

添付-2 優先プロジェクト小水力発電計画概要表及び図面

1. Nam Likna (Sequence No. 4)

A. Salient Features

1.General	Province	Phongsaly		District	Samphan	
	Electr. Status	Partly electrified by pico-hydros with semi-permanent structures				
2.Demand	Load Center	Samphan (District Center)		H/H Number	123	
	Peak Load	26 kW		Peak Hours	4 hours	
3.Hydrology	River	Nam Likna		Basin	Nam Ou	CA 30 km <sup>2</sup>
	Rainfall	1,800 mm		Q <sub>ave</sub>	0.731 m <sup>3</sup> /s	Q <sub>95%</sub> 0.184 m <sup>3</sup> /s
4.Structures						
4.1 Intake	Type	Gabion-core concrete facing		Height	2.5 m	Length 25.5 m
				FSL	618.00 m	FWL 621.38 m
4.2 Desilting Basin	Length	10 m	Width 0.9 m	Side Spillway Length	5 m	
4.3 Headrace Channel	Shape	Trapezoidal (1:0.3)		Lining	Wet Masonry	Length 468 m
	Uniform Depth	0.53 m		Base	0.8 m	
4.4 Head Tank	Type	Surface		NWL	616.88 m	MOL 615.88 m
4.5 Penstock	Type	Exposed		Dia.	0.5 m	Length 15.6 m
4.6 Powerhouse	Type	Surface	EL 605.17 m	Turbine	Cross-Flow	Units 1 nos
5.Power and Energy	Q <sub>design</sub>	0.32 m <sup>3</sup> /s	H <sub>net</sub> 12 m	Installed Capacity	26 kW	
	Energy	117,544 kWh/yr		P.F.	52%	
6.Access Road	Length	0.5 km				
7.Transmission Line	Capacity	400 V		Length	0.5 km	
	Loss	10.0%		Energy Delivered.	105,790 kWh/yr	

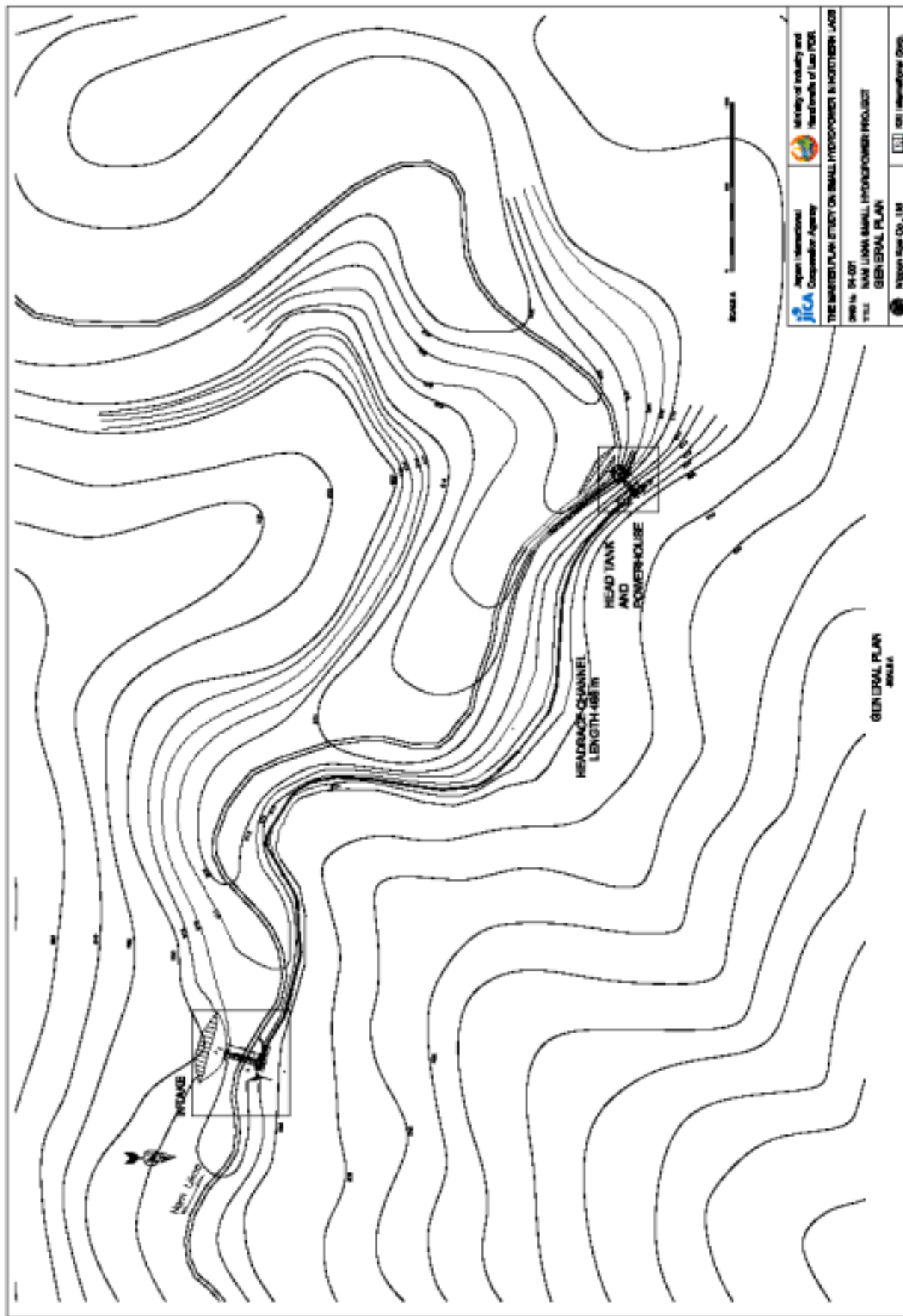
B. Construction Cost

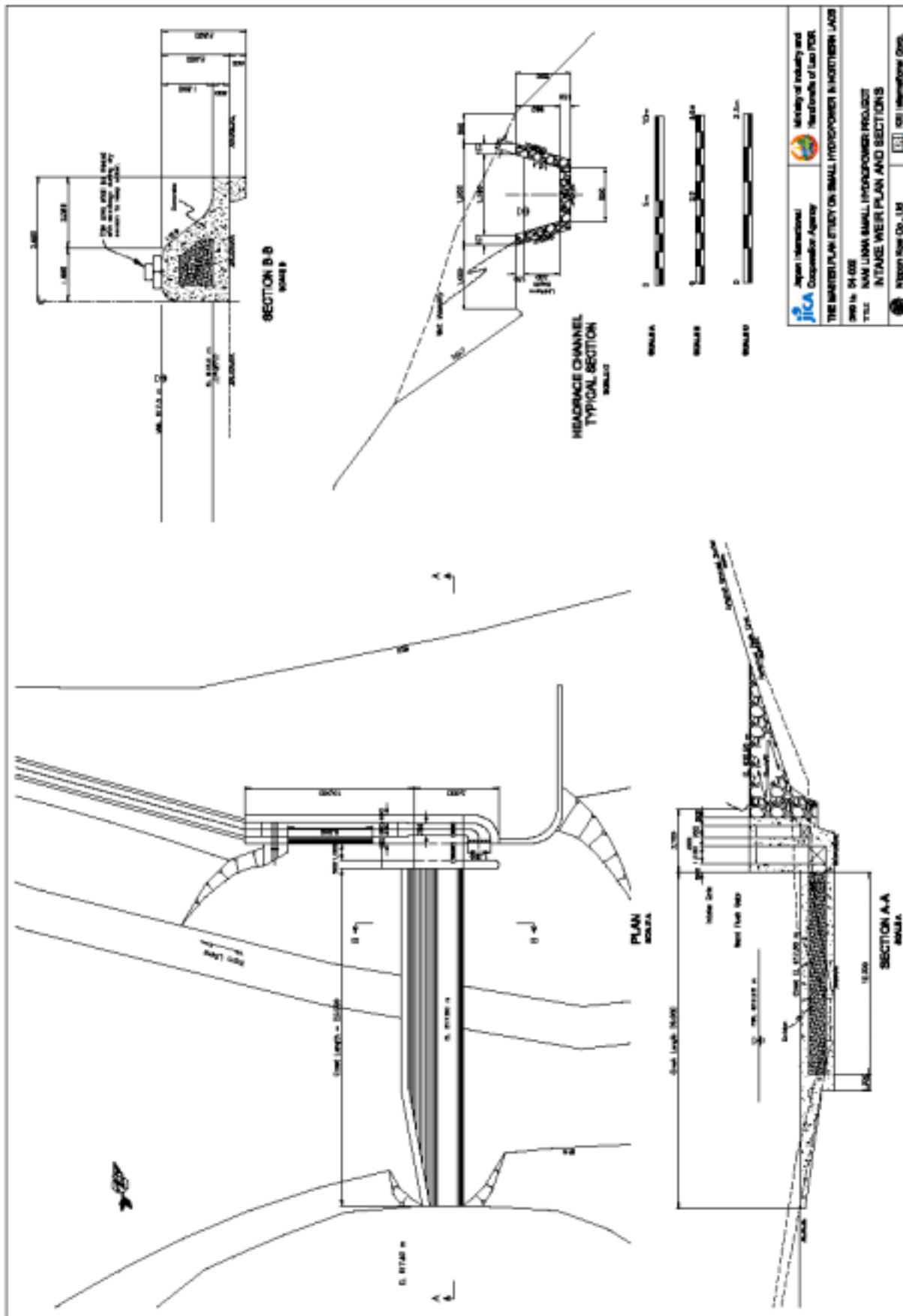
Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 30,853
1.2 Desilting Basin	US\$ 14,786
1.3 Headrace Channel	US\$ 15,574
1.4 Head Tank	US\$ 2,992
1.5 Penstock	US\$ 789
1.6 Powerhouse	US\$ 2,838
1.7 Tailrace	US\$ 32
1.8 Access Road	US\$ 5,000
1.9 Miscellaneous (20% of 1.1~1.11)	US\$ 14,547
<b>Total of Civil Works</b>	<b>US\$ 87,437</b>

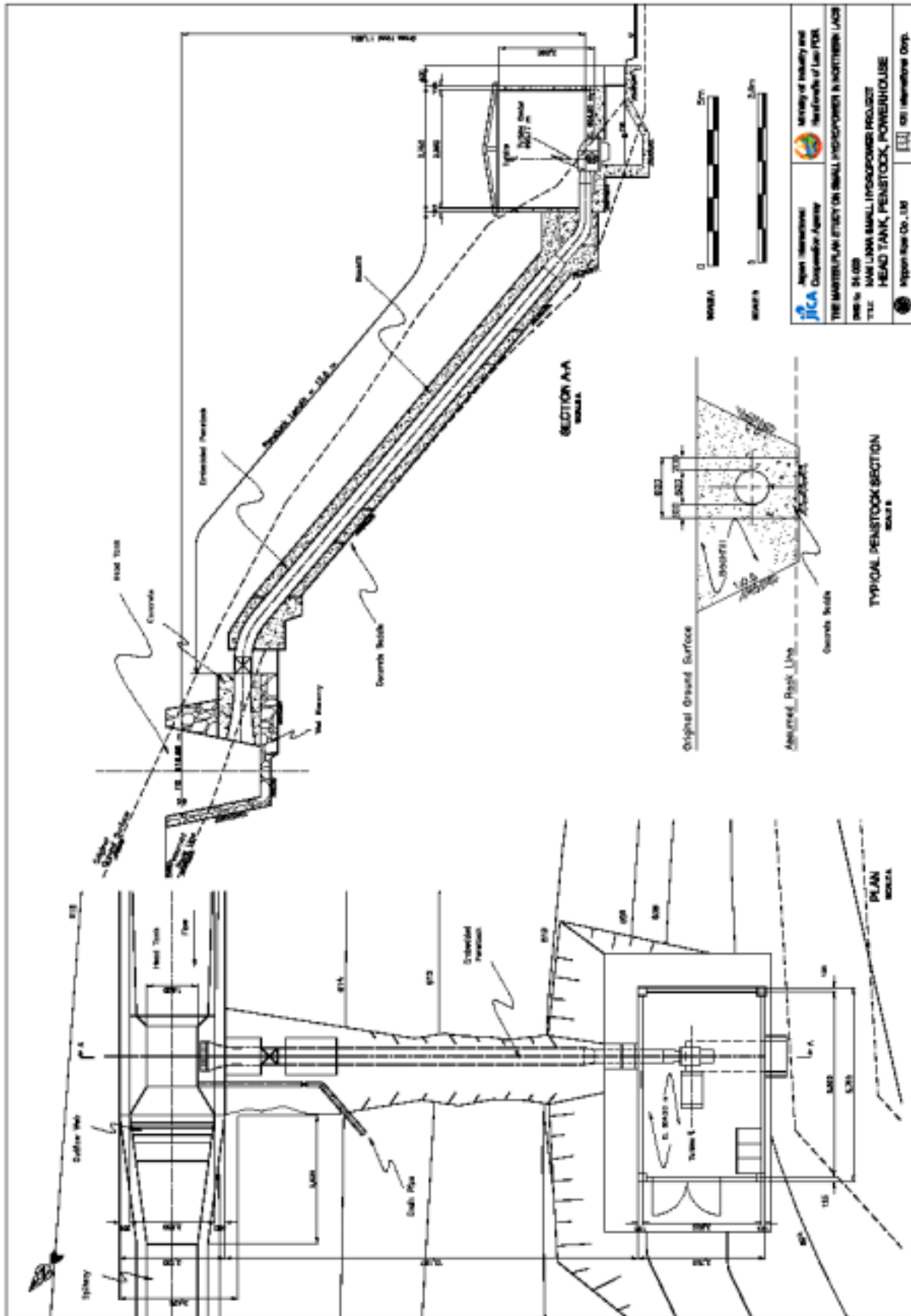
Items	Cost
<b>2.Steel Penstock</b>	US\$ 3,461
<b>3.Gate &amp; Trashracks</b>	US\$ 5,850
<b>4.Turbine &amp; Generator</b>	US\$ 70,057
<b>5. Transformer &amp; Switchgear</b>	US\$ 10,483
<b>6. Transmission Line</b>	US\$ 12,000
<b>7.E&amp;M Miscellaneous (10% of 2-6)</b>	US\$ 8,985
<b>Total of E&amp;M Works</b>	<b>US\$ 110,836</b>
<b>GRAND TOTAL</b>	<b>US\$ 198,273</b>

C. Economic Analysis

1.Unit Construction Cost	US\$ 6,609 /kW				
2.Unit Generation Cost	UScent	/kWh			
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M n/a % of construction
	Replace	n/a years			EIRR n/a %







## 2. Nam Ou Neua (Sequence No. 5)

### A. Salient Features

1.General	Province	Phongsaly		District	Gnod Ou	
	Electr. Status	Electrified by diesel genset				
2.Demand	Load Center	Ou Tai (District Center) and Ou Neua			H/H Number	1,239
	Peak Load	259 kW			Peak Hours	4 hours
3.Hydrology	River	Nam Ou		Basin	Nam Ou	CA 593 km <sup>2</sup>
	Rainfall	1,750 mm		Q <sub>ave</sub>	14.23 m <sup>3</sup> /s	Q <sub>95%</sub> 3.60 m <sup>3</sup> /s
4.Structures						
4.1 Intake	Type	Gabion-core concrete facing			Height	4.0 m
				FSL	753.0 m	FWL 759.26 m
4.2 Desilting Basin	Length	18.5 m	Width	2.5 m	Side Spillway Length 12 m	
4.3 Headrace Channel	Shape	Trapezoidal (1:0.5)			Lining	Wet Masonry
	Uniform Depth	1.04 m			Base	1.3 m
4.4 Head Tank	Regulating Capacity	(None) m <sup>3</sup>			NWL	750.77 m
				MOL	748.27 m	
4.5 Penstock	Type	Exposed			Dia.	0.9 m
				Length	102.3 m	
4.6 Powerhouse	Type	Surface	EL	490.94 m	Turbine	Cross-Flow
					Units	1 nos
5.Power and Energy	Q <sub>design</sub>	1.87 m <sup>3</sup> /s	H <sub>net</sub>	20 m	Installed Capacity 259 kW	
	Energy	1,140,456 kWh/yr			P.F.	50%
6.Access Road	Length	1.0 km				
7.Transmission Line	Capacity	22 kV			Length	40 km
	Loss	10.0%			Energy Delivered.	1,026,410 kWh/yr

### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 168,329
1.2 Desilting Basin	US\$ 109,825
1.3 Headrace Channel	US\$ 364,930
1.4 Head Tank	US\$ 37,016
1.5 Spillway Channel	US\$ 2,277
1.6 Penstock	US\$ 8,038
1.7 Powerhouse	US\$ 19,897
1.8 Tailrace	US\$2,015
1.9 Access Road	US\$ 10,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 144,465
<b>Total of Civil Works</b>	<b>US\$ 866,792</b>
2.Steel Penstock	US\$ 47,984

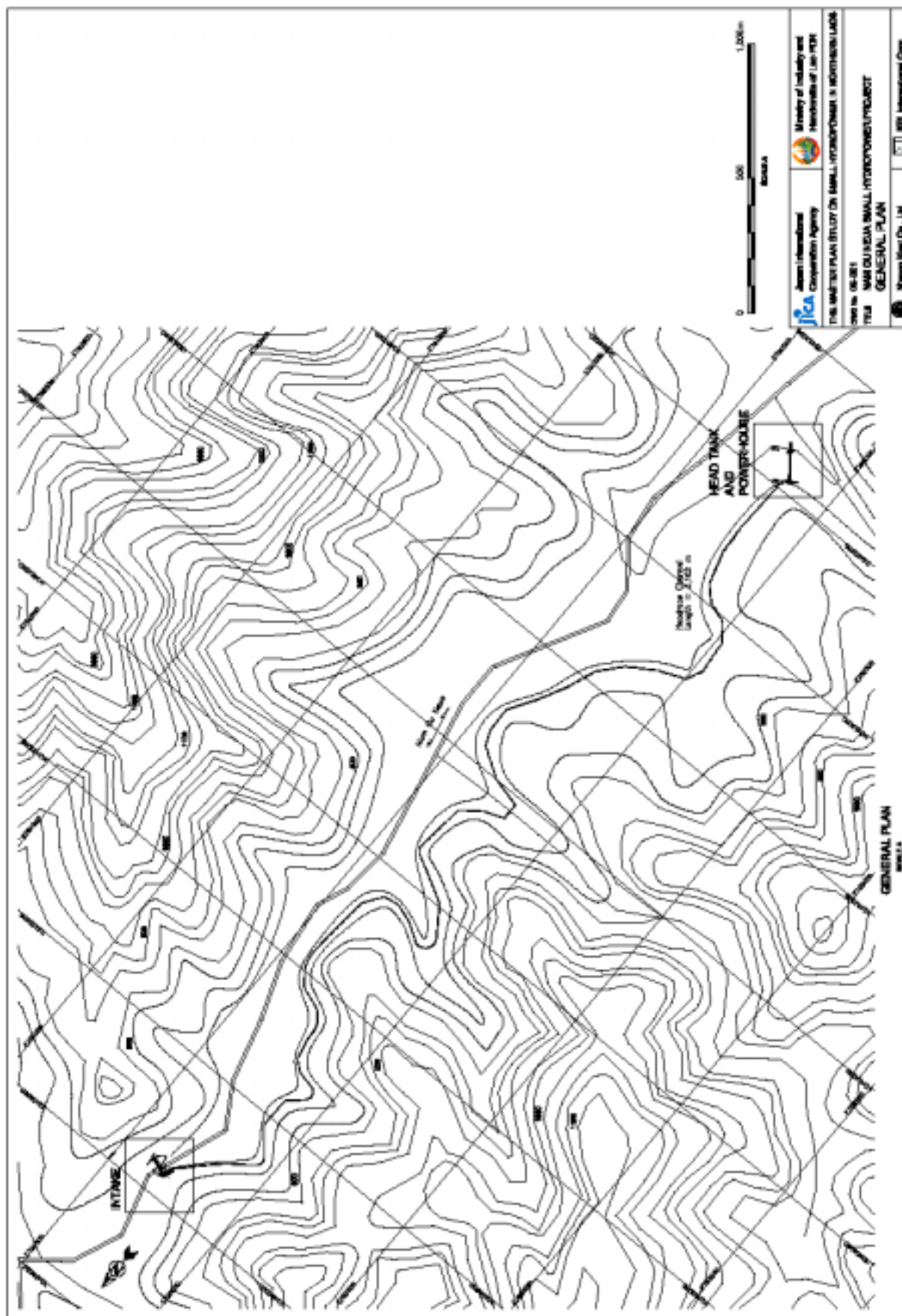
Items	Cost
3.Gate & Trashracks	US\$ 9,999
4.Turbine & Generator	US\$ 123,016
5.Transformer & Switchgear	US\$ 18,408
6.Transmission Line	US\$ 501,727
7.E&M Miscellaneous (10% of 2-5)	US\$ 19,941
<b>Total of E&amp;M Works</b>	<b>US\$ 721,075</b>
<b>GRAND TOTAL</b>	<b>US\$ 1,587,867</b>

### C. Economic Analysis

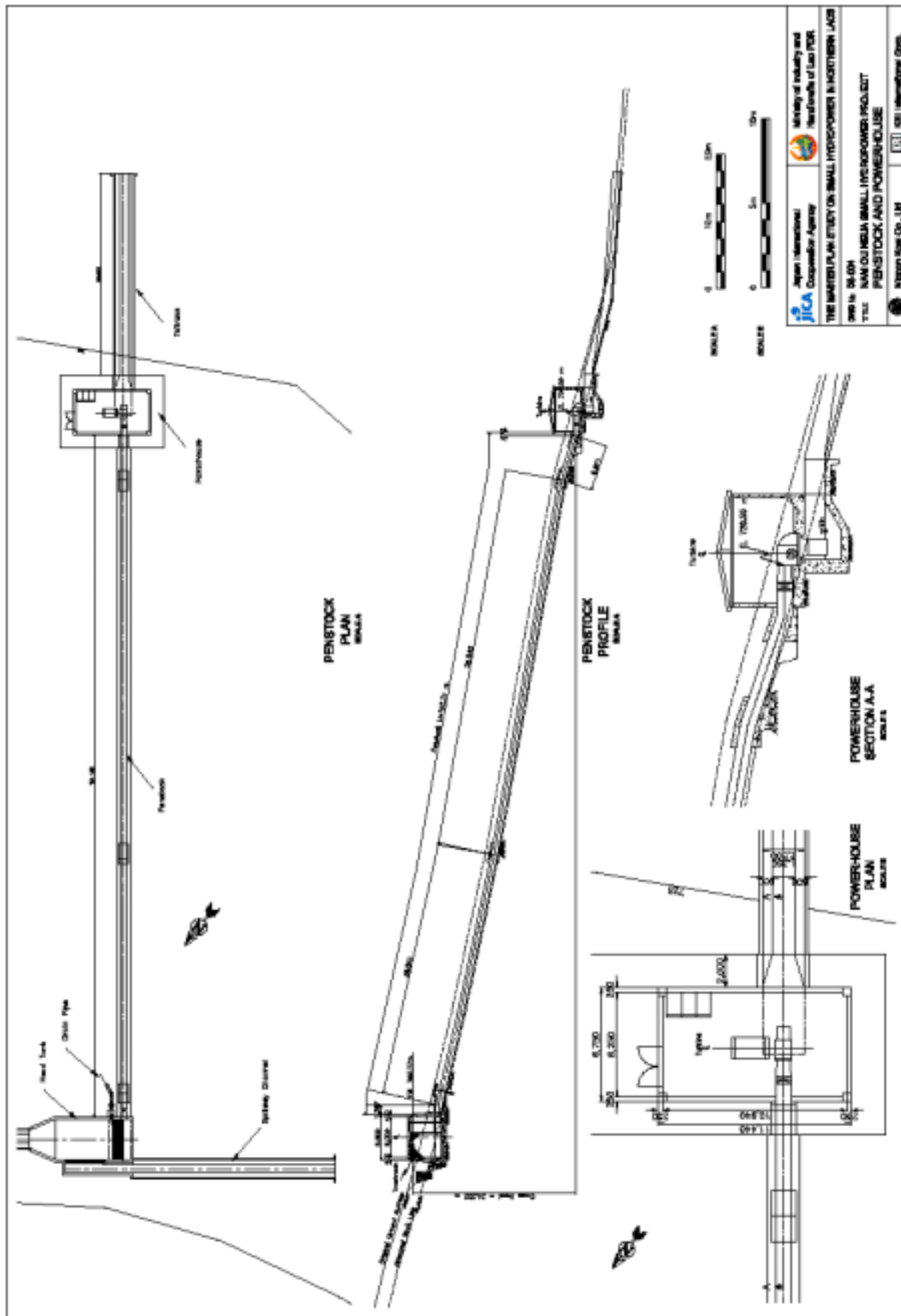
1.Unit Construction Cost	US\$ 6,107 / kW				
2.Unit Generation Cost	UScent / kWh				
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M n/a % of construction
	Replace	n/a years			EIRR n/a %

### D. Remarks

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### 3. Nam Long (Sequence No. 7)

#### A. Salient Features

1.General	Province	Luangnamtha	District	Long
	Electr. Status	Diesel Power Generator (30kW) operated by District		
2.Demand	Load Center	Grid 22kV( to be extended by 2008)	H/H Number	-
	Peak Load	-	Peak Hours	-
3.Hydrology	River	N. Long	Basin	Nam Long
	Rainfall	1,730 mm	Q <sub>ave</sub>	2.80 m <sup>3</sup> /s
			CA	156 km <sup>2</sup>
			Q <sub>95%</sub>	0.43 m <sup>3</sup> /s
4.Structures				
4.1 Intake	Type	Concrete weir	Height	3.7 m
			FSL	1014.70 m
			Length	50 m
			FWL	1019.36 m
4.2 Desilting Basin	Length	26.4 m	Width	2.50 m
			Side Spillway Length	12.0 m
4.3 Headrace Channel	Shape	Rectangle	Lining	Concrete
	Uniform Depth	0.77 m	Base	1.60 m
			Length	4,220 m
4.4 Head Tank	Regulating Capacity	162.0 m <sup>3</sup>	NWL	1,010.178m
			MOL	1,009.27m
4.5 Penstock	Type	Exposed	Dia.	0.80 m
			Length	420.60 m
4.6 Powerhouse	Type	Surface	EL	765.70 m
			Turbine	Francis (H)
			Units	2 nos
5.Power and Energy	Q <sub>design</sub>	1.35 m <sup>3</sup> /s	H <sub>net</sub>	238 m
	Energy	16,782,480 kWh/yr	Installed Capacity	2,500 kW
			P.F.	76.4 %
6.Access Road	Length	7 km		
7.Transmission Line	Capacity	22 kV	Length	15 km
			Loss	9.0%
			Energy Delivered	15,269,367 kWh

#### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 392,385
1.2 Desilting Basin	US\$ 48,400
1.3 Headrace Channel	US\$ 1,190,200
1.4 Head Tank	US\$ 33,950
1.5 Spillway Channel	US\$ 6,600
1.6 Penstock	US\$ 108,140
1.7 Powerhouse	US\$ 91,960
1.8 Tailrace	US\$ 13,340
1.9 Access Road	US\$ 70,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 390,995
<b>Total of Civil Works</b>	<b>US\$ 2,345,970</b>
<b>2.Steel Penstock</b>	<b>US\$ 270,000</b>

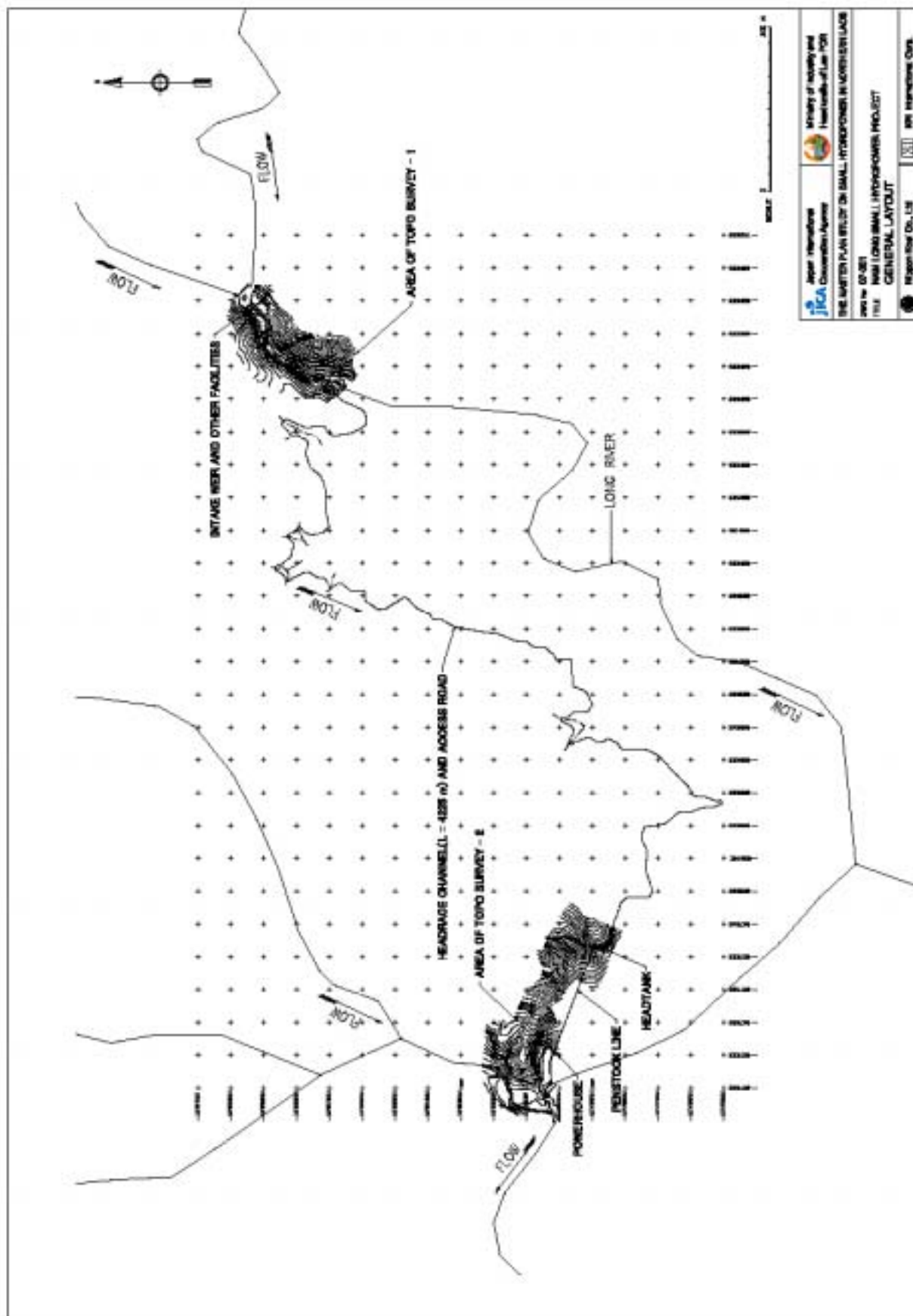
Items	Cost
<b>3.Gate &amp; Trashracks</b>	<b>US\$ 10,500</b>
<b>4.Turbine &amp; Generator</b>	<b>US\$ 273,769</b>
<b>5.Transformer &amp; Switchgear</b>	<b>US\$ 169,397</b>
<b>6.Transmission Line</b>	<b>US\$ 373,000</b>
<b>7.E&amp;M Miscellaneous (10% of 2-5)</b>	<b>US\$ 72,367</b>
<b>Total of E&amp;M Works</b>	<b>US\$ 1,169,033</b>
<b>GRAND TOTAL</b>	<b>US\$ 3,515,003</b>

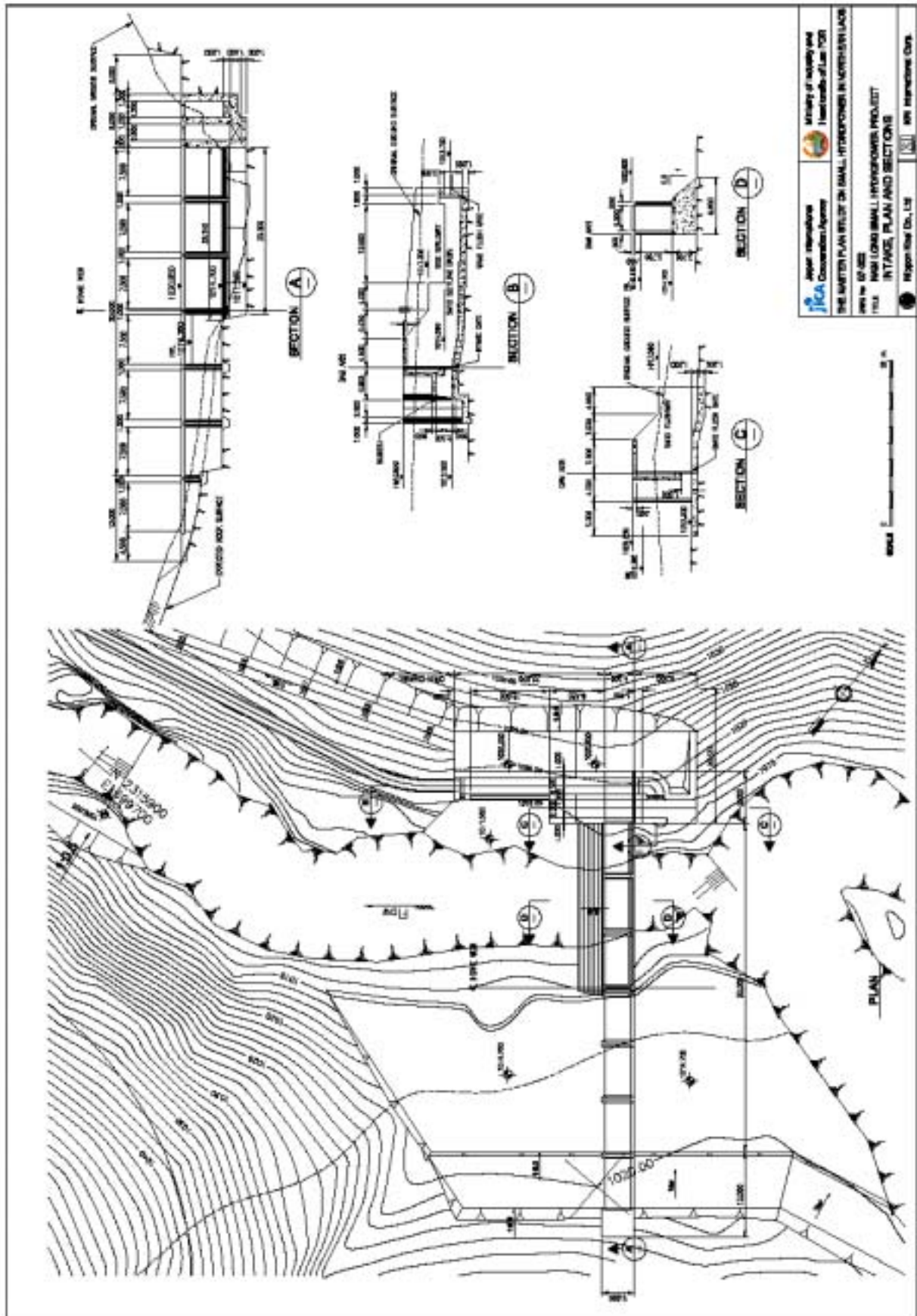
#### C. Economic Analysis

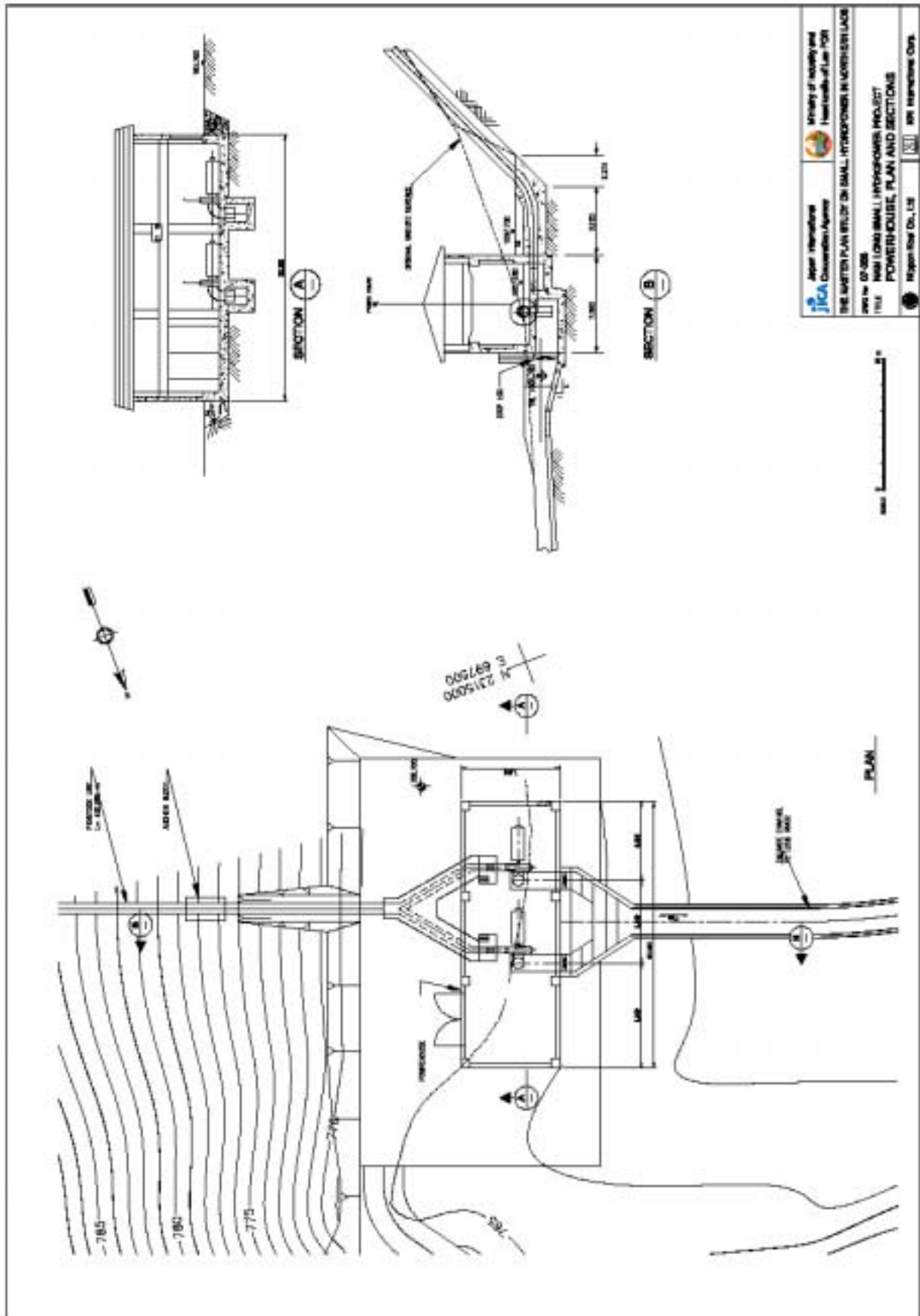
1.Unit Construction Cost	US\$ 1,406 /kW
2.Unit Generation Cost	UScent /kWh
3.Economic Analysis	Project Life n/a years
	Discount Rate n/a%
	O&M n/a % of construction
	EIRR n/a %

#### D. Remarks

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Japan International  
**JICA**  
 Cooperation Agency

Ministry of Economy and  
 Finance of Japan

THE WATER PLAN STUDY ON SMALL HYDROPOWER IN MONTENEGRO

DATE: 02-2008

PROJECT: SMALL HYDROPOWER PROJECT

FILE: POWERHOUSE, PLAN AND SECTIONS

Prepared by: JICA  
 Checked by: JICA  
 Approved by: JICA

#### 4. Nam Ham 2 (Sequence No. 31)

##### A. Salient Features

1.General	Province	Xayabury		District	Boten	
	Electr. Status	Imported power from Thailand				
2.Demand	Load Center	Grid			H/H Number	-
	Peak Load	-			Peak Hours	13 hours
2.Hydrology	River	Nam Ham		Basin	Nam Ham	CA 97 km <sup>2</sup>
	Rainfall	1,350 mm		Q <sub>ave</sub>	1.36 m <sup>3</sup> /s	Q <sub>95%</sub> 0.21 m <sup>3</sup> /s
3.Structures						
3.1 Intake	Type	Gabion-core Concrete-facing			Height	5.0 m
				FSL	541.00 m	FWL 545.48 m
3.2 Desilting Basin	Length	17 m	Width	2.4 m	Side Spillway Length	12.0 m
3.3 Headrace Channel	Shape	Trapezoidal (1:0.2)			Lining	Wet Masonry
	Uniform Depth	0.74 m			Base	1.2 m
3.4 Head Tank	Regulating Capacity	90 m <sup>3</sup>		NWL	538.82 m	MOL 537.37 m
3.5 Penstock	Type	Exposed			Dia.	0.6 m
3.6 Powerhouse	Type	Surface	EL	361.3m	Turbine	Units 2 nos
4.Power and Energy	Q <sub>design</sub>	0.78 m <sup>3</sup> /s	H <sub>net</sub>	170 m	Installed Capacity	1,000 kW
	Energy	6,299,304 kWh/yr		P.F.	72.6%	
5.Access Road	Length	5 km				
6.Transmission Line	Capacity	22 kV	Length	6 km	Loss	8%
					Energy Delivered	5,793,564 kWh/yr

##### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 422,470
1.2 Desilting Basin	US\$ 8,303
1.3 Headrace Channel	US\$ 439,920
1.4 Head Tank	US\$ 24,249
1.5 Spillway Channel	US\$ 0
1.6 Penstock	US\$ 31,715
1.7 Powerhouse	US\$ 47,553
1.8 Tailrace	US\$ 563
1.9 Access Road	US\$ 50,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 204,955
<b>Total of Civil Works</b>	<b>US\$ 1,229,729</b>
<b>2.Steel Penstock</b>	<b>US\$ 234,947</b>

Items	Cost
<b>3.Gate &amp; Trashracks</b>	<b>US\$ 2,891</b>
<b>4.Turbine &amp; Generator</b>	<b>US\$ 177,546</b>
<b>5.Transformer &amp; Switchgear</b>	<b>US\$ 142,319</b>
<b>6.Transmission Line</b>	<b>US\$ 45,622</b>
<b>7.E&amp;M Miscellaneous (10% of 2-6)</b>	<b>US\$ 55,770</b>
<b>Total of E&amp;M Works</b>	<b>US\$ 659,095</b>
<b>GRAND TOTAL</b>	<b>US\$ 1,888,824</b>

##### C. Economic Analysis

1.Unit Construction Cost	US\$ 1,889 /kW				
2.Unit Generation Cost	UScent/kWh				
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M n/a % of construction
	Replace	n/a years			EIRR n/a %

##### D. Remarks

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