1.94**

Item : Asphalt (4)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Asphalt 4			3,300	mt														
	Asphalt Plan (m³) (mt)											0	0	0	0	0	0		
	Mix Needs 1.5 mt / m³																		
	Dam 4 700 1,050											0	0	0	0	0	0		
	Dam 5 1,500 2,250																		
	2,200 3,300																		
	(mt) months monthly Days																		
	2,014 3,300 6 550 156																		
	- Bitumen batching plant "drum mix" (400 t / h) (Included in 6300)			1	un							0	0	0	0	0	0		
												0	0	0	0	0	0		
	Purchase											0	0	0	0	0	0		
	Bitumen											0	0	0	0	0	0		
	- 7.5% of the mix 248 mt Losses 5%			260	mt			625.00				0	0	162,500	0	0	162,500		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			260	mt			250.00				0	0	65,000	0	0	65,000		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			260	mt			1.563				0	0	406	0	0	406		
												0	0	0	0	0	0		
	- Aggregates 3,052 mt Losses 5%			3,205	mt	1.80	1.38	0.00	2.03	3.15	0.07	5,769	4,423	0	6,506	7,269	23,967		224
												0	0	0	0	0	0		
	Mixing 10 h / d			1,560	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	4,680	h	24.00						112,320	0	0	0	0	112,320		4,680
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05		1	1,560	h				18.35	9.05		0	0	0	28,626	10,165	38,791		
	- Bitumen batching plant "drum mix" (400 t / h)		1	1,560	h				15.00			0	0	0	23,400	0	23,400		
												0	0	0	0	0	0		
	Bitument transportation Distance 18 km											0	0	0	0	0	0		
	260 mt											0	0	0	0	0	0		
	40 mt / trip 7 trips 10 h / trip			70	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		4	280	h	24.00						6,720	0	0	0	0	6,720		280
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	63	h				11.50	15.00		0	0	0	725	680	1,405		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	63	h				33.00	18.00		0	0	0	2,079	816	2,895		
												0	0	0	0	0	0		
	Water route 20 h / trip			140	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	420	h	24.00						10,080	0	0	0	0	10,080		420
												0	0	0	0	0	0		
	- Marine Equipment			140	h				60.00			0	0	0	8,400	0	8,400		
												0	0	0	0	0	0		
	Asphalt Plan Installation and remove			8	sh							0	0	0	0	0	0		
	10 h / sh			80	h							0	0	0	0	0	0		
												0	0	0	0	0	0		

Item : Asphalt (4)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES						TOTAL COSTS							
														24.00 $				0.72 $			
	- M-P				7	560	h	24.00						13,440	0	0	0	0	13,440		560
														0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05	20%	1	16	h				18.35	9.05		0	0	0	294	104	398		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	20%	1	16	h				38.25	28.00		0	0	0	612	323	935		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	20%	1	16	h				19.00	29.00		0	0	0	304	334	638		
	- Crane - Rough terrain 50 t (L-Belt)	37.00	20.00	50%	1	40	h				37.00	20.00		0	0	0	1,480	576	2,056		
														0	0	0	0	0	0		
	- Miscelaneous					80	h		200.00					0	16,000	0	0	0	16,000		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
0	**Asphalt 4**					**3,300**	**mt**							**148,329**	**20,423**	**227,906**	**72,426**	**20,267**	**489,351**		**6,164**
				Unit costs			**mt**							**44.95**	**6.19**	**69.06**	**21.95**	**6.141515152**			**1.87**

Item : **Crusher (1)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Crusher 1			**56 751**	**mt**													
	Crusher Plan System (Portable)										0	0	0	0	0	0		
	Needs										0	0	0	0	0	0		
	Site 1										0	0	0	0	0	0		
	Concrete 7 600 m³ (mt)										0	0	0	0	0	0		
	40-20 0.530 mt / m³ 4 028														0			
	20-05 0.530 mt / m³ 4 028														0			
	Sand 0.855 mt / m³ 6 498														0			
	14 554 mt														0			
	Road Pavement (Using TBM excavated material)										0	0	0	0	0	0		
	1.8 mt / m³										0	0	0	0	0	0		
	Road Pavement														0			
	23 443 m³ 1.8 mt / m³ 42 197														0			
	42 197 mt														0			
															0			
	Operation during summer periods only														0			
	Stockpilling a small amount for next springtime start														0			
															0			
	Powerhouse area 100 mt / h (eff.)										0	0	0	0	0	0		
	(mt) Operation (hours)										0	0	0	0	0	0		
	2 011 20 000 200 200										0	0	0	0	0	0		
	2 012 10 000 100 100										0	0	0	0	0	0		
	2 013 15 000 150 150										0	0	0	0	0	0		
	2 014 15 000 150 150														0			
	2 015 3 300 33 33										0	0	0	0	0	0		
	63 300 633 633										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Crushing and stockpiling Total Hours 633										0	0	0	0	0	0		
	Say			630	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	4 410	h	24.00					105 840	0	0	0	0	105 840		4 410
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	100%	2	1 260	h				18.35	9.05	0	0	0	23 121	8 210	31 331		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	100%	1	630	h				38.25	28.00	0	0	0	24 098	12 701	36 799		
	- Cat 725 Articulated Dumper 25 T 24.00 20.00	100%	3	1 890	h				24.00	20.00	0	0	0	45 360	27 216	72 576		
	- Crusher Assembly (300 t / h)	100%	1	630	h				50.00	84.00	0	0	0	31 500	38 102	69 602		
	Production of 1 800 mt / day										0	0	0	0	0	0		
	1.8 mt / m³ 1 000 m³ / d														0			
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 3										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 4 30 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		

Item : **Crusher (1)**

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	396 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Stock pile Winter protection										0	0	0	0	0	0		
	Shelter 100 x 15 m 300 15 4 500 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Supply			4 500	m²		80.00				0	360 000	0	0	0	360 000		
											0	0	0	0	0	0		
	Installation and removing			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	480	h	24.00					11 520	0	0	0	0	11 520		480
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	72	h				13.65	12.96	0	0	0	983	672	1 655		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	12.96	0	0	0	2 376	672	3 048		
											0	0	0	0	0	0		
	- Miscelaneous (footing, railing, etc...)			600	m		110.00				0	66 000	0	0	0	66 000		
											0	0	0	0	0	0		
	Heating 2 013 6 month 180 days										0	0	0	0	0	0		
	24 h / d			4 320	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2 h / d		2	720	h	24.00					17 280	0	0	0	0	17 280		720
											0	0	0	0	0	0		
	- Boiler - 1500 kW 4.00 190.00			4 320	h				4.00	190.00	0	0	0	17 280	590 976	608 256		
											0	0	0	0	0	0		
	- Miscellaneous (piping,pumps, etc...)			1	ls		30 000				0	30 000	0	0	0	30 000		
											0	0	0	0	0	0		
	Crusher Installation and Removing			8	sh						0	0	0	0	0	0		
	10 h / sh			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	560	h	24.00					13 440	0	0	0	0	13 440		560
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	75%	1	60	h				18.35	9.05	0	0	0	1 101	391	1 492		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	40%	1	32	h				38.25	28.00	0	0	0	1 224	645	1 869		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	30%	1	24	h				19.00	29.00	0	0	0	456	501	957		
											0	0	0	0	0	0		
	- Miscellaneous			80	h		30.00				0	2 400	0	0	0	2 400		
											0	0	0	0	0	0		
											0	0	0	0	0	0		
0	**Crusher 1**			**56 751**	**mt**						**148 080**	**458 400**	**0**	**147 499**	**680 086**	**1 434 065**	**25.27**	**6 170**

Unit costs	**mt**	**2.61**	**8.08**	**0.00**	**2.60**	**11.98**		**0.11**

Item : Concrete (1)

											UNIT PRICES						TOTAL COSTS							
WBS	DESCRIPTION						%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																	24.00 $				0.72 $			
	Concrete 1								7,600	m³														
	Concrete Batch Plan																0	0	0	0	0	0		
																	0	0	0	0	0	0		
	Needs	Site 1	Powerhouse	2,995													0	0	0	0	0	0		
			Transfos	1,660																				
			Intake tunnel	1,800																				
			Penstocks and Manifold	650																				
			Miscellaneous	495																				
				7,600																				
		Site 2	Dam 1	860													0	0	0	0	0	0		
			Dam 2	1,300																				
			Intake	760																				
			Spillway 1	750																				
			Miscellaneous	330																				
				4,000																				
		Site 3	Dam 3	200													0	0	0	0	0	0		
			Tunnel 1	900																				
			Miscellaneous	300																				
				1,400																				
		Site 4	Dam 4	700																				
			Dam 5	750																				
			Spillway 2	1,065																				
			Miscellaneous	485																				
				3,000																				
	Camp 1 (Powerhouse)		(m³)	months	monthly	Days											0	0	0	0	0	0		
		2,011	300	3	100	78											0	0	0	0	0	0		
		2,012				0											0	0	0	0	0	0		
		2,013	3,700	6	617	156											0	0	0	0	0	0		
		2,014	3,600	11.5	313	299											0	0	0	0	0	0		
		2,015	0	0		0											0	0	0	0	0	0		
			7,600			**533**											0	0	0	0	0	0		
	Camp 2 (Intake area)																0	0	0	0	0	0		
		2,012	100	2	50	52															0			
		2,013	3,000	6	500	156															0			
		2,014	900	8	113	208															0			
			4,000			**416**															0			
	Camp 3																				0			
		2,013	200	3	67	78															0			
		2,014	1,200	9.0	133	234															0			
			1,400			**312**															0			
	Camp 4																				0			
		2,013	300	3	100	78															0			
		2,014	2,000	11.5	174	299															0			
			2,300			**377**															0			
																					0			
			15,300																					

Item : Concrete (1)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES						TOTAL COSTS							
												24.00 $				0.72 $			
	Purchase											0	0	0	0	0	0		
	Building and Equipment															0			
	- Portable Batch plan - 25 m³ / h			1	un			75,000				0	0	75,000	0	0	75,000		
	- Building (Plan & Cement storage) 1,140 m²			1	un			53,540				0	0	53,540	0	0	53,540		
	- Control module 320 sf			1	un			65,500				0	0	65,500	0	0	65,500		
	- Boiller			1	un			18,000				0	0	18,000	0	0	18,000		
	- Miscelaneous (cement storage, water tank, etc.)			1	un			50,750				0	0	50,750	0	0	50,750		
												0	0	0	0	0	0		
	Cement											0	0	0	0	0	0		
	- Purchase 350 kg / m³ 2,660 mt Losses	5%		2,793	mt			73.00				0	0	203,889	0	0	203,889		
	7,600 m³											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Freight 250.00 USD / mt			2,793	mt			250.00				0	0	698,250	0	0	698,250		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			2,793	mt			0.1825				0	0	510	0	0	510		
												0	0	0	0	0	0		
	Aggregates											0	0	0	0	0	0		
	- 40-20 and 20-05 crushed stone & Sand **2.00** mt / m³			15,200	mt	**2.61**	**8.08**	**0.00**	**2.60**	**11.98**	**0.11**	39,672	122,816	0	39,520	131,109	333,117		**1,672**
												0	0	0	0	0	0		
	- Additives			7,600	m³			2.00				0	0	15,200	0	0	15,200		
												0	0	0	0	0	0		
	Mixing 533 days											0	0	0	0	0	0		
	10 h / d			5,330	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	15,990	h	24.00						383,760	0	0	0	0	383,760		15,990
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	4,797	h				18.35	9.05		0	0	0	88,025	31,257	119,282		
	- Concrete plan	90%	1	4,797	h				10.00			0	0	0	47,970	0	47,970		
												0	0	0	0	0	0		
	Batch Plan Installation and Removing			24	sh							0	0	0	0	0	0		
	10 h / sh			240	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		9	2,160	h	24.00						51,840	0	0	0	0	51,840		2,160
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	75%	1	180	h				18.35	9.05		0	0	0	3,303	1,173	4,476		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	40%	1	96	h				38.25	28.00		0	0	0	3,672	1,935	5,607		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	30%	1	72	h				19.00	29.00		0	0	0	1,368	1,503	2,871		
	- Welding Machine - 400 A 2.00 6.00	60%	1	144	h				2.00	6.00		0	0	0	288	622	910		
												0	0	0	0	0	0		
	- Miscellaneous			1	ls		10,000					0	10,000	0	0	0	10,000		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
0	**Concrete 1**			**7,600**	**m³**							**475,272**	**132,816**	**1,180,639**	**184,146**	**167,599**	**2,140,472**		**19,822**
	Unit costs				**m³**							**62.54**	**17.48**	**155.35**	**24.23**	**22.05**			**2.61**

Item : Rebars (1)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Reinforcing Steel - Camp 1			**456**	**mt**														
	Purchase 7,600 m³ concrete																		
	60 kg / m³																		
	- Rebars 456 mt Losses	5%		479	mt			689				0	0	330,031	0	0	330,031		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			479	mt			250.00				0	0	119,750	0	0	119,750		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			479	mt			1.7225				0	0	825	0	0	825		
												0	0	0	0	0	0		
	Fabrication											0	0	0	0	0	0		
	Production 4 mt / sh			114	sh							0	0	0	0	0	0		
	10 h / sh			1,140	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		6	6,840	h	24.00						164,160	0	0	0	0	164,160		6,840
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	50%	1	570	h				33.00	18.00		0	0	0	18,810	7,387	26,197		
	- Tractor & Trailer 11.50 15.00	50%	1	570	h				11.50	15.00		0	0	0	6,555	6,156	12,711		
	- Boom truck 17 tons 13.65 18.00	25%	1	285	h				13.65	18.00		0	0	0	3,890	3,694	7,584		
												0	0	0	0	0	0		
	- Miscelaneous			456	mt		100.00					0	45,600	0	0	0	45,600		
												0	0	0	0	0	0		
	Rebar Shop 8 sh											0	0	0	0	0	0		
	10 h / sh			80	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		5	400	h	24.00						9,600	0	0	0	0	9,600		400
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	18.00		0	0	0	2,376	933	3,309		
												0	0	0	0	0	0		
	- Supply 1,140 m²			1	un		53,540					0	53,540	0	0	0	53,540		
												0	0	0	0	0	0		
0	**Reinforcing Steel - Camp 1**			**456**	**mt**							**173,760**	**99,140**	**450,606**	**31,631**	**18,170**	**773,307**	**1,695.85**	**7,240**
	Unit costs											**381.05**	**217.41**	**988.17**	**69.37**	**39.85**	**1695.85**		**15.88**

Project : 6g Cost Estimate.xlsx

Item : Crusher (2)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	UNIT PRICES Cons. Mat.	UNIT PRICES Perm. Mat.	UNIT PRICES Equip. Op.	UNIT PRICES Fuel	TOTAL COSTS Man power	TOTAL COSTS Consumable materials	TOTAL COSTS Permanent Materials	TOTAL COSTS Equipment Operation	TOTAL COSTS Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Crusher 2			352,279	mt													
	Crusher Plan System (Portable)										0	0	0	0	0	0		
	Needs										0	0	0	0	0	0		
	Site 2										0	0	0	0	0	0		
	Concrete 4,000 m^3 (mt)										0	0	0	0	0	0		
	40-20 0.530 mt / m^3 2,120														0			
	20-05 0.530 mt / m^3 2,120														0			
	Sand 0.855 mt / m^3 3,420														0			
	Road Pavement (Using TBM excavated material)										0	0	0	0	0	0		
	1.8 mt / m^3										0	0	0	0	0	0		
	Road Pavement														0			
	19,805 m^3 1.8 mt / m^3 35,649														0			
	Dam impervious core														0			
	2,500 m^3 1.8 mt / m^3 4,500														0			
	Dam Filter														0			
	169,150 m^3 1.8 mt / m^3 304,470														0			
	352,279 mt														0			
															0			
	Operation during summer periods only														0			
	Stockpilling a small amount for next springtime start														0			
															0			
	Camp 2 100 mt / h (eff.)										0	0	0	0	0	0		
	(mt) Operation (hours)										0	0	0	0	0	0		
	2,013 150,000 1,500 1,500										0	0	0	0	0	0		
	2,014 150,000 1,500 1,500										0	0	0	0	0	0		
	2,015 53,000 530 530										0	0	0	0	0	0		
	353,000 3,530 3,530										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Crushing and stockpiling Total Hours 3,530										0	0	0	0	0	0		
	Say			3,600	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		7	25,200	h	24.00					604,800	0	0	0	0	604,800		25,200
											0	0	0	0	0	0		
-	Cat 950H Wheel Loader 18.35 9.05	100%	2	7,200	h				18.35	9.05	0	0	0	132,120	46,915	179,035		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	100%	1	3,600	h				38.25	28.00	0	0	0	137,700	72,576	210,276		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	100%	3	10,800	h				24.00	20.00	0	0	0	259,200	155,520	414,720		
-	Crusher Assembly (300 t / h)	100%	1	3,600	h				50.00	84.00	0	0	0	180,000	217,728	397,728		
	Production of 1,800 mt / day										0	0	0	0	0	0		
	1.8 mt / m^3 1,000 m^3 / d														0			
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 3										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 4 30 km / h										0	0	0	0	0	0		

Item : Crusher (2)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	396 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Stock pile Winter protection										0	0	0	0	0	0		
	Shelter 100 x 15 m 300 15 4,500 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Supply			4,500	m²		80.00				0	360,000	0	0	0	360,000		
											0	0	0	0	0	0		
	Installation and removing			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	72	h				13.65	12.96	0	0	0	983	672	1,655		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	12.96	0	0	0	2,376	672	3,048		
											0	0	0	0	0	0		
	- Miscelaneous (footing, railing, etc...)			600	m		110.00				0	66,000	0	0	0	66,000		
											0	0	0	0	0	0		
	Heating 2,013 6 month 180 days										0	0	0	0	0	0		
	24 h / d			4,320	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2 h / d		2	720	h	24.00					17,280	0	0	0	0	17,280		720
											0	0	0	0	0	0		
	- Boiler - 1500 kW 4.00 190.00			4,320	h				4.00	190.00	0	0	0	17,280	590,976	608,256		
											0	0	0	0	0	0		
	- Miscellaneous (piping,pumps, etc...)			1	ls		30,000				0	30,000	0	0	0	30,000		
											0	0	0	0	0	0		
	Crusher Installation and Removing			8	sh						0	0	0	0	0	0		
	10 h / sh			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	560	h	24.00					13,440	0	0	0	0	13,440		560
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	75%	1	60	h				18.35	9.05	0	0	0	1,101	391	1,492		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	40%	1	32	h				38.25	28.00	0	0	0	1,224	645	1,869		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	30%	1	24	h				19.00	29.00	0	0	0	456	501	957		
											0	0	0	0	0	0		
	- Miscellaneous			80	h		30.00				0	2,400	0	0	0	2,400		
											0	0	0	0	0	0		
0	**Crusher 2**			**352,279**	**mt**						**647,040**	**458,400**	**0**	**732,440**	**1,086,596**	**2,924,476**	**8.30**	**26,960**
	Unit costs				**mt**						**1.84**	**1.30**	**0.00**	**2.08**	**3.08**			**0.08**

Project : 6g Cost Estimate.xlsx

Item : Concrete (2)

											UNIT PRICES						TOTAL COSTS							
WBS	DESCRIPTION						%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																	24.00 $				0.72 $			
	Concrete 2								4,000	m³														
	Concrete Batch Plan																0	0	0	0	0	0		
																	0	0	0	0	0	0		
	Needs	Site 1	Powerhouse	2,995													0	0	0	0	0	0		
			Transfos	1,660													0	0	0	0	0	0		
			Intake tunnel	1,800													0	0	0	0	0	0		
			Penstocks and Manifold	650																	0			
			Miscellaneous	495																	0			
				7,600																	0			
																	0	0	0	0	0	0		
		Site 2	Dam 1	860													0	0	0	0	0	0		
			Dam 2	1,300													0	0	0	0	0	0		
			Intake	760													0	0	0	0	0	0		
			Spillway 1	750													0	0	0	0	0	0		
			Miscellaneous	330													0	0	0	0	0	0		
				4,000													0	0	0	0	0	0		
																	0	0	0	0	0	0		
		Site 3	Dam 3	200																	0			
			Tunnel 1	900																	0			
			Miscellaneous	300																	0			
				1,400																	0			
																					0			
		Site 4	Dam 4	700																	0			
			Dam 5	750																	0			
			Spillway 2	1,065																	0			
			Miscellaneous	485																	0			
				3,000																	0			
	Camp 1 (Powerhouse)		**(m³)**	**months**	**monthly**	**Days**															0			
		2,011	300	3	100	78															0			
		2,012				0																		
		2,013	3,700	6	617	156																		
		2,014	3,600	11.5	313	299																		
		2,015	0	0		0																		
			7,600			**533**																		
	Camp 2 (Intake area)																							
		2,012	100	2	50	52																		
		2,013	3,000	6	500	156																		
		2,014	900	8	113	208																		
			4,000			**416**																		
	Camp 3																							
		2,013	200	3	67	78																		
		2,014	1,200	9.0	133	234																		
			1,400			**312**																		
	Camp 4																							
		2,013	300	3	100	78																		
		2,014	2,000	11.5	174	299																		
			2,300			**377**																		
			15,300																					
	Purchase																0	0	0	0	0	0		

Item : Concrete (2)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES						TOTAL COSTS							
												24.00 $				0.72 $			
	Building and Equipment															0			
	- Portable Batch plan - 25 m³ / h			1	un			75,000				0	0	75,000	0	0	75,000		
	- Building (Plan & Cement storage) 1,140 m²			1	un			53,540				0	0	53,540	0	0	53,540		
	- Control module 320 sf			1	un			65,500				0	0	65,500	0	0	65,500		
	- Boiller			1	un			18,000				0	0	18,000	0	0	18,000		
	- Miscelaneous (cement storage, water tank, etc.)			1	un			50,750				0	0	50,750	0	0	50,750		
												0	0	0	0	0	0		
	Cement											0	0	0	0	0	0		
	- Purchase 350 kg / m³ 1,400 mt Losses	5%		1,470	mt			73.00				0	0	107,310	0	0	107,310		
	4,000 m³											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Freight 250.00 USD / mt			1,470	mt			250.00				0	0	367,500	0	0	367,500		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			1,470	mt			0.1825				0	0	268	0	0	268		
												0	0	0	0	0	0		
	Aggregates											0	0	0	0	0	0		
	- 40-20 and 20-05 crushed stone & Sand **2.00** mt / m³			8,000	mt	**1.84**	**1.30**	**0.00**	**2.08**	**3.08**	**0.08**	14,720	10,400	0	16,640	17,741	59,501		**640**
												0	0	0	0	0	0		
	- Additives			4,000	m³			2.00				0	0	8,000	0	0	8,000		
												0	0	0	0	0	0		
	Mixing 416 days											0	0	0	0	0	0		
	10 h / d			4,160	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	12,480	h	24.00						299,520	0	0	0	0	299,520		12,480
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	3,744	h				18.35	9.05		0	0	0	68,702	24,396	93,098		
	- Concrete plan	90%	1	3,744	h				10.00			0	0	0	37,440	0	37,440		
	Cement transportation Distance 20 km											0	0	0	0	0	0		
	1,470 mt											0	0	0	0	0	0		
	40 mt / trip 37 trips 6 h / trip			222	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		4	888	h	24.00						21,312	0	0	0	0	21,312		888
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	200	h				11.50	15.00		0	0	0	2,300	2,160	4,460		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	200	h				33.00	18.00		0	0	0	6,600	2,592	9,192		
												0	0	0	0	0	0		
	Batch Plan Installation and Removing			24	sh							0	0	0	0	0	0		
	10 h / sh			240	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		9	2,160	h	24.00						51,840	0	0	0	0	51,840		2,160
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	75%	1	180	h				18.35	9.05		0	0	0	3,303	1,173	4,476		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	40%	1	96	h				38.25	28.00		0	0	0	3,672	1,935	5,607		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	30%	1	72	h				19.00	29.00		0	0	0	1,368	1,503	2,871		
	- Welding Machine - 400 A 2.00 6.00	60%	1	144	h				2.00	6.00		0	0	0	288	622	910		
												0	0	0	0	0	0		
	- Miscellaneous			1	ls		10,000					0	10,000	0	0	0	10,000		
												0	0	0	0	0	0		
0	**Concrete 2**			**4,000**	**m³**							**387,392**	**20,400**	**745,868**	**140,313**	**52,122**	**1,346,095**		**16,168**
	Unit costs				**m³**							**96.85**	**5.10**	**186.47**	**35.08**	**13.03**	**336.52**		**4.04**

Item : Rebars (2)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES: M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS: Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Reinforcing Steel - Camp 2			**240**	**mt**														
	Purchase 4,000 m³ concrete																		
	60 kg / m³																		
	- Rebars 240 mt Losses	5%		252	mt			689				0	0	173,628	0	0	173,628		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			252	mt			250.00				0	0	63,000	0	0	63,000		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			252	mt			1.7225				0	0	434	0	0	434		
												0	0	0	0	0	0		
	Fabrication											0	0	0	0	0	0		
	Production 4 mt / sh			60	sh							0	0	0	0	0	0		
	10 h / sh			600	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		6	3,600	h	24.00						86,400	0	0	0	0	86,400		3,600
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	50%	1	300	h				33.00	18.00		0	0	0	9,900	3,888	13,788		
	- Tractor & Trailer 11.50 15.00	50%	1	300	h				11.50	15.00		0	0	0	3,450	3,240	6,690		
	- Boom truck 17 tons 13.65 18.00	25%	1	150	h				13.65	18.00		0	0	0	2,048	1,944	3,992		
												0	0	0	0	0	0		
	- Miscelaneous			240	mt		100.00					0	24,000	0	0	0	24,000		
																0			
	Transportation from harbour Distance 20 km															0			
	252 mt															0			
	40 mt / trip 6 trips 6 h / trip			36	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		4	144	h	24.00						3,456	0	0	0	0	3,456		144
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	32	h				11.50	15.00		0	0	0	368	346	714		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	32	h				33.00	18.00		0	0	0	1,056	415	1,471		
												0	0	0	0	0	0		
	Rebar Shop 8 sh											0	0	0	0	0	0		
	10 h / sh			80	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		5	400	h	24.00						9,600	0	0	0	0	9,600		400
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	18.00		0	0	0	2,376	933	3,309		
												0	0	0	0	0	0		
	- Supply 1,140 m²			1	un		53,540					0	53,540	0	0	0	53,540		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
0	**Reinforcing Steel - Camp 2**			**240**	**mt**							**99,456**	**77,540**	**237,062**	**19,198**	**10,766**	**444,022**	**1,850.09**	**4,144**
	Unit costs											**414.40**	**323.08**	**987.76**	**79.99**	**44.86**	**1850.09**		**17.27**

Project : 6g Cost Estimate.xlsx

Item : Crusher (3)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES					TOTAL COSTS							
											24.00 $				0.72 $			
	Crusher 3			**232,962**	**mt**													
	Crusher Plan System (Portable)										0	0	0	0	0	0		
	Needs										0	0	0	0	0	0		
	Powerhouse area										0	0	0	0	0	0		
	Concrete 1,400 m³ (mt)										0	0	0	0	0	0		
	40-20 0.530 mt / m³ 742														0			
	20-05 0.530 mt / m³ 742														0			
	Sand 0.855 mt / m³ 1,197														0			
	Road Pavement														0			
	17,434 m³ 1.8 mt / m³ 31,381														0			
	Dam Filter														0			
	110,500 m³ 1.8 mt / m³ 198,900														0			
	232,962 mt														0			
															0			
	Operation during summer periods only														0			
	Stockpilling a small amount for next springtime start														0			
															0			
	Camp 3 100 mt / h (eff.)										0	0	0	0	0	0		
	(mt) Operation (hours)														0			
	2,014 232,962 2,330 2,330										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Crushing and stockpiling Total Hours 2,330										0	0	0	0	0	0		
	Say			2,300	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		7	16,100	h	24.00					386,400	0	0	0	0	386,400		16,100
											0	0	0	0	0	0		
-	Cat 950H Wheel Loader 18.35 9.05	100%	2	4,600	h				18.35	9.05	0	0	0	84,410	29,974	114,384		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	100%	1	2,300	h				38.25	28.00	0	0	0	87,975	46,368	134,343		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	100%	3	6,900	h				24.00	20.00	0	0	0	165,600	99,360	264,960		
-	Crusher Assembly (300 t / h)	100%	1	2,300	h				50.00	84.00	0	0	0	115,000	139,104	254,104		
	Production of 1,800 mt / day										0	0	0	0	0	0		
	1.8 mt / m³ 1,000 m³ / d														0			
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 3										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 4 30 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		
	396 m³ / truck-sh										0	0	0	0	0	0		

Item : Crusher (3)

									UNIT PRICES					TOTAL COSTS							
WBS	DESCRIPTION				%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
														24.00 $				0.72 $			
	Number of trucks :	3												0	0	0	0	0	0		
														0	0	0	0	0	0		
	Stock pile Winter protection													0	0	0	0	0	0		
	Shelter	100 x 15 m	300	15 4,500 m²										0	0	0	0	0	0		
														0	0	0	0	0	0		
	Supply						4,500	m²		80.00				0	360,000	0	0	0	360,000		
														0	0	0	0	0	0		
	Installation and removing						8	sh						0	0	0	0	0	0		
				10 h / s			80	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					6	480	h	24.00					11,520	0	0	0	0	11,520		480
														0	0	0	0	0	0		
	- Boom truck 17 tons	13.65	18.00		90%	1	72	h				13.65	12.96	0	0	0	983	672	1,655		
	- Crane - Rough terrain 30 t (L-Belt)	33.00	18.00		90%	1	72	h				33.00	12.96	0	0	0	2,376	672	3,048		
														0	0	0	0	0	0		
	- Miscelaneous (footing, railing, etc...)						600	m		110.00				0	66,000	0	0	0	66,000		
														0	0	0	0	0	0		
	Heating	2,013	6 month	180 days										0	0	0	0	0	0		
				24 h / d			4,320	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P		2 h / d			2	720	h	24.00					17,280	0	0	0	0	17,280		720
														0	0	0	0	0	0		
	- Boiler - 1500 kW	4.00	190.00				4,320	h				4.00	190.00	0	0	0	17,280	590,976	608,256		
														0	0	0	0	0	0		
	- Miscellaneous (piping,pumps, etc...)						1	ls		30,000				0	30,000	0	0	0	30,000		
														0	0	0	0	0	0		
	Crusher Installation and Removing						8	sh						0	0	0	0	0	0		
				10 h / sh			80	h						0	0	0	0	0	0		
														0	0	0	0	0	0		
	- M-P					7	560	h	24.00					13,440	0	0	0	0	13,440		560
														0	0	0	0	0	0		
	- Cat 950H Wheel Loader	18.35	9.05		75%	1	60	h				18.35	9.05	0	0	0	1,101	391	1,492		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00		40%	1	32	h				38.25	28.00	0	0	0	1,224	645	1,869		
	- Cat 329DL Hydraulic Excavator	19.00	29.00		30%	1	24	h				19.00	29.00	0	0	0	456	501	957		
	- Miscellaneous						80	h		30.00				0	2,400	0	0	0	2,400		
														0	0	0	0	0	0		
0	**Crusher 3**						**232,962**	**mt**						**428,640**	**458,400**	**0**	**476,405**	**908,663**	**2,272,108**	**9.75**	**17,860**
	Unit costs							**mt**						**1.84**	**1.97**	**0.00**	**2.04**	**3.90**			**0.08**

Item : Concrete (3)

WBS	DESCRIPTION					%	n	Qty	Un.	M-P (UNIT PRICES)	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power (TOTAL COSTS)	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
																24.00 $				0.72 $			
	Concrete 3							1,400	m^3														
	Concrete Batch Plan															0	0	0	0	0	0		
																0	0	0	0	0	0		
	Needs Site 1 Powerhouse	2,995														0	0	0	0	0	0		
	Transfos	1,660														0	0	0	0	0	0		
	Intake tunnel	1,800														0	0	0	0	0	0		
	Penstocks and Manifold	650																		0			
	Miscellaneous	495																		0			
		7,600																		0			
																0	0	0	0	0	0		
	Site 2 Dam 1	860														0	0	0	0	0	0		
	Dam 2	1,300														0	0	0	0	0	0		
	Intake	760														0	0	0	0	0	0		
	Spillway 1	750														0	0	0	0	0	0		
	Miscellaneous	330														0	0	0	0	0	0		
		4,000														0	0	0	0	0	0		
																0	0	0	0	0	0		
	Site 3 Dam 3	200																		0			
	Tunnel 1	900																		0			
	Miscellaneous	300																		0			
		1,400																		0			
																				0			
	Site 4 Dam 4	700																		0			
	Dam 5	750																		0			
	Spillway 2	1,065																		0			
	Miscellaneous	485																		0			
		3,000																		0			
																				0			
	Camp 1 (Powerhouse)	**(m^3)**	**months**	**monthly**	**Days**															0			
	2,011	300	3	100	78															0			
	2,012				0																		
	2,013	3,700	6	617	156																		
	2,014	3,600	11.5	313	299																		
	2,015	0	0		0																		
		7,600			**533**																		
	Camp 2 (Intake area)																						
	2,012	100	2	50	52																		
	2,013	3,000	6	500	156																		
	2,014	900	8	113	208																		
		4,000			**416**																		
	Camp 3																						
	2,013	200	3	67	78																		
	2,014	1,200	9.0	133	234																		
		1,400			**312**																		
	Camp 4																						
	2,013	300	3	100	78																		
	2,014	2,000	11.5	174	299																		
		2,300			**377**																		
		15,300																					
	Purchase															0	0	0	0	0	0		

Item : Concrete (3)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Building and Equipment															0			
	- Portable Batch plan - 25 m³ / h			1	un			75,000				0	0	75,000	0	0	75,000		
	- Building (Plan & Cement storage) 1,140 m²			1	un			53,540				0	0	53,540	0	0	53,540		
	- Control module 320 sf			1	un			65,500				0	0	65,500	0	0	65,500		
	- Boiller			1	un			18,000				0	0	18,000	0	0	18,000		
	- Miscelaneous (cement storage, water tank, etc.)			1	un			50,750				0	0	50,750	0	0	50,750		
												0	0	0	0	0	0		
	Cement											0	0	0	0	0	0		
	- Purchase 350 kg / m³ 490 mt Losses	5%		515	mt			73.00				0	0	37,595	0	0	37,595		
	1,400 m³											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			515	mt			250.00				0	0	128,750	0	0	128,750		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			515	mt			0.1825				0	0	94	0	0	94		
												0	0	0	0	0	0		
	Aggregates											0	0	0	0	0	0		
	- 40-20 and 20-05 crushed stone & Sand **1.80** mt / m³			2,520	mt	**1.84**	**1.97**	**0.00**	**2.04**	**3.90**	**0.08**	4,637	4,964	0	5,141	7,076	21,818		**202**
												0	0	0	0	0	0		
	- Additives			1,400	m³			2.00				0	0	2,800	0	0	2,800		
												0	0	0	0	0	0		
	Mixing 0 days											0	0	0	0	0	0		
	10 h / d			0	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	0	h	24.00						0	0	0	0	0	0		0
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	0	h				18.35	9.05		0	0	0	0	0	0		
	- Concrete plan	90%	1	0	h				10.00			0	0	0	0	0	0		
	Cement transportation Distance 40 km											0	0	0	0	0	0		
	515 mt											0	0	0	0	0	0		
	40 mt / trip 13 trips 10 h / trip			130	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		2	260	h	24.00						6,240	0	0	0	0	6,240		260
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	117	h				11.50	15.00		0	0	0	1,346	1,264	2,610		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	117	h				33.00	18.00		0	0	0	3,861	1,516	5,377		
												0	0	0	0	0	0		
	Batch Plan Installation and Removing			24	sh							0	0	0	0	0	0		
	10 h / sh			240	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		9	2,160	h	24.00						51,840	0	0	0	0	51,840		2,160
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	75%	1	180	h				18.35	9.05		0	0	0	3,303	1,173	4,476		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	40%	1	96	h				38.25	28.00		0	0	0	3,672	1,935	5,607		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	30%	1	72	h				19.00	29.00		0	0	0	1,368	1,503	2,871		
	- Welding Machine - 400 A 2.00 6.00	60%	1	144	h				2.00	6.00		0	0	0	288	622	910		
												0	0	0	0	0	0		
	- Miscellaneous			1	ls		10,000					0	10,000	0	0	0	10,000		
												0	0	0	0	0	0		
0	**Concrete 3**			**1,400**	**m³**							**62,717**	**14,964**	**432,029**	**18,979**	**15,089**	**543,778**		**2,622**
	Unit costs				**m³**							**44.80**	**10.69**	**308.59**	**13.56**	**10.78**	**388.41**		**1.87**

Item : Rebars (3)

WBS	DESCRIPTION	%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
						UNIT PRICES						TOTAL COSTS							
												24.00 $				0.72 $			
	Reinforcing Steel - Camp 3			**84**	**mt**														
	Purchase 1,400 m³ concrete																		
	60 kg / m³																		
	- Rebars 84 mt Losses	5%		88	mt			689				0	0	60,632	0	0	60,632		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			88	mt			250.00				0	0	22,000	0	0	22,000		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			88	mt			1.7225				0	0	152	0	0	152		
												0	0	0	0	0	0		
	Fabrication											0	0	0	0	0	0		
	Production 4 mt / sh			21	sh							0	0	0	0	0	0		
	10 h / sh			210	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		6	1,260	h	24.00						30,240	0	0	0	0	30,240		1,260
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	50%	1	105	h				33.00	18.00		0	0	0	3,465	1,361	4,826		
	- Tractor & Trailer 11.50 15.00	50%	1	105	h				11.50	15.00		0	0	0	1,208	1,134	2,342		
	- Boom truck 17 tons 13.65 18.00	25%	1	53	h				13.65	18.00		0	0	0	723	687	1,410		
												0	0	0	0	0	0		
	- Miscelaneous			84	mt		100.00					0	8,400	0	0	0	8,400		
																0			
	Transportation from harbour Distance 40 km															0			
	88 mt															0			
	40 mt / trip 2 trips 10 h / trip			20	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		4	80	h	24.00						1,920	0	0	0	0	1,920		80
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	18	h				11.50	15.00		0	0	0	207	194	401		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	18	h				33.00	18.00		0	0	0	594	233	827		
												0	0	0	0	0	0		
	Rebar Shop 8 sh											0	0	0	0	0	0		
	10 h / sh			80	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		5	400	h	24.00						9,600	0	0	0	0	9,600		400
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	18.00		0	0	0	2,376	933	3,309		
												0	0	0	0	0	0		
	- Supply 1,140 m²			1	un		53,540					0	53,540	0	0	0	53,540		
												0	0	0	0	0	0		
												0	0	0	0	0	0		
0	**Reinforcing Steel - Camp 3**			**84**	**mt**							**41,760**	**61,940**	**82,784**	**8,573**	**4,542**	**199,599**	**2,376.18**	**1,740**
	Unit costs											**497.14**	**737.38**	**985.52**	**102.06**	**54.07**	**2376.18**		**20.71**

Item : Crusher (4)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	Crusher 4			**332,090**	**mt**													
	Crusher Plan System (Portable)										0	0	0	0	0	0		
	Needs										0	0	0	0	0	0		
	Powerhouse area										0	0	0	0	0	0		
	Concrete 3,000 m³ (mt)										0	0	0	0	0	0		
	40-20 0.530 mt / m³ 1,590														0			
	20-05 0.530 mt / m³ 1,590														0			
	Sand 0.855 mt / m³ 2,565														0			
	Road Pavement														0			
	3,803 m³ 1.8 mt / m³ 6,845														0			
	Dam impervious core														0			
	2,200 m³ 1.8 mt / m³ 3,960														0			
	Dam Filter														0			
	175,300 m³ 1.8 mt / m³ 315,540														0			
	332,090 mt														0			
															0			
	Operation during summer periods only														0			
	Stockpilling a small amount for next springtime start														0			
															0			
	Camp 4 100 mt / h (eff.)										0	0	0	0	0	0		
	(mt) Operation (hours)														0			
	2,014 332,090 3,321 3,321										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Crushing and stockpiling Total Hours 3,321										0	0	0	0	0	0		
	Say			3,300	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
-	M-P		7	23,100	h	24.00					554,400	0	0	0	0	554,400		23,100
											0	0	0	0	0	0		
-	Cat 950H Wheel Loader 18.35 9.05	100%	2	6,600	h				18.35	9.05	0	0	0	121,110	43,006	164,116		
-	Cat D7R II LGP Track-Type Tractor 38.25 28.00	100%	1	3,300	h				38.25	28.00	0	0	0	126,225	66,528	192,753		
-	Cat 725 Articulated Dumper 25 T 24.00 20.00	100%	3	9,900	h				24.00	20.00	0	0	0	237,600	142,560	380,160		
-	Crusher Assembly (300 t / h)	100%	1	3,300	h				50.00	84.00	0	0	0	165,000	199,584	364,584		
	Production of 1,800 mt / day										0	0	0	0	0	0		
	1.8 mt / m³ 1,000 m³ / d														0			
	Average hauling distance : 2.00 km										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Loading 3										0	0	0	0	0	0		
	Going 4 30 km / h										0	0	0	0	0	0		
	Unloading 3										0	0	0	0	0	0		
	Return 4 30 km / h										0	0	0	0	0	0		
	14 min.										0	0	0	0	0	0		
	Efficiency : 85% 16 min. / trip										0	0	0	0	0	0		
	0.27 h / trip										0	0	0	0	0	0		
	9 h / sh										0	0	0	0	0	0		
	33 trips / day										0	0	0	0	0	0		
	Cat 725 Articulated Dumper 25 T 12 m³										0	0	0	0	0	0		

Item : Crusher (4)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
											24.00 $				0.72 $			
	396 m³ / truck-sh										0	0	0	0	0	0		
	Number of trucks : **3**										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Stock pile Winter protection										0	0	0	0	0	0		
	Shelter 100 x 15 m 300 15 4,500 m²										0	0	0	0	0	0		
											0	0	0	0	0	0		
	Supply			4,500	m²		80.00				0	360,000	0	0	0	360,000		
											0	0	0	0	0	0		
	Installation and removing			8	sh						0	0	0	0	0	0		
	10 h / s			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		6	480	h	24.00					11,520	0	0	0	0	11,520		480
											0	0	0	0	0	0		
	- Boom truck 17 tons 13.65 18.00	90%	1	72	h				13.65	12.96	0	0	0	983	672	1,655		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	12.96	0	0	0	2,376	672	3,048		
											0	0	0	0	0	0		
	- Miscelaneous (footing, railing, etc...)			600	m		110.00				0	66,000	0	0	0	66,000		
											0	0	0	0	0	0		
	Heating 2,013 6 month 180 days										0	0	0	0	0	0		
	24 h / d			4,320	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P 2 h / d		2	720	h	24.00					17,280	0	0	0	0	17,280		720
											0	0	0	0	0	0		
	- Boiler - 1500 kW 4.00 190.00			4,320	h				4.00	190.00	0	0	0	17,280	590,976	608,256		
											0	0	0	0	0	0		
	- Miscellaneous (piping,pumps, etc...)			1	ls		30,000				0	30,000	0	0	0	30,000		
											0	0	0	0	0	0		
	Crusher Installation and Removing			8	sh						0	0	0	0	0	0		
	10 h / sh			80	h						0	0	0	0	0	0		
											0	0	0	0	0	0		
	- M-P		7	560	h	24.00					13,440	0	0	0	0	13,440		560
											0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	75%	1	60	h				18.35	9.05	0	0	0	1,101	391	1,492		
	- Cat D7R II LGP Track-Type Tractor 38.25 28.00	40%	1	32	h				38.25	28.00	0	0	0	1,224	645	1,869		
	- Cat 329DL Hydraulic Excavator 19.00 29.00	30%	1	24	h				19.00	29.00	0	0	0	456	501	957		
	- Miscellaneous			80	h		30.00				0	2,400	0	0	0	2,400		
											0	0	0	0	0	0		
0	**Crusher 4**			**332,090**	**mt**						**596,640**	**458,400**	**0**	**673,355**	**1,045,535**	**2,773,930**	**8.35**	**24,860**
	Unit costs				**mt**						**1.80**	**1.38**	**0.00**	**2.03**	**3.15**			**0.07**

Item : Concrete (4)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Concrete 4			3,000	m³														

Concrete Batch Plan

						Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES
Concrete Batch Plan						0	0	0	0	0	0
						0	0	0	0	0	0
Needs	Site 1	Powerhouse	2,995			0	0	0	0	0	0
		Transfos	1,660			0	0	0	0	0	0
		Intake tunnel	1,800			0	0	0	0	0	0
		Penstocks and Manifold	650							0	
		Miscellaneous	495							0	
			7,600							0	
						0	0	0	0	0	0
	Site 2	Dam 1	860			0	0	0	0	0	0
		Dam 2	1,300			0	0	0	0	0	0
		Intake	760			0	0	0	0	0	0
		Spillway 1	750			0	0	0	0	0	0
		Miscellaneous	330			0	0	0	0	0	0
			4,000			0	0	0	0	0	0
						0	0	0	0	0	0
	Site 3	Dam 3	200							0	
		Tunnel 1	900							0	
		Miscellaneous	300							0	
			1,400							0	
										0	
	Site 4	Dam 4	700							0	
		Dam 5	750							0	
		Spillway 2	1,065							0	
		Miscellaneous	485							0	
			3,000							0	
										0	
Camp 1 (Powerhouse)		(m³)	months	monthly	Days					0	
	2,011	300	3	100	78					0	
	2,012				0						
	2,013	3,700	6	617	156						
	2,014	3,600	11.5	313	299						
	2,015	0	0		0						
		7,600			**533**						
Camp 2 (Intake area)											
	2,012	100	2	50	52						
	2,013	3,000	6	500	156						
	2,014	900	8	113	208						
		4,000			**416**						
Camp 3											
	2,013	200	3	67	78						
	2,014	1,200	9.0	133	234						
		1,400			**312**						
Camp 4											
	2,013	300	3	100	78						
	2,014	2,000	11.5	174	299						
		2,300			**377**						

Item : Concrete (4)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	15,300																		
	Purchase											0	0	0	0	0	0		
	Building and Equipment															0			
	- Portable Batch plan - 25 m³ / h			1	un			75,000				0	0	75,000	0	0	75,000		
	- Building (Plan & Cement storage) 1,140 m²			1	un			53,540				0	0	53,540	0	0	53,540		
	- Control module 320 sf			1	un			65,500				0	0	65,500	0	0	65,500		
	- Boiller			1	un			18,000				0	0	18,000	0	0	18,000		
	- Miscelaneous (cement storage, water tank, etc.)			1	un			50,750				0	0	50,750	0	0	50,750		
												0	0	0	0	0	0		
	Cement											0	0	0	0	0	0		
	- Purchase 350 kg / m³ 805 mt Losses	5%		845	mt			73.00				0	0	61,685	0	0	61,685		
	2,300 m³											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Freight 250.00 USD / mt			845	mt			250.00				0	0	211,250	0	0	211,250		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			845	mt			0.1825				0	0	154	0	0	154		
												0	0	0	0	0	0		
	Aggregates											0	0	0	0	0	0		
	- 40-20 and 20-05 crushed stone & Sand **2.00** mt / m³			4,600	mt	**1.80**	**1.38**	**0.00**	**2.03**	**3.15**	**0.07**	8,280	6,348	0	9,338	10,433	34,399		**322**
												0	0	0	0	0	0		
	- Additives			2,300	m³			2.00				0	0	4,600	0	0	4,600		
												0	0	0	0	0	0		
	Mixing 377 days											0	0	0	0	0	0		
	10 h / d			3,770	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	11,310	h	24.00						271,440	0	0	0	0	271,440		11,310
												0	0	0	0	0	0		
	- Cat 950H Wheel Loader 18.35 9.05	90%	1	3,393	h				18.35	9.05		0	0	0	62,262	22,109	84,371		
	- Concrete plan	90%	1	3,393	h				10.00			0	0	0	33,930	0	33,930		
	Cement transportation Distance 40 km											0	0	0	0	0	0		
	845 mt											0	0	0	0	0	0		
																0			
	40 mt / trip 21 trips 10 h / trip			210	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	630	h	24.00						15,120	0	0	0	0	15,120		630
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	189	h				11.50	15.00		0	0	0	2,174	2,041	4,215		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	189	h				33.00	18.00		0	0	0	6,237	2,449	8,686		
												0	0	0	0	0	0		
	Water route 20 h / trip			420	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	1,260	h	24.00						30,240	0	0	0	0	30,240		1,260
												0	0	0	0	0	0		
	- Marine Equipment			420	h				60.00			0	0	0	25,200	0	25,200		
												0	0	0	0	0	0		
	Batch Plan Installation and Removing			24	sh							0	0	0	0	0	0		
	10 h / sh			240	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		9	2,160	h	24.00						51,840	0	0	0	0	51,840		2,160
												0	0	0	0	0	0		

Project : 6g Cost Estimate.xlsx

Item : Concrete (4)

WBS	DESCRIPTION			%	n	Qty	Un.	M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
								UNIT PRICES						TOTAL COSTS							
														24.00 $				0.72 $			
	- Cat 950H Wheel Loader	18.35	9.05	75%	1	180	h				18.35	9.05		0	0	0	3,303	1,173	4,476		
	- Cat D7R II LGP Track-Type Tractor	38.25	28.00	40%	1	96	h				38.25	28.00		0	0	0	3,672	1,935	5,607		
	- Cat 329DL Hydraulic Excavator	19.00	29.00	30%	1	72	h				19.00	29.00		0	0	0	1,368	1,503	2,871		
	- Welding Machine - 400 A	2.00	6.00	60%	1	144	h				2.00	6.00		0	0	0	288	622	910		
														0	0	0	0	0	0		
	- Miscellaneous					1	ls		10,000					0	10,000	0	0	0	10,000		
														0	0	0	0	0	0		
														0	0	0	0	0	0		
0	**Concrete 4**					**3,000**	**m³**							**376,920**	**16,348**	**540,479**	**147,772**	**42,265**	**1,123,784**		**15,682**
	Unit costs						**m³**							**125.64**	**5.45**	**180.16**	**49.26**	**14.09**	**374.59**		**5.23**

Project : 6g Cost Estimate.xlsx

Item : Rebars (4)

WBS	DESCRIPTION	%	n	Qty	Un.	UNIT PRICES M-P	Cons. Mat.	Perm. Mat.	Equip. Op.	Fuel l / h	m - h / un	TOTAL COSTS Man power	Consumable materials	Permanent Materials	Equipment Operation	Fuel Consumption	GLOBAL PRICES	UNIT PRICES	MEN-HOURS
												24.00 $				0.72 $			
	Reinforcing Steel - Camp 4			180	mt														
	Purchase 3,000 m³ concrete																		
	60 kg / m³																		
	- Rebars 180 mt Losses	5%		189	mt			689				0	0	130,221	0	0	130,221		
												0	0	0	0	0	0		
	- Freight 0.9259 $ CDN »»» 254.62 USD / mt			189	mt			250.00				0	0	47,250	0	0	47,250		
	275.00 $ CDN / mt											0	0	0	0	0	0		
												0	0	0	0	0	0		
	- Insurance 0.25 $ / 100$			189	mt			1.7225				0	0	326	0	0	326		
												0	0	0	0	0	0		
	Fabrication											0	0	0	0	0	0		
	Production 4 mt / sh			45	sh							0	0	0	0	0	0		
	10 h / sh			450	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		6	2,700	h	24.00						64,800	0	0	0	0	64,800		2,700
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	50%	1	225	h				33.00	18.00		0	0	0	7,425	2,916	10,341		
	- Tractor & Trailer 11.50 15.00	50%	1	225	h				11.50	15.00		0	0	0	2,588	2,430	5,018		
	- Boom truck 17 tons 13.65 18.00	25%	1	113	h				13.65	18.00		0	0	0	1,542	1,464	3,006		
												0	0	0	0	0	0		
	- Miscelaneous			180	mt		100.00					0	18,000	0	0	0	18,000		
																0			
	Transportation from harbour Distance 40 km															0			
	189 mt															0			
	40 mt / trip 5 trips 10 h / trip			50	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		4	200	h	24.00						4,800	0	0	0	0	4,800		200
																0			
	- Tractor & Trailer 11.50 15.00	90%	1	45	h				11.50	15.00		0	0	0	518	486	1,004		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	45	h				33.00	18.00		0	0	0	1,485	583	2,068		
												0	0	0	0	0	0		
	Water route 20 h / trip			100	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		3	300	h	24.00						7,200	0	0	0	0	7,200		300
												0	0	0	0	0	0		
	- Marine Equipment			100	h				60.00			0	0	0	6,000	0	6,000		
																0			
	Rebar Shop 8 sh											0	0	0	0	0	0		
	10 h / sh			80	h							0	0	0	0	0	0		
												0	0	0	0	0	0		
	- M-P		5	400	h	24.00						9,600	0	0	0	0	9,600		400
												0	0	0	0	0	0		
	- Crane - Rough terrain 30 t (L-Belt) 33.00 18.00	90%	1	72	h				33.00	18.00		0	0	0	2,376	933	3,309		
												0	0	0	0	0	0		
	- Supply 1,140 m²			1	un		53,540					0	53,540	0	0	0	53,540		
																0			
												0	0	0	0	0	0		
0	**Reinforcing Steel - Camp 4**			**180**	**mt**							**86,400**	**71,540**	**177,797**	**21,934**	**8,812**	**366,483**	**2,036.02**	**3,600**
	Unit costs											**480.00**	**397.44**	**987.76**	**121.86**	**48.96**	**2036.02**		**20.00**

Printed on : 25/11/2009
Revised on :

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (1)

	2011												2012												2013												2014												2015												Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
Site 6g Camp (1)																																																																							
Contractor																																																																							
- Project manager						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												44		VUS	P	Port.	Cell.	44	44	44		
- General Superintendant						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												44		VUS	P	Port.	Cell.	44	44	44		
Day																																																																							
- Roads & Camps Super						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																											29		P-Up	P	Port.	Cell.	29	29			29
- Roads General						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								18		Crew		Port.	Cell.	18	18		18	
- Camps General						1	1	1	1	1	1	1	1	1	1																																																10		Crew		Port.	Cell.	10	10		10	
- Tunnels Super												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													37		P-Up	P	Port.	Cell.	37	37			37
- Tunnels General (D+B)												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								28		Crew		Port.	Cell.	28	28		28	
- Tunnels Explosives General													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								27		Crew		Port.	Cell.	27	27		27	
- Tunnels General (TBM)																							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					18		Crew		Port.		18			18	
- Plumbing Super										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												40		P-Up	P	Port.	Cell.	40	40			40
- Plumbing General													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36		Crew		Port.		36			36	
- Electrician Super										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												40		P-Up	P	Port.	Cell.	40	40			40
- Electrician General													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36		P-Up		Port.		36				36
- Concrete Plan Super													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37		Crew	P	Port.	Cell.	37	37		37	
- Concrete Plan «A» General																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31		P-Up		Port.		31				31
- Concrete General																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31		Crew		Port.		31			31	
- Rebar General																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31				Port.		31				
- Crusher general									1	1	1					1	1	1	1	1	1								1	1	1	1	1							1	1	1	1	1																	19		Crew		Port.	Cell.	19	19		19	
- Carpenter General																										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												24		Crew		Port.	Cell.	24	24		24	
- Mechanical- Electrical General																										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												24		P-Up		Port.		24				24
- Mechanical- Electrical Super																										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												24		Crew	P	Port.	Cell.	24	24		24	
- Steel Worker General													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															34		Crew		Port.		34			34	
- Yard General									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															38		Crew		Port.	Cell.	38	38		38	
- Marine Works General									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												41		Crew		Port.		41			41	
Night																																																																							
- Superintendant													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					28		P-Up	P	Port.	Cell.	28	28			28
Roads General						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																	
- Tunnels Super												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													37		P-Up	P	Port.	Cell.	37	37			37
- Tunnels General (D+B)												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								28		P-Up		Port.		28				28
- Tunnels Explosives General													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								27				Port.		27				
- Tunnels General (TBM)																							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					18				Port.		18				
- Concrete General																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31				Port.	Cell.	31	31			
- Rebar General																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31				Port.		31				
- Carpenter General																										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												24				Port.		24				
- Concrete Plan «A» General																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31				Port.		31				
Engineering																																																																								
- Project Engineer «A»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		VUS	P	Port.	Cell.	39	39	39		
- Project Engineer «B»																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												31		P-Up	P	Port.	Cell.	31	31			31
- Formworks Field Engineer «A»																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												25		P-Up	P	Port.	Cell.	25	25			25
- Formworks Field Engineer «B»																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																21		P-Up	P	Port.		21				21
- Concrete Field Engineer																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												25		P-Up	P	Port.	Cell.	25	25			25
- Planning - Project Managing													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			P	Port.		37				
- Quality Control Engineer													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37		P-Up	P	Port.		37				37
- Quality Control Technician «A»													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			D	Port.		37				
- Drafting Technician «A»																	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												33			D	Port.		33				
- Drafting Technician «B»																		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												32			D	Port.		32				
- Drafting Technician «C»																					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															26			D	Port.		26				
- Quantities Technician «A»													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37				Port.		37				
- Surveyer TBM 1																							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					18		Crew	P	Port.		18			18	
- Surveyer TBM 2																							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					18		Crew	P	Port.		18			18	
- Surveyer (D+B) 1												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													37		Crew	P	Port.		37			37	
- Surveyer (D+B) 2												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													37		Crew	P	Port.		37			37	
Office																																																																								
- Office chief											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		VUS	P	Port.	Cell.	39	39	39		
- Payroll											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39			P							
- Secretary											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39			D							
- Receptionist											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39										
- Computer Tech											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39			S		Cell.		39			
- Cost Control											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39			P							
Store & Warehousing																																																																								
- Chief Store Manager & Buyer											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39			P	Port.	Cell.	39	39			
Safety & Miscelaneous																																																																								
- Safety Officer «D»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		P-Up	P	Port.	Cell.	39	39			39
- Safety Officer «N»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		P-Up	P	Port.	Cell.	39	39			39
- First Aid Nurse «A»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		Amb		Port.	Cell.	39	39			
																																																															1876										
General Managing																																																																										
- Project Manager											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		VUS	P	Port.	Cell.	39	39	39		
- Project Manager Assistant											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		P-Up	P	Port.	Cell.	39	39			39
Day																																																																									
- Contract Administrator - Camps											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												39		P-Up	P	Port.	Cell.	39	39			39
- Contract Administrator - Tunnels											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													38		P-Up	P	Port.	Cell.	38	38			38
- Contract Administrator - Powerhouse (Civil)																														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												20		P-Up	P	Port.	Cell.	20	20			20
- Contract Administrator - Mechanical & Electrical Works																														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												20		P-Up	P	Port.	Cell.	20	20			20
- Quantity Tech													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			P							
- Cost Control Administrator													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			P							
- Geologist - (D+B) 1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36			P	Port.	Cell.	36	36			
- Geologist - TBM 1																						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																		21			P	Port.	Cell.	21	21			
- Chief Inspector - Underground excavation													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36		VUS	P	Port.	Cell.	36	36	36		
- Inspector TBM 1																						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																		21		P-Up	P	Port.		21				21
- Inspector (D+B) 1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36		P-Up	P	Port.		36				36
- Inspector (D+B) 2													1	1	1	1	1	1	1	1	1	1	1	1	1	1																																			14			P	Port.	Cell.	14	14			

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (1)

	2011												2012												2013												2014												2015												Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
- Chief Inspector - Concrete Works																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												21		P-Up	P	Port.		21				21
- Inspector Powerhouse 1																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												21		P-Up	P	Port.		21				21
- Inspector Powerhouse 2																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												21		Crew	P	Port.		21			21	
Surveyer - Tunnels													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36										
																																																													0										
Night																																																													0										
- Inspector TBM 1																							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						21				Port.		21				
- Inspector (D+B) 1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36				Port.		36				
- Inspector (D+B) 2													1	1	1	1	1	1	1	1	1	1	1	1	1	1																																			14				Port.		14				
- Inspector Powerhouse 1																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												21				Port.		21				
- Inspector Powerhouse 2																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												21				Port.		21				
Engineering																																																																							
- Resident Engineer													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37		P-Up	P	Port.	Cell.	37	37			37
- Resident Engineer Assistant													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37				Port.	Cell.	37	37			
- Civil Engineer 1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			P	Port.	Cell.	37	37			
- Civil Engineer 2													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37				Port.	Cell.	37	37			
- Mechanical Engineer																														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												20		P-Up	P	Port.	Cell.	20	20			20
- Electrical Engineer																														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												20			P	Port.	Cell.	20	20			
- Quality Control Engineer													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			P	Port.		37				
- Quality Control Tech 1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37				Port.		37				
- Laboratory Engineer													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37		P-Up	P	Port.	Cell.	37	37			37
- Laboratory Tech 1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37				Port.		37				
Office																																																																						
- Receptionist													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			D	Port.	Cell.	37	37			
- Clerk													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37										
- Computer Tech													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1												37			S		Cell.		37			
																																																													1,092										
Site 6g Camp (1)	0	0	0	0	0	6	6	6	9	11	26	31	62	62	62	62	63	64	71	71	72	74	78	76	79	83	81	81	87	91	91	91	91	90	89	89	89	89	89	86	81	81	78	78	77	76	73	73	61	0	0	0	0	0	0	0	0	0	0	0	2986	0									
																																																													2986										
Catering 12% («D» & «N») 0				0	0	1	1	1	2	2	4	4	8	8	8	8	8	8	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11	11	11	10	10	10	10	10	10	9	9	8	0	0	0	0	0	0	0	0	0	0		377										
				0	0	7	7	7	11	13	30	35	70	70	70	70	71	72	80	80	81	83	88	86	89	93	91	91	98	##	##	##	##	##	##	##	##	##	##	97	91	91	88	88	87	86	82	82	69	0	0	0	0	0	0	0	0	0	0		3363										

Server :	2	85	47	2589	1510	241	516	896
Desk :	1			Port.	Cell.	VUS	Crew	P-Up
Portable :	50							
	53							

	Camp 1		Camp 2		Camp 3		Camp 4		TOTAL	
	Qty	Months	Qty	Months	Qty	Months	Qty	Months	Qty	Months
VUS	6	241	1	27	0	0	0	0	**7**	**268**
Crew cab	19	516	28	272	22	139	25	169	**94**	**1,096**
Pick-Up	29	896	21	295	15	142	21	181	**86**	**1,514**
Portable (Cell.)	47	1,510	47	663	39	330	49	414	**182**	**2,917**
Radio portatifs	85	2,589	58	769	43	356	52	431	**238**	**4,145**

	Camp 1	Camp 2	Camp 3	Camp 4	TOTAL
Server :	2	2	2	2	**8**
Desk :	1	1	0	0	**2**
Portable :	50	28	23	20	**121**

SUMMARY

	Qty	Months
VUS	6	241
Crew cab	19	516
Pick-Up	29	896
Portable (Cell.)	47	1510
Radio portatifs	85	2589

	Staff	Labourer	Catering	
(1)	2986	0	377	
(2)	802	0	114	
(3)	369	0	45	
(4)	445	0	55	
	4602	**0**	**591**	**p-mths**
			5,193	
	26	26	26	d / mth
	10	10	10	h / d
	1,196,520	**0**	**153,660**	**m-h**
			1,350,180	

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (2)

	2,012												2,013												2,014												2,015		Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
Site 6g Camp (2)
Contractor
Day
- Roads General									1	1	1						1	1																					5		Crew		Port.	Cell.	5	5		5	
- Camps General						1	1	1	1																														4		Crew		Port.	Cell.	4	4		4	
- Dams Super														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				22		P-Up	P	Port.	Cell.	22	22			22
- Dam 1 Excavation General															1	1	1	1	1	1	1	1	1																9		Crew	P	Port.	Cell.	9	9		9	
Dam 2 Excavation General + Intake													1	1	1	1	1	1	1	1																			8		Crew		Port.	Cell.	8	8		8	
- Dam 2 Foundations General																		1	1	1	1																		4		Crew		Port.	Cell.	4	4		4	
- Dam 1 Foundations General																		1	1	1	1																		4		Crew	P	Port.	Cell.	4	4		4	
- Dams Explosives General (Including intake)									1	1	1	1	1	1	1	1	1	1	1	1																			12		Crew		Port.	Cell.	12	12		12	
- Dam 1 Rockfill General																					1	1								1	1	1	1	1					7		Crew	P	Port.	Cell.	7	7		7	
- Dam 2 Rockfill General																				1	1	1	1							1	1	1	1	1					9		Crew		Port.	Cell.	9	9		9	
Dam 1 - Tunnel General														1	1	1	1																						4		Crew		Port.	Cell.	4	4		4	
- Asphalt Plan General																1	1	1	1	1	1									1	1	1	1	1					11		P-Up		Port.	Cell.	11	11			11
- Asphalt General																1	1	1	1	1	1									1	1	1	1	1					11		P-Up		Port.		11				11
- Concrete Plan «B» General																1	1	1	1	1	1									1	1	1	1	1					11		P-Up	P	Port.		11				11
- Concrete General																1	1	1	1	1	1									1	1	1	1	1					11		Crew	P	Port.	Cell.	11	11		11	
Rebar General																1	1	1	1	1	1									1	1	1	1	1					11		Crew		Port.	Cell.	11	11		11	
- Crusher general																1	1	1	1	1	1									1	1	1	1						10		Crew		Port.		10			10	
- Formwork General																1	1	1	1	1	1								1	1	1	1	1						11		Crew		Port.		11			11	
- Yard General								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				28		Crew		Port.	Cell.	28	28		28	
Night
Roads General									1	1	1						1	1																					5										
- Dam 1 Excavation General															1	1	1	1	1	1	1	1	1																9		Crew		Port.	Cell.	9	9		9	
Dam 2 Excavation General															1	1	1	1	1	1	1	1	1																9		Crew		Port.		9			9	
- Dam 2 Foundations General																		1	1	1	1																		4		Crew		Port.		4			4	
- Dam 1 Foundations General																		1	1	1	1																		4		Crew		Port.	Cell.	4	4		4	
Dam 1 - Tunnel General														1	1	1	1																						4		P-Up		Port.	Cell.	4	4			4
- Dam 2 Rockfill General																				1	1	1	1							1	1	1	1	1					9		P-Up		Port.		9				9
- Dam 1 Rockfill General																					1	1								1	1	1	1	1					7		P-Up		Port.		7				7
- Asphalt Plan General																		1	1	1	1	1	1							1	1	1	1	1					11		P-Up		Port.	Cell.	11	11			11
- Asphalt General																		1	1	1	1	1	1							1	1	1	1	1					11		P-Up		Port.		11				11
- Concrete Plan «B» General																		1	1	1	1	1	1							1	1	1	1	1					11		Crew		Port.	Cell.	11	11		11	
- Concrete General																		1	1	1	1	1	1						1	1	1	1	1	1					12		Crew	P	Port.	Cell.	12	12		12	
Rebar General																		1	1	1	1	1	1						1	1	1	1	1	1					12		Crew		Port.	Cell.	12	12		12	
- Formwork General																		1	1	1	1	1	1						1	1	1	1	1	1					12		Crew		Port.		12			12	
Engineering
- Project Engineer «B»								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27		VUS	P	Port.	Cell.	27	27	27		
- Dams Field Engineer «A»										1	1	1	1	1	1	1	1	1	1	1	1	1	1						1	1	1	1	1	1					20		P-Up	P	Port.	Cell.	20	20			20
- Dams Field Engineer «B»															1	1	1	1	1	1	1	1	1						1	1	1	1	1	1					15										
- Quality Control Technician «B»															1	1	1	1	1	1	1	1	1						1	1	1	1	1	1					15				Port.	Cell.	15	15			
- Quantities Technician «B»																		1	1	1	1	1	1						1	1	1	1	1	1					12			P	Port.	Cell.	12	12			
- Surveyer «A» Dam 1																		1	1	1	1	1	1						1	1	1	1	1	1					12		Crew	P	Port.	Cell.	12	12		12	
- Surveyer «A» Dam 2																		1	1	1	1	1	1						1	1	1	1	1	1					12		Crew	P	Port.		12			12	
- Surveyer - Intake																		1	1	1	1	1	1						1	1	1	1	1	1					12		Crew	P	Port.		12			12	
Store & Warehousing
- Store clerk 1								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27			S	Port.	Cell.	27	27			
Safety & Miscelaneous
- Safety Officer «D»								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27		P-Up	P	Port.	Cell.	27	27			27
- Safety Officer «N»								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27				Port.	Cell.	27	27			
First Aid Nurse «2»								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27		Amb		Port.	Cell.	27	27			
																																							545										
																																							0										

july 7th 2009

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (2)

	2,012												2,013												2,014												2,015		Pers-Month	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	Staff	Labourer
General Managing																																							0	
Day																																							0	
																																							0	
- Contract Administrator - Dams (Assistant)								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27	
- Chief Inspector - Dams															1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					20	
- Inspector Dam 1																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Inspector Dam 2																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Inspector Dam Area & Intake 1																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Surveyer - Dams and Intake																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
																																							0	
Night																																							0	
																																							0	
- Inspector Dam 1																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Inspector Dam 2																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Inspector Dam Area & Intake 1																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
Surveyer - Dams																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
																																							0	
Engineering																																							0	
																																							0	
- Quality Control Tech 2																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Laboratory Tech 2																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Geologist - Dam 1																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
- Geologist - Dam 2																	1	1	1	1	1	1	1						1	1	1	1	1	1					13	
																																							0	
Office																																							0	
																																							0	
- Clerk								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27	
- Receptionist								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					27	
																																							257	
																																							0	
	0	0	0	0	0	1	1	10	13	13	13	11	12	15	21	28	42	54	52	54	54	43	41	11	11	11	11	11	34	47	47	47	47	45	2	0	0	0	802	0
																																							802	
Catering 12% 12%						1	1	2	2	2	2	2	2	2	3	4	6	7	7	7	7	6	5	2	2	2	2	2	5	6	6	6	6	6	1	0			114	
(«D» & «N»)																																								
													14	17	24	32	48	61	59	61	61	49	46	13	13	13	13	13	39	53	53	53	53	51	3	0			916	

	Veh.	Ord.	Communications Radio	Communications Tel.	Radio	Tel.	VUS	Crew	P-Up
- Contract Administrator - Dams (Assistant)	P-Up	P	Port.	Cell.	27	27			27
- Chief Inspector - Dams	P-Up	P	Port.	Cell.	20	20			20
- Inspector Dam 1	P-Up	P	Port.	Cell.	13	13			13
- Inspector Dam 2	P-Up	P	Port.	Cell.	13	13			13
- Inspector Dam Area & Intake 1	P-Up	P	Port.	Cell.	13	13			13
- Surveyer - Dams and Intake	Crew	P	Port.	Cell.	13	13		13	
- Inspector Dam 1 (Night)	P-Up	P	Port.	Cell.	13	13			13
- Inspector Dam 2 (Night)	P-Up	P	Port.	Cell.	13	13			13
- Inspector Dam Area & Intake 1 (Night)	P-Up	P	Port.	Cell.	13	13			13
Surveyer - Dams	Crew	P	Port.	Cell.	13	13		13	
- Quality Control Tech 2		P		Cell.		13			
- Laboratory Tech 2		P	Port.	Cell.	13	13			
- Geologist - Dam 1	P-Up	P	Port.	Cell.	13	13			13
- Geologist - Dam 2	P-Up	P	Port.	Cell.	13	13			13
- Clerk		S	Port.	Cell.	27	27			
- Receptionist		D	Port.	Cell.	27	27			
Server :		2	58	47	769	663	27	272	295
Desk :		1			Port.	Cell.	VUS	Crew	P-Up
Portable :		28							
		31							

SUMMARY	Qty	Months
VUS	1	27
Crew cab	28	272
Pick-Up	21	295
Portable (Cell.)	47	663
Radio portatifs	58	769

july 7th 2009

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (3)

	2,013												2,014												2,015				Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
Site 6g Camp (3)																																							
Contractor																																							
Day																																							
- Super						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						18		P-Up	P	Port.	Cell.	18	18			18
- Camps General						1	1	1	1	1	1																		6		Crew		Port.	Cell.	6	6		6	
- Tunnel General 1 (D+B)											1	1	1	1	1	1													6		Crew		Port.	Cell.	6	6		6	
- Canal 1 & 2 General												1	1	1	1														4		Crew		Port.	Cell.	4	4		4	
Canal Explosives General												1	1	1	1														4		Crew		Port.	Cell.	4	4		4	
Dam 3 Excavation - General									1	1	1	1																	4		Crew	P	Port.	Cell.	4	4		4	
- Dam 3 Foundations General																	1	1	1	1									4		Crew	P	Port.	Cell.	4	4		4	
- Dams Explosives General																	1	1	1	1									4		Crew		Port.	Cell.	4	4		4	
- Dam 3 Rockfill General																	1	1	1	1	1								5		Crew	P	Port.	Cell.	5	5		5	
- Concrete Plan «3» General																1	1	1	1	1	1								6		P-Up	P	Port.		6				6
Concrete General																1	1	1	1	1	1								6		Crew	P	Port.	Cell.	6	6		6	
Formwork General																1	1	1	1	1	1								6		Crew		Port.	Cell.	6	6		6	
- Crusher general									1	1							1	1	1	1									6		Crew		Port.		6			6	
- Yard General										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14		Crew		Port.		14			14	
- Marine works General										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14		Crew		Port.	Cell.	14	14		14	
																													0										
Night																																							
- Tunnel General 1 (D+B) 6											1	1	1	1	1	1													6		P-Up		Port.	Cell.	6	6			6
Dam 3 Excavation - General									1	1	1	1																	4		Crew		Port.	Cell.	4	4		4	
- Canal 1 & 2 General 4												1	1	1	1														4		Crew		Port.	Cell.	4	4		4	
- Dam 3 Rockfill General																	1	1	1	1	1								5		P-Up		Port.	Cell.	5	5			5
Dam 3 Foundations General																	1	1	1	1									4		Crew		Port.	Cell.	4	4		4	
- Concrete Plan «3» General																1	1	1	1	1	1								6		Crew		Port.	Cell.	6	6		6	
Concrete General 6																1	1	1	1	1	1								6		Crew	P	Port.	Cell.	6	6		6	
Tunnel 1 - Formwork 6																1	1	1	1	1	1								6		Crew		Port.		6			6	

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (3)

	2,013												2,014												2,015				Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
Engineering																																							
- Dams Field Engineer «A»											1	1	1	1	1	1	1	1	1	1	1	1							12		P-Up	P	Port.	Cell.	12	12			12
- Quality Control Technician «B»											1	1	1	1	1	1	1	1	1	1	1	1							12				Port.	Cell.	12	12			
- Quantities Technician «B»																1	1	1	1	1	1	1							7			P	Port.	Cell.	7	7			
- Surveyer Tunnel 1											1	1	1	1	1	1													6		Crew	P	Port.	Cell.	6	6		6	
- Surveyer Dam 3																1	1	1	1	1	1	1							7		Crew	P	Port.		7			7	
Store & Warehousing																																							
- Store clerk 1										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14			S	Port.	Cell.	14	14			
Safety & Miscelaneous																																							
- Safety Officer «D»										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14		P-Up	P	Port.	Cell.	14	14			14
- Safety Officer «N»										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14				Port.	Cell.	14	14			
First Aid Nurse «3»										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14		Amb		Port.	Cell.	14	14			
																													0										
																													248										
General Managing																													0										
Day																																							
- Contract Administrator - Dams (Assistant)										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14		P-Up	P	Port.	Cell.	14	14			14
- Chief Inspector - Dam & Canals										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14		P-Up	P	Port.	Cell.	14	14			14
- Inspector Tunnel 1											1	1	1	1	1	1													6		P-Up	P	Port.	Cell.	6	6			6
- Inspector Canals											1	1	1	1	1	1													6		P-Up	P	Port.	Cell.	6	6			6
- Inspector Dam										1	1	1	1	1	1	1	1	1	1										10		P-Up	P	Port.	Cell.	10	10			10
- Surveyer - Dams												1	1	1	1	1	1	1	1	1	1								10		P-Up	P	Port.	Cell.	10	10			10
Night																																							
- Inspector Tunnel 1											1	1	1	1	1	1	1	1											8		P-Up	P	Port.	Cell.	8	8			8
- Inspector Dam 3																	1	1	1	1	1	1	1						7		P-Up	P	Port.	Cell.	7	7			7
Surveyer - Dams											1	1	1	1	1	1	1	1	1	1	1	1	1						13		Crew	P	Port.	Cell.	13	13		13	
Engineering																																							
- Quality Control & Laboratory Tech 2											1	1	1	1	1	1	1	1	1	1	1	1	1						13			P		Cell.		13			
- Geologist - Dam																1	1	1	1	1	1								6		P-Up	P	Port.	Cell.	6	6			6
Office																																							
- Clerk										1	1	1	1	1	1	1	1	1	1	1	1	1	1						14			S	Port.	Cell.	14	14			
																													121										
																													0										
Site 6g Camp (3)	0	0	0	0	0	2	2	2	5	15	24	27	25	25	25	31	33	33	32	31	27	17	13	0	0	0	0	0	369	0									
																													369										
Catering 12% («D» & «N») 12%	0	0	0	0	0	0	0	0	1	2	3	3	3	3	3	4	4	4	4	4	3	2	2	0	0	0	0	0	45										
	0	0	0	0	0	2	2	2	6	17	27	30	28	28	28	35	37	37	36	35	30	19	15	0	0	0	0	0	414										
																															Server :	2	43	39	356	330	0	139	142
																															Desk :	0			Port.	Cell.	VUS	Crew	P-Up
																															Portable :	23							
																																25							

SUMMARY	Qty	Months
VUS	0	0
Crew cab	22	139
Pick-Up	15	142
Portable (Cell.)	39	330
Radio portatifs	43	356

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (4)

	2,013												2,014												2,015			Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
Site 6g Camp (4)																																						
Contractor																																						
Day																																						
Super											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17										
Roads General										1	1																	2		Crew		Port.	Cell.	2	2		2	
- General Canals C 3 & C 4											1	1	1	1										1	1			6		Crew		Port.	Cell.	6	6		6	
Explosives General - canals											1	1	1	1										1	1			6		Crew		Port.	Cell.	6	6		6	
- General D4														1	1	1	1	1										5		Crew		Port.	Cell.	5	5		5	
Foundations D4														1	1	1	1	1										5		Crew	P	Port.	Cell.	5	5		5	
- General D5															1	1	1	1										4		Crew		Port.	Cell.	4	4		4	
Foundations D5															1	1	1	1										4		Crew		Port.	Cell.	4	4		4	
- Dam 4 Rockfill General																			1	1	1	1						4		Crew	P	Port.	Cell.	4	4		4	
- Dam 5 Rockfill General																			1	1	1	1						4		Crew		Port.	Cell.	4	4		4	
- Asphalt Plan General																			1	1	1	1						4		P-Up		Port.	Cell.	4	4			4
Asphalt General D4																			1	1	1	1						4		P-Up		Port.	Cell.	4	4			4
Asphalt General D5																			1	1	1	1						4		P-Up		Port.	Cell.	4	4			4
Explosives General D4 & D5										1	1	1	1	1	1	1	1											8		Crew		Port.	Cell.	8	8		8	
- Tunnels (D+B)										1	1	1	1															4		Crew		Port.	Cell.	4	4		4	
- Explosives General - Tunnel										1	1	1	1															4		Crew		Port.	Cell.	4	4		4	
Concrete Plan General																1	1	1	1	1	1							6		P-Up	P	Port.		6				6
- Crusher general																1	1	1	1	1								5		Crew		Port.		5			5	
Formwork General																1	1	1	1	1	1	1						7		Crew		Port.	Cell.	7	7		7	
- Yard General											1	1	1	1	1	1	1	1	1	1	1	1						12		Crew		Port.		12			12	
- Marine Works General											1	1	1	1	1	1	1	1	1	1	1	1						12		Crew		Port.	Cell.	12	12		12	
Night																																						
- General Canals C 3 & C 4											1	1	1	1														4		Crew		Port.	Cell.	4	4		4	
- Explosives General											1	1	1	1														4		Crew		Port.	Cell.	4	4		4	
- D 4 - Excavation														1	1	1	1	1										5		Crew		Port.	Cell.	5	5		5	
- D 4 - Excavation														1	1	1	1	1										5		Crew		Port.	Cell.	5	5		5	
- General D5															1	1	1	1										4		Crew		Port.	Cell.	4	4		4	
- Foundations D5															1	1	1	1										4		Crew		Port.	Cell.	4	4		4	
- General D4														1	1	1	1	1										5		Crew		Port.	Cell.	5	5		5	
- Foundations D4														1	1	1	1	1										5		Crew		Port.	Cell.	5	5		5	
- Dam 5 Rockfill General																	1	1	1	1	1	1						6		P-Up		Port.	Cell.	6	6			6
- Dam 4 Rockfill General																	1	1	1	1	1	1						6		P-Up		Port.	Cell.	6	6			6
- Explosives General D4 & D5										1	1	1	1															4		Crew		Port.	Cell.	4	4		4	
- Tunnels (D+B)										1	1	1	1															4		P-Up		Port.	Cell.	4	4			4
- D4 - Asphalt General																		1	1	1	1	1						5		P-Up		Port.	Cell.	5	5			5
- D5 - Asphalt General																		1	1	1	1	1						5		P-Up		Port.	Cell.	5	5			5

GREENLAND - ALCOA HYDRO PROJECT

Project : Site 6g Camp (4)

	2,013												2,014												2,015			Pers-Month		Veh.	Ord.	Communications						
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	Staff	Labourer			Radio	Tel.	Radio	Tel.	VUS	Crew	P-Up
Engineering																																						
- Field Engineer «5»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		P-Up	P	Port.	Cell.	15	15			15
- Quality Control Technician «5»											1	1	1	1	1	1	1	1	1	1	1	1	1					13				Port.	Cell.	13	13			
- Quantities Technician «5»															1	1	1	1	1	1	1	1	1					9			P	Port.	Cell.	9	9			
- Surveyer 1											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		Crew	P	Port.	Cell.	15	15		15	
- Surveyer 2											1	1	1						1	1	1	1	1					8		Crew	P	Port.		8			8	
Store & Warehousing																																						
- Store clerk 1											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15			S	Port.	Cell.	15	15			
Safety & Miscelaneous																																						
- Safety Officer «D»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		P-Up	P	Port.	Cell.	15	15			15
- Safety Officer «N»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15				Port.	Cell.	15	15			
- First Aid Nurse «3»											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		Amb		Port.	Cell.	15	15			
																												296										
General Managing																																						
Day																																						
- Contract Administrator - (Assistant)											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		P-Up	P	Port.	Cell.	15	15			15
- Chief Inspector - Dam & Canals											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		P-Up	P	Port.	Cell.	15	15			15
- Inspector Tunnel											1	1	1	1														4		P-Up	P	Port.	Cell.	4	4			4
- Inspector Dam 4													1	1	1	1	1	1	1	1	1	1						10		P-Up	P	Port.	Cell.	10	10			10
- Inspector Dam 5													1	1	1	1	1	1	1	1	1	1						10		P-Up	P	Port.	Cell.	10	10			10
- Surveyer											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			15		P-Up	P	Port.	Cell.	15	15			15
Night																																						
- Inspector Tunnel											1	1	1	1														4		P-Up	P	Port.	Cell.	4	4			4
- Inspector Dam 4													1	1	1	1	1	1	1	1	1	1						10		P-Up	P	Port.	Cell.	10	10			10
- Inspector Dam 5													1	1	1	1	1	1	1	1	1	1						10		P-Up	P	Port.	Cell.	10	10			10
- Surveyer											1	1	1	1	1	1	1	1	1	1	1	1	1	1				14		Crew	P	Port.	Cell.	14	14		14	
																												0										
Engineering																												0										
																												0										
- Quality Control Tech «4»											1	1	1	1	1	1	1	1	1	1	1	1	1	1				14			P		Cell.		14			
- Geologist											1	1	1	1	1	1	1	1	1	1	1	1	1	1				14		P-Up	P	Port.	Cell.	14	14			14
																												0										
Office																												0										
																												0										
- Clerk											1	1	1	1	1	1	1	1	1	1	1	1	1	1				14			S	Port.	Cell.	14	14			
																												149										
																												0										
Site 6g Camp (4)	0	0	0	0	0	0	0	0	0	6	30	29	33	34	33	36	38	39	35	35	34	33	17	16	12	1	1	445	-									
																												445										
Catering 12% 12% («D» & «N»)										1	4	3	4	4	4	4	5	5	4	4	4	4	2	2	1	0	0	55										
											34	32	37	38	37	40	43	44	39	39	38	37	19	18	13	1	1	500										
																														Server :	2	55	52	431	414	0	169	181
																														Desk :	0			Port.	Cell.	VUS	Crew	P-Up
																														Portable :	20							
																															22							

SUMMARY	Qty	Months
VUS	0	0
Crew cab	25	169
Pick-Up	21	181
Portable (Cell.)	49	414
Radio portatifs	52	431