

## Attachment-2 Brief Project Features & Drawings for Pre-F/S project Sites

### 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
<b>4. Structures</b>						
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	

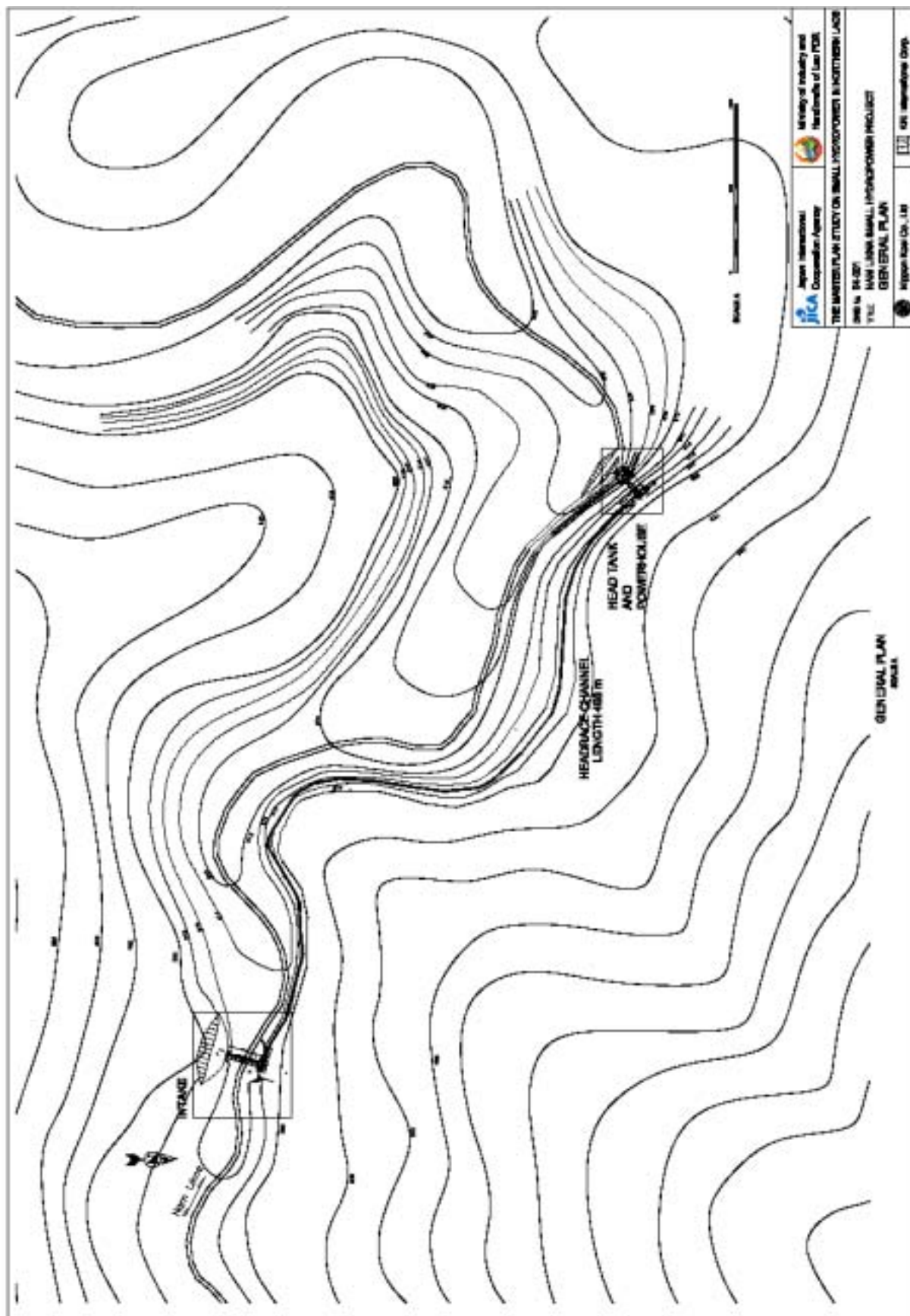
#### B. Construction Cost

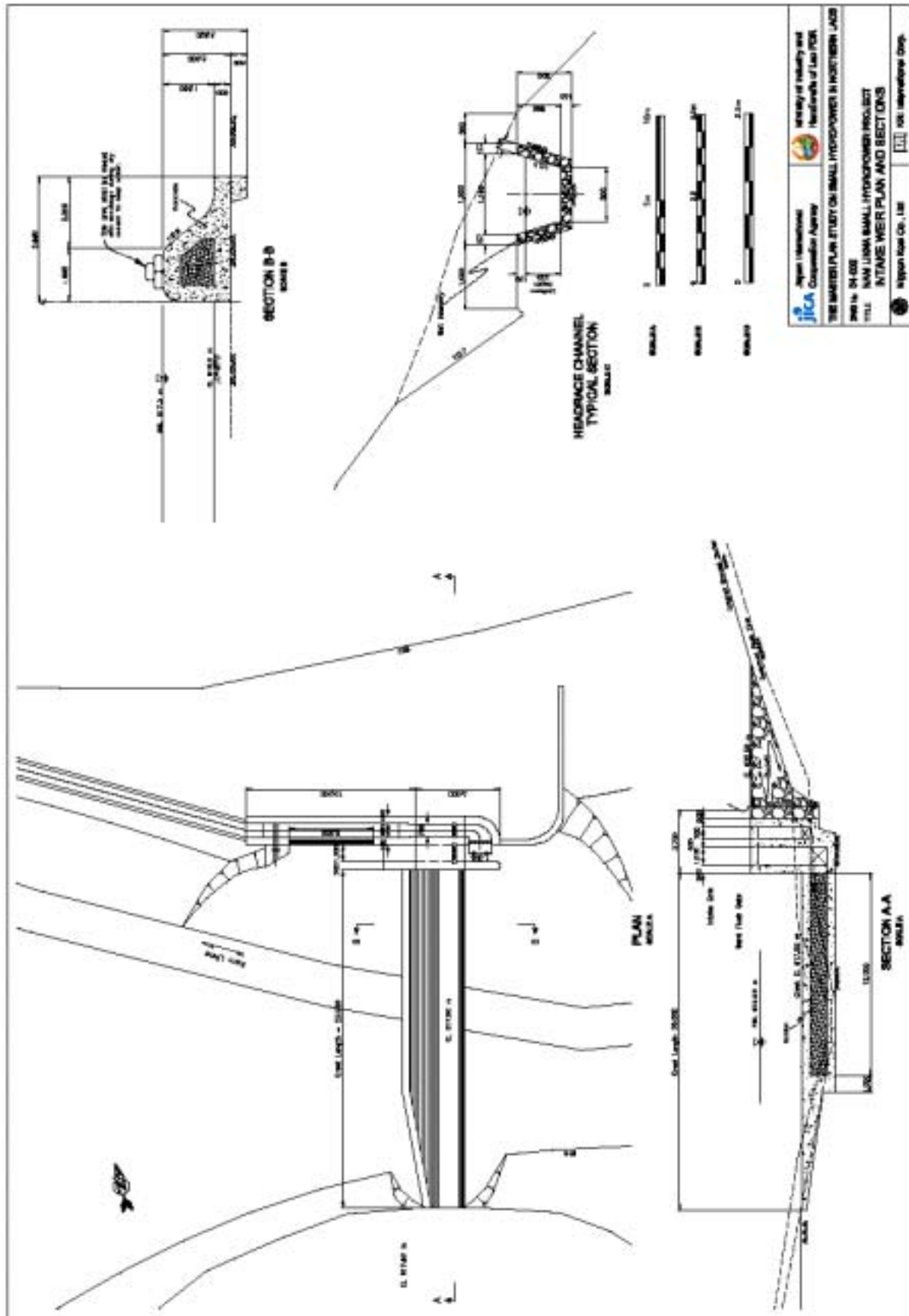
Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 30,853
1.2 Desilting Basin	US\$ 14,786
1.3 Headrace Channel	US\$ 15,574
1.4 Head Tank	US\$ 2,992
1.5 Penstock	US\$ 789
1.6 Powerhouse	US\$ 2,838
1.7 Tailrace	US\$ 32
1.8 Access Road	US\$ 5,000
1.9 Miscellaneous (20% of 1.1~1.11)	US\$ 14,547
<b>Total of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

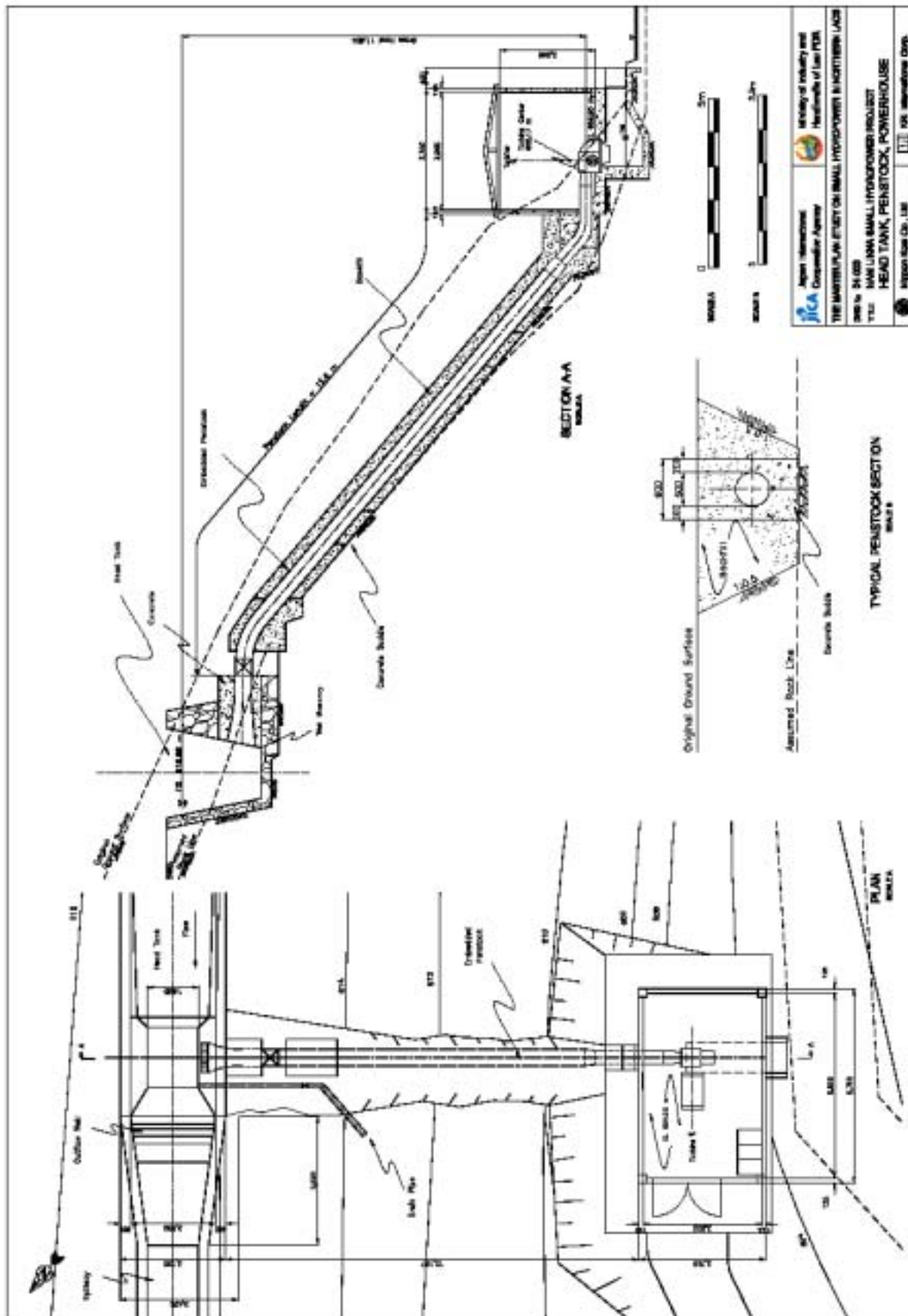
Items	Cost
2.Steel Penstock	US\$ 3,461
3.Gate & Trashracks	US\$ 5,850
4.Turbine & Generator	US\$ 70,057
5. Transformer & Switchgear	US\$ 10,483
6. Transmission Line	US\$ 12,000
7.E&M Miscellaneous (10% of 2-6)	US\$ 8,985
<b>Total of E&amp;M Works</b>	<b>US\$ 110,836</b>
<b>GRAND TOTAL</b>	<b>US\$ 198,273</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	Length	28.0 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	Length	3,102 m
	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

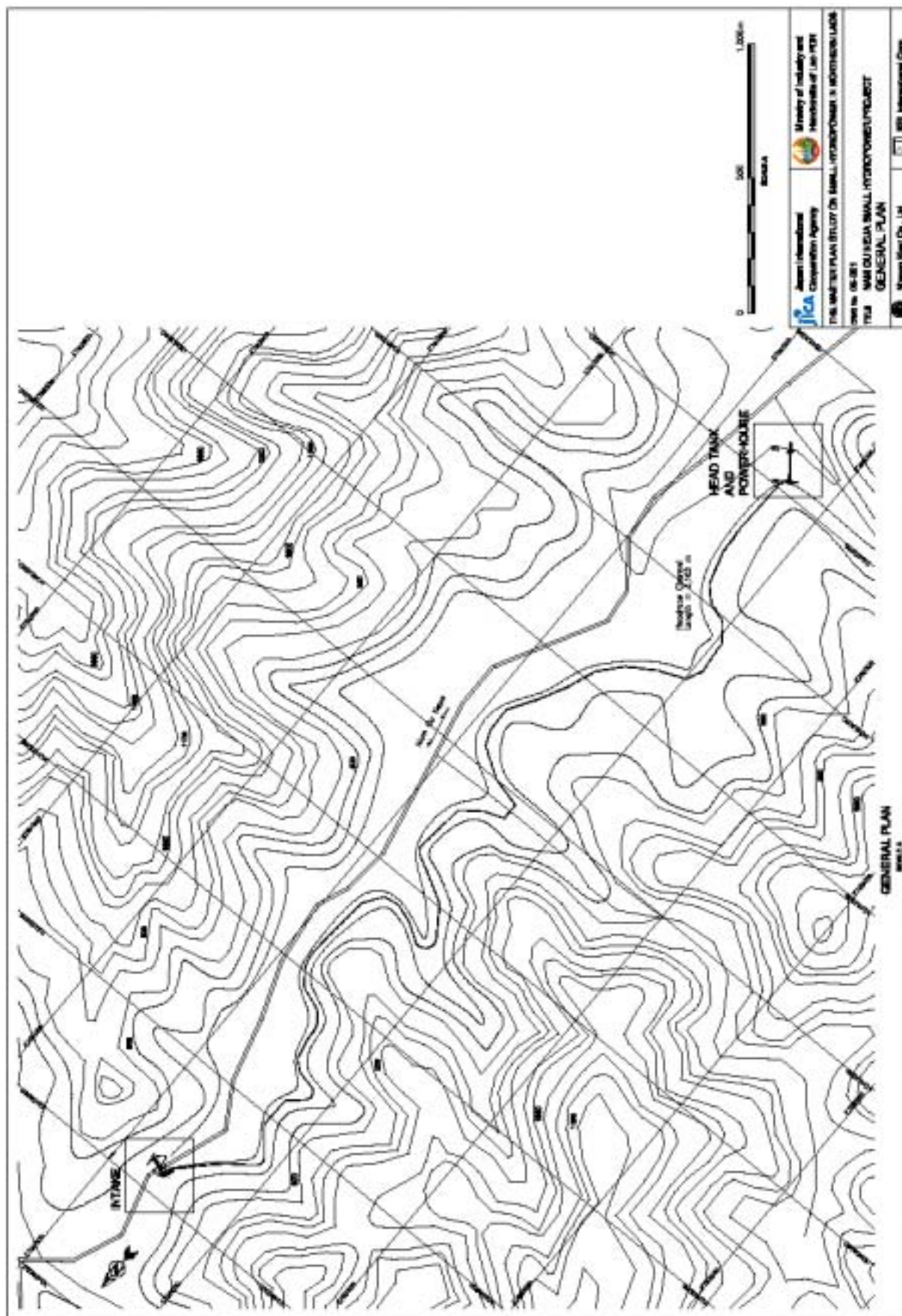
Items	Cost
3.Gate & Trashracks	US\$ 9,999
4.Turbine & Generator	US\$ 123,016
5.Transformer & Switchgear	US\$ 18,408
6.Transmission Line	US\$ 501,727
7.E&M Miscellaneous (10% of 2-5)	US\$ 19,941
<b>Total of E&amp;M Works</b>	<b>US\$ 721,075</b>
<b>GRAND TOTAL</b>	<b>US\$ 1,587,867</b>

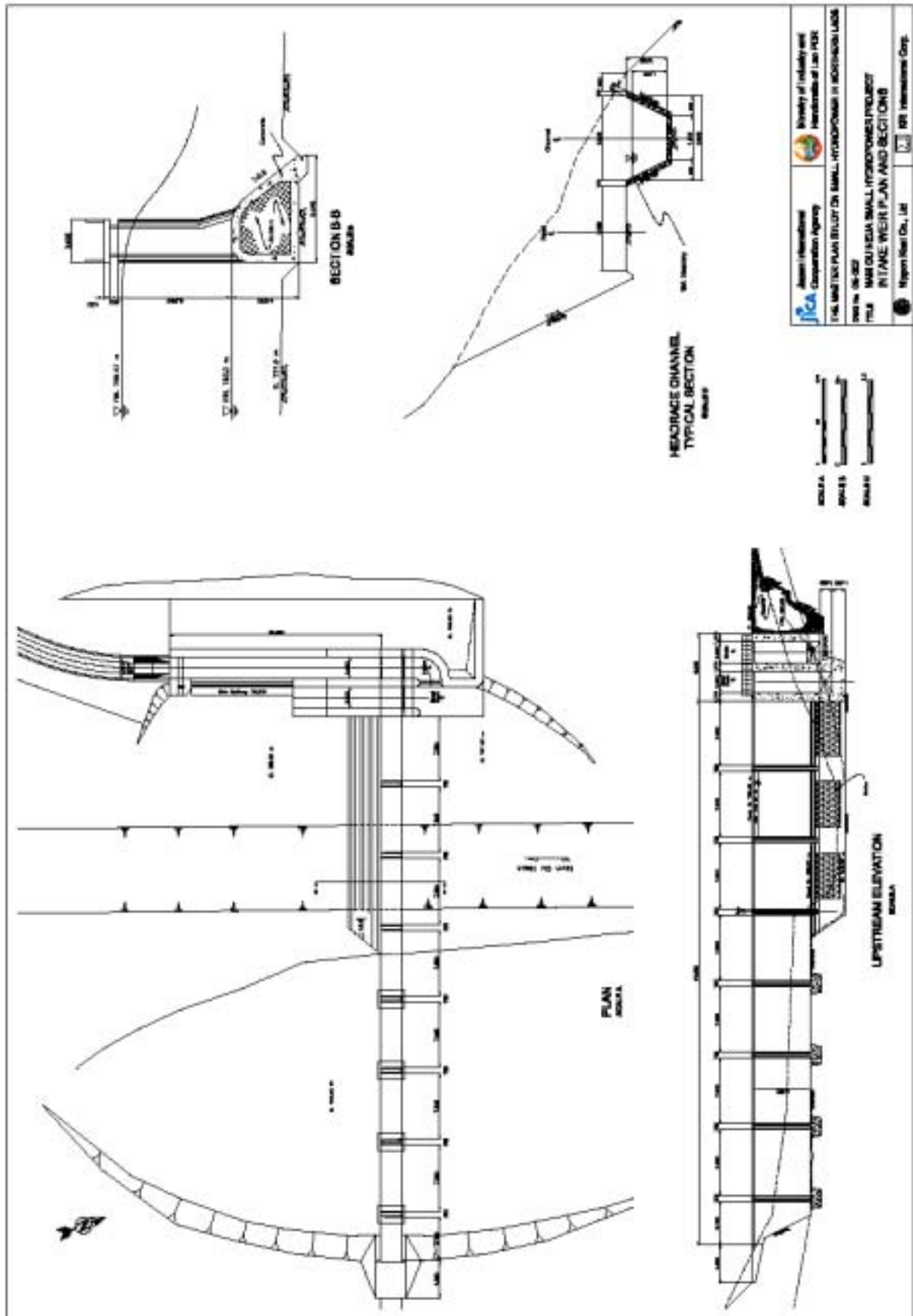
### C. Economic Analysis

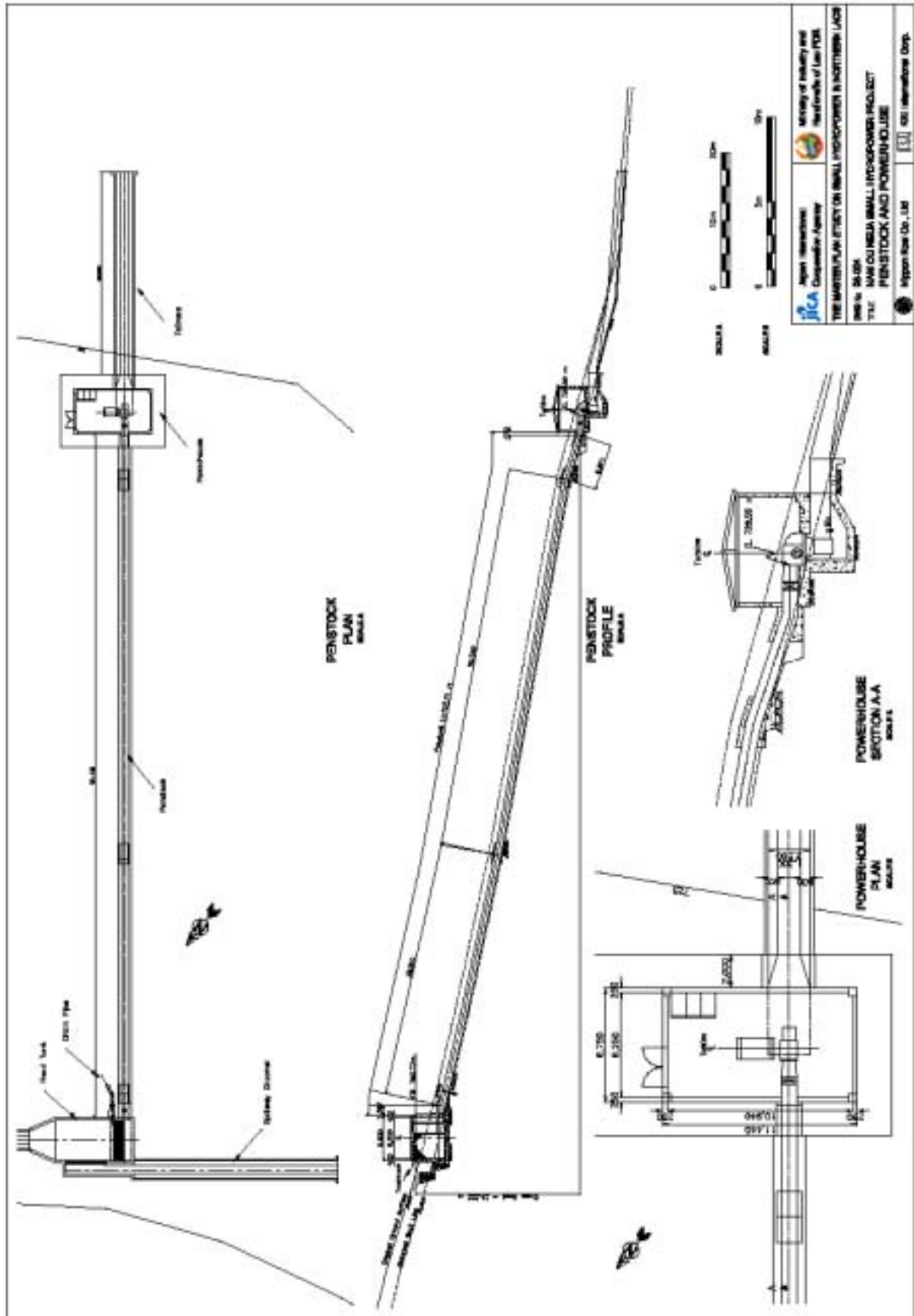
1.Unit Construction Cost	US\$ 6,107 / kW					
2.Unit Generation Cost	UScent / kWh					
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M	n/a % of construction
	Replace	n/a years			EIRR	n/a %

### D. Remarks

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### 3. Nam Boun 2 (Sequence No. 6)

#### A. Salient Features

1.General	Province	Phongsaly		District	Boun Nua	
	Electr. Status	Nam Boun 1 (110 kW) supplies Boun Nua and Nam Ngay (1.2 MW) supplies Phongsaly				
2.Demand	Load Center	Grid (to be extended after 2009)		H/H Number	---	
	Peak Load	---		Peak Hours	---	
3.Hydrology	River	N. Boun (divert to N. Hoy)		Basin	Nam Ou	CA 302 km <sup>2</sup>
	Rainfall	1,800 mm		Q <sub>ave</sub>	7.48 m <sup>3</sup> /s	Q <sub>95%</sub> 1.88 m <sup>3</sup> /s
4.Structures						
4.1 Intake Weir	Type	Gabion-core concrete facing		Height	4.7 m	Length 30.0 m
				FSL	898.87 m	FWL 902.51m
4.2 Desilting Basin	Length	---	Width	---	Side Spillway Length ---	
4.3 Headrace Tunnel (Free-flow)	Shape	Horseshoe (r <sub>0</sub> =0.91 m)		Lining	Wet Masonry	Length 3,102 m
	Uniform Depth	1.59 m		r <sub>0</sub>	0.91 m	
4.4 Head Tank	Regulating Capacity	(None) m <sup>3</sup>		NWL	895.62 m	MOL 893.39 m
4.5 Penstock	Type	Exposed		Dia.	1.45 m	Length 411.8 m
4.6 Powerhouse	Type	Surface	EL 758.44 m	Turbine	Francis (H)	Units 2 nos
5.Power and Energy	Q <sub>design</sub>	3.90 m <sup>3</sup> /s	H <sub>net</sub> 129.5 m	Installed Capacity		4,000 kW
	Energy	27,708,672 kWh/yr		P.F.	78%	
6.Access Road	Length	20 km				
7.Transmission Line	Capacity	22 kV	Length	20 km	Loss	8.0%   Energy Delivered 25,499,716 kWh/yr

#### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake Weir	US\$ 242,920
1.2 Tunnel Portal	US\$ 138,556
1.3 Headrace Tunnel	US\$ 1,745,427
1.4 Head Tank	US\$ 94,151
1.5 Spillway Channel	US\$ 7,284
1.6 Penstock	US\$ 201,589
1.7 Powerhouse	US\$ 176,542
1.8 Tailrace	US\$ 779,082
1.9 Access Road	US\$ 200,000
1.10 Miscellaneous (20% of 1.1-1.9)	US\$ 717,110
<b>Total of Civil Works</b>	<b>US\$ 4,302,661</b>
2.Steel Penstock	US\$ 436,272

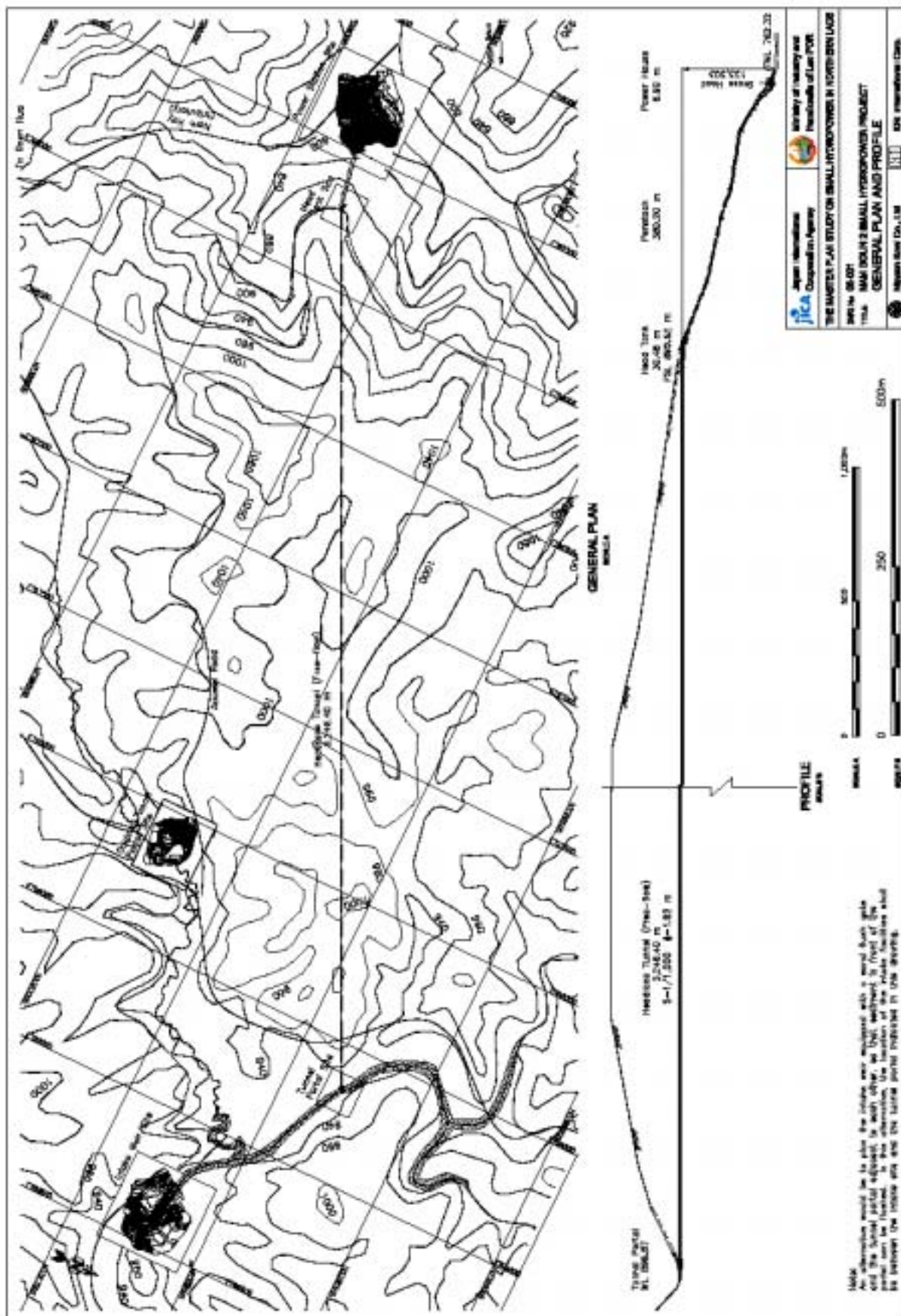
Items	Cost
3.Gate & Trashracks	US\$ 16,374
4.Turbine & Generator	US\$ 485,272
5.Transformer & Switchgear	US\$ 188,493
6.Transmission Line	US\$ 281,868
7.E&M Miscellaneous (10% of 2-5)	US\$ 122,641
<b>Total of E&amp;M Works</b>	<b>US\$ 1,520,921</b>
<b>GRAND TOTAL</b>	<b>US\$ 5,823,581</b>

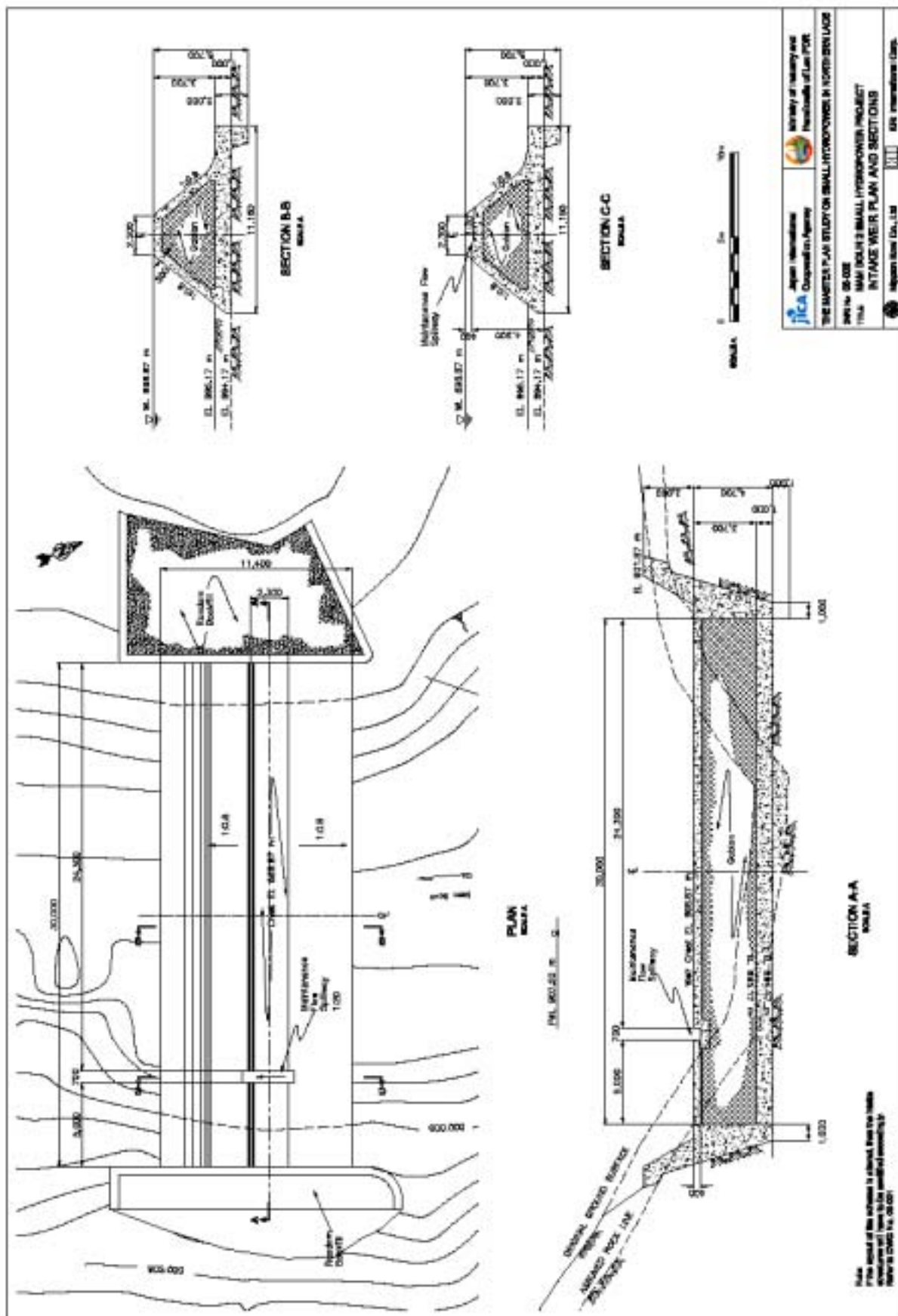
#### C. Economic Analysis

1.Unit Construction Cost	US\$ 1,456 / 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 %

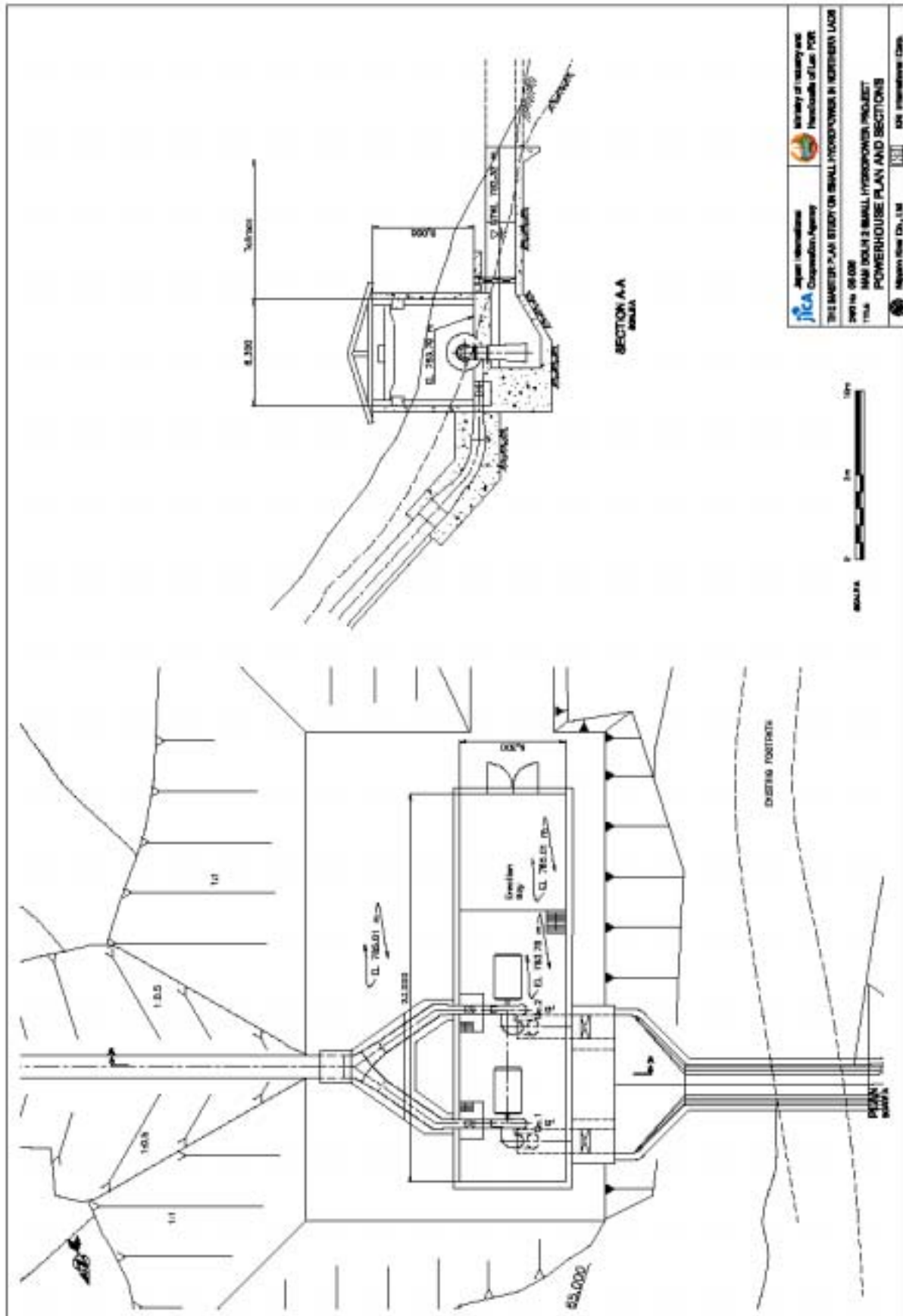
#### D. Remarks

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<p>JICA Japan International Cooperation Agency</p>	<p>Ministry of Natural Resources and Environment of Lao PDR</p>
<p>THE SHIMITEI P-AN STUDY ON SMALL-HYDROPOWER IN NORTHERN LAOS</p>	
<p>№ 176 28-00E SHIMITEI P-AN STUDY ON SMALL-HYDROPOWER PROJECT INTAKE WEIR PLAN AND SECTIONS</p>	
<p>Shimitei P-AN, Ltd.</p>	



## 4. 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	CA	156 km <sup>2</sup>		
	Rainfall	1,730 mm	Q <sub>ave</sub>	2.80 m <sup>3</sup> /s	Q <sub>95%</sub>	0.43 m <sup>3</sup> /s		
4.Structures								
4.1 Intake	Type	Concrete weir		Height	3.7 m	Length	50 m	
				FSL	1014.70 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	Length	4,220 m	
	Uniform Depth	0.77 m		Base	1.60 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	Installed Capacity	2,500 kW		
	Energy	16,782,480 kWh/yr		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>

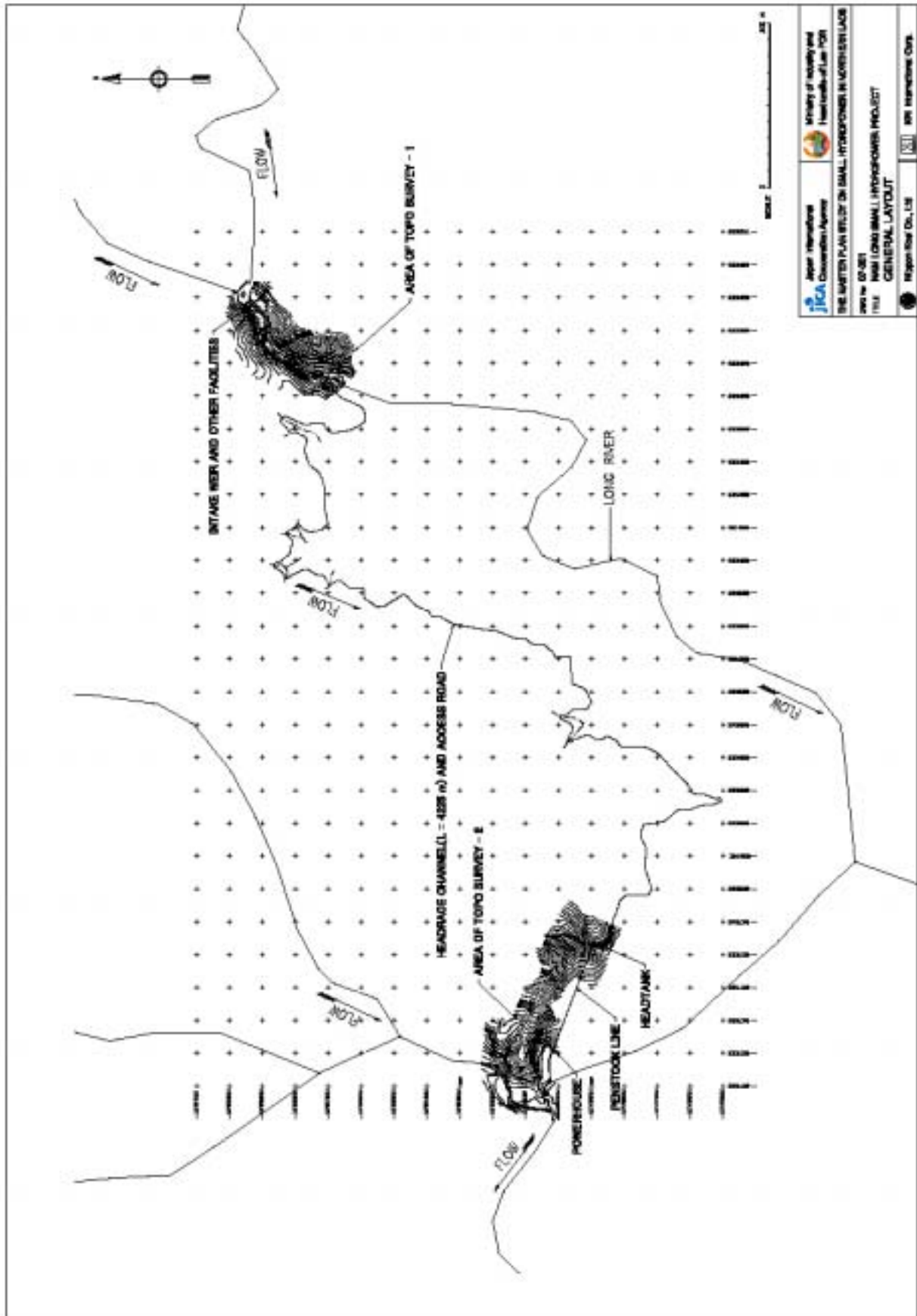
Items	Cost
<b>3.Gate &amp; Trashracks</b>	<b>US\$ 10,500</b>
<b>4.Turbine &amp; Generator</b>	<b>US\$ 273,769</b>
<b>5.Transformer &amp; Switchgear</b>	<b>US\$ 169,397</b>
<b>6.Transmission Line</b>	<b>US\$ 373,000</b>
<b>7.E&amp;M Miscellaneous (10% of 2-5)</b>	<b>US\$ 72,367</b>
<b>Total of E&amp;M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

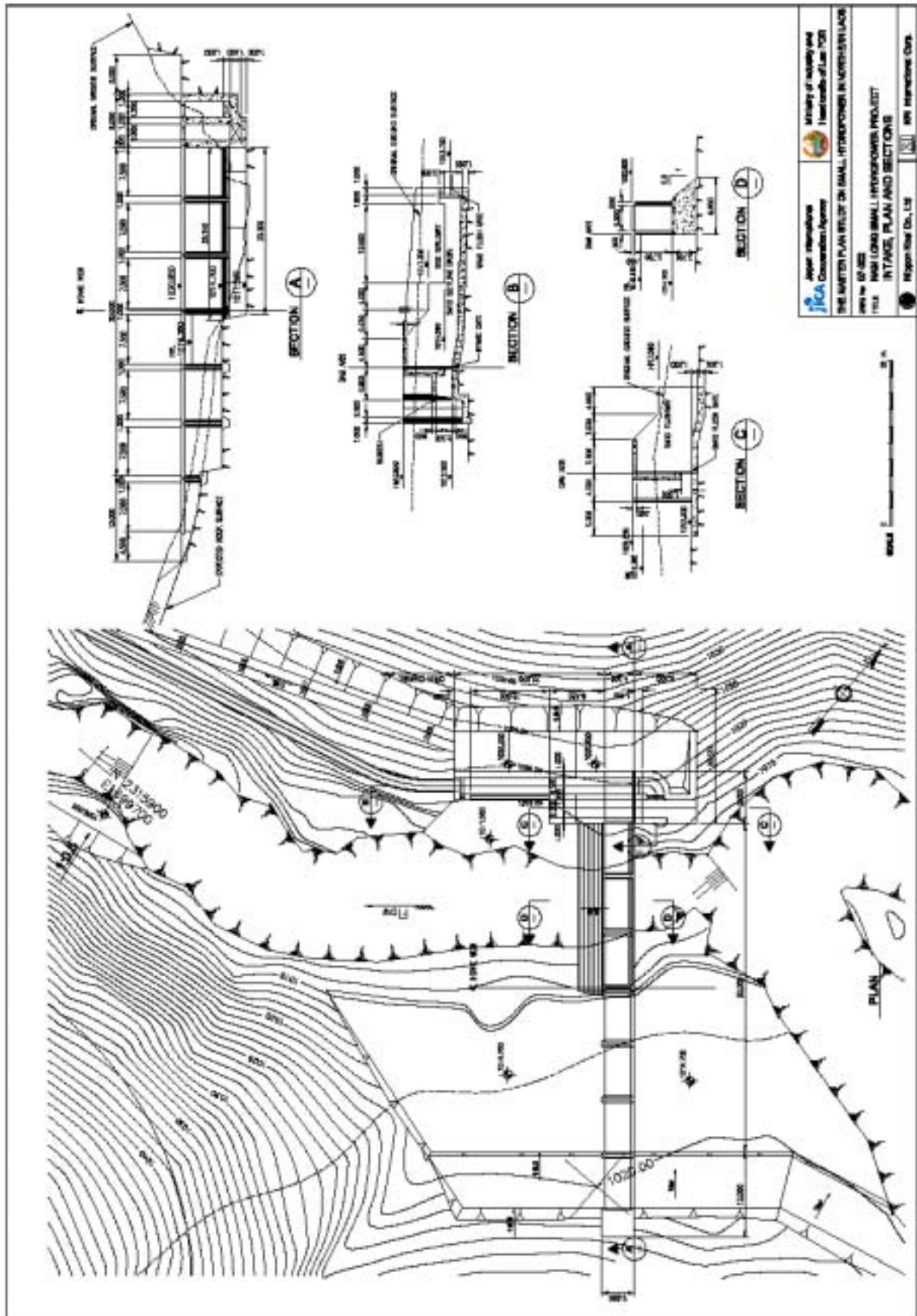
### C. Economic Analysis

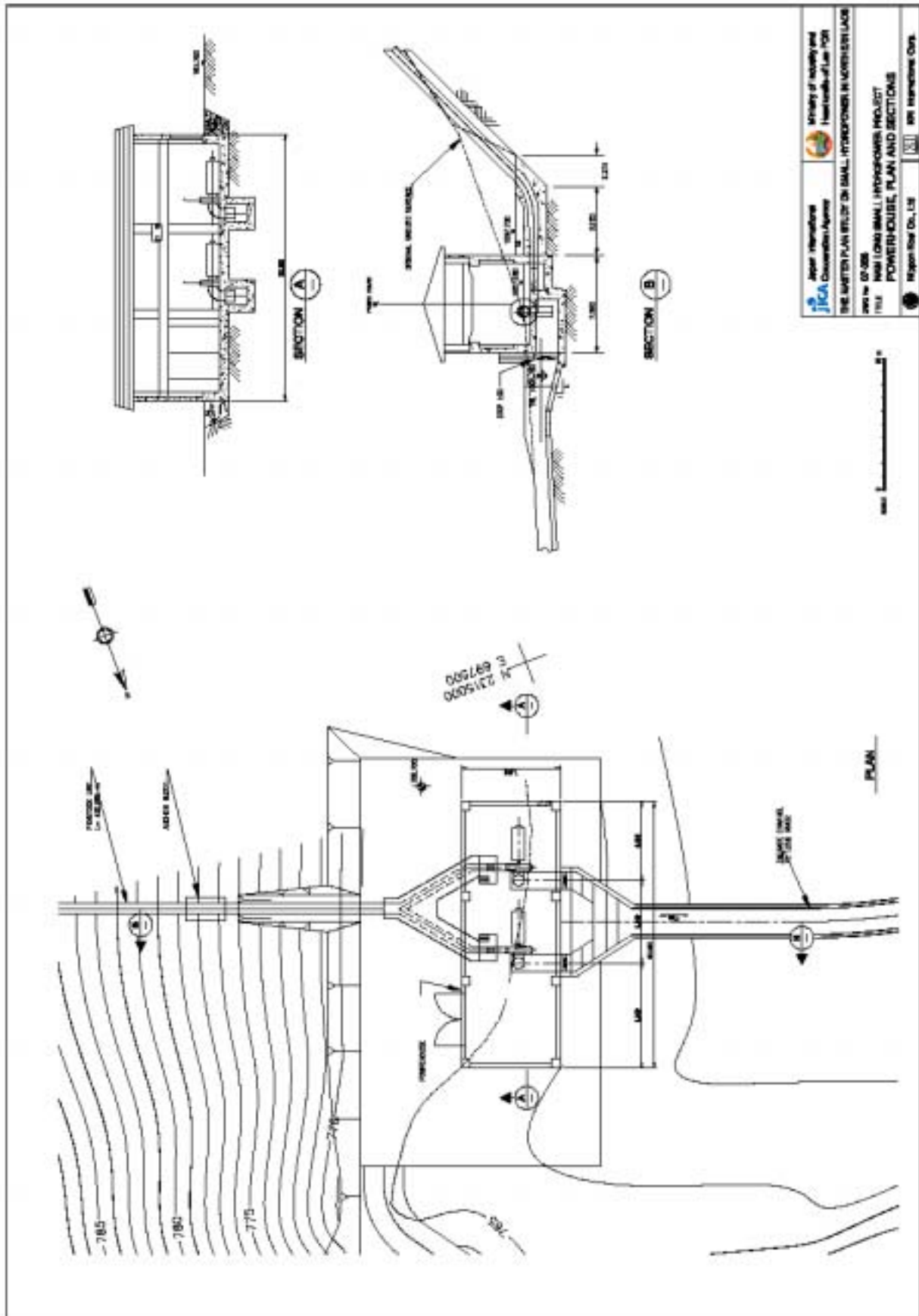
1.Unit Construction Cost	US\$ 1,406 /kW					
2.Unit Generation Cost	UScent /kWh					
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M	n/a % of construction
	Replace	n/a years			EIRR	n/a %

### D. Remarks

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## 5. Nam Gnone (Sequence No. 15)

### A. Salient Features

1.General	Province	Bokeo		District	Houaysay	
	Electr. Status	Import from Thailand by Grid Connection				
2.Demand	Load Center	Grid		H/H Number	-	
	Peak Load	-		Peak Hours	-	
3.Hydrology	River	Nam Gnone		Basin	Nam Souang	CA 121 km <sup>2</sup>
	Rainfall	1,630 mm		Q <sub>ave</sub>	2.13 m <sup>3</sup> /s	Q <sub>95%</sub> 0.33 m <sup>3</sup> /s
4.Structures						
4.1 Intake	Type	Gabion-core concrete facing		Height	2.3 m	Length 20.0 m
				FSL	446.6 m	FWL 450.8 m
4.2 Desilting Basin	Length	15 m	Width	3.0 m	Side Spillway Length	9.0 m
4.3 Headrace Channel	Shape	Trapezoidal (1:0.75)		Lining	Wet Masonry	Length 2,250 m
	Uniform Depth	0.94 m		Base	0.94 m	
4.4 Head Tank	Regulating Capacity	(none) m <sup>3</sup>		NWL	443.8 m	MOL 442.0 m
4.5 Penstock	Type	Exposed		Dia.	0.96 m	Length 100.5 m
4.6 Powerhouse	Type	Surface	TWL	401.1 m	Turbine	Francis (H) Units 1 nos
5.Power and Energy	Q <sub>design</sub>	1.85 m <sup>3</sup> /s	H <sub>net</sub>	42 m	Installed Capacity	600 kW
	Energy	2,923,992 kWh/yr		P.F.	55.5%	
6.Access Road	Length	2 km				
7.Transmission Line	Capacity	22 kV	Length	15 km	Loss	8.7% Energy Delivered 2,668,825 kWh

### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 48,854
1.2 Desilting Basin	US\$ 104,453
1.3 Headrace Channel	US\$ 323,345
1.4 Head Tank	US\$ 33,186
1.5 Spillway Channel	US\$ 6,931
1.6 Penstock	US\$10,869
1.7 Powerhouse	US\$ 39,362
1.8 Tailrace	US\$ 4,855
1.9 Access Road	US\$ 20,000
1.10 Miscellaneous (20% of 1.1-1.9)	US\$ 118,371
<b>Total of Civil Works</b>	<b>US\$ 710,227</b>
2.Steel Penstock	US\$ 42,785

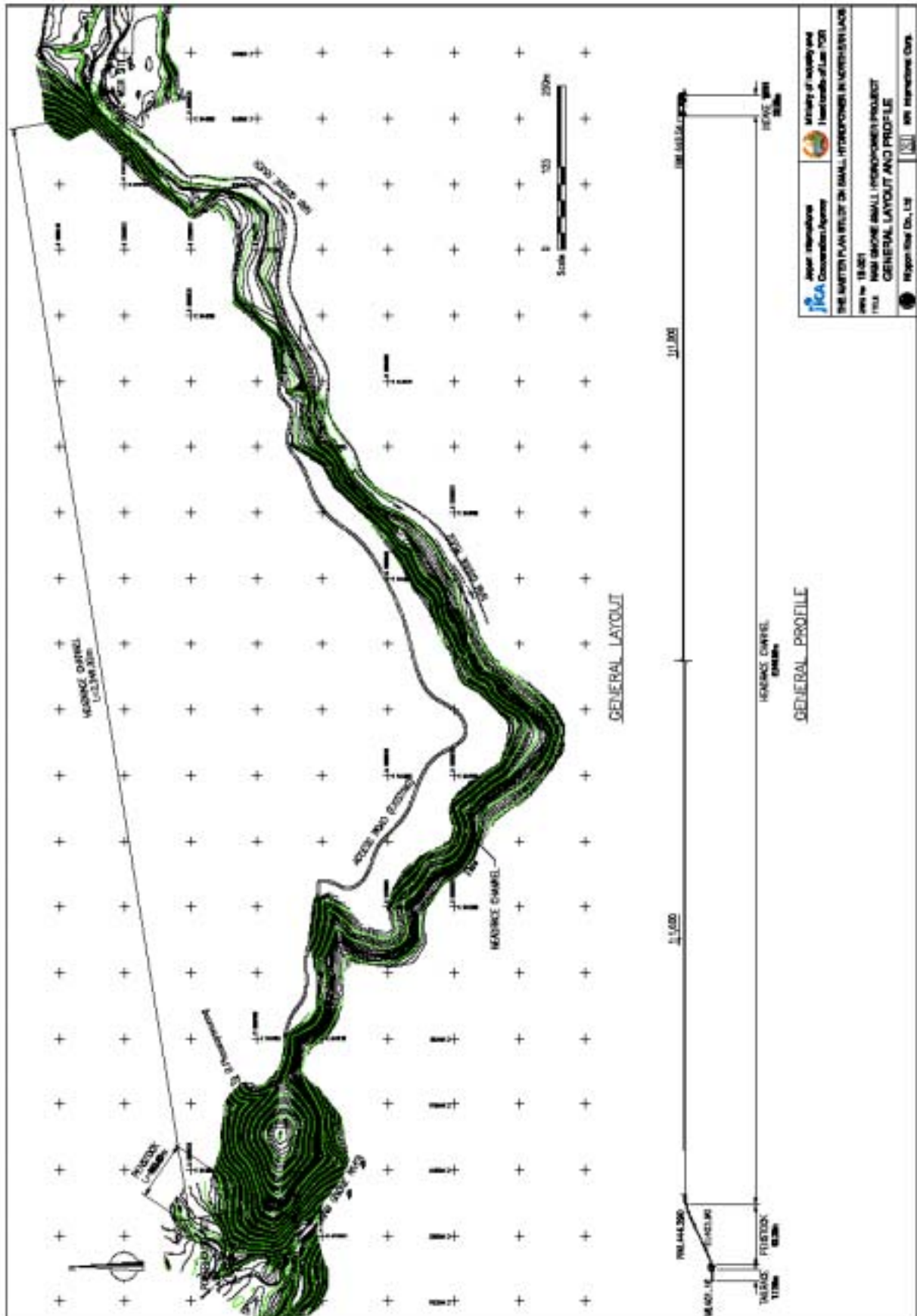
Items	Cost
3.Gate & Trashracks	US\$ 6,152
4.Turbine & Generator	US\$ 197,199
5.Transformer & Switchgear	US\$ 130,303
6.Transmission Line	US\$ 150,921
7.E&M Miscellaneous (10% of 2-5)	US\$ 37,644
<b>Total of E&amp;M Works</b>	<b>US\$ 565,005</b>
<b>GRAND TOTAL</b>	<b>US\$ 1,275,232</b>

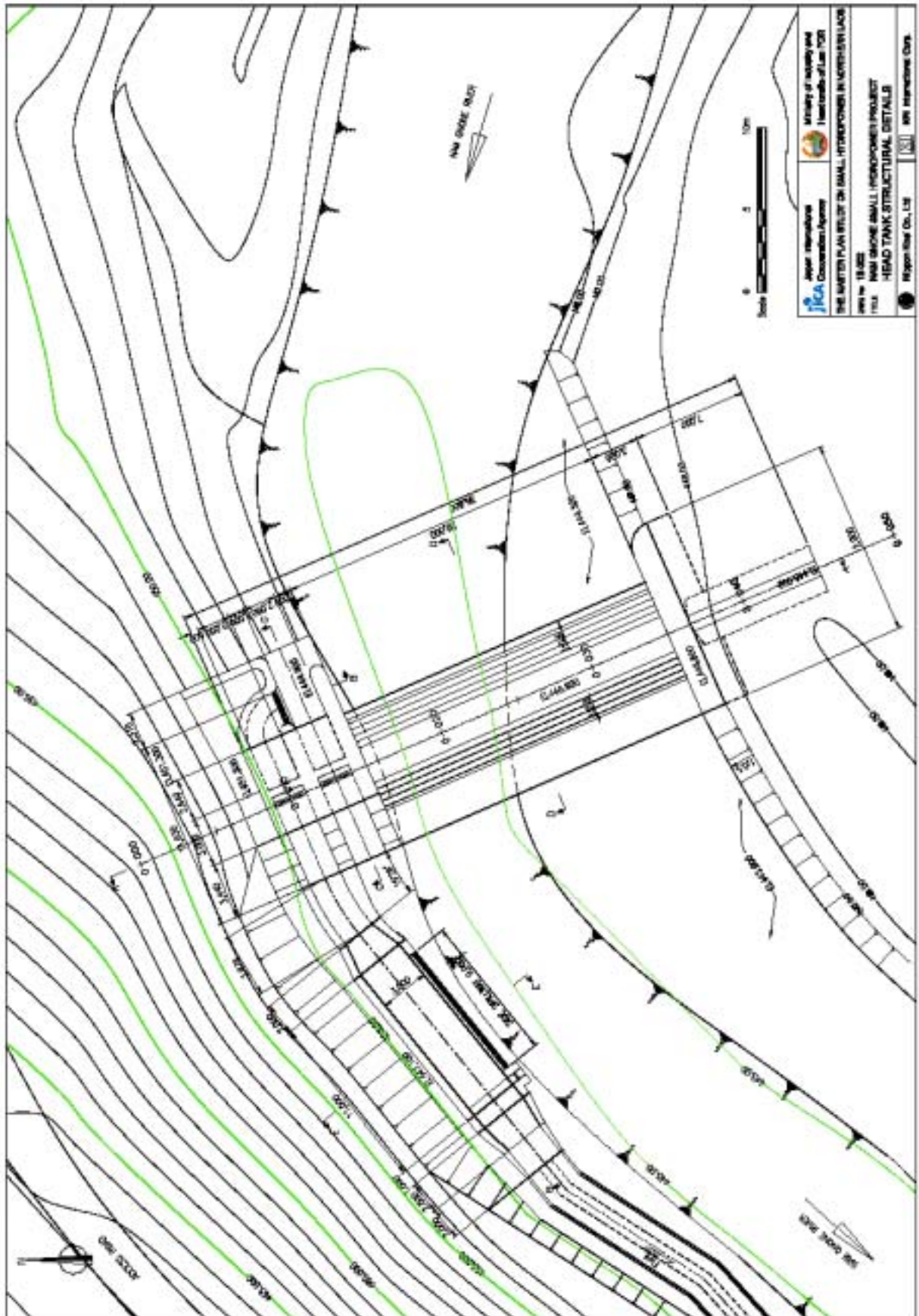
### C. Economic Analysis

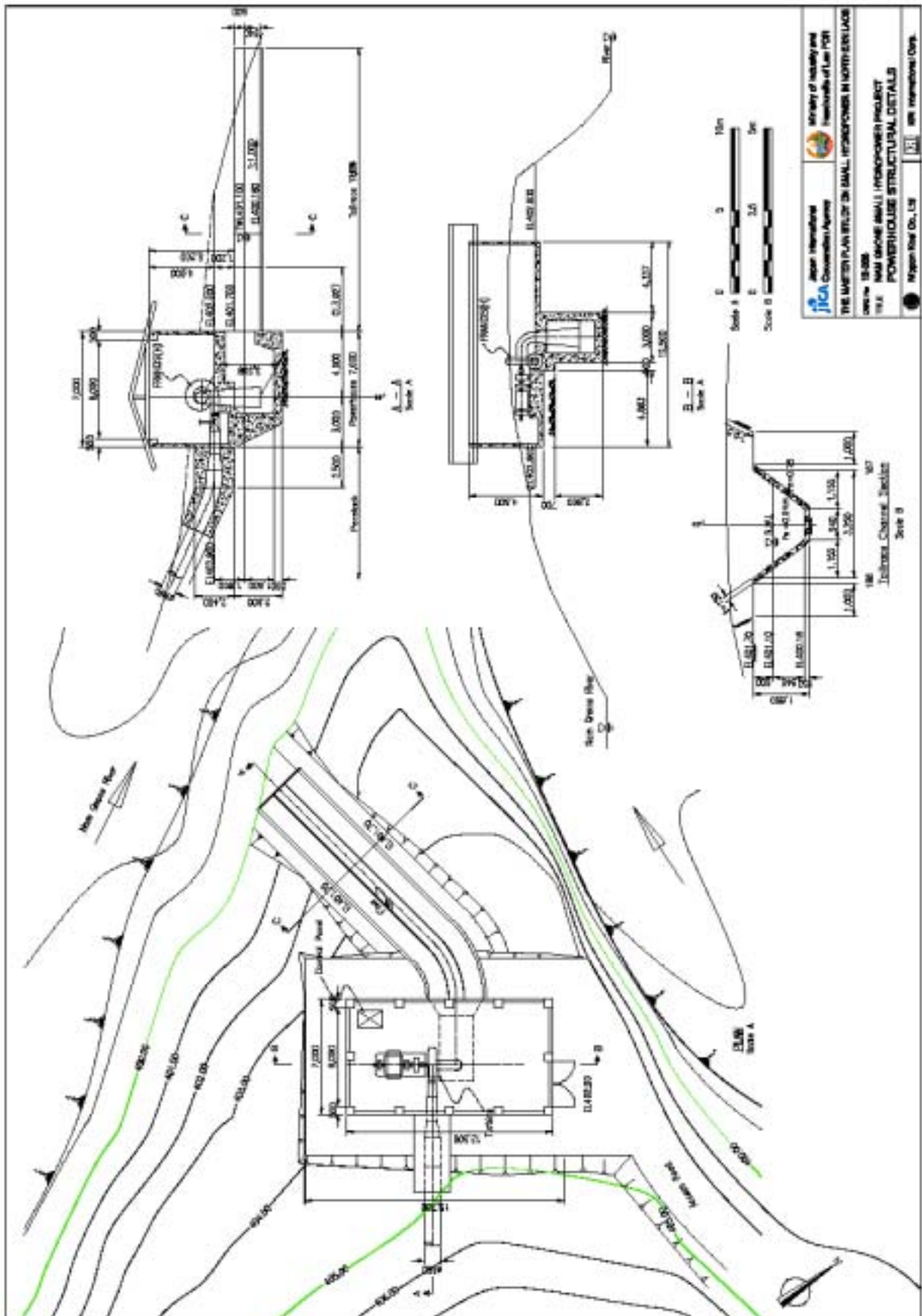
1.Unit Construction Cost	US\$ 2,125/kW				
2.Unit Generation Cost	UScent /kWh				
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M n/a % of construction
	Replace	n/a years			EIRR n/a %

### D. Remarks

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## 6. Nam Chong (Sequence No. 17)

### A. Salient Features

1.General	Province	Bokeo		District	Meung	
	Electr. Status	Partly electrified by pico-hydros with semi-permanent structures				
2.Demand	Load Center	Ban Nam Meung		H/H Number	216 H/H	
	Peak Load	46 kW		Peak Hours	4 hours	
3.Hydrology	River	Nam Chong		Basin	Nam Souang	CA 4.88 km <sup>2</sup>
	Rainfall	1,680 mm		Q <sub>ave</sub>	0.085 m <sup>3</sup> /s	Q <sub>95%</sub> 0.013 m <sup>3</sup> /s
4.Structures						
4.1 Intake	Type	Conc. Type using Existing Irr. Weir		Height	1.5 m	Length 19.7 m
				FSL	795.00 m	FWL 795.86 m
4.2 Desilting Basin	Length	11.0 m	Width	0.7 m	Side Spillway Length	7.5 m
4.3 Headrace Channel	Shape	Trapezoidal (1:0.5)		Lining	Wet Masonry	Length 1,002.05 m
	Uniform Depth	0.40 m		Base	0.5 m	
4.4 Head Tank	Regulating Capacity	15 m <sup>3</sup>		NWL	792.8 m	MOL 792.05 m
4.5 Penstock	Type	Exposed		Dia.	0.24 m	Length 209.95 m
4.6 Powerhouse	Type	Surface	EL	730.25 m	Turbine	Cross Flow Units 1 nos
5.Power and Energy	Q <sub>design</sub>	0.121m <sup>3</sup> /s	H <sub>net</sub>	61.8 m	Installed Capacity	50 kW
	Energy	132,020 kWh/yr		P.F.	30.7%	
6.Access Road	Length	0.5 km				
7.Transmission Line	Capacity	22 kV		Length	5 km	
	Loss	10.0%		Energy Delivered.	118,818 kWh/yr	

### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake Weir	US\$ 1,061
1.2 Intake & Desilting Basin	US\$ 6,448
1.3 Headrace Channel	US\$ 22,312
1.4 Head Tank	US\$ 1,053
1.5 Spillway Channel	US\$ 649
1.6 Penstock	US\$ 369
1.7 Powerhouse	US\$ 5,858
1.8 Tailrace	US\$ 649
1.9 Access Road	US\$ 5,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 8,680
<b>Total of Civil Works</b>	<b>US\$ 52,077</b>
2.Steel Penstock	US\$ 27,954

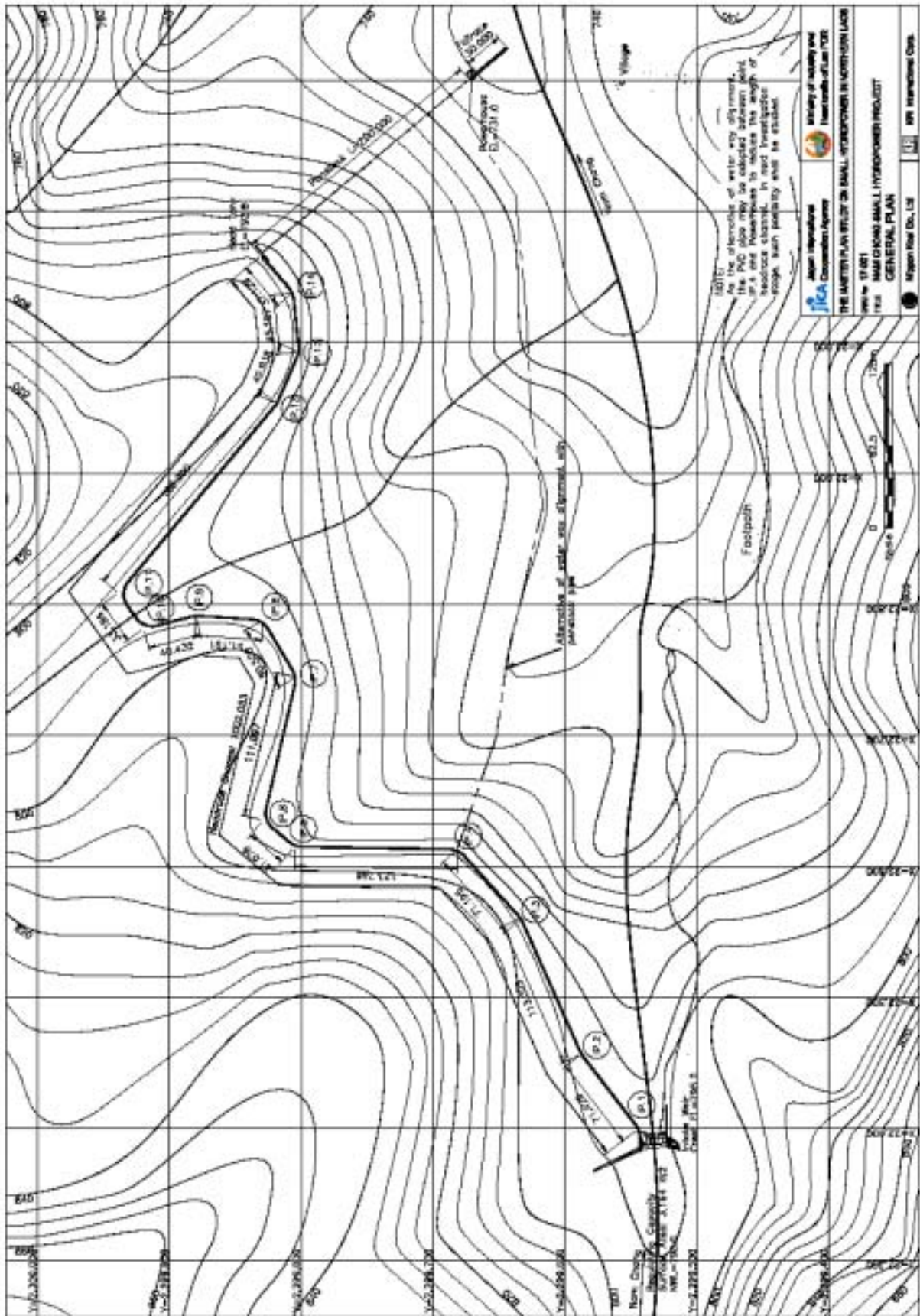
Items	Cost
3.Gate & Trashracks	US\$ 1,200
4.Turbine & Generator	US\$ 69,230
5.Transformer & Switchgear	US\$ 10,470
6.Transmission Line	US\$ 57,453
7.E&M Miscellaneous (10% of 2-6)	US\$ 10,885
<b>Total of E&amp;M Works</b>	<b>US\$ 177,282</b>
<b>GRAND TOTAL</b>	<b>US\$ 229,360</b>

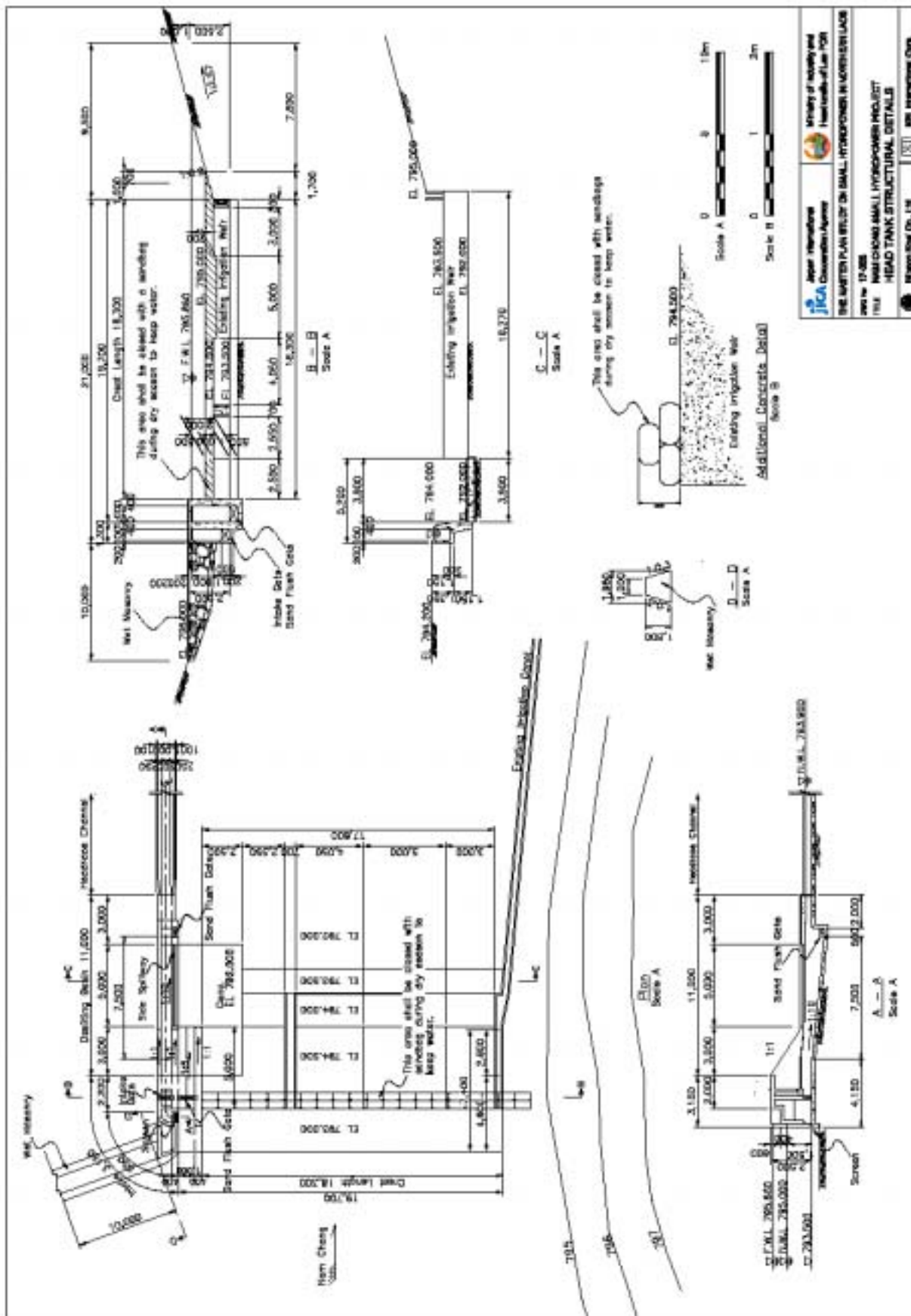
### C. Economic Analysis

1.Unit Construction Cost	US\$ 4,587 /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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JICA  
Japan International  
Cooperation Agency

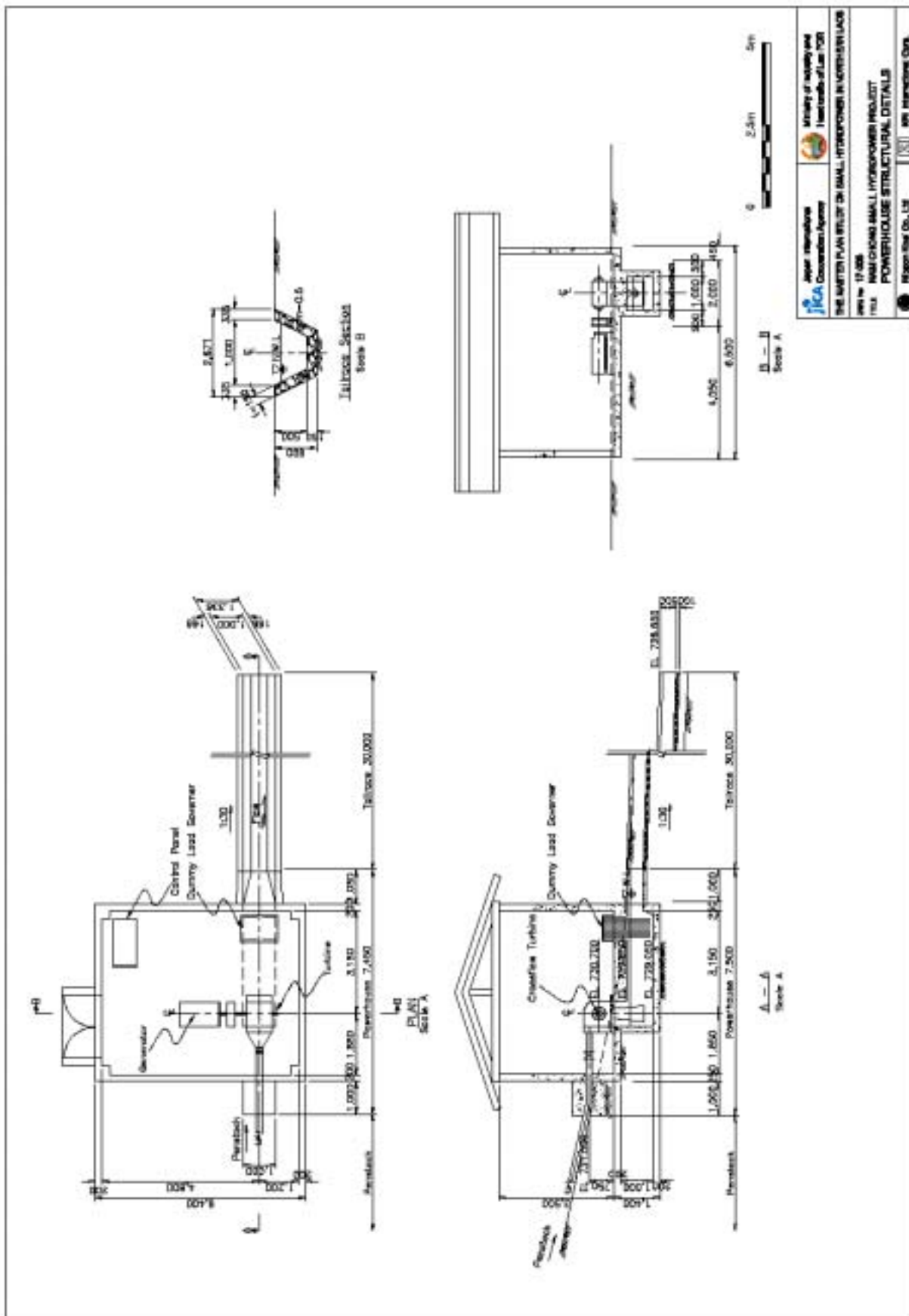
Ministry of Agriculture and  
Forestry of Laos PDR

THE MASTER PLAN STUDY ON SMALL HYDROPOWER IN NORTHERN LAOS

SECTION 17-002  
HEAD TANK SMALL HYDROPOWER PROJECT  
HEAD TANK STRUCTURAL DETAILS

Project No. 152

MR International Corp.





## 7. Nam Hat 2 (Sequence No. 20)

### A. Salient Features

1.General	Province	Bokeo		District	Pha Oudom	
	Electr. Status	Un-electrified				
2.Demand	Load Center	Pha Oudom District Center			H/H Number	693
	Peak Load	116 kW			Peak Hours	4 hours
3.Hydrology	River	Nam Hat		Basin	Nam Hat	CA 117 km <sup>2</sup>
	Rainfall	1,560 mm		Q <sub>ave</sub>	1.89 m <sup>3</sup> /s	Q <sub>95%</sub> 0.29 m <sup>3</sup> /s
4.Structures						
4.1 Intake	Type	Gabion-core Concrete-facing			Height	2.0 m
					FSL	494.00 m
					FWL	498.65 m
4.2 Desilting Basin	Length	12.8 m	Width	1.23 m	Side Spillway Length	4.0 m
4.3 Headrace Channel	Shape	Trapezoidal (1:0.3)			Lining	Wet Masonry
	Uniform Depth	0.50 m			Base	0.75 m
4.4 Head Tank	Regulating Capacity	(none) m <sup>3</sup>			NWL	489.22 m
					MOL	488.07 m
4.5 Penstock	Type	Exposed			Dia.	0.4 m
					Length	162 m
4.6 Powerhouse	Type	Surface	EL	438.00 m	Turbine	Cross Flow
					Units	1 nos
5.Power and Energy	Q <sub>design</sub>	0.36 m <sup>3</sup> /s	H <sub>net</sub>	48 m	Installed Capacity	116 kW
	Energy	508,244 kWh/yr			P.F.	49.9%
6.Access Road	Length	10 km				
7.Transmission Line	Capacity	22 kV			Length	24 km
	Loss	10.0%			Energy Delivered.	457,420 kWh/yr

### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 74,915
1.2 Desilting Basin	US\$ 7,038
1.3 Headrace Channel	US\$ 231,360
1.4 Head Tank	US\$ 10,283
1.5 Spillway Channel	US\$ 4,012
1.6 Penstock	US\$ 4,516
1.7 Powerhouse	US\$ 16,048
1.8 Tailrace	US\$ 932
1.9 Access Road	US\$ 100,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 89,821
<b>Total of Civil Works</b>	<b>US\$ 538,923</b>
2.Steel Penstock	US\$ 35,495

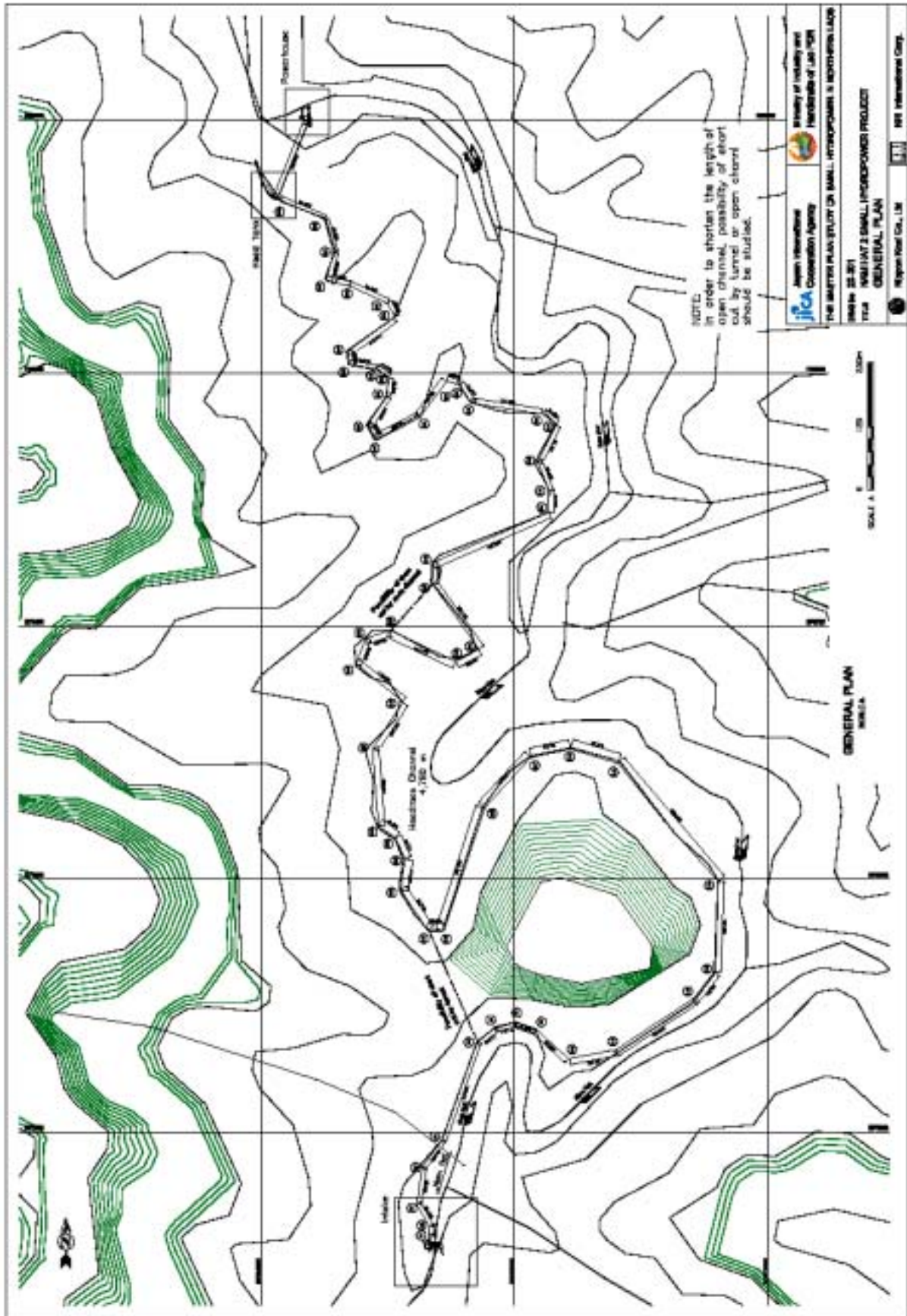
Items	Cost
3.Gate & Trashracks	US\$ 1,843
4.Turbine & Generator	US\$ 79,980
5. Transformer & Switchgear	US\$ 12,920
6.Transmission Line	US\$ 336,639
7.E&M Miscellaneous (10% of 2-5)	US\$ 13,024
<b>Total of E&amp;M Works</b>	<b>US\$ 479,900</b>
<b>GRAND TOTAL</b>	<b>US\$ 1,018,823</b>

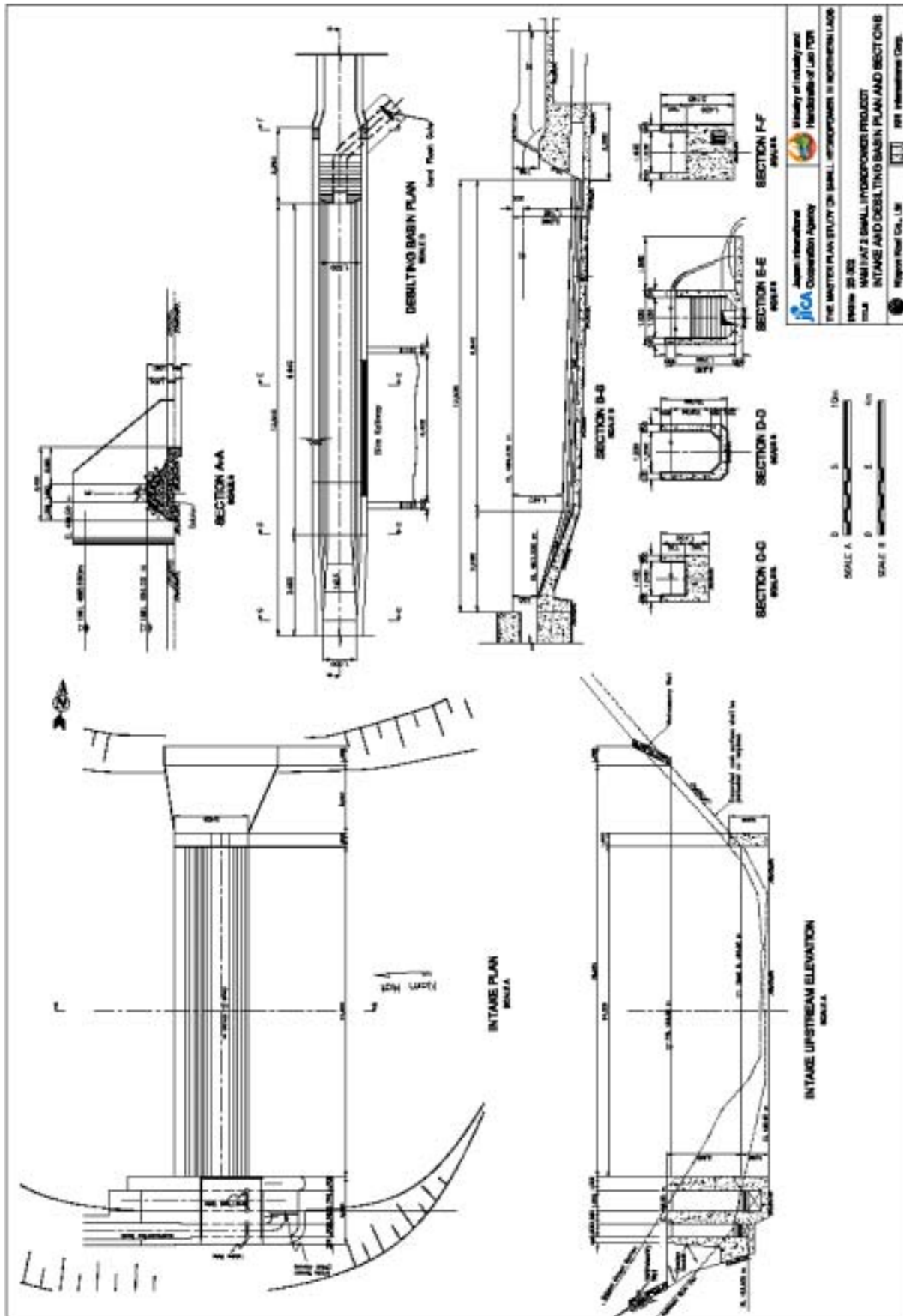
### C. Economic Analysis

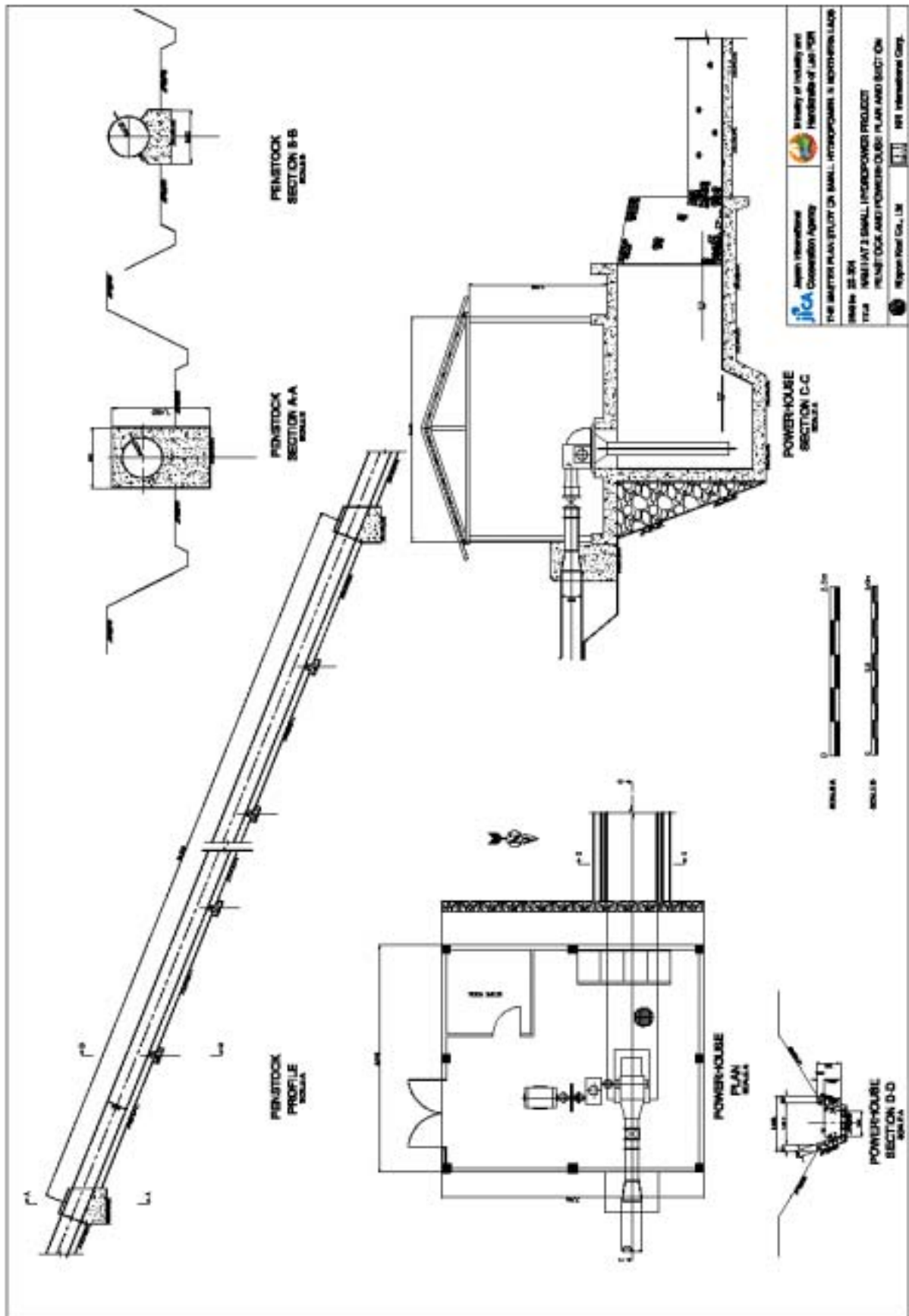
1.Unit Construction Cost	US\$ 8,490 /kW				
2.Unit Generation Cost	UScent /kWh				
3.Economic Analysis	Project Life	n/a years	Discount Rate	n/a%	O&M n/a % of construction
	Replace	n/a years			EIRR n/a %

### D. Remarks

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## 8. Nam Xeng (Sequence No. 23)

### A. Salient Features

1.General	Province	Luangphrabang	District	Vieng Kam
	Electr. Status			
2.Demand	Load Center	Pak Um (New District Center)	H/H Number	503
	Peak Load	106 kW	Peak Hours	4 hours
3.Hydrology	River	Nam Xeng	Basin	Nam Xeng
	Rainfall	1,570 mm	CA	429 km <sup>2</sup>
			Q <sub>ave</sub>	6.98 m <sup>3</sup> /s
			Q <sub>95%</sub>	1.07 m <sup>3</sup> /s
4.Structures				
4.1 Intake	Type	Gabion-core Concrete-facing	Height	4.0 m
	Regulating Capacity	6,168 m <sup>3</sup>	FSL	504.00 m
			FWL	509.35 m
4.2 Desilting Basin	Length	26 m	Width	3.3 m
			Side Spillway Length	10 m
4.3 Headrace Channel	Shape	Trapezoidal (1:0.3)	Lining	Wet Masonry
	Uniform Depth	1.05 m	Base	1.6 m
4.4 Head Tank	Regulating Capacity	---	NWL	502.42 m
			MOL	500.42 m
4.5 Penstock	Type	Exposed	Dia.	0.89 m
			Length	17.99 m
4.6 Powerhouse	Type	Surface	EL	490.94 m
			Turbine	Cross-flow
			Units	1 nos
5.Power and Energy	Q <sub>design</sub>	1.50 m <sup>3</sup> /s	H <sub>net</sub>	10.5 m
	Energy	461,772 kWh/yr	Installed Capacity	106 kW
			P.F.	50.1 %
6.Access Road	Length	8 km		
7.Transmission Line	Capacity	22 kV	Length	17 km
	Loss	10.0%	Energy Delivered.	415,595 kWh/yr

### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 187,113
1.2 Desilting Basin	US\$ 31,900
1.3 Headrace Channel	US\$ 152,574
1.4 Head Tank	US\$ 22,211
1.5 Spillway Channel	US\$ 2,100
1.6 Penstock	US\$ 4,035
1.7 Powerhouse	US\$ 18,392
1.8 Tailrace	US\$730
1.9 Access Road	US\$ 20,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 87,813
<b>Total of Civil Works</b>	<b>US\$ 526,878</b>
2.Steel Penstock	US\$ 6,000

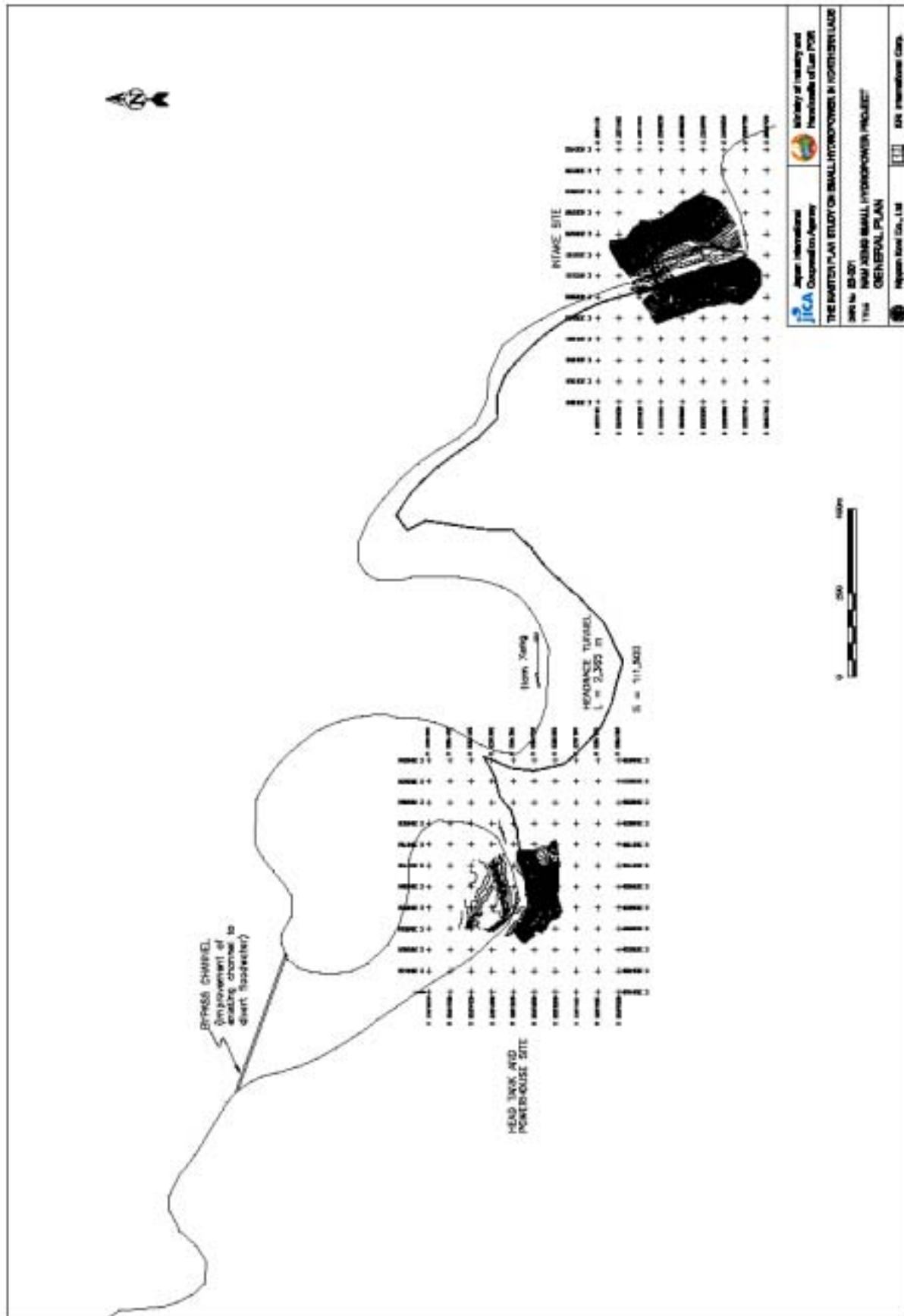
Items	Cost
3.Gate & Trashracks	US\$ 7,500
4.Turbine & Generator	US\$ 96,030
5.Transformer & Switchgear	US\$ 14,370
6.Transmission Line	US\$ 196,224
7.E&M Miscellaneous (10% of 2-5)	US\$ 12,390
<b>Total of E&amp;M Works</b>	<b>US\$ 332,514</b>
<b>GRAND TOTAL</b>	<b>US\$ 859,392</b>

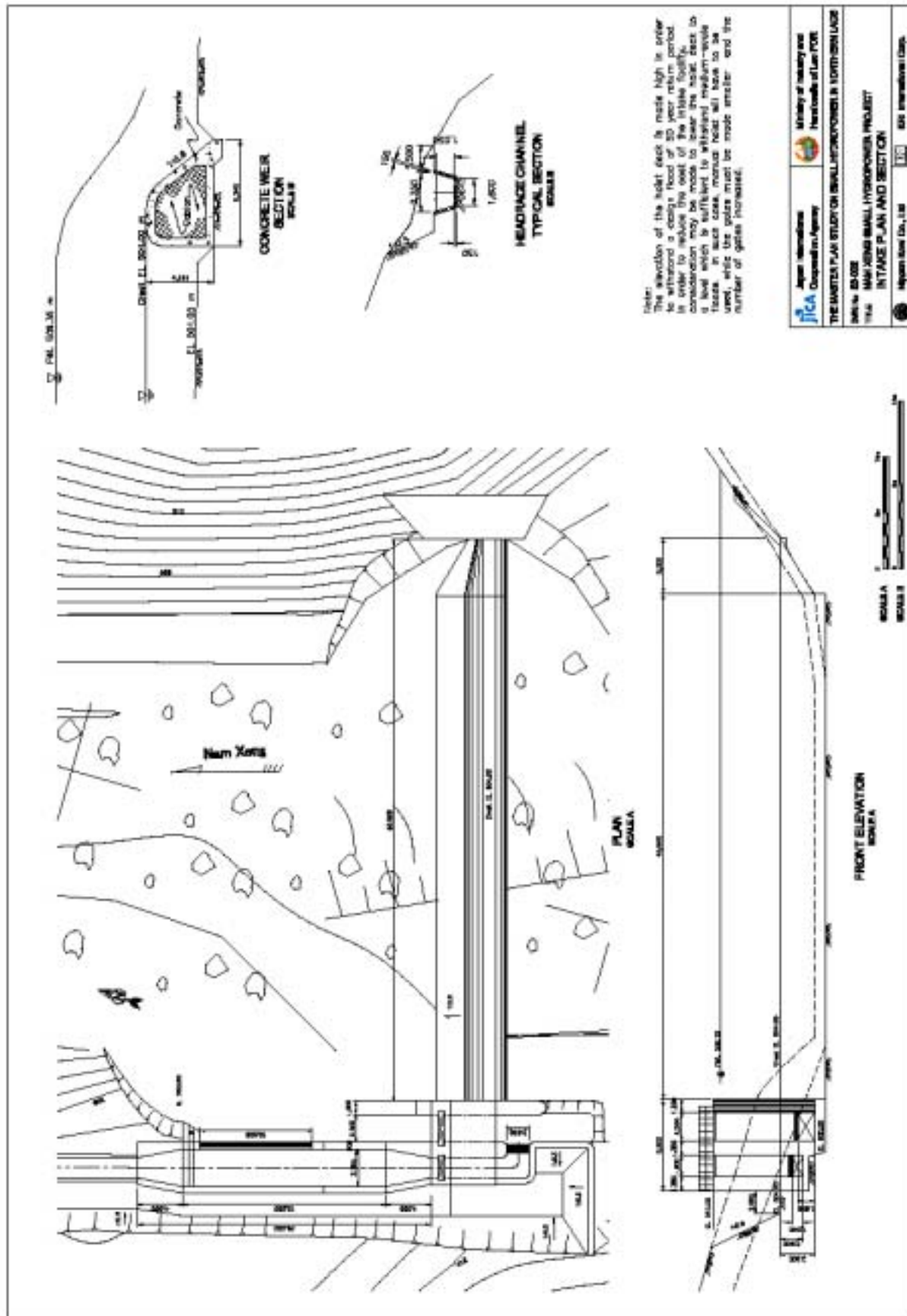
### C. Economic Analysis

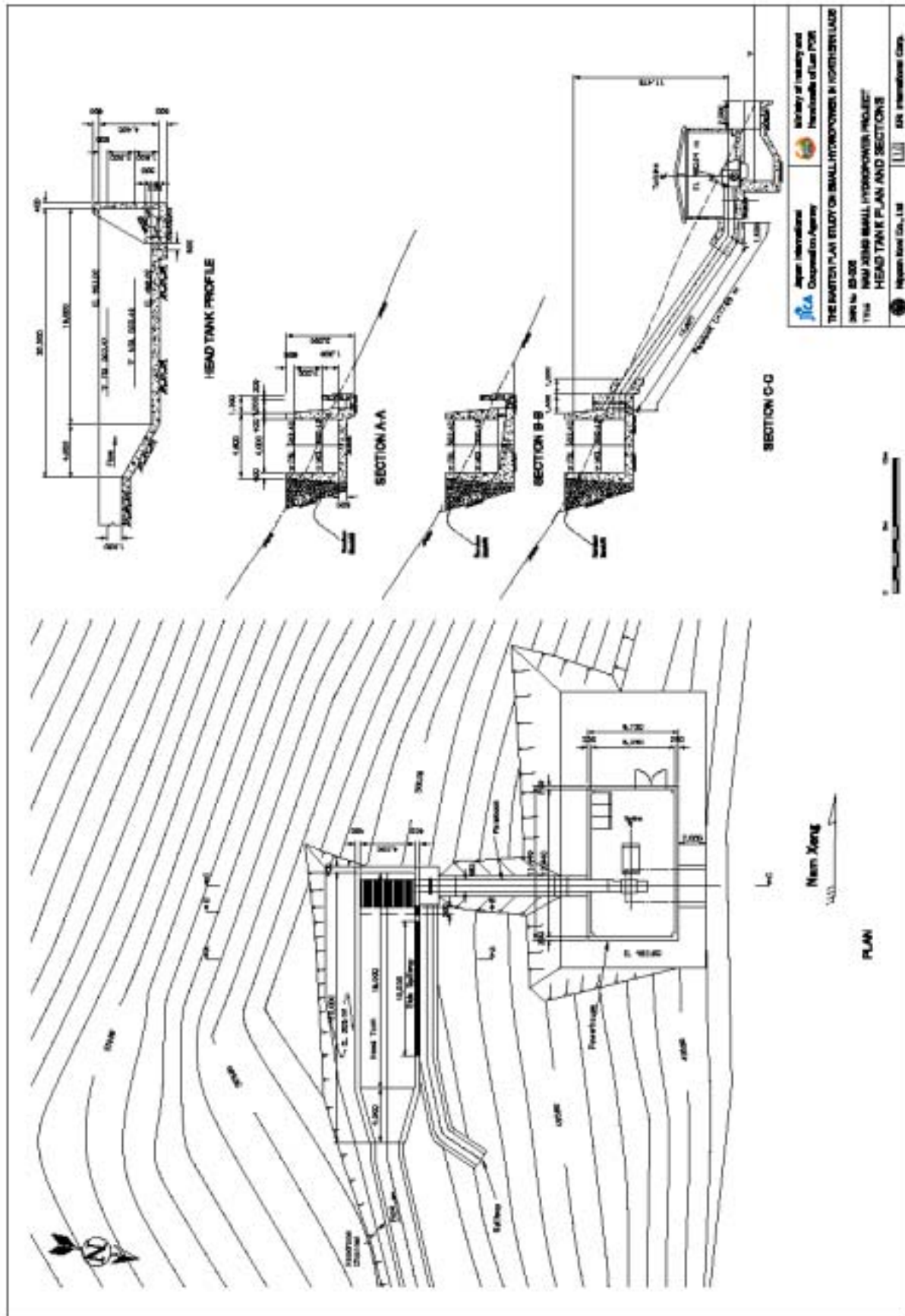
1.Unit Construction Cost	US\$ 7,813 /kW		
2.Unit Generation Cost	UScent /kWh		
3.Economic Analysis	Project Life n/a years	Discount Rate n/a%	O&M n/a % of construction
	Replace n/a years		EIRR n/a %

### D. Remarks

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## 9. Nam Sim (Sequence No. 27)

### A. Salient Features

1.General		Province	Houaphan		District	Viengxay			
		Electr. Status	Power import from Vietnam						
2.Demand		Load Center	Grid		H/H Number	-			
		Peak Load	-		Peak Hours	-			
2.Hydrology		River	Nam Sim		Basin	Nam Sim	CA 197 km <sup>2</sup>		
		Rainfall	1,750 mm		Q <sub>ave</sub>	4.74 m <sup>3</sup> /s	Q <sub>95%</sub> 1.19 m <sup>3</sup> /s		
3.Structures									
3.1 Intake		Weir A	Type	Gabion-core Concrete-facing		Height	7.5 m	Length	30.0 m
		Weir B	Type	Gabion-core Concrete-facing		Height	5.0 m	Length	30.0 m
3.2 Desilting Basin		Length	18.5 m	Width	2.5 - 6.6 m	Side Spillway Length	12 m		
3.3 Headrace Tunnel		Shape	Standard Horseshoe (Pressure)		Lining	Concrete	Length	1,186 m	
3.4 Headrace Channel		Shape	Trapezoidal (1:0.5)		Lining	Wet Masonry	Length	536 m	
		Uniform Depth	1.58 m		Base	2.35 m			
3.5 Head Tank		Regulating Capacity	(none) m <sup>3</sup>		NWL	619.46 m	MOL	616.38 m	
3.6 Penstock		Type	Exposed		Dia.	1.5 m	Length	452 m	
3.7 Powerhouse		Type	Surface	EL	462.56 m	Turbine	Hor. Francis	Units	2 nos
4.Power and Energy		Q <sub>design</sub>	6.0 m <sup>3</sup> /s	H <sub>net</sub>	165 m	Installed Capacity	8,000 kW		
		Energy	34,671,744 kWh/yr		P.F.	49.3 %			
5.Access Road		Length	20 km						
6.Transmission Line		Capacity	22 kV	Length	12 km	Loss	8.7%	Energy Delivered	31,672,903 kWh

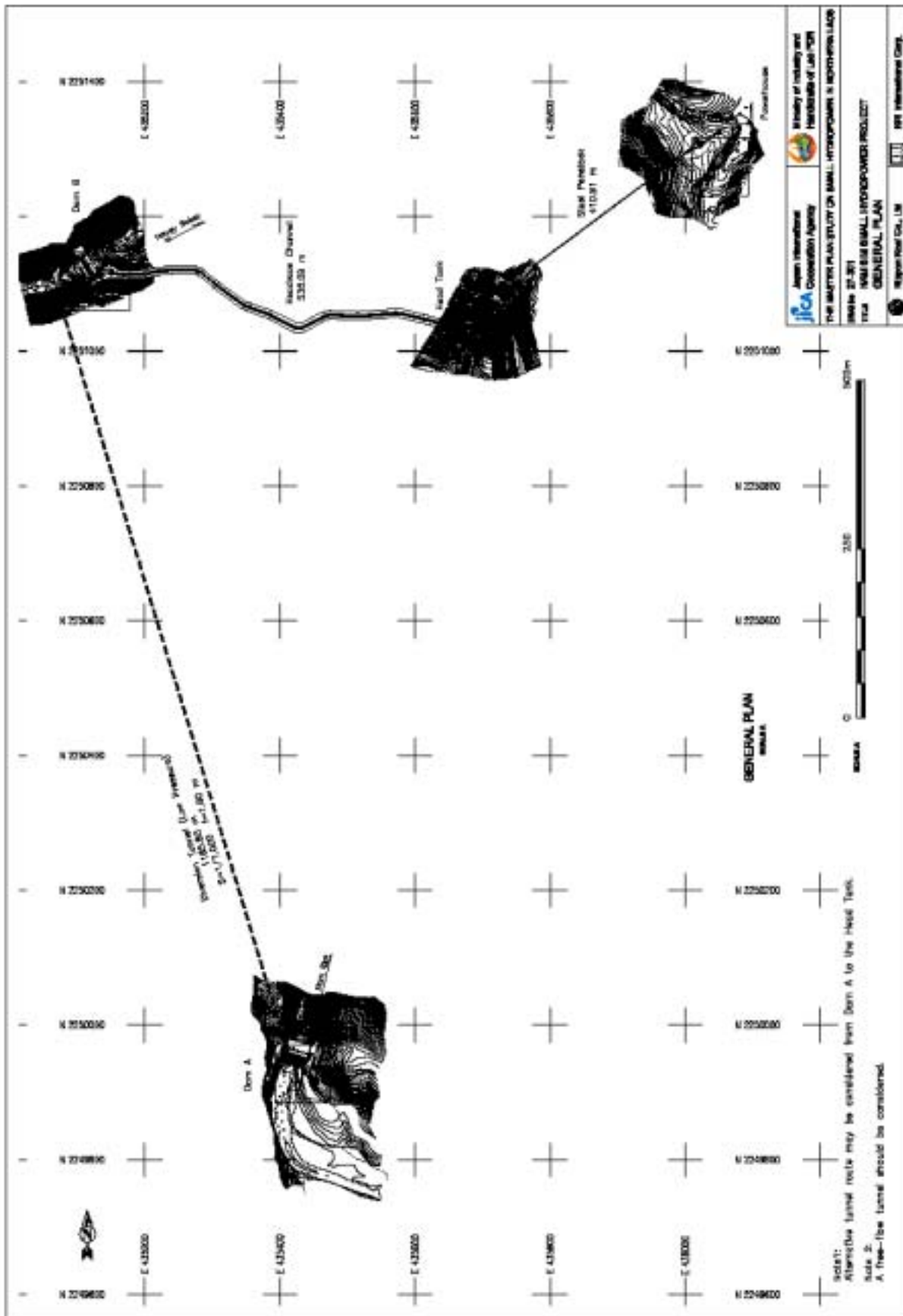
### B. Construction Cost

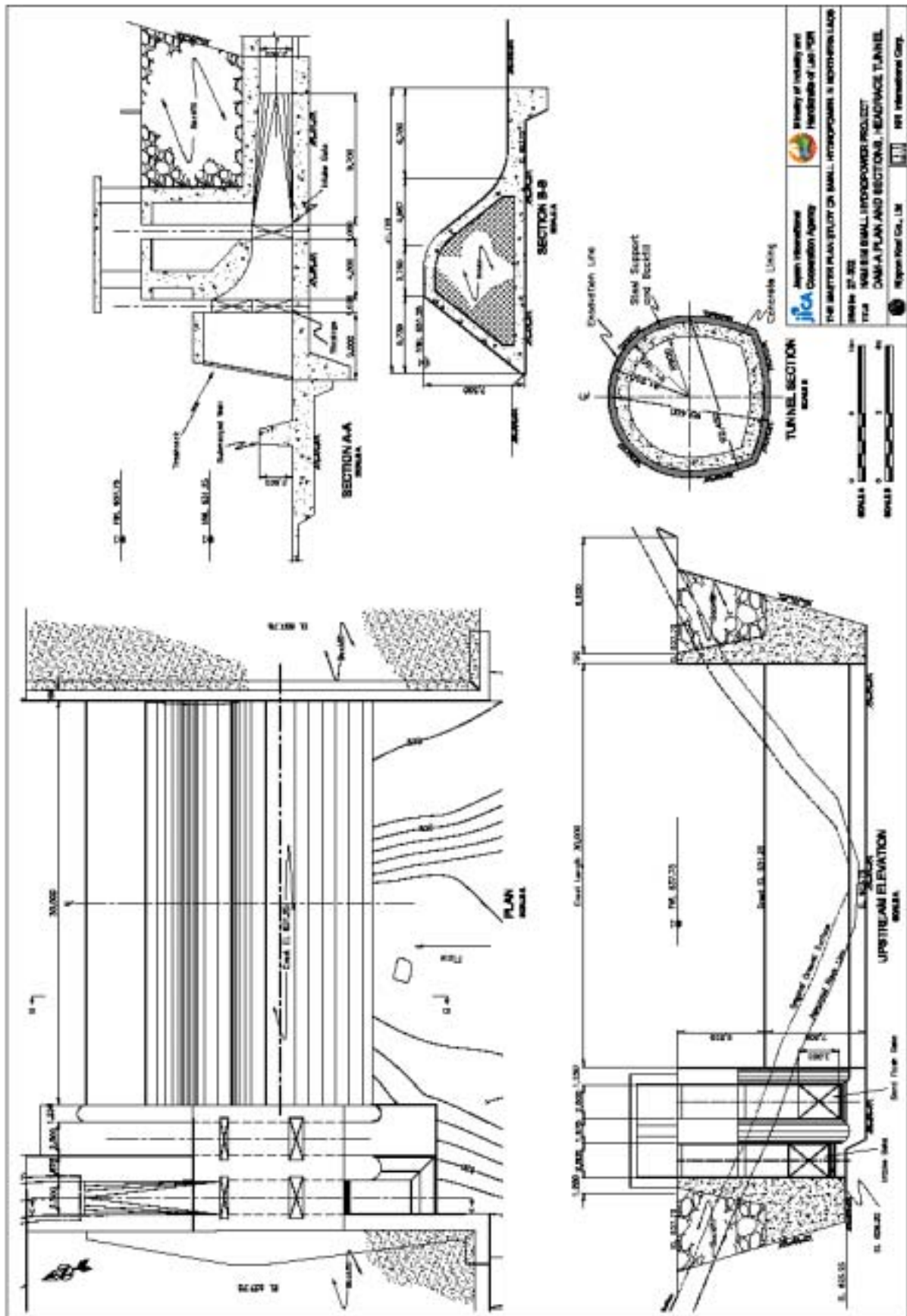
Items	Cost
<b>1.Civil Works</b>	
1.1 Intake Weir A	US\$ 1,338,905
1.2 Headrace Tunnel	US\$ 672,462
1.3 Intake Weir B	US\$ 612,864
1.4 Desilting Basin	US\$ 55,414
1.5 Headrace Channel	US\$ 313,027
1.6 Head Tank	US\$ 99,588
1.7 Spillway	US\$ 12,877
1.8 Penstock	US\$ 418,445
1.9 Powerhouse	US\$ 122,979
1.10 Tailrace	US\$ 6,274
1.11 Access	US\$ 200,000
1.12 Miscellaneous (20% of 1.1~1.11)	US\$ 770,567
<b>Total of Civil Works</b>	<b>US\$ 4,623,403</b>

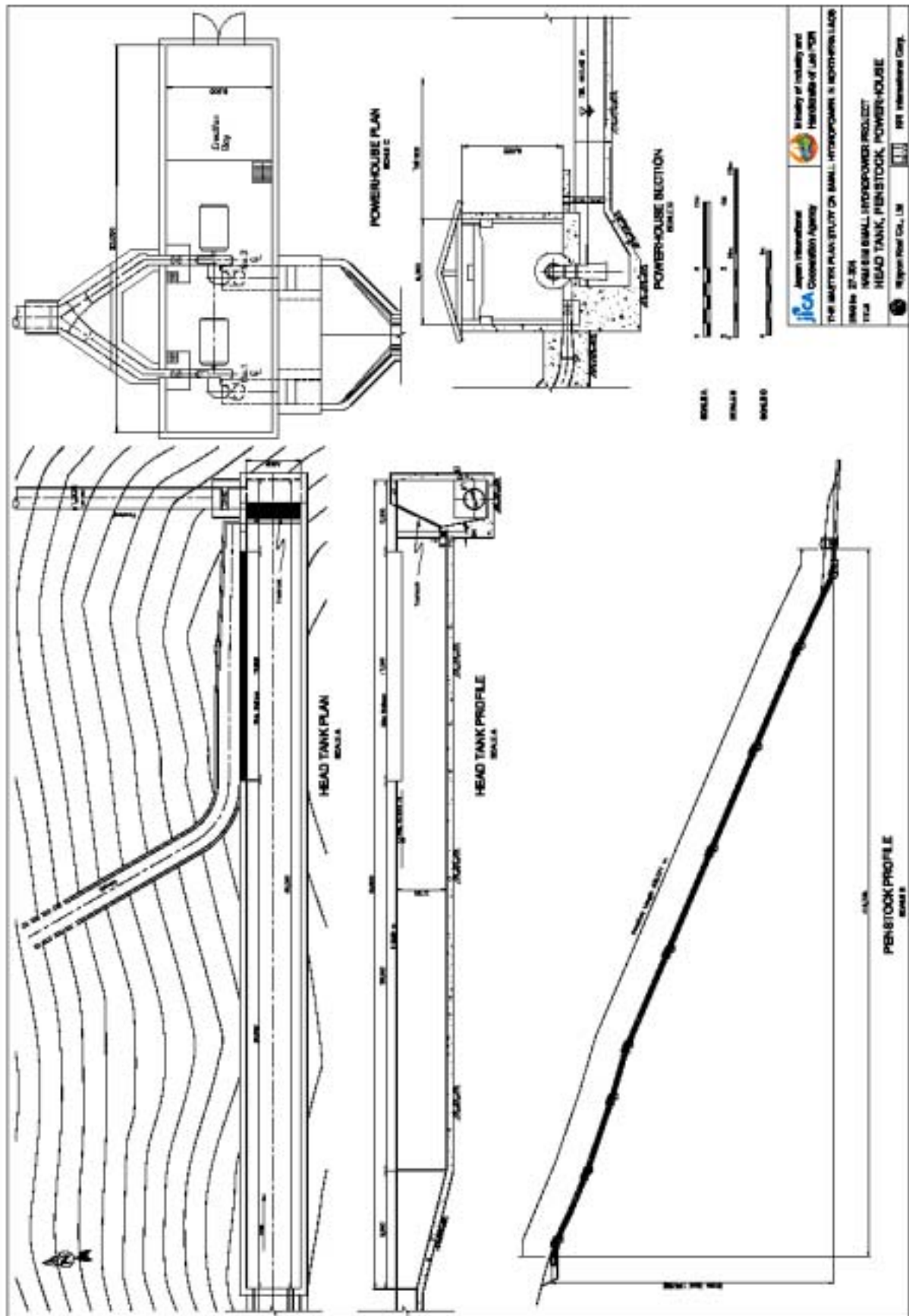
Items	Cost
<b>2.Steel Penstock</b>	<b>US\$ 502,492</b>
<b>3.Gate &amp; Trashracks</b>	<b>US\$ 34,997</b>
<b>4.Turbine &amp; Generator</b>	<b>US\$ 783,190</b>
<b>5.Transformer &amp; Switchgear</b>	<b>US\$ 233,945</b>
<b>6.Transmission Line</b>	<b>US\$ 169,121</b>
<b>7.E&amp;M Miscellaneous (10% of 2-5)</b>	<b>US\$ 155,462</b>
<b>Total of E&amp;M Works</b>	<b>US\$ 1,879,207</b>
<b>GRAND TOTAL</b>	<b>US\$ 6,502,610</b>

### C. Economic Analysis

1.Unit Construction Cost	US\$ 813/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 %







## 10. 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
					Length	649 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>

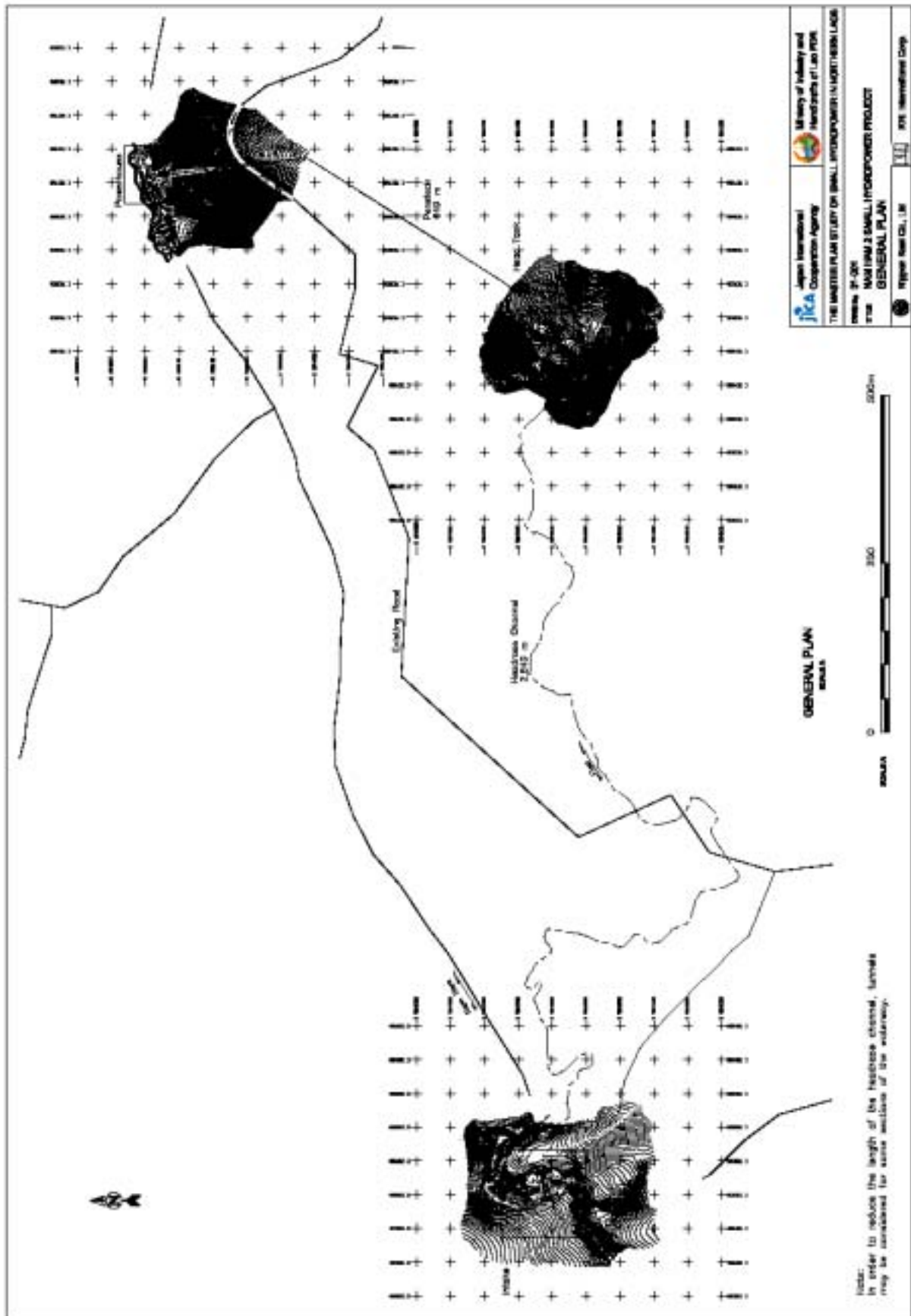
Items	Cost
<b>3.Gate &amp; Trashracks</b>	<b>US\$ 2,891</b>
<b>4.Turbine &amp; Generator</b>	<b>US\$ 177,546</b>
<b>5.Transformer &amp; Switchgear</b>	<b>US\$ 142,319</b>
<b>6.Transmission Line</b>	<b>US\$ 45,622</b>
<b>7.E&amp;M Miscellaneous (10% of 2-6)</b>	<b>US\$ 55,770</b>
<b>Total of E&amp;M Works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

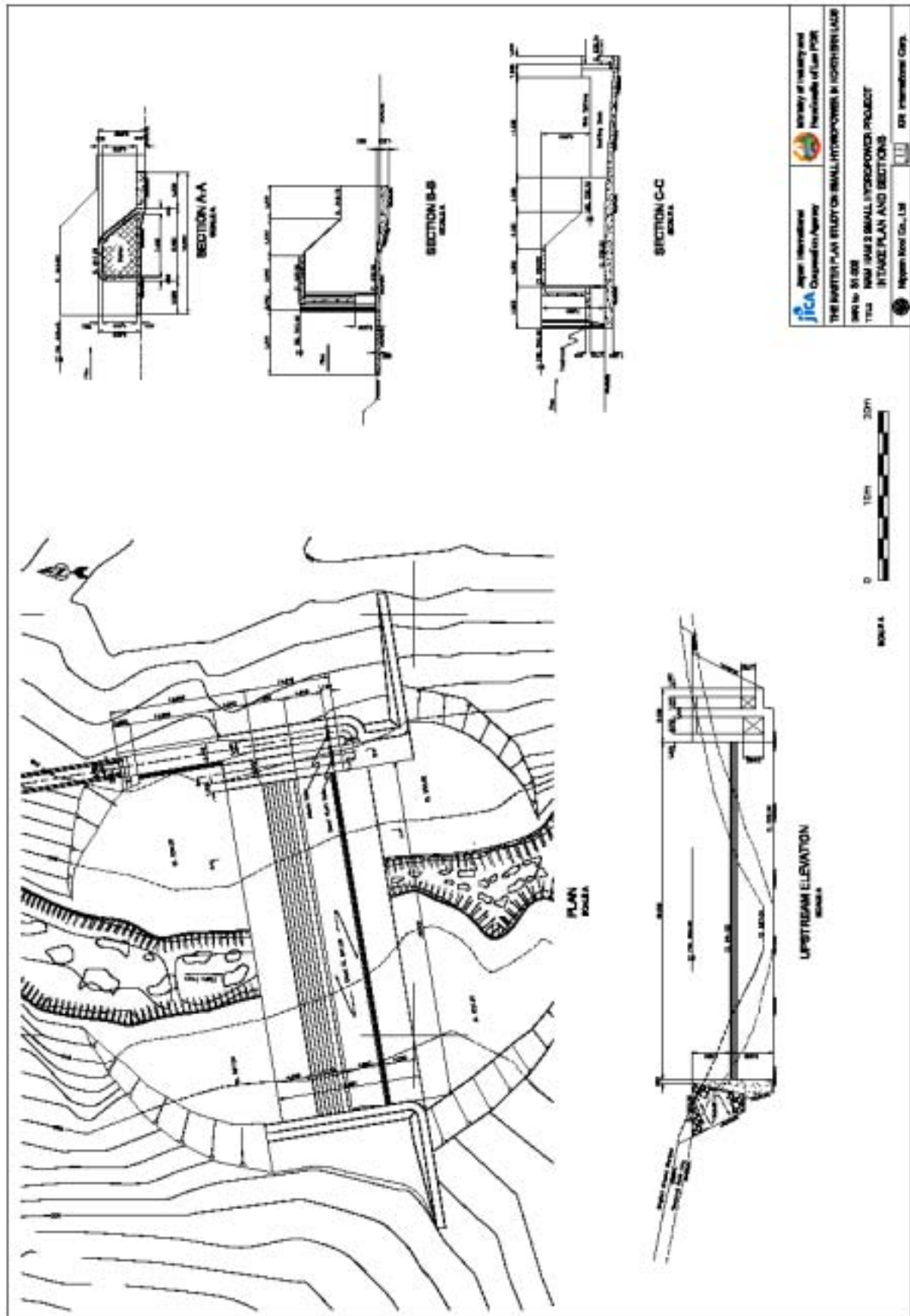
### C. Economic Analysis

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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	JICA Japan International Cooperation Agency		Ministry of Industry and Mines Nongkhai of Lam Phou
THE MASTER PLAN STUDY ON SMALL HYDROPOWER IN NORTHERN LAOS			
MPS No. 01/02			
TITLE: MAM 3000 SMALL HYDROPOWER PROJECT			
THIS DRAWING: INTAKE PLAN AND SECTIONS			
	0 15m 30m		Scale: 1:1000
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## 11. Nam Xan 3 (Sequence No. 32)

### A. Salient Features

1.General	Province	Xiengkhuang		District	Khoune	
	Electr. Status	Un-electrified				
2.Demand	Load Center	Khoune District Center		H/H Number	345	
	Peak Load	73 kW		Peak Hours	4 hours	
2.Hydrology	River	Nam Xan		Basin	Nam Xan	CA 134 km <sup>2</sup>
	Rainfall	1,980 mm		Q <sub>ave</sub>	2,75 m <sup>3</sup> /s	Q <sub>95%</sub> 0.42 m <sup>3</sup> /s
3.Structures						
3.1 Intake	Type	Gabion-core Concrete-facing		Height	2.2 m	Length 27.5 m
				FSL	1,417.20 m	FWL 1,421.52 m
3.2 Desilting Basin	Length	17.0 m	Width	1.5 m	Side Spillway Length	7.0 m
3.3 Headrace Channel	Shape	Rectangular		Lining	Wet Masonry	Length 749 m
	Uniform Depth	0.43 m		Base	0.85 m	
3.4 Head Tank	Regulating Capacity	(none) m <sup>3</sup>		NWL	1,416.45 m	MOL 1,414.40 m
3.5 Penstock	Type	Exposed		Dia.	0.45 m	Length 83 m
3.6 Powerhouse	Type	Surface	EL	1,385.12 m	Turbine	Cross Flow Units 1 nos
4.Power and Energy	Q <sub>design</sub>	0.37 m <sup>3</sup> /s	H <sub>net</sub>	29 m	Installed Capacity	73 kW
	Energy	325,416 kWh/yr		P.F.	50.7%	
5.Access Road	Length	2 km				
6.Transmission Line	Capacity	22 kV		Length	8.5 km	
	Loss	10.0%		Energy Delivered.	292,874 kWh/yr	

### B. Construction Cost

Items	Cost
<b>1.Civil Works</b>	
1.1 Intake	US\$ 86,319
1.2 Desilting Basin	US\$ 17,262
1.3 Headrace Channel	US\$ 24,444
1.4 Head Tank	US\$ 5,297
1.5 Spillway Channel	US\$ 848
1.6 Penstock	US\$ 2,866
1.7 Powerhouse	US\$ 27,699
1.8 Tailrace	US\$ 3,507
1.9 Access Road	US\$ 20,000
1.10 Miscellaneous (20% of 1.1~1.9)	US\$ 37,648
<b>Total of Civil Works</b>	<b>US\$ 225,888</b>
2.Steel Penstock	US\$ 19,966

Items	Cost
3.Gate & Trashracks	US\$ 1,174
4.Turbine & Generator	US\$ 77,179
5.Transformer & Switchgear	US\$ 11,549
6.Transmission Line	US\$ 115,890
7.E&M Miscellaneous (10% of 2-5)	US\$ 10,987
<b>Total of E&amp;M Works</b>	<b>US\$ 236,745</b>
<b>GRAND TOTAL</b>	<b>US\$ 462,633</b>

### C. Economic Analysis

1.Unit Construction Cost	US\$ 5,783 /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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