

B-4 MICROSCOPIC OBSERVATION OF ROCK SAMPLES

Appendix B-4 MICROSCOPIC OBSERVATION OF ROCK SAMPLES

Thin sections were prepared from twelve samples obtained in drill holes and vicinity areas at Nam Ngao dam and Mae Lama Luang dam sites. The quantity of the thin sections are shown in Table A.

The results of the microscopic observation are shown as follows:

Table A

	No.	Locality	Remarks
NAM NGAO DAM	1	Outcrop, Downstream creek of the right bank of the dam site	E 393.350 N 1967.750
	2	Outcrop, ditto	E 393.375 N 1967.730
	3	Outcrop, Downstream creek of the left bank of the dam site	E 393.325 N 1967.380
	4	Drill hole, DL-6, Depth 33.50 - 33.60 m	
	5	Outcrop, Right bank of the Mae Lui Stream	E 395.720 N 1967.450
	6	Outcrop, Creek of the left bank of the Mae Lui Stream	E 394.970 N 1966.025
MAE LAMA LUANG DAM	1	Outcrop, EL.150 m on the right bank of the dam site	
	2	Outcrop, EL.170 m in the downstream creek of the right bank	
	3	Outcrop, EL.145 m in the downstream creek of the left bank	
	4	Outcrop, Left bank of the dam site No. 4	
	5	Drill hole, DL-5, Depth 23.80 m	
	6	Drill hole, DL-5, Depth 30.00 m	



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Date : September 15, 1988.

PETROGRAPHY REPORT

Received from : EGAT

Sample no : ① NG-1 (E 393,350 N 1,967,750)

Rock name : Shale

Description : The rock is brownish gray and indurated. It shows a finely laminated structure of siltstone and mudstone. Microscopically, siltstone is made up of grains of detrital quartz, micas, feldspar, calcite, opaque minerals and other fine-grained minerals. The mudstone is composed of micas, detrital quartz and other extremely fine-grained minerals. Preferred orientation of micas is observed in the rocks. The boundary between mudstone and siltstone is sharp to gradational.



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PETROGRAPHY REPORT

Received from : EGAT

Sample no. : ②NG-2 (E 393,375 N 1,967,730)

Rock name : Medium-grained micaceous sandstone
(Micaceous lithic arkose; Folk, 1974)

Description : The rock is dark gray and indurated. Microscopically, it is composed of fine to medium sand-sized grains of quartz (~ 40%), feldspar (~ 20%), rock-fragments (~ 15%) and micas (~ 5%). Other minor constituents are calcite, tourmaline and opaque minerals. The feldspar is made up of both plagioclase and potash feldspar that are partially altered to sericite. The micas are mostly biotite and muscovite. The rock-fragments constitute volcanics, carbonates, schistose quartz, chert, quartzite etc. Cementing material is calcareous. The rock is poorly sorted and the grains are angular. A few late calcite veinlets are observed.



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PETROGRAPHY REPORT

Received from : EGAT

Sample no : ③ NG-3 (E 393,325 N 1,967,380)

Rock name : Fine-grained micaceous sandstone

(Micaceous lithic arkose; Folk, 1974)

Description : It is a brownish gray, indurated and fine-grained sandstone that contains finely laminated shaly layers. Microscopically, the sandstone is composed of fine-sand-sized grains of quartz (~ 50%), highly altered feldspar (~ 20%), rock-fragments (~ 15%), mica (~ 10%) and other opaque and accessory minerals. The rock-fragments include chert, schistose quartz, quartzite etc. The rock is moderately sorted and the grains are subangular. The cementing material is essentially ferruginous.



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Date : September 15, 1988.

PETROGRAPHY REPORT

Received from : EGAT

Sample no : ④NG-4 (DL-6 Depth 33.50-33.60 m.)

Rock name : fine to medium grained sandstone (Subarkose; Folk 1974)

Description : The rock is medium-gray and indurated. Microscopically, it is composed of fine to medium sand-size grains of predominantly quartz (~ 50%) and minor feldspar (~ 15%) and rock-fragments (<5%). Other minor constituents include mica (muscovite) and sphene. Most of feldspars are plagioclase and potash feldspar that are partially altered to sericite. The rock is moderately to well sorted and the grains are subangular to subrounded. The cementing material is essentially ferruginous. A few late quartz veinlets are also observed.



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Date : July 4, 1989.

PETROGRAPHY REPORT

Received from : EGAT
Sample number : ⑤ NG-5 (E 395,720 N 1,967,450)
Rock name : Conglomerate
Description : The rock is medium gray and indurated. It makes up essentially of granule to pebble-size fragments (size varying from 2mm to 1 cm in diameter) setting in medium to coarse-sand size matrix and cementing materials. The coarse fragments are composed of quartz, feldspar, plutonic rocks, gneissic rock, schist, phyllite, quartz, volcanics, chert. The matrix comprises similar kinds of rock fragments together with some calcite and micaceous minerals.



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Date : July 4, 1989.

PETROGRAPHY REPORT

Received from : EGAT
Sample number : ⑥NG-6 (E394,970 N.1,966,025)
Rock name : Deformed limestone
Description : The rock is medium-gray limestone that show somewhat fragmental texture. Many late calcite veinlets are well observed. Microscopically, the limestone is made up essentially of large recrystallized patches of sparry calcite in smaller pseudospar matrix. The sizes of sparry calcite are quite variable. Most of the sparry calcite crystals are twinned and the twin planes are slightly bent or gliding. This suggests that this limestone has been subjected to some degrees of deformation of stress. Microveinlets of calcite are quite common. No allochemical components, e.g., bioclasts, has been preserved.



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Date : April 27 , 1988

ANALYSIS REPORT

Received from : EGAT
Sample no : ① Ly-1 Mae Lama Luang Dam
References : Collected from Dam Site
Rock name : Mica Schist
Description : The rock is light brown, dense and shows

schistosity. Microscopically, it is a very fine-grained rock and composed essentially of mica (sericite), quartz and feldspar. Other minor constituents include hematite and sphene. The rock shows preferred orientation of mica flakes. Compositional layering of mica-rich alternating with quartz and feldspar-rich is also recognized. The original rock might have been an argillaceous siltstone that had been suffered from a low to moderate regional metamorphism.



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Date : April 27, 1988

ANALYSIS - REPORT

Received from : EGAT
Sample no : ② LY-2 Mae Lama Luang Dam
References : Collected from Dam Site
Rock name : Crenulated Calc-Schist
Description : The rock is brownish gray, dense and shows schistosity and crenulated compositional layering. Microscopically, the rock is composed predominantly of medium-grained calcite, quartz, mica (sericite) and feldspar. Compositional layering in which mica-rich bands alternate with calcite plus quartz-rich bands is obviously recognized. Crenulation (Small-scale folding) of mica-rich layers suggest at least two episodes of strain slip foliation did occur in this rock. The older S_1 is the foliation parallel to bedding and the younger S_2 is the foliation formed along crumples in S_1 .



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Date : April 27, 1988

ANALYSIS REPORT

Received from : EGAT
Sample no : ③ LY-3 Mae Lama Luang Dam
References : Collected from Dam Site
Rock name : Crenulated Calc-schist
Description : This rock is similar in terms of mineralogical composition and texture to that of LY-2. The notable difference is, however, marked by the fact that the LY-3 contains less in amount of the mica-rich layers and they are restricted to a certain zone.



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Date : April 27, 1988

ANALYSIS REPORT

Received from : EGAT

Sample no : ④ Ly-4 Mae Lama Luang Dam

References : Collected from Dam Site

Rock name : Mica Schist

Description : This rock is similar to LY-1 in that it is composed essentially of mica (sericite), quartz and feldspar. The marked differences is that the grain sizes of quartz and feldspar are in the range of medium-sand and both quartz and feldspar constitute much higher in their amounts than those in Ly-1. Other minor constituents include sphene, tourmaline, hematite and opaque minerals. Schistosity and compositional layering are not well developed. However, most quartz grains show wavy extinction. The original rock might have been an argillaceous sandstone that had been suffered from a low to moderate regional metamorphism.



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Date : April 27 , 1988

ANALYSIS REPORT

Received from : EGAT
Sample no : ⑤ LY-5 Mae Lama Luang Dam
References : DL-5, depth 23.80
Rock name : Crenulated Calc-Schist.
Description : This rock is similar to LY-2 and LY-2 and LY-3
both in terms of mineralogical composition and texture. The description
is therefore referred to LY-2 and LY-3.



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Date : April 27 , 1988

ANALYSIS REPORT

Received from : EGAT
Sample no : ⑥ LY-6 Mae Lama Luang Dam
References : DL-5, depth 30.00 m.
Rock name : Calc-Schist
Description : This rock is similar to LY-2 and LY-3 both in terms
of mineralogical composition and texture. Crenulation is however less
obvious.

B-5 TEST RESULTS OF AUGUR DRILLING

MATERIAL TESTING SECTION

GEOLOGY & SOIL ENGINEERING DIVISION

HYDRO POWER ENGINEERING DEPARTMENT

EGAT.

TABLE A (1/6) SUMMARY OF TEST RESULTS

PROJECT: NAM MAE NGAO

IMPERVIOUS MATERIAL

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP. GR.	W, AT RECEIVED (%)	ART'S LIMITS		GRADATION						COMPACTION		PERMEABILITY	
					LL (%)	PI (%)	# 3/4"	# 4"	# 10"	# 40"	# 200"	-2 μ	Max. $\frac{1}{3}$ D ($\frac{1}{m}$)	Wopt. (%)	Min. K_T (cm/sec)	Molded W (%)
ANG-1	0.0-1.0	ML	2.65	22.7	38.84	11.17	100	87.8	76.0	56.3	54.7	44.1	32.1			
	1.0-1.5	SM	2.70	20.0	49.20	18.97	100	81.1	66.5	54.0	45.6	39.8	30.3			
ANG-2	0.0-1.0	CL-ML	2.63	22.8	39.50	14.27	100	99.8	99.2	93.8	73.9	58.3	40.4			
	1.0-2.0	MH	2.67	25.0	52.10	20.53	100	96.7	90.6	83.5	69.3	53.8	35.9			
	2.0-3.0	ML	2.61	24.5	40.60	10.87	100	94.0	84.4	75.5	61.3	47.4	28.5			
	3.0-4.0	ML	2.64	22.6	44.60	15.55	100	87.4	77.2	68.3	57.1	47.7	31.2			
	4.0-5.0	ML	2.62	18.6	42.20	14.37	100	92.9	84.9	75.7	60.6	47.0	32.7			
ANG-3	0.0-1.0	ML	2.63	26.4	49.60	16.74	-	100	99.7	96.0	79.1	62.5	50.5			
	1.0-2.0	MH	2.71	26.2	63.20	23.89	100	99.7	98.7	95.3	82.5	66.0	54.0			
	2.0-3.0	MH	2.65	24.4	53.30	14.57	100	99.8	99.4	97.4	86.5	66.6	51.5			
	3.0-4.0	ML	2.68	19.5	47.92	14.86	100	99.9	99.6	98.6	78.7	60.2	47.0			
ANG-4	0.0-1.0	CL-ML	2.65	19.2	31.75	8.40	100	99.5	98.5	89.0	56.1	41.0	29.5			
	1.0-2.0	CL	2.65	19.0	31.45	9.56	100	99.8	98.8	89.3	56.2	43.3	30.8			
	2.0-2.5	ML	2.65	17.1	35.04	10.40	100	94.7	88.6	77.8	50.3	36.9	27.1			
ANG-5	0.0-1.0	ML	2.62	14.9	32.70	7.79	100	99.9	98.9	84.5	55.7	38.2	26.3			
	1.0-2.0	ML	2.65	18.8	39.50	12.91	100	99.8	99.6	87.2	61.2	46.2	36.0			
	2.0-3.0	ML	2.60	13.8	39.15	12.64	100	99.7	96.8	76.4	52.9	39.3	28.0			
	3.0-5.5	ML	2.66	11.0	30.70	7.40	100	99.8	99.5	95.9	58.6	35.5	23.5			
ANG-6	0.0-1.0	SM	2.53	12.2	28.68	5.33	93.7	60.0	39.1	24.2	17.8	12.5	5.0			
	1.0-2.0	SM	2.60	8.6	29.67	6.53	95.0	62.5	38.4	21.1	15.7	12.2	8.5			
ANG-7	0.0-3.0	ML	2.66	25.1	44.00	13.18	100	99.7	98.6	93.9	74.2	62.7	48.5			
	3.0-5.0	ML	2.69	19.5	46.85	15.48	100	97.2	91.2	83.7	66.1	55.5	42.8			
	5.0-7.0	ML	2.68	16.2	30.23	2.44	100	97.7	95.4	91.3	60.5	40.1	23.3			
	7.0-9.0	ML	2.61	13.5	28.19	2.12	-	100	99.8	96.7	50.9	37.2	16.0			

MATERIAL TESTING SECTION

GEOLOGY & SOIL ENGINEERING DIVISION

HYDRO POWER ENGINEERING DEPARTMENT

EGAT.

TABLE A (2/5) SUMMARY OF TEST RESULTS

PROJECT: NAM NAE NGAO

IMPERVIOUS MATERIAL

SAMPLE	DEPTH (m.)	USCS SOIL	SP.GR.	W, AT RECEIVED (%)	ATT.'S LIMITS		GRADATION								COMPACTION		PERMEABILITY	
					LL (%)	PI (%)												
							" - 3/4	# - 4	# - 10	# - 40	# - 200	-10/μ	-2/μ		Max. I (1/m ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W(%)
ANG-8	0.0-1.0	ML	2.58	20.4	38.20	12.47	100	84.9	75.2	66.3	52.3	42.1	26.3					
	1.0-2.0	CL	2.59	13.0	31.45	8.69	100	91.4	82.4	71.1	51.0	40.6	24.5					
	2.0-3.0	SC	2.58	10.4	29.60	7.27	100	86.1	74.7	62.0	40.6	30.4	18.4					
	3.0-3.5	SC	2.67	13.3	32.55	9.78	100	86.4	73.9	57.9	42.3	30.4	18.5					
ANG-9	0.0-1.0	ML	2.64	21.1	37.00	11.05	100	97.1	92.6	87.0	59.4	45.7	31.5					
	1.0-3.0	SM	2.64	9.0	30.35	7.09	100	92.4	84.9	75.6	38.9	22.4	13.3					
ANG-10	0.0-3.0	MH	2.65	25.2	52.00	22.65	100	98.5	95.7	91.6	71.3	57.6	46.5					
	3.0-5.0	MH	2.68	22.5	53.15	19.91	100	99.1	96.3	92.7	75.7	59.2	45.0					
	5.0-8.0	ML	2.68	20.4	46.15	16.41	100	99.9	98.2	95.5	75.1	55.8	36.2					
ANG-11	0.0-2.0	ML	2.67	30.2	41.30	14.09	100	88.7	80.4	74.7	63.1	46.8	30.0					
	2.0-3.0	ML	2.63	16.9	31.05	7.78	-	100	99.9	99.5	70.9	45.7	30.2					
	3.0-4.0	ML	2.64	11.3	30.75	7.74	-	100	99.9	98.7	61.0	39.1	24.3					
	4.0-5.0	CL-ML	2.63	9.3	24.23	4.64	-	100	99.9	98.2	53.3	37.0	22.0					
ANG-12	0.0-2.0	CL	2.64	18.8	37.05	15.46	100	99.4	98.6	95.8	71.5	61.7	46.9					
	2.0-6.0	CL	2.65	12.3	31.40	9.73	100	97.1	91.9	82.4	54.0	38.0	26.8					
ANG-13	0.0-1.0	CL	2.60	17.7	29.15	9.73	100	99.5	97.2	85.7	55.9	40.0	27.2					
	1.0-2.0	CL	2.62	16.7	35.50	14.08	100	99.7	96.0	80.0	58.6	41.5	30.1					
	2.0-5.0	CL	2.65	13.4	34.77	11.68	100	99.5	97.5	92.3	70.0	45.0	29.8					
ANG-14	0.0-2.0	MH	2.67	23.4	53.70	21.50	100	98.6	97.0	95.3	78.1	67.1	54.5					
	2.0-3.6	CL	2.68	24.3	46.90	22.64	-	100	99.4	98.0	80.1	64.4	50.7					
ANG-15	0.0-2.5	CL	2.61	22.3	32.85	13.16	100	98.8	96.8	92.6	64.7	48.5	36.6					
	2.5-3.8	ML	2.63	18.0	38.63	13.02	100	98.5	95.8	79.7	54.0	42.2	31.9					
	3.8-4.8	CL	2.62	18.5	33.90	10.46	100	99.6	98.0	84.9	53.6	37.8	26.5					
	4.8-7.1	ML	2.68	21.0	35.76	9.13	-	100	99.4	97.3	68.3	45.1	30.0					

TABLE A (3/5) SUMMARY OF TEST RESULTS

IMPERVIOUS MATERIAL

EGAT.

[illegible]

MATERIAL TESTING SECTION
GEOLOGY & SOIL ENGINEERING
DIVISION.

SURVEY & ECOLOGY
DEPARTMENT
EGAT.

TABLE A (4/6) SUMMARY OF TEST RESULTS

PROJECT. NNM YUAM (SITE NAM NGAO) , DRILL HOLES (HAND AUGER)

SAMPLE NO.	DEPTH (m.)	USCS. SOIL GROUP	SP. GR.	W. AT RECEIVED (%)	ATT'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LL. (%)	PI. (%)	# - 3/4"	# - 4	# - 10	# - 40	# - 200	-10 μ	-2 μ	Max. γ_D (1/n ¹)	Wopt. (%)	Min. K _T (cm/sec)	Molded W (%)
ANG-18	0.0-0.8	CL	2.65	12.41	35.00	11.65	100	99.5	98.3	93.0	60.0	48.2	38.5				
ANG-19	0.0-0.8	CL	2.63	8.16	33.10	10.96	100	97.2	94.4	87.2	63.1	46.8	30.8				
ANG-20	0.0-1.4	SM	2.73	11.43	38.50	10.62	98.5	74.2	58.3	43.0	36.3	24.0	12.6				
ANG-21	0.0-3.0	MH	2.70	23.08	57.30	23.22	100	99.7	98.0	92.9	79.2	71.7	58.3				
	3.0-5.0	ML	2.71	19.87	49.40	17.95	100	99.8	97.7	91.3	75.6	60.5	42.4				
	5.0-6.0	ML	2.73	19.18	47.40	19.75	100	99.2	95.0	85.9	67.8	54.1	39.6				
	6.0-6.7	ML	2.74	17.97	44.00	15.90	100	98.9	92.0	79.2	63.0	49.0	35.7				
ANG-22	0.0-0.7	MH	2.67	13.18	50.40	20.86	100	98.5	96.4	89.8	71.0	58.2	45.3				
ANG-23	0.0-1.0	MH	2.70	19.34	51.40	21.74	100	97.8	95.2	92.0	79.7	67.8	47.5				
	1.0-2.0	MH	2.72	19.73	52.60	19.65	100	91.3	85.5	80.6	74.2	60.8	36.0				
	2.0-3.8	ML	2.73	20.03	43.30	13.98	100	95.5	90.1	83.8	76.3	56.9	28.6				
	3.8-4.9	ML	2.71	16.48	34.00	8.96	100	95.6	89.1	79.3	53.7	39.9	19.9				
ANG-24	0.0-0.7	SC	2.66	8.01	30.75	8.85	97.5	90.4	79.3	59.7	46.5	38.9	20.6				
ANG-25	0.0-0.6	MH	2.71	17.37	51.60	19.44	100	95.1	88.5	79.6	68.4	59.5	40.1				
ANG-26	0.0-1.0	SC	2.68	6.20	27.00	7.12	100	89.6	80.7	70.5	44.8	33.5	22.5				
ANG-27	0.0-0.8	ML	2.70	13.31	35.05	9.38	100	95.3	89.4	83.3	61.6	48.8	34.4				

TABLE A (5/5) SUMMARY OF TEST RESULTS

DRILL HOLES (HAND ALGER)

PROJECT. NAM YUAM (SITE NAM NGAO)

B - 117

TABLE. B (1/10) SUMMARY OF TEST RESULTS

PROJECT. NAM YUAM (SITE NO. 5)

Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS. SOIL GROUP	SP.GR.	W, AT RECEIVED (%)	ATT'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LI. (%)	PI. (%)	# - 3/4"	# - 4	# - 10	# - 40	# - 200	-10 μ	-2 μ	Max. γ_p (1/m ²)	Wopt. (%)	Min. K_T (cm/sec)	Molded W (%)
ALY-1	0.0-1.0	ML	2.76	17.25	31.90	8.58	100	88.8	81.2	71.2	57.7	36.5	24.0				
	1.0-2.0	SM	2.74	15.06	28.09	4.82	96.5	78.5	69.0	58.5	45.1	30.8	12.5				
	2.0-3.4	SM	2.76	17.21	NP	NP	97.4	85.0	75.2	62.7	47.7	31.8	11.5				
ALY-2	0.0-2.0	SM	2.74	17.47	NP	NP	92.7	68.1	57.8	46.3	30.3	18.0	5.5				
	2.0-3.0	ML	2.75	10.21	NP	NP	100	85.8	76.9	66.4	52.0	31.3	13.3				
ALY-3	0.0-1.0	ML	2.71	14.17	NP	NP	100	94.8	88.7	80.9	65.6	38.1	18.3				
	1.0-2.0	ML	2.72	13.43	NP	NP	100	94.5	87.6	79.9	64.1	42.4	17.4				
	2.0-3.0	ML	2.74	16.14	NP	NP	100	98.2	94.6	87.3	71.4	39.1	18.0				
	3.0-4.0	SM	2.73	12.28	NP	NP	100	91.7	80.9	66.6	48.9	37.8	8.5				
	4.0-5.0	SM	2.67	11.70	NP	NP	100	84.6	69.8	55.4	37.3	15.5	4.5				
	5.0-5.4	SM	2.69	9.42	NP	NP	100	86.5	71.0	54.4	36.0	17.6	6.4				
ALY-4	0.1-1.0	ML	2.73	13.63	28.10	4.42	100	85.7	76.8	68.5	55.2	32.4	16.7				
	1.0-4.0	ML	2.76	15.73	NP	NP	100	95.2	85.3	72.3	56.4	29.0	11.2				
ALY-5	0.1-1.0	ML	2.71	17.19	29.92	5.45	100	96.6	90.2	81.8	66.1	43.2	22.2				
	1.0-2.0	ML	2.74	14.10	NP	NP	100	92.2	83.2	71.3	52.2	30.6	10.0				
	2.0-2.3	SM	2.70	12.29	NP	NP	100	88.3	79.1	66.0	43.9	24.8	6.3				
ALY-6	0.1-1.0	ML	2.69	16.33	29.80	4.51	100	95.0	86.6	81.4	65.2	42.5	23.3				
	1.0-2.3	ML	2.75	12.26	NP	NP	98.0	89.6	77.3	66.0	52.8	33.0	15.1				

TABLE B (2%) SUMMARY OF TEST RESULTS

PROJECT: NAM YUM (SITE NO.5)

Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS. SOIL GROUP	SP.GR.	W, AT RECEIVED (%)	ATT.'S LIMITS		GRADATION								COMPACTION		PERMEABILITY	
					LL. (%)	Pl. (%)	" - 3/4	# - 4	# - 10	# - 40	# - 200	-10 μ	-2 μ	Max. γ_d (1/ft ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)	
ALY-7	0.1-1.0	ML	2.75	14.10	NP	NP	100	93.8	83.9	71.8	55.3	33.9	14.1					
	1.0-2.0	SM	2.75	15.55	NP	NP	100	86.8	74.9	62.8	45.8	25.8	8.7					
	2.0-2.5	SM	2.73	13.31	NP	NP	100	80.1	68.3	54.8	37.2	19.8	6.5					
ALY-8	0.0-1.0	CL-ML	2.72	13.83	30.30	7.76	100	95.8	87.9	79.5	63.4	38.1	22.2					
	1.0-1.9	ML	2.74	13.72	29.80	5.54	100	89.9	79.8	70.7	58.3	35.5	20.2					
	1.9-2.2	ML	2.70	14.97	NP	NP	100	87.8	79.5	68.9	50.4	24.8	8.7					
	2.2-3.8	ML	2.74	13.67	NP	NP	100	94.8	87.5	77.9	57.9	30.2	12.7					
ALY-10	0.0-1.0	ML	2.70	15.66	31.40	5.57	100	95.7	90.3	83.1	68.5	40.6	23.1					
	1.0-2.6	ML	2.72	14.40	25.05	1.61	100	92.7	84.3	75.2	57.4	34.4	20.2					
ALY-11	0.0-1.0	ML	2.68	18.67	NP	NP	100	90.4	84.7	76.6	52.4	30.2	13.0					
	1.0-2.8	ML	2.72	16.90	NP	NP	100	92.0	85.3	76.7	50.5	27.0	10.8					
ALY-12	0.0-1.0	ML	2.68	15.72	29.92	5.55	100	97.5	95.2	89.9	66.5	41.5	23.5					
	1.0-3.0	ML	2.68	13.22	26.40	3.02	100	95.9	90.0	83.0	61.2	34.1	18.5					
ALY-13	0.1-0.7	ML	2.70	12.79	25.30	3.27	98.9	89.0	81.5	72.7	53.5	26.0	12.8					
	0.7-0.9	SM	2.67	8.80	NP	NP	100	93.4	87.3	77.7	48.1	23.3	8.7					
ALY-14	0.1-1.0	ML	2.71	16.90	NP	NP	100	94.7	90.2	83.9	67.0	37.0	17.8					
	1.0-1.4	SM	2.71	10.31	NP	NP	100	80.3	66.7	56.9	42.1	22.6	7.7					

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TABLE B (3/10) SUMMARY OF TEST RESULTS

PROJECT. NAM YUAM (SITE NO. 5)

Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP. GR.	W, AT RECEIVED (%)	ATT.'S LIMITS		GRADATION										COMPACTION		PERMEABILITY	
					LL (%)	PL (%)	# - 3/4"	# - 4"	# - 10"	# - 40"	# - 200"	-10/μ	-2 μ	Max γ _D (t/n ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)			
ALY-15	0.1-1.0	SM	2.73	13.44	NP	NP	100	91.3	80.4	67.8	44.5	22.6	7.7							
	1.0-1.9	SM	2.75	12.13	NP	NP	100	91.7	80.4	65.1	41.8	20.5	6.0							
ALX-16	0.1-1.0	ML	2.72	14.33	25.55	4.44	100	95.5	89.7	82.3	61.0	31.1	15.6							
	1.0-2.0	SM	2.71	6.81	NP	NP	95.3	84.1	73.3	63.2	47.9	25.2	12.2							
	2.0-3.0	SM	2.72	10.70	NP	NP	100	93.3	82.3	68.5	49.4	25.2	8.7							
	3.0-3.1	SM	2.72	10.55	NP	NP	100	91.0	79.7	64.4	44.5	22.7	6.3							
ALY-18	0.0-1.0	ML	2.65	21.84	46.48	14.55	100	99.4	98.2	96.1	76.8	54.0	40.6							
	1.0-3.0	ML	2.69	22.45	46.15	13.75	100	95.7	92.1	88.7	70.5	50.6	38.1							
	3.0-5.0	ML	2.67	21.01	39.80	9.03	100	96.9	93.7	90.6	65.5	44.1	30.7							
	5.0-5.6	ML	2.70	19.18	NP	NP	100	92.7	87.3	83.1	64.6	35.8	21.1							
ALY-19	0.0-1.0	ML	2.70	22.24	37.0	4.74	100	94.3	89.3	86.5	69.4	37.5	20.7							
	1.0-2.8	ML	2.69	19.04	NP	NP	100	95.3	91.8	89.1	69.7	30.9	13.8							
ALY-20	0.0-1.0	ML	2.65	25.0	49.1	13.57	100	99.9	99.8	99.3	88.0	58.8	41.3							
	1.0-3.0	ML	2.68	21.92	40.50	6.02	100	95.2	91.4	89.5	77.4	46.1	28.1							
	3.0-3.8	ML	2.68	17.67	NP	NP	100	96.3	92.7	89.8	74.9	38.0	22.5							
ALY-21	0.0-1.0	ML	2.65	25.30	43.80	9.63	100	98.5	97.1	95.5	82.6	59.6	29.8							
	1.0-2.0						Sample Loss													
	2.0-2.9	ML	2.68	20.00	NP	NP	100	93.3	86.1	81.3	66.0	38.2	23.6							

TABLE B(4/10) SUMMARY OF TEST RESULTS

PROJECT: NAM YUAM (SITE NO. 5)
Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP.GR.	W _a T RECEIVED (%)	ATT.'S LIMITS		GRADATION								COMPACTION		PERMEABILITY	
					LL (%)	PL (%)	# - 3/4"	# - 4"	# - 10"	# - 40"	# - 200"	-10 μ	-2 μ	Max. γ_D (1/n ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)	
ALY-22	0.0-1.0	ML	2.63	21.75	34.06	1.44	100	99.9	99.8	99.3	86.8	51.0	34.7					
	1.0-3.0	ML	2.69	19.64	40.68	7.15	100	99.9	99.5	99.2	86.0	44.3	27.1					
ALY-23	0.0-1.0	ML	2.61	25.63	49.85	13.87	100	99.8	99.4	98.8	88.2	60.7	41.2					
	1.0-3.0	MH	2.65	21.18	52.42	14.05	100	98.4	96.9	95.8	85.6	58.2	41.0					
	3.0-4.0	ML	2.67	24.72	45.10	11.01	100	98.6	96.6	94.7	83.0	47.6	27.6					
ALY-24	0.0-2.0	ML	2.69	28.04	42.80	6.41	100	98.4	96.8	95.2	85.8	55.1	35.7					
	2.0-2.3				Sample Loss			Loss										
ALY-25	0.1-1.0	SM	2.65	7.94	22.90	3.94	100	90.0	80.1	55.1	36.8	23.7	14.7					
	1.0-2.0	SM-SC	2.65	7.19	26.38	6.06	94.6	80.3	63.2	42.9	30.6	20.1	11.9					
	2.0-3.0	SM-SC	2.70	6.98	23.80	5.18	100	85.5	70.5	49.4	34.9	24.2	12.9					
	3.0-4.0	SM-SC	2.65	8.05	24.40	6.28	100	90.8	78.8	57.6	41.7	28.7	16.6					
	4.0-5.0	SM-SC	2.67	7.46	20.80	4.66	100	96.9	89.2	69.9	49.6	22.1	7.7					
	5.0-6.0	ML	2.67	20.07	NP	NP	100	98.9	94.4	83.8	73.0	41.8	18.4					
ALY-26	0.1-1.0	ML	2.66	20.82	48.62	14.54	-	100	99.7	98.7	86.1	61.9	49.0					
	1.0-2.0	ML	2.72	17.10	41.95	9.63	100	84.6	78.9	74.6	63.5	35.0	25.0					
	2.0-4.0	ML	2.69	15.02	NP	NP	100	91.3	81.9	73.9	59.3	32.0	16.7					
	4.0-4.6	SM	2.74	14.13	NP	NP	99.0	85.9	74.8	64.8	40.6	19.0	9.4					
	4.6-5.4	ML	2.68	16.71	NP	NP	100	96.0	91.9	88.2	63.3	27.0	9.9					

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TABLE B(5%) SUMMARY OF TEST RESULTS

PROJECT: NAM YUAM (SITE NO. 5)
Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP.GR.	W,AT RECEIVED (%)	ATT.'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LL. (%)	Pl. (%)	" - 3/4	# 4	# 10	# 40	# 200	-10/μ	-2 μ	Max. γ _D (1/m ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W(%)
ALY-27	0.1-1.0	ML	2.71	22.47	38.20	6.78	99.1	86.4	82.9	81.1	71.1	37.4	24.3				
	1.0-2.0	ML	2.72	15.88	NP	NP	98.2	87.5	79.6	75.9	60.7	28.5	14.5				
	2.0-4.0	ML	2.73	14.86	NP	NP	100	86.7	79.7	74.0	52.6	22.3	10.2				
	4.0-4.6	ML	2.76	14.40	NP	NP	96.3	89.6	84.0	78.3	51.5	21.6	9.5				
ALY-28	0.1-3.0	ML	2.70	20.96	39.16	6.98	100	91.0	87.3	85.1	70.0	48.2	31.0				
	3.0-5.0	ML	2.72	12.98	NP	NP	100	89.3	84.3	80.6	57.9	28.6	13.3				
	5.0-5.7	ML	2.68	13.81	NP	NP	100	97.7	97.5	97.1	72.1	30.8	13.6				
ALY-29	0.0-1.0	MH	2.70	28.72	53.30	14.51	100	98.9	98.1	97.5	89.6	59.9	42.0				
	1.0-4.0	ML	2.72	24.99	46.65	4.76	100	97.7	96.1	94.5	78.4	49.4	25.1				
	4.0-5.0	ML	2.70	26.61	NP	NP	100	97.0	94.3	92.4	74.4	36.2	12.3				
ALY-30	0.1-2.0	ML	2.72	11.18	NP	NP	100	99.9	99.7	99.3	95.4	56.5	39.9				
	2.0-3.0	ML	2.75	21.43	NP	NP	100	81.9	77.1	73.0	65.4	35.7	19.9				
	3.0-4.0	ML	2.81	21.03	41.60	6.35	100	99.2	98.0	96.4	85.3	44.7	20.7				
	4.0-5.0	ML	6.69	19.21	NP	NP	99.0	96.5	94.7	92.0	83.4	33.4	14.6				
ALY-31	5.0-6.0	ML	2.69	28.19	NP	NP	100	96.6	92.8	89.3	74.5	29.8	9.2				
	0.1-1.0	ML	2.66	24.33	44.20	10.61	100	99.2	98.4	97.7	86.2	58.7	41.1				
	1.0-3.0	ML	2.66	22.24	37.80	8.63	100	97.8	96.9	96.4	79.7	37.0	19.5				
	3.0-5.5	ML	2.65	23.60	NP	NP	100	99.5	98.7	98.2	83.7	35.5	13.9				

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TABLE B (%_W) SUMMARY OF TEST RESULTS

PROJECT: NAM YUAM (SITE NO. 5)

Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP.GR.	W, AT RECEIVED (%)	ATT.'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LL (%)	PI (%)	" - 3/4	# - 4	# - 10	# - 40	# - 200	- 10 μ	- 2 μ	Max γ _D (1/n ³)	Wopt (%)	Min. K _T (cm/sec)	Molded W (%)
ALY-32	0.1-1.0	MH	2.67	28.69	59.30	20.66	-	100	99.9	99.5	92.9	81.0	58.8				
	1.0-3.0	MH	2.70	28.98	61.60	17.87	-	-	100	99.7	94.3	70.9	58.40				
	3.0-4.0	ML	2.72	24.39	48.42	10.03	100	99.7	98.9	98.3	90.4	54.1	32.0				
	4.0-5.0	ML	2.70	24.14	NP	NP	-	100	99.8	99.5	90.2	42.2	19.5				
ALY-33	0.0-1.0	ML	2.62	15.74	33.65	7.70	100	98.7	94.9	81.5	62.1	43.4	25.3				
	1.0-1.4	ML	2.66	15.12	43.70	13.49	100	95.6	84.5	72.1	59.1	41.8	25.7				
ALY-34	0.0-1.0	ML	2.66	22.06	69.43	8.53	100	97.6	94.8	92.5	79.5	48.4	32.8				
	1.0-2.0	ML	2.68	18.49	34.00	4.42	100	96.0	93.1	90.6	73.5	35.7	21.5				
	2.0-2.8	ML	2.67	20.76	NP	NP	100	96.6	91.9	89.1	70.6	28.5	13.5				
ALY-35	0.0-1.0	ML	2.63	23.01	46.17	11.63	-	100	99.5	98.6	85.7	56.2	44.6				
	1.0-2.0	MH	2.65	24.47	52.80	16.20	100	99.2	93.0	97.2	85.6	60.9	48.0				
	2.0-3.0	ML	2.68	21.85	42.60	8.82	100	97.8	94.1	92.1	78.9	51.7	35.5				
ALY-36	0.0-1.0	ML	2.65	24.14	47.50	11.66	100	99.7	99.1	98.3	87.8	64.2	50.0				
	1.0-2.0	MH	2.68	24.59	53.00	13.83	-	100	99.8	99.3	87.0	63.5	50.7				
	2.0-3.0	ML	2.72	22.95	50.80	10.64	100	99.7	98.8	97.9	87.1	63.4	49.5				
ALY-37	0.0-1.0	ML	2.70	22.23	47.78	11.09	96.6	91.7	90.1	88.5	77.2	52.5	37.6				
	1.0-2.0	MH	2.70	23.21	50.30	12.56	92.7	84.3	78.3	75.0	65.4	44.5	30.5				
	2.0-3.0	ML	2.71	20.02	44.90	7.85	100	82.1	73.8	68.0	58.3	34.5	20.1				

TABLE B(7/10) SUMMARY OF TEST RESULTS

PROJECT: NAM YUAN (SITE NO. 5)
Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP. GR.	W, AT RECEIVED (%)	ATT'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LL. (%)	PI. (%)	# 3/4"	# 4"	# 10"	# 40"	# 200"	-10 μ	-2 μ	Max. γ_p (1/m ²)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)
ALY-38	0.0-1.0	ML	2.64	24.33	40.40	8.49	100	99.9	99.3	98.6	85.0	51.2	33.3				
	1.0-2.9	ML	2.63	20.53	38.20	6.08	100	99.8	99.5	99.0	84.4	46.4	24.1				
	2.9-4.4	ML	2.65	15.24	NP	NP	100	99.9	99.6	98.9	81.8	31.5	14.5				
ALY-39	0.0-1.0	MH	2.67	27.93	57.0	16.81	-	100	99.9	99.4	90.9	67.4	30.5				
	1.0-3.0	MH	2.69	25.27	51.80	12.99	100	98.6	97.0	96.1	87.0	63.1	41.4				
	3.0-4.0	ML	2.68	21.67	NP	NP	91.7	85.9	84.4	83.2	70.6	44.0	21.2				
	4.0-4.2	ML	2.67	23.39	47.20	10.26	100	93.8	92.2	91.4	77.7	42.1	22.2				
ALY-40	0.0-1.0	MH	2.65	22.48	56.45	16.09	-	100	99.6	98.6	90.8	72.3	53.3				
	1.0-5.3	MH	2.71	24.19	56.40	13.20	100	99.8	98.9	98.1	91.2	73.8	56.5				
ALY-41	0.0-1.0	ML	2.63	12.67	35.70	10.21	98.5	92.5	83.3	69.8	54.2	39.6	23.4				
	1.0-3.0	ML	2.65	20.16	41.25	9.6	100	98.6	94.2	85.2	69.9	41.6	21.7				
	3.0-3.3	ML	2.62	18.76	NP	NP	100	99.8	99.0	87.4	69.4	39.7	18.3				
ALY-42	0.0-1.0	ML	2.65	18.75	31.38	4.94	100	92.6	89.4	87.8	66.9	37.4	23.4				
	1.0-1.8	ML	2.67	15.14	NP	NP	100	92.3	89.4	88.0	66.9	29.7	18.0				
ALY-43	0.0-1.0	ML	2.67	25.24	44.03	9.97	100	99.6	99.2	98.6	83.5	56.1	40.0				
	1.0-2.0	ML	2.69	26.05	NP	NP	100	95.9	95.0	94.1	79.3	45.3	30.9				
ALY-44	0.0-1.0	ML	2.64	26.03	45.0	11.61	100	99.0	98.4	97.0	83.2	48.9	22.9				
	1.0-2.1	ML	2.67	18.78	34.59	5.96	90.7	77.4	75.3	72.5	56.6	36.6	22.0				
	2.1-2.3	ML	2.70	13.67	NP	NP	100	83.6	76.5	71.0	54.5	25.0	13.2				

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TABLE.B(8%) SUMMARY OF TEST RESULTS

PROJECT. NAM YUAM (SITE NO. 5)
Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP.GR.	W _{AT} RECEIVED (%)	ATT.'S LIMITS		GRADATION								COMPACTION		PERMEABILITY	
					LL. (%)	PI. (%)	" - 3/4	# - 4	# - 10	# - 40	# - 200	- 10 μ	- 2 μ	Max γ_p (1/n ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)	
ALY-45	0.0-1.0	MH	2.69	27.37	51.0	12.38	-	100	99.9	99.2	88.9	65.1	46.6					
	1.0-3.0	MH	2.72	28.90	55.80	15.42	100	98.8	98.7	98.0	88.4	54.9	51.2					
	3.0-4.07	ML	2.72	24.56	46.40	9.87	98.2	89.3	86.2	83.7	73.1	50.9	38.7					
ALY-46	0.0-1.0	ML	2.65	26.55	49.20	13.03	100	99.6	98.5	97.6	88.2	66.9	49.0					
	1.0-3.0	ML	2.67	32.92	48.50	10.36	100	98.6	97.8	97.0	87.4	56.2	42.7					
	3.0-3.5	ML	2.70	21.05	43.60	8.26	100	94.8	94.5	89.3	80.2	44.8	29.8					
ALY-47	0.0-1.0	MH	2.62	28.01	54.10	12.87	100	99.5	98.7	98.0	89.5	65.0	51.0					
	1.0-3.0	MH	2.67	27.64	59.60	18.80	100	99.4	99.0	98.5	90.5	67.4	51.9					
ALY-48	0.0-1.0	MH	2.63	26.99	53.21	13.50	100	99.7	98.6	96.1	90.2	70.5	53.7					
	1.0-3.0	MH	2.70	26.73	55.60	13.79	100	99.9	99.6	99.0	93.0	69.4	56.6					
	3.0-4.0	ML	2.73	21.53	43.85	7.33	100	88.9	83.5	80.6	73.4	45.2	33.4					
	4.0-5.0	ML	2.68	21.49	44.70	8.05	100	99.5	99.0	98.5	90.8	55.8	38.8					
ALY-49	0.1-1.6	SM	2.67	7.25	NP	NP	100	80.2	61.4	40.2	26.0	20.2	14.6					
ALY-50	0.1-2.0	ML	2.67	15.66	NP	NP	100	93.8	87.6	82.9	63.4	23.6	10.8					
ALY-51	0.1-2.0	ML	2.70	23.74	NP	NP	100	96.6	93.7	91.8	83.4	56.9	40.1					
	2.0-3.0	ML	2.74	20.38	NP	NP	100	98.1	94.2	90.2	79.3	43.6	23.5					
	3.0-4.0	ML	2.74	20.24	NP	NP	100	94.1	84.6	77.6	65.9	30.5	16.0					

TABLE B(%) SUMMARY OF TEST RESULTS

PROJECT. NAM YUAM (SITE NO. 5)
Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS. SOIL GROUP	SP.GR.	W, AT RECEIVED (%)	ATT.'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LL. (%)	Pl. (%)	" - 3/4	# - 4	# - 10	# - 40	# - 200	- 10/μ	- 2/μ	Max. γ _D (1/n _t ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)
ALY-52	0.1-1.0	ML	2.69	22.65	42.05	9.86	100	97.9	96.2	95.0	84.6	56.8	39.2				
	1.0-2.0	ML	2.71	16.06	NP	NP	100	89.4	82.6	78.2	61.4	29.0	16.8				
ALY-53	0.1-1.0	MH	2.70	26.84	52.40	13.04	-	100	99.8	99.2	88.9	64.2	49.1				
	1.0-3.0	ML	2.71	24.98	49.50	13.42	100	98.4	96.5	95.1	85.6	58.2	37.8				
	3.0-5.0	ML	2.72	22.56	39.95	5.10	-	100	99.1	98.2	84.6	48.5	23.8				
ALY-54	0.1-3.0	ML	2.70	21.47	45.90	11.26	98.3	97.0	95.1	93.5	81.9	52.6	34.9				
	3.0-5.0	ML	2.66	20.40	NP	NP	-	100	99.8	99.5	82.9	43.7	21.0				
ALY-55	0.1-2.0	ML	2.67	21.07	46.05	12.19	100	96.7	94.7	93.2	81.7	53.9	37.7				
	2.0-3.0	ML	2.72	18.10	NP	NP	100	86.7	81.1	77.9	68.9	38.0	20.5				
	3.0-4.0	ML	2.70	15.22	NP	NP	100	95.9	94.1	92.2	74.6	36.6	18.0				
ALY-56	0.1-1.0	ML	2.64	25.15	49.20	15.25	-	100	99.6	93.7	82.3	58.6	44.8				
	1.0-2.0	ML	2.67	23.34	44.0	12.79	100	97.4	95.2	93.5	78.5	54.0	38.8				
	2.0-3.0	ML	2.65	19.51	NP	NP	100	96.1	93.2	90.6	75.0	40.8	21.3				
ALY-57	0.0-1.0	ML	2.65	12.40	23.20	3.34	100	87.9	82.0	73.4	51.0	28.6	14.4				
	1.0-2.0	ML	2.68	13.80	24.00	2.98	100	90.1	84.3	73.9	52.8	33.6	18.4				
	2.0-4.0	ML	2.68	13.48	NP	NP	100	89.4	78.9	68.1	50.3	30.4	15.2				
ALY-58	0.0-1.0	ML	2.65	16.72	35.43	6.38	100	92.9	89.1	86.3	71.1	39.6	24.7				
	1.0-2.0	ML	2.63	14.85	36.20	6.09	100	91.2	83.9	79.3	63.6	33.2	18.6				
	2.0-3.4	ML	2.69	17.59	NP	NP	100	96.9	94.9	93.6	71.2	31.4	12.9				

TABLE.B.B(10%)SUMMARY OF TEST RESULTS

PROJECT: NAM YUAM (SITE NO. 5)
Impervious Material (Drill Holes)

SAMPLE NO.	DEPTH (m.)	USCS SOIL GROUP	SP.GR.	W, AT RECEIVED (%)	ATT'S LIMITS		GRADATION							COMPACTION		PERMEABILITY	
					LL. (%)	PI. (%)	" - 3/4	# - 4	# - 10	# - 40	# - 200	- 10/μ	- 2/μ	Max. X ₁₀ (1/n ³)	Wopt. (%)	Min. K _T (cm/sec)	Molded, W (%)
ALY-59	0.1-1.0	ML	2.69	17.0	NP	NP	100	95.1	92.8	91.8	77.7	31.7	15.0				
	1.0-2.0	ML	2.71	25.27	NP	NP	100	99.5	98.3	97.0	81.0	34.8	14.4				
	2.0-2.8	MH	2.64	36.30	61.20	12.08	100	91.7	87.3	83.2	74.7	45.6	19.8				
ALY-60	0.0-1.0	ML	2.68	24.31	NP	NP	98.9	95.8	93.8	91.9	77.2	38.2	18.5				
	1.0-1.4	ML	2.69	19.19	NP	NP	100	96.7	95.0	94.3	72.2	29.5	13.0				
ALY-61	0.1-1.0	ML	2.63	20.53	43.13	10.29	100	99.6	98.8	97.9	86.2	54.2	38.3				
	1.0-2.0	ML	2.66	22.12	45.40	10.49	100	98.6	97.6	96.8	84.5	52.6	34.1				
	2.0-3.0	ML	2.66	19.08	NP	NP	100	96.9	94.3	92.6	75.6	41.1	23.5				
	3.0-4.0	ML	2.65	17.07	NP	NP	100	90.1	85.0	82.5	64.6	31.5	13.1				
ALY-62	0.1-2.0	ML	2.65	24.21	NP	NP	100	99.9	99.7	99.3	89.3	57.1	40.0				
	2.0-3.0	ML	2.67	21.64	NP	NP	100	96.3	94.1	92.9	82.4	48.0	58.7				
	3.0-4.0	ML	2.67	20.36	NP	NP	100	99.9	99.5	99.0	85.6	43.6	17.5				
ALY-63	0.0-1.9	ML	2.69	23.13	44.70	10.18	100	94.9	92.7	90.8	76.5	51.5	34.1				
ALY-64	0.1-1.0	ML	2.64	23.25	40.82	9.53	100	96.2	94.1	93.0	82.9	55.0	36.2				
	1.0-2.0	ML	2.70	17.97	NP	NP	100	95.1	91.3	89.6	76.8	42.1	24.5				

APPENDIX—C

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Appendix-C References

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APPENDIX—D

DEVELOPMENT PLAN

APPENDIX-D DEVELOPMENT PLAN

CONTENTS

- D-1 DAILY PLANT FACTOR AND EQUIVALENT PEAK DURATION HOURS
- D-2 RESERVOIR AREA AND STORAGE CAPACITY CURVES OF NAM NGAO DAM
(SITE NO. 1, NO. 3)
- D-3 RESERVOIR AREA AND STORAGE CAPACITY CURVES OF MAE LAMA LUANG DAM
(SITE NEA)
- D-4 BACK WATER EFFECT BY MAE LAMA LUANG RESERVOIR
- D-5 CONSTRUCTION COST FOR SEQUENCE ON PROJECT IMPLEMENTATION
- D-6 CASH FLOW FOR SEQUENCE ON PROJECT IMPLEMENTATION
- D-7 MONTHLY LIST OF MASS CURVE
- D-8 MONTHLY LIST OF POWER AND ENERGY AT GENERATING END

D-1 DAILY PLANT FACTOR AND EQUIVALENT PEAK DURATION HOURS

APPENDIX D-1 DAILY PLANT FACTOR AND EQUIVALENT PEAK DURATION HOURS

The plant factor of 15% (equivalent peak duration hours of 3.6) was adopted in this report. The reason is described below.

- o The load duration curve of the Northern Region in year of 2000 which is described in the Master Plan Study is shown in Fig. 1.

In the region, there is no significant generating facilities to supply the power for the peak load.

- o The Nam Ngao and Mae Lama Luang power plants are the best facilities to supply the power for the peak load.
- o The duration hours of 3 to 7 hours are commonly used for the hydropower planning. The value depends on the load duration curve and supply capability of the system.

The Nam Yuam river basin hydropower integrated projects and other hydropower projects in the northern region should be put into the load duration curve from the top because there is no significant facilities for the peak in Region 4. Considering the firm capacity 330 MW (firm capacity) of Nam Ngao and Mae Lama Luang projects, these project should be put into the slash part in the load curve. The equivalent peak duration hours for the part is 3.6 hours (daily plant factor 15%).

- o Another way to determine the daily plant factor is to be obtained from comparison study concerning the maximum power discharge.

According to the study on maximum power discharge of the investigation stage, the most beneficial case in terms of the (B - C) is the daily plant factor 15% (See: Main Report, Table 8-10 (3)).

Taking into account the reason above, the daily plant factor of 15% was reasonable.

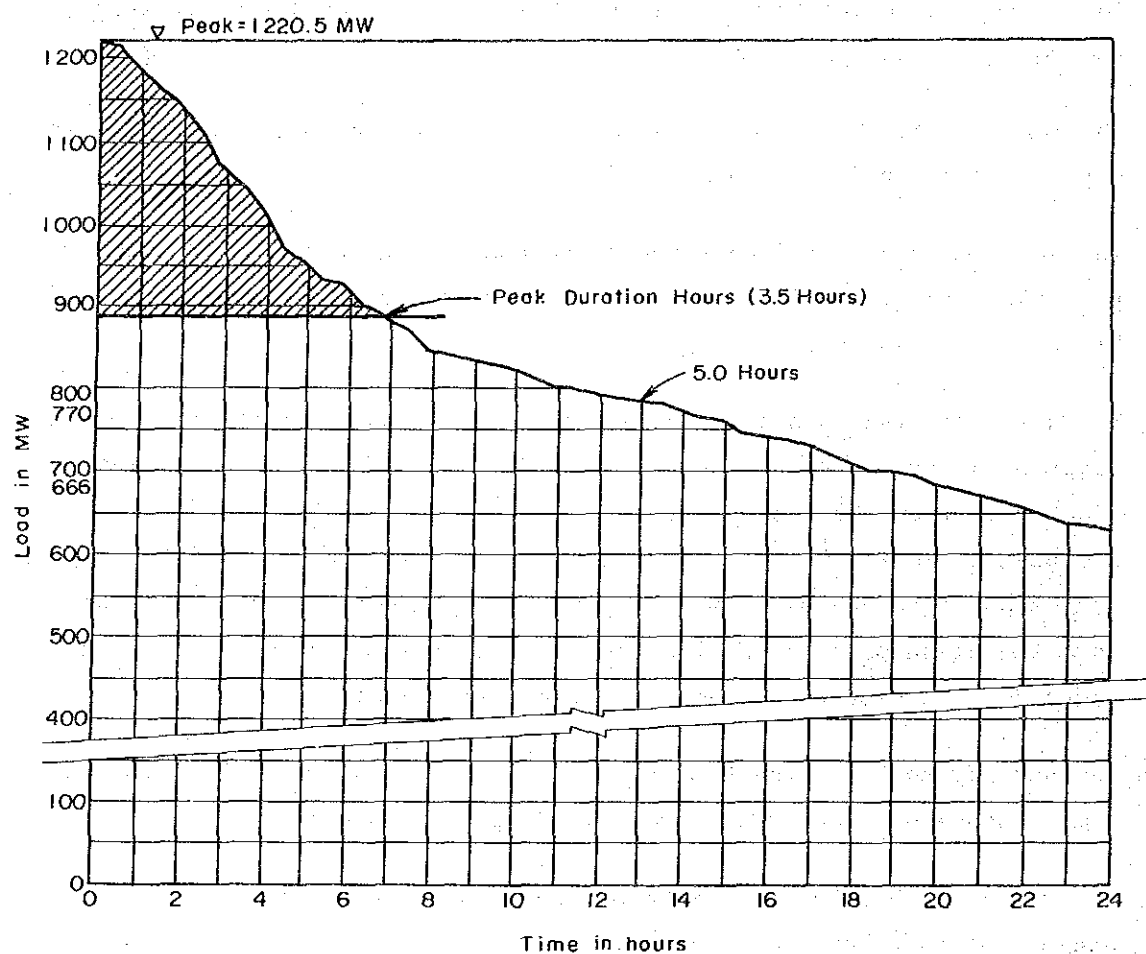
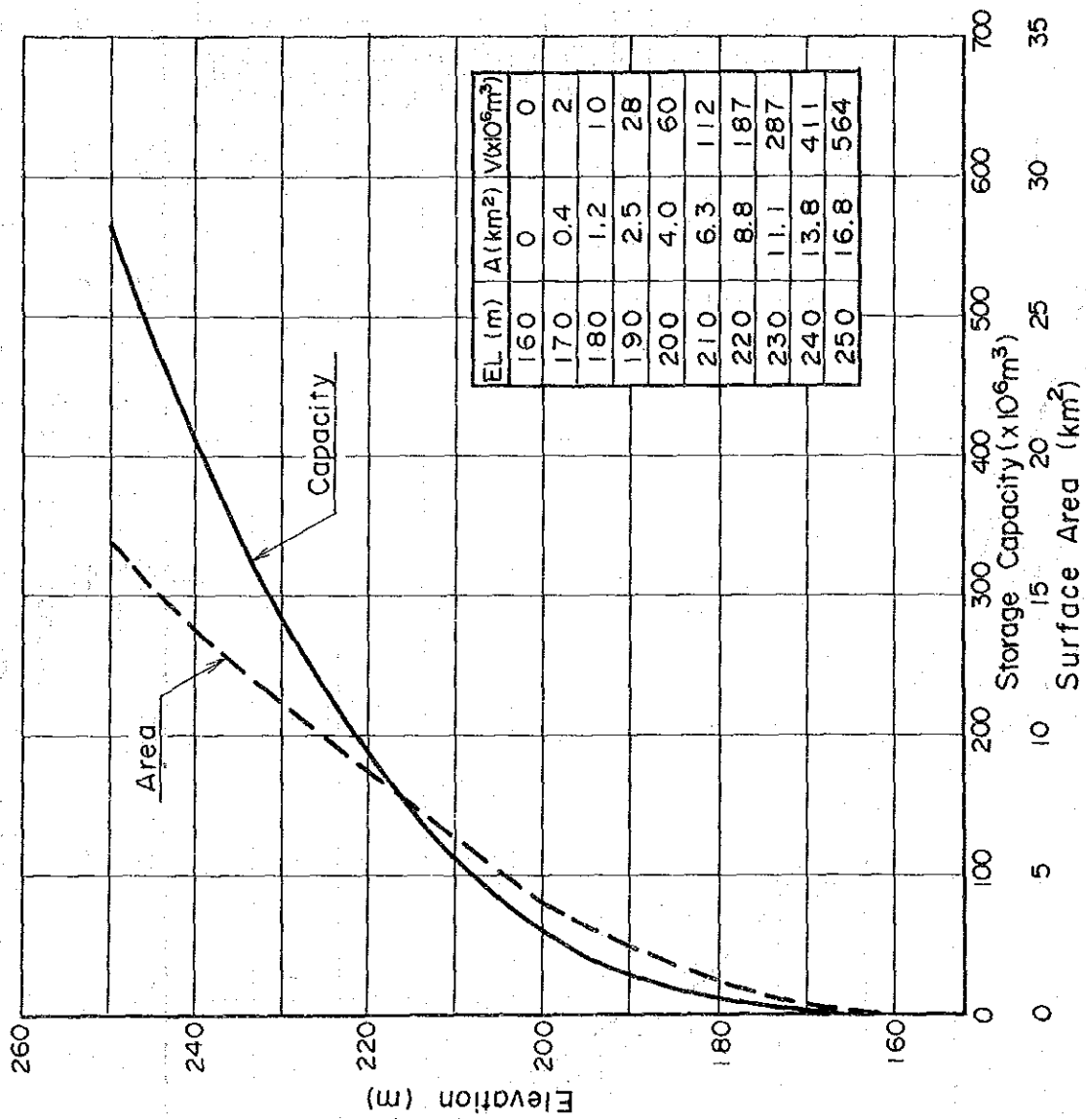
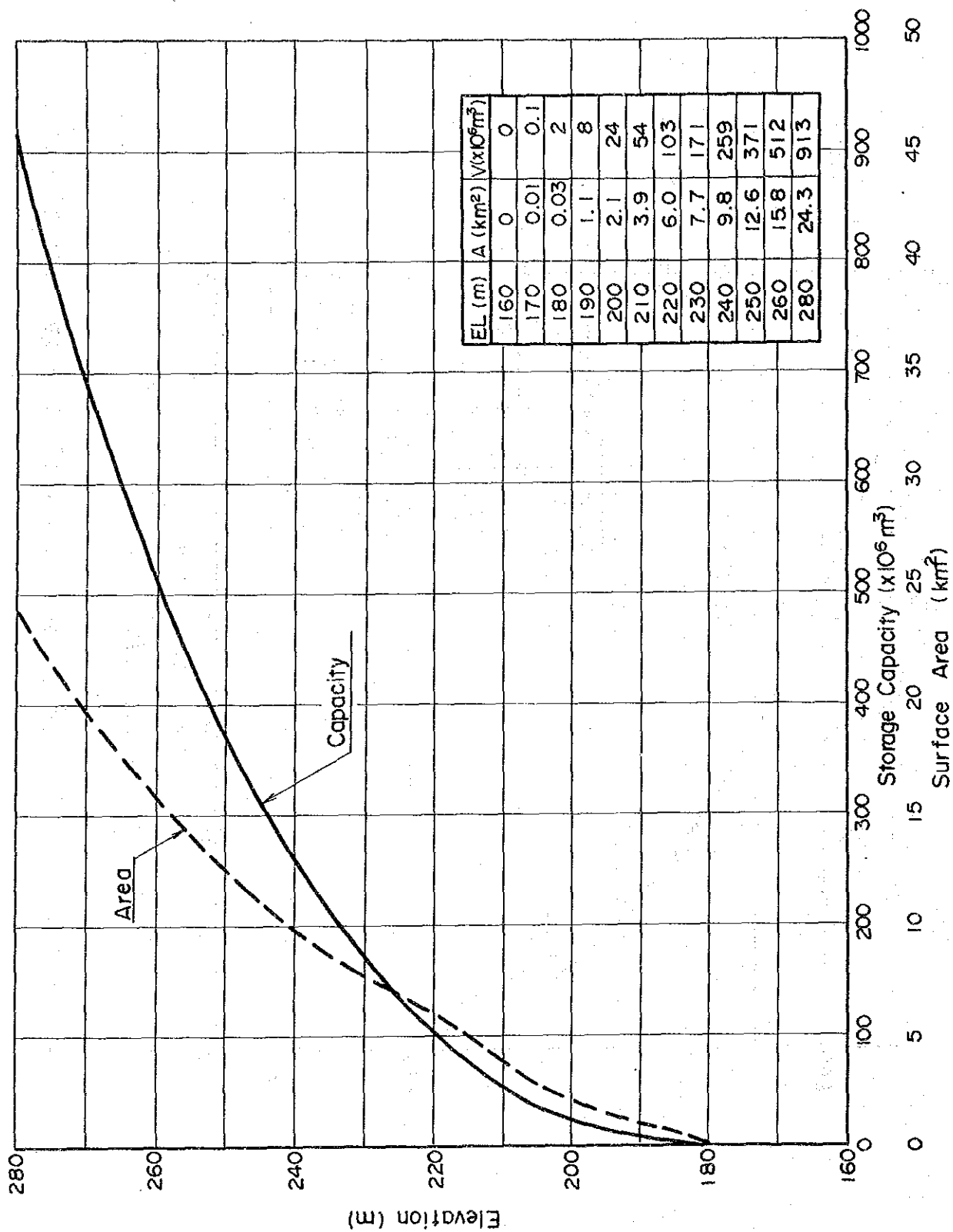


Fig. 1 Load Durations Curve of Northern Region
Year 2000 with Nam Ngao + Nam Yuam

D-2 RESERVOIR AREA AND STORAGE CAPACITY CURVES
OF NAM NGAO DAM (SITE NO. 1, NO. 3)

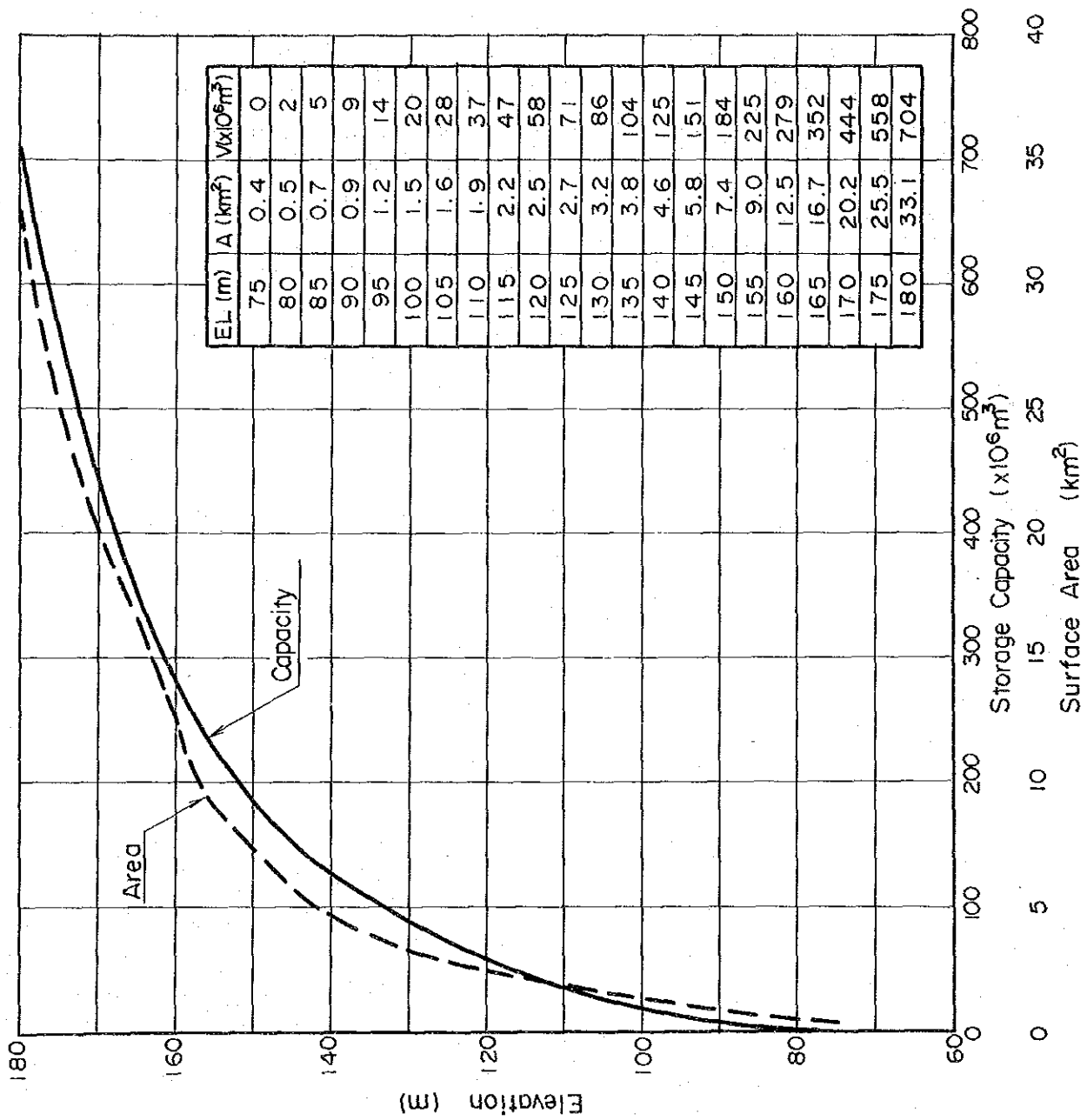


Reservoir Area and Storage Capacity Curve of Nam Ngao Dam (Site No.1)



Reservoir Area and Storage Capacity Curve of Nam Ngao Dam (Site No.3)

**D-3. RESERVOIR AREA AND STORAGE CAPACITY CURVES OF
MAE LAMA LUANG DAM (SITE NEA)**



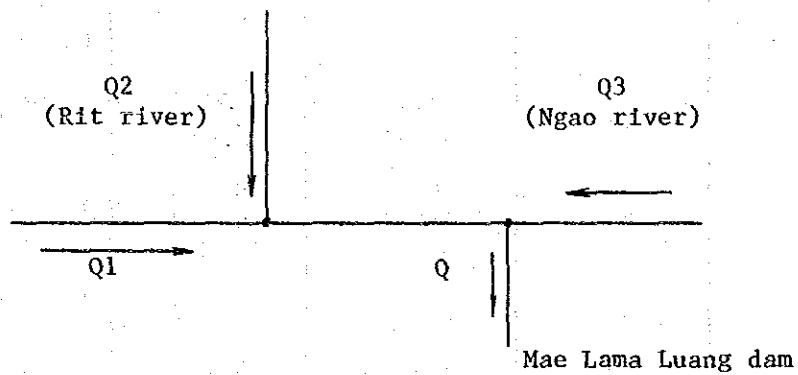
Reservoir Area and Storage Capacity Curve of Mae Lama Luang Dam (Site NEA)

D-4 BACK WATER EFFECT BY MAE LAMA LUANG RESERVOIR

1. Condition

(1) Flood

1,800 m³/sec at Mae Lama Luang dam site with 100 years return period.



$$Q = Q1 + Q2 + Q3$$

$$Q = Q1 + Q2 + Q3$$

$$Q1 = 580 \text{ m}^3/\text{sec}$$

$$Q2 = 220 \text{ "}$$

$$Q3 = 1,000 \text{ "}$$

C.A.:	Mae Lama Luang dam	6,030 km ²	$Q1 = (1,800 - 1,000) \times \frac{3,719}{1,376 + 3,719}$
	Ngao river	935 km ²	$= 580 \text{ m}^3/\text{s}$
	Rit river	1,376 km ²	
	Remaining area	3,719 km ²	

(2) Section

Obtained from 1/10,000 map.

(3) Coefficient of roughness : 0.035

2. Calculation Cases

- Natural condition without the dam
- With dam for the initial water level of 160.0 m - 165.0 m.

Summary of Backwater Effect

Reservoir Water Level at Dam Site	Section No. of End of Backwater	Water Level of End of Backwater		(3) Adopted Water Level for End of Backwater
		(1) With Dam	(2) W/o Dam	
				(Average of (1)
160.0	54	161.5	161.3) 162.1
	55	162.7	162.8	
161.0	54	161.9	161.3) 162.3
	55	162.7	162.8	
162.0	56	164.1	164.0) 164.9
	57	165.7	165.7	
162.5	56	164.1	164.0) 164.9
	57	165.7	165.7	
163.0	56	164.3	164.0) 165.0
	57	165.7	165.8	
163.5	56	164.4	164.0) 165.1
	57	165.7	165.7	
164.0	56	164.7	164.0) 165.2
	57	165.7	165.8	
165.0	57	165.9	165.7) 166.2
	58	166.5	166.5	

(2-1) Result of Calculation

NO.	DL	L	H	H	H	H	H	H	H	H	H
1	0.0	0.0	71.070	160.000	161.000	162.000	162.500	163.000	163.500	164.000	165.000
2	500.0	500.0	73.015	160.001	161.001	162.001	162.500	163.000	163.500	164.000	165.000
3	500.0	1,000.0	75.041	160.001	161.001	162.001	162.500	163.000	163.500	164.000	165.000
4	500.0	1,500.0	75.251	160.001	161.001	162.001	162.500	163.000	163.500	164.000	165.000
5	500.0	2,000.0	76.537	160.000	161.00	162.000	162.500	163.000	163.500	164.000	165.000
6	500.0	2,500.0	77.118	160.000	161.000	162.000	162.500	163.000	163.500	164.000	165.000
7	500.0	3,000.0	78.382	160.002	161.001	162.001	162.501	163.001	163.501	164.001	165.001
8	800.0	3,800.0	79.732	160.002	161.002	162.001	162.501	163.001	163.501	164.001	165.001
9	800.0	4,600.0	80.783	160.002	161.002	162.002	162.501	163.001	163.501	164.001	165.001
10	1,600.0	6,200.0	81.190	160.002	161.002	162.002	162.501	163.001	163.501	164.001	165.001
11	2,100.0	8,300.0	88.750	160.002	161.002	162.002	162.502	163.002	163.501	164.001	165.001
12	900.0	9,200.0	94.370	160.002	161.002	162.002	162.502	163.002	163.502	164.002	165.001
13	1,100.0	10,300.0	97.964	160.002	161.002	162.002	162.502	163.002	163.502	164.002	165.002
14	900.0	11,200.0	101.121	160.002	161.002	162.002	162.502	163.002	163.502	164.002	165.002
15	500.0	11,700.0	102.719	160.001	161.001	162.001	162.501	163.001	163.501	164.001	165.001
16	1,400.0	13,100.0	112.350	160.002	161.002	162.002	162.501	163.001	163.501	164.001	165.001
17	1,500.0	14,600.0	119.012	160.001	161.001	162.001	162.501	163.001	163.501	164.001	165.001
18	1,300.0	15,900.0	127.759	160.005	161.004	162.004	162.504	163.003	163.503	164.003	165.003
19	1,500.0	17,400.0	133.249	160.001	161.000	162.000	162.500	163.000	163.500	164.000	165.000
20	1,200.0	18,600.0	135.072	160.004	161.004	162.003	162.503	163.002	163.502	164.002	165.002
21	1,000.0	19,600.0	135.781	160.006	161.005	162.004	162.503	163.003	163.503	164.003	165.002
22	800.0	20,400.0	136.050	160.006	161.005	162.004	162.503	163.003	163.503	164.003	165.003
23	1,200.0	21,600.0	138.426	160.004	161.003	162.002	162.502	163.002	163.502	164.001	165.001
24	2,900.0	24,500.0	146.009	160.017	161.014	162.012	162.511	163.010	163.509	164.009	165.007
25	1,000.0	25,500.0	146.229	160.023	161.020	162.016	162.515	163.014	163.513	164.012	165.010
26	900.0	26,400.0	146.378	160.025	161.022	162.018	162.516	163.016	163.514	163.013	164.012
27	1,700.0	28,100.0	147.226	160.031	161.026	162.022	162.520	163.018	163.517	164.016	165.014
28	900.0	29,000.0	149.136	160.017	161.012	162.009	162.507	163.006	163.505	164.004	165.003
29	500.0	29,500.0	151.570	160.054	161.042	162.032	162.529	163.025	163.523	164.020	165.016
30	500.0	30,000.0	152.141	160.101	161.081	162.066	162.559	163.054	163.549	164.044	165.037
31	500.0	30,500.0	152.361	160.118	161.095	162.077	162.570	163.063	163.557	164.052	165.044
32	500.0	31,000.0	152.481	160.118	161.094	162.075	162.568	163.061	163.555	164.050	165.041
33	500.0	31,500.0	152.759	160.150	161.120	162.097	162.588	163.080	163.572	164.066	165.055
34	500.0	32,000.0	152.915	160.148	161.118	162.095	162.586	163.077	163.570	164.064	165.053
35	500.0	32,500.0	153.172	160.164	161.131	162.106	162.595	163.086	163.578	164.071	165.059
36	500.0	33,000.0	153.382	160.168	161.133	162.107	162.596	163.086	163.578	164.071	165.059
37	500.0	33,500.0	153.643	160.180	161.142	162.113	162.601	163.091	163.582	164.075	165.062
38	500.0	34,000.0	153.984	160.201	161.159	162.126	162.613	163.102	163.592	164.083	165.068
39	500.0	34,500.0	154.161	160.205	161.161	162.128	162.614	163.102	163.592	164.084	165.069
40	500.0	35,000.0	154.402	160.22	161.172	162.135	162.621	163.109	163.598	164.088	165.072
41	500.0	35,500.0	154.739	160.240	161.186	162.147	162.631	163.118	163.606	164.095	165.078
42	500.0	36,000.0	155.211	160.242	161.186	162.145	162.630	163.116	163.604	164.093	165.076
43	500.0	36,500.0	155.936	160.278	161.211	162.164	162.646	163.129	163.616	164.104	165.085
44	500.0	37,000.0	156.685	160.287	161.209	162.157	162.637	163.121	163.607	164.095	165.076
45	500.0	37,500.0	158.528	160.524	161.369	162.268	162.731	163.200	163.674	164.153	165.119

(2-2) Result of Calculation

NO.	DL	L	H	H	H	H	H	H	H	H	H
46	500.0	38,000.0	157.778	160.613	161.431	162.312	162.768	163.231	163.701	164.176	165.136
47	500.0	38,500.0	158.978	160.687	161.484	162.349	162.800	163.259	163.726	164.197	165.153
48	500.0	39,000.0	159.077	160.709	161.495	162.356	162.806	163.263	163.729	164.200	165.155
49	500.0	39,500.0	159.158	160.725	161.504	162.361	162.809	163.266	163.731	164.201	165.156
50	500.0	40,000.0	159.236	160.738	161.511	162.364	162.812	163.268	163.732	164.202	165.157
51	500.0	40,500.0	159.332	160.751	161.516	162.367	162.813	163.269	163.734	164.204	165.158
52	500.0	41,000.0	159.479	160.768	161.523	162.370	162.816	163.271	163.735	164.205	165.158
53	1,000.0	42,000.0	160.270	160.947	161.591	162.396	162.832	163.282	163.742	164.210	165.161
54	500.0	42,500.0	161.323	161.522	161.889	162.516	162.904	163.325	163.769	164.226	165.166
55	500.0	43,000.0	162.778	162.713	162.734	162.987	163.229	163.540	163.908	164.317	165.206
56	500.0	43,500.0	164.032	164.027	164.028	164.067	164.136	164.259	164.447	164.699	165.364
57	500.0	44,000.0	165.747	165.750	165.749	165.730	165.701	165.668	165.651	165.679	165.921
58	500.0	44,500.0	166.459	166.460	166.460	166.452	166.441	166.430	166.424	166.433	166.538
59	500.0	45,000.0	166.471	166.472	166.472	166.464	166.454	166.442	166.437	166.446	166.549
60	500.0	45,500.0	166.479	166.480	166.480	166.473	166.462	166.451	166.446	166.454	166.557
61	500.0	46,000.0	166.491	166.492	166.491	166.484	166.474	166.462	166.457	166.466	166.567
62	500.0	46,500.0	166.502	166.503	166.502	166.495	166.485	166.474	166.469	166.477	166.577
63	500.0	47,000.0	166.663	166.663	166.663	166.657	166.650	166.641	166.637	166.644	166.723
64	500.0	47,500.0	167.152	167.153	167.153	167.150	167.147	167.143	167.141	167.144	167.179
65	500.0	48,000.0	167.815	167.815	167.815	167.814	167.813	167.812	167.812	167.813	167.823
66	500.0	48,500.0	168.899	168.899	168.899	168.898	168.898	168.898	168.898	168.898	168.900
67	500.0	49,000.0	170.298	170.298	170.298	170.298	170.298	170.298	170.298	170.298	170.297
68	500.0	49,500.0	170.442	170.442	170.442	170.442	170.442	170.442	170.442	170.442	170.441
69	500.0	50,000.0	170.642	170.642	170.642	170.642	170.642	170.642	170.642	170.642	170.641
70	500.0	50,500.0	171.064	171.064	171.064	171.064	171.064	171.064	171.064	171.064	171.063
71	500.0	51,000.0	171.987	171.987	171.987	171.987	171.987	171.987	171.987	171.987	171.987
72	500.0	51,500.0	172.630	172.630	172.630	172.630	172.630	172.630	172.630	172.630	172.630
73	500.0	52,000.0	172.884	172.884	172.884	172.884	172.884	172.884	172.884	172.884	172.884
74	500.0	52,500.0	173.253	173.253	173.253	173.253	173.253	173.253	173.253	173.253	173.253
75	500.0	53,000.0	173.462	173.462	173.462	173.462	173.462	173.462	173.462	173.462	173.462
76	500.0	53,500.0	173.509	173.509	173.509	173.509	173.509	173.509	173.509	173.509	173.509
77	1,000.0	54,500.0	173.755	173.755	173.755	173.755	173.755	173.755	173.755	173.755	173.755
78	500.0	55,000.0	174.074	174.074	174.074	174.074	174.074	174.074	174.074	174.074	174.074
79	500.0	55,500.0	174.593	174.593	174.593	174.593	174.593	174.593	174.593	174.593	174.593
80	500.0	56,000.0	174.963	174.963	174.963	174.963	174.963	174.963	174.963	174.963	174.963
81	500.0	56,600.0	175.432	175.432	175.432	175.432	175.432	175.432	175.432	175.432	175.432
82	500.0	57,000.0	176.210	176.210	176.210	176.210	176.210	176.210	176.210	176.210	176.210



D-5 CONSTRUCTION COST FOR SEQUENCE ON PROJECT IMPLEMENTATION

(1) Construction Cost for Sequence of Project Implementation

(Case A) Nam Ngao Project (Individual Development) P = 140 MW (Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparation Works	0.0	66.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0
2. Environmental Mitigation	0.0	24.6	0.0	61.5	0.0	61.5	0.0	32.8	0.0	24.7	0.0	205.1
3. Civil Works	20.7	16.7	245.5	187.1	331.7	251.4	333.0	294.7	32.5	47.8	963.4	797.7
4. Hydraulic Equipment	0.0	0.0	0.0	0.0	45.1	18.7	46.3	16.8	25.9	6.7	117.3	42.2
5. Electro-mechanical Equipment	0.0	0.0	145.4	3.0	334.6	30.2	280.0	32.8	76.8	27.2	836.8	93.2
6. Transmission Line	0.0	0.0	0.0	0.0	229.0	28.3	182.6	46.5	46.4	18.2	458.0	93.0
Sub Total (1)	20.7	107.3	390.9	287.6	940.4	390.1	841.9	423.6	181.6	124.6	2,375.5	1,333.2
7. Import Duties	0.0	1.1	0.0	51.9	0.0	150.2	0.0	129.0	0.0	33.2	0.0	365.4
8. EGAT Administration	0.0	3.8	0.0	20.4	0.0	39.9	0.0	38.0	0.0	9.2	0.0	111.3
9. Engineering Service	6.4	0.0	33.9	0.0	66.5	0.0	63.3	0.0	15.3	0.0	185.4	0.0
Sub Total (2)	27.1	112.2	424.8	359.9	1,006.9	580.2	905.2	590.6	196.9	167.0	2,560.9	1,809.9
10. Physical Contingency	2.1	10.7	34.7	28.7	77.1	37.3	70.3	40.0	14.5	11.1	198.7	127.8
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)		
11. Price Contingency	4.3	17.7	84.8	71.9	244.6	140.9	260.4	169.9	68.3	57.9	662.4	458.3
Sub Total (3)	33.5	140.6	544.3	460.5	1,328.6	758.4	1,235.9	800.5	279.7	236.0	3,422.0	2,396.0
12.1 Interest	2.7	7.0	46.2	30.0	152.5	67.9	251.4	107.9	273.8	119.7	726.6	332.5
12.2 Commitment Fee	25.7		25.4		21.3		11.4		2.1		85.9	0.0
12. Interest During Construction	28.4	7.0	71.6	30.0	173.8	67.9	262.8	107.9	275.9	119.7	812.5	332.5
Total Project Cost	61.9	147.6	615.9	490.5	1,502.4	826.3	1,498.7	908.4	555.6	355.7	4,234.5	2,728.5
Economic Cost Case-1 (*)	29.2	94.8	459.5	269.0	1,084.0	399.6	975.5	465.5	211.4	117.7	2,759.6	1,346.6
Economic Cost Case-2 (**)	29.2	121.8	459.5	330.7	1,084.0	467.3	975.5	501.6	211.4	144.9	2,759.6	1,572.3

(Note) (*) excluding " 2. Environmental Mitigation " (**) including " 2. Environmental Mitigation "

(2) Construction Cost for Sequence of Project Implementation

Mae Lama Luang Project (Individual Development) P = 160 MW

(CASE B)

(Million Baht)

	1st year			2nd year			3rd year			4th year			5th year			Total		
	FC	LC		FC	LC		FC	LC		FC	LC		FC	LC		FC	LC	Total
1. Preparation Works	0.0	100.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	132.0	132.0
2. Environmental Mitigation	0.0	31.3		0.0	78.3		0.0	0.0		0.0	41.8		0.0	31.4		0.0	261.1	261.1
3. Civil Works	64.1	54.6		132.3	107.3		336.3	328.6		250.8	232.0		12.6	17.7		796.1	740.2	1,536.3
4. Hydraulic Equipment	0.0	0.0		0.0	0.0		5.8	2.5		79.6	29.8		40.4	10.4		125.8	42.7	168.5
5. Electro-mechanical Equipment	0.0	0.0		166.2	3.4		384.4	42.8		341.2	41.8		90.2	30.0		982.0	118.0	1,100.0
6. Transmission Line	0.0	0.0		0.0	0.0		229.0	28.3		182.6	46.5		46.4	18.2		458.0	93.0	551.0
Sub Total (1)	64.1	185.9		298.5	221.0		955.5	480.5		854.2	391.9		189.6	107.7		2,361.9	1,387.0	3,748.9
7. Import Duties	0.0	3.3		0.0	52.4		0.0	151.4		0.0	153.2		0.0	39.7		0.0	400.0	400.0
8. EGAT Administration	0.0	7.5		0.0	15.6		0.0	43.1		0.0	37.4		0.0	8.9		0.0	112.5	112.5
9. Engineering Service	12.5	0.0		26.0	0.0		71.8	0.0		62.3	0.0		14.9	0.0		187.5	0.0	187.5
Sub Total (2)	76.6	196.7		324.5	289.0		1,027.3	675.0		916.5	582.5		204.5	156.3		2,549.4	1,899.5	4,448.9
10. Physical Contingency	6.4	18.6		24.9	22.0		77.1	45.9		69.7	36.5		14.9	9.3		193.0	132.3	325.3
11.1 Escalation Ratio	(1.1580)	(1.1580)		(1.1997)	(1.1997)		(1.2429)	(1.2429)		(1.2877)	(1.2877)		(1.3469)	(1.3469)				
11. Price Contingency	12.1	31.1		64.8	57.7		249.5	164.0		263.7	167.6		70.9	54.2		661.0	474.6	1,135.6
Sub Total (3)	95.1	246.4		414.2	368.7		1,353.9	884.9		1,249.9	786.6		290.3	219.8		3,403.4	2,506.4	5,909.8
12.1 Interest	7.6	12.3		40.7	30.7		149.0	74.9		249.0	114.2		272.2	125.2		718.5	357.3	1,075.8
12.2 Commitment Fee	25.5			24.8			21.7			11.6			2.2			85.8	0.0	85.8
12. Interest During Construction	33.1	12.3		65.5	30.7		170.7	74.9		260.6	114.2		274.4	125.2		804.3	357.3	1,161.6
Total Project Cost	128.2	258.7		479.7	399.4		1,524.6	959.8		1,510.5	900.8		564.7	345.0		4,207.7	2,863.7	7,071.4
Economic Cost Case-1 (*)	83.0	177.6		349.4	172.5		1,104.4	483.4		986.2	419.9		219.4	91.4		2,742.4	1,344.8	4,087.2
Economic Cost Case-2 (**)	83.0	212.0		349.4	258.6		1,104.4	569.5		986.2	465.8		219.4	125.9		2,742.4	1,631.8	4,374.2

(Note) (*) excluding "2. Environmental Mitigation"
(**) including "2. Environmental Mitigation"

(3) Construction Cost for Sequence of Project Implementation

(Case C) (Case D) (Case E) Nam Ngao Project (Integrated Development) P = 140 MW (Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparation Works	0.0	66.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0
2. Environmental Mitigation	0.0	22.9	0.0	57.2	0.0	57.2	0.0	30.5	0.0	22.7	0.0	190.5
3. Civil Works	20.7	16.7	245.5	187.1	331.7	251.4	333.0	294.7	32.5	47.8	963.4	797.7
4. Hydraulic Equipment	0.0	0.0	0.0	0.0	45.1	18.7	46.3	16.8	25.9	6.7	117.3	42.2
5. Electro-mechanical Equipment	0.0	0.0	145.4	3.0	334.6	30.2	280.0	32.8	76.8	27.2	836.8	93.2
6. Transmission Line	0.0	0.0	0.0	0.0	114.0	22.3	91.4	37.0	22.6	14.7	228.0	74.0
Sub Total (1)	20.7	105.6	390.9	283.3	825.4	379.8	750.7	411.8	157.8	119.1	2,145.5	1,299.6
7. Import Duties	0.0	1.0	0.0	51.9	0.0	137.5	0.0	118.9	0.0	30.7	0.0	340.0
8. EGAT Administration	0.0	3.8	0.0	20.2	0.0	36.2	0.0	34.9	0.0	8.3	0.0	103.4
9. Engineering Service	6.3	0.0	33.7	0.0	60.3	0.0	58.1	0.0	13.8	0.0	172.2	0.0
Sub Total (2)	27.0	110.4	424.6	355.4	885.7	553.5	808.8	565.6	171.6	158.1	2,317.7	1,743.0
10. Physical Contingency	2.1	10.6	34.7	28.2	69.1	36.4	63.9	39.1	12.8	10.7	182.6	125.0
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)		
11. Price Contingency	4.3	17.4	84.8	71.0	215.1	134.4	232.7	162.7	59.5	54.8	596.4	440.3
Sub Total (3)	33.4	138.4	544.1	454.6	1,169.9	724.3	1,105.4	767.4	243.9	223.6	3,096.7	2,308.3
12.1 Interest	2.7	6.9	46.2	29.6	139.8	65.8	228.2	104.2	247.7	115.4	664.6	321.9
12.2 Commitment Fee	23.2		23.0		18.9		10.1		1.8		77.0	0.0
12. Interest During Construction	25.9	6.9	69.2	29.6	158.7	65.8	238.3	104.2	249.5	116.5	741.6	323.4
Total Project Cost	59.3	145.3	613.3	484.2	1,328.6	790.1	1,343.7	871.6	493.4	340.5	3,838.3	2,631.7
Economic Cost Case-1 (*)	29.1	94.8	459.3	268.8	954.8	389.5	872.7	452.2	184.4	113.1	2,500.3	1,313.4
Economic Cost Case-2 (**)	29.1	120.0	459.3	331.7	954.8	452.4	872.7	495.8	184.4	138.1	2,500.3	1,528.0
												4,028.3

(Note) (*) excluding " 2. Environmental Mitigation " (**) including " 2. Environmental Mitigation "

(4) Construction Cost for Sequence of Project Implementation

(Case C) (Case D)

Mae Lama Luang Project (Integrated Development) P = 240 MW

(Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1.Preparation Works	0.0	100.0	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.0
2.Environmental Mitigation	0.0	35.9	0.0	89.8	0.0	89.8	0.0	47.9	0.0	36.0	0.0	299.4
3.Civil Works	64.1	54.6	135.9	111.8	341.5	321.9	272.3	267.8	12.8	17.1	826.6	773.2
4.Hydraulic Equipment	0.0	0.0	0.0	0.0	8.1	3.5	101.6	39.0	42.1	10.9	151.8	53.4
5.Electro-mechanical Equipment	0.0	0.0	166.2	3.4	572.0	55.4	550.4	61.8	130.2	50.8	1,418.8	171.4
6.Transmission Line	0.0	0.0	0.0	0.0	229.0	28.3	182.6	46.5	46.4	18.2	458.0	93.0
Sub Total (1)	64.1	190.5	302.1	238.0	1,150.6	498.9	1,106.9	463.0	231.5	133.0	2,855.2	1,523.4
7.Import Duties	0.0	3.3	0.0	52.6	0.0	205.4	0.0	219.6	0.0	50.9	0.0	531.8
8.EGAT Administration	0.0	7.6	0.0	16.2	0.0	49.5	0.0	47.1	0.0	10.9	0.0	131.3
9.Engineering Service	12.7	0.0	27.0	0.0	82.5	0.0	78.5	0.0	18.2	0.0	218.9	0.0
Sub Total (2)	76.8	201.4	329.1	306.8	1,233.1	753.8	1,185.4	729.7	249.7	194.8	3,074.1	2,186.5
10.Physical Contingency	6.4	19.1	25.2	23.7	91.0	47.4	88.7	43.1	17.9	11.2	229.2	144.5
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)		
11.Price Contingency	12.1	31.8	65.7	61.3	299.5	183.1	341.0	209.9	86.6	67.6	804.9	553.7
Sub Total (3)	95.3	252.3	420.0	391.8	1,623.6	984.3	1,615.1	982.7	354.2	273.6	4,108.2	2,884.7
12.1 Interest	7.6	12.6	41.2	32.2	171.1	81.4	300.3	130.5	328.6	146.3	848.8	403.0
12.2 Commitment Fee	30.8		30.1		26.9		14.8		2.7		105.3	0.0
12.Interest During Construction	38.4	12.6	71.3	32.2	198.0	81.4	315.1	130.5	331.3	146.3	954.1	403.0
Total Project Cost	133.7	264.9	491.3	424.0	1,821.6	1,065.7	1,950.2	1,113.2	685.5	419.9	5,062.3	3,287.7
Economic Cost Case-1 (*)	83.2	177.7	354.3	179.1	1,324.1	497.0	1,274.1	500.5	267.6	115.5	3,303.3	1,469.8
Economic Cost Case-2 (**)	83.2	217.2	354.3	277.9	1,324.1	595.8	1,274.1	553.2	267.6	155.1	3,303.3	1,799.2

(Note) (*) excluding "2. Environmental Mitigation"
(**) including "2. Environmental Mitigation"

(5) Construction Cost for Sequence of Project Implementation

(Case E) Mae Lama Luang Project (Integrated Development) P = 160 MW (1st stage, 2 units) (Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparation Works	0.0	100.0	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.0
2. Environmental Mitigation	0.0	32.1	0.0	80.3	0.0	80.3	0.0	42.8	0.0	32.1	0.0	267.6
3. Civil Works	64.1	54.6	135.9	111.8	341.5	321.9	272.3	267.8	12.8	17.1	826.6	1,599.8
4. Hydraulic Equipment	0.0	0.0	0.0	0.0	8.1	3.5	101.6	39.0	42.1	10.9	151.8	205.2
5. Electro-mechanical Equipment	0.0	0.0	166.2	3.4	392.8	42.8	341.2	41.8	90.2	30.0	990.4	1,108.4
6. Transmission Line	0.0	0.0	0.0	0.0	229.0	28.3	182.6	46.5	46.4	18.2	458.0	551.0
Sub Total (1)	64.1	186.7	302.1	228.5	971.4	476.8	897.7	437.9	191.5	108.3	2,426.8	3,865.0
7. Import Duties	0.0	3.3	0.0	52.6	0.0	155.8	0.0	162.0	0.0	39.9	0.0	413.6
8. EGAT Administration	0.0	7.5	0.0	15.9	0.0	43.4	0.0	40.1	0.0	9.0	0.0	115.9
9. Engineering Service	12.5	0.0	26.5	0.0	72.4	0.0	66.8	0.0	15.0	0.0	193.2	193.2
Sub Total (2)	76.6	197.5	328.6	297.0	1,043.8	676.0	964.5	640.0	206.5	157.2	2,620.0	4,587.7
10. Physical Contingency	6.4	18.7	25.2	22.7	78.5	45.5	74.1	41.1	15.1	9.4	199.3	336.7
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)		
11. Price Contingency	12.1	31.2	65.6	59.3	253.5	164.2	277.5	184.1	71.6	54.5	680.3	1,173.6
Sub Total (3)	95.1	247.4	419.4	379.0	1,375.8	885.7	1,316.1	865.2	293.2	221.1	3,499.6	6,098.0
12.1 Interest	7.6	12.4	41.2	31.4	151.3	75.7	256.6	119.0	280.1	130.1	736.8	1,105.4
12.2 Commitment Fee	26.2		25.5		22.4		12.1		2.2		88.4	88.4
12. Interest During Construction	33.8	12.4	66.7	31.4	173.7	75.7	268.7	119.0	282.3	130.1	925.2	1,193.8
Total Project Cost	128.9	259.8	486.1	410.4	1,549.5	961.4	1,584.8	984.2	575.5	351.2	4,324.8	7,291.8
Economic Cost Case-1 (*)	83.0	177.6	353.8	178.8	1,122.3	477.4	1,038.6	472.1	221.6	91.4	2,819.3	4,216.6
Economic Cost Case-2 (**)	93.0	212.9	353.8	267.1	1,122.3	565.7	1,038.6	519.1	221.6	126.7	2,819.3	4,510.8

(Note) (*) excluding "2. Environmental Mitigation" (**) including "2. Environmental Mitigation"

(6) Construction Cost for Sequence of Project Implementation

(Case E) Mac Lasa Luang Project (Integrated Development) P-80 MW (#3)

(Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparation Works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Environmental Mitigation	0.0	10.8	0.0	27.1	0.0	27.1	0.0	14.5	0.0	10.9	0.0	90.4
3. Civil Works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Hydraulic Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Electro-mechanical Equipment	0.0	0.0	0.0	0.0	0.0	0.0	266.9	23.1	215.7	35.0	482.6	58.1
6. Transmission Line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub Total (1)	0.0	10.8	0.0	27.1	0.0	27.1	266.9	37.6	215.7	45.9	482.6	148.5
7. Import Duties	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.4	0.0	53.9	0.0	127.3
8. EGAT Administration	0.0	0.3	0.0	0.8	0.0	0.8	0.0	9.1	0.0	7.8	0.0	18.8
9. Engineering Service	0.5	0.0	1.4	0.0	1.4	0.0	15.2	0.0	13.1	0.0	31.6	0.0
Sub Total (2)	0.5	11.1	1.4	27.9	1.4	27.9	282.1	120.1	228.8	107.6	514.2	294.6
10. Physical Contingency	0.0	1.1	0.0	2.7	0.0	2.7	18.7	3.1	15.1	3.5	33.8	13.1
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)		
11. Price Contingency	0.1	1.8	0.3	5.6	0.3	6.8	81.2	34.6	79.4	37.3	161.3	86.1
Sub Total (3)	0.6	14.0	1.7	36.2	1.7	37.4	382.0	157.8	323.3	148.4	709.3	393.8
12.1 Interest	0.0	0.7	0.1	2.5	0.2	4.4	30.8	12.3	56.7	19.7	87.8	39.6
12.2 Commitment Fee	5.3		5.3		5.3		5.3		2.4		23.6	0.0
12. Interest During Construction	5.3	0.7	5.4	2.5	5.5	4.4	36.1	12.3	59.1	19.7	111.4	39.6
Total Project Cost	5.9	14.7	7.1	38.7	7.2	41.8	418.1	170.1	382.4	168.1	820.7	433.4
Economic Cost Case-1 (*)	0.5	0.3	1.4	0.8	1.4	0.8	300.8	33.8	243.9	45.3	548.0	81.0
Economic Cost Case-2 (**)	0.5	12.2	1.4	30.6	1.4	30.6	300.8	49.8	243.9	57.2	548.0	180.4

(Note) (*) excluding "2. Environmental Mitigation"
(**) including "2. Environmental Mitigation"

(7) Construction Cost for Sequence of Project Implementation

Nam Ngao Project (Integrated Development) P = 140 MW

(Case F)

(Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total		
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	Total
1. Preparation Works	0.0	66.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0	102.0
2. Environmental Mitigation	0.0	24.6	0.0	61.5	0.0	61.5	0.0	32.8	0.0	24.7	0.0	205.1	205.1
3. Civil Works	20.7	16.7	245.5	187.1	331.7	251.4	333.0	294.7	32.5	47.8	963.4	797.7	1,761.1
4. Hydraulic Equipment	0.0	0.0	0.0	0.0	45.1	18.7	46.3	16.8	25.9	6.7	117.3	42.2	159.5
5. Electro-mechanical Equipment	0.0	0.0	145.4	3.0	334.6	30.2	280.0	32.8	76.8	27.2	836.8	93.2	930.0
6. Transmission Line	0.0	0.0	0.0	0.0	229.0	28.3	182.6	46.5	46.4	18.2	458.0	93.0	551.0
Sub Total (1)	20.7	107.3	390.9	287.6	940.4	390.1	841.9	423.6	181.6	124.6	2,375.5	1,333.2	3,708.7
7. Import Duties	0.0	1.1	0.0	51.9	0.0	150.2	0.0	129.0	0.0	33.2	0.0	365.4	365.4
8. EGAT Administration	0.0	3.8	0.0	20.4	0.0	39.9	0.0	38.0	0.0	9.2	0.0	111.3	111.3
9. Engineering Service	6.4	0.0	33.9	0.0	66.5	0.0	63.3	0.0	15.3	0.0	185.4	0.0	185.4
Sub Total (2)	27.1	112.2	424.8	359.9	1,006.9	580.2	905.2	590.6	196.9	167.0	2,560.9	1,809.9	4,370.8
10. Physical Contingency	2.1	10.7	34.7	28.7	77.1	37.3	70.3	40.0	14.5	11.1	198.7	127.8	326.5
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)			
11. Price Contingency	4.3	17.7	84.8	71.9	244.6	140.9	260.4	169.9	68.3	57.9	662.4	458.3	1,120.7
Sub Total (3)	33.5	140.6	544.3	460.5	1,328.6	758.4	1,235.9	800.5	279.7	236.0	3,422.0	2,396.0	5,818.0
12.1 Interest	2.7	7.0	46.2	30.0	152.5	67.9	251.4	107.9	273.8	119.7	726.6	332.5	1,059.1
12.2 Commitment Fee	25.7		25.4		21.3		11.4		2.1		85.9	0.0	85.9
12. Interest During Construction	28.4	7.0	71.6	30.0	173.8	67.9	262.8	107.9	275.9	119.7	812.5	332.5	1,145.0
Total Project Cost	61.9	147.6	615.9	490.5	1,502.4	826.3	1,498.7	908.4	555.6	355.7	4,234.5	2,728.5	6,963.0
Economic Cost Case-1 (*)	29.2	94.8	459.5	269.0	1,084.0	399.6	975.5	465.5	211.4	117.7	2,759.6	1,346.6	4,106.2
Economic Cost Case-2 (**)	29.2	121.8	459.5	336.7	1,084.0	467.3	975.5	501.6	211.4	144.9	2,759.6	1,572.3	4,331.9

(Note) (*) excluding " 2. Environmental Mitigation " (**) including " 2. Environmental Mitigation "

(S) Construction Cost for Sequence of Project Implementation

Mae Lama Luang Project (Integrated Development) P = 240 MW

(Case F)

(Million Baht)

	1st year		2nd year		3rd year		4th year		5th year		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparation Works	0.0	100.0	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.0
2. Environmental Mitigation	0.0	33.6	0.0	83.9	0.0	83.9	0.0	44.8	0.0	33.6	0.0	279.8
3. Civil Works	64.1	54.6	135.9	111.8	341.5	321.9	272.3	267.8	12.8	17.1	826.6	773.2
4. Hydraulic Equipment	0.0	0.0	0.0	0.0	8.1	3.5	101.6	39.0	42.1	10.9	151.8	53.4
5. Electro-mechanical Equipment	0.0	0.0	166.2	3.4	572.0	55.4	550.4	61.8	130.2	50.8	1,418.8	171.4
6. Transmission Line	0.0	0.0	0.0	0.0	114.0	22.3	91.6	37.0	22.6	14.7	228.2	74.0
Sub Total (1)	64.1	188.2	302.1	232.1	1,035.6	487.0	1,015.9	450.4	207.7	127.1	2,625.4	1,484.8
7. Import Duties	0.0	3.3	0.0	52.6	0.0	153.4	0.0	162.0	0.0	39.9	0.0	411.2
8. ECAT Administration	0.0	7.6	0.0	16.0	0.0	45.7	0.0	44.0	0.0	10.0	0.0	123.3
9. Engineering Service	12.6	0.0	26.7	0.0	76.1	0.0	73.3	0.0	16.7	0.0	205.4	0.0
Sub Total (2)	76.7	199.1	328.8	300.7	1,111.7	686.1	1,089.2	656.4	224.4	177.0	2,830.8	2,019.3
10. Physical Contingency	6.4	18.8	25.2	23.1	83.0	46.4	82.3	42.1	16.2	10.7	213.1	141.1
11.1 Escalation Ratio	(1.1580)	(1.1580)	(1.1997)	(1.1997)	(1.2429)	(1.2429)	(1.2877)	(1.2877)	(1.3469)	(1.3469)		
11. Price Contingency	12.1	31.5	65.7	60.0	270.0	166.7	313.4	188.8	77.8	61.4	739.0	508.4
Sub Total (3)	95.2	249.4	419.7	383.8	1,464.7	899.2	1,484.9	887.3	318.4	249.1	3,782.9	2,668.8
12.1 Interest	7.6	12.5	41.2	31.7	158.4	76.7	277.2	121.1	302.7	139.6	787.1	375.6
12.2 Commitment Fee	28.4		27.7		24.5		13.5		2.4		96.5	0.0
12. Interest During Construction	36.0	12.5	68.9	31.7	182.9	76.7	290.7	121.1	305.1	133.6	883.6	375.6
Total Project Cost	131.2	261.9	488.6	415.5	1,647.6	975.9	1,775.6	1,008.4	623.5	382.7	4,666.5	3,044.4
Economic Cost Case-1 (*)	83.1	177.7	354.0	178.9	1,194.7	486.8	1,171.5	487.2	240.6	110.9	3,043.9	1,441.5
Economic Cost Case-2 (**)	83.1	214.6	354.0	271.2	1,194.7	579.1	1,171.5	536.5	240.6	147.8	3,043.9	1,749.2
												4,793.1

(Note) (*) excluding " 2. Environmental Mitigation " (**) including " 2. Environmental Mitigation "

D-6 CASH FLOW FOR SEQUENCE ON PROJECT IMPLEMENTATION

(Unit: Million ¥)

Serial Number	No. after Completion	Cost			Total (N.P.V.)	Benefit			Total (N.P.V.)	B - C
		Investment Cost	OSM Cost	Total		Investment Cost	OSM Cost	Fuel Cost		
1		0.00		0.00	0.00	0.00			0.00	0.00
2		151.00		151.00	134.82	0.00			0.00	-151.00
3		796.20		796.20	634.73	0.00			0.00	-796.20
4		1551.30		1551.30	1104.18	502.12			502.12	-1049.18
5		1477.10		1477.10	938.72	627.65			627.65	-849.45
6		356.30		356.30	202.17	125.53			125.53	-230.77
7	1		54.00	54.00	27.36		37.66	343.35	381.00	193.03
8	2		54.00	54.00	24.43		37.66	343.35	381.00	172.35
9	3		54.00	54.00	21.81		37.66	343.35	381.00	153.88
10	4		54.00	54.00	19.47		37.66	343.35	381.00	137.39
11	5		54.00	54.00	17.39		37.66	343.35	381.00	122.67
12	6		54.00	54.00	15.52		37.66	343.35	381.00	109.53
13	7		54.00	54.00	13.86		37.66	343.35	381.00	97.79
14	8		54.00	54.00	12.38		37.66	343.35	381.00	87.32
15	9		54.00	54.00	11.05		37.66	343.35	381.00	77.96
16	10		54.00	54.00	9.87		37.66	343.35	381.00	69.61
17	11		54.00	54.00	8.81		37.66	343.35	381.00	62.15
18	12		54.00	54.00	7.86		37.66	343.35	381.00	55.49
19	13		54.00	54.00	7.02	502.12	37.66	343.35	833.13	114.84
20	14		54.00	54.00	6.27	627.65	37.66	343.35	1008.66	117.11
21	15		54.00	54.00	5.60	125.53	37.66	343.35	506.54	52.51
22	16		54.00	54.00	5.00		37.66	343.35	381.00	36.27
23	17		54.00	54.00	4.46		37.66	343.35	381.00	31.49
24	18		54.00	54.00	3.98		37.66	343.35	381.00	28.11
25	19		54.00	54.00	3.56		37.66	343.35	381.00	25.10
26	20		54.00	54.00	3.18		37.66	343.35	381.00	22.41
27	21		54.00	54.00	2.84		37.66	343.35	381.00	20.01
28	22	170.66	54.00	224.66	10.54		37.66	343.35	381.00	17.87
29	23	419.52	54.00	473.52	19.83		37.66	343.35	381.00	15.95
30	24	359.72	54.00	413.72	15.47		37.66	343.35	381.00	14.24
31	25	119.60	54.00	173.60	5.79		37.66	343.35	381.00	12.72
32	26		54.00	54.00	1.61		37.66	513.90	551.56	16.44
33	27		54.00	54.00	1.44		37.66	513.90	551.56	14.68
34	28		54.00	54.00	1.28	502.12	37.66	513.90	1053.69	25.03
35	29		54.00	54.00	1.15	627.65	37.66	513.90	1179.22	25.01
36	30		54.00	54.00	1.02	125.53	37.66	513.90	677.09	12.82
37	31		54.00	54.00	0.91		37.66	513.90	551.56	9.33
38	32		54.00	54.00	0.82		37.66	513.90	551.56	8.33
39	33		54.00	54.00	0.73		37.66	513.90	551.56	7.44
40	34		54.00	54.00	0.65		37.66	513.90	551.56	6.64
41	35		54.00	54.00	0.58		37.66	513.90	551.56	5.93
42	36		54.00	54.00	0.52		37.66	513.90	551.56	5.29
43	37		54.00	54.00	0.46		37.66	513.90	551.56	4.73
44	38	295.90	54.00	349.90	2.68		37.66	513.90	551.56	4.22
45	39	263.50	54.00	317.50	2.17		37.66	513.90	551.56	3.77
46	40	74.30	54.00	128.30	0.78		37.66	513.90	551.56	3.36
47	41		54.00	54.00	0.29		37.66	513.90	551.56	3.00
48	42		54.00	54.00	0.26		37.66	513.90	551.56	2.68
49	43		54.00	54.00	0.23	502.12	37.66	513.90	1053.69	4.57
50	44		54.00	54.00	0.21	627.65	37.66	513.90	1179.22	4.57
51	45		54.00	54.00	0.19	125.53	37.66	513.90	677.09	2.34
52	46		54.00	54.00	0.17		37.66	513.90	551.56	1.70
53	47		54.00	54.00	0.15		37.66	513.90	551.56	1.52
54	48		54.00	54.00	0.13		37.66	513.90	551.56	1.36
55	49		54.00	54.00	0.12		37.66	513.90	551.56	1.21
56	50		54.00	54.00	0.11		37.66	513.90	551.56	1.08
		6035.10	2700.00	8735.10	3316.61	5021.22	1882.96	21431.24	28335.42	2851.38
										19600.32

B - C -465.2280
B / C 0.8697279
E D R 0.0995743

(Unit: Million B)

Serial Number	No. after Completion	Cost			Benefit					B - C
		Investment Cost	O&M Cost	Total	Investment Cost	O&M Cost	Fuel Cost	Total		
				(N.P.V.)			(N.P.V.)			
1		0.00		0.00	0.00			0.00	0.00	0.00
2		295.00		295.00	0.00			0.00	0.00	-295.00
3		608.00		608.00	0.00			0.00	0.00	-608.00
4		1673.90		1673.90	1191.45	505.42		505.42	359.75	-1168.48
5		1452.00		1452.00	922.77	631.78		631.78	401.51	-820.22
6		345.30		345.30	195.93	126.36		126.36	71.70	-218.94
7	1		56.40	56.40	28.57		37.91	605.33	643.24	325.88
8	2		56.40	56.40	25.51		37.91	605.33	643.24	290.97
9	3		56.40	56.40	22.78		37.91	605.33	643.24	-259.79
10	4		56.40	56.40	20.34		37.91	605.33	643.24	231.96
11	5		56.40	56.40	18.16		37.91	605.33	643.24	207.11
12	6		56.40	56.40	16.21		37.91	605.33	643.24	184.92
13	7		56.40	56.40	14.48		37.91	605.33	643.24	165.10
14	8		56.40	56.40	12.93		37.91	605.33	643.24	147.41
15	9		56.40	56.40	11.54		37.91	605.33	643.24	131.62
16	10		56.40	56.40	10.30		37.91	605.33	643.24	117.52
17	11		56.40	56.40	9.20		37.91	605.33	643.24	104.93
18	12		56.40	56.40	8.21		37.91	605.33	643.24	93.68
19	13		56.40	56.40	7.33	505.42	37.91	605.33	1148.66	149.37
20	14		56.40	56.40	6.55	631.78	37.91	605.33	1275.01	148.04
21	15		56.40	56.40	5.85	126.36	37.91	605.33	759.59	79.78
22	16		56.40	56.40	5.22		37.91	605.33	643.24	59.54
23	17		56.40	56.40	4.66		37.91	605.33	643.24	53.16
24	18		56.40	56.40	4.16		37.91	605.33	643.24	47.48
25	19		56.40	56.40	3.72		37.91	605.33	643.24	42.38
26	20		56.40	56.40	3.32		37.91	605.33	643.24	37.84
27	21		56.40	56.40	2.96		37.91	605.33	643.24	33.78
28	22	195.04	56.40	251.44	11.79		37.91	605.33	643.24	30.16
29	23	491.28	56.40	547.68	22.93		37.91	605.33	643.24	26.93
30	24	440.45	56.40	496.85	18.57		37.91	605.33	643.24	24.05
31	25	138.23	56.40	194.63	6.50		37.91	605.33	643.24	21.47
32	26		56.40	56.40	1.68		37.91	906.03	943.94	28.13
33	27		56.40	56.40	1.50		37.91	906.03	943.94	25.12
34	28		56.40	56.40	1.34	505.42	37.91	906.03	1449.36	34.43
35	29		56.40	56.40	1.20	631.78	37.91	906.03	1575.72	33.42
36	30		56.40	56.40	1.07	126.36	37.91	906.03	1070.29	20.27
37	31		56.40	56.40	0.95		37.91	906.03	943.94	15.96
38	32		56.40	56.40	0.85		37.91	906.03	943.94	14.25
39	33		56.40	56.40	0.76		37.91	906.03	943.94	12.73
40	34		56.40	56.40	0.68		37.91	906.03	943.94	11.36
41	35		56.40	56.40	0.61		37.91	906.03	943.94	10.14
42	36		56.40	56.40	0.54		37.91	906.03	943.94	9.06
43	37		56.40	56.40	0.48		37.91	906.03	943.94	8.09
44	38	295.90	56.40	352.30	2.69		37.91	906.03	943.94	7.22
45	39	263.50	56.40	319.90	2.18		37.91	906.03	943.94	6.45
46	40	74.30	56.40	130.70	0.80		37.91	906.03	943.94	5.76
47	41		56.40	56.40	0.31		37.91	906.03	943.94	5.14
48	42		56.40	56.40	0.27		37.91	906.03	943.94	4.59
49	43		56.40	56.40	0.24	505.42	37.91	906.03	1449.36	6.29
50	44		56.40	56.40	0.22	631.78	37.91	906.03	1575.72	6.11
51	45		56.40	56.40	0.20	126.36	37.91	906.03	1070.29	3.70
52	46		56.40	56.40	0.17		37.91	906.03	943.94	2.92
53	47		56.40	56.40	0.16		37.91	906.03	943.94	2.60
54	48		56.40	56.40	0.14		37.91	906.03	943.94	2.32
55	49		56.40	56.40	0.12		37.91	906.03	943.94	2.08
56	50		56.40	56.40	0.11		37.91	906.03	943.94	1.85
		6272.90	2820.00	9092.90	3379.32	5054.21	1896.33	37784.08	44733.62	4127.79
										35640.72

B - C 748.47216
B / C 1.2214860
E D R 0.1494911

(Unit: Million B)

Serial Number	No. after Completion	Investment Cost	Cost			Investment Cost	O&M Cost	Benefit			Total (N.P.V.)	B - C
			O&M Cost	Total	Total (N.P.V.)			Fuel Cost	Total	Total (N.P.V.)		
1		0.00		0.00	0.00	0.00			0.00	0.00	0.00	
2		449.50		449.50	401.34	0.00			0.00	0.00	-449.50	
3		1423.20		1423.20	1134.57	0.00			0.00	0.00	-1423.20	
4		3327.10		3327.10	2368.16	1351.60			1351.60	962.05	-1975.50	
5		3185.80		3185.80	2024.63	1689.51			1689.51	1073.71	-1496.29	
6		745.60		745.60	423.07	337.90			337.90	191.73	-407.70	
7	1		120.30	120.30	60.95		101.37	989.41	1090.78	552.62	970.48	
8	2		120.30	120.30	54.42		101.37	989.41	1090.78	493.41	970.48	
9	3		120.30	120.30	48.59		101.37	989.41	1090.78	440.55	970.48	
10	4		120.30	120.30	43.38		101.37	989.41	1090.78	393.36	970.48	
11	5		120.30	120.30	38.73		101.37	989.41	1090.78	351.20	970.48	
12	6		120.30	120.30	34.58		101.37	989.41	1090.78	313.57	970.48	
13	7		120.30	120.30	30.88		101.37	989.41	1090.78	279.98	970.48	
14	8		120.30	120.30	27.57		101.37	989.41	1090.78	249.98	970.48	
15	9		120.30	120.30	24.62		101.37	989.41	1090.78	223.20	970.48	
16	10		120.30	120.30	21.98		101.37	989.41	1090.78	199.28	970.48	
17	11		120.30	120.30	19.62		101.37	989.41	1090.78	177.93	970.48	
18	12		120.30	120.30	17.52		101.37	989.41	1090.78	158.87	970.48	
19	13		120.30	120.30	15.64	1351.60	101.37	989.41	2442.39	317.61	2322.09	
20	14		120.30	120.30	13.97	1689.51	101.37	989.41	2780.29	322.81	2559.99	
21	15		120.30	120.30	12.47	337.90	101.37	989.41	1428.68	148.11	1308.38	
22	16		120.30	120.30	11.13		101.37	989.41	1090.78	100.96	970.48	
23	17		120.30	120.30	9.94		101.37	989.41	1090.78	90.15	970.48	
24	18		120.30	120.30	8.88		101.37	989.41	1090.78	80.49	970.48	
25	19		120.30	120.30	7.93		101.37	989.41	1090.78	71.86	970.48	
26	20		120.30	120.30	7.08		101.37	989.41	1090.78	64.16	970.48	
27	21		120.30	120.30	6.32		101.37	989.41	1090.78	57.29	970.48	
28	22	355.70	120.30	486.00	22.79		101.37	989.41	1090.78	51.15	604.78	
29	23	1141.03	120.30	1261.33	52.81		101.37	989.41	1090.78	45.67	-170.65	
30	24	1063.75	120.30	1184.05	44.25		101.37	989.41	1090.78	40.78	-93.27	
31	25	327.75	120.30	448.05	14.95		101.37	989.41	1090.78	36.41	642.73	
32	26		120.30	120.30	3.59		101.37	1480.91	1582.28	47.15	1461.98	
33	27		120.30	120.30	3.20		101.37	1480.91	1582.28	42.10	1461.98	
34	28		120.30	120.30	2.86	1351.60	101.37	1480.91	2933.88	69.70	2813.58	
35	29		120.30	120.30	2.55	1689.51	101.37	1480.91	3271.78	69.40	3151.48	
36	30		120.30	120.30	2.28	337.90	101.37	1480.91	1920.18	36.37	1799.88	
37	31		120.30	120.30	2.03		101.37	1480.91	1582.28	26.76	1461.98	
38	32		120.30	120.30	1.82		101.37	1480.91	1582.28	23.89	1461.98	
39	33		120.30	120.30	1.62		101.37	1480.91	1582.28	21.33	1461.98	
40	34		120.30	120.30	1.45		101.37	1480.91	1582.28	19.04	1461.98	
41	35		120.30	120.30	1.29		101.37	1480.91	1582.28	17.00	1461.98	
42	36		120.30	120.30	1.15		101.37	1480.91	1582.28	15.18	1461.98	
43	37		120.30	120.30	1.03		101.37	1480.91	1532.28	13.56	1461.98	
44	38	452.60	120.30	572.90	4.38		101.37	1480.91	1582.28	12.10	1009.38	
45	39	411.20	120.30	531.50	3.63		101.37	1480.91	1582.28	10.81	1050.78	
46	40	117.20	120.30	237.50	1.45		101.37	1480.91	1582.28	9.65	1344.78	
47	41		120.30	120.30	0.65		101.37	1480.91	1582.28	8.61	1461.98	
48	42		120.30	120.30	0.58		101.37	1480.91	1582.28	7.69	1461.98	
49	43		120.30	120.30	0.52	1351.60	101.37	1480.91	2933.88	12.73	2813.58	
50	44		120.30	120.30	0.47	1689.51	101.37	1480.91	3271.78	12.68	3151.48	
51	45		120.30	120.30	0.42	337.90	101.37	1480.91	1920.18	6.64	1799.88	
52	46		120.30	120.30	0.37		101.37	1480.91	1582.28	4.89	1461.98	
53	47		120.30	120.30	0.33		101.37	1480.91	1582.28	4.36	1461.98	
54	48		120.30	120.30	0.30		101.37	1480.91	1582.28	3.90	1461.98	
55	49		120.30	120.30	0.26		101.37	1480.91	1582.28	3.48	1461.98	
56	50		120.30	120.30	0.24		101.37	1480.91	1582.28	3.11	1461.98	
		13010.43	6015.00	19025.43	7041.27	13516.04	5068.52	61758.01	80342.56	7991.03	61317.13	

B - C 949.75718
B / C 1.1348843
E D R 0.1401851

(Unit: Million B)

Serial Number	No. after Completion	Cost			Benefit			Total	Total (N.P.V.)	B - C
		Investment Cost	OSM Cost	Total	Investment Cost	OSM Cost	Fuel Cost			
1		0.00		0.00	0.00			0.00	0.00	0.00
2		300.40		300.40	268.21	0.00		0.00	0.00	-300.40
3		632.20		632.20	503.99	0.00		0.00	0.00	-332.20
4		1919.90		1919.90	1366.55	547.18		547.18	389.47	-1372.72
5		1827.30		1827.30	1161.28	683.98		683.98	434.68	-1143.32
6		422.70		422.70	239.85	136.80		136.80	77.62	-285.90
7	1	149.10	69.30	218.40	110.65	0.00	41.04	649.98	691.02	350.09
8	2	791.00	69.30	860.30	389.16	0.00	41.04	649.98	691.02	312.58
9	3	1407.20	69.30	1476.50	596.33	804.38	41.04	649.98	1495.40	603.97
10	4	1358.50	69.30	1427.80	514.88	1005.48	41.04	649.98	1696.50	611.77
11	5	322.50	69.30	391.80	126.15	201.10	41.04	649.98	892.12	287.24
12	6		120.30	120.30	34.58		101.37	989.41	1090.78	313.57
13	7		120.30	120.30	30.88		101.37	989.41	1090.78	279.98
14	8		120.30	120.30	27.57		101.37	989.41	1090.78	249.98
15	9		120.30	120.30	24.62		101.37	989.41	1090.78	223.20
16	10		120.30	120.30	21.98		101.37	989.41	1090.78	199.28
17	11		120.30	120.30	19.62		101.37	989.41	1090.78	177.93
18	12		120.30	120.30	17.52		101.37	989.41	1090.78	158.87
19	13		120.30	120.30	15.64	547.18	101.37	989.41	1637.96	213.00
20	14		120.30	120.30	13.97	683.98	101.37	989.41	1774.76	206.06
21	15		120.30	120.30	12.47	136.80	101.37	989.41	1227.57	127.26
22	16		120.30	120.30	11.13	0.00	101.37	989.41	1090.78	100.96
23	17		120.30	120.30	9.94	0.00	101.37	989.41	1090.78	90.14
24	18		120.30	120.30	8.88	804.38	101.37	989.41	1895.16	139.84
25	19		120.30	120.30	7.93	1005.48	101.37	989.41	2096.26	138.11
26	20		120.30	120.30	7.08	201.10	101.37	989.41	1291.87	75.99
27	21		120.30	120.30	6.32		101.37	989.41	1090.78	57.29
28	22	195.04	120.30	315.34	14.79		101.37	989.41	1090.78	51.15
29	23	721.51	120.30	841.81	35.25		101.37	989.41	1090.78	46.67
30	24	704.03	120.30	824.33	30.82		101.37	989.41	1090.78	40.78
31	25	208.15	120.30	328.45	10.96		101.37	989.41	1090.78	36.41
32	26		120.30	120.30	3.59		101.37	1312.30	1413.66	42.13
33	27	170.66	120.30	290.96	7.74		101.37	1312.30	1413.66	37.62
34	28	419.52	120.30	539.82	12.82	547.18	101.37	1312.30	1960.84	46.59
35	29	359.72	120.30	480.02	10.18	683.98	101.37	1312.30	2097.64	44.50
36	30	119.60	120.30	239.90	4.54	136.80	101.37	1312.30	1550.46	29.36
37	31		120.30	120.30	2.03	0.00	101.37	1480.91	1582.28	26.76
38	32		120.30	120.30	1.82	0.00	101.37	1480.91	1582.28	23.89
39	33		120.30	120.30	1.62	804.38	101.37	1480.91	2386.66	32.17
40	34		120.30	120.30	1.45	1005.48	101.37	1480.91	2587.75	31.15
41	35		120.30	120.30	1.29	201.10	101.37	1480.91	1783.37	19.17
42	36		120.30	120.30	1.15		101.37	1480.91	1582.28	15.18
43	37		120.30	120.30	1.03		101.37	1480.91	1582.28	13.56
44	38	295.90	120.30	416.20	-3.18		101.37	1480.91	1582.28	12.10
45	39	263.50	120.30	383.80	2.62		101.37	1480.91	1582.28	10.81
46	40	74.30	120.30	194.60	1.19		101.37	1480.91	1582.28	9.65
47	41		120.30	120.30	0.65		101.37	1480.91	1582.28	8.61
48	42		120.30	120.30	0.58		101.37	1480.91	1582.28	7.69
49	43	156.70	120.30	277.00	1.20	547.18	101.37	1480.91	2129.46	9.24
50	44	147.70	120.30	268.00	1.04	683.98	101.37	1480.91	2266.25	8.78
51	45	42.90	120.30	163.20	0.56	136.80	101.37	1480.91	1719.07	5.95
52	46		120.30	120.30	0.37	0.00	101.37	1480.91	1582.28	4.89
53	47		120.30	120.30	0.33	0.00	101.37	1480.91	1582.28	4.36
54	48		120.30	120.30	0.30	804.38	101.37	1480.91	2386.66	5.88
55	49		120.30	120.30	0.26	1005.48	101.37	1480.91	2587.75	5.69
56	50		120.30	120.30	0.24	201.10	101.37	1480.91	1783.37	3.50
57	51	51.00	51.00	51.00	0.09		60.33	508.04	568.37	1.00
58	52	51.00	51.00	51.00	0.08		60.33	508.04	568.37	0.89
59	53	51.00	51.00	51.00	0.07		60.33	508.04	568.37	0.79
60	54	51.00	51.00	51.00	0.06		60.33	508.04	568.37	0.71
61	55	51.00	51.00	51.00	0.05		60.33	508.04	568.37	0.63
		13010.03	6015.00	19025.03	5701.16	13515.62	5068.36	61758.01	80341.99	6456.14
										61316.96

B - C 754.9778
B / C 1.1324263
E D R 0.1391305

(Unit: Million ¥)

Serial Number	No. after Completion	Cost			Total (N.P.V.)	Benefit			Total (N.P.V.)	B - C
		Investment Cost	O&M Cost	Total		Investment Cost	O&M Cost	Fuel Cost		
1		0.00		0.00	0.00	0.00			0.00	0.00
2		295.90		295.90	264.20	0.00			0.00	-295.90
3		620.90		620.90	494.98	0.00			0.00	-620.90
4		1688.00		1688.00	1201.49	523.42			523.42	-1164.58
5		1557.70		1557.70	989.95	654.27			654.27	-903.43
6		348.30		348.30	197.63	130.85			130.85	-217.45
7	1	161.80	57.80	219.60	111.26	0.00	39.26	608.46	647.72	428.12
8	2	823.00	57.80	880.80	398.43	0.00	39.26	608.46	647.72	-233.08
9	3	1439.20	57.80	1497.00	604.51	828.14	39.26	608.46	1475.86	-21.14
10	4	1709.10	57.80	1766.90	637.16	817.09	39.26	608.46	1464.81	-302.09
11	5	623.60	57.80	681.40	219.39	207.04	39.26	608.46	854.76	173.36
12	6		122.30	122.30	35.16		101.37	989.41	1090.78	968.48
13	7		122.30	122.30	31.39		101.37	989.41	1090.78	968.48
14	8		122.30	122.30	28.93		101.37	989.41	1090.78	968.48
15	9		122.30	122.30	25.03		101.37	989.41	1090.78	968.48
16	10		122.30	122.30	22.34		101.37	989.41	1090.78	968.48
17	11		122.30	122.30	19.95		101.37	989.41	1090.78	968.48
18	12		122.30	122.30	17.81		101.37	989.41	1090.78	968.48
19	13		122.30	122.30	15.90	523.42	101.37	989.41	1614.20	1191.90
20	14		122.30	122.30	14.20	654.27	101.37	989.41	1745.05	1622.75
21	15		122.30	122.30	12.68	130.85	101.37	989.41	1221.63	1029.33
22	16		122.30	122.30	11.32	0.00	101.37	989.41	1090.78	968.48
23	17		122.30	122.30	10.11	0.00	101.37	989.41	1090.78	968.48
24	18		122.30	122.30	9.02	828.14	101.37	989.41	1918.92	1796.62
25	19		122.30	122.30	8.06	1035.18	101.37	989.41	2125.96	2903.66
26	20		122.30	122.30	7.19	207.04	101.37	989.41	1297.82	1175.52
27	21		122.30	122.30	6.42		101.37	989.41	1090.78	968.48
28	22	195.04	122.30	317.34	14.88		101.37	989.41	1090.78	773.44
29	23	500.94	122.30	623.24	-26.09		101.37	989.41	1090.78	-467.54
30	24	440.45	122.30	562.75	21.04		101.37	989.41	1090.78	528.03
31	25	138.23	122.30	260.53	8.70		101.37	989.41	1090.78	830.25
32	26		122.30	122.30	3.64		101.37	1291.67	1393.04	1270.74
33	27	170.66	122.30	292.96	7.80		101.37	1291.67	1393.04	1100.08
34	28	419.52	122.30	541.82	12.87	523.42	101.37	1291.67	1916.46	1374.64
35	29	693.22	122.30	815.52	17.30	654.27	101.37	1291.67	2647.31	1231.79
36	30	407.91	122.30	530.21	10.04	130.85	101.37	1291.67	1523.89	993.69
37	31		122.30	122.30	2.07	0.00	101.37	1480.91	1582.28	1459.98
38	32		122.30	122.30	1.85	0.00	101.37	1480.91	1582.28	1459.98
39	33		122.30	122.30	1.65	828.14	101.37	1480.91	2410.42	2288.12
40	34		122.30	122.30	1.47	1035.18	101.37	1480.91	2617.45	2495.15
41	35		122.30	122.30	1.31	207.04	101.37	1480.91	1789.31	1667.01
42	36		122.30	122.30	1.17		101.37	1480.91	1582.28	1459.98
43	37		122.30	122.30	1.05		101.37	1480.91	1582.28	1459.98
44	38	295.90	122.30	418.20	3.20		101.37	1480.91	1582.28	1164.08
45	39	263.50	122.30	385.80	2.63		101.37	1480.91	1582.28	1196.43
46	40	74.30	122.30	196.60	1.20		101.37	1480.91	1582.28	1385.68
47	41		122.30	122.30	0.67		101.37	1480.91	1582.28	1459.98
48	42		122.30	122.30	0.59		101.37	1480.91	1582.28	1459.98
49	43	156.70	122.30	279.00	1.21	523.42	101.37	1480.91	2105.70	1926.70
50	44	147.70	122.30	270.00	1.05	654.27	101.37	1480.91	2236.55	1966.55
51	45	42.90	122.30	165.20	0.57	130.85	101.37	1480.91	1713.13	1547.93
52	46		122.30	122.30	0.38	0.00	101.37	1480.91	1582.28	1459.98
53	47		122.30	122.30	0.34	0.00	101.37	1480.91	1582.28	1459.98
54	48		122.30	122.30	0.30	828.14	101.37	1480.91	2410.42	2288.12
55	49		122.30	122.30	0.27	1035.18	101.37	1480.91	2617.45	2495.15
56	50		122.30	122.30	0.24	207.04	101.37	1480.91	1789.31	1667.01
57	51		64.50	64.50	0.11		62.11	570.19	632.30	567.80
58	52		64.50	64.50	0.10		62.11	570.19	632.30	567.80
59	53		64.50	64.50	0.09		62.11	570.19	632.30	567.80
60	54		64.50	64.50	0.08		62.11	570.19	632.30	567.80
61	55		64.50	64.50	0.07		62.11	570.19	632.30	567.80
		13214.47	6115.00	19329.47	5539.75	13297.53	5068.36	61758.01	80123.90	60794.43

B - C 726.4409
B / C 1.1311325
E D R 0.1392649

(Unit: Million B)

Serial Number	No. after Completion	Cost				Benefit					B - C
		Investment Cost	O&M Cost	Total	Total (N.P.V.)	Investment Cost	O&M Cost	Fuel Cost	Total	Total (N.P.V.)	
1		0.00		0.00	0.00	0.00			0.00	0.00	0.00
2		151.00		151.00	134.82	0.00			0.00	0.00	-151.00
3		796.20		796.20	634.73	0.00			0.00	0.00	-796.20
4		1551.30		1551.30	1104.18	502.12			502.12	357.40	-1049.18
5		1477.10		1477.10	938.72	627.65			627.65	398.88	-849.45
6		356.30		356.30	202.17	125.53			125.53	71.23	-230.77
7	1	297.70	54.00	351.70	178.18	0.00	37.66	343.35	381.00	193.03	29.30
8	2	625.20	54.00	679.20	307.24	0.00	37.66	343.35	381.00	172.35	-298.20
9	3	1773.80	54.00	1827.80	738.22	849.44	37.66	343.35	1230.44	496.96	-597.36
10	4	1708.00	54.00	1762.00	635.39	1061.80	37.66	343.35	1442.80	520.29	-319.20
11	5	388.40	54.00	442.40	142.44	212.36	37.66	343.35	593.36	191.05	150.96
12	6		120.30	120.30	34.58		101.37	989.41	1090.78	315.57	970.48
13	7		120.30	120.30	30.88		101.37	989.41	1090.78	279.98	970.48
14	8		120.30	120.30	27.57		101.37	989.41	1090.78	249.98	970.48
15	9		120.30	120.30	24.62		101.37	989.41	1090.78	223.20	970.48
16	10		120.30	120.30	21.98		101.37	989.41	1090.78	199.28	970.48
17	11		120.30	120.30	19.62		101.37	989.41	1090.78	177.93	970.48
18	12		120.30	120.30	17.52		101.37	989.41	1090.78	158.87	970.48
19	13		120.30	120.30	15.64	502.12	101.37	989.41	1592.90	207.14	1472.60
20	14		120.30	120.30	13.97	627.65	101.37	989.41	1718.43	199.52	1598.13
21	15		120.30	120.30	12.47	125.53	101.37	989.41	1216.31	126.09	1096.01
22	16		120.30	120.30	11.13	0.00	101.37	989.41	1090.78	100.96	970.48
23	17		120.30	120.30	9.94	0.00	101.37	989.41	1090.78	90.14	970.48
24	18		120.30	120.30	8.88	849.44	101.37	989.41	1940.22	143.16	1819.92
25	19		120.30	120.30	7.93	1061.80	101.37	989.41	2152.58	141.82	2032.28
26	20		120.30	120.30	7.08	212.36	101.37	989.41	1303.14	76.65	1182.84
27	21		120.30	120.30	6.32		101.37	989.41	1090.78	57.29	970.48
28	22	170.66	120.30	290.96	13.64		101.37	989.41	1090.78	51.15	799.82
29	23	419.52	120.30	539.82	22.60		101.37	989.41	1090.78	45.67	550.96
30	24	359.72	120.30	480.02	17.94		101.37	989.41	1090.78	40.78	610.76
31	25	119.60	120.30	239.90	8.01		101.37	989.41	1090.78	35.41	850.88
32	26		120.30	120.30	3.59		101.37	1159.97	1261.34	37.59	1141.04
33	27	195.04	120.30	315.34	8.39		101.37	1159.97	1261.34	33.56	946.00
34	28	721.51	120.30	841.81	20.00	502.12	101.37	1159.97	1763.46	41.90	921.65
35	29	704.03	120.30	824.33	17.49	627.65	101.37	1159.97	1888.99	40.07	1064.66
36	30	208.15	120.30	328.45	6.22	125.53	101.37	1159.97	1386.87	26.27	1058.42
37	31		120.30	120.30	2.03	0.00	101.37	1480.91	1582.28	26.76	1461.98
38	32		120.30	120.30	1.82	0.00	101.37	1480.91	1582.28	23.89	1461.98
39	33		120.30	120.30	1.62	849.44	101.37	1480.91	2431.72	32.78	2311.42
40	34		120.30	120.30	1.45	1061.80	101.37	1480.91	2644.08	31.83	2523.78
41	35		120.30	120.30	1.29	212.36	101.37	1480.91	1794.64	19.29	1674.34
42	36		120.30	120.30	1.15		101.37	1480.91	1582.28	15.18	1461.98
43	37		120.30	120.30	1.03		101.37	1480.91	1582.28	13.56	1461.98
44	38	295.90	120.30	416.20	3.18		101.37	1480.91	1582.28	12.10	1166.08
45	39	263.50	120.30	383.80	2.62		101.37	1480.91	1582.28	10.81	1198.48
46	40	74.30	120.30	194.60	1.19		101.37	1480.91	1582.28	9.65	1387.68
47	41		120.30	120.30	0.65		101.37	1480.91	1582.28	8.61	1461.98
48	42		120.30	120.30	0.58		101.37	1480.91	1582.28	7.69	1461.98
49	43	156.70	120.30	277.00	1.20	502.12	101.37	1480.91	2084.40	9.05	1807.40
50	44	147.90	120.30	268.20	1.04	627.65	101.37	1480.91	2209.93	8.56	1941.73
51	45	42.90	120.30	163.20	0.56	125.53	101.37	1480.91	1707.81	5.91	1544.61
52	46		120.30	120.30	0.37	0.00	101.37	1480.91	1582.28	4.89	1461.98
53	47		120.30	120.30	0.33	0.00	101.37	1480.91	1582.28	4.36	1461.98
54	48		120.30	120.30	0.30	849.44	101.37	1480.91	2431.72	5.99	2311.42
55	49		120.30	120.30	0.26	1061.80	101.37	1480.91	2644.08	5.81	2523.78
56	50		120.30	120.30	0.24	212.36	101.37	1480.91	1794.64	3.52	1674.34
57	51		66.30	66.30	0.12		63.71	947.11	1010.82	1.77	944.52
58	52		66.30	66.30	0.10		63.71	947.11	1010.82	1.58	944.52
59	53		66.30	66.30	0.09		63.71	947.11	1010.82	1.41	944.52
60	54		66.30	66.30	0.08		63.71	947.11	1010.82	1.26	944.52
61	55		66.30	66.30	0.07		63.71	947.11	1010.82	1.13	944.52
		13004.43	6015.00	19019.43	5427.51	13515.62	5068.36	61658.56	80242.54	5767.56	61223.11

B - C 340.0444
B / C 1.0526520
E D R 0.1285911

D-7 MONTHLY LIST OF MASS CURVE

(1) Monthly List of Mass Curve (Nam Ngao Project)

(Unit : m³/s-d)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >
1959	-1128.0	-2186.5	-3391.4	-4608.9	-5873.8	-6483.2	-6695.5	-4513.0	-2100.9	-2067.3	-2744.1	-3680.0
1960	-4817.0	-5911.2	-7124.3	-8350.3	-8907.1	-9295.5	-9069.9	-5486.1	-1844.3	-703.1	-403.5	-693.6
1961	-1362.5	-2188.5	-3260.6	-4343.8	-5463.3	-5670.7	-4774.4	-2474.7	1756.3	2572.5	2230.4	1811.5
1962	1047.9	152.2	-915.8	-1999.6	-2283.2	-2514.7	-1343.7	495.3	2328.7	5671.6	5538.2	5006.1
1963	4180.6	3263.3	2187.2	1077.9	-136.3	-60.7	982.0	2350.1	3993.4	6230.6	6766.8	6264.2
1964	5516.5	4582.9	3494.9	2396.7	1404.7	457.7	3074.3	4459.0	7207.3	9227.8	8905.0	8319.1
1965	7457.1	6521.9	5435.5	4331.7	3133.3	2667.3	2573.0	4551.3	5763.7	6747.9	7355.5	6644.1
1966	5821.6	4890.9	3786.7	2661.7	1833.9	1545.5	2560.8	6537.4	8407.8	8107.9	7531.7	6688.3
1967	5692.0	4727.5	3607.2	2463.3	1557.5	311.1	472.8	3536.3	6481.3	7688.1	7378.8	6792.8
1968	5938.5	4981.7	3885.5	2750.4	1748.7	1981.3	2257.8	4528.7	5641.8	5934.9	5358.8	4583.4
1969	3646.0	2684.6	1515.4	372.7	-567.3	-402.4	624.7	9855.4	14547.9	16112.5	16446.3	15197.3
1970	1553.2	1432.4	1384.7	1286.2	12118.9	11757.8	12806.6	15059.6	17480.9	18122.2	17856.7	17241.7
1971	16375.5	15453.8	14347.9	13200.3	12187.8	12110.7	16043.4	20510.9	23185.8	23902.5	23688.1	23008.2
1972	22112.8	21146.3	20042.9	18969.9	17832.0	17029.2	19158.9	22730.5	24545.3	25234.1	25271.3	24880.4
1973	24128.6	23252.4	22217.7	21120.2	20199.6	19898.7	20469.2	22456.2	24771.0	26057.9	26077.2	25593.7
1974	24716.6	23785.5	22639.2	21527.5	20591.9	20440.3	21282.1	23559.2	24813.8	25227.7	24967.8	24181.2
1975	23335.7	22425.1	21373.7	20262.4	19251.1	19054.6	20047.3	21366.2	23132.7	24102.7	23879.6	23144.8
1976	22267.7	21321.8	20202.8	19052.3	18082.9	17599.7	18251.9	20331.6	22022.7	22903.2	22774.5	22061.9
1977	21541.6	20646.9	19556.8	18462.4	17366.7	16456.2	16205.5	17526.1	20189.7	20237.3	19847.5	19032.9
1978	18051.7	17100.8	15958.4	14798.8	13754.8	12744.7	13219.9	15355.1	16374.5	16684.2	16014.0	15059.9
1979	13940.2	12897.2	11688.6	10494.4	9289.7	8189.9	7716.2	10552.0	11011.5	11304.0	10703.0	9766.4
1980	8686.6	7609.8	6433.9	5268.3	4372.0	3680.5	3741.6	4506.2	7836.0	9416.4	9386.7	8821.3
1981	7958.9	6974.8	5807.9	4653.0	3499.9	3119.7	4117.9	6981.5	7862.6	9234.8	8066.4	7403.5
1982	6494.9	5534.3	4381.5	3238.1	2279.1	2781.1	4566.0	10319.8	13074.3	14200.2	13956.5	13212.1
1983	12247.2	11240.2	10048.7	8851.2	7617.9	6665.4	5698.8	5842.1	6352.6	6885.5	6659.7	5875.7
1984	4881.6	3837.6	2665.0	1505.9	332.4	966.2	1783.4	4651.4	6037.3	6309.5	5795.5	4943.0
1985	5944.8	2964.2	1813.9	671.2	-814.6	160.3	1842.5	4418.0	6298.4	6692.8	6506.2	5895.5
1986	5054.4	4170.2	3093.2	1993.5	906.9	439.5	1209.5	2155.8	2356.9	1803.2	1001.2	0.0

(2) Monthly List of Mass Curve (Mae Lama Luang Project : Individual Development)

(Unit : m³/s-d)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >
1959	-2421.2	-4703.6	-7316.5	-9933.2	-12628.1	-14166.2	-14977.2	-10883.2	-5843.3	-5661.7	-7093.8	-9075.8
1960	-11475.5	-13826.9	-16455.1	-19096.0	-20481.1	-21661.9	-21939.7	-13748.8	-8919.5	-3823.0	-3224.7	-3823.4
1961	-5289.9	-7042.2	-9324.8	-11679.3	-14092.9	-14839.2	-13182.2	-8592.3	735.2	2554.4	1997.8	1055.2
1962	-560.7	-2421.6	-4690.7	-7028.2	-7753.1	-8512.6	-6381.9	-2554.6	1305.2	7942.7	7706.1	6573.0
1963	4834.5	2915.5	617.0	-1757.3	-4305.2	-4475.0	-2391.0	626.1	4477.5	9301.7	10505.4	9568.5
1964	8023.7	6123.4	3853.7	1516.4	-563.1	-2643.0	2823.0	5887.6	13020.6	17343.9	16946.1	15823.0
1965	14107.4	12231.6	9984.9	7666.9	5187.4	3980.4	3577.7	7754.8	10363.7	13040.9	14345.7	13204.8
1966	11524.3	9632.5	7334.0	4667.2	2915.8	2644.3	4976.0	14041.4	18484.4	18198.4	17116.0	15469.3
1967	13387.0	11341.5	8943.2	6512.7	4271.4	2241.8	2296.8	8138.9	14661.0	16996.1	16322.7	14987.9
1968	13112.8	11042.1	8682.5	6299.4	4261.5	4370.1	4800.4	9351.0	11683.9	12733.9	11681.4	10057.1
1969	8040.8	5992.3	3526.1	1109.2	-901.8	-948.5	611.5	17896.2	27024.0	29838.0	30419.3	29805.2
1970	28422.4	26775.0	24637.6	22554.2	21234.7	20562.7	22294.9	27330.5	32699.2	34432.9	34025.5	32917.3
1971	31131.6	29216.9	26911.3	24516.4	22567.2	22357.6	29870.1	38551.9	44093.1	45726.2	45262.5	43902.6
1972	42035.0	40007.7	37674.2	35419.9	33062.4	31359.2	34778.2	41868.3	45120.8	46318.2	46461.2	45499.7
1973	43856.0	41971.3	39727.7	37374.8	35484.3	34651.2	35999.6	41598.5	47799.1	50666.9	50587.4	49466.5
1974	47668.2	45741.8	43343.6	40954.9	39087.8	38508.9	39675.4	44076.0	46693.1	47482.5	47241.0	45669.1
1975	43986.8	42075.3	39811.4	37432.3	35326.4	34721.2	36310.0	39983.8	45735.0	48537.7	47252.2	45669.1
1976	45478.0	43517.3	41167.5	38748.6	36698.6	35451.7	36222.0	40414.2	43463.9	45513.5	45281.4	43956.3
1977	42743.0	40834.9	38500.1	36211.5	33958.7	32058.5	31461.9	34076.0	40359.4	41194.0	40667.4	39207.5
1978	37348.2	35414.9	33036.6	30412.1	28435.1	26347.2	27771.5	32784.4	36601.7	38261.3	37327.1	35538.7
1979	33411.8	31310.4	28787.3	26310.9	24009.2	21928.4	20987.5	25888.2	26816.7	27434.5	26128.6	24145.7
1980	21847.7	19552.6	17028.3	14540.4	12725.3	11500.8	11655.9	13421.4	20867.7	23975.6	23774.7	22578.5
1981	20708.7	18627.6	16147.7	13892.5	11276.6	10256.4	11783.2	17332.9	19227.0	19833.8	19375.2	17978.3
1982	16015.8	13955.7	11489.8	9090.3	7048.6	7749.5	10472.7	20497.2	26226.0	28929.3	28469.2	26973.3
1983	24978.7	22889.6	20384.4	17863.0	15287.4	13258.2	11234.5	11296.9	12172.5	13106.1	12370.3	10944.9
1984	8535.2	6625.4	4103.5	1650.1	-830.1	-61.0	987.2	5947.8	9545.6	11055.3	10224.6	8529.4
1985	6394.7	4263.5	1749.0	-749.1	-2926.5	-2889.5	-936.6	2857.8	7814.8	11350.1	12228.3	11638.5
1986	10000.7	8182.4	5915.8	3681.6	1519.7	143.5	1104.2	3127.7	3879.4	3084.4	1818.7	0.0

(3) Monthly List of Mass Curve (Mae Lama Luang Project : Integrated Development)

(Unit : m³/s-d)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >
1959	-588.0	-1119.0	-1707.0	-2276.0	-2863.9	-3432.9	-3645.2	-3246.6	-2860.9	-2827.2	-3253.9	-3694.9
1960	-4135.8	-4548.2	-4989.2	-5415.9	-5856.8	-6245.3	-6019.6	-4484.2	-2998.4	-1483.1	-1163.4	-1376.4
1961	-1589.5	-1781.9	-1995.0	-2201.2	-2414.2	-2620.4	-1724.1	-341.6	996.3	1812.5	1654.2	1490.6
1962	1327.1	1179.3	1015.7	857.4	693.8	535.5	1638.5	2741.4	3808.7	4911.7	4778.2	4460.7
1963	4143.1	3856.3	3538.8	3231.5	2913.9	2989.6	3614.9	4240.2	4845.4	5470.7	6006.9	5643.2
1964	5279.5	4939.3	4575.6	4223.6	3859.9	3507.9	4758.0	6008.1	7217.8	8467.9	8145.1	7790.1
1965	7435.2	7114.5	6759.6	6416.0	6061.1	5717.6	5623.2	5844.9	6059.4	6281.1	6495.6	6187.1
1966	5878.5	5599.8	5291.3	4927.7	4684.2	4595.8	5611.1	6646.1	7647.8	7348.0	6853.8	6343.1
1967	5832.4	5371.1	4860.4	4356.2	3855.6	3361.3	3523.0	4670.4	5780.8	6928.2	6528.3	6318.4
1968	6008.5	5718.6	5408.8	5108.9	4799.0	4872.7	4948.9	5025.1	5098.8	5175.0	4794.0	4400.4
1969	4006.8	3651.2	3257.6	2876.6	2483.0	2647.9	3675.0	9095.5	13788.0	15352.6	15686.4	15557.9
1970	15429.5	15313.5	15185.1	15040.8	14932.3	14808.0	15452.6	16097.2	16721.0	17362.3	17096.7	16780.2
1971	16483.6	16177.6	15861.0	15547.7	15238.1	15160.9	17608.9	20056.9	22425.8	23142.5	22928.2	22513.6
1972	22099.0	21711.1	21296.5	20895.3	20480.7	20079.5	21328.2	22576.9	23785.4	24474.2	24511.4	24283.0
1973	24054.5	23848.1	23619.7	23398.6	23170.1	22949.0	23519.5	24118.8	24698.7	25298.0	25317.2	25031.9
1974	24746.6	24488.9	24203.6	23927.5	23642.2	23490.6	23736.9	23983.2	24221.5	24437.8	24207.9	23883.2
1975	23558.4	23265.1	22940.4	22626.1	22301.4	22104.9	22416.9	22728.9	23030.8	23342.8	23119.7	22760.3
1976	22400.8	22064.6	21705.1	21357.3	20997.9	20650.0	21026.4	21402.7	21766.9	22143.2	22014.6	21647.8
1977	21281.1	20949.8	20583.1	20228.2	19861.4	19506.5	19255.8	19344.2	19429.7	19477.3	19087.6	18606.1
1978	18124.7	17689.8	17208.3	16742.4	16260.9	15795.0	15827.6	15860.2	15891.7	15924.3	15343.6	14743.6
1979	14143.6	13601.6	13001.6	12420.9	11820.9	11240.2	10766.5	10691.5	10619.0	10544.0	10073.3	9586.8
1980	9100.3	8645.3	8158.8	7688.0	7201.6	6730.8	6791.9	7420.2	8028.2	8656.5	8626.8	8267.5
1981	7908.3	7583.8	7224.5	6876.9	6517.6	6169.9	6428.8	6827.7	7146.0	7474.9	7286.5	6953.1
1982	6619.8	6318.7	5985.3	5662.7	5329.4	5831.4	7616.3	10003.9	12314.4	13440.3	13196.5	12629.2
1983	12041.8	11549.3	10982.0	10432.9	9865.5	9316.5	8749.1	8203.7	7675.8	7130.4	6602.5	6057.1
1984	5511.6	5001.4	4455.9	3928.1	3382.6	3848.6	4330.0	4811.4	5277.3	5549.6	5137.2	4711.1
1985	4235.0	3900.2	3474.1	3061.8	2635.7	3210.5	3995.0	4779.4	5538.5	5932.9	5746.2	5416.3
1986	5086.3	4788.3	4458.4	4139.1	3809.1	3489.8	2901.8	2313.9	1744.9	1156.9	586.0	0.0

D-8 MONTHLY LIST OF POWER AND ENERGY AT GENERATING END

(1) Monthly List of Power at Generating End
(Nam Ngao Project: Integrated Development)

(Unit: MW)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >	< TOTAL >
1959	140.0	140.0	140.0	140.0	122.9	122.7	124.8	140.0	140.0	140.0	140.0	140.0	1630.4
1960	140.0	140.0	140.0	140.0	130.2	125.9	128.2	140.0	140.0	140.0	140.0	140.0	1644.3
1961	140.0	140.0	140.0	136.2	130.7	126.9	140.0	140.0	140.0	140.0	140.0	140.0	1633.9
1962	140.0	140.0	140.0	136.2	132.1	129.6	140.0	140.0	140.0	140.0	140.0	140.0	1658.0
1963	140.0	140.0	140.0	136.2	136.9	127.5	140.0	140.0	140.0	140.0	140.0	140.0	1660.6
1964	140.0	140.0	140.0	136.2	130.7	125.4	140.0	140.0	140.0	140.0	140.0	140.0	1652.4
1965	140.0	140.0	140.0	136.2	137.0	125.1	125.5	140.0	140.0	140.0	140.0	140.0	1643.7
1966	140.0	140.0	140.0	136.2	130.7	127.5	140.0	140.0	140.0	140.0	140.0	140.0	1654.5
1967	140.0	140.0	140.0	136.2	130.7	131.9	126.8	140.0	140.0	140.0	140.0	140.0	1645.6
1968	140.0	140.0	140.0	136.2	130.7	129.2	140.0	140.0	140.0	140.0	140.0	140.0	1656.1
1969	140.0	140.0	140.0	136.2	130.7	128.8	140.0	140.0	140.0	140.0	140.0	140.0	1655.8
1970	140.0	140.0	140.0	136.2	130.7	126.1	140.0	140.0	140.0	140.0	140.0	140.0	1653.0
1971	140.0	140.0	140.0	136.2	130.7	127.6	140.0	140.0	140.0	140.0	140.0	140.0	1654.5
1972	140.0	140.0	140.0	136.2	137.2	125.4	140.0	140.0	140.0	140.0	140.0	140.0	1658.8
1973	140.0	140.0	140.0	136.2	130.7	126.4	137.3	140.0	140.0	140.0	140.0	140.0	1650.6
1974	140.0	140.0	140.0	136.2	130.7	127.2	140.0	140.0	140.0	140.0	140.0	140.0	1654.1
1975	140.0	140.0	140.0	136.2	130.7	126.9	140.0	140.0	140.0	140.0	140.0	140.0	1653.9
1976	140.0	140.0	140.0	136.2	130.7	125.5	136.2	140.0	140.0	140.0	140.0	140.0	1648.7
1977	140.0	140.0	140.0	136.2	130.7	125.4	124.6	140.0	140.0	140.0	140.0	140.0	1637.0
1978	140.0	140.0	140.0	136.2	130.7	125.4	128.4	140.0	140.0	140.0	140.0	140.0	1640.8
1979	140.0	140.0	140.0	140.0	136.6	99.8	123.5	140.0	140.0	140.0	140.0	140.0	1619.9
1980	140.0	140.0	140.0	136.5	130.8	125.4	126.2	140.0	140.0	140.0	140.0	140.0	1638.9
1981	140.0	140.0	140.0	136.2	137.1	125.7	140.0	140.0	140.0	140.0	140.0	140.0	1659.1
1982	140.0	140.0	140.0	136.2	130.7	130.6	140.0	140.0	140.0	140.0	140.0	140.0	1657.6
1983	140.0	140.0	140.0	136.2	136.8	129.2	64.3	126.7	140.0	140.0	140.0	140.0	1573.2
1984	140.0	140.0	140.0	140.0	136.1	129.4	140.0	140.0	140.0	140.0	140.0	140.0	1665.5
1985	140.0	140.0	140.0	136.3	130.8	131.0	140.0	140.0	140.0	140.0	140.0	140.0	1658.0
1986	140.0	140.0	140.0	136.2	130.7	125.5	136.8	140.0	140.0	140.0	140.0	140.0	1649.2
T O T A L	3920.0	3920.0	3920.0	3829.7	3695.9	3533.1	3722.5	3906.7	3920.0	3920.0	3920.0	3920.0	46127.8
A V E	140.0	140.0	140.0	136.8	132.0	126.2	132.9	139.5	140.0	140.0	140.0	140.0	1647.4
M A X	140.0	140.0	140.0	140.0	137.2	131.9	140.0	140.0	140.0	140.0	140.0	140.0	1665.5
M I N	140.0	140.0	140.0	136.2	122.9	99.8	64.3	126.7	140.0	140.0	140.0	140.0	1573.2

(2) Monthly List of Energy at Generating End

(Nam Ngao Project: Integrated Development)

(Unit: MWh)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >	< TOTAL >
1959	15624.	14112.	15624.	15120.	13711.	13249.	14065.	15624.	63673.	29361.	15650.	16022.	241835.
1960	15814.	14616.	15624.	15120.	22976.	23838.	14319.	40921.	76851.	81603.	33833.	27803.	383319.
1961	26970.	18920.	18067.	17260.	15641.	23965.	15624.	32721.	100800.	46065.	20674.	26702.	362409.
1962	22952.	17511.	18148.	17250.	25454.	24308.	15624.	34428.	66854.	99996.	24665.	24765.	391955.
1963	21681.	17076.	17986.	16751.	15277.	24033.	15624.	20689.	62794.	76397.	38840.	25377.	352525.
1964	23279.	17619.	17750.	16939.	17057.	15325.	15624.	44490.	86382.	71772.	20657.	23644.	370566.
1965	20931.	16714.	17782.	18860.	15286.	22814.	14112.	15624.	36535.	49652.	38235.	23113.	287658.
1966	21742.	16503.	17430.	16445.	16379.	24040.	15624.	72573.	67643.	22243.	15679.	17971.	324573.
1967	18178.	16120.	17109.	16077.	14902.	14245.	14216.	28970.	88446.	54403.	20941.	23642.	327247.
1968	21091.	17152.	17588.	16247.	18875.	24252.	15624.	28313.	51475.	34903.	15682.	19398.	278600.
1969	19384.	16184.	16138.	16101.	18043.	24207.	15624.	104160.	100800.	62040.	34555.	27827.	455063.
1970	27479.	21987.	19682.	19400.	21659.	23659.	15624.	31732.	79402.	42332.	21849.	23038.	348061.
1971	20847.	16986.	17395.	16005.	16670.	24048.	37094.	104160.	84813.	43941.	22952.	21687.	426598.
1972	20248.	16955.	17445.	17458.	15310.	17765.	15624.	80124.	66456.	43346.	28278.	27701.	366711.
1973	23195.	17905.	18808.	16983.	18410.	23902.	15320.	17467.	77129.	56113.	27897.	25775.	338904.
1974	20625.	16794.	16594.	16705.	18126.	23967.	15624.	34346.	52363.	37479.	21989.	19466.	294107.
1975	21272.	17209.	18476.	16714.	16692.	23967.	15624.	15821.	64219.	49348.	22767.	20544.	302653.
1976	20624.	17370.	17135.	15949.	17485.	23776.	15205.	23395.	57412.	47437.	24766.	21005.	301560.
1977	27373.	18125.	17709.	17042.	15094.	15997.	14047.	15624.	49295.	29660.	19240.	18883.	258088.
1978	18488.	16394.	16670.	15773.	16071.	14162.	14336.	15624.	48435.	35254.	15650.	15870.	242726.
1979	15647.	14112.	15624.	15120.	15245.	10774.	13960.	15624.	31049.	34886.	15674.	16059.	213774.
1980	16132.	14864.	15669.	15675.	18881.	20034.	14171.	15624.	57898.	82378.	26861.	24089.	302556.
1981	20924.	15785.	16184.	15865.	15301.	22810.	15624.	42259.	46527.	36587.	23503.	22456.	294766.
1982	19976.	16200.	16463.	16088.	17882.	24439.	15624.	104149.	86514.	52675.	22330.	20344.	412486.
1983	18822.	15262.	15935.	15035.	15268.	13950.	7172.	14207.	15120.	15624.	15230.	15625.	177008.
1984	15624.	14616.	15624.	15120.	15188.	24285.	15624.	57199.	57300.	34454.	16609.	18095.	299737.
1985	18139.	15794.	16513.	16104.	15284.	24487.	15624.	72997.	67856.	37062.	23539.	23128.	346528.
1986	21361.	17744.	17968.	16940.	15263.	23786.	15263.	15624.	15565.	16247.	15527.	15741.	207029.
TOTAL	574422.	466868.	479202.	458175.	474229.	591316.	437638.	1114484.	1759597.	1303255.	644090.	605749.	8909028.
AVE	20515.	16674.	17114.	16363.	16937.	21118.	15630.	39803.	62843.	46545.	23003.	21634.	318180.
MAX	27479.	21987.	19682.	19400.	25454.	24487.	37094.	104160.	100800.	99996.	38840.	27827.	455063.
MIN	15624.	14112.	15624.	15035.	13711.	10774.	7172.	14207.	15120.	15624.	15230.	15625.	177008.

(3) Monthly List of Power at Generating End

(Mae Lama Luang Project: Integrated Development)

(Unit: MW)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >	< TOTAL >
1959	240.0	240.0	240.0	227.4	199.5	192.8	201.1	240.0	240.0	240.0	240.0	240.0	2730.8
1960	240.0	240.0	231.1	220.3	208.2	215.5	209.2	240.0	240.0	240.0	240.0	240.0	2764.3
1961	240.0	240.0	240.0	240.0	227.9	217.3	218.3	240.0	240.0	240.0	240.0	240.0	2823.6
1962	240.0	240.0	240.0	240.0	229.6	219.7	221.8	240.0	240.0	240.0	240.0	240.0	2831.1
1963	240.0	240.0	240.0	240.0	227.2	216.5	223.1	240.0	240.0	240.0	240.0	240.0	2826.9
1964	240.0	240.0	240.0	240.0	229.6	219.3	220.0	240.0	240.0	240.0	240.0	240.0	2849.0
1965	240.0	240.0	240.0	240.0	227.9	217.5	209.2	240.0	240.0	240.0	240.0	240.0	2814.6
1966	240.0	240.0	240.0	240.0	229.6	221.2	229.9	240.0	240.0	240.0	240.0	240.0	2840.7
1967	240.0	240.0	240.0	240.0	229.6	219.7	209.2	240.0	240.0	240.0	240.0	240.0	2818.5
1968	240.0	240.0	240.0	240.0	229.6	222.3	213.7	240.0	240.0	240.0	240.0	240.0	2825.6
1969	240.0	240.0	240.0	240.0	229.6	220.7	216.5	240.0	240.0	240.0	240.0	240.0	2826.8
1970	240.0	240.0	240.0	240.0	229.6	219.7	216.9	240.0	240.0	240.0	240.0	240.0	2826.2
1971	240.0	240.0	240.0	240.0	229.6	222.1	240.0	240.0	240.0	240.0	240.0	240.0	2851.7
1972	240.0	240.0	240.0	240.0	228.8	218.6	227.0	240.0	240.0	240.0	240.0	240.0	2834.4
1973	240.0	240.0	240.0	240.0	229.6	219.7	218.6	240.0	240.0	240.0	240.0	240.0	2828.0
1974	240.0	240.0	240.0	240.0	229.6	219.7	209.9	240.0	240.0	240.0	240.0	240.0	2819.2
1975	240.0	240.0	240.0	240.0	229.6	219.7	215.3	240.0	240.0	240.0	240.0	240.0	2824.7
1976	240.0	240.0	240.0	240.0	229.6	219.7	209.2	240.0	240.0	240.0	240.0	240.0	2818.5
1977	240.0	240.0	240.0	240.0	229.6	219.7	209.2	240.0	240.0	240.0	240.0	240.0	2815.2
1978	240.0	240.0	240.0	240.0	229.6	219.2	220.7	240.0	240.0	240.0	240.0	240.0	2829.6
1979	240.0	240.0	240.0	238.6	228.2	216.4	205.6	240.0	240.0	240.0	240.0	240.0	2808.9
1980	240.0	240.0	235.3	221.6	214.1	215.3	209.2	233.4	240.0	240.0	240.0	240.0	2768.9
1981	240.0	240.0	240.0	240.0	228.2	217.8	214.0	240.0	240.0	240.0	240.0	240.0	2820.1
1982	240.0	240.0	240.0	240.0	229.6	227.2	234.3	240.0	240.0	240.0	240.0	240.0	2851.2
1983	240.0	240.0	240.0	239.2	225.0	208.3	134.0	214.3	240.0	240.0	240.0	240.0	2700.9
1984	240.0	240.0	240.0	236.8	223.0	216.1	212.2	240.0	240.0	240.0	240.0	240.0	2808.2
1985	240.0	240.0	240.0	239.3	228.9	219.7	209.2	240.0	240.0	240.0	240.0	240.0	2817.1
1986	240.0	240.0	240.0	240.0	229.6	219.7	209.2	234.3	240.0	240.0	240.0	240.0	2812.8
TOTAL	6720.0	6720.0	6706.4	6663.2	6331.1	6101.1	5986.8	6678.7	6720.0	6720.0	6720.0	6720.0	78787.1
Average	240.0	240.0	239.5	238.0	226.1	217.9	213.8	238.5	240.0	240.0	240.0	240.0	2813.8
Maximum	240.0	240.0	240.0	240.0	229.6	227.2	240.0	240.0	240.0	240.0	240.0	240.0	2851.7
Minimum	240.0	240.0	231.1	220.3	189.5	192.8	134.0	214.3	240.0	240.0	240.0	240.0	2700.9

(4) Monthly List of Energy at Generating End
(Mae Lama Luang Project: Integrated Development)
(Unit: MWh)

	< JAN >	< FEB >	< MAR >	< APR >	< MAY >	< JUN >	< JUL >	< AUG >	< SEP >	< OCT >	< NOV >	< DEC >	< TOTAL >
1959	29590.	26008.	27405.	25223.	21147.	20820.	25352.	32340.	137435.	59116.	28643.	29427.	462505.
1960	28821.	25831.	28346.	23792.	24536.	33298.	39729.	94485.	146588.	153517.	57456.	54027.	708425.
1961	44501.	34571.	31905.	28369.	26102.	39314.	47428.	63297.	172800.	90568.	35005.	49224.	665085.
1962	41713.	32511.	32154.	28667.	48113.	41903.	47947.	63177.	127967.	178560.	41224.	45496.	729433.
1963	39344.	31409.	31614.	28021.	26048.	43256.	48142.	46754.	127808.	148286.	69224.	49337.	689243.
1964	43084.	33536.	32144.	28670.	29742.	24604.	54134.	102638.	172800.	138665.	38090.	45691.	743800.
1965	39788.	32229.	32566.	29008.	26103.	35304.	36453.	37372.	89085.	107048.	71189.	45343.	581489.
1966	40464.	31926.	31614.	28153.	30219.	46317.	49130.	164551.	139170.	50133.	28837.	31043.	671557.
1967	32706.	29013.	29775.	27037.	26987.	25162.	39678.	57473.	172800.	100477.	32732.	41547.	615387.
1968	36707.	30306.	30488.	27867.	30451.	46465.	46741.	49612.	98640.	76371.	28837.	31476.	533961.
1969	33980.	28957.	28526.	27274.	30909.	45489.	47225.	69654.	156950.	109484.	57319.	52917.	814131.
1970	47472.	37975.	34579.	33121.	42678.	46438.	90513.	178560.	160262.	86995.	36810.	41055.	801661.
1971	38434.	31493.	31482.	27660.	31961.	46438.	90513.	178560.	160262.	86995.	36810.	41055.	801661.
1972	36832.	31127.	30970.	30124.	26171.	29268.	48702.	128329.	116303.	78625.	48603.	48857.	663932.
1973	41174.	32061.	32623.	28396.	32961.	41830.	47477.	74272.	172800.	110709.	44278.	45734.	704315.
1974	38190.	31271.	29778.	28470.	32678.	43564.	46165.	50565.	104099.	70788.	41129.	36905.	553601.
1975	40429.	31552.	32249.	27938.	29292.	43872.	46985.	46356.	163266.	112395.	42852.	42511.	659698.
1976	38656.	32391.	30668.	27240.	30244.	38005.	43268.	37263.	112409.	94994.	41311.	41738.	568187.
1977	48929.	32162.	30944.	29525.	26789.	27301.	35852.	26782.	137091.	71658.	35587.	39097.	541717.
1978	37012.	31139.	30143.	27141.	28082.	24597.	47786.	62484.	126248.	87502.	29853.	32625.	564612.
1979	31911.	27431.	28285.	26059.	26126.	24380.	30449.	35552.	65994.	67875.	28682.	29466.	422190.
1980	28924.	26107.	26674.	24777.	25008.	34012.	42885.	26529.	147922.	115321.	41919.	44259.	584337.
1981	36810.	28337.	28361.	25226.	26126.	38120.	46791.	73821.	90211.	67282.	36910.	40330.	539625.
1982	35019.	28735.	28532.	27580.	30385.	47170.	49768.	178560.	163867.	107550.	36879.	38393.	772437.
1983	34399.	28186.	28324.	26103.	25875.	23752.	14953.	25029.	26139.	38975.	29014.	32466.	333215.
1984	29818.	27310.	28180.	25922.	25719.	45582.	46524.	70762.	122934.	84624.	29676.	34490.	571540.
1985	31694.	27387.	28310.	26109.	27067.	41739.	45707.	66870.	149042.	123530.	62896.	56133.	686484.
1986	41289.	33319.	32201.	30476.	28338.	35609.	44431.	26592.	43015.	39922.	28864.	30034.	414092.
TOTAL	1049710.	854282.	846839.	773248.	815858.	1033420.	1257366.	2078231.	3616441.	2660276.	1141312.	1155597.	17284576.
AVE	37490.	30510.	30244.	27687.	29138.	36908.	44906.	74223.	129159.	95010.	40761.	41271.	617306.
MAX	48929.	37975.	34579.	33121.	48113.	47170.	90513.	178560.	172800.	178560.	71189.	56133.	814131.
MIN	28821.	25831.	26346.	23792.	21147.	20820.	14953.	25029.	26139.	38975.	28643.	29427.	333215.

APPENDIX—E

PRELIMINARY DESIGN

APPENDIX-E PRELIMINARY DESIGN

CONTENTS

- E-1 TRIFURCATION DESIGN OF PENSTOCK FOR
MAE LAMA LUANG HYDROELECTRIC POWER PLANT
- E-2 STUDY ON ALTERNATIVE OF NAM NGAO SPILLWAY

**E-1 TRIFURCATION DESIGN OF PENSTOCK FOR
MAE LAMA LUANG HYDROELECTRIC POWER PLANT**

APPENDIX E-1 TRIFURCATION DESIGN OF PENSTOCK FOR MAE LAMA LUANG
HYDROELECTRIC POWER PLANT

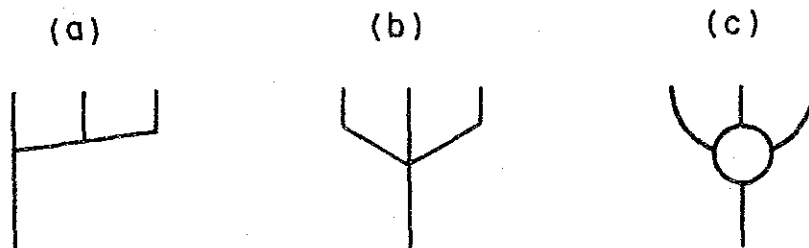
Ramification design of penstock ($D = 7.4$ m) into three manifolds ($D = 4.5$ m respectively) to connect three hydraulic turbines has three types as shown in the following figures, that is, (a) F Branch, (b) Three Pipe Branch and (c) Spherical Branch.

1) Head Loss

Results of hydraulic model tests gave us the head loss ($h_B = f_B \frac{v^2}{2g}$) of 0.25 m for Type (a) and 0.75 m - 1.00 m for Type (b) and (c), and the actual head loss of 0.75 m for Type (a) and 2.25 m - 3.00 m for Types (b) and (c) respectively. The results showed that the Type (a) was the most favorable.

2) Installation

While Type (b) and (c) require a large scale exterior stiffeners resulting in a heavy construction, Type (a) has only an interior stiffener and it is easy to transport and install.



E-2 STUDY ON ALTERNATIVE OF NAM NGAO SPILLWAY

APPENDIX E-2 STUDY ON ALTERNATIVE OF NAM NGAO SPILLWAY

For the original spillway plan, an alternative plan was studied which discharges flood flow through gully on the left bank of the dam. But comparing with the original spillway length of 300 m, the alternative needs about 800 m which results in the increase of construction cost. There is another alternative that the flood flow is to be discharged directly from the spillway which entrance is reinforced with concrete. But in this case there is a possibility of damaging natural ground due to the flood flow of 2,100 m³/sec. And also there is a possibility flooding the hydroelectric power plant located 250 m downstream from the spillway end, and the enormous volume of earth and rock scoured from ground may be deposited at the junction of the Ngao river and dam up the rivers. For the above-mentioned reasons, the original plan was adopted.

APPENDIX—F

CONSTRUCTION PLANNING AND COST ESTIMATE

APPENDIX-F CONSTRUCTION PLANNING AND COST ESTIATE

CONTENTS

F-1 BILL OF QUANTITY

F-1-(1) BILL OF QUANTITY : NAM NGAO PROJECT
INDIVIDUAL AND INTEGRATED DEVELOPMENT

F-1-(2) BILL OF QUANTITY : MAE LAMA LUANG PROJECT
INTEGRATED DEVELOPMENT

F-1-(3) BILL OF QUANTITY : MAE LAMA LUANG PROJECT
INDIVIDUAL DEVELOPMENT

F-2 UNIT CCST OF CIVIL WORKS

F-1 BILL OF QUANTITY

F-1-(1) NAM NGAO PROJECT : INDIVIDUAL AND INTEGRATED PROJECTS

F-1-(2) MAE LAMA LUANG PROJECT: INTEGRATED DEVELOPMENT

F-1-(3) MAE LAMA LUANG PROJECT: INDIVIDUAL DEVELOPMENT

F-1-(1) BILL OF QUANTITY : NAM NGAO PROJECT

INDIVIDUAL AND INTEGRATED DEVELOPMENTS

Nam Ngao Individual and Integrated Development

Construction Cost

Unit : 10⁶Baht

Item	Total	Currency	
		Foreign	Local
Civil Works			
Diversion & Care of River	177.5	87.8	89.4
Dam	1,036.0	643.0	393.0
Spillway	269.8	114.6	155.2
Outlet Works	6.8	2.9	3.9
Intake	27.9	12.2	15.7
Headrace and Penstock	71.5	33.9	37.6
Powerhouse	102.8	49.2	53.6
Tail-race	67.1	30.0	37.1
Switchyard	1.7	0.7	1.0
Sub-total	1,761.1	974.3	786.8
Hydraulic Equipment			
Diversion Gate	6.4	5.1	1.3
Spillway Gate	21.4	17.1	4.3
Intake Gate	10.3	8.2	2.1
Screen	3.4	2.4	1.0
Tail-race	5.6	4.5	1.1
Outlet Valve	14.8	11.6	3.2
Penstock	97.6	68.3	29.3
Sub-total	159.5	117.2	42.3

Description	Unit	Quantity	Unit Price			Cost		
			Total	Foreign	Local	Total	Foreign	Local
Common Excavation	m ³	391,000	60	42	18	23,460,000	16,422,000	7,038,000
Rock Excavation	m ³	44,000	130	65	65	5,720,000	2,860,000	2,860,000
Embankment Rockfill	m ³	5,026,000	110	72	38	552,860,000	361,872,000	190,988,000
Embankment Filter Material	m ³	348,000	150	98	52	52,200,000	34,104,000	18,096,000
Embankment Impervious Material	m ³	324,000	150	98	52	48,600,000	31,752,000	16,848,000
Concrete Facing	m ³	43,000	2,500	704	1,796	107,500,000	30,272,000	77,228,000
Reinforcement	t	3,300	15,600	13,185	2,415	51,480,000	43,510,500	7,969,500
Anchor Bar (ϕ 25m/m, ℓ =3.0m)	PC	730	1,000	800	200	730,000	584,000	146,000
Curtain Grouting	m	36,000	2,500	1,615	885	90,000,000	58,140,000	31,860,000
Consolidation Grouting	m	2,500	2,500	1,615	885	6,250,000	4,037,500	2,212,500
Water stop	m	5,000	600	400	200	3,000,000	2,000,000	1,000,000
Miscellaneous Works	L.S.	1				94,180,000	57,463,000	36,716,800
Sub Total						1,035,980,000	643,017,200	392,962,800

(2) Cofferdam

F - 3

(3) Split way

F - 4

(4) Diversion Work

Description	Unit	Quantity	Unit Price			Cost		
			Total	Foreign	Local	Total	Foreign	Local
Common Excavation	m ³	18,000	60	42	18	1,080,000	756,000	324,000
Rock Excavation	m ³	25,000	130	65	65	3,250,000	1,625,000	1,625,000
Tunnel Excavation	m ³	76,000	580	286	294	44,080,000	21,736,000	22,344,000
Structural Concrete	m ³	6,600	2,400	704	1,696	15,840,000	4,646,400	11,193,600
Concrete Lining	m ³	12,000	2,500	733	1,767	30,000,000	8,796,000	21,204,000
Plug Concrete	m ³	3,800	2,200	645	1,555	8,360,000	2,451,000	5,909,000
Shotcrete	m ²	28,000	260	172	88	7,280,000	4,816,000	2,464,000
Rockbolt	PC	6,200	860	570	290	5,332,000	3,534,000	1,798,000
Reinforcement	t	470	15,600	13,185	2,415	7,332,000	6,196,950	1,135,050
Mortar Injection	m ³	500	3,000	1,580	1,420	1,500,000	790,000	710,000
Curtain Grouting	m	1,700	2,500	1,615	885	4,250,000	2,745,500	1,504,500
Miscellaneous Works	L.S.	1				12,830,400	2,745,500	1,504,500
Sub Total						141,134,400	63,902,135	77,232,265