



OSHPC BARKI TOJIK

TECHNO-ECONOMIC ASSESSMENT STUDY FOR ROGUN HYDROELECTRIC CONSTRUCTION PROJECT



COST ESTIMATE – PHASE II

ALTERNATIVE 1: FSL=1290 M.A.S.L

P002378. RP49_revC

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TECHNO-ECONOMIC ASSESSMENT STUDY FOR ROGUN HYDROELECTRIC CONSTRUCTION PROJECT

VOLUME 4: IMPLEMENTATION STUDIES

CHAPTER 2: COST ESTIMATE

ALTERNATIVE 1 – FSL=1290 M.A.S.L

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PART IV – Alt 1: Calculation assumptions (Civil Works - Dam)

1 Introduction

The Phase II Cost Estimate includes all the works to be done for the completion of Rogun hydroelectric power plant such as the dam, the power facilities, spillways, outlets and additional diversion tunnels. The works executed since 1980 and prior to the end of the Soviet Union are included in the Phase I Cost Estimate.

Only the methodology directly related to quantities established in the Bill of Quantities of the Phase II Cost Estimate are described in this Part IV of the report.

The methodology related to items in the Phase II Cost Estimate established by analogy to items already developed in the Phase I Cost Estimate is not described here.

The aim of this paragraph is to give the main assumptions taken into account for the calculation of quantities and unit prices.

The purpose of this preliminary approach being to derive representative overall cost estimates of each alternative at feasibility level. Comprehensive Method Statements of the works will be prepared at detailed design stage by the Engineer of the project.

2 Construction Facilities

2.1 Roads

A specific note is presented in the part 5 of Cost Estimate report (Appendices), giving more details about roads estimation.

Phase II Cost Estimate includes the improvement of part of the existing site roads and the construction of the additional roads necessary for the dam and appurtenant works. The improvement of the existing roads mainly concerns the widening of the roadway which consequently entails additional excavations, sub-bases, bases and paving works. Besides the rocky slopes of both the existing roads and the new roads excavated in very steep areas, have been protected with rock bolts and galvanized nets reinforced with galvanized steel ropes.

Therefore, various types of roads are identified for the estimation:

- Dushanbe road (Asphalt road),
- Existing roads requiring an enlargement to permit a good access,
- Existing roads without enlargement,
- New roads.

The total amount corresponding to road construction and rehabilitation is about 52 MUS\$. Moreover, the amount of maintenance has been calculated according to the I duration of works for each alternative: it varies between 12 MUS\$ and 19 MUS\$. Therefore, the total amount

Table 2-1 and Table 2-2 summarize these amounts. The mean Cost/km for each type of roads give clear idea of their influence in the total amount.

Table 2-1: Roads, Cost Summary (1)

	Dushanbe road	Existing road (Without excavation)	Existing road (With excavation)	Project roads
Total [US\$]	13,083,679	5,667,776	16,074,526	17,285,361
<i>Excavation and support</i>	335,846	452,448	7,114,417	12,755,071
<i>Roadbed base</i>	1,364,990	2,043,186	4,423,150	1,422,943
<i>Asphalt</i>	9,126,090	0	0	0
<i>Concrete works</i>	1,869,197	3,007,062	3,768,851	1,818,986
<i>Sundries</i>	387,556	165,081	768,109	1,288,362
Length [m]	12,000	21,000	26,320	12,703
[US\$/km]	1,090	270	611	1,361

Table 2-2: Roads, Cost Summary (2)

	Road construction / rehabilitation [US\$]	Maintenance [US\$]	GRAND TOTAL [US\$]
Alt. 1290	52,111,343	19,077,968	71,189,311
Alt. 1255	52,111,343	15,898,307	68,009,650
Alt. 1220	52,111,343	12,718,646	64,829,989

2.2 Contractor’s Camps and Temporary Buildings

2.2.1 General

The Phase II Cost Estimate is based on the assumption that the dam construction with the appurtenant works is carried out by contractors who are fully responsible for the supply, installation, maintenance and removal of both the camps and the temporary buildings necessary for their activities and those of their subcontractors.

2.2.2 Camps

The area for the construction of the camps is located on the right bank upstream of the dam site close to Rogun town as shown on the annexed General Plan View. This area is the same that previously was used for the execution of the existing works.

The camps will include houses, dormitories, guest house, dining halls, laundries, catering, mini-markets, shops, offices, schools, police station, recreational facilities, medical care facilities complete of furniture and all other facilities such as electrical power, potable water, drainage system, sewerage system, fire fighter equipment, communication etc...

Since the total cost of the temporary camps, buildings and of the related facilities can be very variable in accordance with the custom, practice and organization of the contractors, the estimate of these works has been based on actual costs which have been recorded during the construction of several similar hydroelectric projects all over the world and tabulated according to the different total contract price of the works to be done.

2.2.3 Temporary Buildings

The areas for the construction of the temporary buildings are located on the right bank upstream of the dam site and named N1 and N2 as shown on the General Plan View. These areas are the same that previously have been used for the execution of the existing works.

The construction yard N1 is the area where the main temporary buildings (stores, warehouses, laboratory etc.), fuel and oil station and other similar premises have been planned. The main aggregate processing plant and concrete batching/mixing plant necessary for the concrete works are installed on this area as well.

Before the date established for starting the reservoir impounding, the temporary buildings and stationary plants will be relocated downstream of the dam site on the construction sites (yards) named N° 2, 3 and 4 on the annexed General Plan View.

Since the total cost of the temporary buildings can be very variable in accordance with the custom, practice and organization of the contractors, the estimate of these works has been performed as described before in Paragraph 2.2.2 for the camps.

3 Borrow Areas and Quarries

3.1 Borrow area for concrete aggregates

The aggregates for the concrete are obtained from the alluvial borrow area located on the right bank of the Vakhsh River approx. 500 m upstream of the Construction Site N1 and named N° 15(a) on the annexed General Plan View.

When the borrow area 15(a) will be exhausted, the concrete aggregates will be obtained from the borrow area 15 described in the next Sub-chapter 3.2.

The productive strata are composed of conglomerates having a cementation ranging from weak to hard which require the use of explosive for their exploitation.

3.2 Borrow areas for dam embankment located u/s of dam site

Three borrow areas suitable for the alluvial shells, transitions (filters) and loam for core of dam zones are located upstream of the dam site as shown on the annexed General Plan View.

The alluvial shells and transitions (filters) are obtained from the borrow area N° 15 located on the left bank of the Vakhsh River.

The Fine for the core enrichment is obtained from the borrow area N°11 located on the right bank of the Vakhsh River near the Rogun Town. The lack of data regarding borrow area N°11 induces assumptions about the characteristics of materials.

3.3 Borrow areas for dam embankment located d/s of dam site

Two borrow areas suitable for the core are located downstream of the dam site on the left bank of the Vakhsh River as shown on the annexed General Plan View.

These areas are named N° 17(a) and N° 17(b) and both are composed of loam containing approximately 10% of small boulders.

3.4 Removal of overburden from borrow areas

The construction methods related to the removal of the overburden from the borrow areas are included in Phase I Cost estimate.

3.5 Quarry Areas

The quarries necessary for the rocky materials of the dam fills are located downstream of the same dam on the left bank of the Vakhsh River.

Such quarries are named N° 26(a) and N° 26(b) on the annexed General Plan View.

The rock consists of a sandstone formation having an in-situ average specific weight of approx. 2600 kg/m³.

4 Stockpile Areas for Dam Embankment

4.1 General

Table 4-1: Quantities available in stockpiles

	LG1 (Alluvium shell)	LG2 (Alluvium shell)	LG2 (Filters)	LL3 (Loam)
Extracted [m3]	14,620,000	7,490,000	4,030,000	2,500,000
Placed in dam [m3]	13,304,200	6,815,900	4,030,000	2,500,000

The methodology considered for the dam construction is based on the assumption that the entire stockpiled material is used for the embankment.

4.2 Stockpile Areas Located Upstream of the Dam Site

Two stockpile areas named LG 1 and LG 2 on the General Plan View are located on the left bank of the Vakhsh River upstream of the dam site.

The stockpile area LG1 is composed of a main area named LG1 (a) and three surrounding areas named LG1 (b), LG1 (c) and LG1 (d). This area stores alluvial material obtained from the borrow area 15.

The stockpile area LG2 is composed of a main area named LG2 (a) and four surrounding areas named LG2 (b), LG3 (c), LG2 (d) and LG3 (e) This area stores alluvial material obtained from both the borrow area 15 and “Lyabidora” borrow area.

The construction methods related to excavation, loading, transportation and stockpiling of the alluvial material on the above mentioned areas are included in Phase I Cost Estimate.

4.3 Stockpile Areas Located Downstream of the Dam Site

Two stockpile areas named LL3 and LR4 on the annexed General Plan View are located on the left bank of the Vakhsh River downstream of the dam site.

The stockpile LL3 stores the loam obtained from the borrow area N° 17(b). The stockpile LR4 stores the blasted rock obtained from the quarry N° 26(a).

The construction methods related to the excavation, loading, transportation and stockpiling of the loam and of the blasted rock in the above mentioned areas are included in Phase I Cost Estimate.

5 Spoil Areas

Two spoil areas are located upstream of the dam site as shown on the annexed General Plan View.

The area named SA1 is located on the right bank of the Vakhsh River close to the Construction Site N1. The area named SA2 is located on the left bank of the same river approx. 1200 upstream of the level 1 diversion tunnel inlet.

6 Electric Power for Construction

The electric power necessary for the construction of the dam and appurtenant works is produced by means of a temporary powerhouse installed in the Construction Site N° 1.

The temporary powerhouse is similar to that foreseen for Phase I Cost estimate and composed of the following units:

- Six (6) 1000 KVA motor-generators;
- Three (3) 635 KVA motor-generators;
- Transformer units for a total power of 7.3 MVA for raising the voltage from 400 to 24000;
- Fuel tanks with a capacity of 150,000 liters;
- A firefighting system, and
- On-pole 24 KV power distribution lines with a length sufficient to serve all the utilization points planned for the temporary facilities as well as for the temporary and permanent works to be done.

The transformer cabins for lowering the tension of the electric power from 24 kV to the 400/500 voltage of electric engines which are installed on the construction equipment, have been included in the list of the unit price analyses.

The possibility of using the electric power produced by means of the Units 5 and 6 of Rogun HPP after their commissioning has not been considered.

7 Surface Excavation

7.1 Alluvium excavation in riverbed in the core area

The following construction method has been foreseen for the excavation of the alluvium in the river bed:

- Excavation of the loose sand and gravel by means of 179 kW bulldozers working in front of loader machines where the material to be loaded is hard and tough;
- Excavation of the possible cemented sand and gravel by means of 231 kW bulldozers outfitted with mono-shank ripper;
- Loading on dump trucks of the material moved by the bulldozers, by means of 157 kW wheel loaders equipped with 3.30 m³ heaped bucket and 199 kW wheel loaders equipped with 4.30 m³ heaped bucket;
- Loading on dump trucks of the material not removed by bulldozer, by means of 301 kW hydraulic front shovel with 4.10 m³ heaped bucket, where the material can be excavated and loaded without the assistance of bulldozers ;
- Transportation of the excavated material to the designated spoil areas or to the fill areas by means of 36.60 t and 46.20 payload off-highway dump trucks;
- Roughs spreading of the unloaded material in spoil area by means of 72 kW bulldozer;
- Lighting of the work areas by means of mobile diesel powered 6,000 W floodlights when the excavation is carried out during night shifts.

The alluvium has been transported to the spoil area SA2 located on the left bank of the Vakhsh River with an average transportation length of 1800 m.

7.2 Rock excavation in riverbed in the core area

The following construction method has been foreseen for the rock excavation in the river bed:

- Drilling in areas not easily accessible and for secondary blasting by means of hand-held drills outfitted with 38-40 mm diameter and 800-4000 mm long integral drill steels;
- Drilling in confined areas by means of tired hydraulic type drills outfitted with 51 mm diameter and 3660 mm long rods;
- Drilling in larger areas by means of 116 kW hydraulic type crawler-mounted rock drills designed with automatic rod exchanger and outfitted with button bits having a diameter of 76 mm and 3660 mm long rods;

-
- Height of drilling benches ranging from 2 to 4 m for hand held drills, 3 to 6 m for tired hydraulic drill and from 10 to 12 m for crawler hydraulic drills;
 - Hole pattern of approx. 1.40 x 1.50 m (burden x spacing) for hand held drills, of approx. 1.80 x 2.00 m for tired hydraulic drills and approx. 2.40 x 3.10 (burden x spacing) m for crawler rock drills;
 - Transportation of explosive by means of 10 t pay load flat-bed lorry outfitted with 7.0 t/m capacity hydraulic crane;
 - Charging of the holes with amonite and gramonite type explosive;
 - Firing with detonating fuse along the entire drilled length and electric detonators connected with the shot-firing cable;
 - Loading of the excavated material on dump trucks by means of 301 kW hydraulic front shovels with 4.10 m³ heaped bucket equipped with bottom dump type bucket;
 - Assistance to the front shovels by means of 231 kW bulldozers equipped with straight and angled blade;
 - Trimming works in excavation area where necessary by means of 130 kW (1.80 m³ heaped bucket) hydraulic backhoes;
 - Transportation of the excavated material to the spoil area or stockpile by means of 46.20 t pay load off-highway dump trucks;
 - Spreading of the unloaded material in spoil or stockpile area: by means of 72 kW bulldozer;
 - Lighting of the work areas by means of mobile diesel powered 6,000 W floodlights when the work is carried out during night shifts.

The excavated rock has been transported to the spoil area SA2 located on the left bank of the Vakhsh River with an average transportation length of 1800 m.

7.3 Rock excavation of dam core foundation on abutments

7.3.1 Excavation excluding rock presplitting

The following construction method has been foreseen for the excavation of the rock along the dam abutments:

- Drilling at the top of the abutments for the preparation of the next blasting benches by means of hand-held drills outfitted with 38-40 mm diameter and 800-4000 mm long integral drill steels;
- Drilling of the limited areas of the benches at the top by means of tired hydraulic type drills outfitted with 51 mm diameter and 3660 mm long rods;
- Drilling of the other benches by means of 116 kW hydraulic type crawler-mounted rock drills outfitted with automatic rod exchanger and operating with button bits with diameter of 76 mm;

-
- Height of drilling benches ranging from 2 to 4 m for hand held drills, 3 to 6 m for tired hydraulic drill and from 12 to 14 m for crawler hydraulic drills;
 - Hole pattern of approx. 1.40 x 1.50 m (burden x spacing) for hand held drills, of approx. 1.80 x 2.20 m for tired hydraulic drills and of approx. 2.40 x 3.10 m for crawler rock drills;
 - Transportation of explosive to the cableway loading bay by means of 10 t pay load flat-bed lorry outfitted with 7.0 t/m capacity hydraulic crane;
 - Charging of the holes with amonite and gramonite type explosive;
 - Firing with detonating fuse along the entire drilled length and electric detonators connected with the shot-firing cable;
 - Removal of the blasted rock from the benches by means of 170 kW bulldozers outfitted with angled blade;
 - Final cleaning of the benches by means of 130 kW backhoes equipped with 1.80 m² heaped bucket capacity;
 - Loading of the excavated material on dump trucks by means of 301 kW hydraulic front shovels with 4.10 m³ heaped bucket and equipped with bottom dump type bucket;
 - Assistance to the front shovel by means of 231 kW bulldozers equipped with straight or angled blade;
 - Transportation of the excavated material to the spoil area or stockpile by means of 46.20 t pay load off-highway dump trucks;
 - Spreading of the unloaded material in spoil area or stockpile by means of 72 kW bulldozer;
 - Lighting of the work areas by means of mobile diesel powered 6,000 W floodlights when the work is carried out during night shifts.

The excavated rock has been transported to the spoil area SA2 located on the left bank of the Vakhsh River with an average transportation length of 1800 m.

The removal of the blasted rock from the benches after blasting will be executed according the so called “sliding method” which consists in pushing the material by means of bulldozers outside of the bench area so that it can slide downward along the steep abutment up to the river bed. The excavation being carried out from top to bottom.

It is assumed that the transportation from the river bed to the blasting benches of personnel, construction equipment and materials during the execution of the excavation will be performed by means of a 25 t capacity cableway. This cableway will also be used for the execution of other works along the dam abutments.

7.3.2 Presplitting of the rock

With the purpose of obtaining a more uniform final surface of the excavation and a reduced fracturing of the rock which remains in-situ, the presplitting of the rock before performing the drilling and blasting of each bench has been foreseen.

The rock presplitting is done according to the following construction method:

- Drilling by means of 116 kW hydraulic type crawler-mounted rock drills outfitted with automatic rod exchanger and operating with button bits with diameter of 76 mm;
- Interval of holes ranging from 50 to 60 cm;
- Transportation of explosive to the cableway loading bay by means of 10 t pay load flat-bed lorry outfitted with 7.0 t/m capacity hydraulic crane;
- Charging of the holes with no more than 0.80 kg of gelatinized type explosive per square meter ;
- Firing with detonating fuse along the entire drilled length.

8 Concrete foundation

8.1 Concrete at the batching/mixing plant

For Phase II cost estimate, the construction method concerning the batching and mixing of the concrete detailed for Phase I Cost Estimate has been assumed.

8.2 Formworks

For Phase II cost estimate, the construction method concerning the concrete formworks detailed for Phase I Cost Estimate has been assumed.

8.3 Concrete transportation and Placing

8.3.1 Concrete slab foundation

The following construction method has been foreseen for the transportation and placing of the concrete foundation:

- Transportation from the batching/mixing plant to the concrete foundation by means of trucks outfitted with a body specifically designed for concrete having a nominal capacity of 10 m³;
- Transfer of the concrete from the truck to the belt conveyor by mean of a feeder named “Auger Max” of Rotec system;

-
- Transportation of concrete from the level of plinth foundation to the blocks to be poured by means of belt conveyor mounted on crane (Rotec Crater Crane-Model CC-200 x 24");
 - Spreading of the concrete on the blocks by means of 72 kW bulldozer outfitted with universal blade;
 - Compaction of the concrete in layers not exceeding 40 cm by means of 4 x Ø 150 mm hydraulic vibrators mounted on 41 kW hydraulic backhoe and of Ø 87 mm hand-held pneumatic type vibrators.

The height of the blocks is of 2.50 m. The horizontal exposed surface of all blocks is prepared for the next pouring with water jets under a pressure sufficient to remove the unnecessary mortar existing around the coarse aggregates.

After the compaction the exposed surfaces of the concrete is cured for approx. four days by means of sprinklers and perforated pipes fed by hoses connected to the supply pipelines.

8.3.2 Breakwater on dam crest

The following construction method has been foreseen for the transportation and pouring of dam crest breakwater:

- Transportation of concrete from the batching/mixing plant to the structure by means of trucks mixers with a nominal capacity of 10 m³;
- Placing of concrete by means of towed type diesel powered concrete pumps having a maximum capacity of 54 m³/h;
- Compaction of concrete by means of Ø 87 mm hand held air powered immersion type vibrators.

The exposed surfaces of the concrete, after the removal of the formworks, is cured for approx. four days by means of sprinklers and perforated fed by hoses connected to the supply pipelines.

9 Grouting and drainage curtains

The main details necessary to calculate the quantities are given in the paragraph below..

9.1 Stage 1

Two grout curtains (CG 1 and GC 2) in parallel are considered with the characteristics below:

- Grouting density: $\rho = 70 \text{ kg/ml}$
- Primary (P), secondary (S) and tertiary (T) holes
- Spacing between primary: $e = 12 \text{ m}$
- Depth criteria: $p = 0.6 * H = 90 \text{ m}$ (with H=145m the stage 1 height).

- Curtain length: $L = 465 \text{ m}$
- Angle (Downstream – Upstream): $\alpha = 20^\circ$



Figure 9-1: Grout curtain

One drainage curtain (DC) is considered:

- Depth criteria: $p' = 0.6 * p$ (with p: depth of grout curtain)
- Spacing between each holes: $e' = 5 \text{ m}$

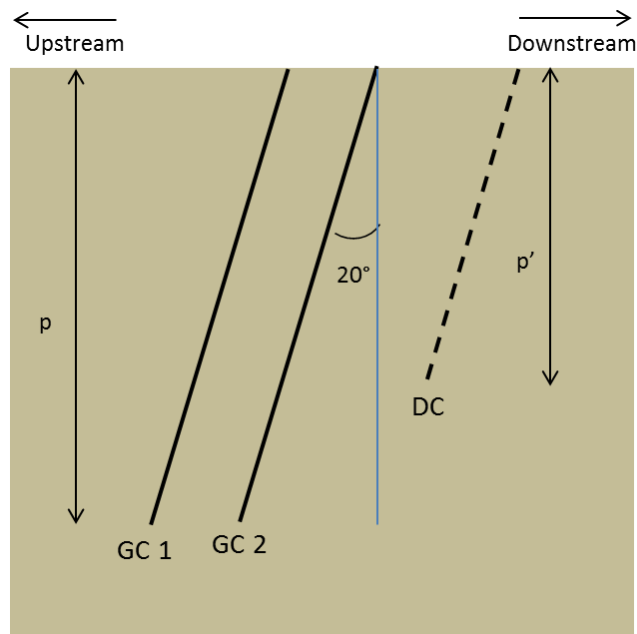


Figure 9-2: Grout and drainage curtains

One control hole is made each 50 m, and 30 water pressure tests are made for each primary hole.

The quantities are detailed in the table below.

Table 9-1: Grout and drainage curtain - Stage 1 - Quantities

B.I.8	Grouting Curtains - Stage 1		
B.I.8.01	<u>Drilling:</u>		
1	Rotary grout holes, vertical, min. diameter 48 mm		
	a) Depth from 0 to 50 m	m	17,194
	b) Depth from 50 to 100 m	m	11,462
2	Rotary control holes, vertical, min. diameter 76 mm:		
	a) Depth from 0 to 50 m	m	540
	b) Depth from 50 to 100 m	m	360
3	Percussion drain holes, vertical, 100 mm min. diameter:		
	a) Depth from 0 to 50 m	m	12,379
	b) Depth from 50 to 100 m	m	8,253
B.I.8.02	<u>Water pressure tests:</u>		
1	Multiple steps	unit	285
B.I.8.03	<u>Grouting:</u>		
1	Cement pressure grouting (excluding materials), vertical holes:		
	a) Depth from 0 to 50 m	t	1,203
	b) Depth from 50 to 100 m	t	802
2	Portland cement ASTM Type I or II	t	1,003
3	Portland cement ASTM Type V (sulfate resistant)	t	1,003
4	Bentonite	t	20
5	Superplasticizer admixture	kg	3,008
B.I.8.04	Miscellaneous works	%	3%

9.2 Stage 2

Two grout curtains in parallel are considered with the characteristics below (with a similar method as for Stage 1):

- Grouting density: $\rho = 70 \text{ kg/ml}$

-
- Primary, secondary and tertiary holes
 - Spacing between primary: $e = 12 \text{ m}$
 - Depth criteria: $p = 0.6 * H = 180 \text{ m}$
 - Grouting surface: $S = 129\,850 \text{ m}^2$
 - Angle (Downstream – Upstream): $\alpha = 20^\circ$

One drilling curtain is considered:

- Depth criteria: $p' = 0.6 * p$ (with p: depth of grout curtain)
- Spacing between each holes: $e' = 5 \text{ m}$

The quantities are detailed in the table below.

Table 9-2: Grout and drilling curtain - Stage 2 - Quantities

B.I.9	Grout and drilling curtain - Stage 2		
B.I.9.01	<u>Drilling</u>		
1	Rotary grout holes, vertical, minimum diameter 48 mm		
	a) Depth from 0 to 50 m	m	32,243
	b) Depth from 50 to 100 m	m	32,243
	c) Depth from 100 to 150 m	m	27,637
2	Rotary control holes, vertical minimum diameter 76 mm:		
	a) Depth from 0 to 50 m	m	2,128
	b) Depth from 50 to 100 m	m	2,128
	c) Depth from 100 to 150 m	m	1,824
3	Percussion drain holes, vertical, 100 mm min. diameter:		
	a) Depth from 0 to 50 m	m	23,215
	b) Depth from 50 to 100 m	m	23,215
	c) Depth from 100 to 150 m	m	19,898
B.I.9.02	<u>Water pressure tests</u>		
1	Multiple steps	unit	570
B.I.9.03	<u>Grouting</u>		
1	Cement pressure grouting (excluding materials), vertical holes:		
	a) Depth from 0 to 50 m	t	2,257
	b) Depth from 50 to 100 m	t	2,257
	c) Depth from 100 to 150 m	t	1,935
2	Portland cement ASTM Type I or II	t	3,225
3	Portland cement ASTM Type V (sulfate resistant)	t	3,225
4	Bentonite	t	64
5	Superplasticizer admixture	kg	9,674
B.I.9.04	Miscellaneous works	%	3%

10 Ionakhsh fault treatment

The main details necessary to calculate the quantities are given in the paragraph below. More details are given in the Phase 0 report regarding the feasibility study of the hydraulic barrier proposed.

10.1 Grouting

A part of the treatment has been already done. The figure below shows the works remaining to be done.

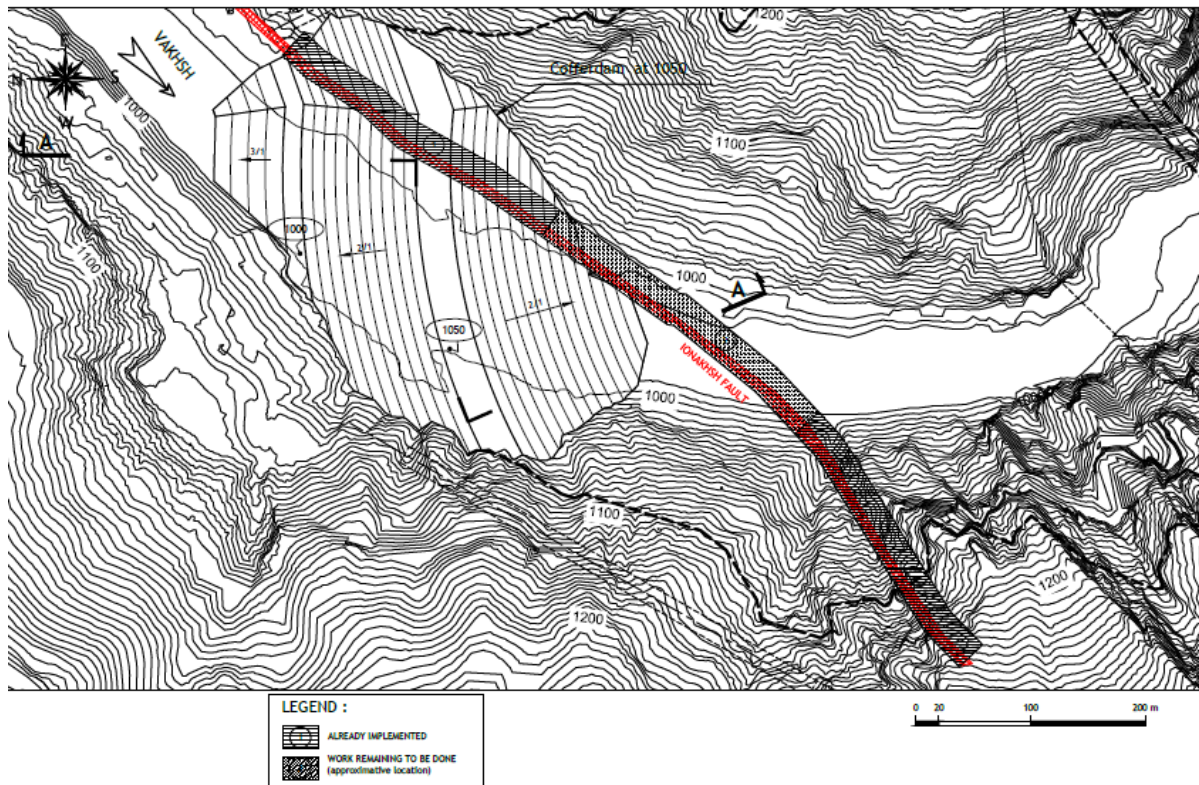


Figure 10-1: Ionakhsh fault grouting – Plan view

The assumptions below are taken into account for the grouting of Ionakhsh fault:

- Grouting density: $\rho = 70 \text{ kg/ml}$
- 20m of grouting (+/-10 m relative to the salt edge)
- 8 rows with an interval of 2 m.
- Approximately 1 m of interval between each hole, over a length $L = 300\text{m}$.

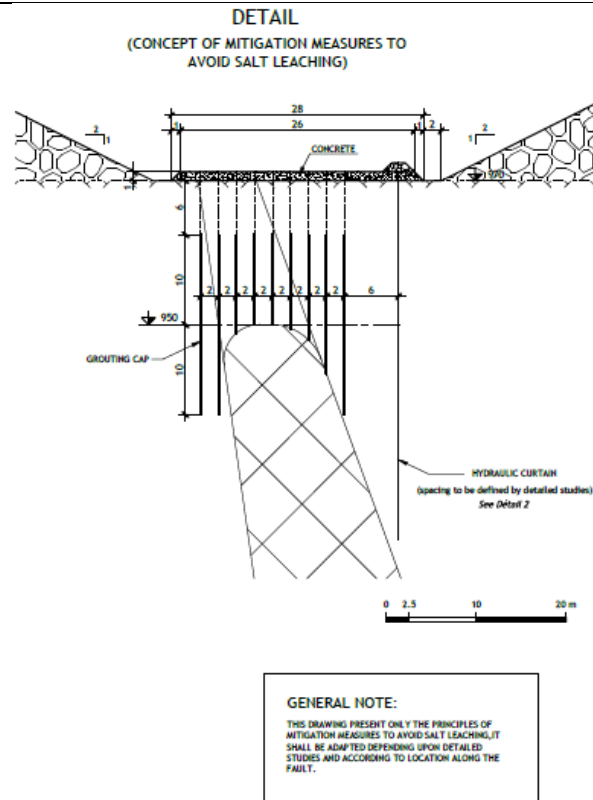


Figure 10-2: Ionakhsh fault grouting – Cross section

Table 10-1 give sthe details of quantities used for Ionakhsh fault treatment.

Table 10-1: Ionakhsh fault treatment – Quantities

Ionakhsh fault treatment (grouting and hydraulic curtain):			
1	Rotary drilling grout holes, Ø 48 mm, 45 m max. depth	m	108,000
2	Cement pressure grouting (excluding injected materials)	t	1,680
3	Portland cement ASTM Type V (sulfate resistant)	t	1,680
4	Bentonite	t	34
5	Superplasticizer admixture	kg	5,040

10.2 Hydraulic curtain

According to Phase 0 report:

In order to avoid the drilling of numerous individual injection wells, which spacing is to be rather reduced to be efficient (some 1.5 m), and with the concern of providing a really continuous hydraulic curtain, the Consortium has contemplated the realization of subhorizontal injections wells, following the level of the top of the salt rock; to be drilled from the banks.

This configuration of the hydraulic curtain corresponds to the “horizontal hydraulic curtain”, tests 1 to 4 of the Annexure “Modelling”.

A detailed analysis has been made by TEAS in order estimate the amount of this mitigation measure. The estimation show in Figure 10-5 corresponds to 1 hydraulic curtain. A direct calculation (conservative) gives the amount for three horizontal hydraulic curtains (cf. Table 10-2).

Table 10-2: Hydraulic curtain estimation - Summary

	Stage 1	Stage 2	Total [€]	Total [US\$]
<i>One hydraulic bareer</i>	2,692,050	1,522,900	4,214,950	5,648,033
<i>Three hydraulic bareers</i>	8,076,150	4,568,700	12,644,850	16,944,099

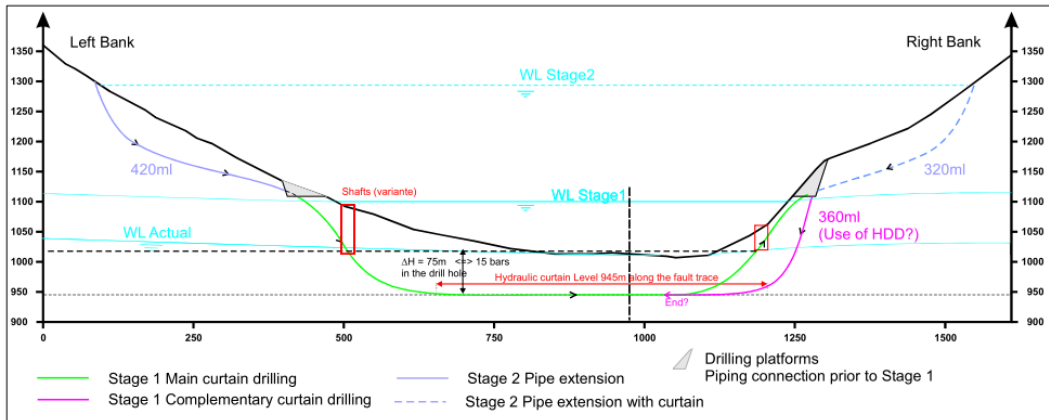


Figure 10-3: Hydraulic curtain definition (1)

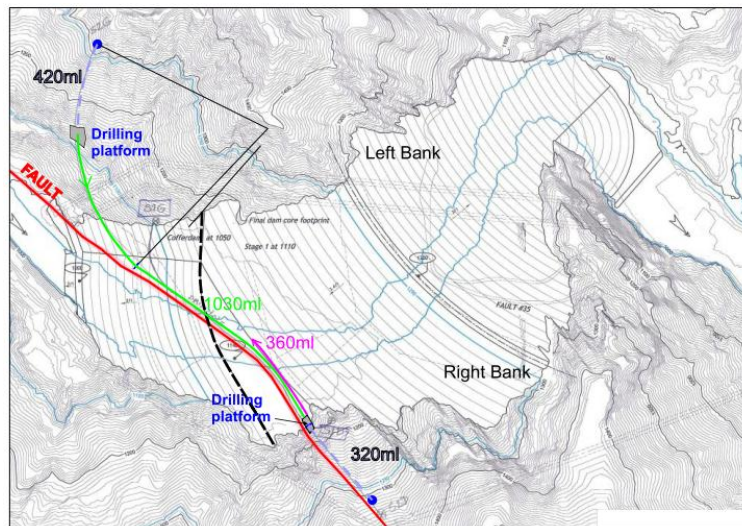


Figure 10-4: Hydraulic curtain definition (2)

Budget Price Rogun Stage 1						
	Detail	Unit	Day	Qty	Unit price	Total
Main curtain 1030ml						
Pilot drilling		ml	8	1030	€ 550.00	€ 566 500.00
Reamings		ml	3	1030	€ 150.00	€ 154 500.00
HDPE welding	100M/day	day	10		€ 3 500.00	€ 35 000.00
HDPE pulling		day	3		€ 7 000.00	€ 21 000.00
Mud pipe cleaning		day	2		€ 7 000.00	€ 14 000.00
Rig up down		day	4		€ 7 000.00	€ 28 000.00
Site preparation mud pit...		day	4		€ 7 000.00	€ 28 000.00
Site logistic		day	34		€ 2 500.00	€ 85 000.00
Equipment						
Mud costs		LS			€	€ 75 000.00
HDPE cost		ml		1030	€ 70.00	€ 72 100.00
Curtain Stainless steel		ml		1030	€ 200.00	€ 206 000.00
Devico drilling services						
1 engineer trajectory + coring		day	34		€ 2 000.00	€ 68 000.00
Price per meter		ml		1030	€ 75.00	€ 77 250.00
Mud engineer + lodging		day	34		€ 2 000.00	€ 68 000.00
Over head cost						
Drilling project manager			38		€ 1 500.00	€ 57 000.00
Transport costs/flights		LS			€	€ 25 000.00
Transport Costs rig, pumps....					€	€ 350 000.00
Complementary curtain 690ml						
Pilot drilling		ml	2	360	€ 550.00	€ 198 000.00
Reamings		ml	1	360	€ 150.00	€ 54 000.00
HDPE welding	100M/day	day	7		€ 3 500.00	€ 24 500.00
HDPE pulling		day	2		€ 7 000.00	€ 14 000.00
Mud pipe cleaning		day	2		€ 7 000.00	€ 14 000.00
Rig up down		day	4		€ 7 000.00	€ 28 000.00
Site preparation mud pit...		day	0		€ 7 000.00	€ -
Site logistic		day	18		€ 2 500.00	€ 45 000.00
Equipment						
Mud costs		LS			€	€ 55 000.00
HDPE cost		ml		360	€ 70.00	€ 25 200.00
Curtain Stainless steel		ml		360	€ 200.00	€ 72 000.00
Devico drilling services						
1 engineer		day	18		€ 2 000.00	€ 36 000.00
Price per meter		ml		360	€ 75.00	€ 27 000.00
Mud engineer + lodging		day	18		€ 2 000.00	€ 36 000.00
Over head cost						
Drilling project manager			22		€ 1 500.00	€ 33 000.00
Transport Costs		n/a			€	€
Pipe perforation necessary, lost casing bit (one way drilling)					€	€ 100 000.00
Total Stage 1						€ 2 692 050.00
Overcost Cored drilling (OPTIONAL) 1030ml						€ 500 000.00
Cost reduction possibility after the first drilling experience						4% € 99 000.00
No mud engineer						
No Devico directionnal drilling						
Total Transport Cost from Europe						14% € 375 000.00
Can be reduced using "local driller"						
Minimum Stage 1						€ 2 218 050.00

Budget Price Rogun Stage 2						
	Detail	Unit	Day	Qty	Unit price	Total
Left bank pipe extention drilling 420m						
Pilot drilling		ml	4	420	€ 550.00	€ 231 000.00
Reamings		ml	3	420	€ 150.00	€ 63 000.00
HDPE welding	100M/day	day	3		€ 3 500.00	€ 10 500.00
HDPE pulling		day	1		€ 7 000.00	€ 7 000.00
Mud pipe cleaning		day	1		€ 7 000.00	€ 7 000.00
Rig up down		day	4		€ 7 000.00	€ 28 000.00
Site preparation mud pit...		day	4		€ 7 000.00	€ 28 000.00
Site logistic		day	20		€ 2 500.00	€ 50 000.00
Equipment						
Mud costs		LS			€	€ 45 000.00
HDPE cost		ml		420	€ 50.00	€ 21 000.00
Curtain Stainless steel		n/a			€ 200.00	€ -
Devico drilling services						
1 engineer trajectory + coring		day	20		€ 2 000.00	€ 40 000.00
Price per meter		ml		420	€ 75.00	€ 31 500.00
Mud engineer + lodging		day	20		€ 2 000.00	€ 40 000.00
Over head cost						
Drilling project manager			24		€ 1 500.00	€ 36 000.00
Transport costs/flights		LS			€	€ 25 000.00
Transport Costs		50%			0.5 € 200 000.00	€ 100 000.00
Connection to Stage 1 pipe						€ 20 000.00
Right bank pipe extention drilling with CURTAIN						
						€ 767 650.00
Pilot drilling		ml	3	320	€ 550.00	€ 176 000.00
Reamings		ml	2	320	€ 150.00	€ 48 000.00
HDPE welding	100M/day	day	3		€ 3 500.00	€ 10 500.00
HDPE pulling		day	1		€ 7 000.00	€ 7 000.00
Mud pipe cleaning		day	1		€ 7 000.00	€ 7 000.00
Rig up down		day	4		€ 7 000.00	€ 28 000.00
Site preparation mud pit...		day	4		€ 7 000.00	€ 28 000.00
Site logistic		day	18		€ 2 500.00	€ 45 000.00
Equipment						
Mud costs		LS			€	€ 55 000.00
HDPE cost		ml		320	€ 70.00	€ 22 400.00
Curtain Stainless steel		ml		320	€ 200.00	€ 64 000.00
Devico drilling services						
1 engineer		day	18		€ 2 000.00	€ 36 000.00
Price per meter		ml		690	€ 75.00	€ 51 750.00
Mud engineer + lodging		day	18		€ 2 000.00	€ 36 000.00
Over head cost						
Drilling project manager			22		€ 1 500.00	€ 33 000.00
Transport Costs		50%			0.5 € 200 000.00	€ 100 000.00
Connection to Stage 1 pipe						€ 20 000.00
Total Stage 2						€ 1 550 650.00
Cost reduction possibility after the first drilling experience						15%
No mud engineer						€ 235 250.00
No Devico directionnal drilling						
Total Transport Cost from Europe						15% € 225 000.00
Can be reduced using "local driller"						
Minimum Stage 2						€ 1 325 649.85

Figure 10-5: Hydraulic curtain estimation - Details

11 Dam Fills

11.1 General

The dam construction has been divided into six phases having the following elevations:

Table 11-1: Construction phasing

Phase	Elevation (masl)		
	Bottom	Top	Barycentre
1	972.00	1,110.00	1,049.50
2	972.00	1,060.00	1,010.80
3	972.00	1,144.00	1,033.20
4	1,060.00	1,170.00	1,118.80
5	1,138.00	1,210.00	1,184.00
6	1,210.00	1,300.00	1,238.80

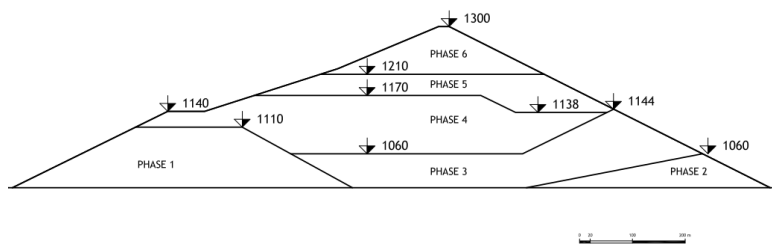


Figure 11-1: Construction phasing – Longitudinal section.

Note that Phase 1 corresponds basically to cofferdam and stage 1 phase of construction.

The above mentioned six zones of the dam embankment have the following compacted volume:

Table 11-2: Materials quantities

Phase	Volume (m3)					
	Alluvium shell	Rock fill shell	Core	Fine filter	Coarse filter	Rip-rap
1	10,497,251	2,016,210	----	88,890	177,780	----
2	2,418,575	935,035	----	----	----	----
3	6,935,810	1,077,240	1,567,260	372,840	469,145	----
4	15,295,370	2,606,935	3,209,040	643,145	976,120	----
5	6,735,233	4,119,019	996,115	385,270	503,970	129,790
6	1,181,625	6,610,120	1,220,075	976,510	1,027,980	424,885

Note: The core is composed of 10% of Fine and 90% of loam by volume

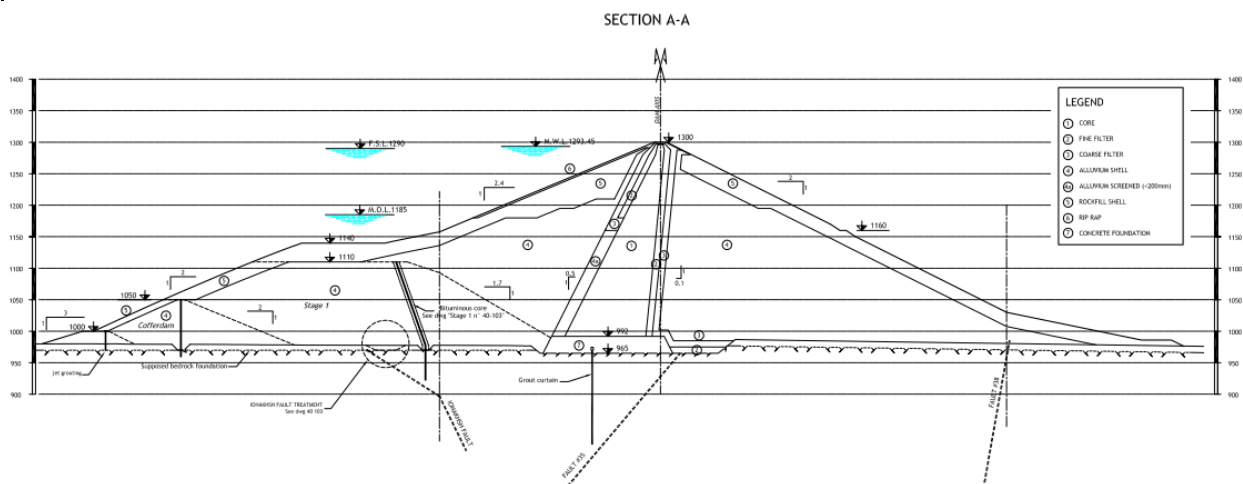


Figure 11-2: Materials definition - Section A-A.

11.2 Source of Fill Materials

The borrow areas, stockpiles and quarries from which alluvium, loam, Fine and rock fill will be taken, have been described before in Chapters 3 and 4.

The methodology used takes into account various criteria to define the transportation of material and the choice of source for each phase:

- The water level which increases with dam construction and then the flooding of borrow area 15, the stockpiles LG2 and later LG1. Phases 5 and 6 require an intermediate stockpile close to the belt conveyor service yard. This induces an anticipated transportation of materials.
- The quantities of material available in the stockpile, in order to use the totality of the volume already extracted.
- The lengths of transportation, if various ways are possible, in order to limit the price.

The alluvium shell for the various dam phases will be obtained as follows:

- Dam phases 1, 2, 3 from the borrow area 15;
- Dam phase 4 from the stockpile areas LG1, LG2 and borrow area 15.
- Dam phase 5 from the stockpile area LG1.
- Dam phase 6 from the borrow area 15.

Regarding the Phase 2, 3 and 6, the transfer of material from the borrow area 15 to higher elevation is performed before the reservoir impounding can submerge the area.

The rock fill shell and rip-rap for all dam phases will be obtained from the quarries 26a and 26b.

The loam for the various dam phases will be obtained as follows:

- Dam phase 3 and 5 from the stockpile area LL3;
- Dam phases 4 and 6 from the borrow areas 17a and 17b.

The fine for all dam phases will be obtained from the borrow area N11.

The alluvium material for transition layers 1 and 2 (filters) for the various dam phases will be obtained as follows:

- Dam phase 1 and 5 from the borrow area 15.
- Dam phases 3 and 6 from the stockpile area LG2;
- Dam phase 4 from the borrow area 15 and the stockpile area LG2.

Table 11-2: Source of materials

Material		Phase 1	Phase 2	Phase 3	Phase 4			Phase 5	Phase 6
1	Alluvium shell	BA15	BA15	BA15	BA15	LG1	LG2	LG1	BA15
2	Rock shell	Q26	Q26	Q26	Q26			Q26	Q26
4	Core (Loam)			LL3	BA17			LL3	BA17
5	Transition layer 1	BA15		LG2	LG2	BA15		BA15	LG2
6	Transition layer 2	BA15		LG2	LG2			BA15	LG2
7	Rip rap							Q26	Q26

Table 11-3: Quantity per material and phase

Material		Phase 1	Phase 2	Phase 3	Phase 4			Phase 5	Phase 6
1	Alluvium shell	10,497,251	2,418,575	6,935,810	1,910,503	6,568,967	6,815,900	6,735,233	1,181,625
2	Rock shell	2,016,210	935,035	1,077,240	2,606,935			4,119,019	6,610,620
4	Core (Loam + Pure Clay)			1,567,260	3,209,040			996,115	1,220,075
5	Transition layer 1	88,890		372,840	207,405	435,740		385,270	976,510
6	Transition layer 2	177,780		469,145	976,120			503,930	1,027,980
7	Rip rap							129,790	424,885

The table below gives the description of transportation for each material and phase considered.

Table 11-4: Fill materials transportation per material and phase

Phase 1							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Alluvium shell (by trucks)	BA15	Int. Stock. 1	>>>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	Dam
Alluvium shell (by conveyor)	BA15	LG1	>>>>>>>>	Load. Stat. 1	Conveyor 1-3	>>>>>>>>	Dam
Rockfillfill shell	Q26	>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	Dam
Core (Loam)							
Fine Filter	BA15	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>>	Dam
Coarse Filter	BA15	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>>	Dam
Rip rap							
Phase 2							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Alluvium shell	BA15	LG1	>>>>>>>>	Load. Stat. 1	Conveyor 1-3	>>>>>>>>	Dam
Rockfillfill shell	Q26	>>>>>>>> >	>>>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	Dam
Core (Loam)							
Fine Filter							
Coarse Filter							
Rip rap							
Phase 3							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Alluvium shell	BA15	LG1	>>>>>>>>	Load. Stat. 1	Conveyor 1-3	>>>>>>>>	Dam
Rockfillfill shell	Q26	>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	Dam
Core (Loam)	LL3	>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	Dam
Fine Filter	LG2	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>>	Dam
Coarse Filter	LG2	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>>	Dam
Rip rap							

Phase 4							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Alluvium shell (from LG1)	LG1	>>>>>>	>>>>>>>	Load. Stat. 1	Conveyor 1-3	>>>>>>>	Dam
Alluvium shell (from LG2)	LG2	>>>>>>	>>>>>>>	Load. Stat. 2	Conveyor 2-3	>>>>>>>	Dam
Alluvium shell (from BA15)	BA15	LG1	>>>>>>>	Load. Stat. 1	Conveyor 1-3	>>>>>>>	Dam
Rockfillfill shell	Q26	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Core (Loam)	BA17	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Fine Filter (from LG2)	LG2	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>	Dam
Fine Filter (from BA15)	BA15	LG2	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>	Dam
Coarse Filter	LG2	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	>>>>>>>	Dam
Rip rap							
Phase 5							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Alluvium shell	LG1	>>>>>>	>>>>>>>	Load. Stat. 1	Conveyor 1-3	>>>>>>>	Dam
Rockfillfill shell	Q26	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Core (Loam)	LL3	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Fine Filter	BA15	LG2	Process. Plant	Load. Stat. 2	Conveyor 2-3	Inter. Stock. 2	Dam
Coarse Filter	BA15	LG2	Process. Plant	Load. Stat. 2	Conveyor 2-3	Inter. Stock. 2	Dam
Rip rap	Q26	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Phase 6							
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Alluvium shell	BA15	LG1	>>>>>>>	Load. Stat. 1	Conveyor 1-3	Int. Stock. 2	Dam
Rockfillfill shell	Q26	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Core (Loam)	BA17	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam
Fine Filter	LG2	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	Inter. Stock. 2	Dam
Coarse Filter	LG2	>>>>>>	Process. Plant	Load. Stat. 2	Conveyor 2-3	Inter. Stock. 2	Dam
Rip rap	Q26	>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	>>>>>>>	Dam

The intermediate stockpiles 1 and 2 are defined on the figures below.

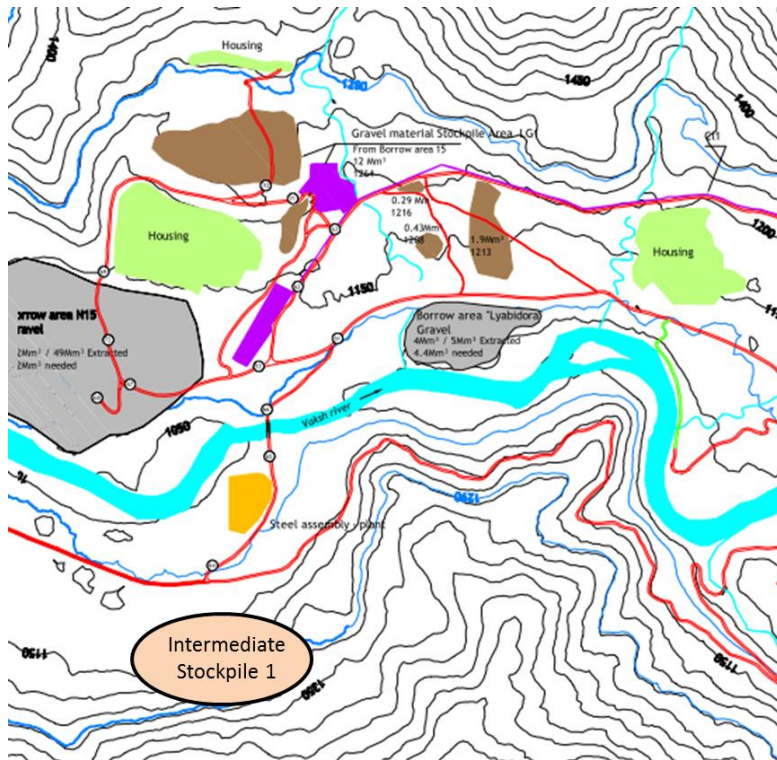


Figure 11-3: Intermediate stockpile 1

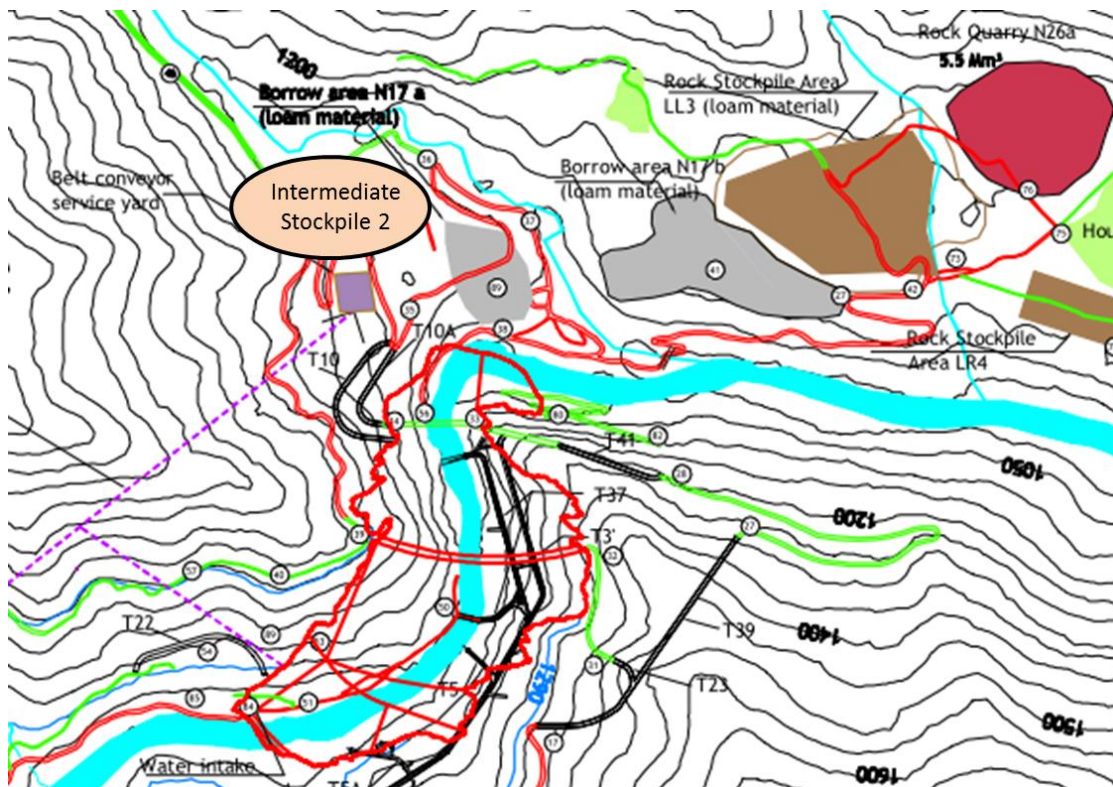


Figure 11-4: Intermediate stockpile 2

11.3 Filter processing

The alluvium stockpiled in LG2 area and obtained from BA15 will be processed in a stationary plant located close to the Loading Station 2 of the belt conveyor system.

The plant has been designed for a 380 t/h capacity and is mainly composed of a primary jaw type crusher, secondary gyratory (cone) type crushers, vibratory screens, fine particle separators, conveyor belts, steel hoppers and vibrating feeders.

From the plant a coarse filter having a grading 1.00 – 40.00 mm and a fine filter having a grading 0.05-18.00 mm as shown on the annexed Figure 1 will be obtained.

The granular material, ready for the transportation to the dam and to the loading station 2 of belt conveyor, will be stockpiled by means of radial type stackers installed on the area close to the processing plant with a sufficient volume to provide a uniform supply to the dam transitions.

11.4 Belt Conveyor Loading Stations

Two stations have been foreseen for the transfer of the alluvium and filters to the belt conveyor system designed for the transportation of the dam fill materials.

The loading station 1 is located close to the stockpile area LG1. The loading station 2 is located close to the stockpile area LG2.

The loading station 1 is composed of two receiving hoppers and transfer units with a capacity of 2175 t/h/each and therefore with a total capacity of 4350 t/h. The loading station 2 is composed of a single receiving hopper and transfer units with a capacity of 2175 t/h.

Each receiving hopper and transfer unit is composed of a heavy-duty feeder, a jaw crusher and a belt conveyor which conveys the material to the main belt conveyor line described in below the Paragraph in Sub-chapter 2.5.

The alluvial shell of the dam fill can contain boulders up to a maximum size of 700 mm and therefore the jaw crusher is a unit that is not strictly necessary for the operation of the loading stations. However such equipment has been installed because its use could be necessary in case an excess of belt (rubber belt) wearing is recorded during the work progress.

11.5 Belt Conveyor System

11.5.1 Main characteristics

The belt conveyor system is located on the left bank of the Vakhsh River as shown on the General Plan View and is composed of a main line and a branch line.

The main line spans from the Loading Station 1 to the delivery point at dam embankment, has a total length of 6,380 m and is composed of two parallel conveyors each one having three flights (C1, T2 and T3) installed in sequence.

The branch line spans from the Loading Station 2 to the above mentioned flight C1, has a length of 600 m and is composed of two parallel conveyors having a single flight (T1).

Length, elevation and other information of four flights are as follows:

Flight N°	Length (m)	Elevation (masl)		Δ (m) (end-start)	Installation (open/tunnel)
		Start Point	End Point		
C1	3100	1191	1235	+ 44	Open air
T1	600	1153	1235	+ 82	Open air
T2	780	1235	1170	- 80	Open air
T3	2500	1170	1170	0	Open air: 400 m Tunnel: 2100 m

The flight 1 (C1) is located along an alignment which is not straight being present some small curves. However such curves do not affect the capacity and the full operation of the unit being the equipment designed to overcome such particular operating conditions.

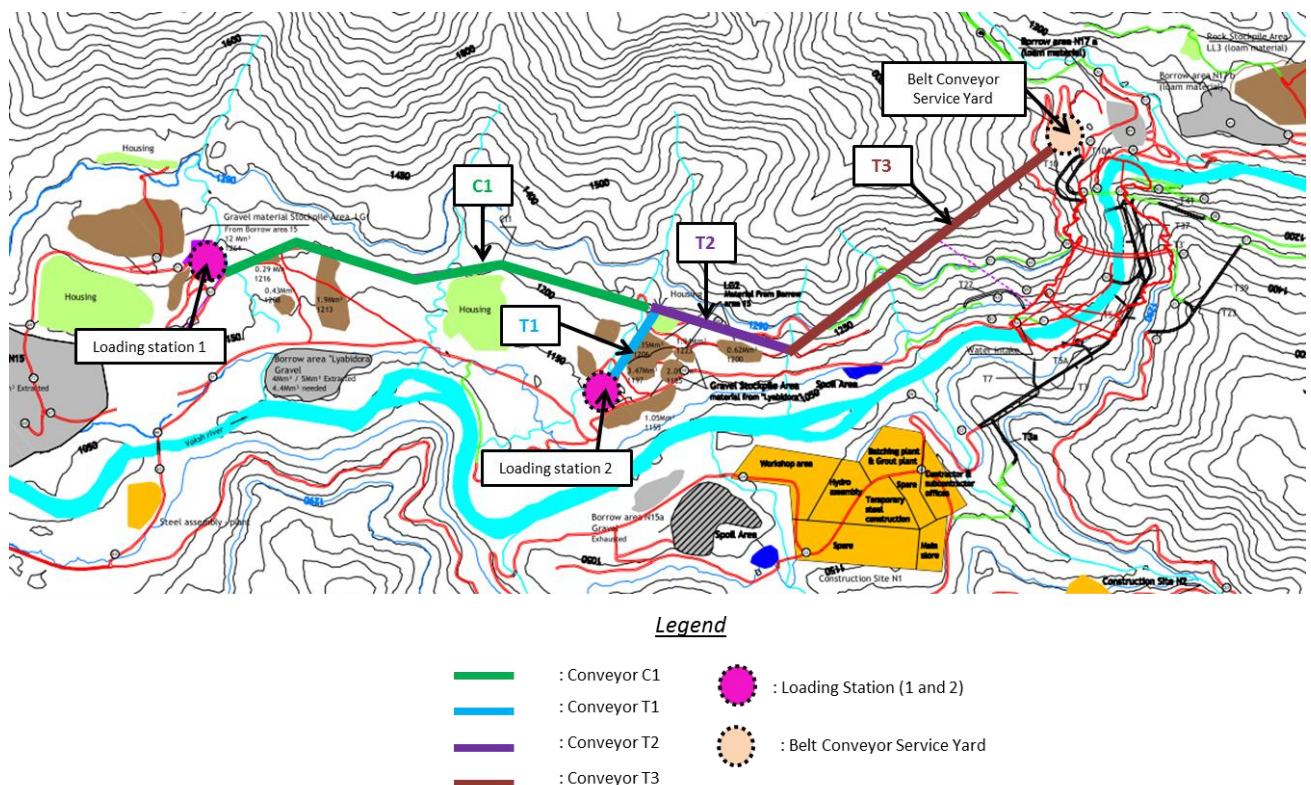


Figure 11-5: Belt Conveyor System

The volume calculation of the conveyor (capacity, filling ratio, etc.), has been based on a material having a bulk density of 1.5 t/m³.

The main characteristics of the conveyor are as follows:

- Type of belt steel cords
- Belt width 1600 mm
- Belt speed 3.75 m/s
- Idler trough angle 35°
- Capacity 2175 t/h
- High/low coating of belt 5 mm + 5mm anti-abrasive Type A
- Tension system gravity
- Installed power C1=800 kW, T1=640 kW, T2=150 kW, T3=560 kW

The engine of the belt conveyor T2 is a generator and therefore the power of this engine will only be used for moving the unit when the equipment starts the operation.

The maximum section of the handled material in square meters of the belt conveyor has been based on the Standard ISO 5048-1979.

The maximum capacity of the belt (t/h) has been based on 22 days of work per month, 20 hours a day (two-10 hours shifts a day) and on the following factors:

- Seasonality factor 0.79
- Repair factor 1.30
- Peak factor 1.30

The maximum capacity of the belt is required during the construction of dam phase 4 with a total of approx. 40 million of tons to be transported in a time of 44 months.

It is supposed that the conveyor will be available at the beginning of stage 1 dam construction. Therefore, the cofferdam construction will requires trucks for alluvium shell and filters materials.

11.5.2 Transported Materials

The weight of the materials to be transported by the belt conveyor subdivided for the seven dam phases and the two loading stations is given in the following table.

Dam Phase	Material	Loading Station 1 (t)	Loading Station 2 (t)
1	Alluvium shell	19,323,465	
	Fine Filter		202,669
	Coarse Filter		405,338
2	Alluvium shell	5,965,115	
3	Alluvium shell	16,332,030	
	Fine filters		849,437
	Coarse filters		1,068,847
4	Alluvium shell	19,966,948	16,049,673
	Fine filters		1,465,269
	Coarse filters		2,223,882
5	Alluvium shell	15,859,723	
	Fine filters		877,756
	Coarse filters		1,148,097
6	Alluvium shell	15,859,723	
	Fine filters		2,224,770
	Coarse filters		2,342,034

11.5.3 Productivity of dump trucks

The productivity of the dump trucks used for the transportation of this alluvium, rock, filters and other fill materials to be moved along similar long routes has been calculated considering the main factors which affect the haul and return time.

To this purpose the road of each route was:

- a) First subdivided into homogeneous stretches establishing for each stretch the minimum lane width, length, slope, number of sharp curves and roadway surface type (dirt surface, base course surface and paved surface);
- b) Then established both the practical rolling resistance, i.e. the force that resists movement of machines on different types of terrain and the grade resistance by means of the above mentioned slope.

According to the grade and rolling resistance, the total resistance and the effective grade have been established. With the use of the performance charts, which are given by the dump truck manufactures, and the effective grade, the average speed of the equipment was established.

Finally the total round trip time of each trip has been determined considering the average speed, the proper speed factor and the miscellaneous times such as maneuver in load area, load, acceleration, turning and dumping and spotting in load area.

11.6 Alluvium shell for Cofferdam dam

11.6.1 General

The alluvium for the construction of cofferdam shell is obtained from the borrow area 15 and stockpiled on the right bank in the area close to the suspension bridge over the Vahksh (cf. General Plan View). Then the material is reloaded and transported to the embankment.

The entire volume of the alluvium will be blasted before the loading on dump trucks because of the cementation of the granular elements.

11.6.2 Pre-blasting of alluvium

The following construction method has been foreseen for the rock drilling and blasting of the cemented conglomerate:

- Drilling by means of 119 kW hydraulic type crawler-mounted rock drills outfitted with automatic rod exchanger and operating with button bits with diameter of 76 mm;
- Height of drilling benches ranging from 16 to 18 m;
- Hole pattern of approx. 3.50 x 4.00 m ;
- Transportation of explosive by means of 10 t pay load flat-bed lorry outfitted with 7.0 t/m capacity hydraulic crane;
- Charging of the holes with gramonite type explosive;
- Firing with detonating fuse along the entire length of holes and electric detonators connected with the shot-firing cable.

11.6.3 Alluvium loading and stockpiling

The following methodology has been foreseen for the loading, transportation and stockpiling of the alluvium proceeding from the borrow area 15:

- Loading on dump trucks by means of hydraulic front shovels equipped with 5.70 m³ heaped bucket capacity and wheel loaders equipped with 7.30 m³ heaped bucket capacity;
- Transportation of the excavated material to designated stockpile area by means of 55.60 tons payload off-highway dump trucks;
- Roughs spreading of the unloaded material in stockpile area by means of 153 kW bulldozers;
- Lighting of the work areas by means of mobile diesel powered 6,000 W floodlights when the work is carried out during night shifts.

The total transportation length from the borrow area to the stockpile considered for the cost estimate is of 3000 m.

11.6.4 Alluvium transportation to dam and placing

The stockpiled alluvium is loaded on dump trucks by means of wheel loaders with 5.80 m³ heaped bucket capacity and transported to the embankment by means of 36.60 tons payload off-highway dump trucks.

The total transportation length from the stockpile area to the average placing point on dam considered for the cost estimate is of approx. 13,600 m.

The road routes covered by the dump trucks from the material source to the dam, according to the General Plan View of Annex B (Part VIII), are as follows:

67 – 53 – 61 – 66 – 65 – 64 – 25 – 23 – 21 – 22 – T3 – on embankment

The alluvium is unloaded on the surface of the previously compacted layer of the embankment or of the foundation leaving a set of close heaps. Such heaps are then leveled by means of 179 kW bulldozers outfitted with universal type blade to obtain uniform layers of approx. 80 cm once compacted.

The layers so obtained are moistened with a rate of approx. 200 liters of water per cubic meter of compacted material.

The water is raised to the level of the shell under placing by means of centrifugal pumps located at the toe of the dam upstream face and stored in mobile water towers outfitted with hydraulic power package so that the tanks can be hydraulically erected up to a level sufficient for a fast discharge of the water into mobile sprinkler tanks.

The shell is watered by means of semi-trailer sprinkler tanks having a capacity of 38,000 liters and equipped with automatic water control system designed for maintaining a uniform volume output on the fill.

After the watering, the fill is compacted with six (6) passes of smooth drum vibration rollers having a linear load along the compaction drum of 50 kg/cm.

The work areas are illuminated by means of mobile diesel powered 6,000 W floodlights when the work is carried out during night shifts.

11.7 Alluvium shell for Dam Phase 1 to 6

11.7.1 General

Dam phases 1, 2 and 3

The alluvium necessary for the shell of dam phases 1 (except cofferdam), 2 and 3 is taken from the borrow area 15 and moved to the LG1 stockpile area.

Then the alluvium is reloaded and transported to the loading station 1 of conveyor belt system, transferred to the belt conveyor by means of the same station, transported by means of the conveyor belt system to the terminal hopper and finally transported to the dam by means of dump trucks and placed.

Dam phase 4

Approx. 43% of the alluvium necessary for the shell of dam phase 4 is taken from the stockpile area LG1, transported to the loading station 1 of the conveyor belt, transferred to the belt conveyor by means of the same station, transported by means of the belt conveyor to the terminal hopper and finally transported to the dam by means of dump trucks and placed.

Approx. 45% of the alluvium necessary for the shell of dam phase 4 is taken from the stockpile area LG2, transported to the loading station 2 of the conveyor belt, transferred to the belt conveyor by means of the same station, transported by means of the belt conveyor to the terminal hopper and finally transported to the dam by means of dump trucks and placed.

The remaining quantity of the alluvium necessary for the shell of dam phase 4 is taken from the borrow area 15 and moved to LG1 stockpile area. Then the material is reloaded, transported and placed as specified before for dam phases 2 and 3.

Dam phase 5

The alluvium necessary for the shell of dam phase 5 is taken from the stockpile area LG1 and then transported and placed as specified before for the material of dam phase 4 taken from this stockpile.

Dam phase 6

The alluvium necessary for the shell of dam phase 6 is taken from the borrow area 15 and transported to LG1 stockpile area.

Then the material is loaded, transported to the loading station 1 of the conveyor belt, transferred to the belt conveyor by means of the same station, transported by means of the belt conveyor to the terminal hopper, transported to the intermediate stockpile, reloaded and finally transported to the dam by means of dump trucks and placed.

11.7.2 Pre-blasting of BA15 alluvium

The alluvium of BA15 will be pre-blasted as specified before for the shell in Paragraph 11.6.2.

11.7.3 Transportation of alluvium from BA15 to LG1

The alluvium of borrow area 15 is loaded both by means of hydraulic front shovels equipped with 5.70 m³ heaped bucket capacity and wheel loaders equipped with 7.30 m³ heaped

bucket and transported to stockpile area LG1 by means of 55.60 tons payload off-highway dump trucks.

The total transportation length from the BA15 to LG1 considered for the cost estimate is of approx. 3,000 m.

11.7.4 Transportation of alluvium from LG1 to loading station 1

The alluvium stockpiled in area LG1 is loaded by means of by means of hydraulic front shovels equipped with 5.70 m³ heaped bucket capacity and wheel loaders equipped with 7.30 m³ heaped bucket capacity and transported to the loading station 1 by means of 55.60 tons payload off-highway dump trucks.

The total transportation length from LG1 to the loading station 1 considered for the cost estimate is of approx. 1,000 m.

11.7.5 Transportation of alluvium from LG2 to loading station 2

The alluvium stockpiled in LG2 is loaded by means of 275 kW hydraulic wheel loader equipped with 5.80 m³ heaped bucket capacity and transported to the loading station 2 by means of 36.60 tons payload off-highway dump trucks.

The total transportation length from LG2 to the loading station 2 considered for the cost estimate is of approx. 1,000 m.

11.7.6 Transfer to the belt conveyor

The transfer of the filters from the dump trucks to the belt conveyors is done by means of the loading stations 1 and 2.

11.7.7 Transportation with belt conveyor to terminal hopper

The transportation of the alluvium from the loading station 1 to the dam area is done by means of the flights C1, T2 and T3 of the belt conveyor system.

The transportation of the alluvium from the loading station 2 to the dam area is done by means of the flights T1, T2 and T3 of the belt conveyor system.

The material is unloaded into a 200 m³ capacity hopper which is located on the belt conveyor terminal platform.

11.7.8 Transportation from hopper to dam embankment and placing

The alluvium is transported to the embankment by means of 36.60 t pay load off-highway dump trucks and then placed for the shell of dam phase 1.

The average transportation lengths from the belt conveyor hopper to the placing area considered for the cost estimate are as follows:

- Dam Phase 1 1,600 m.
- Dam Phase 2 1,600 m.
- Dam phase 3 1,800 m;
- Dam phase 4 2,700 m;
- Dam phase 5 2,800 m.

The road routes covered are as follows.

Dam phase	Routes
2, 3	Conveyor belt – 35 – T10/T10A – 34 – T37 – T3 – T5A/BRIDGE 50-on embankment
4,5,6	Conveyor belt – 35 – T10/T10A - on embankment

11.7.9 Transportation from the terminal hopper to the intermediate stockpile

The alluvium of dam phase 6 is transported from the terminal hopper of the conveyor belt to the intermediate stockpile by means of 36.60 tons payload off-highway dump trucks. The material is roughly spread on the stockpile by means of 153 kW bulldozer.

The total transportation length from the terminal hopper to the intermediate stockpile considered for the cost estimate is of approx. 900 m.

11.7.10 Transportation from the intermediate stockpile to the dam and placing

The alluvium is loaded in the stockpile by means of 275 kW wheel loaders outfitted with 5.80 m³ heaped bucket capacity and transported to the embankment by means of 36.60 tons payload off-highway dump trucks.

The total transportation length from the stockpile area to the dam considered for the cost estimate is of approx. 2,850 m.

The material is placed on the embankment as specified before in Paragraph 11.6.3 for the alluvial shell of dam phase 1.

11.8 Rock fill Shell

11.8.1 General

The rock for the construction of the shell zones of the six dam phases is taken from the quarries 26a and 26b, transported to the embankment by means of dump trucks and finally placed on the same embankment in uniform layers.

11.8.2 Drilling and blasting

The following construction method has been foreseen for the rock drilling and blasting of the rock formation:

- Drilling for starting the excavation at the quarry top by means of hand-held drills outfitted with 38-40 mm diameter and 800-4000 mm long integral drill steels;
- Drilling by means of 149 kW hydraulic type crawler-mounted rock drills outfitted with automatic rod exchanger and operating with button bits with diameter of 89 mm and 108 mm;
- Height of drilling benches ranging from 2 to 3 m for hand held drills and from 16 to 18 m for crawler hydraulic drills;
- Hole pattern of approx. 1.20 x 1.50 m (burden x spacing) for Ø 38-40 mm holes, of approx. 3.10 x 3.90 m for Ø 89 mm holes and of approx. 3.50 x 4.30 m for Ø 108 mm holes;
- Transportation of explosive by means of 10 t pay load flat-bed lorry outfitted with 7.0 t/m capacity hydraulic crane;
- Charging of the holes with amonite and gramonite type explosive;
- Firing with detonating fuse along the entire length of holes and electric detonators connected with the shot-firing cable.

11.8.3 Loading, transportation and placing

The following construction method has been foreseen for the rock loading, transportation and placing:

- Loading of the blasted material on dump trucks by means of 301 kW hydraulic front shovels equipped with 4.10 m³ heaped bottom dump type bucket;
- Assistance to the front shovels and moving of the rock from bench to bench by means of 231 kW bulldozers equipped with straight and angled blade;
- Transportation of the blasted rock to the embankment by means of 36.6 t pay load off-highway dump trucks;
- Spreading of the unloaded material on the embankment in order to obtain uniform layers of approx. 100 cm once compacted by means of 179 kW and 231 kW bulldozers outfitted with universal type blade;

- Compaction of the fill with eight (8) passes of smooth drum vibration rollers having a linear load along the compaction drum of 50 kg/cm;
- Lighting of the working areas by means of mobile diesel powered 6,000 W floodlights when the work is carried out during night shifts.

Before compaction the layers are moistened with a rate of approx. 300 liters o water per cubic meter of compacted material.

The water is raised to the level of the rockfill under placing, stored in mobile water towers and sprinkled as described before in Paragraph 9.6.3 for the Shoulder materials.

The average transportation lengths from the quarries to the placing area considered for the cost estimate are as follows:

- Dam phase 1 6,500 m;
- Dam phase 2 5,500 m;
- Dam phase 3 5,700 m;
- Dam phase 4 6,600 m;
- Dam phase 5 6,700 m;
- Dam phase 6 6,750 m.

The road routes covered by the dump trucks from the material source to the dam, according to the General Plan View of Annex B (Part VIII), are as follows:

Dam Phase	Routes
1	76 – 75 – 73 – 42 – 27 – 38 – 56 – 33 – T37 – T3 – T5A/BRIDGE 50
2, 3, 4, 5, 6	76 – 75 – 73 – 42 – 27 – 38 – 56 - on embankment

11.9 Transition Layers (Filters)

11.9.1 General

Dam Phase 1 (only for cofferdam)

The alluvium necessary for the filters of dam phase 1 is taken from the borrow area 15, moved to the filter processing plant, processed and stockpiled.

Then the processed filters are loaded and transported to the embankment by means of dump trucks and finally placed on the same embankment in uniform layers.

Dam phase 1 (stage 1 dam) , 3

The alluvium necessary for the filters of dam phase 1 (except cofferdam) 3 is taken from the stockpile area LG2, moved to the filter processing plant, processed and stockpiled.

Then the processed filters are loaded and transported to the loading station 2 of conveyor belt system, transferred to the belt conveyor by means of the same station, transported by means of the conveyor belt to the terminal hopper and finally transported to the dam by means of dump trucks and placed.

Dam phase 4

Approx. 73% of the alluvium necessary for the filters of dam phase 4 is taken from the stockpile area LG2, moved to the to the filter processing plant, processed and stockpiled.

The remaining quantity of the alluvium is taken from the borrow area 15, moved to the filter processing plant, processed and stockpiled.

Then the processed filters are reloaded, transported to dam by means of dump trucks and placed as specified for dam phase 3.

Dam phase 5

The alluvium necessary for the filters of dam phase 5 is taken from the borrow area 15, moved to the stockpile area LG2, reloaded in LG2, transported to the filter processing plant, processed and stockpiled.

Then the processed filters are loaded and transported to the loading station 2 of conveyor belt system, transferred to the belt conveyor by means of the same station, transported by means of the conveyor belt to the terminal hopper, transported to the intermediate stockpile, reloaded in the stockpile and finally transported to the dam by means of dump trucks and placed.

Dam phase 6

The alluvium necessary for the filters of dam phase 6 is taken from the stockpile area LG2, moved to the to the filter processing plant, processed and stockpiled.

Then the processed filters are loaded in stockpile, transported to dam and placed as specified for dam phase 5.

11.9.2 Pre-blasting of BA15 alluvium

The alluvium of BA15 is pre-blasted as specified before for the shell in Paragraph 11.6.2.

11.9.3 Transportation of alluvium from BA15 to processing plant

The alluvium of borrow area 15 is loaded by means of hydraulic front shovels equipped with 5.70 m³ heaped bucket capacity and transported to processing plant by means of 55.60 tons payload off-highway dump trucks.

The total transportation length from the stockpile area to the plant considered for the cost estimate is of approx. 5,600 m.

11.9.4 Transportation of alluvium from BA15 to LG2

The alluvium of borrow area 15 is loaded and transported with the construction equipment specified before in Paragraph 11.7.5.

The total transportation length from the stockpile area to the plant considered for the cost estimate is of approx. 5,800 m.

11.9.5 Transportation of alluvium from LG2 to processing plant

The alluvium stockpiled in LG2 is loaded by means of 275 kW hydraulic wheel loader equipped with 5.80 m³ heaped bucket capacity and transported to the processing plant by means of 36.60 tons payload off-highway dump trucks.

The total transportation length from the stockpile area to the plant considered for the cost estimate is of approx. 1,000 m.

11.9.6 Alluvium processing and filter stockpiling

The alluvium is processed for obtaining the required filter grading and then the material is stockpiled in the surrounding area by means of the stationary plant.

11.9.7 Filter transportation from processing plant to dam and placing

The stockpiled filters at the processing plant are loaded by means of wheel loaders outfitted with 4.30 m³ heaped bucket capacity and transported to the embankment by means of 36.60 tons payload off-highway dump trucks.

The total transportation length from the stockpile area to the dam considered for the cost estimate is of approx. 2,750 m.

The road routes covered by the dump trucks from the stockpile to the dam, according to the General Plan View of annexed report, are as follows is: 60 - T22 – 51 – on embankment.

The filters are unloaded on the surface of the previously compacted layer or of the foundation by means of chutes suitable to keep the material within the established designed lines of dam fills. The unloading will be done slowly in order to avoid the trespassing of the limits especially where the filters are narrow and to obtain layers with a height of approx. 30 cm after compaction.

The layers so obtained are leveled by means of 72 kW bulldozers and 103 kW motorgraders, then are moistened with a rate of approx. 200 liters of water per cubic meter of compacted material.

The water is raised to the level of the filters under placing and stored in mobile water towers as described before in Paragraph 9.6.3 for the alluvium shell.

The filter are watered by means of tanks mounted on trucks having a capacity of 24,000 liters and equipped with automatic water control system designed for maintaining a uniform volume output on the fill.

After the watering, the filters are compacted with six (6) passes of smooth drum vibration rollers having a linear load along the compaction drum of 38 kg/cm.

11.9.8 Transportation to loading station

The stockpiled filters are loaded by means of wheel loaders with 5.80 m³ heaped bucket capacity and transported to the loading station 2 by means of 36.60 tons payload off-highway dump trucks.

The average transportation length from the stockpile area to the station 2 considered for the cost estimate is of approx. 1000 m.

11.9.9 Transfer to the belt conveyor

The transfer of the filters from the dump trucks to the belt conveyors is done by means of the loading station 2 specified before in Sub-chapter 9.4.

11.9.10 Transportation with belt conveyor to terminal hopper

The transportation of the filters from the loading station 2 to the dam area is done by means of the flights T1, T2 and T3 of the belt conveyor system described before in Sub-chapter 11.7.7. The material is unloaded in a 200 m³ capacity hopper which is located at the belt conveyor delivery point.

11.9.11 Transportation from terminal hopper to dam and placing

The filters are transported from the terminal hopper of the conveyor belt to the dam by means of 36.60 tons payload off-highway dump trucks.

The material is placed as specified before in Paragraph 11.7.8 for the filters which are transported from the processing plant to the dam by means of dump trucks.

The average transportation lengths from the belt conveyor hopper to the placing area considered for the cost estimate are as follows:

- Dam phase 3 1,800 m;
- Dam phase 4 2,700 m;
- Dam phase 5 2,800 m;
- Dam phase 6 2,850 m;

11.9.12 Transportation from the terminal hopper to the intermediate stockpile

The filters are transported from the terminal hopper of the conveyor belt to the intermediate stockpile by means of 36.60 tons payload off-highway dump trucks. The material is roughly spread on the stockpile by means of 153 kW bulldozer.

The total transportation length from the terminal hopper to the intermediate stockpile considered for the cost estimate is of approx. 700 m.

11.9.13 Transportation from the intermediate stockpile to the dam and placing

The stockpiled filters are loaded by means of 275 kW wheel loaders outfitted with 5.80 m³ heaped bucket capacity and transported to the embankment by means of 36.60 tons payload off-highway dump trucks.

The total transportation lengths from the stockpile area to the dam considered for the cost estimate are of approx. 2,800 m and 2,850 m respectively for filters of dam phase 5 and phase 6 respectively.

The material is placed in dam as specified before in Paragraph 11.7.10 for the filters which are transported from the processing plant to the dam by means of dump trucks.

11.10 Loam and Fine (Core Materials)

11.10.1 General

The core is composed of a mixture of loam and fines. It was assumed for cost estimation purpose that the mixture contains 90% of loam and 10% of fine by volume. The loam are taken from borrow area N17 and the stockpile area LL3, while the fine is taken from borrow area N11. This was a conservative assumption to account for price increase if the entire volume of the core would have to be enriched with fines.

The lack of data regarding borrow area N°11 induces hypothesis about the characteristics of materials and in particular the moisture content that is reported to be high, involving a drying procedure in the treatment of this material before transportation to the embankment.

Besides the loam contains boulders up to 200 mm in size which have to be eliminated before its transport to the dam. The quantity of boulders has been estimated approx. 10% of the in-situ volume.

11.10.2 Drying of the loam

The lowering of the moisture content of the loam has been assumed following this construction method:

- Excavation of small drain ditches excavated paralleling and with an interval of approximately 20 m;
- Shaping of the borrow area surface in such a way to obtain approx. 10 m slopes towards longitudinal drain ditches;
- Placing of a plastic type membrane along the ditches with a thickness of approx 3 mm;
- Placing of a thin reinforced plastic membrane over the slopes in strips having a width of approx. 5 m at the end of the first dry season and fixing of the same with small sand bags;
- Fold up the strips of membrane during the subsequent dry seasons so that the loam can lose part of its moisture;
- Replace the strips of membrane in the original position before the beginning of the subsequent wet seasons.

11.10.3 Drying of the fine

The lowering of the moisture content of the fine is in accordance with following construction method:

- Removal of the top soil as necessary;

-
- Ploughing of a layer of fines to a depth of approx. 40 cm during the summer time and leave the material to dry up to a moisture content to be established by the laboratory;
 - Removal and heaping up of the dried fines layer by means of bulldozers;
 - Loading of the fines by means of wheel loaders and transport of the material to stockpiles located in the surrounding area;
 - Repetition of the above listed operations in order to stockpile a sufficient volume of material as necessary for the construction of the dam core up to the next dry season;
 - Covering of the stockpiles with a thin reinforced plastic membrane.

11.10.4 Loading and screening of the loam

The loading and screening of the loam is in accordance with following construction method:

- Excavation of the loam by means of 153 kW and 179 kW bulldozers and dozing of the material towards the apron of trap/belt type loaders;
- Loading by means of dozer trap/belt loaders equipped with 48" x 45' (width x length) conveyor belt and a vibrating screen mounted at its tip;
- Separation the granular material exceeding 100 mm from the finer one by means of the vibrating screen;
- Loading of the screened coarse material by means of wheel loaders with 3.10 m³ heaped bucket capacity;
- Transport of the screened coarse material to disposal or stockpile areas by means of 36.60 t pay load off-highway dump trucks;
- Transport of the fine loam component to the dam.

11.10.5 Transport and placing of loam

The loam is transported to the embankment by means of 36.6 t pay load dumpers and unloaded on the surface of the previously compacted layer leaving a set of close heaps.

Such heaps of loam are leveled first by means of 153 kW and 179 kW bulldozers outfitted with universal type blade to obtain rough layers of approx. 27 cm once compacted and then by means of 103 kW motorgraders to obtain a more uniform surface and the required thickness.

The average transport lengths from borrow and stockpile areas to the placing locations considered for the cost estimate are as follows:

- Dam phase 3 5,000 m;
- Dam phase 4 5,800 m;

-
- Dam phase 5 5,900 m;
 - Dam phase 6 5,950 m.

The road routes covered by the dump trucks from the material source to the dam, according to the General Plan View of annexed report, are as follows: 42 – 27 – 38 – on embankment.

11.10.6 Loading, transport and placing of fine

The fine is loaded by means of wheel loaders with 3.10 m³ heaped bucket capacity and transported to the embankment by means of 24 t pay load dump trucks.

The fine is unloaded into the hopper of the clay spreading machines foreseen for placing the material over the loam layer with a uniform layer having a thickness of 3 cm once compacted.

The average transport lengths, from the borrow area to the placing areas, considered for the cost estimate are as follows:

- Dam phase 3 11,300 m;
- Dam phase 4 12,000 m;
- Dam phase 5 12,700 m;
- Dam phase 6 13,400 m.

The road routes covered by the dump trucks from the material source to the dam, according to the General Plan View of Annex B (Part VIII), are as follows from BA11:

83 – 14 – 15 - 20 – 17- T23 - 27 – 28 – T41 – on embankment.

11.10.7 Mixing and compaction of loam and fines – Assumed method

The following method has been assumed to build up unit price of mixing and compaction before placing the material for the core. This will have to be defined more precisely at detailed design stage, but seems a reasonable assumption for cost estimation at this phase of the study.

The overlapped layers of loam and of fine, placed as described before in Paragraphs 9.12.5 and 9.12.6, are mixed by means of two full passes of 245 kW soil-stabilizer operating at a speed of approx. 30 meters per minute.

The loose core layer is compacted with eight (8) passes of pad-foot drum vibration rollers having a linear load along the compaction drum of 44 kg/cm to obtain in-place layers having a thickness of 30 cm.

11.11 Rip-rap

11.11.1 General

Rip-rap rock fragments for the dam phases 5 and 6 will be obtained from the quarries 26a and 26b during the blasting executed for obtaining the rock shell material of the dam.

The fragments first are selected and stockpiled in areas close to the quarries. Then the fragments are reloaded and transported to the embankment by means of dump trucks and placed on the inclined face of the dam upstream surface.

11.11.2 Drilling and blasting

The drilling and blasting of the rock is performed as described before in Paragraph 11.8.2 for the rock shell.

For obtaining rock fragments according to the required quantity and size, the drilling and blasting operations will be adjusted from time to time by mainly changing, burden, spacing, explosive quantity and holes diameter.

11.11.3 Selection of rock fragments and stockpiling

Both after blasting and during the loading of the rock on the dump trucks for the dam shells, the large rock fragments will be selected one by one and stockpiled in surrounding flat or semi-flat areas located in the range of one-way distance of 800 m.

The selection and stockpiling are executed by means of 157 kW wheel loaders equipped with hydraulic rock grapple. The transport to the stockpiles is performed by means of 36.6 t pay load off-highway dump trucks.

11.11.4 Reloading of rock fragments, transport and placing

The following construction method has been foreseen for the rock reloading, transport and placing of the rock fragments:

- Loading of the fragment on the dump trucks by means of 157 kW wheel loaders equipped with hydraulic rock grapple ;
- Transport to the embankment by means of 36.6 t pay load off-highway dump trucks;
- Placing by means of 200 kW hydraulic excavators equipped with rock grapple of the rock fragments which cannot be placed in the final position during the unloading operation.

Particular care is exercised to fill the voids between the fragments with small rock elements during the placing operation.

PART V – Alt 1: PRICE LIST (Civil Works)

1 Introduction

In the Part V of this volume are listed the unit prices that have been applied to the Priced Bill of Quantities included in Part VI.

The main unit prices related to the excavation, concrete and fills of the dam have been established with the detailed analyses which are included in Part VIII (Annex A) of this Volume.

The unit prices of the drilling and grouting works of the dam curtains have been established according to the prevailing quotation for similar works which are under construction in foreign countries having a labor cost level close to that currently in force in Tajikistan.

The unit prices of the related to the diversion tunnels, outlets, spillways, power facilities and road-works, have been established on the analogy of the works which have been analyzed for the Phase I Cost Estimate.

The unit prices of minor works have been established partly on the analogy of the analyzed prices and partly from rates of similar projects currently in progress in various countries.

The rates are given in local and foreign currency. The currency splitting of the unit prices is in accordance with the details of the analyses performed. The currency splitting of the unit prices that have not been analyzed has been established on the analogy of the analyzed prices.

2 Table

PART VI – Alt 1: PRICE BILL OF QUANTITIES & COST SUMMARY (Civil Works)

DAM 1290

ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
A	GENERAL PROJECT COSTS								
A.I	MOBILIZATION - DEMOBILIZATION - CAMPS								
A.I.01	Mobilization and demobilization	l.s.	1		4 409 307		39 683 764		44 093 071
A.I.02	Camps, buildings and appurtenant facilities								
	1 Construction	l.s.	1		8 818 614		49 972 147		58 790 761
	2 Maintenance	l.s.	1		3 174 701		17 989 973		21 164 674
	TOTAL AMOUNT OF MOBILIZATION - DEMOBILIZATION - CAMPS				16 402 622		107 645 883		124 048 505
A.II	ROADS (CONSTRUCTION - IMPROVEMENT - MAINTENANCE)								
A.II.1	ROAD IMPROVEMENT - ROAD FROM SITE TO DUSHANBE								
	TOTAL AMOUNT OF ROAD IMPROVEMENT - ROAD FROM SITE TO DUSHANBE						1 962 552		11 121 127
A.II.2	ROAD IMPROVEMENT - SITE ROADS - WITHOUT ENLARGEMENT								
	TOTAL AMOUNT OF ROAD IMPROVEMENT - SITE ROADS - WITHOUT ENLARGEMENT						850 166		4 817 610
A.II.3	ROAD IMPROVEMENT - SITE ROADS - WITH ENLARGEMENT								
	TOTAL AMOUNT OF ROAD IMPROVEMENT - SITE ROADS - WITH ENLARGEMENT						2 411 179		13 663 347
A.II.4	NEW ROADS - SITE ROADS								
	TOTAL AMOUNT OF NEW ROADS - SITE ROADS						2 592 804		14 692 557
A.II.5	ROADS MAINTENANCE - SITE ROADS								
A.II.5.01	Maintenance of roadbed								
	1 Maintenance of concrete pavings	m ² /year	211 200	0.27	57 024	4.04	853 248	4.31	910 272
	2 Maintenance of asphalt pavings	m ² /year	1 128 000	0.23	259 440	1.28	1 443 840	1.51	1 703 280
	3 Maintenance of gravel surfacing pavings	m ² /year	9 360 000	0.20	1 872 000	1.31	12 261 600	1.51	14 133 600
A.II.5.02	Removal of landslides and rock falls from roadbed:								
	1 Roads mainly excavated in rock formations	m ³	300 168	0.14	42 024	1.25	375 210	1.39	417 234
	2 Roads mainly excavated in loose formations	m ³	360 000	0.14	50 400	1.25	450 000	1.39	500 400
A.II.5.03	Sundries								
	1 Miscellaneous works	%	8%		182 471		1 230 712		1 413 183
	TOTAL AMOUNT OF ROADS MAINTENANCE - SITE ROADS				2 463 359		16 614 610		19 077 968
	TOTAL AMOUNT OF ROADS (CONSTRUCTION - IMPROVEMENT - MAINTENANCE)						10 280 060		71 189 311
	TOTAL AMOUNT OF GENERAL PROJECT COSTS						26 682 682		195 237 817
B	DAM WORKS								
B.I	DAM - COMMON WORKS OF PHASES FROM 1 TO 6								
B.I.1	Fix Type Cableway, 25 t Capacity								
B.I.1.01	Cableway, supply and installation	l.s.	1		700 000		2 800 000		3 500 000
B.I.1.02	Cableway, operation and maintenance	l.s.	1		34 353		1 179 498		1 213 851
	Total No. B.I.1				734 353		3 979 498		4 713 851
B.I.2	Dam Excavation								
B.I.2.01	Excavation above river bed:								
	1 Excavation on right bank for clay core foundation, unclassified	m ³	1 042 401	2.34	2 439 218	14.84	15 469 231	17.18	17 908 449
	2 Excavation on left bank for clay core foundation, unclassified	m ³	754 549	2.23	1 682 644	13.38	10 095 866	15.61	11 778 510
B.I.2.02	Excavation in river bed:								
	1 Excavation, alluvium	m ³	522 789	0.31	162 065	3.62	1 892 496	3.93	2 054 561

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
	Excavation, rock	m ³	20 000	1.90	38 000	9.00	180 000	10.90	218 000
	Sundries								
B.1.2.03	1 Presplitting	m ²	143 126	3.56	509 529	16.25	2 325 798	19.81	2 835 326
	2 Care of water and miscellaneous works	%	3%		144 944		898 902		1 043 845
	Total No. B.1.2				4 976 399		30 862 292		35 838 691
B.1.3	Protection of Dam Core Excavation Surfaces								
B.1.3.01	Surface preparation	m ²	74 301	1.50	111 452	6.00	445 806	7.50	557 258
B.1.3.02	Welded wire fabric	kg	186 000	0.50	93 000	1.93	358 980	2.43	451 980
B.1.3.03	Grouted anchor bars, 22 mm diameter	m	24 000	1.44	34 560	10.97	263 280	12.41	297 840
B.1.3.04	Shotcrete, thickness 5 cm	m ²	74 301	0.89	66 128	5.55	412 371	6.44	478 498
B.1.3.05	Portland cement ASTM Type I or II	t	37 151	5.16	191 697	252.60	9 384 216	257.76	9 575 913
B.1.3.06	Miscellaneous works	%	2%		9 937		217 293		227 230
	Total No. B.1.3				506 773		11 081 946		11 588 719
B.1.4	Reinforcement of Dam Core Excavation Surfaces								
B.1.4.01	Surface preparation	m ²	68 825	1.50	103 238	6.00	412 950	7.50	516 188
B.1.4.02	Trellis composed of welded wire fabric	kg	33 600	0.50	16 800	1.93	64 848	2.43	81 648
B.1.4.03	Rock bolts, 26.50 mm diameter	m	58 000	2.62	151 960	27.27	1 581 660	29.89	1 733 620
B.1.4.04	Concrete	m ³	10 324	16.40	169 314	75.80	782 559	92.20	951 873
B.1.4.05	Portland cement ASTM Type I or II	t	3 717	5.16	19 178	252.60	938 823	257.76	958 001
B.1.4.06	Miscellaneous works	%	2%		9 210		75 617		84 827
	Total No. B.1.4				469 699		3 856 457		4 326 156
B.1.5	Dam Core Plint								
B.1.5.01	Concrete works:								
	1 Concrete	m ³	354 405	5.65	2 002 388	44.77	15 866 712	50.42	17 869 100
27.0%	2 Formworks, flat modular	m ²	95 700	3.77	360 789	14.61	1 398 177	18.38	1 758 966
1.8%	3 Formworks, flat non modular	m ²	6 480	6.06	39 269	17.78	115 214	23.84	154 483
	4 Portland cement ASTM Type I or II	t	79 741	5.16	411 464	252.60	20 142 608	257.76	20 554 072
B.1.5.02	Blanket grouting								
	1 Percussion grout holes, 64 mm diameter	m	198 735	5.90	1 172 537	33.30	6 617 876	39.20	7 790 412
	2 Cement pressure grouting (excluding materials)	t	19 873	42.60	846 590	124.85	2 481 144	167.45	3 327 734
	3 Portland cement ASTM Type I or II	t	19 873	5.16	102 545	252.60	5 019 920	257.76	5 122 464
	4 Bentonite	t	397	8.93	3 549	437.33	173 821	446.26	177 370
	5 Superplasticizer admixture	kg	59 619	0.05	2 981	2.41	143 682	2.46	146 663
B.1.5.03	Sundries:								
	1 Surface preparation	m ²	23 000	1.50	34 500	6.00	138 000	7.50	172 500
	2 Steel pipes for grouting connections	kg	7 000	0.50	3 500	4.00	28 000	4.50	31 500
	3 PVC waterstops, width 300 mm	m	250	2.70	675	15.30	3 825	18.00	4 500
	4 Care of water and miscellaneous works	%	3%		149 424		1 563 869		1 713 293
	Total No. B.1.5				5 130 210		53 692 848		58 823 058
B.1.6	Breakwater on Dam Crest								
B.1.6.01	Concrete	m ³	2 200	8.20	18 040	37.90	83 380	46.10	101 420
B.1.6.02	Formworks, flat surfaces	m ²	3 000	6.06	18 180	17.78	53 340	23.84	71 520
B.1.6.03	Reinforcing steel	t	110	242.54	26 679	1 308.26	143 909	1550.80	170 588
B.1.6.04	Portland cement ASTM Type I or II	t	792	5.16	4 087	252.60	200 059	257.76	204 146
B.1.6.05	Miscellaneous works	%	2%		1 340		9 614		10 953
	Total No. B.1.6				68 326		490 302		558 627
B.1.7	Grouting Galleries on Dam Abutments								
B.1.7.01	Excavation and supports:								
	1 Excavation	m ³	51 600	25.00	1 290 000	102.00	5 263 200	127.00	6 553 200
	2 Rock bolts, 22 mm diameter	m	30 200	1.71	51 642	24.13	728 726	25.84	780 368
	3 Welded wire fabric	kg	54 000	0.58	31 320	2.16	116 640	2.74	147 960
	4 Shotcrete	m ³	3 630	14.59	52 962	103.39	375 306	117.98	428 267
	5 Portland cement ASTM Type I or II	t	908	5.16	4 683	252.60	229 235	257.76	233 917
	6 Portland cement ASTM Type V (sulfate resistant)	t	908	6.06	5 499	296.70	269 255	302.76	274 755

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
B.1.7.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	12 100	24.00	290 400	138.00	1 669 800	162.00	1 960 200
	2 Concrete, invert	m ³	3 400	18.00	61 200	84.00	285 600	102.00	346 800
B.1.7.03	Sundries:								
	1 Portland cement ASTM Type I or II	t	2 790	5.16	14 396	252.60	704 754	257.76	719 150
	2 Portland cement ASTM Type V (sulfate resistant)	t	2 790	6.06	16 907	296.70	827 793	302.76	844 700
	3 Miscellaneous works	%	3%		54 570		314 109		368 680
	Total No. B.1.7				1 873 580		10 784 418		12 657 998
B.1.8	Grouting Curtains - Stage 1								
B.1.8.01	Drilling:								
	1 Rotary grout holes, vertical, min. diameter 48 mm								
	a) Depth from 0 to 50 m	m	17 194	11.00	189 130	62.50	1 074 600	73.50	1 263 730
	b) Depth from 50 to 100 m	m	11 462	12.76	146 260	72.50	831 024	85.26	977 284
	2 Rotary control holes, vertical, min. diameter 76 mm:								
	a) Depth from 0 to 50 m	m	540	22.10	11 934	125.10	67 554	147.20	79 488
	b) Depth from 50 to 100 m	m	360	25.64	9 229	145.12	52 242	170.75	61 471
	3 Percussion drain holes, vertical, 100 mm min. diameter:								
	a) Depth from 0 to 50 m	m	12 379	8.80	108 937	49.90	617 722	58.70	726 659
	b) Depth from 50 to 100 m	m	8 253	10.21	84 245	57.88	477 705	68.09	561 950
B.1.8.02	Water pressure tests:								
	1 Multiple steps	unit	285	23.00	6 555	128.00	36 480	151.00	43 035
B.1.8.03	Grouting:								
	1 Cement pressure grouting (excluding materials), vertical holes:								
	a) Depth from 0 to 50 m	t	1 203	53.42	64 264	160.28	192 817	213.70	257 081
	b) Depth from 50 to 100 m	t	802	61.47	49 299	184.42	147 905	245.89	197 204
	2 Portland cement ASTM Type I or II	t	1 003	5.16	5 173	252.60	253 232	257.76	258 404
	3 Portland cement ASTM Type V (sulfate resistant)	t	1 003	6.06	6 075	296.70	297 442	302.76	303 517
	4 Bentonite	t	20	8.93	179	437.33	8 768	446.26	8 948
	5 Superplasticizer admixture	kg	3 008	0.05	150	2.41	7 248	2.46	7 398
B.1.8.04	Miscellaneous works	%	3%		20 443		121 942		142 385
	Total No. B.1.8				701 873		4 186 681		4 888 553
B.1.9	Grouting Curtains - Stage 2								
B.1.9.01	Drilling								
	1 Rotary grout holes, vertical, minimum diameter 48 mm								
	a) Depth from 0 to 50 m	m	32 243	11.00	354 673	62.50	2 015 188	73.50	2 369 861
	b) Depth from 50 to 100 m	m	32 243	12.76	411 421	72.50	2 337 618	85.26	2 749 038
	c) Depth from 100 to 150 m	m	27 637	15.18	419 651	86.28	2 384 382	101.46	2 804 033
	2 Rotary control holes, vertical minimum diameter 76 mm:		92 123						
	a) Depth from 0 to 50 m	m	2 128	22.10	47 029	125.10	266 213	147.20	313 242
	b) Depth from 50 to 100 m	m	2 128	25.64	54 553	145.12	308 807	170.75	363 360
	c) Depth from 100 to 150 m	m	1 824	30.51	55 644	172.69	314 983	203.19	370 627
	3 Percussion drain holes, vertical, 100 mm min. diameter:								
	a) Depth from 0 to 50 m	m	23 215	8.80	204 290	49.90	1 158 419	58.70	1 362 709
	b) Depth from 50 to 100 m	m	23 215	10.21	236 977	57.88	1 343 765	68.09	1 580 742
	c) Depth from 100 to 150 m	m	19 898	12.15	241 716	68.88	1 370 641	81.03	1 612 357
B.1.9.02	Water pressure tests								
	1 Multiple steps	unit	570	23.00	13 110	128.00	72 960	151.00	86 070
B.1.9.03	Grouting								
	1 Cement pressure grouting (excluding materials), vertical holes:								
	a) Depth from 0 to 50 m	t	2 257	53.42	120 577	160.28	361 776	213.70	482 353
	b) Depth from 50 to 100 m	t	2 257	61.47	138 747	184.42	416 264	245.89	555 011
	c) Depth from 100 to 150 m	t	1 935	70.70	136 783	212.10	410 350	282.80	547 133
	2 Portland cement ASTM Type I or II	t	3 225	5.16	16 638	252.60	814 509	257.76	831 147
	3 Portland cement ASTM Type V (sulfate resistant)	t	3 225	6.06	19 540	296.70	956 709	302.76	976 250
	4 Bentonite	t	64	8.93	576	437.33	28 203	446.26	28 779
	5 Superplasticizer admixture	kg	9 674	0.05	484	2.41	23 313	2.46	23 797

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
B.I.9.04	Miscellaneous works	%	3%		74 172		437 523		511 695
	Total No. B.I.9				2 546 583		15 021 621		17 568 204
	TOTAL AMOUNT OF DAM - COMMON WORKS OF PHASES FROM 1 TO 6				17 007 795		133 956 063		150 963 858
B.II	DAM - PHASE 1								
B.II.1	<u>Pre-cofferdam:</u>								
1	Concrete blocks, 10 ton weight	m3	20 000	15.20	304 000	74.40	1 488 000	89.60	1 792 000
2	Portland cement for ditto, Type I ASTM	t	5 200	5.16	26 832	252.60	1 313 520	257.76	1 340 352
3	Selected rockfill, fragment weight from 1 to 2 ton	m3	11 300	2.90	32 770	22.70	256 510	25.60	289 280
4	Selected rockfill, fragment weight from 3 to 4 ton	m3	26 200	3.50	91 700	27.20	712 640	30.70	804 340
5	Selected rockfill, fragment weight from 5 to 7 ton	m3	6 800	4.10	27 880	31.80	216 240	35.90	244 120
6	Clay blanket	m3	23 000	1.80	41 400	16.40	377 200	18.20	418 600
7	Filters	m3	7 800	1.03	8 034	12.53	97 734	13.56	105 768
B.II.2	<u>Impermeabilization diaphragm of pre-cofferdam:</u>								
1	Cased grout boreholes, 90 mm diameter	m	2 200	22.00	48 400	124.00	272 800	146.00	321 200
2	Fiberglass valved pipes, 2" size	m	2 200	1.00	2 200	14.00	30 800	15.00	33 000
3	Cement pressure grouting (excluding injected materials)	t	600	28.00	16 800	157.00	94 200	185.00	111 000
4	Set paker at each valve	unit	4 400	1.50	6 600	8.50	37 400	10.00	44 000
5	Portland cement Type I ASTM	t	600	5.16	3 096	252.60	151 560	257.76	154 656
B.II.3	<u>lonakhsh fault treatment (grouting and hydraulic curtain):</u>								
1	Rotary drilling grout holes, Ø 48 mm, 45 m max. depth	m	108 000	11.00	1 188 000	62.50	6 750 000	73.50	7 938 000
2	Cement pressure grouting (excluding injected materials)	t	1 680	36.20	60 816	102.00	171 360	138.20	232 176
3	Portland cement ASTM Type V (sulfate resistant)	t	1 680	6.06	10 181	296.70	498 456	302.76	508 637
4	Bentonite	t	34	8.93	300	437.33	14 694	446.26	14 994
5	Superplasticizer admixture	kg	5 040	0.05	252	2.41	12 146	2.46	12 398
6	Hydraulic curtain (three directional drillings)	unit	3		1 694 410		15 249 689		16 944 099
B.II.4	<u>Embankment</u>								
1	Alluvium shell (from BA15 by trucks)	m3	2 274 500	2.22	5 049 390	21.04	47 855 480	23.26	52 904 870
2	Alluvium shell (from BA15 by conveyor)	m3	8 222 751	1.64	13 509 980	17.59	144 634 079	19.23	158 144 059
3	Rockfill, shell zones (from Q26)	m3	2 016 210	1.56	3 145 288	11.36	22 904 146	12.92	26 049 433
4	Filter, transition fine zone (from BA15)	m3	88 890	1.60	142 615	19.78	1 758 173	21.38	1 900 788
5	Filter, transition coarse zone (from BA15)	m3	177 780	1.60	285 230	19.78	3 516 346	21.38	3 801 576
B.II.5	<u>Bituminous inclined impermeabilization diaphragm</u>								
1	Excavation, alluvium	m3	3 600	0.35	1 260	3.70	13 320	4.05	14 580
2	Excavation, rock	m3	7 200	1.83	13 176	8.93	64 296	10.76	77 472
3	Rock surface preparation	m2	1 700	1.50	2 550	6.00	10 200	7.50	12 750
4	Concrete plint for bituminous inclined core	m3	10 000	5.40	54 000	43.60	436 000	49.00	490 000
5	Formworks	m2	3 500	6.06	21 210	17.78	62 230	23.84	83 440
6	Portland cement ASTM Type I or II	t	2 600	5.16	13 416	252.60	656 760	257.76	670 176
7	Bituminous inclined core	m3	23 704	58.00	1 374 832	332.00	7 869 728	390.00	9 244 560
B.II.6	<u>Sundries</u>								
1	Dam instrumentation	l.s.	1		442 650		4 413 364		4 856 015
2	Care of water and miscellaneous works	%	4.5%		1 242 867		11 787 258		13 030 125
	TOTAL AMOUNT OF DAM - PHASE 1				28 862 135		273 726 330		302 588 465
B.III	DAM PHASES FROM 2 TO 6								
B.III.1	Dam Phase 2								
1	Alluvium shell (From BA15)	m3	2 418 575	1.64	3 973 719	17.59	42 541 525	19.23	46 515 244
2	Rockfill, shell zones	m3	935 035	1.33	1 243 597	8.69	8 125 454	10.02	9 369 051
3	Dam instrumentation	l.s.	1		104 346		1 013 340		1 117 686
4	Miscellaneous works	%	2.5%		133 042		1 292 008		1 425 050
	Total No. B.III.1				5 454 703		52 972 327		58 427 030
B.III.2	Dam phase 3								
1	Alluvium shell (from BA15)	m3	6 935 810	1.68	11 672 968	17.97	124 633 038	19.65	136 306 006

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
2	Rockfill, shell zones	m3	1 077 240	1.39	1 497 364	9.38	10 104 511	10.77	11 601 875
3	Core (loam from LL3)	m3	1 567 260	1.65	2 587 546	12.81	20 073 466	14.46	22 661 012
4	Filter, transition fine zone	m3	372 840	1.40	523 616	19.62	7 314 823	21.02	7 838 439
5	Filter, transition coarse zone	m3	469 145	1.40	658 867	19.62	9 204 250	21.02	9 863 117
6	Dam instrumentation	l.s.	1		338 807		3 426 602		3 765 409
7	Miscellaneous works	%	2.5%		431 979		4 368 917		4 800 896
	Total No. B.III.2				17 711 148		179 125 606		196 836 754
B.III.3	Dam phase 4								
1	Alluvium shell (from BA15)	m3	1 910 503	1.92	3 673 897	20.19	38 572 100	22.11	42 245 998
2	Alluvium shell (from LG1)	m3	6 568 967	1.36	8 953 502	15.17	99 647 945	16.53	108 601 447
3	Alluvium shell (from LG2)	m3	6 815 900	1.13	7 671 295	12.82	87 407 102	13.95	95 078 397
4	Rockfill, shell zones	m3	2 606 935	1.56	4 066 819	11.28	29 406 227	12.84	33 473 045
5	Core (loam from BA17)	m3	3 209 040	1.85	5 920 679	14.61	46 887 283	16.46	52 807 962
6	Filter, transition fine zone (from LG2)	m3	207 405	1.70	353 501	22.55	4 676 817	24.25	5 030 318
7	Filter, transition fine zone (from BA15)	m3	435 740	2.36	1 030 264	29.76	12 967 274	32.12	13 997 537
8	Filter, transition coarse zone (from LG2)	m3	976 120	1.70	1 663 699	22.55	22 010 725	24.25	23 674 424
9	Dam instrumentation	l.s.	1		666 673		6 831 509		7 498 183
10	Miscellaneous works	%	2.5%		833 341		8 539 387		9 372 728
	Total No. B.III.3				34 833 670		356 946 369		391 780 039
B.III.4	Dam phase 5								
1	Alluvium shell (from LG1)	m3	6 735 233	1.40	9 449 532	15.59	104 998 915	16.99	114 448 447
2	Rockfill, shell zones	m3	4 119 019	1.62	6 672 811	11.98	49 345 848	13.60	56 018 658
3	Core (loam from LL3)	m3	996 115	1.89	1 881 661	15.07	15 011 453	16.96	16 893 114
4	Filter, transition fine zone (from BA15)	m3	385 270	2.25	868 553	30.94	11 919 946	33.19	12 788 498
5	Filter, transition coarse zone (from BA15)	m3	503 930	2.25	1 136 060	30.94	15 591 191	33.19	16 727 251
6	Rip-rap (from Q26)	m3	129 790	2.09	271 261	17.53	2 275 219	19.62	2 546 480
7	Dam instrumentation	l.s.	1		405 598		3 982 851		4 388 449
8	Miscellaneous works	%	2.5%		517 137		5 078 136		5 595 272
	Total No. B.III.4				21 202 612		208 203 558		229 406 170
B.III.5	Dam phase 6								
1	Alluvium shell (from BA15)	m3	1 181 625	2.13	2 520 406	23.81	28 133 900	25.94	30 654 307
2	Rockfill, shell zones	m3	6 610 620	1.66	10 973 629	12.41	82 037 794	14.07	93 011 423
3	Core (loam from BA17)	m3	1 220 075	1.93	2 355 965	15.38	18 762 313	17.31	21 118 278
4	Filter, transition fine zone	m3	976 510	1.92	1 879 196	24.63	24 050 660	26.55	25 929 856
5	Filter, transition coarse zone	m3	1 027 980	1.92	1 978 245	24.63	25 318 325	26.55	27 296 570
6	Rip-rap (from Q26)	m3	424 885	2.21	938 996	18.87	8 017 580	21.08	8 956 576
7	Dam instrumentation	l.s.	1		412 929		3 726 411		4 139 340
8	Miscellaneous works	%	2.5%		526 484		4 751 175		5 277 659
	Total No. B.III.5				21 585 849		194 798 159		216 384 009
	TOTAL AMOUNT OF DAM PHASES FROM 2 TO 6				100 787 983		992 046 019		1 092 834 002
	TOTAL AMOUNT OF DAM WORKS				146 657 913		1 399 728 412		1 546 386 324
C	UNDERGROUND WORKS								
C.I	POWER SYSTEM STRUCTURES								
C.I.1	POWERHOUSE, MISCELLANEOUS WORKS, REMEDIAL WORKS								
C.I.1.1	SURFACE WORKS OF UNDERGROUND STRUCTURES								
C.I.1.1.1	Level 1 and Level 2 Diversion Tunnel, Outlet Culverts								
C.I.1.1.1.01	Excavation and supports:								
1	Excavation, common	m³	42 650.0	0.40	17 060	4.47	190 646	4.87	207 706

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	2 Excavation, rock	m ³	10 650.0	1.73	18 425	8.30	88 395	10.03	106 820
	3 Excavation, common, under water (restor. the original riverbed)	m ³	226 000.0	1.00	226 000	10.84	2 449 840	11.84	2 675 840
C.I.1.1.1.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat (culverts)	m ³	65 070.0	6.14	399 530	33.64	2 188 955	39.78	2 588 485
	2 Concrete, above foundation (culverts)	m ³	87 950.0	8.30	729 985	34.10	2 999 095	42.40	3 729 080
	3 Reinforcing steel	t	7 500.0	242.54	1 819 050	1 308.26	9 811 950	1 550.80	11 631 000
	4 Formworks	m ²	47 600.0	6.06	288 453	17.78	846 192	23.84	1 134 645
	5 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	6 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³	22 660.0	3.56	80 670	7.61	172 443	11.17	253 112
C.I.1.1.1.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	53 557.0	5.16	276 354	252.60	13 528 498	257.76	13 804 852
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	10%		385 553		3 227 601		3 613 154
	Total No. C.I.1.1.1				4 241 079		35 503 614		39 744 693
C.I.1.1.2	Diversion Tunnels River Crossing Culverts								
C.I.1.1.2.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	12 875.0	0.23	2 897	2.44	31 402	2.66	34 299
	2 Excavation, rock	m ³	38 625.0	1.31	50 614	5.05	195 087	6.36	245 701
	3 Overhauling in excess of 500 m, common material	m ³ /km	38 625.0	0.07	2 704	0.81	31 286	0.88	33 990
	4 Overhauling in excess of 500 m, rock	m ³ /km	115 875.0	0.09	10 406	1.03	119 699	1.12	130 104
	5 Rock bolts, 22 mm diameter	m	1 700.0	1.71	2 907	21.50	36 550	23.21	39 457
	6 Rock bolts, 26.5 mm diameter	m	1 300.0	2.62	3 406	27.27	35 451	29.89	38 857
	7 Rock bolts, 32 mm diameter	m	500.0	2.81	1 405	35.42	17 710	38.23	19 115
	8 Shotcrete	m ³	360.0	15.10	5 436	93.73	33 743	108.83	39 179
	9 Welded wire fabric	kg	9 000.0	0.50	4 500	1.93	17 370	2.43	21 870
C.I.1.1.2.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³	31 200.0	5.10	159 120	29.54	921 648	34.64	1 080 768
	2 Concrete elevation	m ³	151 380.0	8.30	1 256 454	34.10	5 162 058	42.40	6 418 512
	3 Concrete, filling	m ³	20 400.0	6.35	129 540	34.33	700 332	40.68	829 872
	4 Reinforcing steel	t	6 390.0	242.54	1 549 831	1 308.26	8 359 781	1 550.80	9 909 612
	5 Flat type Formworks	m ²	15 670.0	6.06	94 959	17.78	278 568	23.84	373 527
	6 Curved type Formworks	m ²	4 400.0	10.67	46 961	26.77	117 773	37.44	164 735
	7 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	8 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³	28 450.0	3.56	101 282	7.61	216 505	11.17	317 787
	9 Overhauling in excess of 1000 m from batching plant	m ³ /km	182 580.0	0.11	20 084	0.86	157 019	0.97	177 103
C.I.1.1.2.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	58 587.6	5.16	302 312	252.60	14 799 228	257.76	15 101 540
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Backfill, random material	m ³	7 800.0	0.26	2 063	1.83	14 262	2.09	16 325
	4 Compaction of Backfill	m ³	7 800.0	0.12	936	0.97	7 566	1.09	8 502
	5 Care of water and miscellaneous works	%	3%		112 434		937 591		1 050 026
	Total No. C.I.1.1.2				3 860 251		32 190 629		36 050 880
C.I.1.1.3	Stage 1 Power Tunnel Intake								
C.I.1.1.3.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	50.0	0.31	16	3.37	169	3.68	184
	2 Excavation, rock	m ³	430.0	1.53	658	6.38	2 743	7.91	3 401
	3 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
C.I.1.1.3.02	<u>Concrete works:</u>								
	1 Concrete	m ³	1 620.0	13.00	21 060	38.28	62 014	51.28	83 074
	2 Reinforcing steel	t	83.7	242.54	20 301	1 308.26	109 501	1 550.80	129 802
	3 Miscellaneous steel works	kg	5 800.0	0.77	4 466	5.23	30 334	6.00	34 800
	4 Formworks	m ²	570.0	6.73	3 836	20.10	11 457	26.83	15 293
C.I.1.1.3.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	567.0	5.16	2 926	252.60	143 224	257.76	146 150
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Miscellaneous	%	2%		1 065		7 189		8 254

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	Total No. C.I.1.1.3				54 327		366 631		420 958
	Total No. C.I.1.1				8 155 657		68 060 875		76 216 531
C.I.1.2	POWER FACILITIES								
C.I.1.2.1	Stage 1 Power Tunnel								
C.I.1.2.1.01	<u>Excavation and supports:</u>								
	1 Excavation (up to gate chamber)	m ³	1 340.7	7.80	10 457	32.64	43 760	40.44	54 218
	2 Rock bolts, 26.5 mm diameter	m	29.0	2.83	82	31.18	905	34.01	987
C.I.1.2.1.02	<u>Concrete works:</u>								
	1 Concrete, full ring (up to gate chamber)	m ³	548.1	11.30	6 194	79.87	43 777	91.17	49 970
	2 Reinforcing steel	t	30.8	325.47	10 015	1 359.52	41 832	1 684.99	51 847
	3 Percussion contact grout holes, 40-48 mm min. diameter	m	34.8	4.04	141	18.36	639	22.40	780
	4 Rotary consolidation grout holes, 40-48 mm min. diameter	m	348.2	8.99	3 130	27.90	9 715	36.89	12 845
	5 Contact & consolidation cement grouting, excluding materials	t	18.6	42.60	791	124.85	2 317	167.45	3 108
C.I.1.2.1.03	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	107.9	5.16	557	252.60	27 265	257.76	27 822
	2 Portland cement ASTM type V (sulfate resistant)	t	107.9	6.06	654	296.70	32 025	302.76	32 679
	3 Care of water and miscellaneous works	%	3%		961		6 067		7 028
	Total No. C.I.1.2.1				32 981		208 303		241 284
C.I.1.2.2	Power Tunnel Stage 1 - Erection Chamber & Penstocks								
C.I.1.2.2.01	<u>Concrete works:</u>								
	1 Concrete, penstocks	m ³	1 660.0	5.99	9 943	40.60	67 396	46.59	77 339
	2 Reinforcing steel	t	41.5	325.47	13 507	1 399.52	58 080	1 724.99	71 587
C.I.1.2.2.02	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	257.3	5.16	1 328	252.60	64 994	257.76	66 322
	2 Portland cement ASTM type V (sulfate resistant)	t	257.3	6.06	1 559	296.70	76 341	302.76	77 900
	3 Care of water and miscellaneous	%	3%		790		8 004		8 794
	Total No. C.I.1.2.2				27 127		274 815		301 943
C.I.1.2.3	Powerhouse, Stage 2 below elevations 966.5 - 962.2 masl								
C.I.1.2.3.01	<u>Excavation and supports:</u>								
	1 Excavation								
	Units 5 and 6 from El. 962.20 to El. 946.90	m ³	23 818	7.00	166 726	43.00	1 024 174	50.00	1 190 900
	Units 5 and 6 from El. 946.90 to El. 932.50	m ³	5 082	12.00	60 984	53.00	269 346	65.00	330 330
	Units 1 to 4 from El. 966.50 to El. 946.90	m ³	35 597	7.00	249 179	43.00	1 530 671	50.00	1 779 850
	Units 1 to 4 from El. 946.90 to El. 932.50	m ³	9 073	12.00	108 876	53.00	480 869	65.00	589 745
	2 Grouted anchor bars, 36 mm diameter, lateral walls	m	9 410	2.05	19 299	22.48	211 576	24.54	230 875
C.I.1.2.3.02	<u>Concrete Works</u>								
	1 Concrete from Elevation 932.50 to 953.70 masl	m ³	12 600	8.00	100 800	63.00	793 800	71.00	894 600
	2 Concrete from Elevation 953.0 to 974.60 masl	m ³	25 200	10.00	252 000	79.00	1 990 800	89.00	2 242 800
	3 Concrete for Structures (stairways etc.)	m ³	786	51.00	40 086	120.00	94 320	171.00	134 406
	4 Reinforcing Steel	t	1 965	325.47	639 549	1 359.52	2 671 457	1 684.99	3 311 005
C.I.1.2.3.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	1 610	4.04	6 504	18.36	29 560	22.40	36 064
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	6 425	8.99	57 761	37.90	243 508	46.89	301 268
	3 Drain Holes 75 mm diameter, vault	m		5.68		28.91		34.59	
	4 Drain Holes 75 mm diameter, lateral walls	m		5.68		28.91		34.59	
	5 Contact pressure grouting excluding injected materials	t	32	39.94	1 278	121.05	3 874	160.99	5 152
	6 Consolidation pressure grouting excluding injected materials	t	321	45.26	14 528	127.52	40 934	172.78	55 462
C.I.1.2.3.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	6 929	5.16	35 754	252.60	1 750 278	257.76	1 786 032
	2 Portland cement ASTM type V (sulfate resistant)	t	6 929	6.06	41 990	296.70	2 055 849	302.76	2 097 839
	3 Tendons, 70 t capacity, PHA 7K7 15 mm L=12	ea		250.95		1 162.06		1 413.01	
	4 Tendons, 70 t capacity, PHA 7K7 15 mm L=15	ea		289.79		1 325.48		1 615.27	
	5 Tendons, 70 t capacity, PHA 7K7 15 mm L=19	ea	129	350.60	45 227	1 575.00	203 175	1 925.60	248 402

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
6	Care of water and miscellaneous	%	10.0%		184 054		1 339 419		1 523 473
	Total No. C.I.1.2.3				2 024 596		14 733 608		16 758 204
C.I.1.2.4	Transformer Chamber								
C.I.1.2.4.01	Excavation and supports:								
1	Excavation	m ³	23 110	6.48	149 753	30.25	699 078	36.73	848 830
2	Rock bolts, 36 mm diameter	m	1 150	3.02	3 473	39.12	44 988	42.14	48 461
C.I.1.2.4.02	Concrete works:								
1	Concrete from Elevation 967.00 to 983.20 masl	m ³	18 570	8.00	148 560	63.00	1 169 910	71.00	1 318 470
2	Concrete from Elevation 983.2 to 991.30 masl	m ³	11 400	10.00	114 000	79.00	900 600	89.00	1 014 600
3	Concrete for Structures (stairways etc.)	m ³	3 731	51.00	190 281	120.00	447 720	171.00	638 001
4	Reinforcing steel	t	1 647	325.47	536 091	1 399.52	2 305 191	1 724.99	2 841 283
C.I.1.2.4.03	Drilling and grouting:								
1	Drain holes, 75 mm diameter	m		5.68		28.91		34.59	
C.I.1.2.4.04	Sundries:								
1	Portland cement ASTM type I or II	t	6 066	5.16	31 301	252.60	1 532 317	257.76	1 563 619
2	Portland cement ASTM type V (sulfate resistant)	t	6 066	6.06	36 761	296.70	1 799 836	302.76	1 836 597
3	Tendons, 70 t capacity, PHA 7K7 15 mm L=17	ea	62	313.60	19 443	1 408.80	87 346	1 722.40	1 06 789
4	Tendons, 70 t capacity, PHA 7K7 15 mm L=19	ea	48	350.60	16 829	1 575.00	75 600	1 925.60	92 429
5	Care of water and miscellaneous	%	10.0%		124 649		906 259		1 030 908
	Total No. C.I.1.2.4				1 371 142		9 968 844		11 339 986
C.I.1.2.5	Bus Duct Galleries (Units 1 to 3)								
C.I.1.2.5.01	Excavation and supports:								
1	Excavation	m ³	14 991	9.10	136 418	44.59	668 449	53.69	804 867
2	Rock bolts, 26.5 mm diameter	m	2 670	2.83	7 556	31.18	83 251	34.01	90 807
3	Rock bolts, 32 mm diameter	m	3 600	3.02	10 872	39.12	140 832	42.14	151 704
C.I.1.2.5.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	5 112	13.00	66 456	105.00	536 760	118.00	603 216
2	Concrete, invert	m ³	2 379	6.10	14 512	46.00	109 434	52.10	123 946
3	Reinforcing steel	t	504	325.47	164 037	1 359.52	685 198	1 684.99	849 235
C.I.1.2.5.03	Sundries:								
1	Portland cement ASTM type I or II	t	1 348	5.16	6 958	252.60	340 601	257.76	347 558
2	Portland cement ASTM type V (sulfate resistant)	t	1 348	6.06	8 171	296.70	400 064	302.76	408 236
3	Care of water and miscellaneous	%	3%		12 449		88 938		101 387
	Total No. C.I.1.2.5				427 429		3 053 526		3 480 955
C.I.1.2.6	Draft Tubes (Units 1 to 6)								
C.I.1.2.6.01	Excavation and supports:								
1	Excavation	m ³	45 384	11.99	543 973	58.71	2 664 404	70.69	3 208 376
2	Rock bolts, 32 mm diameter	m	17 256	3.02	52 112	39.12	675 036	42.14	727 148
C.I.1.2.6.02	Concrete works:								
1	Concrete lining	m ³	17 475	20.60	359 987	99.62	1 740 871	120.22	2 100 859
2	Reinforcing steel	t	745	325.47	242 462	1 359.52	1 012 788	1 684.99	1 255 250
C.I.1.2.6.03	Sundries:								
1	Portland cement ASTM type I or II	t	3 146	5.16	16 231	252.60	794 559	257.76	810 790
2	Portland cement ASTM type V (sulfate resistant)	t	3 146	6.06	19 062	296.70	933 276	302.76	952 338
3	Care of water and miscellaneous	%	3%		37 015		234 628		271 643
	Total No. C.I.1.2.6				1 270 841		8 055 562		9 326 404
C.I.1.2.7	Draft Tubes Collector of Units 1-2-3 (Upstream Stretch)								
C.I.1.2.7.01	Excavation and supports:								
1	Excavation	m ³	7 769.4	7.27	56 484	34.80	270 375	42.07	326 859
2	Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
3	Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
4	Rock bolts, 32 mm diameter	m	2 046.3	3.02	6 180	39.12	80 051	42.14	86 231
5	Steel ribs	kg	44 727.9	0.13	5 815	2.94	131 500	3.07	137 315

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.I.1.2.7.02	Concrete works:								
1	Concrete, arch	m ³	609.1	14.65	8 921	165.48	100 787	180.13	109 708
2	Concrete, sidewalls	m ³	517.0	17.25	8 918	83.40	43 115	100.65	52 034
3	Concrete, invert and mat	m ³	263.6	6.04	1 592	45.14	11 901	51.18	13 493
4	Reinforcing steel	t	80.5	325.47	26 200	1 359.52	109 441	1 684.99	135 642
C.I.1.2.7.03	Drilling and grouting:								
1	Drain holes, 50-76 mm diameter	m		5.68		28.91		34.59	
2	Contact & consolidation cement grouting, excluding materials	t	4.8	42.60	204	124.85	599	167.45	804
C.I.1.2.7.04	Sundries:								
1	Portland cement ASTM type I or II	t	252.5	5.16	1 303	252.60	63 792	257.76	65 095
2	Portland cement ASTM type V (sulfate resistant)	t	252.5	6.06	1 530	296.70	74 929	302.76	76 459
3	Care of water and miscellaneous works	%	3%		3 514		26 595		30 109
	Total No. C.I.1.2.7				120 662		913 086		1 033 748
C.I.1.2.8	Draft Tubes Main Collector of Units 1-2-3 (Downstream Stretch)								
C.I.1.2.8.01	Excavation and supports:								
1	Excavation	m ³	46 943.5	6.61	310 297	31.63	1 484 823	38.24	1 795 119
2	Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
3	Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
4	Rock bolts, 32 mm diameter	m	22 384.9	3.02	67 602	39.12	875 697	42.14	943 300
5	Steel ribs	kg	54 873.1	0.13	7 134	2.94	161 327	3.07	168 460
C.I.1.2.8.02	Concrete works:								
1	Concrete, arch	m ³	2 836.2	13.95	39 565	157.60	446 985	171.55	486 550
2	Concrete, sidewalls	m ³	2 338.3	16.43	38 418	79.43	185 731	95.86	224 149
3	Concrete, invert and mat	m ³	1 686.5	5.75	9 697	42.99	72 503	48.74	82 200
4	Reinforcing steel	t	376.6	325.47	122 572	1 359.52	511 995	1 684.99	634 567
C.I.1.2.8.03	Drilling and grouting:								
1	Drain holes, 50-76 mm diameter	m	3 128.2	5.68	17 768	28.91	90 435	34.59	108 203
2	Contact & consolidation cement grouting, excluding materials	t	21.9	42.60	933	124.85	2 734	167.45	3 667
C.I.1.2.8.04	Sundries:								
1	Portland cement ASTM type I or II	t	1 245.9	5.16	6 429	252.60	314 722	257.76	321 151
2	Portland cement ASTM type V (sulfate resistant)	t	1 245.9	6.06	7 550	296.70	369 667	302.76	377 218
3	Care of water and miscellaneous works	%	3%		18 839		135 499		154 338
	Total No. C.I.1.2.8				646 804		4 652 119		5 298 923
C.I.1.2.9	Draft Tubes Collector of Units 4-5-6 (Upstream Stretch - Sections 1 and 2)								
C.I.1.2.9.01	Excavation and supports:								
1	Excavation	m ³		7.27		34.80		42.07	
2	Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
3	Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
4	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
5	Steel ribs	kg		0.13		2.94		3.07	
C.I.1.2.9.02	Concrete works:								
1	Concrete, arch	m ³	970.0	14.65	14 208	165.48	160 516	180.13	174 724
2	Concrete, sidewalls	m ³	834.0	17.25	14 388	83.40	69 557	100.65	83 945
3	Concrete, invert and mat	m ³	425.0	6.04	2 566	45.14	19 184	51.18	21 750
4	Reinforcing steel	t	131.0	325.47	42 637	1 359.52	178 097	1 684.99	220 734
C.I.1.2.9.03	Drilling and grouting:								
1	Drain holes, 50-76 mm diameter	m		5.68		28.91		34.59	
2	Contact & consolidation cement grouting, excluding materials	t	4.6	42.60	196	124.85	574	167.45	770
C.I.1.2.9.04	Sundries:								
1	Portland cement ASTM type I or II	t	404	5.16	2 082	252.60	101 929	257.76	104 011
2	Portland cement ASTM type V (sulfate resistant)	t	404	6.06	2 445	296.70	119 724	302.76	122 170
3	Care of water and miscellaneous works	%	3%		2 356		19 487		21 843
	Total No. C.I.1.2.9				80 877		669 069		749 947

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.I.1.2.10	Draft Tubes Main Collector of Units 4-5-6 (Downstream Stretch - Sections 3 and 4)								
C.I.1.2.10.01	<u>Excavation and supports:</u>								
	1 Excavation	m ³		6.61		31.63		38.24	
	2 Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
	3 Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
	4 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	5 Steel ribs	kg		0.13		2.94		3.07	
C.I.1.2.10.02	<u>Concrete works:</u>								
	1 Concrete, arch	m ³	1 348.0	13.95	18 805	157.60	212 445	171.55	231 249
	2 Concrete, sidewalls	m ³	989.0	16.43	16 249	79.43	78 556	95.86	94 806
	3 Concrete, invert and mat	m ³	751.0	5.75	4 318	42.99	32 285	48.74	36 604
	4 Reinforcing steel	t	158.2	325.47	51 474	1 359.52	215 011	1 684.99	266 485
C.I.1.2.10.03	<u>Drilling and grouting:</u>								
	1 Drain holes, 50-76 mm diameter	m	1 565.4	5.68	8 891	28.91	45 256	34.59	54 147
	2 Contact & consolidation cement grouting, excluding materials	t	11.9	42.60	507	124.85	1 486	167.45	1 993
C.I.1.2.10.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	562	5.16	2 899	252.60	141 908	257.76	144 807
	2 Portland cement ASTM type V (sulfate resistant)	t	562	6.06	3 404	296.70	166 683	302.76	170 088
	3 Care of water and miscellaneous works	%	3%		3 196		26 809		30 005
	Total No. C.I.1.2.10				109 744		920 439		1 030 183
C.I.1.2.11	Switchyard								
C.I.1.2.11.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	265 000.0	0.40	106 000	4.47	1 184 550	4.87	1 290 550
	2 Excavation, rock	m ³	394 600.0	1.73	682 658	8.30	3 275 180	10.03	3 957 838
C.I.1.2.11.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³	11 985.0	6.14	73 588	33.64	403 175	39.78	476 763
	2 Concrete, above foundation	m ³	2 115.0	8.30	17 555	34.10	72 122	42.40	89 676
	3 Reinforcing steel	t	705.0	242.54	170 991	1 308.26	922 323	1 550.80	1 093 314
	4 Formworks	m ²	4 230.0	6.06	25 634	17.78	75 197	23.84	100 831
	5 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	6 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.I.1.2.11.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	4 935.0	5.16	25 465	252.60	1 246 581	257.76	1 272 046
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		33 057		215 374		248 431
	Total No. C.I.1.2.11				1 134 946		7 394 502		8 529 448
C.I.1.2.12	Cables Duct								
C.I.1.2.12.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	4 375.5	0.40	1 750	4.47	19 558	4.87	21 309
	2 Excavation, rock	m ³	6 562.5	1.73	11 353	8.30	54 469	10.03	65 822
	3 Grouted anchor bars, 32 mm diameter	m	726.0	1.63	1 183	15.71	11 405	17.34	12 589
C.I.1.2.12.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³	2 481.0	6.14	15 233	33.64	83 461	39.78	98 694
	2 Concrete, above foundation	m ³	3 033.0	8.30	25 174	34.10	103 425	42.40	128 599
	3 Reinforcing steel	t	414.0	242.54	100 412	1 308.26	541 620	1 550.80	642 031
	4 Formworks	m ²	5 268.0	6.06	31 924	17.78	93 650	23.84	125 574
	5 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³	1 350.0	2.98	4 023	4.57	6 170	7.55	10 193
	6 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.I.1.2.12.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	1 985.0	5.16	10 243	252.60	501 421	257.76	511 664
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		6 039		42 455		48 494
	Total No. C.I.1.2.12				207 334		1 457 634		1 664 968
	Total No. C.I.1.2				7 454 485		52 301 508		59 755 992

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.I.1.3	DRAINAGE AND VENTILATION GALLERIES								
C.I.1.3.1	Powerhouse Drainage Gallery, High Level								
C.I.1.3.1.01	Excavation and supports:								
	1 Excavation	m ³	38 102.0	14.28	544 097	64.48	2 456 817	78.76	3 000 914
	2 Rock bolts, 22 mm diameter	m	6 475.0	1.71	11 072	24.13	156 242	25.84	167 314
	3 Rock bolts, 26.5 mm diameter	m	1 140.0	2.83	3 226	31.18	35 545	34.01	38 771
C.I.1.3.1.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	3 695.0	17.52	64 736	108.42	400 612	125.94	465 348
	2 Concrete, invert	m ³	2 700.0	15.32	41 364	67.17	181 359	82.49	222 723
	3 Reinforcing steel	t	241.0	325.47	78 438	1 359.52	327 644	1 684.99	406 083
C.I.1.3.1.03	Drilling and grouting:								
	1 Drain holes, 75 mm diameter	m	25 335.0	5.68	143 903	28.91	732 435	34.59	876 338
	2 Percussion contact grouting holes, 40-48 mm dia.	m	770.0	5.68	4 374	28.91	22 261	34.59	26 634
	3 Contact pressure grouting (excluding injected materials)	t	21.9	42.60	934	124.85	2 739	167.45	3 673
C.I.1.3.1.04	Sundries:								
	1 Portland cement ASTM type I or II	t	1 162	5.16	5 996	252.60	293 538	257.76	299 535
	2 Portland cement ASTM type V (sulfate resistant)	t	1 162	6.06	7 042	296.70	344 786	302.76	351 828
	3 Care of water and miscellaneous works	%	3%		27 155		148 619		175 775
	Total N° 3.1 -				932 338		5 102 597		6 034 935
C.I.1.3.2	Ventilation shaft								
C.I.1.3.2.01	Excavation and supports:								
	1 Excavation	m ³	8 751.4	32.00	280 045	128.00	1 120 182	160.00	1 400 227
	2 Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
	3 Rock bolts, 26.5 mm diameter	m	4 469.0	2.83	12 647	31.18	139 342	34.01	151 989
	4 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	5 Shotcrete	m ³	270.0	14.59	3 939	103.39	27 915	117.98	31 855
	6 Welded wire fabric	kg	6 750.0	0.58	3 915	2.16	14 580	2.74	18 495
	7 Steel ribs	kg	2 700.0	0.13	351	2.94	7 938	3.07	8 289
C.I.1.3.2.02	Concrete works:								
	1 Concrete, shaft	m ³	1 814.0	30.00	54 420	211.00	382 754	241.00	437 174
	6 Reinforcing steel	t	108.8	325.47	35 424	1 359.52	147 970	1 684.99	183 394
C.I.1.3.2.03	Drilling and grouting:								
	1 Drain holes, 50-76 mm diameter	m		5.68		28.91		34.59	
	2 Contact & consolidation cement grouting, excluding materials	t	10.8	42.60	461	124.85	1 352	167.45	1 813
C.I.1.3.2.04	Sundries:								
	1 Portland cement ASTM type I or II	t	384	5.16	1 979	252.60	96 901	257.76	98 880
	2 Portland cement ASTM type V (sulfate resistant)	t	384	6.06	2 325	296.70	113 818	302.76	116 143
	3 Care of water and miscellaneous works	%	3%		11 865		61 583		73 448
	Total N° 3.2 -				407 373		2 114 335		2 521 708
C.I.1.3.3	Ventilation Gallery								
C.I.1.3.3.01	Excavation and supports:								
	1 Excavation	m ³	16 683.1	8.77	146 311	37.35	623 114	46.12	769 425
	2 Rock bolts, 22 mm diameter	m	915.5	1.71	1 566	24.13	22 091	25.84	23 657
	3 Rock bolts, 26.5 mm diameter	m	7 719.7	2.83	21 847	31.18	240 700	34.01	262 547
	4 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	5 Shotcrete	m ³	490.0	14.59	7 149	103.39	50 661	117.98	57 810
	6 Welded wire fabric	kg	12 250.0	0.58	7 105	2.16	26 460	2.74	33 565
	7 Steel ribs	kg	25 933.0	0.13	3 371	2.94	76 243	3.07	79 614
C.I.1.3.3.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	2 800.0	9.10	25 480	83.30	233 240	92.40	258 720
	2 Concrete, invert and mat	m ³	1 434.4	7.70	11 045	55.70	79 896	63.40	90 941
	3 Reinforcing steel	t	232.9	325.47	75 799	1 359.52	316 621	1 684.99	392 421
C.I.1.3.3.03	Drilling and grouting:								
	1 Drain holes, 50-76 mm diameter	m		5.68		28.91		34.59	

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.I.2.2	UNDERGROUND WORKS - Headrace Tunnels Stretch up to Gates Chamber (Circular) - six tunnels from 140 to 104 m								
C.I.2.2.01	<u>Excavation and supports:</u>								
1	Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	10 560	8.02	84 691	33.87	357 667	41.89	442 358
	c) Rock Class III	m ³	15 840	8.77	138 917	37.35	591 624	46.12	730 541
	d) Rock Class IV	m ³	18 480	9.24	170 755	40.89	755 647	50.13	926 402
	e) Rock Class V	m ³	7 920	10.24	81 101	45.20	357 984	55.44	439 085
2	Grouted anchor bars, 22 mm diameter	m	5 120	1.49	7 629	13.63	69 786	15.12	77 414
3	Grouted anchor bars, 26 mm diameter	m	3 200	1.58	5 056	15.28	48 896	16.86	53 952
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	2 560	1.71	4 378	24.13	61 773	25.84	66 150
6	Rock bolts, 26.5 mm diameter	m	1 280	2.83	3 622	31.18	39 910	34.01	43 533
7	Rock bolts, 32 mm diameter	m	640	3.02	1 933	39.12	25 037	42.14	26 970
8	Shotcrete	m ³	1 275	14.59	18 602	103.39	131 822	117.98	150 425
9	Welded wire fabric	kg	32 200	0.58	18 676	2.16	69 552	2.74	88 228
10	Steel ribs	kg	102 420	0.13	13 315	2.94	301 115	3.07	314 429
C.I.2.2.02	<u>Concrete works:</u>								
1	Concrete	m ³	19 215	12.90	247 874	91.50	1 758 173	104.40	2 006 046
2	Reinforcing steel	t	1 155	325.47	375 918	1 359.52	1 570 246	1 684.99	1 946 163
C.I.2.2.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 965	4.04	7 939	18.36	36 077	22.40	44 016
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	13 900	8.99	124 961	27.90	387 810	36.89	512 771
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	625	42.60	26 625	124.85	78 031	167.45	104 656
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.I.2.2.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	7 348	5.16	37 913	252.60	1 855 991	257.76	1 893 904
2	Portland cement ASTM type V (sulfate resistant)	t		6.06		296.70		302.76	
3	Care of water and miscellaneous works	%	3%		41 097		254 914		296 011
	Total No. C.I.2.2				1 411 001		8 752 055		10 163 056
C.I.2.3	UNDERGROUND WORKS - Gates Chamber and Gates Shaft (six structures)								
C.I.2.3.01	<u>Excavation and supports:</u>								
1	Excavation								
	a) Gates Chamber	m ³	29 000	9.20	266 800	41.70	1 209 300	50.90	1 476 100
	b) Gates Shaft	m ³	36 480	32.00	1 167 360	128.00	4 669 440	160.00	5 836 800
2	Grouted anchor bars, 22 mm diameter	m	6 300	1.49	9 387	13.63	85 869	15.12	95 256
3	Grouted anchor bars, 26 mm diameter	m	4 600	1.58	7 268	15.28	70 288	16.86	77 556
4	Grouted anchor bars, 32 mm diameter	m	2 000	1.62	3 240	17.76	35 520	19.38	38 760
5	Rock bolts, 22 mm diameter	m	3 700	1.71	6 327	24.13	89 281	25.84	95 608
6	Rock bolts, 26.5 mm diameter	m	1 900	2.83	5 377	31.18	59 242	34.01	64 619
7	Rock bolts, 32 mm diameter	m	920	3.02	2 778	39.12	35 990	42.14	38 769
8	Shotcrete	m ³	2 710	14.59	39 539	103.39	280 187	117.98	319 726
9	Welded wire fabric	kg	67 420	0.58	39 104	2.16	145 627	2.74	184 731
10	Steel ribs	kg		0.13		2.94		3.07	
C.I.2.3.02	<u>Concrete works:</u>								
1	Concrete of gates chamber, backfill	m ³	20 050	8.00	160 400	47.00	942 350	55.00	1 102 750
2	Concrete, gates shaft	m ³	17 400	30.00	522 000	211.00	3 671 400	241.00	4 193 400
3	Reinforcing steel	t	2 180	325.47	709 525	1 359.52	2 963 754	1 684.99	3 673 278
C.I.2.3.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 290	4.04	5 212	18.36	23 684	22.40	28 896
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	21 560	8.99	193 824	27.90	601 524	36.89	795 348
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	930	42.60	39 618	124.85	116 111	167.45	155 729
5	Cement grouting between concrete and steel lining	m ²	8 275	2.85	23 584	8.55	70 751	11.40	94 335
6	Bentonite	t		8.93		437.33		446.26	
C.I.2.3.04	<u>Sundries:</u>								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
1	Portland cement ASTM type I or II	t	7 774	5.16	40 111	252.60	1 963 586	257.76	2 003 697
2	Portland cement ASTM type V (sulfate resistant)	t	6 360	6.06	38 542	296.70	1 887 012	302.76	1 925 554
3	Care of water and miscellaneous works	%	3%		98 400		567 627		666 027
	Total No. C.I.2.3				3 378 395		19 488 544		22 866 939
C.I.2.4	UNDERGROUND WORKS - Penstocks Erection Chamber (145 m)								
C.I.2.4.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	65 000	9.20	598 000	41.70	2 710 500	50.90	3 308 500
2	Grouted anchor bars, 22 mm diameter	m	1 920	1.49	2 861	13.63	26 170	15.12	29 030
3	Grouted anchor bars, 26 mm diameter	m	1 600	1.58	2 528	15.28	24 448	16.86	26 976
4	Grouted anchor bars, 32 mm diameter	m	670	1.62	1 085	17.76	11 899	19.38	12 985
5	Rock bolts, 22 mm diameter	m	1 280	1.71	2 189	24.13	30 886	25.84	33 075
6	Rock bolts, 26.5 mm diameter	m	670	2.83	1 896	31.18	20 891	34.01	22 787
7	Rock bolts, 32 mm diameter	m	320	3.02	966	39.12	12 518	42.14	13 485
8	Shotcrete	m ³	455	14.59	6 638	103.39	47 042	117.98	53 681
9	Welded wire fabric	kg	11 350	0.58	6 583	2.16	24 516	2.74	31 099
10	Steel ribs	kg		0.13		2.94		3.07	
C.I.2.4.02	<u>Concrete works:</u>								
1	Concrete	m ³	18 800	16.00	300 800	150.00	2 820 000	166.00	3 120 800
2	Reinforcing steel	t	1 315	325.47	427 993	1 359.52	1 787 769	1 684.99	2 215 762
C.I.2.4.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	275	4.04	1 111	18.36	5 049	22.40	6 160
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	7 100	8.99	63 829	27.90	198 090	36.89	261 919
3	Drain holes, 76 mm diameter	m	5 080	5.68	28 854	28.91	146 863	34.59	175 717
4	Contact & consolidation cement grouting, excluding materials	t	380	42.60	16 188	124.85	47 443	167.45	63 631
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.I.2.4.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	3 626	5.16	18 709	252.60	915 864	257.76	934 573
2	Portland cement ASTM type V (sulfate resistant)	t	2 975	6.06	18 029	296.70	882 683	302.76	900 711
3	Care of water and miscellaneous works	%	3%		44 948		291 379		336 327
	Total No. C.I.2.4				1 543 208		10 004 010		11 547 218
C.I.2.5	UNDERGROUND WORKS - Horizontal Penstocks								
C.I.2.5.01	<u>Excavation and supports:</u>								
1	Excavation								
	a) Rock Class I	m ³		10.33		42.90		53.23	
	b) Rock Class II	m ³	4 175	11.31	47 219	48.00	200 400	59.31	247 619
	c) Rock Class III	m ³	3 350	12.43	41 641	54.70	183 245	67.13	224 886
	d) Rock Class IV	m ³	6 690	13.11	87 706	59.16	395 780	72.27	483 486
	e) Rock Class V	m ³	2 500	14.58	36 450	68.13	170 325	82.71	206 775
2	Grouted anchor bars, 22 mm diameter	m	1 885	1.49	2 809	13.63	25 693	15.12	28 501
3	Grouted anchor bars, 26 mm diameter	m	1 000	1.58	1 580	15.28	15 280	16.86	16 860
4	Grouted anchor bars, 32 mm diameter	m	350	1.62	567	17.76	6 216	19.38	6 783
5	Rock bolts, 22 mm diameter	m	800	1.71	1 368	24.13	19 304	25.84	20 672
6	Rock bolts, 26.5 mm diameter	m	500	2.83	1 415	31.18	15 590	34.01	17 005
7	Rock bolts, 32 mm diameter	m	150	3.02	453	39.12	5 868	42.14	6 321
8	Shotcrete	m ³	465	14.59	6 784	103.39	48 076	117.98	54 861
9	Welded wire fabric	kg	8 420	0.58	4 884	2.16	18 187	2.74	23 071
10	Steel ribs	kg		0.13		2.94		3.07	
C.I.2.5.02	<u>Concrete works:</u>								
1	Concrete, backfill	m ³	6 350	17.00	107 950	115.00	730 250	132.00	838 200
	Reinforcing steel	t		325.47		1 359.52		1 684.99	
C.I.2.5.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m		4.04		18.36		22.40	
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m		8.99		27.90		36.89	
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t		42.60		124.85		167.45	
5	Cement grouting between concrete and steel lining	m ²	6 280	2.85	17 898	8.55	53 694	11.40	71 592

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
	6 Bentonite	t		8.93		437.33		446.26	
C.I.2.5.04	Sundries:								
	1 Portland cement ASTM type I or II	t	1 241	5.16	6 405	252.60	313 540	257.76	319 945
	2 Portland cement ASTM type V (sulfate resistant)	t	1 000	6.06	6 060	296.70	296 700	302.76	302 760
	3 Care of water and miscellaneous works	%	3%		11 136		74 944		86 080
	Total No. C.I.2.5				382 324		2 573 093		2 955 416
C.I.2.6	UNDERGROUND WORKS - Penstocks shafts and blocks								
C.I.2.6.01	Excavation and supports:								
	1 Excavation of shaft, rock	m ³	49 080	28.00	1 374 240	112.00	5 496 960	140.00	6 871 200
	2 Excavation of blocks, rock	m ³	89 028	9.20	819 058	41.70	3 712 468	50.90	4 531 525
	3 Grouted anchor bars, 22 mm diameter	m	11 260	1.49	16 777	13.63	153 474	15.12	170 251
	4 Grouted anchor bars, 26 mm diameter	m	7 500	1.58	11 850	15.28	114 600	16.86	126 450
	5 Grouted anchor bars, 32 mm diameter	m	5 400	1.62	8 748	17.76	95 904	19.38	104 652
	6 Rock bolts, 22 mm diameter	m	7 500	1.71	12 825	24.13	180 975	25.84	193 800
	7 Rock bolts, 26.5 mm diameter	m	3 560	2.83	10 075	31.18	111 001	34.01	121 076
	8 Rock bolts, 32 mm diameter	m	1 830	3.02	5 527	39.12	71 590	42.14	77 116
	9 Shotcrete	m ³	5 116	14.59	74 642	103.39	528 943	117.98	603 586
	10 Welded wire fabric	kg	128 430	0.58	74 489	2.16	277 409	2.74	351 898
	11 Steel ribs	kg		0.13		2.94		3.07	
C.I.2.6.02	Concrete works:								
	1 Concrete, penstock shaft	m ³	15 075	17.00	256 275	115.00	1 733 625	132.00	1 989 900
	2 Concrete, blocks	m ³	68 610	9.00	617 490	52.00	3 567 720	61.00	4 185 210
	3 Reinforcing steel	t	140	325.47	45 566	1 359.52	190 333	1 684.99	235 899
C.I.2.6.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m		4.04		18.36		22.40	
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m		8.99		27.90		36.89	
	3 Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
	4 Contact & consolidation cement grouting, excluding materials	t		42.60		124.85		167.45	
	5 Cement grouting between concrete and steel lining	m ²	42 325	2.85	120 626	8.55	361 879	11.40	482 505
	6 Bentonite	t		8.93		437.33		446.26	
C.I.2.6.04	Sundries:								
	1 Portland cement ASTM type I or II	t	15 211	5.16	78 491	252.60	3 842 400	257.76	3 920 890
	2 Portland cement ASTM type V (sulfate resistant)	t	13 870	6.06	84 052	296.70	4 115 229	302.76	4 199 281
	3 Care of water and miscellaneous works	%	3%		108 322		736 635		844 957
	Total No. C.I.2.5				3 719 053		25 291 143		29 010 197
	TOTAL AMOUNT OF UPSTREAM WATERWAYS				20 547 139		139 642 236		160 189 375
	TOTAL AMOUNT OF POWER SYSTEM STRUCTURES				42 793 157		302 443 361		345 236 517
C.II	RIVER DIVERSION STRUCTURES								
C.II.1	DIVERSION TUNNELS - REMEDIAL WORKS								
C.II.1.1	Tunnel Pressure Stretch (D-shaped) - 471.5 m								
C.II.1.1.01	Excavation and supports:								
	1 Grouted anchor bars, 26 mm diameter	m	15 850	1.58	25 043	15.28	242 188	16.86	267 231
C.II.1.1.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	5 530	9.10	50 323	83.30	460 649	92.40	510 972
	2 Concrete, invert	m ³	2 370	7.70	18 249	55.70	132 009	63.40	150 258
	3 Reinforcing steel	t	237	325.47	77 136	1 359.52	322 206	1 684.99	399 343
	4 Lattice Girders Ribs	kg	365 900	0.68	248 812	2.82	1 031 838	3.50	1 280 650
C.II.1.1.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	815	4.04	3 293	18.36	14 963	22.40	18 256
	2 Drain holes, 76 mm diameter	m	21 125	5.68	119 990	28.91	610 724	34.59	730 714
	3 Contact & consolidation cement grouting, excluding materials	t	33	42.60	1 389	124.85	4 070	167.45	5 459
C.II.1.1.04	Sundries:								
	1 Portland cement ASTM type I or II	t	1 538	5.16	7 934	252.60	388 398	257.76	396 332

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
2	Portland cement ASTM type V (sulfate resistant)	t	1 260	6.06	7 636	296.70	373 842	302.76	381 478
3	Care of water and miscellaneous works	%	3%		16 794		107 427		124 221
	Total N° C.II.1.1 -				576 598		3 688 314		4 264 912
C.II.1.2	Tunnel Free-flow Stretch (D-shaped) - 1010.9 m - 60 cm thick								
C.II.1.2.01	<u>Excavation and supports:</u>								
1	Grouted anchor bars, 26 mm diameter	m	43 670	1.58	68 999	15.28	667 278	16.86	736 276
C.II.1.2.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	24 405	9.10	222 086	83.30	2 032 937	92.40	2 255 022
2	Concrete, invert	m ³	10 460	7.70	80 542	55.70	582 622	63.40	663 164
3	Reinforcing steel	t	1 046	325.47	340 442	1 359.52	1 422 058	1 684.99	1 762 500
4	Lattice Girders Ribs	kg	1 106 350	0.68	752 318	2.82	3 119 907	3.50	3 872 225
C.II.1.2.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 780	4.04	11 231	18.36	51 041	22.40	62 272
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	23 765	5.32	126 430	22.59	536 851	27.91	663 281
3	Drain holes, 76 mm diameter	m	48 520	5.68	275 594	28.91	1 402 713	34.59	1 678 307
4	Contact & consolidation cement grouting, excluding materials	t	1 100	42.60	46 860	124.85	137 335	167.45	184 195
C.II.1.2.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	7 771	5.16	40 097	252.60	1 962 891	257.76	2 002 989
2	Portland cement ASTM type V (sulfate resistant)	t	5 532	6.06	33 524	296.70	1 641 344	302.76	1 674 868
3	Care of water and miscellaneous works	%	3%		59 944		406 709		466 653
	Total N° C.II.1.2 -				2 058 065		13 963 687		16 021 751
C.II.1.3	Transition Downstream from Gates and Sloped Stretch - 392 m								
C.II.1.3.01	<u>Excavation and supports:</u>								
1	Grouted anchor bars, 26 mm diameter	m	15 410	1.58	24 348	15.28	235 465	16.86	259 813
2	High strength rock bolts (Dywidag type), 26 mm, 60 t w.l.	m	22 565	5.66	127 718	62.36	1 407 153	68.02	1 534 871
C.II.1.3.02	<u>Drilling and grouting:</u>								
1	Drain holes, 76 mm diameter	m	19 260	5.68	109 397	28.91	556 807	34.59	666 203
C.II.1.3.03	<u>Sundries:</u>								
1	Care of water and miscellaneous works	%	3%		7 844		65 983		73 827
	Total N° C.II.1.3 -				269 306		2 265 408		2 534 714
C.II.1.4	Tunnel Free-flow Stretch (D-shaped) - 77.7 m - 180 cm thick								
C.II.1.4.01	<u>Excavation and supports:</u>								
1	High strength rock bolts (Dywidag type), 26 mm, 60 t w.l.	m	4 350	5.66	24 621	62.36	271 266	68.02	295 887
C.II.1.4.02	<u>Drilling and grouting:</u>								
1	Drain holes, 76 mm diameter	m	4 740	5.68	26 923	28.91	137 033	34.59	163 957
C.II.1.4.03	<u>Sundries:</u>								
1	Care of water and miscellaneous works	%	3%		1 546		12 249		13 795
	Total N° C.II.1.4 -				53 091		420 548		473 639
C.II.1.5	Maintenance, Emergency and Sector Gates Structures								
C.II.1.5.01	<u>Drilling and grouting:</u>								
1	Drain holes, 101 mm diameter	m	3 030	8.70	26 361	49.20	149 076	57.90	175 437
C.II.1.5.02	<u>Sundries:</u>								
1	Care of water and miscellaneous works	%	5%		1 318		7 454		8 772
	Total N° C.II.1.5 -				27 679		156 530		184 209
C.II.1.6	Drainage and Grouting Tunnels D/S from T-2 (D-shaped) - 450 m long								
C.II.1.6.01	<u>Excavation and supports:</u>								
1	Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	1 875	8.02	15 038	33.87	63 506	41.89	78 544
	c) Rock Class III	m ³	1 210	8.77	10 612	37.35	45 194	46.12	55 805
	d) Rock Class IV	m ³	3 345	9.24	30 908	40.89	136 777	50.13	167 685
	e) Rock Class V	m ³	1 735	10.24	17 766	45.20	78 422	55.44	96 188
2	Grouted anchor bars, 22 mm diameter	m	1 800	1.49	2 682	13.63	24 534	15.12	27 216
3	Grouted anchor bars, 26 mm diameter	m	1 200	1.58	1 896	15.28	18 336	16.86	20 232
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	800	1.71	1 368	24.13	19 304	25.84	20 672

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
6	Rock bolts, 26.5 mm diameter	m	600	2.83	1 698	31.18	18 708	34.01	20 406
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	430	14.59	6 274	103.39	44 458	117.98	50 731
9	Welded wire fabric	kg	10 100	0.58	5 858	2.16	21 816	2.74	27 674
10	Steel ribs	kg	86 100	0.13	11 193	2.94	253 134	3.07	264 327
C.II.1.6.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	3 000	9.10	27 300	83.30	249 900	92.40	277 200
2	Concrete, invert	m ³	1 140	7.70	8 778	55.70	63 498	63.40	72 276
3	Reinforcing steel	t	224	325.47	72 905	1 359.52	304 532	1 684.99	377 438
C.II.1.6.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	375	4.04	1 515	18.36	6 885	22.40	8 400
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	7 185	5.32	38 224	22.59	162 309	27.91	200 533
3	Drain holes, 76 mm diameter	m	9 050	5.68	51 404	28.91	261 636	34.59	313 040
4	Contact & consolidation cement grouting, excluding materials	t	520	42.60	22 152	124.85	64 922	167.45	87 074
5	Bentonite	t		8.93		437.33		446.26	
C.II.1.6.04	Sundries:								
1	Portland cement ASTM type I or II	t	1 183	5.16	6 102	252.60	298 700	257.76	304 801
2	Portland cement ASTM type V (sulfate resistant)	t	980	6.06	5 939	296.70	290 766	302.76	296 705
3	Care of water and miscellaneous works	%	3%		10 188		72 820		83 008
	Total N° C.II.1.6 -				349 799		2 500 156		2 849 956
	TOTAL AMOUNT OF DIVERSION TUNNELS - REMEDIAL WORKS					3 334 539	22 994 642		26 329 181
C.II.2	DIVERSION TUNNEL 3								
C.II.2.1	SURFACE WORKS - Intake Structure								
C.II.2.1.01	Excavation and supports:								
1	Excavation, common	m ³	35 000.0	0.25	8 750	2.71	94 850	2.96	103 600
2	Excavation, rock	m ³	55 000.0	1.46	80 300	5.61	308 550	7.07	388 850
3	Overhauling in excess of 500 m, common material	m ³ /km	122 500.0	0.07	8 575	0.81	99 225	0.88	107 800
4	Overhauling in excess of 500 m, rock	m ³ /km	192 500.0	0.09	17 287	1.03	198 853	1.12	216 139
5	Rock bolts, 22 mm diameter	m	3 000.0	1.71	5 130	21.50	64 500	23.21	69 630
6	Rock bolts, 26.5 mm diameter	m	1 200.0	2.62	3 144	27.27	32 724	29.89	35 868
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	410.0	15.10	6 191	93.73	38 429	108.83	44 620
9	Welded wire fabric	kg	10 200.0	0.50	5 100	1.93	19 686	2.43	24 786
C.II.2.1.02	Concrete works:								
1	Concrete, foundation and mat	m ³	2 520.0	5.10	12 852	29.54	74 441	34.64	87 293
2	Concrete elevation	m ³	5 685.0	8.30	47 186	34.10	193 859	42.40	241 044
3	Reinforcing steel	t	492.5	242.54	119 451	1 308.26	644 318	1 550.80	763 769
4	Flat type Formworks	m ²	4 940.0	6.06	29 936	17.78	87 819	23.84	117 755
5	Curved type Formworks	m ²	950.0	10.67	10 139	26.77	25 428	37.44	35 568
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.II.2.1.03	Sundries:								
1	Portland cement, type I or II ASTM	t	2 810.1	5.16	14 500	252.60	709 831	257.76	724 331
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Backfill, random material	m ³	45 000.0	0.26	11 903	1.83	82 283	2.09	94 185
4	Care of water and miscellaneous works	%	3%		11 413		80 244		91 657
	Total No. C.II.2.1				391 856		2 755 039		3 146 896
C.II.2.2	SURFACE WORKS - Outlet Structures including chute and flip bucket								
C.II.2.2.01	Excavation and supports:								
1	Excavation, common	m ³	108 000.0	0.25	27 000	2.71	292 680	2.96	319 680
2	Excavation, rock	m ³	217 000.0	1.46	316 820	5.61	1 217 370	7.07	1 534 190
3	Overhauling in excess of 500 m, common material	m ³ /km	378 000.0	0.07	26 460	0.81	306 180	0.88	332 640
4	Overhauling in excess of 500 m, rock	m ³ /km	759 500.0	0.09	68 203	1.03	784 564	1.12	852 767
5	Rock bolts, 22 mm diameter	m	4 700.0	1.71	8 037	21.50	101 050	23.21	109 087
6	Rock bolts, 26.5 mm diameter	m	3 500.0	2.62	9 170	27.27	95 445	29.89	104 615
7	Rock bolts, 32 mm diameter	m	1 500.0	2.81	4 215	35.42	53 130	38.23	57 345
8	Grouted anchor bars, 22 mm diameter	m	5 500.0	1.44	7 920	10.97	60 335	12.41	68 255

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
9	Grouted anchor bars, 26 mm diameter	m	4 000.0	1.58	6 320	12.80	51 200	14.38	57 520
10	Grouted anchor bars, 32 mm diameter	m	2 000.0	1.63	3 260	15.71	31 420	17.34	34 680
11	Shotcrete	m ³	2 220.0	15.10	33 522	93.73	208 081	108.83	241 603
12	Welded wire fabric	kg	55 500.0	0.50	27 750	1.93	107 115	2.43	134 865
C.II.2.2.02	Concrete works:								
1	Concrete, foundation and mat	m ³	20 950.0	5.10	106 845	29.54	618 863	34.64	725 708
2	Concrete elevation	m ³	6 000.0	8.30	49 800	34.10	204 600	42.40	254 400
3	Reinforcing steel	t	1 350.0	242.54	327 429	1 308.26	1 766 151	1 550.80	2 093 580
4	Flat type Formworks	m ²	8 140.0	6.06	49 328	17.78	144 706	23.84	194 034
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.II.2.2.03	Sundries:								
1	Portland cement, type I or II ASTM	t	9 623.0	5.16	49 655	252.60	2 430 770	257.76	2 480 424
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Tendons, 70 t capacity, PHA 7K7 15 mm L=18	ea	30.0	332.13	9 964	1 491.67	44 750	1 823.80	54 714
4	Care of water and miscellaneous works	%	3%		33 951		255 552		289 503
	Total No. C.II.2.2				1 165 648		8 773 961		9 939 610
C.II.2.3	SURFACE WORKS - Plunge Pool and Left Bank Slope								
C.II.2.3.01	Excavation and supports:								
1	Excavation, common	m ³	266 266.7	0.25	66 567	2.71	721 583	2.96	788 149
2	Excavation, rock	m ³	133 133.3	1.46	194 375	5.61	746 878	7.07	941 253
3	Excavation, common, under water	m ³	178 400.0	1.00	178 400	10.84	1 933 856	11.84	2 112 256
4	Excavation, rock, under water	m ³	89 200.0	3.29	293 022	12.62	1 125 927	15.91	1 418 949
5	Excavation, trench for cut-off	m ³	4 500.0	0.50	2 250	4.80	21 600	5.30	23 850
6	Overhauling in excess of 500 m, common material	m ³ /km	898 333.3	0.07	62 883	0.81	727 650	0.88	790 533
7	Overhauling in excess of 500 m, rock	m ³ /km	444 666.7	0.09	39 931	1.03	459 341	1.12	499 272
C.II.2.3.02	Concrete works:								
1	Concrete, cut-off	m ³	4 500.0	5.10	22 950	29.54	132 930	34.64	155 880
2	Reinforcing steel	t	135.0	242.54	32 743	1 308.26	176 615	1 550.80	209 358
C.II.2.3.03	Sundries:								
1	Rip-rap protection	m ³	3 000.0	2.88	8 640	16.32	48 960	19.20	57 600
2	Portland cement, type I or II ASTM	t	1 440.0	5.16	7 430	252.60	363 744	257.76	371 174
3	Care of water and miscellaneous works	%	5%		45 460		322 954		368 414
	Total No. C.II.2.3				954 651		6 782 038		7 736 688
C.II.2.4	UNDERGROUND WORKS - Tunnel Pressure Stretch (Circular) - 491 m - deducted executed works								
C.II.2.4.01	Excavation and supports:								
1	Excavation								
a)	Rock Class I	m ³		4.97		26.97		31.94	
b)	Rock Class II	m ³		5.59		29.93		35.52	
c)	Rock Class III	m ³	6 793	6.20	42 132	33.10	224 879	39.31	267 011
d)	Rock Class IV	m ³	47 450	6.72	318 710	35.83	1 700 101	42.55	2 018 811
e)	Rock Class V	m ³	24 288	7.34	178 351	40.42	981 845	47.77	1 160 196
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m	3 173	1.58	5 014	15.28	48 491	16.86	53 505
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	29 752	1.71	50 875	24.13	717 904	25.84	768 779
6	Rock bolts, 26.5 mm diameter	m	3 570	2.83	10 104	31.18	111 318	34.01	121 422
7	Rock bolts, 32 mm diameter	m	992	3.02	2 995	39.12	38 796	42.14	41 791
8	Shotcrete	m ³	1 210	14.59	17 652	103.39	125 091	117.98	142 743
9	Welded wire fabric	kg	51 728	0.58	30 002	2.16	111 732	2.74	141 735
10	Steel ribs	kg	728 353	0.13	94 686	2.94	2 141 358	3.07	2 236 044
C.II.2.4.02	Concrete works:								
1	Concrete, arch	m ³	21 917	8.90	195 061	75.20	1 648 155	84.10	1 843 215
2	Concrete, sidewalls	m ³	17 534	11.40	199 883	54.70	959 086	66.10	1 158 968
3	Concrete, invert	m ³	13 150	6.00	78 901	43.00	565 457	49.00	644 358
4	Reinforcing steel	t	3 642	325.47	1 185 227	1 359.52	4 950 808	1 684.99	6 136 035
C.II.2.4.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	3 570	4.04	14 424	18.36	65 549	22.40	79 972

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	14 866	8.99	133 644	27.90	414 757	36.89	548 401
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	570	42.60	24 292	124.85	71 194	167.45	95 486
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.II.2.4.04	Sundries:								
1	Portland cement ASTM type I or II	t	10 025	5.16	51 731	252.60	2 532 433	257.76	2 584 164
2	Portland cement ASTM type V (sulfate resistant)	t	10 025	6.06	60 754	296.70	2 974 556	302.76	3 035 310
3	Care of water and miscellaneous works	%	3%		80 833		611 505		692 338
	Total No. C.II.2.4				2 775 272		20 995 017		23 770 288
C.II.2.5	UNDERGROUND WORKS - Tunnel Free-flow Stretch (horseshoe) - 588 m								
C.II.2.5.01	<u>Excavation and supports:</u>								
1	Excavation								
a)	Rock Class I	m ³		4.99		26.86		31.85	
b)	Rock Class II	m ³	104 638	5.54	579 928	29.57	3 093 746	35.11	3 673 674
c)	Rock Class III	m ³	38 960	6.14	239 108	32.70	1 273 962	38.84	1 513 069
d)	Rock Class IV	m ³	30 041	6.63	199 215	35.38	1 062 977	42.02	1 262 192
e)	Rock Class V	m ³	20 384	7.35	149 808	40.26	820 639	47.61	970 447
2	Grouted anchor bars, 22 mm diameter	m	4 275	1.49	6 370	13.63	58 267	15.12	64 637
3	Grouted anchor bars, 26 mm diameter	m	5 441	1.58	8 596	15.28	83 135	16.86	91 732
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	7 705	1.71	13 175	24.13	185 911	25.84	199 086
6	Rock bolts, 26.5 mm diameter	m	9 084	2.83	25 708	31.18	283 245	34.01	308 953
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	2 380	14.59	34 729	103.39	246 104	117.98	280 833
9	Welded wire fabric	kg	66 261	0.58	38 431	2.16	143 124	2.74	181 555
10	Steel ribs	kg	332 083	0.13	43 171	2.94	976 323	3.07	1 019 494
C.II.2.5.02	<u>Concrete works:</u>								
1	Concrete, arch	m ³	26 096	8.90	232 258	75.20	1 962 448	84.10	2 194 705
2	Concrete, sidewalls	m ³	14 680	11.40	167 357	54.70	803 019	66.10	970 376
3	Concrete, invert	m ³	24 474	6.00	146 843	43.00	1 052 376	49.00	1 199 219
4	Reinforcing steel	t	3 187	325.47	1 037 192	1 359.52	4 332 451	1 684.99	5 369 643
C.II.2.5.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	4 110	4.04	16 603	18.36	75 455	22.40	92 058
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 469	8.99	40 178	27.90	124 691	36.89	164 870
3	Drain holes, 76 mm diameter	m	10 085	5.68	57 282	28.91	291 554	34.59	348 837
4	Contact & consolidation cement grouting, excluding materials	t	233	42.60	9 933	124.85	29 112	167.45	39 045
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.II.2.5.04	Sundries:								
1	Portland cement ASTM type I or II	t	11 185	5.16	57 712	252.60	2 825 216	257.76	2 882 928
2	Portland cement ASTM type V (sulfate resistant)	t	11 000	6.06	66 660	296.70	3 263 700	302.76	3 330 360
3	Care of water and miscellaneous works	%	10%		317 026		2 298 745		2 615 771
	Total No. C.II.2.5				3 487 283		25 286 200		28 773 484
C.II.2.6	UNDERGROUND WORKS - Upstream Emergency Gates Chamber - 160 m								
C.II.2.6.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	70 110	9.20	645 012	41.70	2 923 587	50.90	3 568 599
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
4	Grouted anchor bars, 32 mm diameter	m	5 450	1.62	8 829	17.76	96 792	19.38	105 621
5	Rock bolts, 22 mm diameter	m	3 500	1.71	5 985	24.13	84 455	25.84	90 440
6	Rock bolts, 26.5 mm diameter	m	5 000	2.83	14 150	31.18	155 900	34.01	170 050
7	Rock bolts, 32 mm diameter	m	3 200	3.02	9 664	39.12	125 184	42.14	134 848
8	Shotcrete	m ³	415	14.59	6 055	103.39	42 907	117.98	48 962
9	Welded wire fabric	kg	10 300	0.58	5 974	2.16	22 248	2.74	28 222
10	Steel ribs	kg		0.13		2.94		3.07	
C.II.2.6.02	<u>Concrete works:</u>								
1	Concrete	m ³	35 615	16.00	569 840	150.00	5 342 250	166.00	5 912 090
2	Reinforcing steel	t	1 960	325.47	637 921	1 359.52	2 664 659	1 684.99	3 302 580

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.II.2.6.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 720	4.04	6 949	18.36	31 579	22.40	38 528
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 300	8.99	29 667	27.90	92 070	36.89	121 737
3	Drain holes, 76 mm diameter	m	290	5.68	1 647	28.91	8 384	34.59	10 031
4	Contact & consolidation cement grouting, excluding materials	t	123	42.60	5 240	124.85	15 357	167.45	20 596
5	Cement grouting between concrete and steel lining	m ²	2 545	2.85	7 253	8.55	21 760	11.40	29 013
6	Bentonite	t		8.93		437.33		446.26	
C.II.2.6.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	6 192	5.16	31 948	252.60	1 563 986	257.76	1 595 934
2	Portland cement ASTM type V (sulfate resistant)	t	5 515	6.06	33 421	296.70	1 636 301	302.76	1 669 721
3	Steel lining	kg	499 460	0.77	384 584	5.23	2 612 176	6.00	2 996 760
4	Care of water and miscellaneous works	%	3%		72 124		523 188		595 312
	Total No. C.II.2.6				2 476 264		17 962 781		20 439 045
C.II.2.7	UNDERGROUND WORKS - Downstream Emergency & Sector Gates Chamber - 201 m								
C.II.2.7.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	100 220	9.20	922 024	41.70	4 179 174	50.90	5 101 198
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
4	Grouted anchor bars, 32 mm diameter	m	4 600	1.62	7 452	17.76	81 696	19.38	89 148
5	Rock bolts, 22 mm diameter	m	5 460	1.71	9 337	24.13	131 750	25.84	141 086
6	Rock bolts, 26.5 mm diameter	m	7 800	2.83	22 074	31.18	243 204	34.01	265 278
7	Rock bolts, 32 mm diameter	m	3 600	3.02	10 872	39.12	140 832	42.14	151 704
8	Shotcrete	m ³	560	14.59	8 170	103.39	57 898	117.98	66 069
9	Welded wire fabric	kg	14 050	0.58	8 149	2.16	30 348	2.74	38 497
10	Steel ribs	kg		0.13		2.94		3.07	
C.II.2.7.02	<u>Concrete works:</u>								
1	Concrete	m ³	52 130	16.00	834 080	150.00	7 819 500	166.00	8 653 580
2	Reinforcing steel	t	2 870	325.47	934 099	1 359.52	3 901 822	1 684.99	4 835 921
C.II.2.7.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 340	4.04	9 454	18.36	42 962	22.40	52 416
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 500	8.99	40 455	27.90	125 550	36.89	166 005
3	Drain holes, 76 mm diameter	m	370	5.68	2 102	28.91	10 697	34.59	12 798
4	Contact & consolidation cement grouting, excluding materials	t	170	42.60	7 242	124.85	21 225	167.45	28 467
5	Cement grouting between concrete and steel lining	m ²	2 555	2.85	7 282	8.55	21 845	11.40	29 127
6	Bentonite	t		8.93		437.33		446.26	
C.II.2.7.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	8 874	5.16	45 788	252.60	2 241 471	257.76	2 287 259
2	Portland cement ASTM type V (sulfate resistant)	t	8 230	6.06	49 874	296.70	2 441 841	302.76	2 491 715
3	Steel lining	kg	500 950	0.77	385 732	5.23	2 619 969	6.00	3 005 700
4	Care of water and miscellaneous works	%	3%		99 126		723 354		822 479
	Total No. C.II.2.7				3 403 309		24 835 138		28 238 447
C.II.2.8	UNDERGROUND WORKS - Upstream Fault Crossing Stretch - 40 m								
C.II.2.8.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	21 600	9.20	198 720	41.70	900 720	50.90	1 099 440
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	2 800	1.71	4 788	24.13	67 564	25.84	72 352
6	Rock bolts, 26.5 mm diameter	m	3 700	2.83	10 471	31.18	115 366	34.01	125 837
7	Rock bolts, 32 mm diameter	m	2 300	3.02	6 946	39.12	89 976	42.14	96 922
8	Shotcrete	m ³	295	14.59	4 304	103.39	30 500	117.98	34 804
9	Welded wire fabric	kg	4 900	0.58	2 842	2.16	10 584	2.74	13 426
10	Steel ribs	kg	160 000	0.13	20 800	2.94	470 400	3.07	491 200
C.II.2.8.02	<u>Concrete works:</u>								
1	Concrete	m ³	10 970	9.01	98 821	60.32	661 674	69.33	760 495
2	Reinforcing steel	t	880	325.47	286 414	1 359.52	1 196 378	1 684.99	1 482 791
3	Cellular Concrete Filling	m ³	10 660	16.00	170 560	150.00	1 599 000	166.00	1 769 560
C.II.2.8.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m		4.04		18.36		22.40	

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 500	8.99	31 465	27.90	97 650	36.89	129 115
	3 Drain holes, 76 mm diameter	m	980	5.68	5 566	28.91	28 332	34.59	33 898
	4 Contact & consolidation cement grouting, excluding materials	t	115	42.60	4 899	124.85	14 358	167.45	19 257
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.II.2.8.04	Sundries:								
	1 Portland cement ASTM type I or II	t	3 944	5.16	20 353	252.60	996 343	257.76	1 016 696
	2 Portland cement ASTM type V (sulfate resistant)	t	3 225	6.06	19 544	296.70	956 858	302.76	976 401
	3 Steel lining	kg		0.77		5.23		6.00	
	4 Care of water and miscellaneous works	%	3%		26 595		217 071		243 666
	Total No. C.II.2.8				913 088		7 452 772		8 365 860
C.II.2.9	UNDERGROUND WORKS - Downstream Fault Crossing Stretch - 40 m								
C.II.2.9.01	Excavation and supports:								
	1 Rock Excavation	m ³	25 300	9.20	232 760	41.70	1 055 010	50.90	1 287 770
	2 Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
	3 Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	2 240	1.71	3 830	24.13	54 051	25.84	57 882
	6 Rock bolts, 26.5 mm diameter	m	3 200	2.83	9 056	31.18	99 776	34.01	108 832
	7 Rock bolts, 32 mm diameter	m	2 000	3.02	6 040	39.12	78 240	42.14	84 280
	8 Shotcrete	m ³	325	14.59	4 742	103.39	33 602	117.98	38 344
	9 Welded wire fabric	kg	6 000	0.58	3 480	2.16	12 960	2.74	16 440
	10 Steel ribs	kg	165 000	0.13	21 450	2.94	485 100	3.07	506 550
C.II.2.9.02	Concrete works:								
	1 Concrete	m ³	12 400	9.01	111 703	60.32	747 927	69.33	859 630
	2 Reinforcing steel	t	980	325.47	318 961	1 359.52	1 332 330	1 684.99	1 651 290
	3 Cellular Concrete Filling	m ³	10 660	16.00	170 560	150.00	1 599 000	166.00	1 769 560
C.II.2.9.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m		4.04		18.36		22.40	
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 450	8.99	31 016	27.90	96 255	36.89	127 271
	3 Drain holes, 76 mm diameter	m	940	5.68	5 339	28.91	27 175	34.59	32 515
	4 Contact & consolidation cement grouting, excluding materials	t	115	42.60	4 899	124.85	14 358	167.45	19 257
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.II.2.9.04	Sundries:								
	1 Portland cement ASTM type I or II	t	4 200	5.16	21 674	252.60	1 061 034	257.76	1 082 708
	2 Portland cement ASTM type V (sulfate resistant)	t	3 440	6.06	20 846	296.70	1 020 648	302.76	1 041 494
	3 Steel lining	kg		0.77		5.23		6.00	
	4 Care of water and miscellaneous works	%	3%		28 991		231 524		260 515
	Total No. C.II.2.9				995 347		7 948 989		8 944 336
C.II.2.10	UNDERGROUND WORKS - Drainage and Grouting Tunnels of Gates Chambers (D-shaped) - 2 tunnels 220 m long								
C.II.2.10.01	Excavation and supports:								
	1 Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	3 771	8.02	30 247	33.87	127 738	41.89	157 985
	c) Rock Class III	m ³	503	8.77	4 410	37.35	18 782	46.12	23 192
	d) Rock Class IV	m ³	4 735	9.24	43 754	40.89	193 624	50.13	237 377
	e) Rock Class V	m ³	1 090	10.24	11 157	45.20	49 246	55.44	60 403
	2 Grouted anchor bars, 22 mm diameter	m	4 190	1.49	6 244	13.63	57 116	15.12	63 360
	3 Grouted anchor bars, 26 mm diameter	m	534	1.58	844	15.28	8 164	16.86	9 008
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	1 048	1.71	1 791	24.13	25 279	25.84	27 070
	6 Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	492	14.59	7 184	103.39	50 907	117.98	58 091
	9 Welded wire fabric	kg	12 739	0.58	7 389	2.16	27 516	2.74	34 905
	10 Steel ribs	kg	54 057	0.13	7 027	2.94	158 928	3.07	165 955
C.II.2.10.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	4 012	9.10	36 513	83.30	334 231	92.40	370 744

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	2 Concrete, invert	m ³	1 069	7.70	8 228	55.70	59 519	63.40	67 747
	3 Reinforcing steel	t	270	325.47	87 970	1 359.52	367 459	1 684.99	455 429
C.II.2.10.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	471	4.04	1 905	18.36	8 655	22.40	10 560
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 327	8.99	38 897	27.90	120 714	36.89	159 611
	3 Drain holes, 76 mm diameter	m	4 358	5.68	24 754	28.91	125 993	34.59	150 747
	4 Contact & consolidation cement grouting, excluding materials	t	230	42.60	9 818	124.85	28 775	167.45	38 593
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.II.2.10.04	Sundries:								
	1 Portland cement ASTM type I or II	t	1 039	5.16	5 361	252.60	262 445	257.76	267 807
	2 Portland cement ASTM type V (sulfate resistant)	t	1 039	6.06	6 296	296.70	308 264	302.76	314 560
	3 Care of water and miscellaneous works	%	3%		10 194		70 001		80 194
	Total No. C.II.2.10				349 982		2 403 358		2 753 340
C.II.2.11	UNDERGROUND WORKS - Access Tunnel to Gates Chambers (D-shaped) - 800 m								
C.II.2.11.01	Excavation and supports:								
	1 Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	17 625	8.02	141 349	33.87	596 946	41.89	738 295
	c) Rock Class III	m ³	2 646	8.77	23 207	37.35	98 834	46.12	122 041
	d) Rock Class IV	m ³	21 969	9.24	202 996	40.89	898 322	50.13	1 101 318
	e) Rock Class V	m ³	11 249	10.24	115 192	45.20	508 465	55.44	623 657
	2 Grouted anchor bars, 22 mm diameter	m	10 622	1.49	15 826	13.63	144 772	15.12	160 598
	3 Grouted anchor bars, 26 mm diameter	m	7 015	1.58	11 084	15.28	107 195	16.86	118 279
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	775	1.71	1 326	24.13	18 710	25.84	20 036
	6 Rock bolts, 26.5 mm diameter	m	511	2.83	1 445	31.18	15 926	34.01	17 371
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	1 618	14.59	23 613	103.39	167 333	117.98	190 946
	9 Welded wire fabric	kg	39 692	0.58	23 022	2.16	85 735	2.74	108 757
	10 Steel ribs	kg	333 969	0.13	43 416	2.94	981 870	3.07	1 025 286
C.II.2.11.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	21 692	9.10	197 400	83.30	1 806 969	92.40	2 004 369
	2 Concrete, invert	m ³	5 415	7.70	41 698	55.70	301 637	63.40	343 335
	3 Reinforcing steel	t	1 502	325.47	488 706	1 359.52	2 041 372	1 684.99	2 530 077
C.II.2.11.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	5 588	4.04	22 574	18.36	102 590	22.40	125 164
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	5 194	8.99	46 693	27.90	144 908	36.89	191 601
	3 Drain holes, 76 mm diameter	m	5 600	5.68	31 808	28.91	161 896	34.59	193 704
	4 Contact & consolidation cement grouting, excluding materials	t	324	42.60	13 789	124.85	40 413	167.45	54 202
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.II.2.11.04	Sundries:								
	1 Portland cement ASTM type I or II	t	5 326	5.16	27 485	252.60	1 345 464	257.76	1 372 949
	2 Portland cement ASTM type V (sulfate resistant)	t	4 400	6.06	26 664	296.70	1 305 480	302.76	1 332 144
	3 Care of water and miscellaneous works	%	3%		44 979		326 245		371 224
	Total No. C.II.2.11				1 544 272		11 201 081		12 745 354
C.II.2.12	UNDERGROUND WORKS - Ventilation Tunnel (180 m) and Ventilation Shaft (15 m)								
C.II.2.12.01	Excavation and supports:								
	1 Excavation, Tunnel								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	2 093	8.02	16 783	33.87	70 879	41.89	87 663
	c) Rock Class III	m ³	614	8.77	5 388	37.35	22 945	46.12	28 333
	d) Rock Class IV	m ³	2 844	9.24	26 282	40.89	116 308	50.13	142 590
	e) Rock Class V	m ³	652	10.24	6 681	45.20	29 489	55.44	36 170
	2 Excavation, Shaft	m ³	561	32.00	17 949	128.00	71 794	160.00	89 743
	3 Grouted anchor bars, 22 mm diameter	m	1 374	1.49	2 047	13.63	18 722	15.12	20 769
	4 Grouted anchor bars, 26 mm diameter	m	687	1.58	1 085	15.28	10 494	16.86	11 579
	5 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
6	Rock bolts, 22 mm diameter	m	858	1.71	1 468	24.13	20 715	25.84	22 183
7	Rock bolts, 26.5 mm diameter	m	515	2.83	1 458	31.18	16 061	34.01	17 518
8	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
9	Shotcrete	m ³	299	14.59	4 369	103.39	30 961	117.98	35 330
10	Welded wire fabric	kg	7 365	0.58	4 272	2.16	15 908	2.74	20 180
11	Steel ribs	kg	28 893	0.13	3 756	2.94	84 945	3.07	88 701
C.II.2.12.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	1 393	9.10	12 676	83.30	116 037	92.40	128 713
2	Concrete, invert	m ³	542	7.70	4 173	55.70	30 189	63.40	34 363
3	Concrete, shaft	m ³	157	30.00	4 704	211.00	33 086	241.00	37 790
4	Reinforcing steel	t	111	325.47	36 207	1 359.52	151 240	1 684.99	187 448
C.II.2.12.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	246	4.04	994	18.36	4 518	22.40	5 513
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	977	8.99	8 787	27.90	27 269	36.89	36 055
3	Drain holes, 76 mm diameter	m	905	5.68	5 139	28.91	26 157	34.59	31 296
4	Contact & consolidation cement grouting, excluding materials	t	75	42.60	3 203	124.85	9 388	167.45	12 591
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.II.2.12.04	Sundries:								
1	Portland cement ASTM type I or II	t	482	5.16	2 485	252.60	121 627	257.76	124 111
2	Portland cement ASTM type V (sulfate resistant)	t	482	6.06	2 918	296.70	142 861	302.76	145 779
3	Care of water and miscellaneous works	%	3%		5 185		35 148		40 333
	Total No. C.II.2.12				178 008		1 206 743		1 384 751
	TOTAL AMOUNT OF DIVERSION TUNNEL 3					18 634 981	137 603 117		156 238 098
	TOTAL AMOUNT OF RIVER DIVERSION STRUCTURES					21 969 520	160 597 760		182 567 279
C.III	FLOOD MANAGMENT STRUCTURES								
C.III.1	MIDDLE OUTLET LEVEL 1								
C.III.1.1	SURFACE WORKS - Intake Culvert Structure								
C.III.1.1.01	Excavation and supports:								
1	Excavation, common	m ³	108 000.0	0.25	27 000	2.71	292 680	2.96	319 680
2	Excavation, rock	m ³	217 000.0	1.46	316 820	5.61	1 217 370	7.07	1 534 190
3	Overhauling in excess of 500 m, common material	m ³ /km	378 000.0	0.07	26 460	0.81	306 180	0.88	332 640
4	Overhauling in excess of 500 m, rock	m ³ /km	759 500.0	0.09	68 203	1.03	784 564	1.12	852 767
5	Rock bolts, 22 mm diameter	m	9 130.0	1.71	15 612	21.50	196 295	23.21	211 907
6	Rock bolts, 26.5 mm diameter	m	4 000.0	2.62	10 480	27.27	109 080	29.89	119 560
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	1 535.0	15.10	23 179	93.73	143 876	108.83	167 054
9	Welded wire fabric	kg	38 300.0	0.50	19 150	1.93	73 919	2.43	93 069
C.III.1.1.02	Concrete works:								
1	Concrete, foundation and mat	m ³	26 250.0	5.10	133 875	29.54	775 425	34.64	909 300
2	Concrete elevation	m ³	58 900.0	8.30	488 870	34.10	2 008 490	42.40	2 497 360
3	Reinforcing steel	t	5 955.0	242.54	1 444 326	1 308.26	7 790 688	1 550.80	9 235 014
4	Flat type Formworks	m ²	19 880.0	6.06	120 472	17.78	353 410	23.84	473 881
5	Curved type Formworks	m ²	8 500.0	10.67	90 721	26.77	227 517	37.44	318 238
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
8	RCC filling below concrete culvert	m ³	14 750.0	3.06	45 135	17.72	261 370	20.78	306 505
C.III.1.1.03	Sundries:								
1	Portland cement, type I or II ASTM	t	27 938.8	5.16	144 164	252.60	7 057 328	257.76	7 201 492
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Care of water and miscellaneous works	%	3%		89 234		647 946		737 180
	Total No. C.III.1.1				3 063 700		22 246 137		25 309 837
C.III.1.2	SURFACE WORKS - Outlet Structures and flip buckets								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.III.1.2.01	<u>Excavation and supports:</u>								
1	Excavation, common	m ³	453 628.3	0.25	113 407	2.71	1 229 333	2.96	1 342 740
2	Excavation, rock	m ³	907 256.7	1.46	1 324 595	5.61	5 089 710	7.07	6 414 305
3	Overhauling in excess of 500 m, common material	m ³ /km	2 268 141.7	0.07	158 770	0.81	1 837 195	0.88	1 995 965
4	Overhauling in excess of 500 m, rock	m ³ /km	4 536 283.3	0.09	407 358	1.03	4 685 981	1.12	5 093 339
5	Rock bolts, 22 mm diameter	m		1.71		21.50		23.21	
6	Rock bolts, 26.5 mm diameter	m	21 121.9	2.62	55 339	27.27	575 994	29.89	631 334
7	Rock bolts, 32 mm diameter	m	17 281.6	2.81	48 561	35.42	612 113	38.23	660 674
8	Grouted anchor bars, 22 mm diameter	m		1.44		10.97		12.41	
9	Grouted anchor bars, 26 mm diameter	m	21 343.4	1.58	33 723	12.80	273 195	14.38	306 918
10	Grouted anchor bars, 32 mm diameter	m	17 462.8	1.63	28 464	15.71	274 340	17.34	302 804
11	Shotcrete	m ³	3 446.0	15.10	52 034	93.73	322 989	108.83	375 023
12	Welded wire fabric	kg	102 000.1	0.50	51 000	1.93	196 860	2.43	247 860
C.III.1.2.02	<u>Concrete works:</u>								
1	Concrete, foundation and mat	m ³	109 059.0	5.10	556 201	29.54	3 221 603	34.64	3 777 804
2	Concrete elevation	m ³	11 134.5	8.30	92 416	34.10	379 686	42.40	472 103
3	Reinforcing steel	t	4 616.7	242.54	1 119 738	1 308.26	6 039 864	1 550.80	7 159 602
4	Flat type Formworks	m ²	12 104.0	6.06	73 349	17.78	215 175	23.84	288 524
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.III.1.2.03	<u>Sundries:</u>								
1	Portland cement, type I or II ASTM	t	40 012.6	5.16	206 465	252.60	10 107 182	257.76	10 313 647
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Tendons, 70 t capacity, L=40	ea	20.0	722.33	14 447	3 244.14	64 883	3 966.47	79 329
4	Care of water and miscellaneous works	%	3%		130 076		1 053 783		1 183 859
	Total No. C.III.1.2				4 465 944		36 179 885		40 645 828
C.III.1.3	SURFACE WORKS - Plunge Pool and Left Bank Slope								
C.III.1.3.01	<u>Excavation and supports:</u>								
1	Excavation, common	m ³	67 733.3	0.25	16 933	2.71	183 557	2.96	200 491
2	Excavation, rock	m ³	33 866.7	1.46	49 445	5.61	189 992	7.07	239 437
3	Excavation, common, under water	m ³	200 700.0	1.00	200 700	10.84	2 175 588	11.84	2 376 288
4	Excavation, rock, under water	m ³	100 300.0	3.29	329 486	12.62	1 266 037	15.91	1 595 522
5	Overhauling in excess of 500 m, common material	m ³ /km	671 083.3	0.07	46 976	0.81	543 578	0.88	590 553
6	Overhauling in excess of 500 m, rock	m ³ /km	335 416.7	0.09	30 120	1.03	346 485	1.12	376 606
7	Care of water and miscellaneous works	%	10%		67 366		470 524		537 890
	Total No. C.III.1.3				741 026		5 175 761		5 916 787
C.III.1.4	UNDERGROUND WORKS - Tunnel Pressure Stretch (Circular 15 m) - 535 m								
C.III.1.4.01	<u>Excavation and supports:</u>								
1	Excavation								
a)	Rock Class I	m ³		4.97		26.97		31.94	
b)	Rock Class II	m ³	64 153	5.59	358 882	29.93	1 920 084	35.52	2 278 966
c)	Rock Class III	m ³	29 616	6.20	183 678	33.10	980 378	39.31	1 164 055
d)	Rock Class IV	m ³	23 168	6.72	155 614	35.83	830 096	42.55	985 710
e)	Rock Class V	m ³	31 556	7.34	231 717	40.42	1 275 631	47.77	1 507 349
2	Grouted anchor bars, 22 mm diameter	m	7 034	1.49	10 481	13.63	95 875	15.12	106 355
3	Grouted anchor bars, 26 mm diameter	m	5 694	1.58	8 997	15.28	87 008	16.86	96 005
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	8 625	1.71	14 749	24.13	208 124	25.84	222 873
6	Rock bolts, 26.5 mm diameter	m	1 163	2.83	3 291	31.18	36 264	34.01	39 555
7	Rock bolts, 32 mm diameter	m	930	3.02	2 810	39.12	36 399	42.14	39 209
8	Shotcrete	m ³	2 038	14.59	29 729	103.39	210 673	117.98	240 402
9	Welded wire fabric	kg	53 398	0.58	30 971	2.16	115 339	2.74	146 310
10	Steel ribs	kg	587 104	0.13	76 324	2.94	1 726 087	3.07	1 802 410

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.III.1.4.02	Concrete works:								
	1 Concrete, arch	m ³	21 633	8.90	192 530	75.20	1 626 772	84.10	1 819 302
	2 Concrete, sidewalls	m ³	17 306	11.40	197 289	54.70	946 643	66.10	1 143 932
	3 Concrete, invert	m ³	12 980	6.00	77 877	43.00	558 121	49.00	635 999
	4 Reinforcing steel	t	2 884	325.47	938 769	1 359.52	3 921 329	1 684.99	4 860 097
C.III.1.4.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	3 908	4.04	15 788	18.36	71 748	22.40	87 535
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	6 792	8.99	61 062	27.90	189 502	36.89	250 563
	3 Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
	4 Contact & consolidation cement grouting, excluding materials	t	307	42.60	13 080	124.85	38 334	167.45	51 414
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.1.4.04	Sundries:								
	1 Portland cement ASTM type I or II	t	8 918	5.16	46 016	252.60	2 252 644	257.76	2 298 660
	2 Portland cement ASTM type V (sulfate resistant)	t	8 920	6.06	54 055	296.70	2 646 564	302.76	2 700 619
	3 Care of water and miscellaneous works	%	3%		81 111		593 208		674 320
	Total No. C.III.1.4				2 784 820		20 366 822		23 151 642
C.III.1.5	UNDERGROUND WORKS - Tunnels Pressure Stretches (n*2 Circular 10.8 m) - 250 m total								
C.III.1.5.01	Excavation and supports:								
	1 Excavation								
	a) Rock Class I	m ³		5.14		25.46		30.60	
	b) Rock Class II	m ³	6 820	5.43	37 056	29.47	200 988	34.90	238 044
	c) Rock Class III	m ³	7 191	5.98	43 025	32.37	232 743	38.35	275 769
	d) Rock Class IV	m ³	11 275	6.48	73 097	35.05	395 213	41.54	468 310
	e) Rock Class V	m ³	11 440	7.15	81 825	39.58	452 796	46.73	534 621
	2 Grouted anchor bars, 22 mm diameter	m	2 440	1.49	3 635	13.63	33 254	15.12	36 889
	3 Grouted anchor bars, 26 mm diameter	m	3 416	1.58	5 397	15.28	52 191	16.86	57 588
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	1 464	1.71	2 503	24.13	35 323	25.84	37 826
	6 Rock bolts, 26.5 mm diameter	m	2 440	2.83	6 905	31.18	76 072	34.01	82 976
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	874	14.59	12 758	103.39	90 405	117.98	103 163
	9 Welded wire fabric	kg	18 314	0.58	10 622	2.16	39 559	2.74	50 181
	10 Steel ribs	kg	294 589	0.13	38 297	2.94	866 092	3.07	904 388
C.III.1.5.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	9 562	9.10	87 016	83.30	796 530	92.40	883 545
	2 Concrete, invert	m ³	3 360	7.70	25 870	55.70	187 134	63.40	213 004
	3 Reinforcing steel	t	750	325.47	244 164	1 359.52	1 019 898	1 684.99	1 264 063
C.III.1.5.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	1 025	4.04	4 140	18.36	18 816	22.40	22 956
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 283	8.99	38 504	27.90	119 494	36.89	157 997
	3 Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
	4 Contact & consolidation cement grouting, excluding materials	t	267	42.60	11 373	124.85	33 330	167.45	44 703
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.1.5.04	Sundries:								
	1 Portland cement ASTM type I or II	t	2 395	5.16	12 360	252.60	605 089	257.76	617 450
	2 Portland cement ASTM type V (sulfate resistant)	t	2 400	6.06	14 544	296.70	712 080	302.76	726 624
	3 Care of water and miscellaneous works	%	3%		22 593		179 010		201 603
	Total No. C.III.1.5				775 683		6 146 018		6 921 701
C.III.1.6	UNDERGROUND WORKS - Upstream Maintenance Gates Chamber - 90 m								
C.III.1.6.01	Excavation and supports:								
	1 Rock Excavation	m ³	34 915	9.20	321 218	41.70	1 455 956	50.90	1 777 174
	2 Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
3	Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
4	Grouted anchor bars, 32 mm diameter	m	4 080	1.62	6 610	17.76	72 461	19.38	79 070
5	Rock bolts, 22 mm diameter	m	2 000	1.71	3 420	24.13	48 260	25.84	51 680
6	Rock bolts, 26.5 mm diameter	m	2 600	2.83	7 358	31.18	81 068	34.01	88 426
7	Rock bolts, 32 mm diameter	m	1 000	3.02	3 020	39.12	39 120	42.14	42 140
8	Shotcrete	m ³	187	14.59	2 728	103.39	19 334	117.98	22 062
9	Welded wire fabric	kg	4 660	0.58	2 703	2.16	10 066	2.74	12 768
10	Steel ribs	kg		0.13		2.94		3.07	
C.III.1.6.02	<u>Concrete works:</u>								
1	Concrete	m ³	15 225	16.00	243 600	150.00	2 283 750	166.00	2 527 350
2	Reinforcing steel	t	837	325.47	272 418	1 359.52	1 137 918	1 684.99	1 410 337
C.III.1.6.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	780	4.04	3 151	18.36	14 321	22.40	17 472
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 500	8.99	13 485	27.90	41 850	36.89	55 335
3	Drain holes, 76 mm diameter	m	190	5.68	1 079	28.91	5 493	34.59	6 572
4	Contact & consolidation cement grouting, excluding materials	t	56	42.60	2 386	124.85	6 992	167.45	9 377
5	Cement grouting between concrete and steel lining	m ²	2 350	2.85	6 698	8.55	20 093	11.40	26 790
6	Bentonite	t		8.93		437.33		446.26	
C.III.1.6.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	2 752	5.16	14 201	252.60	695 193	257.76	709 394
2	Portland cement ASTM type V (sulfate resistant)	t	2 260	6.06	13 696	296.70	670 542	302.76	684 238
3	Steel lining	kg	461 200	0.77	355 124	5.23	2 412 076	6.00	2 767 200
4	Care of water and miscellaneous works	%	3%		38 187		270 435		308 622
	Total No. C.III.1.6				1 311 081		9 284 926		10 596 007
C.III.1.7	UNDERGROUND WORKS - Downstream Emergency & Sector Gates Chambers - 118 m each								
C.III.1.7.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	81 618	9.20	750 885	41.70	3 403 468	50.90	4 154 353
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m	7 000	1.58	11 060	15.28	106 960	16.86	118 020
4	Grouted anchor bars, 32 mm diameter	m	10 330	1.62	16 735	17.76	183 461	19.38	200 195
5	Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
6	Rock bolts, 26.5 mm diameter	m	5 000	2.83	14 150	31.18	155 900	34.01	170 050
7	Rock bolts, 32 mm diameter	m	6 062	3.02	18 307	39.12	237 145	42.14	255 453
8	Shotcrete	m ³	770	14.59	11 239	103.39	79 645	117.98	90 885
9	Welded wire fabric	kg	22 802	0.58	13 225	2.16	49 252	2.74	62 478
10	Steel ribs	kg		0.13		2.94		3.07	
C.III.1.7.02	<u>Concrete works:</u>								
1	Concrete	m ³	42 966	16.00	687 455	150.00	6 444 887	166.00	7 132 342
2	Reinforcing steel	t	2 363	325.47	769 110	1 359.52	3 212 648	1 684.99	3 981 758
C.III.1.7.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	3 300	4.04	13 333	18.36	60 593	22.40	73 926
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	5 760	8.99	51 787	27.90	160 717	36.89	212 504
3	Drain holes, 76 mm diameter	m	950	5.68	5 394	28.91	27 457	34.59	32 851
4	Contact & consolidation cement grouting, excluding materials	t	440	42.60	18 754	124.85	54 965	167.45	73 719
5	Cement grouting between concrete and steel lining	m ²	2 628	2.85	7 491	8.55	22 473	11.40	29 964
6	Bentonite	t		8.93		437.33		446.26	
C.III.1.7.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	7 268	5.16	37 503	252.60	1 835 896	257.76	1 873 399
2	Portland cement ASTM type V (sulfate resistant)	t	7 268	6.06	44 044	296.70	2 156 414	302.76	2 200 459
3	Steel lining	kg	515 824	0.77	397 184	5.23	2 697 757	6.00	3 094 941
4	Care of water and miscellaneous works	%	3%		86 030		626 689		712 719
	Total No. C.III.1.7				2 953 686		21 516 328		24 470 015
C.III.1.8	UNDERGROUND WORKS - Tunnels Free-flow Stretches (D-shaped) - 2 tunnels 405 m total								
C.III.1.8.01	<u>Excavation and supports:</u>								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
1	Excavation								
	a) Rock Class I	m ³		4.99		26.86		31.85	
	b) Rock Class II	m ³	18 836	5.54	104 394	29.57	556 914	35.11	661 308
	c) Rock Class III	m ³	15 743	6.14	96 616	32.70	514 770	38.84	611 387
	d) Rock Class IV	m ³	28 913	6.63	191 732	35.38	1 023 052	42.02	1 214 785
	e) Rock Class V	m ³	16 899	7.35	124 200	40.26	680 361	47.61	804 562
2	Grouted anchor bars, 22 mm diameter	m	4 533	1.49	6 755	13.63	61 789	15.12	68 544
3	Grouted anchor bars, 26 mm diameter	m	6 347	1.58	10 028	15.28	96 977	16.86	107 005
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	2 720	1.71	4 651	24.13	65 633	25.84	70 285
6	Rock bolts, 26.5 mm diameter	m	4 533	2.83	12 829	31.18	141 349	34.01	154 178
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	1 749	14.59	25 523	103.39	180 865	117.98	206 388
9	Welded wire fabric	kg	36 918	0.58	21 412	2.16	79 742	2.74	101 154
10	Steel ribs	kg	350 652	0.13	45 585	2.94	1 030 917	3.07	1 076 502
C.III.1.8.02	Concrete works:								
1	Concrete, arch	m ³	12 261	8.90	109 122	75.20	922 016	84.10	1 031 138
2	Concrete, sidewalls	m ³	7 806	11.40	88 983	54.70	426 961	66.10	515 944
3	Concrete, invert	m ³	7 806	6.00	46 833	43.00	335 637	49.00	382 470
4	Reinforcing steel	t	1 573	325.47	512 095	1 359.52	2 139 070	1 684.99	2 651 164
C.III.1.8.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 959	4.04	7 916	18.36	35 975	22.40	43 891
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	5 249	8.99	47 184	27.90	146 434	36.89	193 619
3	Drain holes, 76 mm diameter	m	5 878	5.68	33 388	28.91	169 940	34.59	203 328
4	Contact & consolidation cement grouting, excluding materials	t	322	42.60	13 714	124.85	40 194	167.45	53 908
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.1.8.04	Sundries:								
1	Portland cement ASTM type I or II	t	5 014	5.16	25 873	252.60	1 266 553	257.76	1 292 426
2	Portland cement ASTM type V (sulfate resistant)	t	5 014	6.06	30 385	296.70	1 487 674	302.76	1 518 059
3	Care of water and miscellaneous works	%	10%		155 922		1 140 282		1 296 204
	Total No. C.III.1.8				1 715 141		12 543 105		14 258 246
C.III.1.9	UNDERGROUND WORKS - Ventilation Tunnel (120 m) and Ventilation Shaft (100 m)								
C.III.1.9.01	Excavation and supports:								
1	Excavation, Tunnel								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	997	8.02	7 992	33.87	33 752	41.89	41 744
	c) Rock Class III	m ³	614	8.77	5 388	37.35	22 945	46.12	28 333
	d) Rock Class IV	m ³	1 686	9.24	15 575	40.89	68 923	50.13	84 498
	e) Rock Class V	m ³	870	10.24	8 908	45.20	39 319	55.44	48 226
2	Excavation, Shaft	m ³	3 739	32.00	119 657	128.00	478 628	160.00	598 285
3	Grouted anchor bars, 22 mm diameter	m	2 034	1.49	3 031	13.63	27 726	15.12	30 757
4	Grouted anchor bars, 26 mm diameter	m	1 017	1.58	1 607	15.28	15 541	16.86	17 148
5	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
6	Rock bolts, 22 mm diameter	m	1 271	1.71	2 174	24.13	30 678	25.84	32 852
7	Rock bolts, 26.5 mm diameter	m	763	2.83	2 159	31.18	23 785	34.01	25 944
8	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
9	Shotcrete	m ³	498	14.59	7 262	103.39	51 461	117.98	58 723
10	Welded wire fabric	kg	10 732	0.58	6 224	2.16	23 180	2.74	29 405
11	Steel ribs	kg	37 845	0.13	4 920	2.94	111 265	3.07	116 185
C.III.1.9.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	942	9.10	8 573	83.30	78 477	92.40	87 050
2	Concrete, invert	m ³	366	7.70	2 822	55.70	20 412	63.40	23 234
3	Concrete, shaft	m ³	1 045	30.00	31 361	211.00	220 572	241.00	251 933
4	Reinforcing steel	t	126	325.47	40 871	1 359.52	170 722	1 684.99	211 593

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.III.1.9.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	164	4.04	663	18.36	3 012	22.40	3 675
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	2 119	8.99	19 046	27.90	59 108	36.89	78 153
	3 Drain holes, 76 mm diameter	m	603	5.68	3 426	28.91	17 438	34.59	20 864
	4 Contact & consolidation cement grouting, excluding materials	t	136	42.60	5 805	124.85	17 014	167.45	22 820
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.1.9.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	604	5.16	3 116	252.60	152 529	257.76	155 645
	2 Portland cement ASTM type V (sulfate resistant)	t	604	6.06	3 659	296.70	179 158	302.76	182 818
	3 Care of water and miscellaneous works	%	3%		9 127		55 369		64 497
	Total No. C.III.1.9				313 365		1 901 017		2 214 382
C.III.1.10	UNDERGROUND WORKS - Drainage and Grouting Tunnels of Gates Chambers (D-shaped) - 2 tunnels 215 and 325 m long								
C.III.1.10.01	<u>Excavation and supports:</u>								
	1 Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	4 629	8.02	37 121	33.87	156 770	41.89	193 891
	c) Rock Class III	m ³	617	8.77	5 412	37.35	23 050	46.12	28 463
	d) Rock Class IV	m ³	5 811	9.24	53 698	40.89	237 629	50.13	291 327
	e) Rock Class V	m ³	1 337	10.24	13 692	45.20	60 439	55.44	74 131
	2 Grouted anchor bars, 22 mm diameter	m	5 143	1.49	7 663	13.63	70 097	15.12	77 760
	3 Grouted anchor bars, 26 mm diameter	m	656	1.58	1 036	15.28	10 019	16.86	11 055
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	1 286	1.71	2 199	24.13	31 024	25.84	33 223
	6 Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	604	14.59	8 817	103.39	62 477	117.98	71 294
	9 Welded wire fabric	kg	15 634	0.58	9 068	2.16	33 770	2.74	42 838
	10 Steel ribs	kg	66 343	0.13	8 625	2.94	195 048	3.07	203 673
C.III.1.10.02	<u>Concrete works:</u>								
	1 Concrete, arch and sidewalls	m ³	4 924	9.10	44 811	83.30	410 193	92.40	455 004
	2 Concrete, invert	m ³	1 311	7.70	10 098	55.70	73 047	63.40	83 145
	3 Reinforcing steel	t	332	325.47	107 963	1 359.52	450 972	1 684.99	558 935
C.III.1.10.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	579	4.04	2 337	18.36	10 623	22.40	12 960
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	5 439	8.99	48 894	27.90	151 739	36.89	200 633
	3 Drain holes, 76 mm diameter	m	5 450	5.68	30 954	28.91	157 550	34.59	188 504
	4 Contact & consolidation cement grouting, excluding materials	t	413	42.60	17 595	124.85	51 566	167.45	69 160
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.1.10.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	1 340	5.16	6 916	252.60	338 579	257.76	345 496
	2 Portland cement ASTM type V (sulfate resistant)	t	1 340	6.06	8 120	296.70	397 578	302.76	405 698
	3 Care of water and miscellaneous works	%	3%		12 751		87 665		100 416
	Total No. C.III.1.10				437 769		3 009 835		3 447 604
C.III.1.11	UNDERGROUND WORKS - Access Tunnel to Gates Chambers (D-shaped) - 1216 m								
C.III.1.11.01	<u>Excavation and supports:</u>								
	1 Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	30 651	8.02	245 819	33.87	1 038 141	41.89	1 283 960
	c) Rock Class III	m ³	8 002	8.77	70 177	37.35	298 874	46.12	369 051
	d) Rock Class IV	m ³	29 242	9.24	270 200	40.89	1 195 722	50.13	1 465 922
	e) Rock Class V	m ³	12 816	10.24	131 235	45.20	579 281	55.44	710 517
	2 Grouted anchor bars, 22 mm diameter	m	11 395	1.49	16 978	13.63	155 311	15.12	172 290

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
3	Grouted anchor bars, 26 mm diameter	m	6 325	1.58	9 993	15.28	96 642	16.86	106 635
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	8 450	1.71	14 450	24.13	203 901	25.84	218 350
6	Rock bolts, 26.5 mm diameter	m	1 536	2.83	4 348	31.18	47 904	34.01	52 252
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	2 317	14.59	33 810	103.39	239 593	117.98	273 403
9	Welded wire fabric	kg	60 149	0.58	34 887	2.16	129 922	2.74	164 809
10	Steel ribs	kg	380 817	0.13	49 506	2.94	1 119 602	3.07	1 169 109
C.III.1.11.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	32 456	9.10	295 350	83.30	2 703 585	92.40	2 998 935
2	Concrete, invert	m ³	8 117	7.70	62 502	55.70	452 128	63.40	514 631
3	Reinforcing steel	t	2 169	325.47	705 897	1 359.52	2 948 602	1 684.99	3 654 499
C.III.1.11.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 266	4.04	9 155	18.36	41 607	22.40	50 762
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	6 530	8.99	58 701	27.90	182 176	36.89	240 877
3	Drain holes, 76 mm diameter	m	8 501	5.68	48 287	28.91	245 772	34.59	294 060
4	Contact & consolidation cement grouting, excluding materials	t	352	42.60	14 999	124.85	43 958	167.45	58 957
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.1.11.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	7 188	5.16	37 092	252.60	1 815 772	257.76	1 852 864
2	Portland cement ASTM type V (sulfate resistant)	t	7 190	6.06	43 571	296.70	2 133 273	302.76	2 176 844
3	Care of water and miscellaneous works	%	3%		64 709		470 153		534 862
	Total No. C.III.1.11				2 221 668		16 141 922		18 363 590
	TOTAL AMOUNT OF MIDDLE OUTLET LEVEL 1					20 783 884	154 511 755		175 295 639
C.III.2	MIDDLE OUTLET LEVEL 2								
C.III.2.1	SURFACE WORKS - Intake Structure								
C.III.2.1.01	<u>Excavation and supports:</u>								
1	Excavation, common	m ³	45 000.0	0.25	11 250	2.71	121 950	2.96	133 200
2	Excavation, rock	m ³	71 500.0	1.46	104 390	5.61	401 115	7.07	505 505
3	Overhauling in excess of 500 m, common material	m ³ /km	157 500.0	0.07	11 025	0.81	127 575	0.88	138 600
4	Overhauling in excess of 500 m, rock	m ³ /km	250 250.0	0.09	22 472	1.03	258 508	1.12	280 981
5	Rock bolts, 22 mm diameter	m	4 000.0	1.71	6 840	21.50	86 000	23.21	92 840
6	Rock bolts, 26.5 mm diameter	m	1 800.0	2.62	4 716	27.27	49 086	29.89	53 802
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	550.0	15.10	8 305	93.73	51 552	108.83	59 857
9	Welded wire fabric	kg	13 500.0	0.50	6 750	1.93	26 055	2.43	32 805
C.III.2.1.02	<u>Concrete works:</u>								
1	Concrete, foundation and mat	m ³	2 770.0	5.10	14 127	29.54	81 826	34.64	95 953
2	Concrete elevation	m ³	6 035.0	8.30	50 091	34.10	205 794	42.40	255 884
3	Reinforcing steel	t	547.5	242.54	132 791	1 308.26	716 272	1 550.80	849 063
4	Flat type Formworks	m ²	5 240.0	6.06	31 754	17.78	93 152	23.84	124 906
5	Curved type Formworks	m ²	1 005.0	10.67	10 726	26.77	26 901	37.44	37 627
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.III.2.1.03	<u>Sundries:</u>								
1	Portland cement, type I or II ASTM	t	3 065.1	5.16	15 816	252.60	774 244	257.76	790 060
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Backfill, random material	m ³	65 000.0	0.26	17 193	1.83	118 853	2.09	136 045
4	Care of water and miscellaneous works	%	3%		13 447		94 166		107 614
	Total No. C.III.2.1				461 693		3 233 048		3 694 741
C.III.2.2	SURFACE WORKS - Outlet Structures, Chutes and Flip Buckets								
C.III.2.2.01	<u>Excavation and supports:</u>								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
1	Excavation, common	m ³	53 416.0	0.25	13 354	2.71	144 757	2.96	158 111
2	Excavation, rock	m ³	106 832.0	1.46	155 975	5.61	599 328	7.07	755 302
3	Overhauling in excess of 500 m, common material	m3/km	186 956.0	0.07	13 087	0.81	151 434	0.88	164 521
4	Overhauling in excess of 500 m, rock	m3/km	373 912.0	0.09	33 577	1.03	386 251	1.12	419 828
5	Rock bolts, 22 mm diameter	m	2 750.4	1.71	4 703	21.50	59 134	23.21	63 837
6	Rock bolts, 26.5 mm diameter	m	2 750.4	2.62	7 206	27.27	75 003	29.89	82 209
7	Rock bolts, 32 mm diameter	m	2 062.8	2.81	5 796	35.42	73 064	38.23	78 861
8	Grouted anchor bars, 22 mm diameter	m	2 404.7	1.44	3 463	10.97	26 379	12.41	29 842
9	Grouted anchor bars, 26 mm diameter	m	2 404.7	1.58	3 799	12.80	30 780	14.38	34 579
10	Grouted anchor bars, 32 mm diameter	m	4 797.6	1.63	7 820	15.71	75 371	17.34	83 191
11	Shotcrete	m ³	1 251.8	15.10	18 901	93.73	117 327	108.83	136 228
12	Welded wire fabric	kg	31 701.6	0.50	15 851	1.93	61 184	2.43	77 035
C.III.2.2.02	Concrete works:								
1	Concrete, foundation and mat	m ³	18 648.0	5.10	95 105	29.54	550 862	34.64	645 967
2	Concrete elevation	m ³	10 622.3	8.30	88 165	34.10	362 219	42.40	450 384
3	Reinforcing steel	t	1 248.8	242.54	302 891	1 308.26	1 633 794	1 550.80	1 936 686
4	Flat type Formworks	m ²	12 838.0	6.06	77 797	17.78	228 223	23.84	306 020
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.III.2.2.03	Sundries:								
1	Portland cement, type I or II ASTM	t	9 929.8	5.16	51 238	252.60	2 508 260	257.76	2 559 498
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Tendons, 70 t capacity, PHA 7K7 15 mm L=18	ea	62.0	332.13	20 592	1 491.67	92 484	1 823.80	113 076
4	Care of water and miscellaneous works	%	3%		27 580		215 276		242 855
	Total No. C.III.2.2				946 901		7 391 130		8 338 030
C.III.2.3	SURFACE WORKS - Plunge Pool and Left Bank Slope								
C.III.2.3.01	Excavation and supports:								
1	Excavation, common	m ³	192 960.0	0.25	48 240	2.71	522 922	2.96	571 162
2	Excavation, rock	m ³	96 480.0	1.46	140 861	5.61	541 253	7.07	682 114
3	Excavation, common, under water	m ³	205 500.0	1.00	205 500	10.84	2 227 620	11.84	2 433 120
4	Excavation, rock, under water	m ³	102 700.0	3.29	337 370	12.62	1 296 331	15.91	1 633 700
5	Overhauling in excess of 500 m, common material	m3/km	796 920.0	0.07	55 784	0.81	645 505	0.88	701 290
6	Overhauling in excess of 500 m, rock	m3/km	398 360.0	0.09	35 773	1.03	411 506	1.12	447 279
7	Care of water and miscellaneous works	%	10%		82 353		564 514		646 866
	Total No. C.III.2.3				905 880		6 209 650		7 115 530
C.III.2.4	UNDERGROUND WORKS - Tunnel Pressure Stretch (Circular) - 498 m								
C.III.2.4.01	Excavation and supports:								
1	Excavation								
a)	Rock Class I	m ³		4.97		26.97		31.94	
b)	Rock Class II	m ³	59 657	5.59	333 727	29.93	1 785 499	35.52	2 119 225
c)	Rock Class III	m ³	27 540	6.20	170 803	33.10	911 660	39.31	1 082 463
d)	Rock Class IV	m ³	21 544	6.72	144 707	35.83	771 911	42.55	916 618
e)	Rock Class V	m ³	29 344	7.34	215 475	40.42	1 186 218	47.77	1 401 693
2	Grouted anchor bars, 22 mm diameter	m	6 541	1.49	9 746	13.63	89 154	15.12	98 901
3	Grouted anchor bars, 26 mm diameter	m	5 295	1.58	8 366	15.28	80 910	16.86	89 276
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	8 021	1.71	13 715	24.13	193 536	25.84	207 251
6	Rock bolts, 26.5 mm diameter	m	1 082	2.83	3 061	31.18	33 722	34.01	36 783
7	Rock bolts, 32 mm diameter	m	865	3.02	2 613	39.12	33 847	42.14	36 460
8	Shotcrete	m ³	1 895	14.59	27 646	103.39	195 906	117.98	223 552
9	Welded wire fabric	kg	49 655	0.58	28 800	2.16	107 254	2.74	136 054
10	Steel ribs	kg	545 952	0.13	70 974	2.94	1 605 099	3.07	1 676 073
C.III.2.4.02	Concrete works:								
1	Concrete, arch	m ³	20 116	8.90	179 035	75.20	1 512 746	84.10	1 691 781
2	Concrete, sidewalls	m ³	16 093	11.40	183 461	54.70	880 289	66.10	1 063 750

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
	3 Concrete, invert	m ³	12 070	6.00	72 419	43.00	519 001	49.00	591 419
	4 Reinforcing steel	t	2 682	325.47	872 967	1 359.52	3 646 469	1 684.99	4 519 436
C.III.2.4.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	3 634	4.04	14 681	18.36	66 719	22.40	81 400
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	6 316	8.99	56 782	27.90	176 219	36.89	233 000
	3 Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
	4 Contact & consolidation cement grouting, excluding materials	t	286	42.60	12 163	124.85	35 647	167.45	47 811
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.2.4.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	8 294	5.16	42 796	252.60	2 095 003	257.76	2 137 799
	2 Portland cement ASTM type V (sulfate resistant)	t	8 294	6.06	50 260	296.70	2 460 758	302.76	2 511 018
	3 Care of water and miscellaneous works	%	3%		75 426		551 627		627 053
	Total No. C.III.2.4				2 589 622		18 939 195		21 528 817
C.III.2.5	UNDERGROUND WORKS - Discharge Tunnels Stretch (Circular) - 265 m								
C.III.2.5.01	<u>Excavation and supports:</u>								
	1 Excavation								
	a) Rock Class I	m ³		5.14		25.46		30.60	
	b) Rock Class II	m ³	14 540	5.43	78 998	29.47	428 481	34.90	507 480
	c) Rock Class III	m ³	10 026	5.98	59 989	32.37	324 510	38.35	384 500
	d) Rock Class IV	m ³	15 443	6.48	100 122	35.05	541 328	41.54	641 450
	e) Rock Class V	m ³	10 430	7.15	74 602	39.58	412 824	46.73	487 426
	2 Grouted anchor bars, 22 mm diameter	m	6 838	1.49	10 188	13.63	93 196	15.12	103 384
	3 Grouted anchor bars, 26 mm diameter	m	2 802	1.58	4 428	15.28	42 820	16.86	47 247
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	1 771	1.71	3 029	24.13	42 744	25.84	45 773
	6 Rock bolts, 26.5 mm diameter	m	461	2.83	1 303	31.18	14 360	34.01	15 664
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	960	14.59	14 008	103.39	99 264	117.98	113 272
	9 Welded wire fabric	kg	21 753	0.58	12 617	2.16	46 986	2.74	59 602
	10 Steel ribs	kg	230 918	0.13	30 019	2.94	678 900	3.07	708 920
C.III.2.5.02	<u>Concrete works:</u>								
	1 Concrete, arch and sidewalls	m ³	13 937	9.10	126 829	83.30	1 160 977	92.40	1 287 806
	2 Concrete, invert	m ³	4 266	7.70	32 844	55.70	237 589	63.40	270 433
	3 Reinforcing steel	t	933	325.47	303 718	1 359.52	1 268 661	1 684.99	1 572 380
C.III.2.5.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	1 311	4.04	5 296	18.36	24 067	22.40	29 363
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 862	8.99	34 716	27.90	107 740	36.89	142 456
	3 Drain holes, 76 mm diameter	m	1 346	5.68	7 647	28.91	38 920	34.59	46 567
	4 Contact & consolidation cement grouting, excluding materials	t	79	42.60	3 350	124.85	9 819	167.45	13 170
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.2.5.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	3 168	5.16	16 346	252.60	800 185	257.76	816 531
	2 Portland cement ASTM type V (sulfate resistant)	t	3 168	6.06	19 197	296.70	939 885	302.76	959 082
	3 Care of water and miscellaneous works	%	5%		46 962		365 663		412 625
	Total No. C.III.2.5				986 210		7 678 919		8 665 129
C.III.2.6	UNDERGROUND WORKS - Upstream Maintenance Gates Chamber - 90 m								
C.III.2.6.01	<u>Excavation and supports:</u>								
	1 Rock Excavation	m ³	34 915	9.20	321 218	41.70	1 455 956	50.90	1 777 174
	2 Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
	3 Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
	4 Grouted anchor bars, 32 mm diameter	m	4 080	1.62	6 610	17.76	72 461	19.38	79 070
	5 Rock bolts, 22 mm diameter	m	2 000	1.71	3 420	24.13	48 260	25.84	51 680
	6 Rock bolts, 26.5 mm diameter	m	2 600	2.83	7 358	31.18	81 068	34.01	88 426
	7 Rock bolts, 32 mm diameter	m	1 000	3.02	3 020	39.12	39 120	42.14	42 140

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
8	Shotcrete	m ³	187	14.59	2 728	103.39	19 334	117.98	22 062
9	Welded wire fabric	kg	4 660	0.58	2 703	2.16	10 066	2.74	12 768
10	Steel ribs	kg		0.13		2.94		3.07	
C.III.2.6.02	Concrete works:								
1	Concrete	m ³	15 225	16.00	243 600	150.00	2 283 750	166.00	2 527 350
2	Reinforcing steel	t	837	325.47	272 418	1 359.52	1 137 918	1 684.99	1 410 337
C.III.2.6.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	780	4.04	3 151	18.36	14 321	22.40	17 472
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 500	8.99	13 485	27.90	41 850	36.89	55 335
3	Drain holes, 76 mm diameter	m	190	5.68	1 079	28.91	5 493	34.59	6 572
4	Contact & consolidation cement grouting, excluding materials	t	56	42.60	2 386	124.85	6 992	167.45	9 377
5	Cement grouting between concrete and steel lining	m ²	2 350	2.85	6 698	8.55	20 093	11.40	26 790
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.6.04	Sundries:								
1	Portland cement ASTM type I or II	t	2 506	5.16	12 931	252.60	633 035	257.76	645 966
2	Portland cement ASTM type V (sulfate resistant)	t	2 506	6.06	15 187	296.70	743 552	302.76	758 739
3	Steel lining	kg	461 200	0.77	355 124	5.23	2 412 076	6.00	2 767 200
4	Care of water and miscellaneous works	%	3%		38 193		270 760		308 954
	Total No. C.III.2.6				1 311 309		9 296 103		10 607 412
C.III.2.7	UNDERGROUND WORKS - Downstream Emergency & Sector Gates Chamber - 180 m								
C.III.2.7.01	Excavation and supports:								
1	Rock Excavation	m ³	91 120	9.20	838 304	41.70	3 799 704	50.90	4 638 008
2	Grouted anchor bars, 22 mm diameter	m	2 000	1.49	2 980	13.63	27 260	15.12	30 240
3	Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
4	Grouted anchor bars, 32 mm diameter	m	4 590	1.62	7 436	17.76	81 518	19.38	88 954
5	Rock bolts, 22 mm diameter	m	5 460	1.71	9 337	24.13	131 750	25.84	141 086
6	Rock bolts, 26.5 mm diameter	m	5 800	2.83	16 414	31.18	180 844	34.01	197 258
7	Rock bolts, 32 mm diameter	m	3 600	3.02	10 872	39.12	140 832	42.14	151 704
8	Shotcrete	m ³	560	14.59	8 170	103.39	57 898	117.98	66 069
9	Welded wire fabric	kg	14 050	0.58	8 149	2.16	30 348	2.74	38 497
10	Steel ribs	kg		0.13		2.94		3.07	
C.III.2.7.02	Concrete works:								
1	Concrete	m ³	48 050	16.00	768 800	150.00	7 207 500	166.00	7 976 300
2	Reinforcing steel	t	2 650	325.47	862 496	1 359.52	3 602 728	1 684.99	4 465 224
C.III.2.7.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 340	4.04	9 454	18.36	42 962	22.40	52 416
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 500	8.99	40 455	27.90	125 550	36.89	166 005
3	Drain holes, 76 mm diameter	m	370	5.68	2 102	28.91	10 697	34.59	12 798
4	Contact & consolidation cement grouting, excluding materials	t	170	42.60	7 242	124.85	21 225	167.45	28 467
5	Cement grouting between concrete and steel lining	m ²	2 555	2.85	7 282	8.55	21 845	11.40	29 127
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.7.04	Sundries:								
1	Portland cement ASTM type I or II	t	7 899	5.16	40 759	252.60	1 995 287	257.76	2 036 046
2	Portland cement ASTM type V (sulfate resistant)	t	7 899	6.06	47 868	296.70	2 343 633	302.76	2 391 501
3	Steel lining	kg	500 950	0.77	385 732	5.23	2 619 969	6.00	3 005 700
4	Care of water and miscellaneous works	%	3%		92 215		673 247		765 462
	Total No. C.III.2.7				3 166 065		23 114 797		26 280 862
C.III.2.8	UNDERGROUND WORKS - Vortex Chambers and Connections								
C.III.2.8.01	Excavation and supports:								
1	Rock Excavation	m ³	53 925	9.20	496 110	41.70	2 248 673	50.90	2 744 783
2	Grouted anchor bars, 22 mm diameter	m	4 780	1.49	7 122	13.63	65 151	15.12	72 274
3	Grouted anchor bars, 26 mm diameter	m		1.58		15.28		16.86	
4	Grouted anchor bars, 32 mm diameter	m	4 500	1.62	7 290	17.76	79 920	19.38	87 210
5	Rock bolts, 22 mm diameter	m	3 000	1.71	5 130	24.13	72 390	25.84	77 520
6	Rock bolts, 26.5 mm diameter	m	2 600	2.83	7 358	31.18	81 068	34.01	88 426
7	Rock bolts, 32 mm diameter	m	900	3.02	2 718	39.12	35 208	42.14	37 926

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
8	Shotcrete	m ³	990	14.59	14 444	103.39	102 356	117.98	116 800
9	Welded wire fabric	kg	19 870	0.58	11 525	2.16	42 919	2.74	54 444
10	Steel ribs	kg		0.13		2.94		3.07	
C.III.2.8.02	Concrete works:								
1	Concrete	m ³	24 610	16.00	393 760	150.00	3 691 500	166.00	4 085 260
2	Reinforcing steel	t	1 320	325.47	429 620	1 359.52	1 794 566	1 684.99	2 224 187
C.III.2.8.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 125	4.04	4 545	18.36	20 655	22.40	25 200
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 870	8.99	34 791	27.90	107 973	36.89	142 764
3	Drain holes, 76 mm diameter	m	3 430	5.68	19 482	28.91	99 161	34.59	118 644
4	Contact & consolidation cement grouting, excluding materials	t	220	42.60	9 372	124.85	27 467	167.45	36 839
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.8.04	Sundries:								
1	Portland cement ASTM type I or II	t	4 270	5.16	22 035	252.60	1 078 690	257.76	1 100 725
2	Portland cement ASTM type V (sulfate resistant)	t	4 270	6.06	25 878	296.70	1 267 013	302.76	1 292 891
3	Silica fumes	t	683	11.70	7 994	573.30	391 711	585.00	399 705
4	Care of water and miscellaneous works	%	5%		74 959		560 321		635 280
	Total No. C.III.2.8				1 574 134		11 766 743		13 340 877
C.III.2.9	UNDERGROUND WORKS - Vortex Shaft and Elbow								
C.III.2.9.01	Excavation and supports:								
1	Rock Excavation	m ³	64 820	14.10	913 962	64.00	4 148 480	78.10	5 062 442
2	Grouted anchor bars, 22 mm diameter	m	6 750	1.49	10 058	13.63	92 003	15.12	102 060
3	Grouted anchor bars, 26 mm diameter	m	5 750	1.58	9 085	15.28	87 860	16.86	96 945
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	3 700	1.71	6 327	24.13	89 281	25.84	95 608
6	Rock bolts, 26.5 mm diameter	m	1 740	2.83	4 924	31.18	54 253	34.01	59 177
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	1 480	14.59	21 593	103.39	153 017	117.98	174 610
9	Welded wire fabric	kg	32 450	0.58	18 821	2.16	70 092	2.74	88 913
10	Steel ribs	kg	22 600	0.13	2 938	2.94	66 444	3.07	69 382
C.III.2.9.02	Concrete works:								
1	Concrete, shaft	m ³	8 960	18.00	161 280	102.00	913 920	120.00	1 075 200
2	Concrete, elbow	m ³	25 550	30.00	766 500	120.00	3 066 000	150.00	3 832 500
3	Reinforcing steel	t	1 346	325.47	438 083	1 359.52	1 829 914	1 684.99	2 267 997
C.III.2.9.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 160	4.04	4 686	18.36	21 298	22.40	25 984
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	11 210	8.99	100 778	27.90	312 759	36.89	413 537
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	790	42.60	33 654	124.85	98 632	167.45	132 286
5	Cement grouting between concrete and steel lining	m ²	4 210	2.85	11 999	8.55	35 996	11.40	47 994
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.9.04	Sundries:								
1	Portland cement ASTM type I or II	t	6 250	5.16	32 248	252.60	1 578 649	257.76	1 610 897
2	Portland cement ASTM type V (sulfate resistant)	t	6 250	6.06	37 873	296.70	1 854 256	302.76	1 892 129
3	Silica fumes	t	1 000	11.70	11 699	573.30	573 263	585.00	584 963
4	Steel lining	kg	720 850	0.77	555 055	5.23	3 770 046	6.00	4 325 100
5	Care of water and miscellaneous works	%	5%		157 078		940 808		1 097 886
	Total No. C.III.2.9				3 298 640		19 756 970		23 055 609
C.III.2.10	UNDERGROUND WORKS - Ventilation Tunnel (275 m) and Ventilation Shaft (13 m)								
C.III.2.10.01	Excavation and supports:								
1	Excavation, Tunnel								
a)	Rock Class I	m ³		7.10		28.19		35.29	
b)	Rock Class II	m ³	2 284	8.02	18 315	33.87	77 349	41.89	95 664
c)	Rock Class III	m ³	939	8.77	8 231	37.35	35 055	46.12	43 286
d)	Rock Class IV	m ³	4 346	9.24	40 154	40.89	177 693	50.13	217 847

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	e) Rock Class V	m ³	1 993	10.24	20 413	45.20	90 105	55.44	110 518
2	Excavation, Shaft	m ³	486	32.00	15 555	128.00	62 222	160.00	77 777
3	Grouted anchor bars, 22 mm diameter	m	1 928	1.49	2 873	13.63	26 279	15.12	29 152
4	Grouted anchor bars, 26 mm diameter	m	964	1.58	1 523	15.28	14 730	16.86	16 254
5	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
6	Rock bolts, 22 mm diameter	m	1 205	1.71	2 061	24.13	29 078	25.84	31 138
7	Rock bolts, 26.5 mm diameter	m	723	2.83	2 046	31.18	22 544	34.01	24 590
8	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
9	Shotcrete	m ³	462	14.59	6 739	103.39	47 756	117.98	54 495
10	Welded wire fabric	kg	10 649	0.58	6 176	2.16	23 001	2.74	29 177
11	Steel ribs	kg	84 098	0.13	10 933	2.94	247 249	3.07	258 182
C.III.2.10.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	2 162	9.10	19 678	83.30	180 126	92.40	199 803
2	Concrete, invert	m ³	841	7.70	6 477	55.70	46 851	63.40	53 328
3	Concrete, shaft	m ³	136	30.00	4 077	211.00	28 674	241.00	32 751
4	Reinforcing steel	t	177	332.26	58 665	1 359.52	240 038	1 691.78	298 703
C.III.2.10.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	376	4.04	1 519	18.36	6 903	22.40	8 422
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 580	8.99	14 209	27.90	44 096	36.89	58 304
3	Drain holes, 76 mm diameter	m	1 382	5.68	7 851	28.91	39 962	34.59	47 814
4	Contact & consolidation cement grouting, excluding materials	t	116	42.60	4 957	124.85	14 528	167.45	19 485
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.10.04	Sundries:								
1	Portland cement ASTM type I or II	t	727	5.16	3 752	252.60	183 691	257.76	187 443
2	Portland cement ASTM type V (sulfate resistant)	t	727	6.06	4 407	296.70	215 761	302.76	220 167
3	Care of water and miscellaneous works	%	3%		7 818		55 611		63 429
	Total No. C.III.2.10				268 429		1 909 301		2 177 730
C.III.2.11	UNDERGROUND WORKS - Vortex Chambers Aeration Gallery - 60 m								
C.III.2.11.01	Excavation and supports:								
1	Rock Excavation	m ³	1 085	19.22	20 844	78.11	84 710	97.33	105 554
2	Grouted anchor bars, 22 mm diameter	m	600	1.49	894	13.63	8 178	15.12	9 072
3	Grouted anchor bars, 26 mm diameter	m	153	1.58	242	15.28	2 338	16.86	2 580
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	78	1.71	133	24.13	1 882	25.84	2 016
6	Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	87	14.59	1 269	103.39	8 995	117.98	10 264
9	Welded wire fabric	kg	1 845	0.58	1 070	2.16	3 985	2.74	5 055
10	Steel ribs	kg	5 130	0.13	667	2.94	15 082	3.07	15 749
C.III.2.11.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	330	18.37	6 062	105.64	34 861	124.01	40 923
2	Concrete, invert	m ³	93	13.26	1 233	64.27	5 977	77.53	7 210
3	Reinforcing steel	t	21	325.47	6 884	1 359.52	28 754	1 684.99	35 638
C.III.2.11.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	81	4.04	327	18.36	1 487	22.40	1 814
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	279	8.99	2 508	27.90	7 784	36.89	10 292
3	Drain holes, 76 mm diameter	m	300	5.68	1 704	28.91	8 673	34.59	10 377
4	Contact & consolidation cement grouting, excluding materials	t	18	42.60	780	124.85	2 285	167.45	3 064
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.11.04	Sundries:								
1	Portland cement ASTM type I or II	t	96	5.16	497	252.60	24 352	257.76	24 849
2	Portland cement ASTM type V (sulfate resistant)	t	96	6.06	584	296.70	28 603	302.76	29 188
3	Care of water and miscellaneous works	%	3%		1 371		8 038		9 409
	Total No. C.III.2.11				47 070		275 985		323 056

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
C.III.2.12	UNDERGROUND WORKS - Downstream Fault Crossing Stretches - 40 + 130 m								
C.III.2.12.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	57 163	9.20	525 895	41.70	2 383 676	50.90	2 909 571
2	Grouted anchor bars, 22 mm diameter	m	6 375	1.49	9 499	13.63	86 891	15.12	96 390
3	Grouted anchor bars, 26 mm diameter	m	4 250	1.58	6 715	15.28	64 940	16.86	71 655
4	Grouted anchor bars, 32 mm diameter	m	3 719	1.62	6 024	17.76	66 045	19.38	72 069
5	Rock bolts, 22 mm diameter	m	3 719	1.71	6 359	24.13	89 733	25.84	96 093
6	Rock bolts, 26.5 mm diameter	m	2 763	2.83	7 818	31.18	86 135	34.01	93 953
7	Rock bolts, 32 mm diameter	m	2 125	3.02	6 418	39.12	83 130	42.14	89 548
8	Shotcrete	m ³	999	14.59	14 572	103.39	103 261	117.98	117 833
9	Welded wire fabric	kg	16 575	0.58	9 614	2.16	35 802	2.74	45 416
10	Steel ribs	kg	544 000	0.13	70 720	2.94	1 599 360	3.07	1 670 080
C.III.2.12.02	<u>Concrete works:</u>								
1	Concrete	m ³	29 538	9.01	266 084	60.32	1 781 604	69.33	2 047 687
2	Reinforcing steel	t	2 216	325.47	721 364	1 359.52	3 013 206	1 684.99	3 734 570
3	Cellular Concrete Filling	m ³	27 731	16.00	443 700	150.00	4 159 688	166.00	4 603 388
C.III.2.12.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	3 315	4.04	13 393	18.36	60 863	22.40	74 256
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	11 900	8.99	106 981	27.90	332 010	36.89	438 991
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	595	42.60	25 347	124.85	74 286	167.45	99 633
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.2.12.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	9 685	5.16	49 976	252.60	2 446 486	257.76	2 496 462
2	Portland cement ASTM type V (sulfate resistant)	t	9 685	6.06	58 692	296.70	2 873 604	302.76	2 932 297
3	Steel lining	kg		0.77		5.23		6.00	
4	Care of water and miscellaneous works	%	5%		117 458		967 036		1 084 494
	Total No. C.III.2.12				2 466 627		20 307 756		22 774 384
C.III.2.13	UNDERGROUND WORKS - Drainage and Grouting Tunnels of Gates Chambers (D-shaped) - 2 tunnels 220 m long								
C.III.2.13.01	<u>Excavation and supports:</u>								
1	Excavation								
a)	Rock Class I	m ³		7.10		28.19		35.29	
b)	Rock Class II	m ³	3 600	8.02	28 872	33.87	121 932	41.89	150 804
c)	Rock Class III	m ³	480	8.77	4 210	37.35	17 928	46.12	22 138
d)	Rock Class IV	m ³	4 520	9.24	41 765	40.89	184 823	50.13	226 588
e)	Rock Class V	m ³	1 040	10.24	10 650	45.20	47 008	55.44	57 658
2	Grouted anchor bars, 22 mm diameter	m	4 000	1.49	5 960	13.63	54 520	15.12	60 480
3	Grouted anchor bars, 26 mm diameter	m	510	1.58	806	15.28	7 793	16.86	8 599
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	1 000	1.71	1 710	24.13	24 130	25.84	25 840
6	Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	470	14.59	6 857	103.39	48 593	117.98	55 451
9	Welded wire fabric	kg	12 160	0.58	7 053	2.16	26 266	2.74	33 318
10	Steel ribs	kg	51 600	0.13	6 708	2.94	151 704	3.07	158 412
C.III.2.13.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	3 830	9.10	34 853	83.30	319 039	92.40	353 892
2	Concrete, invert	m ³	1 020	7.70	7 854	55.70	56 814	63.40	64 668
3	Reinforcing steel	t	258	325.47	83 971	1 359.52	350 756	1 684.99	434 727
C.III.2.13.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	450	4.04	1 818	18.36	8 262	22.40	10 080
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 890	8.99	34 971	27.90	108 531	36.89	143 502
3	Drain holes, 76 mm diameter	m	4 130	5.68	23 458	28.91	119 398	34.59	142 857
4	Contact & consolidation cement grouting, excluding materials	t	274	42.60	11 672	124.85	34 209	167.45	45 881
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.III.2.13.04	Sundries:								
	1 Portland cement ASTM type I or II	t	1 019	5.16	5 257	252.60	257 336	257.76	262 593
	2 Portland cement ASTM type V (sulfate resistant)	t	1 019	6.06	6 174	296.70	302 263	302.76	308 437
	3 Care of water and miscellaneous works	%	3%		9 739		67 239		76 978
	Total No. C.III.2.13				334 357		2 308 544		2 642 901
C.III.2.14	UNDERGROUND WORKS - Access Tunnel to Gates Chambers (D-shaped) - 690 m								
C.III.2.14.01	Excavation and supports:								
	1 Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	17 388	8.02	139 452	33.87	588 932	41.89	728 383
	c) Rock Class III	m ³	4 539	8.77	39 811	37.35	169 549	46.12	209 361
	d) Rock Class IV	m ³	16 589	9.24	153 283	40.89	678 326	50.13	831 609
	e) Rock Class V	m ³	7 270	10.24	74 449	45.20	328 623	55.44	403 072
	2 Grouted anchor bars, 22 mm diameter	m	6 464	1.49	9 632	13.63	88 107	15.12	97 739
	3 Grouted anchor bars, 26 mm diameter	m	3 588	1.58	5 669	15.28	54 825	16.86	60 494
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	4 794	1.71	8 197	24.13	115 672	25.84	123 869
	6 Rock bolts, 26.5 mm diameter	m	872	2.83	2 467	31.18	27 176	34.01	29 642
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	1 315	14.59	19 180	103.39	135 920	117.98	155 100
	9 Welded wire fabric	kg	34 122	0.58	19 791	2.16	73 704	2.74	93 495
	10 Steel ribs	kg	216 035	0.13	28 085	2.94	635 144	3.07	663 229
C.III.2.14.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	18 412	9.10	167 550	83.30	1 533 728	92.40	1 701 279
	2 Concrete, invert	m ³	4 605	7.70	35 457	55.70	256 490	63.40	291 947
	3 Reinforcing steel	t	1 230	325.47	400 451	1 359.52	1 672 725	1 684.99	2 073 176
C.III.2.14.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	1 286	4.04	5 194	18.36	23 603	22.40	28 797
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 704	8.99	33 301	27.90	103 347	36.89	136 648
	3 Drain holes, 76 mm diameter	m	4 823	5.68	27 393	28.91	139 425	34.59	166 818
	4 Contact & consolidation cement grouting, excluding materials	t	200	42.60	8 509	124.85	24 937	167.45	33 446
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.2.14.04	Sundries:								
	1 Portland cement ASTM type I or II	t	4 078	5.16	21 044	252.60	1 030 197	257.76	1 051 241
	2 Portland cement ASTM type V (sulfate resistant)	t	4 078	6.06	24 715	296.70	1 210 053	302.76	1 234 768
	3 Care of water and miscellaneous works	%	3%		36 709		266 714		303 423
	Total No. C.III.2.14				1 260 339		9 157 198		10 417 537
	TOTAL AMOUNT OF MIDDLE OUTLET LEVEL 2				19 617 275		141 345 341		160 962 616
C.III.3	HIGH LEVEL TUNNELS SPILLWAYS (TWO TUNNELS)								
C.III.3.1	SURFACE WORKS - Intake Structure								
C.III.3.1.01	Excavation and supports:								
	1 Excavation, common	m ³	30 500.0	0.25	7 625	2.71	82 655	2.96	90 280
	2 Excavation, rock	m ³	61 500.0	1.46	89 790	5.61	345 015	7.07	434 805
	3 Overhauling in excess of 500 m, common material	m ³ /km	137 250.0	0.07	9 608	0.81	111 173	0.88	120 780
	4 Overhauling in excess of 500 m, rock	m ³ /km	276 750.0	0.09	24 852	1.03	285 883	1.12	310 735
	5 Rock bolts, 22 mm diameter	m	5 500.0	1.71	9 405	21.50	118 250	23.21	127 655
	6 Rock bolts, 26.5 mm diameter	m	4 200.0	2.62	11 004	27.27	114 534	29.89	125 538
	7 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
	8 Shotcrete	m ³	970.0	15.10	14 647	93.73	90 918	108.83	105 565
	9 Welded wire fabric	kg	24 200.0	0.50	12 100	1.93	46 706	2.43	58 806
C.III.3.1.02	Concrete works:								
	1 Concrete, foundation and mat	m ³	2 186.0	5.10	11 149	29.54	64 574	34.64	75 723
	2 Concrete elevation	m ³	3 917.5	8.30	32 515	34.10	133 587	42.40	166 102
	3 Reinforcing steel	t	352.0	242.54	85 374	1 308.26	460 508	1 550.80	545 882

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	4 Flat type Formworks	m ²	5 145.0	6.06	31 178	17.78	91 463	23.84	122 642
	5 Curved type Formworks	m ²	940.0	10.67	10 033	26.77	25 161	37.44	35 193
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.III.3.1.03	Sundries:								
	1 Portland cement, type I or II ASTM	t	2 389.6	5.16	12 330	252.60	603 618	257.76	615 948
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		10 848		77 221		88 070
	Total No. C.III.3.1				372 458		2 651 266		3 023 724
C.III.3.2	SURFACE WORKS - Outlet Structures including chutes, stilling basins and flip bucket								
C.III.3.2.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	415 400.0	0.25	103 850	2.71	1 125 734	2.96	1 229 584
	2 Excavation, rock	m ³	969 300.0	1.46	1 415 178	5.61	5 437 773	7.07	6 852 951
	3 Overhauling in excess of 500 m, common material	m ³ /km	1 661 600.0	0.07	116 312	0.81	1 345 896	0.88	1 462 208
	4 Overhauling in excess of 500 m, rock	m ³ /km	3 877 200.0	0.09	348 173	1.03	4 005 148	1.12	4 353 320
	5 Rock bolts, 22 mm diameter	m	18 000.0	1.71	30 780	21.50	387 000	23.21	417 780
	6 Rock bolts, 26.5 mm diameter	m	28 200.0	2.62	73 884	27.27	769 014	29.89	842 898
	7 Rock bolts, 32 mm diameter	m	26 500.0	2.81	74 465	35.42	938 630	38.23	1 013 095
	8 Grouted anchor bars, 22 mm diameter	m		1.44		10.97		12.41	
	9 Grouted anchor bars, 26 mm diameter	m	44 150.0	1.58	69 757	12.80	565 120	14.38	634 877
	10 Grouted anchor bars, 32 mm diameter	m	52 000.0	1.63	84 760	15.71	816 920	17.34	901 680
	11 Shotcrete	m ³	11 025.0	15.10	166 478	93.73	1 033 373	108.83	1 199 851
	12 Welded wire fabric	kg	246 530.0	0.50	123 265	1.93	475 803	2.43	599 068
C.III.3.2.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³	159 060.0	5.10	811 206	29.54	4 698 632	34.64	5 509 838
	2 Concrete elevation	m ³	66 277.5	8.30	550 103	34.10	2 260 063	42.40	2 810 166
	3 Reinforcing steel	t	12 380.0	242.54	3 002 645	1 308.26	16 196 259	1 550.80	19 198 904
	4 Flat type Formworks	m ²	54 624.5	6.06	331 021	17.78	971 068	23.84	1 302 089
	5 Curved type Formworks	m ²		10.67		26.77		37.44	
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.III.3.2.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	77 069.3	5.16	397 677	252.60	19 467 693	257.76	19 865 370
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Tendons, 70 t capacity, PHA 7K7 15 mm L=18	ea	1 000.0	332.13	332 130	1 491.67	1 491 670	1 823.80	1 823 800
	4 Tendons, 70 t capacity, PHA 7K7 15 mm L=30	ea	1 500.0	576.06	864 090	2 416.47	3 624 705	2 992.53	4 488 795
	5 Tendons, 70 t capacity, PHA 7K7 15 mm L=40	ea	1 040.0	779.33	810 503	3 187.14	3 314 626	3 966.47	4 125 129
	6 Care of water and miscellaneous works	%	5%		485 314		3 446 256		3 931 570
	Total No. C.III.3.2				10 191 591		72 371 382		82 562 973
C.III.3.3	SURFACE WORKS - Plunge Pool and Right Bank Slope Protection								
C.III.3.3.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	38 907.0	0.25	9 727	2.71	105 438	2.96	115 165
	2 Excavation, rock	m ³	31 833.0	1.46	46 476	5.61	178 583	7.07	225 059
	3 Excavation, common, under water	m ³	12 969.0	1.00	12 969	10.84	140 584	11.84	153 553
	4 Excavation, rock, under water	m ³	10 611.0	3.29	34 857	12.62	133 937	15.91	168 794
	5 Excavation, trench for cut-off	m ³	18 374.5	0.50	9 187	4.80	88 198	5.30	97 385
	6 Overhauling in excess of 500 m, common material	m ³ /km	140 501.0	0.07	9 835	0.81	113 806	0.88	123 641
	7 Overhauling in excess of 500 m, rock	m ³ /km	84 888.0	0.09	7 623	1.03	87 689	1.12	95 312
C.III.3.3.02	<u>Concrete works:</u>								
	1 Concrete, cut-off and protection	m ³	21 390.5	5.10	109 092	29.54	631 875	34.64	740 967
	2 Reinforcing steel	t	962.6	242.54	233 462	1 308.26	1 259 295	1 550.80	1 492 757
C.III.3.3.03	<u>Sundries:</u>								
	1 Tendons, 70 t capacity, PHA 7K7 15 mm L=15	ea	200.0	289.79	57 958	1 325.48	265 096	1 615.27	323 054
	2 Portland cement ASTM type I or II	t	6 845	5.16	35 320	252.60	1 729 037	257.76	1 764 357
	3 Portland cement ASTM type V (sulfate resistant)	t		6.06		296.70		302.76	
	4 Care of water and miscellaneous works	%	10%		56 651		473 354		530 004
	Total No. C.III.3.3				623 157		5 206 892		5 830 049
C.III.3.4	UNDERGROUND WORKS - Tunnel Pressure Stretch (Horseshoe) - 718 m (two tunnels)								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.III.3.4.01	Excavation and supports:								
1	Excavation								
	a) Rock Class I	m ³		4.97		26.97		31.94	
	b) Rock Class II	m ³	25 305	5.59	141 559	29.93	757 367	35.52	898 926
	c) Rock Class III	m ³	8 720	6.20	54 082	33.10	288 661	39.31	342 742
	d) Rock Class IV	m ³	41 880	6.72	281 301	35.83	1 500 547	42.55	1 781 848
	e) Rock Class V	m ³	14 185	7.34	104 162	40.42	573 425	47.77	677 587
2	Grouted anchor bars, 22 mm diameter	m	14 000	1.49	20 860	13.63	190 820	15.12	211 680
3	Grouted anchor bars, 26 mm diameter	m	8 780	1.58	13 872	15.28	134 158	16.86	148 031
4	Grouted anchor bars, 32 mm diameter	m	1 670	1.62	2 705	17.76	29 659	19.38	32 365
5	Rock bolts, 22 mm diameter	m	5 000	1.71	8 550	24.13	120 650	25.84	129 200
6	Rock bolts, 26.5 mm diameter	m	3 500	2.83	9 905	31.18	109 130	34.01	119 035
7	Rock bolts, 32 mm diameter	m	1 445	3.02	4 364	39.12	56 528	42.14	60 892
8	Shotcrete	m ³	2 260	14.59	32 973	103.39	233 661	117.98	266 635
9	Welded wire fabric	kg	50 630	0.58	29 365	2.16	109 361	2.74	138 726
10	Steel ribs	kg	367 600	0.13	47 788	2.94	1 080 744	3.07	1 128 532
C.III.3.4.02	Concrete works:								
1	Concrete, arch	m ³	11 810	8.90	105 109	75.20	888 112	84.10	993 221
2	Concrete, sidewalls	m ³	9 445	11.40	107 673	54.70	516 642	66.10	624 315
3	Concrete, invert	m ³	7 085	6.00	42 510	43.00	304 655	49.00	347 165
4	Reinforcing steel	t	1 580	325.47	514 243	1 359.52	2 148 042	1 684.99	2 662 284
C.III.3.4.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 340	4.04	9 454	18.36	42 962	22.40	52 416
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	9 360	8.99	84 146	27.90	261 144	36.89	345 290
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	440	42.60	18 744	124.85	54 934	167.45	73 678
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.3.4.04	Sundries:								
1	Portland cement ASTM type I or II	t	5 263	5.16	27 157	252.60	1 329 409	257.76	1 356 565
2	Portland cement ASTM type V (sulfate resistant)	t	5 263	6.06	31 893	296.70	1 561 502	302.76	1 593 396
3	Care of water and miscellaneous works	%	3%		50 772		368 763		419 536
	Total No. C.III.3.4				1 743 188		12 660 876		14 404 064
C.III.3.5	UNDERGROUND WORKS - Tunnel Free-flow Stretch (D-shaped) - 1465 m (two tunnels)								
C.III.3.5.01	Excavation and supports:								
1	Excavation								
	a) Rock Class I	m ³		4.99		26.86		31.85	
	b) Rock Class II	m ³	67 075	5.54	371 747	29.57	1 983 162	35.11	2 354 909
	c) Rock Class III	m ³	91 970	6.14	564 443	32.70	3 007 344	38.84	3 571 787
	d) Rock Class IV	m ³	48 008	6.63	318 361	35.38	1 698 722	42.02	2 017 082
	e) Rock Class V	m ³	24 372	7.35	179 119	40.26	981 202	47.61	1 160 322
2	Grouted anchor bars, 22 mm diameter	m	22 746	1.49	33 891	13.63	310 023	15.12	343 914
3	Grouted anchor bars, 26 mm diameter	m	13 822	1.58	21 838	15.28	211 194	16.86	233 032
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	11 615	1.71	19 861	24.13	280 265	25.84	300 126
6	Rock bolts, 26.5 mm diameter	m	8 711	2.83	24 652	31.18	271 612	34.01	296 264
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	5 014	14.59	73 150	103.39	518 369	117.98	591 519
9	Welded wire fabric	kg	120 939	0.58	70 145	2.16	261 228	2.74	331 373
10	Steel ribs	kg	584 031	0.13	75 924	2.94	1 717 050	3.07	1 792 974
C.III.3.5.02	Concrete works:								
1	Concrete, arch	m ³	27 450	8.90	244 302	75.20	2 064 212	84.10	2 308 514
2	Concrete, sidewalls	m ³	15 448	11.40	176 104	54.70	844 988	66.10	1 021 091
3	Concrete, invert	m ³	25 756	6.00	154 535	43.00	1 107 500	49.00	1 262 035
4	Reinforcing steel	t	3 576	325.47	1 164 007	1 359.52	4 862 172	1 684.99	6 026 180
C.III.3.5.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	4 796	4.04	19 376	18.36	88 054	22.40	107 429
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	8 982	8.99	80 749	27.90	250 601	36.89	331 350
3	Drain holes, 76 mm diameter	m	17 403	5.68	98 848	28.91	503 116	34.59	601 964
4	Contact & consolidation cement grouting, excluding materials	t	494	42.60	21 029	124.85	61 630	167.45	82 658

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.3.5.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	12 359	5.16	63 775	252.60	3 121 985	257.76	3 185 759
	2 Portland cement ASTM type V (sulfate resistant)	t	12 359	6.06	74 898	296.70	3 667 034	302.76	3 741 932
	3 Care of water and miscellaneous works	%	10%		385 075		2 781 146		3 166 222
	Total No. C.III.3.5				4 235 828		30 592 609		34 828 437
C.III.3.6	UNDERGROUND WORKS - Upstream Maintenance Gates Chambers (70 m each)								
C.III.3.6.01	<u>Excavation and supports:</u>								
	1 Rock Excavation	m ³	32 280	9.20	296 976	41.70	1 346 076	50.90	1 643 052
	2 Grouted anchor bars, 22 mm diameter	m	2 000	1.49	2 980	13.63	27 260	15.12	30 240
	3 Grouted anchor bars, 26 mm diameter	m	1 320	1.58	2 086	15.28	20 170	16.86	22 255
	4 Grouted anchor bars, 32 mm diameter	m	3 000	1.62	4 860	17.76	53 280	19.38	58 140
	5 Rock bolts, 22 mm diameter	m	1 000	1.71	1 710	24.13	24 130	25.84	25 840
	6 Rock bolts, 26.5 mm diameter	m	2 600	2.83	7 358	31.18	81 068	34.01	88 426
	7 Rock bolts, 32 mm diameter	m	1 000	3.02	3 020	39.12	39 120	42.14	42 140
	8 Shotcrete	m ³	194	14.59	2 830	103.39	20 058	117.98	22 888
	9 Welded wire fabric	kg	4 840	0.58	2 807	2.16	10 454	2.74	13 262
	10 Steel ribs	kg		0.13		2.94		3.07	
C.III.3.6.02	<u>Concrete works:</u>								
	1 Concrete	m ³	15 600	16.00	249 600	150.00	2 340 000	166.00	2 589 600
	2 Reinforcing steel	t	780	325.47	253 867	1 359.52	1 060 426	1 684.99	1 314 292
C.III.3.6.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	810	4.04	3 272	18.36	14 872	22.40	18 144
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 560	8.99	14 024	27.90	43 524	36.89	57 548
	3 Drain holes, 76 mm diameter	m	280	5.68	1 590	28.91	8 095	34.59	9 685
	4 Contact & consolidation cement grouting, excluding materials	t	50	42.60	2 130	124.85	6 243	167.45	8 373
	5 Cement grouting between concrete and steel lining	m ²	2 700	2.85	7 695	8.55	23 085	11.40	30 780
	6 Bentonite	t		8.93		437.33		446.26	
C.III.3.6.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	2 565	5.16	13 234	252.60	647 831	257.76	661 064
	2 Portland cement ASTM type V (sulfate resistant)	t	2 565	6.06	15 542	296.70	760 932	302.76	776 473
	3 Steel lining	kg	530 000	0.77	408 100	5.23	2 771 900	6.00	3 180 000
	4 Care of water and miscellaneous works	%	3%		38 810		278 956		317 766
	Total No. C.III.3.6				1 332 492		9 577 477		10 909 969
C.III.3.7	UNDERGROUND WORKS - Downstream Emergency & Sector Gates Chambers (136 m each)								
C.III.3.7.01	<u>Excavation and supports:</u>								
	1 Rock Excavation	m ³	79 410	9.20	730 572	41.70	3 311 397	50.90	4 041 969
	2 Grouted anchor bars, 22 mm diameter	m	2 250	1.49	3 353	13.63	30 668	15.12	34 020
	3 Grouted anchor bars, 26 mm diameter	m	1 750	1.58	2 765	15.28	26 740	16.86	29 505
	4 Grouted anchor bars, 32 mm diameter	m	5 500	1.62	8 910	17.76	97 680	19.38	106 590
	5 Rock bolts, 22 mm diameter	m	3 000	1.71	5 130	24.13	72 390	25.84	77 520
	6 Rock bolts, 26.5 mm diameter	m	4 150	2.83	11 745	31.18	129 397	34.01	141 142
	7 Rock bolts, 32 mm diameter	m	3 750	3.02	11 325	39.12	146 700	42.14	158 025
	8 Shotcrete	m ³	490	14.59	7 149	103.39	50 661	117.98	57 810
	9 Welded wire fabric	kg	12 200	0.58	7 076	2.16	26 352	2.74	33 428
	10 Steel ribs	kg		0.13		2.94		3.07	
C.III.3.7.02	<u>Concrete works:</u>								
	1 Concrete	m ³	48 900	16.00	782 400	150.00	7 335 000	166.00	8 117 400
	2 Reinforcing steel	t	2 700	325.47	878 769	1 359.52	3 670 704	1 684.99	4 549 473
C.III.3.7.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	2 040	4.04	8 242	18.36	37 454	22.40	45 696
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 900	8.99	35 061	27.90	108 810	36.89	143 871
	3 Drain holes, 76 mm diameter	m	450	5.68	2 556	28.91	13 010	34.59	15 566
	4 Contact & consolidation cement grouting, excluding materials	t	130	42.60	5 538	124.85	16 231	167.45	21 769
	5 Cement grouting between concrete and steel lining	m ²	3 390	2.85	9 662	8.55	28 985	11.40	38 646
	6 Bentonite	t		8.93		437.33		446.26	
C.III.3.7.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	7 999	5.16	41 276	252.60	2 020 611	257.76	2 061 887

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
2	Portland cement ASTM type V (sulfate resistant)	t	7 999	6.06	48 475	296.70	2 373 377	302.76	2 421 853
3	Steel lining	kg	666 000	0.77	512 820	5.23	3 483 180	6.00	3 996 000
4	Care of water and miscellaneous works	%	3%		93 385		689 380		782 765
	Total No. C.III.3.7				3 206 207		23 668 726		26 874 933
C.III.3.8	UNDERGROUND WORKS - Drainage and Grouting Tunnels of Gates Chambers (D-shaped) - 2 tunnels each 220 m long								
C.III.3.8.01	<u>Excavation and supports:</u>								
1	Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	3 771	8.02	30 247	33.87	127 738	41.89	157 985
	c) Rock Class III	m ³	503	8.77	4 410	37.35	18 782	46.12	23 192
	d) Rock Class IV	m ³	4 735	9.24	43 754	40.89	193 624	50.13	237 377
	e) Rock Class V	m ³	1 090	10.24	11 157	45.20	49 246	55.44	60 403
2	Grouted anchor bars, 22 mm diameter	m	4 190	1.49	6 244	13.63	57 116	15.12	63 360
3	Grouted anchor bars, 26 mm diameter	m	534	1.58	844	15.28	8 164	16.86	9 008
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	1 048	1.71	1 791	24.13	25 279	25.84	27 070
6	Rock bolts, 26.5 mm diameter	m		2.83		31.18		34.01	
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	492	14.59	7 184	103.39	50 907	117.98	58 091
9	Welded wire fabric	kg	12 739	0.58	7 389	2.16	27 516	2.74	34 905
10	Steel ribs	kg	54 057	0.13	7 027	2.94	158 928	3.07	165 955
C.III.3.8.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	4 012	9.10	36 513	83.30	334 231	92.40	370 744
2	Concrete, invert	m ³	1 069	7.70	8 228	55.70	59 519	63.40	67 747
3	Reinforcing steel	t	270	325.47	87 970	1 359.52	367 459	1 684.99	455 429
C.III.3.8.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	471	4.04	1 905	18.36	8 655	22.40	10 560
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 653	8.99	41 827	27.90	129 807	36.89	171 634
3	Drain holes, 76 mm diameter	m	4 701	5.68	26 704	28.91	135 920	34.59	162 624
4	Contact & consolidation cement grouting, excluding materials	t	242	42.60	10 309	124.85	30 214	167.45	40 523
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.3.8.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	1 045	5.16	5 391	252.60	263 901	257.76	269 292
2	Portland cement ASTM type V (sulfate resistant)	t	1 045	6.06	6 331	296.70	309 974	302.76	316 305
3	Care of water and miscellaneous works	%	3%		10 357		70 709		81 066
	Total No. C.III.3.8				355 581		2 427 691		2 783 272
C.III.3.9	UNDERGROUND WORKS - Access Tunnel to Gates Chambers (D-shaped) - 350 m								
C.III.3.9.01	<u>Excavation and supports:</u>								
1	Excavation								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	7 718	8.02	61 894	33.87	261 392	41.89	323 286
	c) Rock Class III	m ³	3 453	8.77	30 286	37.35	128 982	46.12	159 268
	d) Rock Class IV	m ³	8 418	9.24	77 778	40.89	344 192	50.13	421 969
	e) Rock Class V	m ³	3 687	10.24	37 751	45.20	166 637	55.44	204 389
2	Grouted anchor bars, 22 mm diameter	m	3 967	1.49	5 910	13.63	54 066	15.12	59 976
3	Grouted anchor bars, 26 mm diameter	m	1 867	1.58	2 949	15.28	28 523	16.86	31 472
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	1 808	1.71	3 092	24.13	43 635	25.84	46 727
6	Rock bolts, 26.5 mm diameter	m	467	2.83	1 321	31.18	14 551	34.01	15 871
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	700	14.59	10 213	103.39	72 373	117.98	82 586
9	Welded wire fabric	kg	17 500	0.58	10 150	2.16	37 800	2.74	47 950
10	Steel ribs	kg	109 667	0.13	14 257	2.94	322 420	3.07	336 677
C.III.3.9.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	9 368	9.10	85 252	83.30	780 382	92.40	865 634
2	Concrete, invert	m ³	2 333	7.70	17 967	55.70	129 967	63.40	147 933
3	Reinforcing steel	t	631	325.47	205 236	1 359.52	857 291	1 684.99	1 062 527
C.III.3.9.03	<u>Drilling and grouting:</u>								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	1 Percussion contact grout holes, 40-48 mm diameter	m	653	4.04	2 639	18.36	11 995	22.40	14 635
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 878	8.99	16 886	27.90	52 406	36.89	69 292
	3 Drain holes, 76 mm diameter	m	2 450	5.68	13 916	28.91	70 830	34.59	84 746
	4 Contact & consolidation cement grouting, excluding materials	t	102	42.60	4 324	124.85	12 672	167.45	16 996
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.3.9.04	Sundries:								
	1 Portland cement ASTM type I or II	t	2 081	5.16	10 735	252.60	525 539	257.76	536 274
	2 Portland cement ASTM type V (sulfate resistant)	t	2 081	6.06	12 608	296.70	617 289	302.76	629 897
	3 Care of water and miscellaneous works	%	3%		18 755		135 988		154 743
	Total No. C.III.3.9				643 920		4 668 928		5 312 848
C.III.3.10	UNDERGROUND WORKS - Ventilation Tunnel (135 m)								
C.III.3.10.01	<u>Excavation and supports:</u>								
	1 Excavation, Tunnel								
	a) Rock Class I	m ³		7.10		28.19		35.29	
	b) Rock Class II	m ³	1 121	8.02	8 991	33.87	37 971	41.89	46 962
	c) Rock Class III	m ³	461	8.77	4 041	37.35	17 209	46.12	21 250
	d) Rock Class IV	m ³	2 133	9.24	19 712	40.89	87 231	50.13	106 943
	e) Rock Class V	m ³	979	10.24	10 021	45.20	44 233	55.44	54 254
	2 Grouted anchor bars, 22 mm diameter	m	863	1.49	1 287	13.63	11 769	15.12	13 056
	3 Grouted anchor bars, 26 mm diameter	m	432	1.58	682	15.28	6 597	16.86	7 279
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	540	1.71	923	24.13	13 023	25.84	13 946
	6 Rock bolts, 26.5 mm diameter	m	324	2.83	916	31.18	10 096	34.01	11 013
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	206	14.59	3 012	103.39	21 345	117.98	24 357
	9 Welded wire fabric	kg	4 813	0.58	2 791	2.16	10 395	2.74	13 186
	10 Steel ribs	kg	40 285	0.13	5 237	2.94	118 438	3.07	123 675
C.III.3.10.02	<u>Concrete works:</u>								
	1 Concrete, arch and sidewalls	m ³	1 062	9.10	9 660	83.30	88 425	92.40	98 085
	2 Concrete, invert	m ³	413	7.70	3 179	55.70	23 000	63.40	26 179
	3 Reinforcing steel	t	83	325.47	27 125	1 359.52	113 304	1 684.99	140 429
C.III.3.10.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	185	4.04	746	18.36	3 389	22.40	4 134
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	676	8.99	6 080	27.90	18 868	36.89	24 948
	3 Drain holes, 76 mm diameter	m	679	5.68	3 854	28.91	19 618	34.59	23 472
	4 Contact & consolidation cement grouting, excluding materials	t	51	42.60	2 178	124.85	6 384	167.45	8 562
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.III.3.10.04	Sundries:								
	1 Portland cement ASTM type I or II	t	337	5.16	1 741	252.60	85 231	257.76	86 973
	2 Portland cement ASTM type V (sulfate resistant)	t	337	6.06	2 045	296.70	100 112	302.76	102 156
	3 Care of water and miscellaneous works	%	3%		3 427		25 099		28 526
	Total No. C.III.3.10				117 648		861 737		979 385
	TOTAL AMOUNT OF HIGH LEVEL TUNNELS SPILLWAYS (TWO TUNNELS)				22 822 070		164 687 583		187 509 653
C.III.4	SURFACE SPILLWAY								
C.III.4.1	SURFACE WORKS - Spillway Structures including ogee, chute and flip bucket								
C.III.4.1.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m3	2 207 028	0.23	496 581	2.44	5 382 940	2.66	5 879 522
	2 Excavation, rock	m3	5 149 731	1.31	6 748 208	5.05	26 010 262	6.36	32 758 470
	3 Overhauling in excess of 500 m, common material	m3/km	11 035 138.1	0.07	772 460	0.81	8 938 462	0.88	9 710 922
	4 Overhauling in excess of 500 m, rock	m3/km	25 748 655.6	0.09	2 312 229	1.03	26 598 361	1.12	28 910 591
	5 Rock bolts, 25 mm diameter	m	169 236	2.62	443 398	27.27	4 615 065	29.89	5 058 463
	6 Rock bolts, 32 mm diameter	m	145 467	2.81	408 763	35.42	5 152 455	38.23	5 561 219
	7 Grouted anchor bars, 25 mm diameter	m	338 472	1.58	534 786	12.80	4 332 441	14.38	4 867 227
	8 Grouted anchor bars, 32 mm diameter	m	290 935	1.63	474 224	15.71	4 570 586	17.34	5 044 809
	9 Shotcrete	m3	26 235	15.10	396 142	93.73	2 458 969	108.83	2 855 111

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
10	Welded wire fabric	kg	888 034.6	0.50	444 017	1.93	1 713 907	2.43	2 157 924
C.III.4.1.02	Concrete works:								
1	Concrete, foundation and mat	m3	138 689	5.10	707 314	29.54	4 096 873	34.64	4 804 187
2	Concrete elevation	m3	21 360	8.30	177 288	34.10	728 376	42.40	905 664
3	Reinforcing steel (50 kg/m3)	t	6 402	242.54	1 552 731	1 308.26	8 375 428	1 550.80	9 928 160
4	Flat type Formworks	m2	53 350	6.06	323 296	17.78	948 405	23.84	1 271 700
5	Curved type Formworks	m2		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m2 max. load	m3		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m2 max. load	m3		3.56		7.61		11.17	
8	Overhauling in excess of 1000 m from batching plant	m3/km	160 049	0.11	17 605	0.86	137 642	0.97	155 248
C.III.4.1.03	Sundries:								
1	Portland cement, type I or II ASTM	t	34 633.1	5.16	178 707	252.60	8 748 328	257.76	8 927 035
2	Portland cement, type V ASTM (sulfate resistant)	t	28 388.1	6.06	172 032	296.70	8 422 756	302.76	8 594 788
3	Tendons, L=40m	ea	41	779.33	31 953	3 187.14	130 673	3 966.47	162 625
4	Backfill, random material	m3		0.26		1.83		2.09	
5	Compaction of Backfill	m3		0.12		0.97		1.09	
6	Care of water and miscellaneous works	%	3%		485 752		3 640 858		4 126 610
	Total No. C.III.4.1				16 677 486		125 002 787		141 680 273
C.III.4.2	UNDERGROUND WORKS								
C.III.4.2.01	Excavation and supports:								
1	Excavation								
	a) Rock Class I	m3		7.10		28.19		35.29	
	b) Rock Class II	m3	30 839	8.02	247 329	33.87	1 044 519	41.89	1 291 848
	c) Rock Class III	m3	61 678	8.77	540 917	37.35	2 303 678	46.12	2 844 595
	d) Rock Class IV	m3	30 839	9.24	284 953	40.89	1 261 009	50.13	1 545 962
	e) Rock Class V	m3		10.24		45.20		55.44	
2	Grouted anchor bars, 22 mm diameter	m	12 569	1.49	18 727	13.63	171 312	15.12	190 040
3	Grouted anchor bars, 26 mm diameter	m	6 733	1.58	10 638	15.28	102 877	16.86	113 515
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	6 284	1.71	10 745	24.13	151 627	25.84	162 373
6	Rock bolts, 26.5 mm diameter	m	4 725	2.83	13 370	31.18	147 311	34.01	160 682
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m3	2 673	14.59	39 001	103.39	276 375	117.98	315 376
9	Welded wire fabric	kg	64 503	0.58	37 412	2.16	139 326	2.74	176 738
10	Steel ribs	kg	311 080	0.13	40 440	2.94	914 575	3.07	955 015
C.III.4.2.02	Concrete works:								
1	Concrete, arch	m3	15 259	8.90	135 807	75.20	1 147 492	84.10	1 283 299
2	Concrete, sidewalls	m3	19 242	11.40	219 362	54.70	1 052 554	66.10	1 271 916
3	Concrete, invert	m3	21 599	6.00	129 591	43.00	928 736	49.00	1 058 327
4	Reinforcing steel (50kg/m3)	t	2 805	325.47	912 943	1 359.52	3 813 454	1 684.99	4 726 397
C.III.4.2.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 590	4.04	10 466	18.36	47 561	22.40	58 027
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 042	8.99	36 334	37.90	153 177	46.89	189 510
3	Drain holes, 76 mm diameter	m	6 378	5.68	36 224	28.91	184 374	34.59	220 598
4	Contact & consolidation cement grouting, excluding materials	t	186	42.60	7 935	124.85	23 256	167.45	31 191
5	Cement grouting between concrete and steel lining	m2		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.III.4.2.04	Sundries:								
1	Portland cement ASTM type I or II	t	10 629	5.16	54 845	252.60	2 684 833	257.76	2 739 677
2	Portland cement ASTM type V (sulfate resistant)	t	8 712	6.06	52 797	296.70	2 584 964	302.76	2 637 761
3	Care of water and miscellaneous works	%	3%		85 195		573 990		659 185
	Total No. C.III.4.2				2 925 032		19 707 000		22 632 032
C.III.4.3	Amount to be deducted (Outlet similar with MLO1)				2 232 972		18 089 942		20 322 914
	TOTAL AMOUNT OF SURFACE SPILLWAY				17 369 547		126 619 844		143 989 391

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
	TOTAL AMOUNT OF FLOOD MANAGMENT STRUCTURES				80 592 776		587 164 523		667 757 300
C.IV	TRANSPORTATION TUNNELS AND GALLERIES								
C.IV.1	TRANSPORTATION TUNNEL T-10 (access from dam d/s shoulder to left bank)								
C.IV.1.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.1.1.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	5 100.0	0.25	1 275	2.71	13 821	2.96	15 096
	2 Excavation, rock	m ³	10 100.0	1.46	14 746	5.61	56 661	7.07	71 407
	3 Overhauling in excess of 500 m, common material	m ³ /km	17 850.0	0.07	1 250	0.81	14 459	0.88	15 708
	4 Overhauling in excess of 500 m, rock	m ³ /km	35 350.0	0.09	3 174	1.03	36 517	1.12	39 691
	5 Rock bolts, 22 mm diameter	m	950.0	1.71	1 625	21.50	20 425	23.21	22 050
	6 Rock bolts, 26.5 mm diameter	m	510.0	2.62	1 336	27.27	13 908	29.89	15 244
	7 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
	8 Shotcrete	m ³	165.0	15.10	2 492	93.73	15 465	108.83	17 957
	9 Welded wire fabric	kg	6 080.0	0.50	3 040	1.93	11 734	2.43	14 774
C.IV.1.1.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³	502.0	5.10	2 560	29.54	14 829	34.64	17 389
	2 Concrete elevation	m ³	850.0	8.30	7 055	34.10	28 985	42.40	36 040
	3 Reinforcing steel	t	91.2	242.54	22 120	1 308.26	119 313	1 550.80	141 433
	4 Flat type Formworks	m ²	1 490.0	6.06	9 029	17.78	26 488	23.84	35 517
	5 Curved type Formworks	m ²		10.67		26.77		37.44	
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.1.1.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	506.9	5.16	2 616	252.60	128 040	257.76	130 656
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		2 170		15 019		17 189
	Total No. C.IV.1.1				74 486		515 665		590 151
C.IV.1.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 270 m								
C.IV.1.2.01	<u>Excavation and supports:</u>								
	1 Excavation								
	a) Rock Class I	m ³		5.14		25.65		30.79	
	b) Rock Class II	m ³	7 115.3	5.92	42 127	29.97	213 258	35.89	255 385
	c) Rock Class III	m ³	6 035.3	6.67	40 257	33.91	204 658	40.58	244 915
	d) Rock Class IV	m ³	6 268.2	7.15	44 814	36.60	229 411	43.75	274 225
	e) Rock Class V	m ³	5 209.4	8.01	41 731	42.58	221 839	50.60	263 571
	2 Grouted anchor bars, 22 mm diameter	m	2 118	1.49	3 155	13.63	28 864	15.12	32 019
	3 Grouted anchor bars, 26 mm diameter	m	1 800	1.58	2 844	15.28	27 504	16.86	30 348
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	1 218	1.71	2 082	24.13	29 382	25.84	31 464
	6 Rock bolts, 26.5 mm diameter	m	900	2.83	2 547	31.18	28 062	34.01	30 609
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	625	14.59	9 114	103.39	64 588	117.98	73 703
	9 Welded wire fabric	kg	15 533	0.58	9 009	2.16	33 551	2.74	42 560
	10 Steel ribs	kg	131 156	0.13	17 050	2.94	385 600	3.07	402 650
C.IV.1.2.02	<u>Concrete works:</u>								
	1 Concrete, arch and sidewalls	m ³	9 715	9.10	88 404	83.30	809 235	92.40	897 639
	2 Concrete, invert	m ³	2 430	7.70	18 711	55.70	135 351	63.40	154 062
	3 Reinforcing steel	t	662	325.47	215 385	1 359.52	899 682	1 684.99	1 115 067
C.IV.1.2.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	815	4.04	3 294	18.36	14 969	22.40	18 263
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 588	8.99	14 278	27.90	44 312	36.89	58 590
	3 Drain holes, 76 mm diameter	m	2 398	5.68	13 622	28.91	69 333	34.59	82 955
	4 Contact & consolidation cement grouting, excluding materials	t	86	42.60	3 654	124.85	10 708	167.45	14 361
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.IV.1.2.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	2 127	5.16	10 973	252.60	537 178	257.76	548 151

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
2	Portland cement ASTM type V (sulfate resistant)	t	2 127	6.06	12 887	296.70	630 960	302.76	643 848
3	Care of water and miscellaneous works	%	3%		17 878		138 553		156 432
	Total No. C.IV.1.2				613 817		4 756 998		5 370 815
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-10				688 303		5 272 663		5 960 966
C.IV.2	TRANSPORTATION TUNNEL T-18 (access to chamber of waterways penstocks shafts)								
C.IV.2.1	SURFACE WORKS - Inlet portal								
C.IV.2.1.01	<u>Excavation and supports:</u>								
1	Excavation, common	m ³	2 550.0	0.25	638	2.71	6 911	2.96	7 548
2	Excavation, rock	m ³	5 050.0	1.46	7 373	5.61	28 331	7.07	35 704
3	Overhauling in excess of 500 m, common material	m3/km	8 925.0	0.07	625	0.81	7 229	0.88	7 854
4	Overhauling in excess of 500 m, rock	m3/km	17 675.0	0.09	1 587	1.03	18 258	1.12	19 845
5	Rock bolts, 22 mm diameter	m	475.0	1.71	812	21.50	10 213	23.21	11 025
6	Rock bolts, 26.5 mm diameter	m	255.0	2.62	668	27.27	6 954	29.89	7 622
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	82.5	15.10	1 246	93.73	7 733	108.83	8 978
9	Welded wire fabric	kg	3 040.0	0.50	1 520	1.93	5 867	2.43	7 387
C.IV.2.1.02	<u>Concrete works:</u>								
1	Concrete, foundation and mat	m ³	251.0	5.10	1 280	29.54	7 415	34.64	8 695
2	Concrete elevation	m ³	425.0	8.30	3 528	34.10	14 493	42.40	18 020
3	Reinforcing steel	t	45.6	242.54	11 060	1 308.26	59 657	1 550.80	70 716
4	Flat type Formworks	m ²	745.0	6.06	4 515	17.78	13 244	23.84	17 759
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.2.1.03	<u>Sundries:</u>								
1	Portland cement, type I or II ASTM	t	253.4	5.16	1 308	252.60	64 020	257.76	65 328
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Care of water and miscellaneous works	%	3%		1 085		7 510		8 594
	Total No. C.IV.2.1				37 243		257 832		295 076
C.IV.2.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 710 m								
C.IV.2.2.01	<u>Excavation and supports:</u>								
1	Excavation								
a)	Rock Class I	m ³		5.14		25.65		30.79	
b)	Rock Class II	m ³	21 851.7	5.92	129 375	29.97	654 934	35.89	784 310
c)	Rock Class III	m ³	12 694.1	6.67	84 672	33.91	430 459	40.58	515 131
d)	Rock Class IV	m ³	19 762.4	7.15	141 289	36.60	723 285	43.75	864 574
e)	Rock Class V	m ³	10 274.6	8.01	82 308	42.58	437 539	50.60	519 847
2	Grouted anchor bars, 22 mm diameter	m	5 960	1.49	8 881	13.63	81 240	15.12	90 121
3	Grouted anchor bars, 26 mm diameter	m	5 110	1.58	8 074	15.28	78 084	16.86	86 158
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	3 401	1.71	5 815	24.13	82 060	25.84	87 876
6	Rock bolts, 26.5 mm diameter	m	2 551	2.83	7 218	31.18	79 527	34.01	86 745
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	1 583	14.59	23 093	103.39	163 646	117.98	186 739
9	Welded wire fabric	kg	40 900	0.58	23 722	2.16	88 343	2.74	112 065
10	Steel ribs	kg	258 675	0.13	33 628	2.94	760 505	3.07	794 133
C.IV.2.2.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	25 442	9.10	231 526	83.30	2 119 354	92.40	2 350 880
2	Concrete, invert	m ³	6 358	7.70	48 959	55.70	354 160	63.40	403 119
3	Reinforcing steel	t	1 696	325.47	551 952	1 359.52	2 305 555	1 684.99	2 857 507
C.IV.2.2.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	2 171	4.04	8 770	18.36	39 854	22.40	48 624
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 088	8.99	36 752	27.90	114 059	36.89	150 812
3	Drain holes, 76 mm diameter	m	6 304	5.68	35 807	28.91	182 251	34.59	218 058
4	Contact & consolidation cement grouting, excluding materials	t	222	42.60	9 440	124.85	27 666	167.45	37 106
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
C.IV.2.2.04	Sundries:								
1	Portland cement ASTM type I or II	t	5 555	5.16	28 664	252.60	1 403 205	257.76	1 431 869
2	Portland cement ASTM type V (sulfate resistant)	t	5 555	6.06	33 664	296.70	1 648 183	302.76	1 681 847
3	Care of water and miscellaneous works	%	3%		46 008		353 217		399 226
	Total No. C.IV.2.2				1 579 618		12 127 127		13 706 745
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-18				1 616 861		12 384 959		14 001 820
C.IV.3	TRANSPORTATION TUNNEL T-39 (access to dam d/s shoulder from right bank access road)								
C.IV.3.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.3.1.01	Excavation and supports:								
1	Excavation, common	m ³	5 100.0	0.25	1 275	2.71	13 821	2.96	15 096
2	Excavation, rock	m ³	10 100.0	1.46	14 746	5.61	56 661	7.07	71 407
3	Overhauling in excess of 500 m, common material	m ³ /km	17 850.0	0.07	1 250	0.81	14 459	0.88	15 708
4	Overhauling in excess of 500 m, rock	m ³ /km	35 350.0	0.09	3 174	1.03	36 517	1.12	39 691
5	Rock bolts, 22 mm diameter	m	950.0	1.71	1 625	21.50	20 425	23.21	22 050
6	Rock bolts, 26.5 mm diameter	m	510.0	2.62	1 336	27.27	13 908	29.89	15 244
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	165.0	15.10	2 492	93.73	15 465	108.83	17 957
9	Welded wire fabric	kg	6 080.0	0.50	3 040	1.93	11 734	2.43	14 774
C.IV.3.1.02	Concrete works:								
1	Concrete, foundation and mat	m ³	502.0	5.10	2 560	29.54	14 829	34.64	17 389
2	Concrete elevation	m ³	850.0	8.30	7 055	34.10	28 985	42.40	36 040
3	Reinforcing steel	t	91.2	242.54	22 120	1 308.26	119 313	1 550.80	141 433
4	Flat type Formworks	m ²	1 490.0	6.06	9 029	17.78	26 488	23.84	35 517
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.3.1.03	Sundries:								
1	Portland cement, type I or II ASTM	t	506.9	5.16	2 616	252.60	128 040	257.76	130 656
2	Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
3	Care of water and miscellaneous works	%	3%		2 170		15 019		17 189
	Total No. C.IV.3.1				74 486		515 665		590 151
C.IV.3.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 1865 m								
C.IV.3.2.01	Excavation and supports:								
1	Excavation								
a)	Rock Class I	m ³		5.14		25.65		30.79	
b)	Rock Class II	m ³	49 203	5.92	291 314	29.97	1 474 712	35.89	1 766 025
c)	Rock Class III	m ³	41 672	6.67	277 962	33.91	1 413 108	40.58	1 691 070
d)	Rock Class IV	m ³	60 567	7.15	433 015	36.60	2 216 678	43.75	2 649 693
e)	Rock Class V	m ³	17 988	8.01	144 094	42.58	765 989	50.60	910 083
2	Grouted anchor bars, 22 mm diameter	m	17 284	1.49	25 754	13.63	235 586	15.12	261 340
3	Grouted anchor bars, 26 mm diameter	m	14 818	1.58	23 413	15.28	226 420	16.86	249 833
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	9 886	1.71	16 904	24.13	238 538	25.84	255 442
6	Rock bolts, 26.5 mm diameter	m	7 389	2.83	20 910	31.18	230 378	34.01	251 288
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	4 291	14.59	62 599	103.39	443 597	117.98	506 195
9	Welded wire fabric	kg	109 454	0.58	63 483	2.16	236 421	2.74	299 904
10	Steel ribs	kg	452 971	0.13	58 886	2.94	1 331 734	3.07	1 390 620
C.IV.3.2.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	66 549	9.10	605 595	83.30	5 543 524	92.40	6 149 119
2	Concrete, invert	m ³	16 642	7.70	128 146	55.70	926 977	63.40	1 055 123
3	Reinforcing steel	t	4 433	325.47	1 442 873	1 359.52	6 027 020	1 684.99	7 469 892
C.IV.3.2.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	5 636	4.04	22 768	18.36	103 473	22.40	126 241
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	10 497	8.99	94 368	27.90	292 866	36.89	387 234
3	Drain holes, 76 mm diameter	m	16 551	5.68	94 007	28.91	478 478	34.59	572 485
4	Contact & consolidation cement grouting, excluding materials	t	571	42.60	24 312	124.85	71 253	167.45	95 565

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.IV.3.2.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	14 561	5.16	75 136	252.60	3 678 189	257.76	3 753 326
	2 Portland cement ASTM type V (sulfate resistant)	t	14 561	6.06	88 242	296.70	4 320 343	302.76	4 408 585
	3 Care of water and miscellaneous works	%	3%		119 813		907 659		1 027 472
	Total No. C.IV.3.2				4 113 594		31 162 942		35 276 536
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-39				4 188 080		31 678 607		35 866 687
C.IV.4	TRANSPORTATION TUNNEL T-22 (access to Stage 1 dam crest from left bank) - partly constructed								
C.IV.4.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.4.1.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	2 550.0	0.25	638	2.71	6 911	2.96	7 548
	2 Excavation, rock	m ³	5 050.0	1.46	7 373	5.61	28 331	7.07	35 704
	3 Overhauling in excess of 500 m, common material	m3/km	8 925.0	0.07	625	0.81	7 229	0.88	7 854
	4 Overhauling in excess of 500 m, rock	m3/km	17 675.0	0.09	1 587	1.03	18 258	1.12	19 845
	5 Rock bolts, 22 mm diameter	m	475.0	1.71	812	21.50	10 213	23.21	11 025
	6 Rock bolts, 26.5 mm diameter	m	255.0	2.62	668	27.27	6 954	29.89	7 622
	7 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
	8 Shotcrete	m ³	82.5	15.10	1 246	93.73	7 733	108.83	8 978
	9 Welded wire fabric	kg	3 040.0	0.50	1 520	1.93	5 867	2.43	7 387
C.IV.4.1.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³	502.0	5.10	2 560	29.54	14 829	34.64	17 389
	2 Concrete elevation	m ³	665.0	8.30	5 520	34.10	22 677	42.40	28 196
	3 Reinforcing steel	t	45.6	242.54	11 060	1 308.26	59 657	1 550.80	70 716
	4 Flat type Formworks	m ²	745.0	6.06	4 515	17.78	13 244	23.84	17 759
	5 Curved type Formworks	m ²		10.67		26.77		37.44	
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.4.1.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	410.6	5.16	2 119	252.60	103 709	257.76	105 827
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		1 207		9 168		10 376
	Total No. C.IV.4.1				41 448		314 778		356 227
C.IV.4.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped)								
C.IV.4.2.01	<u>Excavation and supports:</u>								
	1 Excavation	m ³	19 287.2	6.76	130 381	29.84	575 530	36.60	705 911
	2 Rock bolts, 26.5 mm diameter	m	1 664.6	2.83	4 711	31.18	51 903	34.01	56 614
	3 Steel ribs	kg	185 885.6	0.13	24 165	2.94	546 504	3.07	570 669
C.IV.4.2.02	<u>Concrete works:</u>								
	1 Concrete, arch and sidewalls	m ³	1 441.0	11.68	16 831	87.51	126 105	99.19	142 936
	2 Concrete, invert	m ³	1 080.7	6.06	6 549	42.99	46 459	49.05	53 008
	3 Reinforcing steel	t	129.9	325.47	42 278	1 359.52	176 601	1 684.99	218 880
C.IV.4.2.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grouting holes, holes, 40-48 mm diameter	m	220.5	4.04	891	18.36	4 048	22.40	4 939
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	1 959.0	5.32	10 422	22.59	44 254	27.91	54 676
	3 Contact and cons. grouting (excluding injected materials)	t	167.7	39.94	6 699	121.05	20 305	160.99	27 004
	4 Drain holes, 75 mm diameter	m	72.1	5.68	409	28.91	2 084	34.59	2 493
C.IV.4.2.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	538	5.16	2 775	252.60	135 843	257.76	138 618
	2 Portland cement ASTM type V (sulfate resistant)	t	538	6.06	3 259	296.70	159 560	302.76	162 819
	3 Care of water and miscellaneous works	%	3%		7 481		56 676		64 157
	Total No. C.IV.4.2				256 853		1 945 872		2 202 724
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-22				298 301		2 260 650		2 558 951
C.IV.5	TRANSPORTATION TUNNEL T-10A (Construction Tunnel)								

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
C.IV.5.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.5.1.01	<u>Excavation and supports:</u>								
	1 Excavation, common	m ³	5 100.0	0.25	1 275	2.71	13 821	2.96	15 096
	2 Excavation, rock	m ³	10 100.0	1.46	14 746	5.61	56 661	7.07	71 407
	3 Overhauling in excess of 500 m, common material	m ³ /km	17 850.0	0.07	1 250	0.81	14 459	0.88	15 708
	4 Overhauling in excess of 500 m, rock	m ³ /km	35 350.0	0.09	3 174	1.03	36 517	1.12	39 691
	5 Rock bolts, 22 mm diameter	m	950.0	1.71	1 625	21.50	20 425	23.21	22 050
	6 Rock bolts, 26.5 mm diameter	m	510.0	2.62	1 336	27.27	13 908	29.89	15 244
	7 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
	8 Shotcrete	m ³	165.0	15.10	2 492	93.73	15 465	108.83	17 957
	9 Welded wire fabric	kg	6 080.0	0.50	3 040	1.93	11 734	2.43	14 774
C.IV.5.1.02	<u>Concrete works:</u>								
	1 Concrete, foundation and mat	m ³		5.10		29.54		34.64	
	2 Concrete elevation	m ³	370.0	8.30	3 071	34.10	12 617	42.40	15 688
	3 Reinforcing steel	t	22.2	242.54	5 384	1 308.26	29 043	1 550.80	34 428
	4 Flat type Formworks	m ²	210.0	6.06	1 273	17.78	3 733	23.84	5 006
	5 Curved type Formworks	m ²		10.67		26.77		37.44	
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.5.1.03	<u>Sundries:</u>								
	1 Portland cement, type I or II ASTM	t	192.7	5.16	994	252.60	48 663	257.76	49 657
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		1 190		8 311		9 501
	Total No. C.IV.5.1				40 849		285 358		326 207
C.IV.5.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 200 m								
C.IV.5.2.01	<u>Excavation and supports:</u>								
	1 Excavation								
	a) Rock Class I	m ³		5.14		25.65		30.79	
	b) Rock Class II	m ³	4 620.8	5.92	27 358	29.97	138 494	35.89	165 852
	c) Rock Class III	m ³	3 919.5	6.67	26 144	33.91	132 909	40.58	159 053
	d) Rock Class IV	m ³	4 070.7	7.15	29 103	36.60	148 985	43.75	178 088
	e) Rock Class V	m ³	3 383.1	8.01	27 101	42.58	144 067	50.60	171 169
	2 Grouted anchor bars, 22 mm diameter	m	1 569	1.49	2 337	13.63	21 380	15.12	23 718
	3 Grouted anchor bars, 26 mm diameter	m	1 333	1.58	2 107	15.28	20 373	16.86	22 480
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	902	1.71	1 542	24.13	21 764	25.84	23 307
	6 Rock bolts, 26.5 mm diameter	m	667	2.83	1 887	31.18	20 787	34.01	22 673
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	463	14.59	6 751	103.39	47 843	117.98	54 595
	9 Welded wire fabric	kg	11 506	0.58	6 673	2.16	24 853	2.74	31 526
	10 Steel ribs	kg	97 153	0.13	12 630	2.94	285 630	3.07	298 260
C.IV.5.2.02	<u>Concrete works:</u>								
	1 Concrete, arch and sidewalls	m ³	5 397	9.10	49 113	83.30	449 575	92.40	498 688
	2 Concrete, invert	m ³	1 350	7.70	10 395	55.70	75 195	63.40	85 590
	3 Reinforcing steel	t	368	325.47	119 658	1 359.52	499 824	1 684.99	619 482
C.IV.5.2.03	<u>Drilling and grouting:</u>								
	1 Percussion contact grout holes, 40-48 mm diameter	m	453	4.04	1 830	18.36	8 316	22.40	10 146
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	882	8.99	7 932	27.90	24 618	36.89	32 550
	3 Drain holes, 76 mm diameter	m	1 332	5.68	7 568	28.91	38 518	34.59	46 086
	4 Contact & consolidation cement grouting, excluding materials	t	48	42.60	2 030	124.85	5 949	167.45	7 979
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.IV.5.2.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	1 207	5.16	6 231	252.60	305 007	257.76	311 238
	2 Portland cement ASTM type V (sulfate resistant)	t	1 207	6.06	7 317	296.70	358 257	302.76	365 574
	3 Care of water and miscellaneous works	%	3%		10 671		83 170		93 842
	Total No. C.IV.5.2				366 379		2 855 514		3 221 893
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-10A					407 228		3 140 872	
									3 548 100

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
C.IV.6	TRANSPORTATION TUNNEL T-3a (Construction Tunnel)								
C.IV.6.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.6.1.01	Excavation and supports:								
	1 Excavation, common	m ³	6 800.0	0.25	1 700	2.71	18 428	2.96	20 128
	2 Excavation, rock	m ³	13 466.7	1.46	19 661	5.61	75 548	7.07	95 209
	3 Overhauling in excess of 500 m, common material	m3/km	23 800.0	0.07	1 666	0.81	19 278	0.88	20 944
	4 Overhauling in excess of 500 m, rock	m3/km	47 133.3	0.09	4 233	1.03	48 689	1.12	52 921
	5 Rock bolts, 22 mm diameter	m	1 266.7	1.71	2 166	21.50	27 233	23.21	29 399
	6 Rock bolts, 26.5 mm diameter	m	680.0	2.62	1 782	27.27	18 544	29.89	20 325
	7 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
	8 Shotcrete	m ³	220.0	15.10	3 322	93.73	20 621	108.83	23 943
	9 Welded wire fabric	kg	8 106.7	0.50	4 053	1.93	15 646	2.43	19 699
C.IV.6.1.02	Concrete works:								
	1 Concrete, foundation and mat	m ³		5.10		29.54		34.64	
	2 Concrete elevation	m ³	493.3	8.30	4 095	34.10	16 823	42.40	20 917
	3 Reinforcing steel	t	29.6	242.54	7 179	1 308.26	38 724	1 550.80	45 904
	4 Flat type Formworks	m ²	280.0	6.06	1 697	17.78	4 978	23.84	6 674
	5 Curved type Formworks	m ²		10.67		26.77		37.44	
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.6.1.03	Sundries:								
	1 Portland cement, type I or II ASTM	t	256.9	5.16	1 325	252.60	64 885	257.76	66 210
	2 Portland cement, type V ASTM (sulfate resistant)	t		6.06		296.70		302.76	
	3 Care of water and miscellaneous works	%	3%		1 586		11 082		12 668
	Total No. C.IV.6.1				54 465		380 477		434 943
C.IV.6.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 450 m								
C.IV.6.2.01	Excavation and supports:								
	1 Excavation								
	a) Rock Class I	m ³		5.14		25.65		30.79	
	b) Rock Class II	m ³	17 950.0	5.92	106 275	29.97	537 993	35.89	644 268
	c) Rock Class III	m ³	18 190.0	6.67	121 331	33.91	616 827	40.58	738 158
	d) Rock Class IV	m ³	18 760.0	7.15	134 123	36.60	686 597	43.75	820 720
	e) Rock Class V	m ³	6 355.0	8.01	50 908	42.58	270 623	50.60	321 532
	2 Grouted anchor bars, 22 mm diameter	m	6 588	1.49	9 816	13.63	89 791	15.12	99 606
	3 Grouted anchor bars, 26 mm diameter	m	5 600	1.58	8 847	15.28	85 561	16.86	94 409
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	3 788	1.71	6 477	24.13	91 403	25.84	97 880
	6 Rock bolts, 26.5 mm diameter	m	2 800	2.83	7 923	31.18	87 297	34.01	95 221
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	1 240	14.59	18 092	103.39	128 204	117.98	146 295
	9 Welded wire fabric	kg	32 100	0.58	18 618	2.16	69 336	2.74	87 954
	10 Steel ribs	kg	132 165	0.13	17 181	2.94	388 565	3.07	405 747
C.IV.6.2.02	Concrete works:								
	1 Concrete, arch and sidewalls	m ³	16 274	9.10	148 089	83.30	1 355 583	92.40	1 503 671
	2 Concrete, invert	m ³	4 070	7.70	31 341	55.70	226 713	63.40	258 054
	3 Reinforcing steel	t	815	325.47	265 258	1 359.52	1 684 009	1 684.99	1 373 267
C.IV.6.2.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m	1 300	4.04	5 252	18.36	23 868	22.40	29 120
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	2 400	8.99	21 576	27.90	66 960	36.89	88 536
	3 Drain holes, 76 mm diameter	m	3 800	5.68	21 584	28.91	109 858	34.59	131 442
	4 Contact & consolidation cement grouting, excluding materials	t	100	42.60	4 260	124.85	12 485	167.45	16 745
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.IV.6.2.04	Sundries:								
	1 Portland cement ASTM type I or II	t	3 584	5.16	18 493	252.60	905 318	257.76	923 812
	2 Portland cement ASTM type V (sulfate resistant)	t	3 584	6.06	21 719	296.70	1 063 373	302.76	1 085 092
	3 Care of water and miscellaneous works	%	3%		31 115		237 731		268 846
	Total No. C.IV.6.2				1 068 279		8 162 094		9 230 374

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-3a				1 122 744		8 542 572		9 665 316
C.IV.7	TRANSPORTATION TUNNEL T-50 (access to power intakes yard from dam crest)								
C.IV.7.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.7.1.01	<u>Excavation and supports:</u>								
1	Excavation, common	m ³	5 100.0	0.25	1 275	2.71	13 821	2.96	15 096
2	Excavation, rock	m ³	10 100.0	1.46	14 746	5.61	56 661	7.07	71 407
3	Overhauling in excess of 500 m, common material	m ³ /km	17 850.0	0.07	1 250	0.81	14 459	0.88	15 708
4	Overhauling in excess of 500 m, rock	m ³ /km	35 350.0	0.09	3 174	1.03	36 517	1.12	39 691
5	Rock bolts, 22 mm diameter	m	950.0	1.71	1 625	21.50	20 425	23.21	22 050
6	Rock bolts, 26.5 mm diameter	m	510.0	2.62	1 336	27.27	13 908	29.89	15 244
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	165.0	15.10	2 492	93.73	15 465	108.83	17 957
9	Welded wire fabric	kg	6 080.0	0.50	3 040	1.93	11 734	2.43	14 774
C.IV.7.1.02	<u>Concrete works:</u>								
1	Concrete, foundation and mat	m ³	502.0	5.10	2 560	29.54	14 829	34.64	17 389
2	Concrete elevation	m ³	850.0	8.30	7 055	34.10	28 985	42.40	36 040
3	Reinforcing steel	t	91.2	242.54	22 120	1 308.26	119 313	1 550.80	141 433
4	Flat type Formworks	m ²	1 490.0	6.06	9 029	17.78	26 488	23.84	35 517
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.7.1.03	<u>Sundries:</u>								
1	Portland cement, type I or II ASTM	t	253.4	5.16	1 308	252.60	64 020	257.76	65 328
2	Portland cement, type V ASTM (sulfate resistant)	t	253.4	6.06	1 536	296.70	75 197	302.76	76 733
3	Care of water and miscellaneous works	%	3%		2 176		15 355		17 531
	Total No. C.IV.7.1				74 721		527 177		601 898
C.IV.7.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 340 m								
C.IV.7.2.01	<u>Excavation and supports:</u>								
1	Excavation								
a)	Rock Class I	m ³		5.14		25.65		30.79	
b)	Rock Class II	m ³	7 480.0	5.92	44 286	29.97	224 189	35.89	268 475
c)	Rock Class III	m ³	6 076.1	6.67	40 529	33.91	206 043	40.58	246 572
d)	Rock Class IV	m ³	9 465.2	7.15	67 670	36.60	346 415	43.75	414 086
e)	Rock Class V	m ³	8 203.9	8.01	65 719	42.58	349 356	50.60	415 076
2	Grouted anchor bars, 22 mm diameter	m	2 742	1.49	4 085	13.63	37 373	15.12	41 458
3	Grouted anchor bars, 26 mm diameter	m	2 347	1.58	3 708	15.28	35 864	16.86	39 572
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	1 568	1.71	2 682	24.13	37 845	25.84	40 527
6	Rock bolts, 26.5 mm diameter	m	1 174	2.83	3 321	31.18	36 591	34.01	39 912
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	834	14.59	12 161	103.39	86 181	117.98	98 342
9	Welded wire fabric	kg	19 577	0.58	11 355	2.16	42 287	2.74	53 642
10	Steel ribs	kg	206 468	0.13	26 841	2.94	607 015	3.07	633 856
C.IV.7.2.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	12 437	9.10	113 181	83.30	1 036 037	92.40	1 149 218
2	Concrete, invert	m ³	3 115	7.70	23 984	55.70	173 497	63.40	197 481
3	Reinforcing steel	t	877	325.47	285 574	1 359.52	1 192 869	1 684.99	1 478 443
C.IV.7.2.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 031	4.04	4 165	18.36	18 929	22.40	23 094
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	2 457	8.99	22 086	27.90	68 544	36.89	90 630
3	Drain holes, 76 mm diameter	m	3 016	5.68	17 132	28.91	87 196	34.59	104 328
4	Contact & consolidation cement grouting, excluding materials	t	126	42.60	5 373	124.85	15 747	167.45	21 120
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.IV.7.2.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	2 739	5.16	14 133	252.60	691 865	257.76	705 998
2	Portland cement ASTM type V (sulfate resistant)	t	2 739	6.06	16 598	296.70	812 654	302.76	829 252
3	Care of water and miscellaneous works	%	3%		23 538		183 195		206 732

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	Total No. C.IV.7.2				808 122		6 289 691		7 097 813
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-50				882 844		6 816 868		7 699 712
C.IV.8	TRANSPORTATION TUNNEL T-2 (access to DT Gates Chambers, Saline Gallery and Dam Curtain Gallery)								
C.IV.8.1	PERMANENT LINING ACTIVITIES								
C.IV.8.1.01	Excavation and supports								
1	Excavation	m ³		8.42		43.85		52.27	
C.IV.8.1.02	Concrete works								
1	Concrete, arch and sidewalls	m ³	10 583.0	10.19	107 841	89.32	945 274	99.51	1 053 114
2	Concrete, invert	m ³	5 905.0	6.39	37 733	41.51	245 117	47.90	282 850
3	Reinforcing steel	t	659.5	325.47	214 647	1 359.52	896 603	1 684.99	1 111 251
C.IV.8.1.03	Drilling and grouting								
1	Percussion contact grouting holes, holes, 40-48 mm diameter	m	3 000.0	4.04	12 120	18.36	55 080	22.40	67 200
2	Contact pressure grouting (excluding injected materials)	t	100.0	39.94	3 994	121.05	12 105	160.99	16 099
C.IV.8.1.04	Sundries								
1	Portland cement ASTM type I or II	t	3 017.8	5.16	15 572	252.60	762 306	257.76	777 878
2	Portland cement ASTM type V (sulfate resistant)	t	3 017.8	6.06	18 288	296.70	895 393	302.76	913 681
3	Care of water and miscellaneous works	%	3.0%		12 306		114 356		126 662
	Total No. C.IV.8.1				422 501		3 926 234		4 348 736
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-2				422 501		3 926 234		4 348 736
C.IV.9	TRANSPORTATION TUNNEL T-8 (access to DT Gates Chambers from Tunnel T-8)								
C.IV.9.1	PERMANENT LINING ACTIVITIES								
C.IV.9.01	Excavation and supports								
1	Excavation	m ³		7.67		33.65		41.32	
C.IV.9.02	Concrete works								
1	Concrete, arch and sidewalls	m ³	2 843.9	10.43	29 662	84.40	240 027	94.83	269 690
2	Concrete, invert	m ³	1 044.1	8.90	9 292	56.53	59 023	65.43	68 315
3	Reinforcing steel	t	242.4	325.47	78 899	1 359.52	329 569	1 684.99	408 468
C.IV.9.03	Drilling and grouting								
1	Percussion contact grouting holes, holes, 40-48 mm diameter	m	1 000.0	4.04	4 040	18.36	18 360	22.40	22 400
2	Contact pressure grouting (excluding injected materials)	t	35.0	39.94	1 398	121.05	4 237	160.99	5 635
C.IV.9.04	Sundries								
1	Portland cement ASTM type I or II	t	699.8	5.16	3 611	252.60	176 781	257.76	180 392
2	Portland cement ASTM type V (sulfate resistant)	t	699.8	6.06	4 241	296.70	207 644	302.76	211 885
3	Care of water and miscellaneous works	%	3.0%		3 934		31 069		35 004
	Total No. C.IV.9.1				135 078		1 066 710		1 201 788
	TOTAL AMOUNT OF TRANSPORTATION TUNNEL T-8				135 078		1 066 710		1 201 788
C.IV.10	CONVEYOR BELT TUNNEL N. 3								
C.IV.10.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.10.1.01	Excavation and supports:								
1	Excavation, common	m ³	4 050.0	0.25	1 013	2.71	10 976	2.96	11 988
2	Excavation, rock	m ³	8 100.0	1.46	11 826	5.61	45 441	7.07	57 267
3	Overhauling in excess of 500 m, common material	m ³ /km	14 175.0	0.07	992	0.81	11 482	0.88	12 474
4	Overhauling in excess of 500 m, rock	m ³ /km	28 350.0	0.09	2 546	1.03	29 286	1.12	31 831
5	Rock bolts, 22 mm diameter	m	760.0	1.71	1 300	21.50	16 340	23.21	17 640
6	Rock bolts, 26.5 mm diameter	m	410.0	2.62	1 074	27.27	11 181	29.89	12 255
7	Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
8	Shotcrete	m ³	130.0	15.10	1 963	93.73	12 185	108.83	14 148
9	Welded wire fabric	kg	4 850.0	0.50	2 425	1.93	9 361	2.43	11 786
C.IV.10.1.02	Concrete works:								
1	Concrete, foundation and mat	m ³	400.0	5.10	2 040	29.54	11 816	34.64	13 856
2	Concrete elevation	m ³	775.0	8.30	6 433	34.10	26 428	42.40	32 860
3	Reinforcing steel	t	90.0	242.54	21 829	1 308.26	117 743	1 550.80	139 572

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	4 Flat type Formworks	m ²	1 235.0	6.06	7 484	17.78	21 955	23.84	29 439
	5 Curved type Formworks	m ²		10.67		26.77		37.44	
	6 Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
	7 Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.10.1.03	Sundries:								
	1 Portland cement, type I or II ASTM	t	217.3	5.16	1 121	252.60	54 877	257.76	55 998
	2 Portland cement, type V ASTM (sulfate resistant)	t	217.3	6.06	1 317	296.70	64 458	302.76	65 775
	3 Care of water and miscellaneous works	%	3%		1 901		13 306		15 207
	Total No. C.IV.10.1				65 262		456 833		522 095
C.IV.10.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 1100 m								
C.IV.10.2.01	Excavation and supports:								
	1 Excavation								
	a) Rock Class I	m ³		5.14		25.65		30.79	
	b) Rock Class II	m ³	21 445.0	5.92	126 967	29.97	642 744	35.89	769 711
	c) Rock Class III	m ³	25 610.0	6.67	170 824	33.91	868 440	40.58	1 039 265
	d) Rock Class IV	m ³	18 590.0	7.15	132 907	36.60	680 375	43.75	813 283
	e) Rock Class V	m ³	7 660.0	8.01	61 362	42.58	326 196	50.60	387 558
	2 Grouted anchor bars, 22 mm diameter	m	12 500	1.49	18 625	13.63	170 375	15.12	189 000
	3 Grouted anchor bars, 26 mm diameter	m	7 500	1.58	11 850	15.28	114 600	16.86	126 450
	4 Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
	5 Rock bolts, 22 mm diameter	m	4 250	1.71	7 268	24.13	102 553	25.84	109 820
	6 Rock bolts, 26.5 mm diameter	m	2 250	2.83	6 368	31.18	70 155	34.01	76 523
	7 Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
	8 Shotcrete	m ³	2 870	14.59	41 873	103.39	296 729	117.98	338 603
	9 Welded wire fabric	kg	103 450	0.58	60 001	2.16	223 452	2.74	283 453
	10 Steel ribs	kg	226 770	0.13	29 480	2.94	666 704	3.07	696 184
C.IV.10.2.02	Concrete works:								
	1 Concrete, invert	m ³	3 310	7.70	25 487	55.70	184 367	63.40	209 854
	2 Reinforcing steel	t	268	325.47	87 226	1 359.52	364 351	1 684.99	451 577
C.IV.10.2.03	Drilling and grouting:								
	1 Percussion contact grout holes, 40-48 mm diameter	m		4.04		18.36		22.40	
	2 Rotary consolidation grout holes, 40-48 mm min. diameter	m	4 720	8.99	42 433	27.90	131 688	36.89	174 121
	3 Drain holes, 76 mm diameter	m	9 850	5.68	55 948	28.91	284 764	34.59	340 712
	4 Contact & consolidation cement grouting, excluding materials	t	270	42.60	11 502	124.85	33 710	167.45	45 212
	5 Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
	6 Bentonite	t		8.93		437.33		446.26	
C.IV.10.2.04	Sundries:								
	1 Portland cement ASTM type I or II	t	1 310	5.16	6 761	252.60	330 994	257.76	337 756
	2 Portland cement ASTM type V (sulfate resistant)	t	1 310	6.06	7 941	296.70	388 781	302.76	396 722
	3 Care of water and miscellaneous works	%	3%		27 145		176 429		203 574
	Total No. C.IV.10.2				931 968		6 057 408		6 989 376
	TOTAL AMOUNT OF CONVEYOR BELT TUNNEL N. 3				997 230		6 514 240		7 511 471
C.IV.11	CONVEYOR BELT TUNNEL N. 4								
C.IV.11.1	SURFACE WORKS - Upstream and downstream portals								
C.IV.11.1.01	Excavation and supports:								
	1 Excavation, common	m ³	4 050.0	0.25	1 013	2.71	10 976	2.96	11 988
	2 Excavation, rock	m ³	8 100.0	1.46	11 826	5.61	45 441	7.07	57 267
	3 Overhauling in excess of 500 m, common material	m ³ /km	14 175.0	0.07	992	0.81	11 482	0.88	12 474
	4 Overhauling in excess of 500 m, rock	m ³ /km	28 350.0	0.09	2 546	1.03	29 286	1.12	31 831
	5 Rock bolts, 22 mm diameter	m	760.0	1.71	1 300	21.50	16 340	23.21	17 640
	6 Rock bolts, 26.5 mm diameter	m	410.0	2.62	1 074	27.27	11 181	29.89	12 255
	7 Rock bolts, 32 mm diameter	m		2.81		35.42		38.23	
	8 Shotcrete	m ³	130.0	15.10	1 963	93.73	12 185	108.83	14 148
	9 Welded wire fabric	kg	4 850.0	0.50	2 425	1.93	9 361	2.43	11 786
C.IV.11.1.02	Concrete works:								
	1 Concrete, foundation and mat	m ³	400.0	5.10	2 040	29.54	11 816	34.64	13 856
	2 Concrete elevation	m ³	775.0	8.30	6 433	34.10	26 428	42.40	32 860

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
3	Reinforcing steel	t	90.0	242.54	21 829	1 308.26	117 743	1 550.80	139 572
4	Flat type Formworks	m ²	1 235.0	6.06	7 484	17.78	21 955	23.84	29 439
5	Curved type Formworks	m ²		10.67		26.77		37.44	
6	Scaffolding for slab formworks, 20 KN/m ² max. load	m ³		2.98		4.57		7.55	
7	Scaffolding for slab formworks, 50 KN/m ² max. load	m ³		3.56		7.61		11.17	
C.IV.11.1.03	Sundries:								
1	Portland cement, type I or II ASTM	t	217.3	5.16	1 121	252.60	54 877	257.76	55 998
2	Portland cement, type V ASTM (sulfate resistant)	t	217.3	6.06	1 317	296.70	64 458	302.76	65 775
3	Care of water and miscellaneous works	%	3%		1 901		13 306		15 207
	Total No. C.IV.11.1				65 262		456 833		522 095
C.IV.11.2	UNDERGROUND WORKS - Tunnel Stretch (D-shaped) - 700 m								
C.IV.11.2.01	Excavation and supports:								
1	Excavation								
	a) Rock Class I	m ³		5.14		25.65		30.79	
	b) Rock Class II	m ³	13 646.8	5.92	80 797	29.97	409 019	35.89	489 816
	c) Rock Class III	m ³	16 297.3	6.67	108 706	33.91	552 644	40.58	661 350
	d) Rock Class IV	m ³	11 830.0	7.15	84 577	36.60	432 966	43.75	517 543
	e) Rock Class V	m ³	4 874.5	8.01	39 049	42.58	207 579	50.60	246 628
2	Grouted anchor bars, 22 mm diameter	m	7 955	1.49	11 852	13.63	108 420	15.12	120 273
3	Grouted anchor bars, 26 mm diameter	m	4 773	1.58	7 541	15.28	72 927	16.86	80 468
4	Grouted anchor bars, 32 mm diameter	m		1.62		17.76		19.38	
5	Rock bolts, 22 mm diameter	m	2 705	1.71	4 625	24.13	65 261	25.84	69 885
6	Rock bolts, 26.5 mm diameter	m	1 432	2.83	4 052	31.18	44 644	34.01	48 696
7	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
8	Shotcrete	m ³	1 826	14.59	26 647	103.39	188 828	117.98	215 474
9	Welded wire fabric	kg	65 832	0.58	38 182	2.16	142 197	2.74	180 379
10	Steel ribs	kg	144 308	0.13	18 760	2.94	424 266	3.07	443 026
C.IV.11.2.02	Concrete works:								
1	Concrete, invert	m ³	2 106	7.70	16 219	55.70	117 324	63.40	133 543
2	Reinforcing steel	t	171	325.47	55 507	1 359.52	231 860	1 684.99	287 367
C.IV.11.2.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m		4.04		18.36		22.40	
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	3 004	8.99	27 003	27.90	83 801	36.89	110 804
3	Drain holes, 76 mm diameter	m	6 268	5.68	35 603	28.91	181 213	34.59	216 816
4	Contact & consolidation cement grouting, excluding materials	t	172	42.60	7 319	124.85	21 452	167.45	28 771
5	Cement grouting between concrete and steel lining	m ²		2.85		8.55		11.40	
6	Bentonite	t		8.93		437.33		446.26	
C.IV.11.2.04	Sundries:								
1	Portland cement ASTM type I or II	t	834	5.16	4 303	252.60	210 633	257.76	214 936
2	Portland cement ASTM type V (sulfate resistant)	t	834	6.06	5 053	296.70	247 406	302.76	252 459
3	Care of water and miscellaneous works	%	3%		17 274		112 273		129 547
	Total No. C.IV.11.2				593 071		3 854 714		4 447 785
	TOTAL AMOUNT OF CONVEYOR BELT TUNNEL N. 4				658 333		4 311 547		4 969 879
C.IV.12	ACCESS ADIT P37 (to powerhouse draft tubes and drainage gallery - 2nd stretch) - 114 m								
C.IV.12.01	Excavation and supports:								
1	Excavation	m3	8 977.2	8.25	74 062	37.94	340 595	46.19	414 657
2	Rock bolts, 22 mm diameter	m	7 703.0	1.71	13 172	24.13	185 873	25.84	199 045
3	Rock bolts, 26.5 mm diameter	m	750.0	2.83	2 123	31.18	23 385	34.01	25 508
4	Rock bolts, 32 mm diameter	m		3.02		39.12		42.14	
5	Shotcrete	m ³	210	14.59	3 064	103.39	21 712	117.98	24 776
6	Welded wire fabric	kg	7 020	0.58	4 072	2.16	15 163	2.74	19 235
7	Steel ribs	kg		0.13		2.94		3.07	
C.IV.12.02	Concrete works:								
1	Concrete, arch and sidewalls	m3	854.7	11.39	9 735	89.06	76 116	100.45	85 851
2	Concrete, lean and backfill	m3	8 000.0	6.35	50 800	34.33	274 640	40.68	325 440
3	Concrete, invert and mat	m3	228.6	10.71	2 448	60.91	13 921	71.62	16 369
4	Reinforcing steel	t	43.3	325.47	14 103	1 359.52	58 911	1 684.99	73 014

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
C.IV.12.03	<u>Drilling and grouting:</u>								
1	Drain holes, 50-76 mm diameter	m		5.68		28.91		34.59	
2	Percussion contact grout holes, 40-48 mm diameter	m	285.0	4.04	1 151	18.36	5 233	22.40	6 384
3	Contact & consolidation cement grouting, excluding materials	t	5.0	42.60	215	124.85	629	167.45	844
C.IV.12.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	1 639	5.16	8 459	252.60	414 095	257.76	422 554
2	Portland cement ASTM type V (sulfate resistant)	t	1 639	6.06	9 934	296.70	486 390	302.76	496 324
3	Care of water and miscellaneous works	%	3%		5 800		57 500		63 300
	Total No. C.IV.12				199 137		1 974 163		2 173 301
	TOTAL AMOUNT OF ACCESS ADIT P37				199 137		1 974 163		2 173 301
C.IV.13	PROVISIONAL SUM FOR TUNNELS PLUGGING				500 000		4 500 000		5 000 000
C.IV.14	REMEDIAL WORKS - TRANSPORTATION TUNNELS AND GALLERIES								
C.IV.14.1	ACCESS TUNNEL T-4 - REMEDIAL WORKS								
C.IV.14.1.01	<u>Excavation and supports:</u>								
1	Grouted anchor bars, 26 mm diameter	m	15 880	1.58	25 090	15.28	242 646	16.86	267 737
C.IV.14.1.02	<u>Concrete works:</u>								
1	Concrete, arch and sidewalls	m ³	10 075	9.10	91 683	83.30	839 248	92.40	930 930
2	Concrete, invert	m ³	3 820	7.70	29 414	55.70	212 774	63.40	242 188
3	Reinforcing steel	t	1 045	325.47	340 116	1 359.52	1 420 698	1 684.99	1 760 815
4	Lattice Girders Ribs	kg		0.68		2.82		3.50	
C.IV.14.1.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 945	4.04	7 858	18.36	35 710	22.40	43 568
2	Drain holes, 76 mm diameter	m	11 120	5.68	63 162	28.91	321 479	34.59	384 641
3	Contact & consolidation cement grouting, excluding materials	t	62	42.60	2 641	124.85	7 741	167.45	10 382
C.IV.14.1.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	2 705	5.16	13 959	252.60	683 346	257.76	697 305
2	Portland cement ASTM type V (sulfate resistant)	t	2 220	6.06	13 453	296.70	658 674	302.76	672 127
3	Care of water and miscellaneous works	%	3%		17 621		132 669		150 291
	Total N° C.IV.14.1				604 997		4 554 986		5 159 983
C.IV.14.2	Access Tunnel T- 4 Fault 35 Crossing Stretch - 80 m								
C.IV.14.2.01	<u>Excavation and supports:</u>								
1	Rock Excavation	m ³	2 955	32.00	94 560	128.00	378 240	160.00	472 800
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m	1 000	1.58	1 580	15.28	15 280	16.86	16 860
4	Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
5	Rock bolts, 26.5 mm diameter	m	945	2.83	2 674	31.18	29 465	34.01	32 139
6	Shotcrete	m ³	305	14.59	4 450	103.39	31 534	117.98	35 984
7	Welded wire fabric	kg	5 990	0.58	3 474	2.16	12 938	2.74	16 413
8	Steel ribs	kg	98 145	0.13	12 759	2.94	288 546	3.07	301 305
C.IV.14.2.02	<u>Concrete works:</u>								
1	Concrete	m ³	4 350	9.01	39 186	60.32	262 378	69.33	301 564
2	Reinforcing steel	t	310	325.47	100 896	1 359.52	421 451	1 684.99	522 347
C.IV.14.2.03	<u>Drilling and grouting:</u>								
1	Percussion contact grout holes, 40-48 mm diameter	m	465	4.04	1 879	18.36	8 537	22.40	10 416
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	2 555	5.32	13 593	22.59	57 717	27.91	71 310
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	198	42.60	8 435	124.85	24 720	167.45	33 155
5	Bentonite	t		8.93		437.33		446.26	
C.IV.14.2.04	<u>Sundries:</u>								
1	Portland cement ASTM type I or II	t	951	5.16	4 905	252.60	240 128	257.76	245 033
2	Portland cement ASTM type V (sulfate resistant)	t	951	6.06	5 761	296.70	282 050	302.76	287 811
3	Demolition of existing Concrete Lining	m ³	1 700	45.04	76 568	301.58	512 686	346.62	589 254
4	Care of water and miscellaneous works	%	5%		18 536		128 284		146 820
	Total N° C.IV.14.2				389 255		2 693 956		3 083 211

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ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
C.IV.14.3	ACCESS TUNNEL T-3' - REMEDIAL WORKS								
C.IV.14.3.01	Excavation and supports:								
1	Grouted anchor bars, 26 mm diameter	m	14 840	1.58	23 447	15.28	226 755	16.86	250 202
C.IV.14.3.02	Concrete works:								
1	Concrete, arch and sidewalls	m ³	7 940	9.10	72 254	83.30	661 402	92.40	733 656
2	Concrete, invert	m ³	3 015	7.70	23 216	55.70	167 936	63.40	191 151
3	Reinforcing steel	t	830	325.47	270 140	1 359.52	1 128 402	1 684.99	1 398 542
4	Lattice Girders Ribs	kg		0.68		2.82		3.50	
C.IV.14.3.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	1 650	4.04	6 666	18.36	30 294	22.40	36 960
2	Drain holes, 76 mm diameter	m	11 790	5.68	66 967	28.91	340 849	34.59	407 816
3	Contact & consolidation cement grouting, excluding materials	t	52	42.60	2 215	124.85	6 492	167.45	8 707
C.IV.14.3.04	Sundries:								
1	Portland cement ASTM type I or II	t	2 136	5.16	11 023	252.60	539 617	257.76	550 640
2	Portland cement ASTM type V (sulfate resistant)	t	1 750	6.06	10 605	296.70	519 225	302.76	529 830
3	Care of water and miscellaneous works	%	3%		14 596		108 629		123 225
	Total N° C.IV.14.3				501 129		3 729 600		4 230 730
C.IV.14.4	Access Tunnel T-3' Fault 35 Crossing Stretch - 80 m								
C.IV.14.4.01	Excavation and supports:								
1	Rock Excavation	m ³	2 725	32.00	87 200	128.00	348 800	160.00	436 000
2	Grouted anchor bars, 22 mm diameter	m		1.49		13.63		15.12	
3	Grouted anchor bars, 26 mm diameter	m	850	1.58	1 343	15.28	12 988	16.86	14 331
4	Rock bolts, 22 mm diameter	m		1.71		24.13		25.84	
5	Rock bolts, 26.5 mm diameter	m	722	2.83	2 043	31.18	22 512	34.01	24 555
6	Shotcrete	m ³	246	14.59	3 589	103.39	25 434	117.98	29 023
7	Welded wire fabric	kg	4 850	0.58	2 813	2.16	10 476	2.74	13 289
8	Steel ribs	kg	76 565	0.13	9 953	2.94	225 101	3.07	235 055
C.IV.14.4.02	Concrete works:								
1	Concrete	m ³	3 785	9.01	34 097	60.32	228 299	69.33	262 395
2	Reinforcing steel	t	265	325.47	86 250	1 359.52	360 273	1 684.99	446 522
C.IV.14.4.03	Drilling and grouting:								
1	Percussion contact grout holes, 40-48 mm diameter	m	460	4.04	1 858	18.36	8 446	22.40	10 304
2	Rotary consolidation grout holes, 40-48 mm min. diameter	m	2 580	5.32	13 726	22.59	58 282	27.91	72 008
3	Drain holes, 76 mm diameter	m		5.68		28.91		34.59	
4	Contact & consolidation cement grouting, excluding materials	t	200	42.60	8 520	124.85	24 970	167.45	33 490
5	Bentonite	t		8.93		437.33		446.26	
C.IV.14.4.04	Sundries:								
1	Portland cement ASTM type I or II	t	837	5.16	4 317	252.60	211 338	257.76	215 655
2	Portland cement ASTM type V (sulfate resistant)	t	837	6.06	5 070	296.70	248 234	302.76	253 304
3	Demolition of existing Concrete Lining	m ³	1 305	45.04	58 777	301.58	393 562	346.62	452 339
4	Care of water and miscellaneous works	%	5%		15 978		108 936		124 914
	Total N° C.IV.14.4				335 534		2 287 650		2 623 184
C.IV.14.5	CABLES GALLERIES - REMEDIAL WORKS								
C.IV.14.5.01	Excavation and supports:								
1	Grouted anchor bars, 26 mm diameter	m	17 980	1.58	28 408	15.28	274 734	16.86	303 143
2	Shotcrete	m ³	2 500	15.10	37 750	93.73	234 325	108.83	272 075
3	Welded wire fabric	kg	111 000	0.50	55 500	1.93	214 230	2.43	269 730
C.IV.14.5.03	Drilling and grouting:								
1	Drain holes, 76 mm diameter	m	24 000	5.68	136 320	28.91	693 840	34.59	830 160
2	Contact & consolidation cement grouting, excluding materials	t		42.60		124.85		167.45	
C.IV.14.5.04	Sundries:								
1	Portland cement ASTM type I or II	t	615	5.16	3 173	252.60	155 349	257.76	158 522
2	Portland cement ASTM type V (sulfate resistant)	t	510	6.06	3 091	296.70	151 317	302.76	154 408
3	Care of water and miscellaneous works	%	3%		7 927		51 714		59 641
	Total N° C.IV.14.5				272 170		1 775 509		2 047 679
C.IV.14.6	POWERHOUSE DRAINAGE GALLERIES - REMEDIAL WORKS (738 + 447+ 395 m)								
C.IV.14.6.01	Excavation and supports:								
1	Grouted anchor bars, 26 mm diameter	m	13 275	1.58	20 975	15.28	202 842	16.86	223 817

DAM 1290

ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
				(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	2 Shotcrete	m ³	1 865	15.10	28 162	93.73	174 806	108.83	202 968
	3 Welded wire fabric	kg	82 860	0.50	41 430	1.93	159 920	2.43	201 350
C.IV.14.6.03	<u>Drilling and grouting:</u>								
	1 Drain holes, 76 mm diameter	m	18 660	5.68	105 989	28.91	539 461	34.59	645 449
	2 Contact & consolidation cement grouting, excluding materials	t		42.60		124.85		167.45	
C.IV.14.6.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	459	5.16	2 370	252.60	116 007	257.76	118 376
	2 Portland cement ASTM type V (sulfate resistant)	t	380	6.06	2 303	296.70	112 746	302.76	115 049
	3 Care of water and miscellaneous works	%	3%		6 037		39 173		45 210
	Total N° C.IV.14.6				207 264		1 344 955		1 552 219
C.IV.14.7	STAGE 1 HEADRACE TUNNEL - GATES CHAMBER DRAINAGE GALLERIES - REMEDIAL WORKS (97 + 77 m)								
C.IV.14.7.01	<u>Excavation and supports:</u>								
	1 Grouted anchor bars, 26 mm diameter	m	1 460	1.58	2 307	15.28	22 309	16.86	24 616
	2 Shotcrete	m ³	205	15.10	3 096	93.73	19 215	108.83	22 310
	3 Welded wire fabric	kg	9 115	0.50	4 558	1.93	17 592	2.43	22 149
C.IV.14.7.03	<u>Drilling and grouting:</u>								
	1 Drain holes, 76 mm diameter	m	2 055	5.68	11 672	28.91	59 410	34.59	71 082
	2 Contact & consolidation cement grouting, excluding materials	t		42.60		124.85		167.45	
C.IV.14.7.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	47	5.16	244	252.60	11 935	257.76	12 179
	2 Portland cement ASTM type V (sulfate resistant)	t	45	6.06	273	296.70	13 352	302.76	13 624
	3 Care of water and miscellaneous works	%	3%		664		4 314		4 979
	Total N° C.IV.14.7				22 813		148 127		170 940
C.IV.14.8	DIVERSION TUNNELS GATES CHAMBERS DRAINAGE GALLERIES - REMEDIAL WORKS (385 +108 m)								
C.IV.14.8.01	<u>Excavation and supports:</u>								
	1 Grouted anchor bars, 26 mm diameter	m	4 950	1.58	7 821	15.28	75 636	16.86	83 457
	2 Shotcrete	m ³	700	15.10	10 570	93.73	65 611	108.83	76 181
	3 Welded wire fabric	kg	31 000	0.50	15 500	1.93	59 830	2.43	75 330
C.IV.14.8.03	<u>Drilling and grouting:</u>								
	1 Drain holes, 76 mm diameter	m	7 000	5.68	39 760	28.91	202 370	34.59	242 130
	2 Contact & consolidation cement grouting, excluding materials	t		42.60		124.85		167.45	
C.IV.14.8.04	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	170	5.16	877	252.60	42 942	257.76	43 819
	2 Portland cement ASTM type V (sulfate resistant)	t	145	6.06	879	296.70	43 022	302.76	43 900
	3 Care of water and miscellaneous works	%	3%		2 262		14 682		16 945
	Total N° C.IV.14.8				77 669		504 093		581 762
C.IV.14.9	ACCESS TUNNEL T-3 - REMEDIAL WORKS - 1535 m								
C.IV.14.9.01	<u>Excavation and supports:</u>								
	1 Expansion bolts	unit	25 725	1.20	30 870	11.80	303 555	13.00	334 425
	2 Steel Wire Mesh	kg	73 080	0.50	36 540	1.93	141 044	2.43	177 584
C.IV.14.9.02	<u>Concrete works:</u>								
	1 Concrete, repair of damages	m ³	4 840	11.32	54 769	103.11	499 048	114.42	553 817
C.IV.14.9.03	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	924	5.16	4 768	252.60	233 402	257.76	238 170
	2 Portland cement ASTM type V (sulfate resistant)	t	770	6.06	4 666	296.70	228 459	302.76	233 125
	3 Reshaping of damaged concrete portions	m ³	635	27.30	17 336	249.90	158 687	277.20	176 022
	4 Care of water and miscellaneous works	%	3%		4 468		46 926		51 394
	Total N° C.IV.14.9				153 417		1 611 121		1 764 538
C.IV.14.10	ACCESS TUNNEL T-37 - REMEDIAL WORKS - 640 m								
C.IV.14.10.01	<u>Excavation and supports:</u>								
	1 Expansion bolts	unit	7 957	1.20	9 548	11.80	93 887	13.00	103 435
	2 Steel Wire Mesh	kg	22 603	0.50	11 301	1.93	43 624	2.43	54 925
C.IV.14.10.02	<u>Concrete works:</u>								
	1 Concrete, repair of damages	m ³	1 497	11.32	16 940	103.11	154 351	114.42	171 291
C.IV.14.10.03	<u>Sundries:</u>								
	1 Portland cement ASTM type I or II	t	284	5.16	1 465	252.60	71 723	257.76	73 188
	2 Portland cement ASTM type V (sulfate resistant)	t	240	6.06	1 454	296.70	71 208	302.76	72 662

DAM 1290

ITEM	Description of Works	Unit	Quantity (1)	Local Curr. (US\$ equiv.)		Foreign Curren. (US\$)		Total (US\$ equivalent)	
				Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
3	Reshaping of damaged concrete portions	m ³	196	27.30	5 362	249.90	49 080	277.20	54 442
4	Care of water and miscellaneous works	%	3%		1 382		14 516		15 898
	Total N° C.IV.14.10				47 452		498 389		545 841
C.IV.14.11	ACCESS TUNNEL T-37' - REMEDIAL WORKS - 170 m								
C.IV.14.11.01	Excavation and supports:								
1	Expansion bolts	unit	1 960	1.20	2 352	11.80	23 128	13.00	25 479
2	Steel Wire Mesh	kg	5 568	0.50	2 784	1.93	10 746	2.43	13 530
C.IV.14.11.02	Concrete works:								
1	Concrete, repair of damages	m ³	369	11.32	4 173	103.11	38 022	114.42	42 195
C.IV.14.11.03	Sundries:								
1	Portland cement ASTM type I or II	t	69	5.16	356	252.60	17 446	257.76	17 802
2	Portland cement ASTM type V (sulfate resistant)	t	60	6.06	364	296.70	17 802	302.76	18 166
3	Reshaping of damaged concrete portions	m ³	48	27.30	1 321	249.90	12 090	277.20	13 411
4	Care of water and miscellaneous works	%	3%		340		3 577		3 917
	Total N° C.IV.14.11				11 690		122 810		134 500
	TOTAL AMOUNT OF REMEDIAL WORKS - TRANSPORTATION TUNNELS AND GALLERIES				2 623 391		19 271 195		21 894 586
	TOTAL AMOUNT OF TRANSPORTATION TUNNELS AND GALLERIES				14 740 032		111 661 280		126 401 313
	TOTAL AMOUNT OF UNDERGROUND WORKS				160 095 485		1 161 866 924		1 321 962 409
	GRAND TOTAL OF CIVIL WORKS				333 436 080		2 730 150 470		3 063 586 550

PART VII – Alt 1: PRICE BILL OF QUANTITIES & COST SUMMARY (Permanent equipment)

ROGUN HYDROELECTRIC POWER PLANT
 COST ESTIMATE PHASE II E&M_1290-1255_2800MW

ITEM	E&M COSTS - 2800 MW INSTALLED CAPACITY - 6 UNITS - FSL 1255 & 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1	REUTILIZATION OF UNIT 6											
1.1	REUTILIZATION OF UNIT 6 - UNIT											
1.1.1	Hydraulic Turbine and Governor											
	Hydraulic Turbines and Governors - unit 6, based on existing final capacity	MW	1	466.7	600.0	32 013	19 207 500	6 914 700	768 300	11 524 500		
1.1.2	Generator and Excitation Equipment											
	Generator and Excitation Equipment - unit 6, based on existing final capacity	MW	1	466.7	600.0	64 025	38 415 000	10 372 050	1 152 450	26 890 500		
	Total N°1.1 ----->>							17 286 750	1 920 750	38 415 000	57 622 500	
	Total N°1 ----->>>							17 286 750	1 920 750	38 415 000		57 622 500
2	REUTILIZATION OF UNIT 5											
2.1	REUTILIZATION OF UNIT 5 - UNIT											
2.1.1	Hydraulic Turbine and Governor											
	Hydraulic Turbines and Governors - unit 5, based on existing final capacity	MW	1	466.7	600.0	32 013	19 207 500	6 914 700	768 300	11 524 500		
2.1.2	Generator and Excitation Equipment											
	Generator and Excitation Equipment - unit 5, based on existing final capacity	MW	1	466.7	600.0	86 434	51 860 250	22 472 775	2 496 975	26 890 500		
	Total N°2.1 ----->>							29 387 475	3 265 275	38 415 000	71 067 750	
	Total N°2 ----->>>							29 387 475	3 265 275	38 415 000		71 067 750
3	FOUR NEW UNITS											
3.1	NEW UNITS - UNIT											
3.1.1	Hydraulic Turbine and Governor											
	Units 4, 3, 2, 1	MW	4	466.7	1 866.7	64 025	119 513 333	86 049 600	9 561 067	23 902 667		

ITEM	E&M COSTS - 2800 MW INSTALLED CAPACITY - 6 UNITS - FSL 1255 & 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
3.1.2	Generator and Excitation Equipment											
	Units 4, 3, 2, 1	MW	4	466.7	1 866.7	64 025	119 513 333	80 073 933	9 561 067	29 878 333		
	Total N°3.1 ----->>							166 123 533	19 122 133	53 781 000	239 026 667	
3.2	UNITS - BOP											
3.2.1	Automation											
	Units 6, 5, 4, 3, 2, 1	MW	1	2800.0	2 800.0	12 814	35 879 200	27 626 984	2 870 336	5 381 880		
3.2.2	BOP Mechanical (including PH Cranes)											
	Units 6, 5, 4, 3, 2, 1	MW	1	2800.0	2 800.0	15 377	43 055 600	33 152 812	3 444 448	6 458 340		
3.2.3	BOP Electrical											
	Units 6, 5, 4, 3, 2, 1	MW	1	2800.0	2 800.0	19 221	53 818 800	41 440 476	4 305 504	8 072 820		
3.2.4	HV Transformers											
	Units 6, 5, 4, 3, 2, 1	MW	1	2800.0	2 800.0	25 629	71 761 200	57 408 960	10 046 568	4 305 672		
3.2.4	Switchward and Links											
	Units 6, 5, 4, 3, 2, 1	MW	1	2800.0	2 800.0	16 659	46 645 200	35 916 804	3 731 616	6 996 780		
	Total N°3.2 ----->>							195 546 036	24 398 472	31 215 492	251 160 000	
	Total N°3 ----->>>							361 669 569	43 520 605	84 996 492		490 186 667
4	MISCELLANEA											
	Miscellanea on EM equipment	%		5.0%				20 417 190	2 435 332	8 091 325		30 943 846
	TOTAL AMOUNT OF E&M EQUIPMENT							428 760 984	51 141 962	169 917 817		649 820 763

ROGUN HYDROELECTRIC POWER PLANT
 COST ESTIMATE PHASE II E&M_1290-1255_3200MW

ITEM	E&M COSTS - 3200 MW INSTALLED CAPACITY - 6 UNITS - FSL 1255 & 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal	Subtotal
								Manufact.	Transport	Installation	II level	I level
1	REUTILIZATION OF UNIT 6											
1.1	REUTILIZATION OF UNIT 6 - UNIT											
1.1.1	Hydraulic Turbine and Governor											
	Hydraulic Turbines and Governors - unit 6, based on existing final capacity	MW	1	533.3	600.0	32 500	19 500 000	7 020 000	780 000	11 700 000		
1.1.2	Generator and Excitation Equipment											
	Generator and Excitation Equipment - unit 6, based on existing final capacity	MW	1	533.3	600.0	65 000	39 000 000	10 530 000	1 170 000	27 300 000		
	Total N°1.1 ----->>							17 550 000	1 950 000	39 000 000	58 500 000	
	Total N°1 ----->>>							17 550 000	1 950 000	39 000 000		58 500 000
2	REUTILIZATION OF UNIT 5											
2.1	REUTILIZATION OF UNIT 5 - UNIT											
2.1.1	Hydraulic Turbine and Governor											
	Hydraulic Turbines and Governors - unit 5, based on existing final capacity	MW	1	533.3	600.0	32 500	19 500 000	7 020 000	780 000	11 700 000		
2.1.2	Generator and Excitation Equipment											
	Generator and Excitation Equipment - unit 5, based on existing final capacity	MW	1	533.3	600.0	87 750	52 650 000	22 815 000	2 535 000	27 300 000		
	Total N°2.1 ----->>							29 835 000	3 315 000	39 000 000	72 150 000	
	Total N°2 ----->>>							29 835 000	3 315 000	39 000 000		72 150 000
3	FOUR NEW UNITS											
3.1	NEW UNITS - UNIT											
3.1.1	Hydraulic Turbine and Governor											
	Units 4, 3, 2, 1	MW	4	533.3	2 133.3	62 530	133 397 333	96 046 080	10 671 787	26 679 467		

ITEM	E&M COSTS - 3200 MW INSTALLED CAPACITY - 6 UNITS - FSL 1255 & 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal	Subtotal
								Manufact.	Transport	Installation	II level	I level
3.1.2	Generator and Excitation Equipment											
	Units 4, 3, 2, 1	MW	4	533.3	2 133.3	62 530	133 397 333	89 376 213	10 671 787	33 349 333		
	Total N°3.1 ----->>>							185 422 293	21 343 573	60 028 800	266 794 667	
3.2	UNITS - BOP											
3.2.1	Automation											
	Units 6, 5, 4, 3, 2, 1	MW	1	3200.0	3 200.0	12 499	39 996 800	30 797 536	3 199 744	5 999 520		
3.2.2	BOP Mechanical (including PH Cranes)											
	Units 6, 5, 4, 3, 2, 1	MW	1	3200.0	3 200.0	14 998	47 993 600	36 955 072	3 839 488	7 199 040		
3.2.3	BOP Electrical											
	Units 6, 5, 4, 3, 2, 1	MW	1	3200.0	3 200.0	18 748	59 993 600	46 195 072	4 799 488	8 999 040		
3.2.4	HV Transformers											
	Units 6, 5, 4, 3, 2, 1	MW	1	3200.0	3 200.0	24 997	79 990 400	63 992 320	11 198 656	4 799 424		
3.2.4	Switchward and Links											
	Units 6, 5, 4, 3, 2, 1	MW	1	3200.0	3 200.0	16 248	51 993 600	40 035 072	4 159 488	7 799 040		
	Total N°3.2 ----->>>							217 975 072	27 196 864	34 796 064	279 968 000	
	Total N°3 ----->>>							403 397 365	48 540 437	94 824 864		546 762 667
4	MISCELLANEA											
	Miscellanea on EM equipment	%		5.0%				22 539 118	2 690 272	8 641 243		33 870 633
	TOTAL AMOUNT OF E&M EQUIPMENT							473 321 484	56 495 709	181 466 107		711 283 300

ROGUN HYDROELECTRIC POWER PLANT
 COST ESTIMATE PHASE II E&M 1290_3600 MW

ITEM	E&M COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1	REPOWERING OF UNIT 6											
1.1	REPOWERING OF UNIT 6 - UNIT											
1.1.1	Hydraulic Turbine and Governor											
	Hydraulic Turbines and Governors - unit 6	MW	1	600.0	600.0	32 500	19 500 000	7 020 000	780 000	11 700 000		
1.1.2	Generator and Excitation Equipment											
	Generator and Excitation Equipment - unit 6	MW	1	600.0	600.0	65 000	39 000 000	10 530 000	1 170 000	27 300 000		
	Total N°1.1 ----->>							<i>17 550 000</i>	<i>1 950 000</i>	<i>39 000 000</i>	58 500 000	
1.2	REPOWERING OF UNIT 6 - BOP											
1.2.1	Automation											
	Automation - unit 6	MW	1	600.0	600.0	12 350	7 410 000	5 705 700	592 800	1 111 500		
1.2.2	BOP Mechanical											
	BOP Mechanical - unit 6	MW	1	600.0	600.0	14 800	8 880 000	6 837 600	710 400	1 332 000		
1.2.3	BOP Electrical											
	BOP Electrical - unit 6	MW	1	600.0	600.0	18 450	11 070 000	8 523 900	885 600	1 660 500		
1.2.4	HV Transformers											
	HV Transformers - unit 6	MW	1	600.0	600.0	24 600	14 760 000	11 808 000	2 066 400	885 600		
1.2.4	Switchyard and Links											
	Switchyard and Links - unit 6	MW	1	600.0	600.0	16 000	9 600 000	7 392 000	768 000	1 440 000		
	Total N°1.2 ----->>							<i>40 267 200</i>	<i>5 023 200</i>	<i>6 429 600</i>	51 720 000	
	Total N°1 ----->>>							<i>57 817 200</i>	<i>6 973 200</i>	<i>45 429 600</i>		110 220 000

ITEM	E&M COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
2	REPOWERING OF UNIT 5											
2.1	REPOWERING OF UNIT 5 - UNIT											
2.1.1	Hydraulic Turbine and Governor											
	Hydraulic Turbines and Governors - unit 5	MW	1	600.0	600.0	32 500	19 500 000	7 020 000	780 000	11 700 000		
2.1.2	Generator and Excitation Equipment											
	Generator and Excitation Equipment - unit 5	MW	1	600.0	600.0	87 750	52 650 000	22 815 000	2 535 000	27 300 000		
	Total N°2.1 ----->>							29 835 000	3 315 000	39 000 000	72 150 000	
2.2	REPOWERING OF UNIT 5 - BOP											
2.2.1	Automation											
	Automation - unit 5	MW	1	600.0	600.0	12 350	7 410 000	5 705 700	592 800	1 111 500		
2.2.2	BOP Mechanical (including PH Cranes)											
	BOP Mechanical - unit 5	MW	1	600.0	600.0	14 800	8 880 000	6 837 600	710 400	1 332 000		
2.2.3	BOP Electrical											
	BOP Electrical - unit 5	MW	1	600.0	600.0	18 450	11 070 000	8 523 900	885 600	1 660 500		
2.2.4	HV Transformers											
	HV Transformers - unit 5	MW	1	600.0	600.0	24 600	14 760 000	11 808 000	2 066 400	885 600		
2.2.4	Switchyard and Links											
	Switchyard and Links - unit 5	MW	1	600.0	600.0	16 000	9 600 000	7 392 000	768 000	1 440 000		
	Total N°2.2 ----->>							40 267 200	5 023 200	6 429 600	51 720 000	
	Total N°2 ----->>>							70 102 200	8 338 200	45 429 600		123 870 000

ITEM	E&M COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
3	FOUR NEW UNITS											
3.1	NEW UNITS - UNIT											
3.1.1	Hydraulic Turbine and Governor											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	65 000	156 000 000	112 320 000	12 480 000	31 200 000		
3.1.2	Generator and Excitation Equipment											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	65 000	156 000 000	104 520 000	12 480 000	39 000 000		
	Total N°3.1 ----->>							216 840 000	24 960 000	70 200 000	312 000 000	
3.2	NEW UNITS - BOP											
3.2.1	Automation											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	12 350	29 640 000	22 822 800	2 371 200	4 446 000		
3.2.2	BOP Mechanical											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	14 800	35 520 000	27 350 400	2 841 600	5 328 000		
3.2.3	BOP Electrical											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	18 450	44 280 000	34 095 600	3 542 400	6 642 000		
3.2.4	HV Transformers											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	24 600	59 040 000	47 232 000	8 265 600	3 542 400		
3.2.4	Switchyard and Links											
	Units 1, 2, 3, 4	MW	4	600.0	2 400.0	16 000	38 400 000	29 568 000	3 072 000	5 760 000		
	Total N°3.2 ----->>							161 068 800	20 092 800	25 718 400	206 880 000	
	Total N°3 ----->>>							377 908 800	45 052 800	95 918 400		518 880 000

ROGUN HYDROELECTRIC POWER PLANT
 COST ESTIMATE PHASE II E&M 1290_3600 MW

ITEM	E&M COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal	Subtotal
								Manufact.	Transport	Installation	II level	I level
4	MISCELLANEA											
	Miscellanea on EM equipment	%		6.0%				30 349 692	3 621 852	11 206 656		45 178 200
	TOTAL AMOUNT OF E&M EQUIPMENT							536 177 892	63 986 052	197 984 256		798 148 200

ROGUN HYDROELECTRIC POWER PLANT
COST ESTIMATE PHASE II EXISTING HSS

ITEM	EXISTING HSS EQUIPMENT COST OF REMAINING WORKS TO COMPLETION Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)					
						Supply & Transport		Installation		Subtotal	Subtotal
						Unit Price	Cost	Unit Price	Cost	II level	I level
1	EXISTING HSS EQUIPMENT										
1.1	DIVERSION TUNNELS REPAIR GATE CHAMBER										
1.1.1	Gates										
	Sliding gates with embedded parts and gates	t	6								
1.1.2	Auxiliary items										
	Auxiliary items	t	1								
1.1.3	Cranes										
	cranes	t	2								
	Total N°1.1 ----->>										
1.2	DIVERSION TUNNELS: EMERGENCY/ REPAIR GATE AND MAIN GATE CHAMBER										
1.2.1	Radial gates										
	Radial gates with embedded parts and drive	t	6								
1.2.2	Slide gates										
	Slide gates with embedded parts and drive	t	6								
1.2.3	Cranes										
	cranes	t	2								
1.2.4	Auxiliary items										
	Auxiliary items	t	1								
	Total N°1.2 ----->>									-	

ITEM	EXISTING HSS EQUIPMENT COST OF REMAINING WORKS TO COMPLETION Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)					
						Supply & Transport		Installation		Subtotal	Subtotal
						Unit Price	Cost	Unit Price	Cost	II level	I level
1.3	POWER OUTLET / DRAFT TUBE										
1.3.1	Slide gates										
	Slide gate at power outlet with embedded parts	t	2	90	180.0			4 550	819 000		
1.3.2	Sectional gates										
	Sectional gate at draft tube with embedded parts	t	6	82.0	492.0			4 550	2 238 600		
1.3.3	Cranes										
	cranes	t	1	118.0	118.0			3 900	460 200		
1.3.4	Auxiliary items										
	Auxiliary items	t	1	45.0	45.0			4 550	204 750		
	Total N°1.3 ----->>									3 722 550	
1.4	TEMPORARY POWER INTAKE										
1.4.1	Trash Racks										
	Trash Racks and embedded parts	t	1	426	426.0			1 950	830 700		
	Total N°1.4 ----->>									830 700	

ITEM	EXISTING HSS EQUIPMENT COST OF REMAINING WORKS TO COMPLETION Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)					
						Supply & Transport		Installation		Subtotal	Subtotal
						Unit Price	Cost	Unit Price	Cost	II level	I level
1.5	GATE CHAMBER OF TEMPORARY WATERWAYS										
1.5.1	Slide gates										
	Slide gates with embedded parts - supplied and transported	t	2	217	434.0						
	Slide gates with embedded parts - installed	t	2	164	328.0			4 550	1 492 400		
1.5.2	Slide gates										
	Slide gates with embedded parts	t	2	205.0	410.0			4 550	1 865 500		
1.5.3	Cranes										
	cranes - supplied and transported	t	1	85.0	85.0						
	cranes - installed	t	1	50.0	50.0			3 900	195 000		
1.5.4	Steel Lining										
	Steel Lining	t	2								
1.5.5	Auxiliary items										
	Auxiliary items	t	1								
	Total N°1.5 ----->>									3 552 900	
1.6	PENSTOCK										
1.6.1	Steel Lining										
	Steel Lining - supplied and transported	t	1	2100	2 100.0						
	Steel Lining - installed	t	1	600	600.0			3 250	1 950 000		
	Total N°1.6 ----->>									1 950 000	
	Total N°1 ----->>										10 056 150
	TOTAL AMOUNT OF EXISTING HSS EQUIPMENT										10 056 150

ITEM	HSS COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1	HSS EQUIPMENT											
1.1	DIVERSION TUNNEL 3RD LEVEL (DT3)											
1.1.1	EOT Cranes											
	Eot crane - span 10÷14 m - max load 80 ton	n°	2	100	200.0	14 300	2 860 000	2 288 000	228 800	343 200		
1.1.2	Emergency Gates											
	emergency gates 4.3 x 7.1 m (WxH) - design pressure: 150 m head	t	8	152.8	1 222.4	11 050	13 507 520	10 806 016	1 080 602	1 620 902		
1.1.3	Sector Gates											
	sector gates 4.3 x 5.2 m (WxH) - design pressure: 150 m head	t	4	138.6	554.4	11 050	6 126 120	4 900 896	490 090	735 134		
	Total N°1.1 ----->>							17 994 912	1 799 491	2 699 237	22 493 640	
1.2	MIDDLE LEVEL OUTLET N.1 (MLO1)											
1.2.1	EOT Cranes											
	Eot crane - span 10÷14 m - max load 130 ton	n°	2	140	280.0	14 300	4 004 000	3 083 080	320 320	600 600		
1.2.2	Maintenance Gates											
	maintenance gates 6.0 x 10.0 m (WxH) - design pressure: 150 m head	t	2	308.6	617.2	11 050	6 820 060	5 251 446	545 605	1 023 009		
1.2.3	Emergency Gates											
	emergency gates 3.9 x 7.75 m (WxH) - design pressure: 150 m head	t	4	141.7	566.8	11 050	6 263 140	4 822 618	501 051	939 471		
1.2.4	Sector Gates											
	sector gates 3.9 x 5.95 m (WxH) - design pressure: 150 m head	t	4	134.3	537.2	11 050	5 936 060	4 570 766	474 885	890 409		
	Total N°1.2 ----->>							17 727 910	1 841 861	3 453 489	23 023 260	

ITEM	HSS COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1.3	MIDDLE LEVEL OUTLET N.2 (MLO2)											
1.3.1	EOT Cranes											
	Eot crane - span 10÷14 m - max load 130 ton	n°	2	140	280.0	14 300	4 004 000	3 083 080	320 320	600 600		
1.3.2	Maintenance Gates											
	maintenance gates 6.0 x 10.0 m (WxH) - design pressure: 150 m head	t	2	308.6	617.2	11 050	6 820 060	5 251 446	545 605	1 023 009		
1.3.3	Emergency Gates											
	emergency gates 4.3 x 7.1 m (WxH) - design pressure: 150 m head	t	4	152.8	611.2	11 050	6 753 760	5 200 395	540 301	1 013 064		
1.3.4	Sector Gates											
	sector gates 4.3 x 5.2 m (WxH) - design pressure: 150 m head	t	4	138.6	554.4	11 050	6 126 120	4 717 112	490 090	918 918		
	Total N°1.3 ----->>							18 252 034	1 896 315	3 555 591	23 703 940	
1.4	HIGH LEVEL SPILLWAY TUNNEL 1 (HLST1)											
1.4.1	EOT Cranes											
	Eot crane - span 10÷13 m - max load 40 ton	n°	2	50	100.0	11 050	1 105 000	850 850	88 400	165 750		
1.4.2	Maintenance Gates											
	maintenance gates 3.5 x 6.7 m (WxH) - design pressure: 110 m head	t	2	88.7	177.4	11 050	1 960 270	1 509 408	156 822	294 041		
1.4.3	Emergency Gates											
	emergency gates 3.5 x 5.15 m (WxH) - design pressure: 110 m head	t	3	73.9	221.7	11 050	2 449 785	1 886 334	195 983	367 468		
1.4.4	Sector Gates											
	sector gates 3.5 x 4.65 m (WxH) - design pressure: 110 m head	t	3	89.8	269.4	11 050	2 976 870	2 292 190	238 150	446 531		
	Total N°1.4 ----->>							6 538 782	679 354	1 273 789	8 491 925	

ITEM	HSS COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1.5	HIGH LEVEL SPILLWAY TUNNEL 2 (HLST2)											
1.5.1	EOT Cranes											
	Eot crane - span 10÷13 m - max load 40 ton	n°	2	50	100.0	11 050	1 105 000	850 850	88 400	165 750		
1.5.2	Maintenance Gates											
	maintenance gates 3.5 x 6.7 m (WxH) - design pressure: 110 m head	t	2	88.7	177.4	11 050	1 960 270	1 509 408	156 822	294 041		
1.5.3	Emergency Gates											
	emergency gates 3.5 x 5.15 m (WxH) - design pressure: 110 m head	t	3	73.9	221.7	11 050	2 449 785	1 886 334	195 983	367 468		
1.5.4	Sector Gates											
	sector gates 3.5 x 4.65 m (WxH) - design pressure: 110 m head	t	3	89.8	269.4	11 050	2 976 870	2 292 190	238 150	446 531		
	Total N°1.5 ----->>							6 538 782	679 354	1 273 789	8 491 925	

ITEM	HSS COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1.6	SURFACE SPILLWAY											
1.6.1	Gantry Crane											
	Gantry crane	n°	1	70	70.0	14 300	1 001 000	770 770	80 080	150 150		
1.6.2	Stoplogs											
	maintenance gates 8.0 x 8.0 m (WxH) - design pressure:8.0 m head	t	4	41.1	164.5	6 500	1 069 120	855 296	85 530	128 294		
1.6.3	Sector Gates											
	sector gates 8.0 x 8.0 m (WxH) - design pressure:8.0 m head	t	4	44.7	178.8	11 050	1 975 740	1 521 320	158 059	296 361		
	Total N°1.6 ----->>							3 147 386	323 669	574 805	4 045 860	
1.7	PERMANENT POWER INTAKES											
1.7.1	External Removable trash racks											
	External Removable wide mesh trash racks (2 racks, each rack 6.5 x 8.25 m)	t	48	5.5	264.0	5 200	1 372 800	1 098 240	109 824	164 736		
1.7.2	Intakes stoplogs											
	Stoplogs for multi-level intakes. Two stoplogs for each external intake are foreseen, 6.5 x 8.25 m; four couples of elements are provided.	t	8	199.2	1 593.6	6 500	10 358 400	7 975 968	828 672	1 553 760		
1.7.3	Intakes steel movable closure elements											
	Steel closures for multi-level intakes. Two elements for each external intake are foreseen, 6.5 x 8.25 m; four couples of elements for each power intake are provided.	t	48	59.1	2 836.8	4 000	11 347 200	8 737 344	907 776	1 702 080		
1.7.4	Power Intakes Removable trash racks											
	Removable trash racks (2 racks for each intake, each rack 7 x 45 m) maximum water velocity on gross area 0.43 m/s, 3 m design differential pressure	t	12	135	1 620.0	5 200	8 424 000	6 739 200	673 920	1 010 880		
1.7.5	Steel lining											
	Steel lining for transition downstream stoplogs	t	6	50	300.0	6 500	1 950 000	1 053 000	117 000	780 000		

ITEM	HSS COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
1.7.6	Intake slide gate											
	Servomotor operated intake slide gate 6.3 x 8 m, 118 m design pressure	t	6	430	2 580.0	11 050	28 509 000	21 951 930	2 280 720	4 276 350		
1.7.7	Stoplogs											
	Stoplogs: single element 6.3 x 8 m; two elements are provided for the 6 intakes; 118 m design pressure	t	2	120	240.0	6 500	1 560 000	1 201 200	124 800	234 000		
1.7.8	Aeration pipe & accessories											
	Aeration pipe 1.2 m diameter, linings, supporting beams	t	6	166	996.0	6 500	6 474 000	4 337 580	517 920	1 618 500		
1.7.9	Gantry crane											
	Upper Gantry crane 2 x 70 t to lift stoplogs and servomotor, 11.5 span	t	1	118	118.0	14 300	1 687 400	1 299 298	134 992	253 110		
	Total N°1.7 ----->>							54 393 760	5 695 624	11 593 416	71 682 800	
1.8	PENSTOCKS											
1.8.1	Penstocks											
	Permanent penstocks for all six units	t	6	1893	11 358.0	6 500	73 827 000	39 866 580	4 429 620	29 530 800		
1.8.2	Maintenance crane											
	Maintenance crane	t	1	45	45.0	14 300	643 500	495 495	51 480	96 525		
	Total N°1.8 ----->>							40 362 075	4 481 100	29 627 325	74 470 500	
	Total N°1 ----->>							164 955 641	17 396 768	54 051 441	236 403 850	

ITEM	HSS COSTS - 3600 MW INSTALLED CAPACITY - FSL 1290 Description of Works	Unit	n°	unit qty	Quantity	Total (US\$ equivalent)						
						Unit Price	Total Cost	Breakdown of Total Cost			Subtotal II level	Subtotal I level
								Manufact.	Transport	Installation		
2	MISCELLANEA											
	Miscellanea on HSS equipment	%		4.0%				6 598 226	695 871	2 162 058		9 456 154
	TOTAL AMOUNT OF HSS EQUIPMENT							171 553 867	18 092 639	56 213 498		245 860 004

ROGUN HYDROELECTRIC POWER PLANT
 COST ESTIMATE PHASE II TL&SS 3200-2800 MW

ITEM	TL/SS COSTS - 3200-2800 MW INSTALLED CAPACITY Description of Works	Unit	Quantity	Total (US\$ equivalent)								
				Unit Price	Cost	Breakdown of Total Cost			Subtotal III level	Subtotal II level	Subtotal I level	
						Manufact.	Transport	Installation				
1	TRANSMISSION LINE AND SUBSTATION BAY REINFORCEMENTS											
1.1	Line L-Obi-Rogun HPP/3 OBIGARM - ROGUN HPP											
	Line_500 kV 3xAC-400 - single circuit	km	8.0	400 000	3 200 000	2 064 000	256 000	880 000.00				
	500 kV bays at substations	n°	2.0	1 550 000	3 100 000	2 154 500	248 000	697 500.00				
	<i>Subtotal</i>				6 300 000							
	<i>miscellanea</i>	%	3%		189 000							
	<i>spare parts</i>	%	2%		126 000							
	Total N°1.1 ----->>					4 429 425	529 200	1 656 375	6 615 000			
1.2	Line L-Obi-Rogun HPP/2 OBIGARM - ROGUN HPP											
	Line_500 kV 3xAC-400 - single circuit	km	8.0	400 000	3 200 000	2 064 000	256 000	880 000.00				
	500 kV bays at substations	n°	2.0	1 550 000	3 100 000	2 154 500	248 000	697 500.00				
	<i>Subtotal</i>				6 300 000							
	<i>miscellanea</i>	%	3%		189 000							
	<i>spare parts</i>	%	2%		126 000							
	Total N°1.2 ----->>					4 429 425	529 200	1 656 375	6 615 000			
1.3	Line L-Obi-Rogun HPP/1 OBIGARM - ROGUN HPP											
	Line_500 kV 3xAC-400 - single circuit	km	8.0	400 000	3 200 000	2 064 000	256 000	880 000.00				
	500 kV bays at substations	n°	2.0	1 550 000	3 100 000	2 154 500	248 000	697 500.00				
	<i>Subtotal</i>				6 300 000							
	<i>miscellanea</i>	%	3%		189 000							
	<i>spare parts</i>	%	2%		126 000							
	Total N°1.3 ----->>					4 429 425	529 200	1 656 375	6 615 000			
	Total N° 1 ----->>					13 288 275	1 587 600	4 969 125				19 845 000
	TOTAL AMOUNT OF TL/SS REINFORCEMENTS AND RELEVANT WORKS					13 288 275	1 587 600	4 969 125				19 845 000

ITEM	TL/SS COSTS - 3600 MW INSTALLED CAPACITY Description of Works	Unit	Quantity	Total (US\$ equivalent)								
				Unit Price	Cost	Breakdown of Total Cost			Subtotal III level	Subtotal II level	Subtotal I level	
						Manufact.	Transport	Installation				
1	TRANSMISSION LINE AND SUBSTATION BAY REINFORCEMENTS											
1.1	Line L-Obi-Rogun HPP/3 OBIGARM - ROGUN HPP											
	Line_500 kV 3xAC-400 - single circuit	km	8.0	400 000	3 200 000	2 064 000	256 000	880 000.00				
	500 kV bays at substations	n°	2.0	1 550 000	3 100 000	2 154 500	248 000	697 500.00				
	<i>Subtotal</i>				<i>6 300 000</i>							
	<i>miscellanea</i>	%	3%		<i>189 000</i>							
	<i>spare parts</i>	%	2%		<i>126 000</i>							
	Total N°1.1 ----->>					4 429 425	529 200	1 656 375	6 615 000			
1.2	Line L-Obi-Rogun HPP/2 OBIGARM - ROGUN HPP											
	Line_500 kV 3xAC-400 - single circuit	km	8.0	400 000	3 200 000	2 064 000	256 000	880 000.00				
	500 kV bays at substations	n°	2.0	1 550 000	3 100 000	2 154 500	248 000	697 500.00				
	<i>Subtotal</i>				<i>6 300 000</i>							
	<i>miscellanea</i>	%	3%		<i>189 000</i>							
	<i>spare parts</i>	%	2%		<i>126 000</i>							
	Total N°1.2 ----->>					4 429 425	529 200	1 656 375	6 615 000			
1.3	Line L-Obi-Rogun HPP/1 OBIGARM - ROGUN HPP											
	Line_500 kV 3xAC-400 - single circuit	km	8.0	400 000	3 200 000	2 064 000	256 000	880 000.00				
	500 kV bays at substations	n°	2.0	1 550 000	3 100 000	2 154 500	248 000	697 500.00				
	<i>Subtotal</i>				<i>6 300 000</i>							
	<i>miscellanea</i>	%	3%		<i>189 000</i>							
	<i>spare parts</i>	%	2%		<i>126 000</i>							
	Total N°1.3 ----->>					4 429 425	529 200	1 656 375	6 615 000			
	Total N° 1 ----->>					13 288 275	1 587 600	4 969 125				19 845 000
	TOTAL AMOUNT OF TL/SS REINFORCEMENTS AND RELEVANT WORKS					13 288 275	1 587 600	4 969 125				19 845 000