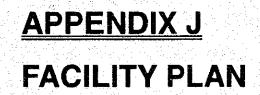
The study on Improvement of Water Supply System in Yangon City in the Union of Myanmar

Final Report



The Study on Improvement of Water Supply System in Yangon City in the Union of Myanmar

Appendix J

## APPENDIX J FACILITY PLAN

As described in Chapter 5, detailed data and design calculations are showed here. The contents are as follows;

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	1.1 CASE-1 GYOBYU TO YEGU P/SJ-1
•	1.2 CASE-2 GYOBYU P/S TO YEGU P/SJ-2
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#### APPENDIX J FACILITY PLAN

#### **1 HYDRAULIC CALCULATION FOR GYOBYU PUMPING STATION**

#### 1.1 CASE-1 GYOBYU TO YEGU P/S

1. Design Flow

#### 26 MGD =118,170 m<sup>3</sup>/day =

#### $82.06 \text{ m}^3/\text{min} =$

#### $1.37 \text{ m}^3/\text{sec}$

2. Necessary Pump Head

Friction loss will be calculated based on "Hazen - Williams Formula";

 $H = 10.666 \text{ x } \text{C}^{-1.85} \text{ x } \text{D}^{-4.87} \text{ x } \text{Q}^{1.85} \text{ x } \text{L}$ 

where;

H: Friction Loss Head (m)

L: Pipe Length (m) =

C: Velocity Coefficient (=88 : Existing Pipe)

D : Inner Pipe Diameter (m) 1.4

Q: Flow Rate  $(m^3/sec) = 1.37$ 

64,000 (to Yegu P/S)

Parameter		D	Q	L	Н	ΣΗ
Dimension	None	m	m <sup>3</sup> /sec	m	m	m
Gyobyu	88	1.4	1.37	64,000	59.8	
			ļ			

Thus, H = 59.8 m = 196.26 ft

Natural Water Head is;	
LWL of Reservoir 173.35	(by hydrological calculation)
+ 13.7	(Pump Head = $44.95$ ft
= 218.3	ft
Remaining water head is;	
$H_{\rm R} = 22.0$	ft > 19.34 ft : HWL of Yegu P/S
ОК	
Necessary Pump No.	
Design Flow 118,170	) m <sup>3</sup> /day
Pump Capacity 3,310	m <sup>3</sup> /hr
Pump Efficiency 65	% (Estimated pump efficiency of existing pumps manufactured in 1962)
Pump Number 2.2	29 say 3 units on duty
	(Number of existing pumps is three so, No stand-by pump can be secured)

There are three pumps in Gyobyu P/S and currently, only two pumps are operated. This is because YCDC seldom operated the P/S owing to the frequent power failure and to preserve the water level of Gyobyu reservoir in high level, say arround + 190 ft above mean However, same to the other existing reservoirs, Gyobyu reservoir water must be fully optimized to relieve the current water shortage and thus, pumps will be fully operated

According to the project implementation schedule, replacement of the existing three pumps in Gyobyu P/S is planned on 2004 and proposed Terminal Reservoir will be constructed in 2006.

After the completion of Terminal Reservoir, Gyobyu water shall be pumped to this reservoir. Thus, Gyobyu P/S will pump reservoir water to Yegu P/S with the existing equipment untill 2003, rehabilitated in 2004 and water will be converted to Terminal Reservoir from 2006.

Calcuration of possible pump flow by the existing pumps

One stand-by pump must be secued to cope with machine accident and thus, duty pump number is two.

Pump Capacity Pump Efficiency	3,310 65	m <sup>3</sup> /hr %		
Pump Number	2			
Pump Flow	4,303	$m^3/hr =$	103,272	m <sup>3</sup> /day

#### 1.2 CASE-2 GYOBYU TO TERMINAL RESERVOIR (HLAWGA WTP)

(1) Design Flow

26	MGD =
118,170	m <sup>3</sup> /day =

 $82.06 \text{ m}^3/\text{min} =$ 

 $1.37 \text{ m}^3/\text{sec}$ 

(2) Necessary Pump Head

Friction loss will be calculated based on "Hazen - Williams Formula";

H = 10.666 x  $C^{-1.85}$  x  $D^{-4.87}$  x  $Q^{1.85}$  x L

where;

- H: Friction Loss Head (m)
- C: Velocity Coefficient (=88 : Existing Pipe, =120 : New Pipe)
- D : Inner Pipe Diameter (m) 1.4

Q : Flow Rate  $(m^3/sec) = 1.37$ 

L : Pipe Length (m) =

50,680 (to Proposed Terminal Reservoir) 1,900 (Connection Pipe)

Parameter	C	D	Q	L	Н	ΣH
Dimension	None	m	m <sup>3</sup> /sec	m	m	m
Gyobyu	88	1.4	1.37	50,680	47.4	
	120	1.4	1.37	2,950	1.6	
				Total	48.9	

Thus, H = 48.9 m = 160.51 ft

By Gravity Flow

Necessary Natural Water Head is;

HWL of Reservoir 36.00 ft = 11 m

Water level in Gyobyu reservoir must be greater than;

 $W_L = 196.5$  ft

173.35 (LWL by hydrological calculation)

Water must be supplied to the proposed Terminal Reservoir constantly throught a year and thus, supply by "gravity flow" is not applicable.

#### By Pumps

Natural Water Hea	id is;				
LWL of Reservoir	173.35	(by hydrologic	al calcula	tion)	
+	13.7	(Pump Head	11	44.95	ft
	218.3	ft	· .		
1. A Contract of the second					

Remaining water head is;  $H_R = 57.8$ OK

ft > 36 ft : design HWL of proposed Terminal Reservoir

Necessary Pump No.

Design Flow	118,170	m <sup>3</sup> /day
Pump Capacity	3,310	m <sup>3</sup> /hr
Pump Efficiency	65	% (Estimated pump efficiency of existing pumps manufactured in 1962)
Pump Number	2.29	say 3 units on duty
		(Number of existing pumps is three so, No stand-by pump can be secured)

The existing three pumps including electric equipment have already been deteriorated and need immediate replacement.

In case of new pumps, 85% of pump effeciency can be expected and necessary duty pump number is;

Design Flow	118,170	m <sup>3</sup> /day
Pump Capacity	3,310	m <sup>3</sup> /hr
Pump Efficiency	85	%
Pump Number	1.75	say 2 units on duty

If three pumps are repleced, two pumps can be operated as "duty pump" and remaining one will be used as "stand-by".

#### 2 NECESSARY PUMP NUMBER IN PHUGYI PUMPING STATION

1. Design Flow

54 MGD =  $245,430 \text{ m}^3/\text{day} =$ 

 $170.44 \text{ m}^3/\text{min} =$ 

 $2.84 \text{ m}^3/\text{sec}$ 

2. Necessary Pump Number

Design Flow	245,430	m <sup>3</sup> /day
Pump Capacity	5,160	m <sup>3</sup> /hr
Pump Efficiency	80	%
Pump Number	2.48	say 3 units on duty

Now there are 3 existing pumps in Phugyi P/S and they are operated alternatively. The average pumping amount is around 50 MGD.

However, the design flow of 54 MGD is average intake amount and during rainny season, intake amount will be increased to minimize overflow amount from spilway. By hydrological calculation, possible intake peak factor was estimated at 1.2 and thus;

Necessary Pump No.

Design Flow	294,520	m³/day	(245,430	x 1.2)
Pump Capacity	5,160	m <sup>3</sup> /hr		lan di secondari di s
Pump Efficiency	80	%		
Pump Number	2.97	say 3 units o	on duty	÷ .1

So, the existing three pumps must be operated almost 24 hour/day. At least one pump must be secured as "stand-by" to cope with accidental case.

Therefore, additional one (1) pump is needed to secure stable water supply to Hlawga Reservoir.

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#### **3 PUMP AND MOTOR SPECIFICATION OF TRANSMISSION PUMPS**

Parameter	C	D	Q	L	H	ΣH
Dimension	None	m	m <sup>3</sup> /sec	m	m	m
<b>Ferminal Reservoir to Ko</b>	kine Servi	ce Reservo	ir			
Existing 66'	110	1,65	2.16	16,200	10.5	······································
Existing 42	85	1.05	2.16	3,200	30.1	
New 56'		1.4	2.16	1,350	1.7	42.3
Existing 56'	85	1.4	2.07	19,600	42.0	······································
Existing 42'	85	1.05	0.99	18,600	41.4	in t
Natural Water Head	from	to	Head (ft)	Head (m)	Allowance (m)	Total H (m)
	36	140	104	31.7	5.0	79.0
						79.0
Design Pumping Volume	423,000	$m^3/day =$	293.75	m <sup>3</sup> /min		
Pump Number	4	units	······································	•		
Pump Discharge by unit	73.44	$m^3/min =$	80	m <sup>3</sup> /min		
Motor Out-put		kW =	1,150	kW		······································
•*						
Terminal Reservoir to CB	Hlawga S	Service Res	ervoir			·····
New Pipe	120	2.2	6.4	3,900	3.9	15
Natural Water Head	from	to	Head (ft)	Head (m)	Allowance (m)	Total H (m)
	36	127	91	27.7	5.0	36.7
			·····		T T	38.0
Design Pumping Volume	553,000	$m^3/day =$	384.03	m <sup>3</sup> /min		
Pump Number	5	units		••••••••••••••••••••••••••••••••••••••		
Pump Discharge by unit	76.81	m <sup>3</sup> /min	,,,			·
Motor Out-put	616	kW =	640	kW		
••••••••••••••••••••••••••••••••••••••	· · · · · · · · · · · · · · · · · · ·			L		
						· · · · · · · · · · · · · · · · · · ·
Terminal Reservoir to CB	West Ser	vice Reserv	voir			
New Pipe	120	2.7	8.76	7,500	5.0	
Natural Water Head	from	to	Head (ft)	Head (m)	Allowance (m)	Total H (m)
	36	118	82	25.0	5.0	35.0
			· · · · · · · · · · · · · · · · · · ·		ľ	38.0
Design Pumping Volume	757,000	m <sup>3</sup> /day =	525.69	m <sup>3</sup> /min	- · · · · · · · · · · · · · · · · · · ·	
Pump Number	7	units				
Pump Discharge by unit	75.10	m <sup>3</sup> /min			j	
Motor Out-put		kW =	640	kW	 	
<b>_</b>						· · · ·

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	· · · ·					
Parameter	С	D	Q	j L	H	$\Sigma H$
Dimension	None	m	m <sup>3</sup> /sec	m	m	m
Ngamoeyeik P/S to Hlawg	a Reservo	ir (Case 1)		· ·		s. 1
	set in					Not
New Pipe	120	1.8	4.73	30,750	47.3	Applicable
Existing Pipe	120	1.4	4.73	13,280	69.4	<del>116.7</del>
Ngamoeyeik P/S to Hlawg		ir (Case 2)		1997 - D. S.		
New Pipe	120	1.8	4.73	30,750	47.3	
New Pipe	. 120	1.1	1.64	13,280	31.7	Double Pipe
Existing Pipe	120	1.4	3.09	13,280	31.6	
	2000 - 100 -	1999				78.9
Natural Water Head	from	to to	Head (ft)	Head (m)	Allowance (m)	Total H (m)
	81	62	-19	-5.8	5.0	78.2
				· · · ·		78.0
Design Pumping Volume	409,050	$m^3/day =$	284.06	m <sup>3</sup> /min		
Pump Number	4	units				an an an an an an
Pump Discharge by unit	71.02	m <sup>3</sup> /min				
Motor Out-put	1,168	kW =	1,200	kW		
		-				

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.

## 4 PUMP AND MOTOR SPECIFICATION OF DISTRIBUTION PUMPS

Dimension CB Down Town East Servic Design Pumping Volume Pump Number Pump Discharge by unit Motor Out-put East Block South Service R	<u>456,400</u> 2	m /oir m <sup>3</sup> /day =	<sup>3</sup> /sec	m	m	Pump Head
Design Pumping Volume Pump Number Pump Discharge by unit Motor Out-put	<u>456,400</u> 2					Dump Hand
Pump Number Pump Discharge by unit Motor Out-put	2	m <sup>3</sup> /day =			· · ·	Dump Hand
Pump Number Pump Discharge by unit Motor Out-put	2	m <sup>3</sup> /day =				Fump neau
Pump Number Pump Discharge by unit Motor Out-put	2	m <sup>3</sup> /day =			· · · · · · · · · · · · · · · · · · ·	27.0
Pump Discharge by unit Motor Out-put			316.94	m <sup>3</sup> /min		
Motor Out-put	160 47	units			··· .	
Motor Out-put	158.47	m <sup>3</sup> /min		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	903	kW =	900	kW	· · · · · · · · · · · · · · · · · · ·	
1 (D). D. C						
ast Block South Service R	leservoir					
					:	Pump Head
					·	24.0
	203,000	m <sup>3</sup> /day =	140.97	m <sup>3</sup> /min	··	
Pump Number	2	units				······
Pump Discharge by unit	70.49	m <sup>3</sup> /min				•
Motor Out-put	357	kW =	350	kW		
Cast Block Central Service	Keservoi	r				
					· · · · · · · · · · · · · · · · · · ·	Pump Head
· · · · · · · · · · · · · · · · · · ·		3		2		24.0
	186,200	$m^3/day =$	129.31	m <sup>3</sup> /min	· · ·	:
Pump Number	2	units		· · · ·		
Pump Discharge by unit	64.65	m <sup>3</sup> /min		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
Motor Out-put	327	kW =	350	kW		
East Block North Service R	acaruair				· · · · · · · · · · · · · · · · · · ·	
Last Diver Huith Bei vice R	VESCI YUR					Pump Head
· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·			27.0
Design Pumping Volume	86,800	m <sup>3</sup> /day =	60.28	m <sup>3</sup> /min	<u> </u>	
Pump Number	1	units	00.20			
Pump Discharge by unit	60.28	m <sup>3</sup> /min				
Motor Out-put	343	kW =	350	kW		
			0.00	L VY		
West Block South Service I	Reservoir	)				
						Pump Head
				<u></u>		24.0
Design Pumping Volume	35,000	m <sup>3</sup> /day =	24.31	m <sup>3</sup> /min		
Pump Number	1	units	·			
Pump Discharge by unit	24.31	m <sup>3</sup> /min	· · · ·	i		·····
Motor Out-put	123	kW =	125	kW		
					·····	
					······	
					· · · · · · · · · · · · · · · · · · ·	

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Parameter	С	D	Q	L	H	ΣΗ
Dimension	None	m	m <sup>3</sup> /sec	m	m	m
West Block Central Servic	e Reservo	ir	· · ·			,
						Pump Head (m
	· · ·					27.0
Design Pumping Volume	33,600	$m^3/day =$	23,33	m <sup>3</sup> /min		
Pump Number	1	units				
Pump Discharge by unit	23.33	m <sup>3</sup> /min				
Motor Out-put	133	kW =	140	kW		
West Block North Service	Reservoir	•			ļ	
					[	Pump Head (m
	······································					27.0
Design Pumping Volume	135,800	$m^3/day =$	94.31	m <sup>3</sup> /min		
Pump Number	1	units				
Pump Discharge by unit	94.31	m <sup>3</sup> /min	and and a second se			· · · · · · · · · · ·
Motor Out-put	537	kW =	550	kW		
						25.5
			·····	· · · ·		· · · ·
						· · · · · ·
· · ·						

# 5 LIST OF TRANSMISSION PUMPS

Pump Location	Name of Pump	Total Discharge per P/S (m <sup>3</sup> /day)	Discharge/unit	Head (m)	Motor Output (kW)	No. of Units*	Remarks
Gyobyu P/S	Transmission	118,200 (26 MGD)	3,310 m <sup>3</sup> /hr	13.7	184	3	Existing three pumps including electric equipment will be refurbished
Phugyi P/S	Transmission	245,400 (54 MGD)	5,160 m <sup>3</sup> /hr	24	450	1	One additional pump equivalent to the specification of existing ones
Terminal Res to Kokine S Res	Transmission	423,000	80 m <sup>3</sup> /min	79	1,150	5 (1)	
Terminal Res to CB Hlawga S Res	Transmission	553,000	80 m <sup>3</sup> /min	38	640	6 (1)	
Terminal Res to CB West S Res	Transmission	757,000	80 m <sup>3</sup> /min	38	640	8 (1)	
Ngamoeyeik P/S	Transmission	409,000 (90 MGD)	71 m <sup>3</sup> /min	78	1,200	5 (1)	
Hlaing WTP	Intake Pump	981,500	115 m <sup>3</sup> /min	30	750	7 (1)	
	Transmission	940,000	85 m <sup>3</sup> /min	55	1,150	9 (1)	

6 (1) = Total 6 units, including I unit as stand-by

s stain-by

#### 6 LIST OF DISTRIBUTION PUMPS

Pump Location	No.	Name of Pump	Total Discharge (m <sup>3</sup> /day)	Discharge/unit (m <sup>3</sup> /min)	Head (m)	Motor Output (kW)	No. of Units*	Remarks
CB Down Town East		Distribution	456,400	158.00	27	900	3 (1)	······································
East Block South		Distribution	203,000	70.00	24	350	3 (1)	
East Block Central		Distribution	186,200	64.65	24	350	3 (1)	
East Block North		Distribution	86,800	60.28	27	350	2 (1)	
South Block South	Dala	Distribution	35,000	24.31	24	125	2(1)	
South Block Central	SK+KY	Distribution	33,600	23.33	27	140	2 (1)	
South Block North	HT	Distribution	, 135,800	94.31	27	550	2(1)	· · · · · · · · · · · · · · · · · · ·
		A						
· · · · · · · · · · · · · · · · · · ·	. 	· · · · · · · · · · · · · · · · · · ·						
			······································					
	Note)		s including 1 unit as					

J-10

Note)

3 (1) = Total 3 units, including 1 unit as stand-by

#### 7 CAPACITY CALCULATION FOR HLAING W.T.P

Total Daby Max Daily Max Retention Time Surface Load Hor, Flow Veloc	Phase I 470,000cu m/day (235,000cu m/day x 2units) 470,000 cu m/day 493,500 cu m/day 20,563 cu m/hour 342,7 cu m/min 5.712 cu m/sec 987000 cu m/day	Dally Max Dally Max	Phase 2(total) 40,000cu m/day (235,000c 940,000 cu m/day 987,000 cu m/day 41,125 cu m/hour 685.4 cu m/min 11.424 cu m/sec	cu m/day x 4unlts
Daty Max Datly Max Retention Time Surface Load	470,000 cu m/day 493,500 cu m/day 20,563 cu m/hour 342.7 cu m/mln 5.712 cu m/sec 987000 cu m/day	Dally Max Dally Max	940,000 cu m/day 987,000 cu m/day 41,125 cu m/hour 685.4 cu m/inin	cu m/day x 4units
Pally Max Retention Time Surface Load	493,500 cu m/day 20,563 cu m/hour 342.7 cu n/mhn 5,712 cu n/sec 987000 cu m/day	Delly hiex	987,000 cu nyday 41,125 cu nyhour 685.4 cu nyinin	
Retention Time Surface Load	20,563 cu m/hour 342.7 cu m/min 5,712 cu n/sec 987000 cu m/day		41,125 cu m/hour 685.4 cu m/min	
Retention Time Surface Load	20,563 cu m/hour 342.7 cu m/min 5,712 cu n/sec 987000 cu m/day		41,125 cu m/hour 685.4 cu m/min	
Surface Load	342.7 cu nymin 5.712 cu nysec 987000 cu m/day		41,125 cu m/hour 685.4 cu m/min	
Surface Load	5.712 cu nysec 987000 cu m/day			
Surface Load	5.712 cu nysec 987000 cu m/day			
Surface Load	987000 cu m/day			
Surface Load				
Surface Load				
Surface Load				· · · ·
Surface Load				
Surface Load	T= 10.20 min			
LUDL PROV YEAR				
		(		
L/W Ratio	L/W= 3-8 times			
Depth	D = 3-4 m			
Depth of 0.5m of	r 1.0m is provided for sludge settlement.			
No. 1	4 basins	· · ·	the same to the left	<b>`</b>
. Wm x	Lm xDm xNunits		and same to the left	•
42	14 3.0 4			
				· · ·
¥ -	1,764 cu m/basin			
Т=	10.3 min		1	
1				
	V.V LINESCL			
				1
<u> </u>			······	······································
<u></u>	· · · · · · · · · · · · · · · · · · ·			······
· · · · · · · · · · · · · · · · · · ·				987,000 cu m/
Retention Time	T> 1-5 min	Retention Time	T>	1-5 min
1				
	1 units	Rectangular		
Lm	x Wm x Dm x Nunits	Lm x	Wm x Dm y	x N units
10.0	6.0 6.0 1.0	10.0	6.0 6.0	2.0
UV -	360.0 cu m/unit	UV -	360.0 cu m/unit	
V=	360.0 си т	V=	720.0 cu m	
) T=	1.1 min	Т-	1.1 min	
Gravity Mixing		Gravity Mixing		
· · · ·	<u> </u>			
	493,500 cu m/day			987,000 cu m/
Releption Time	T = 20 - 40 min	Petention Time	~-	20 - 40 min
				13,708 cu.m
ACQUART TODA		wednikeg kolsuls	¥ =	-
	15,708 cu.m			27,417 cu.m
	18.6 m - t- t- t-		196	
g	26.0 CU myminybasin	- q=	28.0 cu nymin/basin	
	12		<b>A</b> 4	
				No.of Channel
				2
Lm				No.of Channel
22.0	1.8 3.3 2	22.0	1.8 3.3	2
Lm	x W m x D m x No.of Channel	Lm x	Wm x Dm x I	No.of Channel
22.0	2.4 3.3 2	22.0	2.4 3.3	2
Step 1	188.8 cu m/unit	Step 1	188.8 cu n	n/enit
-	261.4 cu m/unit			
-		1		
				4 100
. 1 .	10/0 IUIU	1=	28.0 min	
L		İz		
	•			
. *				
-				
·				
· . ·			·.	
-	42 V - T - L/W - a - v - V - Retention Time Rectangular L m 10.0 UV - V - T - Gravity Mixing Retention Time Required Volum q = L m 22.0 L m 22.0 L m	42       14       3.0       4         V =       1,764 cu m/basin       T       10.3 min         L/W =       3.0 times       a       0         L/W =       3.0 times       a       0.0 cm/sec         493,500 cu m/day         Retention Time       T >       1 - 5 min         Rectangular       1 units       1 units       1 units         L m       x Wm       x D m       x N units         10.0       6.0       6.0       1.0         UV =       360.0 cu m/unit       V =       369.0 cu m/day         V=       360.0 cu m       1.0       10         UV =       360.0 cu m/unit       V =       369.500 cu m/day         V=       360.0 cu m/unit       V =       369.500 cu m/day         Greavity Mixing       0       493,500 cu m/day       493,500 cu m/day         Retention Time       T =       20 - 40 min       13,708 cum         q =       28.6 cu m/min/basin       13,708 cum       13,708 cum         q =       28.6 cu m/min/basin       12,20,13,3,3,2       2       1,m x W m x D m x No.of Channel         22.0       1.8       3.3       2       1,m x W m x D m x No.of Channel       22.0,2,4,3	42       14       3.0       4 $V =$ 1,764       cu m/basin         T =       10.3       min         L/W =       3.0       times         a =       0       mn/min         v =       0.0       cn/sec         493,500         493,500         cu m/day         Retention Time         T >         1 - 5 min         Retention Time         Retention Time         T >         10.0         UV -         360.0 cu m/unit         UV -         V -         T =         1.0         UV -         UV -         UV -         V -         UV -         UV -         UV -         Cu m/min/basin         Q =         L m         L m         L m          1.3	Wm       x L m       x D m       x Vanité         42       14       3,0       4 $V =$ 1,764       cu n/basin       T         T       10.3 min       L/W =       3.0 fines         a =       0       0 maymin       * $v =$ 0.0 cm/sec       493,500 cu n/day       Retention Time       T>         Retention Time       T>       1 - 5 min       Retention Time       T>       2 units         L       m       x Wm       x D m       x N usits       L       m       x Wm       2 units         L       m       x Wm       x D m       x N usits       L       m       x Wm       2 units         L       m       x Wm       x D m       x N usits       UV -       360.0 cu m/unit       V -       720.0 cu m       T -       10.0       6.0       6.0       10         UV -       360.0 cu m/unit       V -       6.654 cum       UV -       360.0 cu m/unit       V -       720.0 cu m       T -       1.1 min         Gravity Mixing       T -       2.0 - 40 min       Gravity Mixing       Gravity Mixing       g -       2.6. cu n/unit/basin       g -       2.6. cu n/unin/basin       g -<

Total Capacity = 940,000 cu m/day

Item	Phase 1	Phase 2(total)
ATC/11	Total 470,000cu m/day (235,000cu m/day x 2units)	Total 940,000cu m/day (235,000cu m/day x 4units)
) Sedimentation Basin	493,500 cu m/day	987,000 cu m/day
Туре	Rectangular, Horizontal Flow	Rectangular, Horizontal Flow
		<b>6</b>
Unit Flow	g = 1,714 cu m/hr/basin	q = 1,714 cu m/hr/basin
Criteria	Retention Time T = 2.5-4 hours	Retention Time T = 2.5-4 hours
CHICH .	Surface Load a 15 - 30 inmunin	Surface Load a = 15-30 mm/mh
	Hor, Flow Velocity v < 0.40 m/min	
		L/W Ratio L/W = 3-8 times
	Depth $D = 3.4 m$	Depth D = 3-4 m
. ·	Depth of 30 cm or more is provided for sludge settlement,	Depth of 30 cm or more is provided for sludge settlement.
Dimension	No. 12 basins	No. 24 basins
· · · · · ·	Wm xLm xDm xNunits	Wm xLm xDm xNunlis
	22 80 3.8 12	22 80 3.8 24
		en al de la companya
Volume	V = 6,688 cu m/basin	V = 6,688 cu m/basin
Retention Time	T = 3.9 hours	T = 3.9 hours
L/W Ratio	L/W == 3.6	1./W= 3.6
Surface Load	a = 16.2 mm/mln	a = 16.2 mm/min
Hor. Flow Velocity	v = 0.34 m/mln	v = 0.34 m/min
Overflow Weir	Load = 350 m3/m/day	Load = 350 m3/m/day
Trough Length	L= 118 m or longer	L = 118 m or longer
inough Lengin	1/- Eta il ol ivagei	L- 116 in or longer
<ul> <li>March 1997 And Annual Annua Annual Annual A Annual Annual Annua</li> </ul>	No. 14 formula	
	No. 14 troughs	No. 28 troughs
	Lm x Nunits	Lm x Nunits
	4.4 14	4.4 28
and the second second second		
	L = 123.2 m	L= 246.4 m
Sludge Removal	Cable-operated underwater bogie studge collector or	Cable-operated underwater bogie sludge collector or
	Travelling bridge sludge collector	Travelling bridge sludge collector
Sludge Amount	So = Q * (K*(T1-T2)+B*C*156/102)*10*-6	So = Q * (K*(T1-T2)+B*C*156/102)*10^-6
Solid Amount	where So:Sludge dry weight(ton)	where So:Sludge dry weight(ton)
(ton-DS)	Q :Treated water amount(m3/d)	Q :Treated water amount(m3/d)
	K :Coefficient converting turbidity	K :Coefficient converting turbidity
	to SS (0.8-1.5 ->>1,2)	to SS (0.8-1.5->>1.2)
	T1 :Turbidity in raw water (ave= 154	T1 :Turbidity in raw water (ave=
	T2 : Turbidity after Sedimentation (ave = 5)	T2 : Turbidity after Sedimentation (ave = 5)
· ·	B :Alum dos age rate (ave.= 50	B :Alum dosage rate (ave.=
	B = 4 + 2 * (T1) * 0.5 = 28.8	B=4+2*(T1)*0.5= 2
· · · · · ·	C :Concentration of AL2O3 85	C :Concentration of AL2O3
	5 TO THE	C requirementation of AL2O3
	So = 91.26 ton-DS/day	Com 101 51 (m DC/3
	50 - 71.40 ton-153/day	So = 182.51 ton-DS/day
· · · · · ·	Water Contents of Destand Cludes	
	Water Contents of Drained Sludge	Water Contents of Drained Studge
	(with wash-out water)	(with wash-out water)
	w = 99.0 %	w = 99.0 %
	Frequency of Cleaning : Continuous	Frequency of Cleaning : Continuous
·		
Sludge Volume	Total v = 9,126 cu.m/day	Total v == 18,251 cu.m/day
	So = 91.26 ton-DS/day	Sc = 182.51 ton-DS/day
		1 States and the second s second second sec second second sec

Item	Phase 1	· · · · · · · · · · · · · · · · · · ·	1	Phase 2(total)	
ALCEI	Total 470,000cu n/day (235,000	cu nyday x 2units)	Total 940,000	cu n/day (235,000c	n n/day x 4units)
4) Rapid Sand Filter		493,500 ca m/day			987,000 cu m/day
Туре	Down Flow, Single Media		Down Flow, Single Media		
No	44 units	4 stand by		88 units	8 stand by
Unit Flow	q = 11,216 cu n/day/unit		գ≖ մե,2	16 cu ni/day/unit	
Criteria	Filtration Rate Fr =	120 - 150 m/day 5.0 - 6.25 m/hour	Filtration Rate	ķt a	120 - 150 m/day \$.0 - 6.25 m/hour
	Filter Area per Unit A <	90 są m	Filter Area per Unit	λ<	90 sq m
Dimension	Wm x Lm x Nunits 5.8 14.8 44		Wm xLm 5.8 14.8	x N units 88	*
	40 A = 85.8 sq m/unit	4 stand by	A= 8	80 5.8 sq nvenit	8 stand by
Filtration Rate	Fr = 130.7 n/day		Fr == 130	).7 m/day	
Filtration Rate	Fr'≖ 143.7 m/day		Fr'= 143	).7 m/day	• •
during washing	4 units out of 40units /2days = 20 units are was	hing	8 units out of 88units /2d	ays = 40 units are was}	ling
Filters for Backwashing Filter Washing					
Frequency	Once a day for each filler		Once a day for each filter		
Rate	Surface Washing rate =	0.20 m3/m2/min	Surface Washing	rate =	0.20 m3/m2/min
and a second	duration = Backwashing rate =	6 min		duration =	6 min
	Backwashing rate = duration =	0.70 au3/m2/m4a 8 min	Backwashing	rate = duration =	0.70 m3/m2/min 8 min
Water Amount	Surface Washing Vs =	103.0 cu m/unit	Surface Washing	Vs =	103.0 cu m/unit
for washing	Backwashing Vb =	480.7 cu n/unit	Backwashing	Vb =	480.7 cu m∕unit
	Vs + Vb =	583.7 cu m/unit		Vs + Vb =	583.7 cu m/unit
for Total Units	Total Amount for Washing	25,683 cu m/day	Total Amount for Washir	g	51,367 cu m/day
	Percentage for Planned Flow	5.2 %	Percentage for Planned F	low	5.2 %
Solid Amount	So = Q*K*(T1-T2)*10*-6		So = Q*K*(T1-T2)*10*	-6	
in Wastewater	where So:Sludge dry weight(ton)	<ul> <li>For a second seco</li></ul>	where So:5	iludge dry weight(ton)	
(ton-DS)	Q :Treated water amount(m3			ated water amount(m3/	
	K :Coefficient converting tur to SS (0.8-1.5 ->>1		K :Coe	flicient converting turb to SS (0.8-1.5 ->>1.	
	Tl :Turbidity before filter(av T2 :Turbidity after filter(ave			bidity before filter(ave bidity after filter(ave =	
	So = 2.37 ton-DS/day		So≖ 4.	74 ton-DS/day	· .
SS Contents	s ≈ 92 mg/l		s =	92 mg/l	

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Item	Phase 1	Phase 2(total)
	Total 470,000cu m/day (235,000cu m/day x 2units)	Total 940,000cu m/day (235,000cu m/day x 4units)
).Chlorination Mixing Channel	470,000 cu m/day	987,000 cu m/day
Location	at the Inlet of the Clear Water Reservoir	at the Inlet of the Clear Water Reservoir
Criterla	Contact Time T > 2 minutes	Contact Time T> 2 minutes
Required Volume	V ⊨ 653 cu m	V = 1306 cu m
Dimension	No. 2 units	No. 4 units
	Lm xWm XDm XNunits 36.0 6.0 3.0 2	Lm х Wm х Dm х Nunits 36.0 6.0 3.0 4
Total Volume		
Retention Time	y = 1,296 cu m i = 2.0 min	v = 2,592 cu m t = 2.0 min
Clear Water Reservoir	470,000 cu m/day	074 600
Criterla		987,000 cu m/day Retention Time T> 1 hours
Required Volume	V = 19,583 cu m	V = 39,167 cu m
Dimension	No. 2 units	No. 4 units
	Lm xWm xDm xNunits	Lm xWm xDm xNunits
	84.0 42.0 3.0 2	84.0 42.0 3.9 4
Total Volume	V∼ 21,168 cu m	V = 42,336 cu m
Retention Time	T = 1.08 hours	T = 1.03 hours
) Backwash Water Storage Tank	470,000 cu m/day	987,000 cu m/day
Retention Time	1 hours	1 hours
Backwash Water	Vs + Vb = 584 cu.mvfilter unit	Vs + Vb = 584 cu.m/filter unit
Required Volume	2 Mters 1,167 cù.m	2 filters 1,167 cu.m
No.	N = 2 units one Stand-by	N = 4 units one Stand-by
Dimension	Lm xWm xDm xNunits 36.0 12.0 3.0 I	Lm xWm xDm xNunits 36.0 12.9 3.0 3
Total Volume	v = 1,2% cu m	v = 3,888 cu m
Frequency of Wash	Once a day = 20 filters/day	Once a day = 40 filters/day
Sludge Lagoon	470,000 cu m/day	584 000
Vater Contents of Drain Sludge	₩= 99.0 %	987,000 cu n√ðay ₩≈ 99.0 %
:		
iludge Amount	v≃ 9,363 cu.m/day So≂ 93.6 ten-DS/day	v = 18,725 cu.m/day So = 187.3 ton-DS/day
Sludge Amount(6 months)	Q = 17,087 ton-DS for all Sed.Basin and Filter	Q = 34,173 ton-DS for all Sed.Basin and Filter
Drying Period	for 1.5 years 65 %	for 1.5 years 65 %
Dried Volume	v = 48,819 cum < 51,840 cum	v≈ 97,638 cum < 51,840 cum
Dimension	Rectangular 3	Rectangular 6
	Lm x Wm x Dm x Nunits 180.0 48.0 3.0 3	Lm x Wm x Dm x Nunits 180.0 48.0 3.0 6
/olume	¥≈ 77,760 cum	v = 155,520 cu m
		Alum - Specific Gravity Lime - Specific Gravity
and the second		
	(% as Al2(SO4)3-18H2O) (% as Ca (OH)2) 5 1.0254 5 1.0308	(% as A12(SO4)3-18H2O) (% as Ca (OH)2) 5 1.0254 5 1.

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## 8 CAPACITY CALCULATION FOR FLWGA W.T.P

74	Phase 1	Phase 2(lotal)
Item	Total 820,000cu m/day	Total 820,000cu m/day (205,000cu m/day x 4units)
Plant Capacity	Daily Max 820,000 cu m/day	Daty Max 820,000 cu n/day
Planned Flow	Dauy Max 861,000 cu n√day	Note that the second se
t Iting t ion	35,675 cu n√hour	Dally Max 861,000 cu nvlday 35,875 cu nvlhour
	597.9 cu nvinin	597.9 cu m/min
	9.965 cu nvisec	9.965 cu m/sec
1) Receiving Well-A	861,000 cu nvday	*******
Criteria	Retention Time T> 1 - 5 min	······································
Dimension	Circular 1 units	
	DIAm x Dm x Nm	
	36.0 3,0 1.0	
	and the second	the same to the left
	V- 3052,1 cu m	
	T= 5.1 min	
2) Receiving Well-B	1,760,000 cu myday	
Criteria	Retention Time T> 1-5 mln	
Dinuension	Rectangular 1 units Lm x Wm x Dm x N units	
	30.0 14.0 6.0 1	
· · · · · · · · · · · · · · · · · · ·		the same to the left
Unit Volume	UV = 2520.0 cu m/unit V= 2520.0 cu m	
	T• 2.1 min	
	Gravity Mixing	A second s
3) Barati ta - 30, 11 (2		
3) Receiving Well-C		861,090         cu m/day           Retention Time         T >         1 - 5 min
		EXTENSION SHIPE 1 / 1 - 2 (187
Dimension		Rectangular 2 units
		Lm x Wm x Dm x N units 16.0 8.0 6.0 2
Unit Volume		UV = 768.0 cu nvunit
		V≈ 1536.0 cum T≈ 2.6 min
		Gravity Mixing
Dentil Conta 1996		· · · · · · · · · · · · · · · · · · ·
Rapid Sand Filter Type		561,000 cu m/day Down Flow, Single Niedia
		Down 1 10%; Onigie Inscola
No.		112 units 8 stand by
Unit Flow		q = 7,688 co m/day/min
		y - spoo en second stiller
Desige Criterla		Filtration Rate Fr = 80-100 m/day
		• 3,3-4,2 m/bour Filter Årea per Unit A < 90 sq m
Dimension		Wm x Lm x Nunits
· ·		5.8 14.8 112 104 8 stand by
		A = 85.8 sq munit
Ciliantian Trata		
Filtration Rate		Fr = 89.6 m/day
Filtration Rate		Fr'= 96.4 m/day
during washing		8 units out of 104units /2days = 52 units are washing
Filters for Backwashing		
Filter Washing		
Frequency		Once a day for each filter
Rate		Surface Washing tate = 0.20 mV/m2/min
		duration = 6 min
		Backwashing Fate = 0.70 m3/m2/min
and the second		duration = 8 min
and the second		
Water Amount		Surface Washing Vs = 103.0 cu m/unit

Item	Phase i	Phase 2(total)
	Total 820,000cu m/day	Total 820,000cu m/day (205,000cu m/day x 4units)
for Total Units		Total Amount for Washing 32,688 cu m/day Percentage for Planned Flow 3.80 %
Solid Amount	and the second	So = Q*K*(T1-T2)*10^ 6
in Wastewater		where So:Sludge dry weight(ion)
(ton-DS)		Q : Treated water amount (m3/d)
1		K : Coefficient converting turbidity
		- to SS (0.8-1.5 ->>1.2)
. '		Ti :Turbidiy before filter(ave≃ T2 :Turbidiy after filter(ave =
and the second		So = 4.13 ton-DS/day
SS Contents		s == 126 ing/i
Chlorination Mixing Channel	1,760,000 cu nvday	1,760,000 cu m/day
Location	at the Inlet of the Clear Water Reservoir	at the Inlet of the Clear Water Reservoir
Criteria	Contact Time T > 2 minutes	Contact Time T > 2 minutes
Required Volune	V = 2444 cu m	V ≈ 2444 cu m
Dimension	No. 6 units	No. 8 units
	Lm x Wm x Dm x Nunits	Lm x Wm x Dm x Nunits
	36.0 6.0 3.0 6	36.0 6.0 3.0 8
Total Volume	v= 3,888 cum	y == 5,184 cu m
Retention Time	1 ** 1.6 min	t = 2.1 min
Clear Water Reservoir	1,760,000 cu ny'day	1,760,000 cu m/day
Criterla	Retention Time T> 1 hours	Retention Time T> 1 hours
Required Volume	Y = 73.333 cu m	V = 73,333 cu m
Dimension	No. 6 units	No. 8 units
	Lm xWm xDm xNunits	Lm x W m x D m x N units
	84.0 42.0 3.0 6	84.0 42.0 3.0 8
Total Volume	V = 63,504 co m	V = 84,672 cu m
Retention Time	T = 0.87 hours	T = 1.15 hours
Backwash Water Storage Tank	and the second	1,760,000 cu m/day
Retention Time		1 hours
Backwash Water		Vs + Vb = 584 cu.m/filler unit
Required Volume		4 filters 2,335 cu.m
No.		Nes 2 units and Stand has
		N * Z units one Stand-by
Dimension		Lnt x W m x D m x Nunits 50.0 16.0 3.9 1
Total Volume		y = 2,400 ca m
· · · ·		
Frequency of Wash		Once a day = 52 filters/day
Sludge Lagoon	1,760,060 cu m/day	1,760,000 cu m/day
Vater Contents of Drain Sludge	₩≈ 99.0 %	W= 99.0 %
ludge Aniount		
	So = 0.0 ton-DS/day	So = 4.1 ton-DS/day
ludge Amount(6 months)	Q = 0 ton-DS for all Sed.Basin and Filter	Q = 754 ton-D5 for all Sed.Basin and Filter
-		
Prying Period Pryed Volume	for J.5 year 65 % v× 0 cum < 4,315 cum	for 1.5 year 65 % v = 2,155 cu m < 4,315 cu m
Dimension .	Reclangular 1	Rectangular 3
	Lm x Wm x Dm x Nunits	Lm xWm xDm xNunits
	L m x W m x D m x N units 48.0 29.0 3.1 1	48.0 29.0 3.1 3
olume		

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(Summary) Items	unit	2000	2005	2010	2015	2020	Remarks
· ·					· ·		
Water Demand	m <sup>3</sup> /day	615,100	1,080,300	1,466,000	1,792,100	1,912,700	Daily Maximum
Reservoirs (Total)	m <sup>3</sup> /day	395,500	847,600	847,600	847,600		
Gyobyu	m <sup>3</sup> /day	93,200	118,200	118,200	118,200		20.5 to 26 MGD
Phugyi	m <sup>3</sup> /day	227,300	245,400	245,400	245,400	Diverted to	50 to 54 MGD
Hlawga	m <sup>3</sup> /day	75,000	75,000	75,000	75,000	Hlawga WTP	16.5 MGD
Ngamoeyeik	m <sup>3</sup> /day	0	409,000	409,000	409,000		90 MGD
Groundwater (Total)	m <sup>3</sup> /day	43,900	66,600	132,300	158,200	161,600	
Left Bank	m <sup>3</sup> /day	41,700	64,700	54,400	39,200	33,600	
Rigt Bank (Total)	m <sup>3</sup> /day	2,200	1,900	77,900	119,000	128,000	
Hlaingthaya	m <sup>3</sup> /day	200	200	76,400	78,600	79,000	
KY + SK	m <sup>3</sup> /day	0	0	0	20,200	24,500	
Dala	m <sup>3</sup> /day	2,000	1,700	1,500	20,200	24,500	
Hlaing WTP						· · · · · · · · · · · · · · · · · · ·	
Implementation Phasing		0	0	50%	50%	100%	
Treated Water Amount	m <sup>3</sup> /day	0	0	470,000	470,000	940,000	· · ·
Hlawga WTP	m³/day	0	0	0	0	820,000	
Total Available Water Amount	m³/day	439,400	914,200	1,449,900	1,475,800	1,921,600	/ · · · · · · · · · · · · · · · ·
Water Balance	m <sup>3</sup> /day	-175,700	-166,100	-16,100	-316,300	8,900	 

## (Groundwater)

	2000	2005	2010	2015	2020	Remarks
Right Bank (m <sup>3</sup> /day)	2,246	1,920	77,865	118,908	128,051	GW Total
Hlaingthaya	0	0	75,748	96,035	97,006	Water deamand including Industry
Well Production	219	188	76,378	78,558	78,989	
No.of well newly drilled	0	0	59	10	9	
Sub-total of well No.	0	0	59	69	78	
SW Introduction	0	0	0	0	18,017	
KY + SK	1,956	7,418	14,449	20,125	23,645	Water Demand
Well Production	0	0	0	20,175	24,531	
No.of well newly drilled	0	0	0	15	6	
Sub-total of well No.	0	0	0	15	21	
Dala	2,150	7,841	12,994	19,495	24,515	Water Demand
Well Production	2,027	1,732	1,487	20,175	24,531	
No.of well newly drilled	0	0	0	15	6	
Sub-total of well No.	0	0	0	15	21	
No.of well newly drilled	0	0	59	40	21	Total of Right Bank
Sub-total of well No.	0	0	59	99	120	
Left Bank						· · · · · · · · · · · · · · · · · · ·
MCM/Y	15.20	23.62	19.84	14.29	12.27	
m³/day	41,644	64,712	54,356	39,151	33,616	<i>,</i>
Fotal	43,890	66,632	132,221	158,059	161,667	GW Total

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The study on Improvement of Water Supply System in Yangon City in the Union of Myanmar

Final Report

## APPENDIX K

INSTITUTION AND ORGANIZATIONS FOR SYSTEM MANAGEMENT The Study on Improvement of Water Supply System in Yangon City in the Union of Myanmar

<u>Appendix K</u>

### APPNDIX K INSTITUTION AND ORGANIZATIONS FOR SYSTEM MANAGEMENT

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## APPENDIX K INSTITUTION AND ORGANIZATIONS FOR SYSTEM MANAGEMENT

#### 1 ROLE AND FUNCTIONS OF THE ENGINEERING DEPARTMENT (WATER & SANITATION)

- (a) Maintaining reservoirs, pressure machines, pumps and tube wells and to supply water for the city dwellers to get clean water.
- (b) Disposing of water and organic waste matter using sewerage and sanitation equipment.
- (c) Constructing, maintaining, repairing water supply system and sewerage.
- (d) Installing water meters and collecting water tax.
- (e) Issuing permit to install water pipes, pumps, and to construct septic tanks after thorough inspection.
- (f) Cleaning water pipelines, replacing old pipes with new ones and supply water rotationally to those wards which receive less water so as to obtain more water.
- (g) Cleaning, mending, inspecting pipe joints of the transmission main pipes from Gyophyu, Hlawga and Phugyi reservoirs.
- (h) Constructing tanks in suitable places so as to have a good flow of water to the city.
- (i) Transporting drinking water for those people residing at the other side of the Yangon River and constructing water tanks or ponds in suburban areas and satellite towns.
- (j) Putting alum into filter tanks to have sediment settled and putting chlorine into pipe lines.
- (k) Finding ways and means to prevent wastage of water; repairing and mending of pipes that leak water.
- (1) Importing pipes and machinery spare parts, pumps, chlorine and alum, and giving necessary instruction for the use of these materials.
- (m) Planning and managing to run daily hydraulic power plant, for the east and west Yangon, to remove excrements, discarded by the city dwellers, into the river by using air pressure.
- (n) Planning and managing not to block the sewerage and to protect the environmental pollution.
- (o) Planning to use toilets requiring manual flushing instead of using toilets requiring four cornered wooden vessels as receptacles in suburban areas.
- (p) Ordering and storing machinery and spare parts for pressure plant.
- (q) Maintaining pressure machines at Yegu, Hlawga and Phyugyi water pumps stations.
- (r) Repairing pumps promptly whenever they become out of order and spare parts for these pumps are manufactured at the workshop.

- (s) Ordering and storing alum and mineral salt in time not to become out of stock.
- (t) Managing sanitary machines and pressure machines to run 24 hrs.
- (u) Measuring the rate of water producing at the existing tube wells and digging new wells installing pumps and laying pipe lines.
- (v) Undertaking security of Gyophyu pipe line, Phugyi pipe line, and Hlawga pipe line and constructing cross-bridges over these pipe lines.
- (w) Maintaining hydrants, building water tanks for fire dept.
- (x) Taking action to those who illegally connect to water pipes.
- (y) In executing the above tasks and to have progress yearly the Dept draws up short and long term plans and yearly budget, providing budget and expending and supervising taxes received.

#### 2 DUTIES OF THE CHIEF ENGINEER, ASSISTANT CHIEF ENGINEER AND BRANCH DEPARTMENT HEAD

- (a) To give guidance to accomplish the work of the Department.
- (b) To manage and do the work of the Department in accordance with law, rules and regulations instructions and committee's policy.
- (c) To distribute work to the officers of the Dept and to do the staff administration and to look after welfare of the staff.
- (d) To supervise the departmental work and its employees.
- (e) To take responsibility of the committee, with its approval, regarding committee's instructions.
- (f) To give instructions, assign duties and supervise work done by Deputy Dept officer, Assist: Dept Officers; Engineers, and other Officers.
- (g) To supervise and control the work done within the budget limit approved by the committee.
- (h) To inspect water supply stations, workshops, reservoirs, pressure machines and whether these are in systematic order.
- (i) To draw up plan and implement it regarding the sufficient supply of drinking water for the city dwellers. To manage the work regarding connecting of water pipe lines according to the rules and regulations.
- (j) Townships where water supply from main reservoirs can not be made, tube wells are dug and supply of water is managed.
- (k) To install new large and small pipes and to maintain such pipe lines.
- (1) To find ways and means to prevent wastage of water and to supervise to collect water tax fully.
- (m) To make requisition for the machinery spare parts and water pipes so as to run the work smoothly.
- (n) To make systematic arrangement when disposing of excrement from septic tanks, sanitary pipes so as not to pollute environment.
- (o) To draw plans and submit such plans to the committee for approval regarding

new water supply project for the capital, the search for new water sources, building new reservoirs, construction of new sanitary pipes and septic tanks.

- (p) General Supervision for the systematic expenditure of departmental implementing projects, ordinary/ lot capital expense, claims for the estimate budget related matters. All these cases are being implemented by the respective departments concerned.
- (q) Besides the water supply work to the regular seasonal festivals, routine respective work's have to be done in the line of duty.

#### 3 DUTIES OF THE DEPUTY HEAD OF DEPARTMENT /ENGINEERING DEPARTMENT (WATER AND SANITATION)

#### 3.1 DUTIES ASSIGNED TO THE HEAD OF DEPARTMENT

- (a) Fully responsible for the implementation of the Head of Dept's duties in coordination with the Deputy Head's work supervisions, and support.
- (b) Taking charge of the department during the absence of the Head of Dept
- (c) Other special assigned duties given by the Head of Department
- (d) Co-ordination and success of works in dealing with relevant departments placed under the committee.

#### 3.2 DUTIES OF ASST. HEAD OF DEPT

- (a) Shall be responsible to comply with the directions given by Head of Department and Deputy Head of Dept
- (b) Constant supervision and accomplishments to the works of Head of Branches, Head of Sections and Engineers, by giving additional assignments and directives as necessary from time to time.
- (c) Long run perpetuity of the major water reservoirs, conservation of the water resource forests, maintenance and repair and upkeep of the water pipes projected works for the procurement of drinking and potable water, cleaning of lakes water volume survey works, records compilation, exploration of new water resources, general supervision and reports submissions to Head of Dept, and Deputy Heads.
- (d) Diggings of tube wells, mechanised artisan wells, repair and maintenance, brick water storage ponds construction and supervisory works.
- (e) Scrutinizing & legal action takings to prevent water wastages, water pipe joining permit, sanitary tank buildings, sanitary pipes layout, permit, works supervision.
- (f) Proper flow and non-blocking of human wastage disposal works, underground sanitary cubes cleaning, and their management.

- (g) Air compressor mechanical stations, sanitary boiler driving, storage and fill up mattes, & necessary management and work-implementation.
- (h) Planning and supervision for the progress and execution of assignments by branch sections for the responsible works concerned under one's management.
- (i) Co-ordination and supervision for the success of branch departments under one's charge.
- (j) Other duties assigned by Senior authorities emergency cases and special duties as directed by the Head of Dept. up to full completion.
- 3.3 DUTIES OF BRANCH HEAD OF DEPARTMENT
  - (a) Branch Head of Department, Asst. Head of dept's directions to comply and taking full responsibility to implement it. Level to level supervision of the branch engineer's under his supervision, inspection and additional directions.
  - (b) For the smooth success of the assignments, undertaking necessary supportive measures, inspection, supervision and works performances though the different levels of senior officials concerned.
  - (c) Welfare matters of the staffs under his charge, planning administration by offering rewards, serve actively, in the line of duty.

<b>District Name</b>	Township Name
District (East)	Dagon Myothit East
	Dagon Myothit North
************	Dagon Myothit Seikkan
·····	Dagon Myothit South
	North Okkalapa
******	South Okkalapa
***********************	Thingangyun
District (North)	Hlaing
*******	Hlaingthaya
•••••••	Insein
******	Kamayut
	Mayangone
*******	Mingalardon
•••••••	Shwepyitha
District (South)	Botataung
	Dala
	Dawbon
	Mingalartaungnyunt
	Pazundaung
	Seikan Port
	Seikkyi Kanaungto
	Tamwe
	Thaketa
	Yankin
District (West)	Ahlone
	Bahan
	Dagon
	Kyauktada
•••••	Kyeemyindaing
	Lanmadaw
	Latha
	Pabedan
In A simple grave a principal distance and machines tools to date:	Sanchaung

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## Table K.1 Grouping of Townships by Districts

Туре	Description	Number	Annual Registration Fee (Ks.)
Licensed Water & Sanitation Engineer	Permitted to undertake designs and plumbing work	12	10,000
Licensed Master Plumber	Permitted to do all plumbing work	261	6,500
Working Plumber	Permitted to work only under the supervision of the above two types. Not permitted to by self.	164	4,000

#### Table K.2 List of Plumbers Registered with YCDC

Source: YCDC

Note: Passing of a departmental examination is required for the first two categories. Registration for the last category is by recommendation of either of the first two.

#### Table K.3 List of Co-operative Societies involved in Water Supply in the City

Township	No.	Members	No.	Year	Water Cost
	Societies	Benefited	Tubewells	Built	(cents/50 gl)
Ahlone	1	345	1	1985/86	10
Dawbon	3	450	1	1990/91	30
			1	1991/92	N 14 14
<u> </u>			1	1993/94	
Mayangone	2	67	6	1977-89	35
Mingalardon	1	20	1	1994/95	35
North Okklapa	4	450	4	89-99	25
South Okklapa	2	255	2	88-90	20
Thaketa	2	550	2	75-87	20
Thingangyun	5	1767	5	89-98	30

Source: Ministry of Co-operatives

#### Table K.4 Revenue Forecasts and Actuals, Water Supply & Sanitation Department

		Actual (million Kyats)						
Year	Revenue Forecast (mil	Govt Depts	Private customers	Connection fee	Other	Total		
1991/92	Kyats)	20.87	27.75	8.34	1.09	58.05		
1992/93		27,87	35.77	10.34	3.09			
1993/94	1	28.42	44,4	11.02	1.25	85.09		
1994/95		44.63	96.77	19.55	2.68	163.63		
1995/96		48.77	193.61	59.52	9.39	311.29		
1996/97	405	58.45	206.86	74.39	8.95	348.65		
1997/98	500	58.02	282.41	125.7	6.64	472.77		
1998/99	600	63.4	244.81	104.34	13.18	425.73		
1999/00	600	74.44	259.47	201.02	17.59	552.52		
2000/01	660	69.44	249.47	194.02	16.63	529.56		

Source: Finance and Administrative Division

## Table K.5 Expenditure Forecasts and Actuals, Water Supply & SanitationDepartment

	Expenditure Foreca		ecast (million Ky	ats) Actual Expenditure (million Kyats)				
Year	Salary & Wages	Overhead Charges	Maintenance	Total	Salary & Wages	Overhead Charges	Maintenance	Total
1991/92	16.07	19.83	13.22	49.12	10.2	19.19]	19.75	49.14
1992/93	15.75	29.23	16.2	61.18	13.3	22.9	18.55	54.75
1993/94	17.8	27.48	17.7	62.98	15.95	25.44	16.58	57.97
1994/95	18.3	33.12	20.7	72.12	15.62	32.38	15.14	63.14
1995/96	19.1	36.22	22.2	77.52	14.85	34.55	17.63	67.03
1996/97	18.8	37.65	23.2	79.65	14.54	35.16	23.96	73.66
1997/98	18.8	37.56	23.5	79.86	14.66	52.65	31.27	98.58
1998/99	18.8	47.56	31.6	97.96	15.6	84.34	43.64	143.58
1999/00	18.8	60.5	32.3	111.6	18.01	92	47.34	157.35
2000/01	18.8	76.1	30.3	125.2	73.00	108.02	59.91	240.93

Source: Finance & Administrative Division, YCDC

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Component	Description
Participants	Corporate staff; senior managers and professionals; junior
	professionals; township professional and other rank staff;
	administrative and account staff; staff doing minor role; new
	recruits
Subject	Determine subjects for training considering the new and
	existing functions of staff throughout the department.
	Include engineering, other subjects (planning, monitoring,
	data collection and analysis, customer education, etc.) and
	administrative and accounting subjects.
Training types	Pre-service, in-service; on-the-job; short and long-term
	in country and overseas;
Training facility	Assessment of current hardware and software facilities
	prevail in and around the City, investigate quality, adequacy
	and availability; cost
Syllabus	Assess syllabus and course contents for different types of
· · · · · ·	training; examine the extent to which they address to current
:	needs, identify strengths and areas for improvement
Resources	Evaluate current allocation, adequacy and problems
Evaluation of training	Present evaluation of training; formats; identify data needs
	and develop new formats

### Table K.6 Components for Training Needs Assessment

<u>Appendix K</u>

#### Table K.7 Education and Awareness Needs by Customer Types

Customer Type	Aim
Customers with water connections and	Education and training on proper water
especially free water customers	use, reduction of waste, control of UfW use,
	basic knowledge on O&M tasks etc.
	Educate paid customers on cost of water,
	the calculation of water bills and of the
	need for prompt payment of bills
Free water customers	Educate free water customers on the value
	of water and solicit their cooperation to use
	this resource effectively and economically
All customers	Awareness on water production,
	distribution costs and cost of maintenance
	of the supply network
Customers of communal tanks, and lakes	Sanitary and hygienic education on water
and ponds	use, safe drinking water, treatment
	methods etc.
Customers of communal tanks, ponds and	Secure the participation of users for
lakes	cleaning of tanks, ponds and lakes, and
	adding chemicals to clean / purify water.
School children	General awareness about City water
	supply and water sanitation
Community organizations	Value of drinking water; water
	conservation, sanitary and hygienic
	education
All water users	Status of City water supply and planned
·	improvements
	· · · · · · · · · · · · · · · · · · ·

#### Table K.8 Project Cost by Main Institutional Element

Activity Area	Unit	Approximate Cost
Planning, Programming & Monitoring	\$	31,500
Human Resources Strengthening	\$	794,500
Department staff cost	Ks.	50,420,000
Operation, Maintenance & Repairs	\$	255,000
Strengthening Legislative & Regulatory Matters	\$	3,500
Information & Education Materials	\$	5,500
Building Customer/Client Relations	\$	55,800
Training	\$	32,400
	\$	1,178,200
Grand Total	Ks.	50,420,000

Note: All cost items are to be reviewed when more reliable data of the proposed development work is known

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Item	Project Cost	2002	2003 (	2004 (	2005	2006 (	2007	2008	2009	2010	2011	2012	2013	2014	2015
Personal services (Cost in	794,500	109,000	587,500	53,000		15,000			1	30,000					
Local staff cost (Ks.)	50,420,000	308,000	2,784,000	2,784,000	2,784,000	2,784,000	2.784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	#######	#######
Equipment (\$)	225,000		30,000	195,000		1		1							1
Buildings (\$)	85,000		20,000	65,000					F					1	
Training workshops (\$)	11,900	200	2,400	2,900	400	400	400	400	400	400	400	400]	400	400	400
IE materials (\$)	6,000			6,000				ļ				1		1	
NGO contracts (\$)	55,800	)	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100
Total (\$)	1,178,200	109,200	643,000	325,000	3,500	18,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Total (Ks.)	50,420,000	308,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	2,784,000	#######	#######

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## Table K-9 Distribution of Institutional Development Cost by Project Year

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## APPENDIX L

INITIAL ENVIRONMENTAL EXAMINATION

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## APPNDIX L INITIAL ENVIRONMENTAL EXAMINATION

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**1** MYANMAR LAWS RELATING TO ENVIRONMENT

#### 1.1 ADMINISTRATIVE SECTOR

- 1. The Territorial Sea and Maritime Zones Law, 1977
- 2. The Emergency Provisions Act, 1950
- 3. The Essential Supplies and Services Act, 1947
- 4. The Police Act, 1945
- 5. The Poison Act, 1919
- 6. The Explosive Substances Act, 1908
- 7. The Town Act, 1907
- 8. The Village Act, 1907
- 9. The Yangon Police Act, 1899
- 10. The Explosives Act, 1887
- 11. The Panel Code, 1861 of Offence Affecting the Public Health, Safety, Convenience, Decency and Morals.

#### 1.2 AGRICULTURE AND IRRIGATION SECTOR

- 12. The Plant Pest Quarantine Law, 1993
- 13. The Pesticide Law, 1990
- 14. The Embankment Act, 1909

#### 1.3 CULTURE SECTOR

15. The Protection and Preservation of Cultural Heritage Region Law, 1998

#### 1.4 CITY DEVELOPMENT SECTOR

- 16. The Development Committees Law, 1993
- 17. The Mandalay City Development Law, 1992
- 18. The City of Yangon Development Law, 1990 (Amended in 1995 and again in 1996)
- 19. The Underground Water Act, 1930
- 20. The Water Power Act, 1927
- 21. The City of Yangon Municipal Act, 1992
- 22. The Yangon Water-works Act, 1885

#### 1.5 FINANCE & REVENUE SECTOR

23. The Myanmar Insurance Law, 1993

#### 1.6 FORESTRY SECTOR

- 24. The Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law, 1994
- 25. The Forest Law, 1992

#### 1.7 HEALTH SECTOR

- 26. The National Food Law, 1997
- 27. The Traditional Drug Law, 1996
- 28. The Prevention and Control of Communicable Diseases Law, 1995
- 29. The National Drug Law, 1992
- 30. The Union of Myanmar Public Health Law, 1972

#### 1.8 HOTEL AND TOURISM SECTOR

31. The Myanmar Hotel and Tourism Law, 1993

#### 1.9 INDUSTRIAL SECTOR

- 32. The Private Industrial Enterprise Law, 1990
- 33. The Factories Act, 1951
- 34. The Oilfield (Worker and Welfare) Act, 1951
- 35. The Petroleum Act, 1934
- 36. The Oilfields Act, 1918

#### 1.10 LIVESTOCK AND FISHERIES SECTOR

- 37. The Animal Health and Development Law, 1993
- 38. The Freshwater Fisheries Law, 1992
- 39. The Myanmar Marine Fisheries Law, 1990 (Amended in 1993)
- 40. The Law Relating to Aquaculture, 1989
- 41. The Law Relating to the Fishing Rights of Foreign Fishing Vessels, 1989 (Amended in 1993)

#### 1.11 MINING SECTOR

- 42. The Myanmar Gemstone Law, 1995
- 43. The Myanmar Pearl Law, 1995
- 44. The Myanmar Mines Law, 1994
- 45. The Salt Enterprise Law, 1992
- 46. The Land Acquisition (Mines) Act, 1885

#### 1.12 SCIENCE AND TECHNOLOGY SECTOR

47. The Science and Technology Development Law, 1994

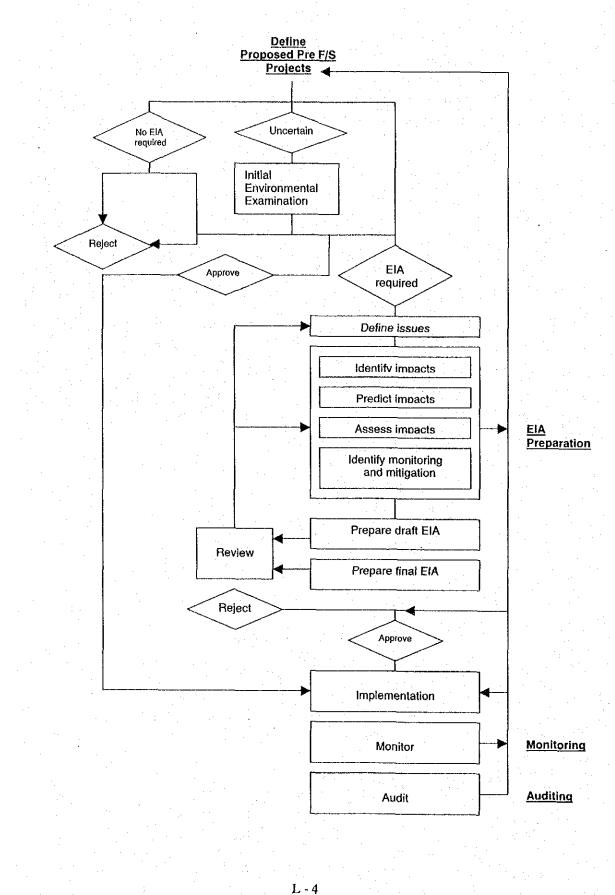
#### **1.13 TRANSPORTATION SECTOR**

- 48. The Highway Law, 2000
- 49. The Motor Vehicle Law, 1964

(The Law amending the Motor Vehicle Law of 1964 enacted in 1989)

- 50. The Myanmar Aircraft Act, 1934
- 51. The Inland Steam Vessels Act, 1917
- 52. The Port Act, 1908
- 53. The Defile Traffic Act, 1907
- 54. The Yangon Port Act, 1905
- 55. The Canal Act, 1905
- 56. The Obstruction in Fairways Act, 1881





Appendix L

#### SAMPLE OF SCOPING CHECKLIST OF EIA

Project name/location Enumerator's name Assessment: 1st /2nd/

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Date \_\_\_\_\_\_Sheet 1 of 3

For each potential	Po	sitive Imp	acts	Nej	gative Imp	acts
Environmental effect place (X)	Non	Minor	Majar	Non	Minor	Majar
Hydrology						
• Low flow regime			· · ·			
• Flood regime						
• Operation of dam						·
• Water table level		· · · · · ·				
• Surface water quality						
• Ground water quality						
• Eutrophication						• •
Pollution						
• Noise						
<ul> <li>Agrochemicals</li> </ul>						
• Organic pollution						
• Anaerobic effects						
• Gas emission						
Soils					· · · · ·	
Salinization			·			
• Soil properties						
• Water logging						
• Erosion	н н н					
• Soil Fertility						. 1
Soil Productivity	· .					
Sediments						
• Local erosion						
• Hinterland effect						
• River morphology						
• Channel engine						•
• Sedimentation			1.14			
• Estuary erosion			· .			

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For each potential	Pos	sitive Imp	acts	Ne	gative Imp	acts
Environmental effect place (X)	Non	Minor	Majar	Non	Minor	Majar
Ecology				-		
<ul> <li>Projects lands</li> </ul>						
• Water bodies			· · ·			
• Surrounding area						
• Valleys and slopes					-	
• Wetlands and plains					· · ·	
• Wildlife						
• Vegetation						
• Climate						
Socio-Economic						
<ul> <li>Population change</li> </ul>				· ·		
• Income		· · ·			· · ·	1. 1. 1. 1.
• Employment					- -	·
• Arable agriculture		-				· ·
• Settlement		-			- -	
• Recreational sites						
Historical and archaeology site						
Livestock raising		·····				
• Tourism						
• Infrastructure				· · · · ·		÷.
• Fishing		······································				
• Land tenure		•.				:
Health						
<ul> <li>Water and sanitation</li> </ul>						
• Nutrition						
Relocation effect				:		
• Disease effect						
<ul> <li>Disease ecology</li> </ul>						· · · ·
<ul> <li>Disease control</li> </ul>					1 1 1 1	· · ·
• Disease hazards						

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<u>Appendix L</u>

					S	heet 3of 2
For each potential	Po	sitive Imp	acts	Ne	gative Imp	acts
Environmental effect place (X)	Non	Minor	Majar	Non	Minor	Majar
Imbalances						
• Pests and weeds		· ·				
• Animal disease						
• Aquatic weeds			11			
<ul> <li>Structural damages</li> </ul>						

.

• St ١g

• Animal imbalances

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# APPENDIX M ECONOMIC AND FINANCIAL ANALYSIS

# APPNDIX M ECONOMIC AND FINANCIAL ANALYSIS

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## Appendix M.1 Average Household Income and Expenditure by Township

			Average					Household	expenditur	e -						Detail of	f expenditu	ures on	utilities			_
Name of township	Average family size (persons)	Working member (persons)	HH income (Kyat/ month)	Food and beverage	Clothing	House rent and repairs	Utilities	Charity and ceremonials		Transport- ation	Medical care	Tax	Total	Potable water	Waste water disposal	Solid waste disposal	Telephor c	<sup>n</sup> Gas	Electricit	Fuel	Total	Bala
01 Ahlone	5:00		29,586	23,571	<b>.</b> 1,571	343	2,919	2,171	3,957	3,214	1,286	0	39,034	179	0	- 45	657	- 24	1.657	357	2.919	A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.
02 Bahan		01,73	85,464	25,091	3,545	327,	10,583	1,773	7,864	3,773	1,909	0	54,865	204	0		2,218	183	7,941	000000000000000000000000000000000000000	<sup>°</sup> ₩₩₩₩	ener en en
03 Botataung	4.63	L.63	47,125	11,938	738	0	3,344	675	1,188	3.313	813	0	22,007	127	0	180	975	0	2,063	0		
04 Dagon	6.43	1.14	24,971	40,071	639	186	9,099	2,500	4;357	2,443	1,514	552	61,361	439	0	53	1.186	226	7,000	197		
05 Dagon Myothit East	6.44	2.33	48,144	21,889	711	433	3,764	583	5,822	3,173	1,156	0	37,532	1,009	46	22	756	422	736	772	3,764	10.
06 Dagon Myothit North	5.23	2.69	49,947	20,154	338	415	3,466	1,692	2,308	2,892	562	2,054	33,882	1,035	60	32	715	172	615	838	3,466	
07 Dagon Myothit Seikkan	5.20	1.60	70,240	24,200	1,000	1,660	3,740	1,600	4,800	1,740	2,200	80	41,020	1,360	85	30	400	150	959	756	3,740	
08 Dagon Myothit South	6.11	2.64	28,404	16,304	429	354	2,660	546	1,204	1,786	836	60	24,177	857	24	16	214	54	184	1,311	2,660	
09. Dala	5.13	2.06	13,844	8,875	531	0	2,389	225	1,219	706	456	0 O	14,402	152	0	0	0	0 ···	513		2,389	
10 Dawbon	6.00	1 27	32,055	24,182	L,009	564	3,526	1,255	3,641	2,473	1,341	226	38,216	1,055	0		182	227	513	1,518	3.526	-6
11 Hlaing	4.83	I.43	31,841	26,565	1,437	1,253	3,461	1,739	3,357	3,548	2,430	891	44,681	711	0	48	298	*111*	1,47,1	822	3,461	-1
12 Hlaingthaya	6.71	2.29	29,492	16,750	375	254	3,178	558	1,717	1,577	463	20	24,891	175	0	0	38	7	338	2,621	3,178	4.
3 Insein	593	1.93	40,413	28,696	1,267	254	3,598	1,374	5,707	2,957	3,872	· 920	48,643	289		40	698,	429	E,355	787	3,598	-8
14 Kamayut	6.36	2.07	34,321	8,643	757	21	2.342	371	2,964	2,150	1,329	. 91	18,669	212	15	90	538	119	775	593	2,342	1
5 Kyauktada	5.17	1.33	45,233	41,667	1,217	317	3,889	1,750	2,567	1717	933	0	54,056	146	0	60	1 217	0	1.867	600	3,889	-8
6 Kycemyindaing	5.81	1 25	39.088	20,000	606	87	3,616	1,194	7.344	3713	5.406	0	41.965	148	0	70	538	448	1,894	519	3,616	2
7 Lanmadaw	4 14	1.14	69,443	25,000	2,557	229	2,957	1,671	10,714	9.600	2,357	7.471	62,557	262	Ō	51	943	486	1,100	114	ego, of eo - e - e - e -	
8 Latha	3.20	1.60	30.400	33,700	000	114	3,799	900	1.600	1.500	1.400	448	24:461	149		196	554	:200	2 700	0	3.799	5
19 Mayangone	5.17	1.00	37,079	23,483	610	234	3.419	1.621	4,310	2,400	914	121	37.112	198	0	30	297	100	1.357		3:419	ŵ
20 Mingalardon	5.50	2.00	34,257	15,938	615	63	2,473	479	2.096	2.048	174	85	23,970	146	1	33	882	21	407	20 da de 1973	2,473	10200.0
21 Mingalartaungnyunt	5.56	1.56	31,125	15,375	425	24	1.776	356	1.219	2.219	469	0	21:863	148	0	135	563	0	931	0	1.776	and the second sec
22 North Okkalapa	6.27	2.16	45.876	20,722	622	123	2.258	444	2.184	1.760	650	928	29.693	354	14	25	138	62	393		2,258	
23 Pabedan	5.25	2.50	39,350	18.000	1.100	198	1.920	500	625	250	1.250	1.300	25,143	210	. 100	50	325	0	1:225	0	1.920	
24 Pazundaung	4.29	1.57	18,100	9.643	586	1.500	2.241	471	429	1.786	343		16.998	132	. ĩ	180	1.071	ŏ	857	0	2.241	St. 11.
25 Sanchaung	3,62	1.08	42,615	15,538	854	831	3.019	1,577	1,485	2.608	1,731	846	28,488	140	15	45	880	615	1.140		5,019	
26 Seikan Port	3.04	(10 <b>00</b> ))))	0.749740.0	(0,000,		001	3,015		1,40,5	2,000		040	20,400	66. <b>67 Y</b> (* )	0.040.000	00000000		0.5		102	2,013	
27 Seikkyi Kanaungto	6.67	1.33	19,575	19.333	1,200	267	2742	6 999	7 600	0.400	2.067	0	42.275	0	0	0	100	0	275	a a ca	2.742	~
In the second	ALL AND ALL ALL ALL ALL ALL ALL ALL ALL ALL AL						2,742	6,733	7,500	2,433				• •	-	-		Ŷ			2,742	
28 Shwepyitha	4.67	) 48	30,715	10,324	299	1,627	2,825	350	1,495	857	576	375	19,228	. 117	2	50	310	199	400	an 10 wa	2,825	0.0000
29 South Okkalapa	5.58	2.17	19,541	10,942	1,046	59	1,825	523	1,354	810	722	334	17,616	226	48	88	202	73	500	5000 - CO C MAR	1,825	
30 Tamwe	5.67	2,00	36,461	19,389	311	0	2,395	378	667	3,472	467	0	27,079	179	0	144	389	0	1.183	500	2,395	
31 Thaketa	6.05	1,74	19,861	32,474	221	13	707	276	-934	2,046	200	0 	16,872	119	4 	89	71	0	332	92	707	2
32 Thingangyun	5.97		83,015	28,017	2,424	3,610	5,813	3,328	6,428	4,738	2,305	3,167	57.830	638	136	120	470	524	3,076	850		
33 Yankin	6.50	2.00	48,750	21,917	675	0	4,008	1,083	792	2,792	.683	0	31,949	264	0	135	900	0	2,083		4,008	
verall average	5.44	1.76	39,260	19, <b>965</b>	960	480	3,430	1,272	3,245	2,578	1,338	562	33,829	367	17	67	585	152	1,492	761	3,430	5
verage in HHs who connect with CDC water supply systems	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	. 0	0	
verage in HHs who do not innect with YCDC water supply	6.01	1.95	38,692	19,343	819	1,026	3,620	959	3,017	2,184	1,392	503	32,862	579	23	38	411	163	1,079	1,393	3,686	5,
er capita income in overall averag	ge .	-	22,364	1			•													· · ·	· · · · ·	
Note 1)				-			(Note 2)	;														
Average in HHs who connect	with YCD	C water sup	oply system	ns.			Average	in HHs who	do not conn	ect with	Expenditure	No. of	•									
Average in HHs both who co					supply syst	ems.	YCDČ	water supply s	vstems		(Kyat/mth)	samples										
Average in HHs who do not o								oiped water			841	6	•									
				,				n Tube Well			827	ģ										
								af also soull			17	,										

Protected dug well

Private water tanker

Neighbor's tap/well Bottled water

3 2 31

24

13

1,025 1,512

1,052

Sources: Result of Consumer Survey made by JICA Study Team, July 2001.

## Appendix M.2 Basic Unit for Estimation of Saved Amount of Medical Expenditure

Number of cases in overall diseases     Outpatients* Inpatients     Death     Total point       Prove of hospital streetive does as in total 2000/02     241,871     227,218     10,355     237,573     469,089     12,71%     100,00%       Revenue of hospital streetive does as in total 2000/02     434,588     92,60%     366,40       2000/02     600,000     Amount of medical 620,000     expenditure to be save amount allocated to water borne diseases (Thousand Kyats/annum)     39,166     5,873       Average amount allocated to water borne diseases (Thousand Kyats/annum)     39,166     5,873     500       Year     Diarhoea     Dysentery     Viral hepatitis     Typhoid     Total       1991     24,828     19,565     657     161     40,725       1992     24,523     15,355     657     161     40,725       1993     26,613     14,649     660     236     41,978       1995     28,349     10,380     670     224     39,623       1996     24,649     8,209     444     210     35,512		· .	ng Amount		***************************************	Inpat	ionts incl.	death*	Total	Share rate	(As of 1998 Percentage
Foral administration       241,871       227,218       10,355       237,573       4469,899       12.71%       100.00%         Water borne disease in total       34,701       7.40%       34,701       7.40%         Others       434,388       92.60%       83.90       33.90       33.90         1999900       368.40       600.00       Amount of medical       600.00       Amount of medical         2001/02       600.00       Amount of medical       620.00       expenditure to be save         Average onial allocated to water borne diseases (Thousand Kyats/annum)       39,168       5,875         Source: * Hospital Statistics Annual Report 1998, Ministry of Health.       ***       100.00%       Year       10anhoea Dysentery       Viral hepatitis       Typhoid       Total       100.00%       10.91%       30,76         1992       24,552       15,355       657       161       40,725       10.919       13.80.4649       82.09       19.68       19.91       33.90       30%       10.96%       10.96%       10.96%       10.96%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%       10.91%<	Numbe	r of cases i	n overall di	seases	Outpatients*	Inpatients	Death	Total			-
Water borne disease in total         34,701         7.40%           Others         434,388         92.60%           Revenue of hospituls received consisting of treatment charges, and subsidies (Million Kyats)**         33.90           1999K99         368.40           2000/01         600.00         Amount of medical           2001/02         620.00         expenditure to be save           Annual average since 1999/00         529.47         by clean water supply           Verage amount allocated to water borne diseases (Thousand Kyats/annum)         39.168         5,875           Source:         * Hospital Statistics Annual Report 1998, Ministry of Health.         (Note 2)         water environment consisting of clean water supply and sewerage         clean water supply and sewerage         clean water supply and sewerage         30%           Year         Diarrhoen         Dysentery         Viral hepatitis         Typhoid         Total         improved ratio of water borne         diseases by inprovement of           1992         24,542         15,355         657         161         40,728         improved ratio of water borne         diseases by clean water supply: of the about site is indeveloping         10%           1995         28,349         10,380         670         224         39,623         improved ratio of water borne	-		angon(as of	1998)		•		· · · ·			
Others434,38892.60%Revenue of hospitals received consisting of treatment charges, and subsidies (Million Kyats)**33.901999/00368.402000/01600.00Annual average since 1999/0052.947Average amount allocated to water borne diseases (Thousand Kyats/annum)39,168Source:* Hospital Statistics Annual Report 1998, Ministry of Health.** Hospital Statistics Annual Report 1998, Ministry of Health.(Note 2)** Mainstry of Health.(Note 2)** Mainstry of Health.Total199128,80819,68674924449,487199224,55215,355199326,43314,649199430,71111,826199528,4048,209199420,71111,826199524,6498,209199420,71111,826199524,6498,209199430,71111,826199720,2538,112199720,2538,11248919629,050199817,9887,0403661625,575199915,6155,78730015621,858200014,7216,399199430,71419844449,487199720,253199817,98817,99720,253199817,989199928,108199817,989199430,616 <td>Fotal admini</td> <td></td> <td></td> <td></td> <td>241,871</td> <td>227,218</td> <td>10,355</td> <td>237,573</td> <td>-</td> <td>12.71%</td> <td>100.00%</td>	Fotal admini				241,871	227,218	10,355	237,573	-	12.71%	100.00%
Revenue of hospitals received consisting of treatment charges, and subsidies (Million Kyats)** 1998/99 1998/90 33.90 2000/01 2000/01 2000/02 4000.00 Anount of medical 2001/02 4000 4000 4000 4000 4000 4000 4000 4			ne disease i	n total							7.40%
1998/99       33.90         1999/00       368.40         2000/01       600.00         2001/02       620.00         Annual average since 1999/00       529.47         Source:       * Hospital Statistics Annual Report 1998, Ministry of Health.       (Note 2)         ** Ministry of Health.       (Note 2)         ** Mainistry of Health.       (Note 1)         Water Borne Diseases in Yangon       (Note 2)         Year       Diarnhoea       Dysentery         1992       24,522       15,355         1993       26,683       166       749         1992       24,522       15,355       657       161       40,725         1993       26,433       14,649       660       236       41,978         1994       30,711       11,826       821       193       43,551         1993       24,649       8,209       444       210       35,123         1996       24,649       8,209       444       210       35,123         1997       15,053       5,112       489       96       20,050         1998       17,088       7,040       366       161       25,575         1999							· · · · · · · · ·			· · · · ·	92.60%
1999/00     368.40       2000/01     600.00       Annual average since 1999/00     52.947       Verage anount allocated to water borne diseases (Thousand Kyats/annum)     39,168       Source: * Hospital Statistics Annual Report 1998, Ministry of Health.     (Note 2)       ** Ministry of Health.     (Note 2)       Water Borne Diseases in Yangon     (Note 2)       Year Diarnoca Dysentery     Viral hepatitis       1991     28,508     19,686       1992     24,525     15,355       1992     24,525     15,355       1993     26,433     14,649       1994     30,711     11,826       1995     23,404     10,300       1995     23,404     10,300       1995     23,404     10,300       1996     24,649     8,009       1997     20,233     8,112     489       1996     23,001     11,826     821       1997     20,233     8,112     489       1998     17,988     7,040     386       1999     15,615     5,787     300       1998     17,988     7,040     366       1999     15,615     5,787       1999     15,615     5,787       1999     15,615	Revenue of l	-	ceived cons	sisting of tr	eatment charg	ses, and subs	idies (Mil	lion Kyats)**			
2000/02 G0.00 Amount of medical 2001/02 G0.00 Amount of medical 2001/02 G0.00 S29.47 by clean water supply 39.168 S.875 (Note 2) Source: * Hospital Statistics Annual Report 1998, Ministry of Health. Source: * Hospital Statistics Annual Report 1998, Ministry of Health. (Note 1) Water Borne Diseases in Yangon Viral 1991 28,808 19,686 749 244 49,487 Similar projects in developing 1992 24,552 15,355 657 161 40,725 1993 26,433 14,649 660 236 41,978 1994 30,711 11,826 821 193 43,551 1994 30,711 11,826 821 193 43,551 1996 24,649 8,209 444 210 33,512 1997 20,253 8,112 489 196 29,050 1996 17,946 9,8209 444 210 33,512 1997 20,253 8,112 489 196 29,050 1998 17,988 7,040 336 161 25,575 1999 15,615 5,787 300 156 21,858 2000 14,721 6,399 338 194 21,652 Average 3,208 10,744 551 198 34,701 Source: Ministry of Health. (Note) ** In Myammer, they have no health insurance systems until present time. 8. Saved Amount of Income to be decreased by water borne disease Average duration of stay of inpatients: Total number of days of outpatients visited to hospitals: Total number of days of outpatient strendances: 576,756 Average number of outpatient attendances: 576,756 Average number of outpatient strendances: 2,383 Total number of outpatient strendances: 2,383 Average number of outpatient strendances: 576,756 Average number of outpatient attendances: 2,383 Average number of outpatient strendances: 2,383 Average number of outpatient strendances: 2,383 Average number of outpatient attendances: 2,383 Average number of outpatient strendances: 2,383 Average number of outpatient strendances: 2,383 Average number of outpatient strendances Average numb										•	•
2001/02     620.00     expenditure to be save Annual average since 1999/00     5875       Verage amount allocated to water borne diseases (Thousand Kyats/annum)     39,168     5,875       Source: * Hospital Statistics Annual Report 1998, Ministry of Health.     (Note 2)     Improved ratio of water borne       ** Ministry of Health.     (Note 2)     Improved ratio of water borne     30%       Year     Diarhoen     Dysentery     Viral     Total       1991     28,808     19,686     749     244     49,487       1992     24,552     15,355     657     161     40,725       1993     26,433     14,649     660     236     41,978       1994     30,711     11,826     821     193     43,551       1995     28,349     10,380     670     224     39,623       1996     24,649     8,209     444     210     33,512       1997     20,233     8,112     489     196     29,050       1998     17,788     7,040     386     161     25,575       1999     15,615     5,787     300     156     21,858       2000     14,721     6,399     338     194     21,652       Average duration of stay of inpatients:     7,7573     Av											c 11 1
Annual average since 1999/00     529.47     by clean water supply Average amount allocated to water borne diseases (Thousand Kyats/annum)     5875       Average amount allocated to water borne diseases (Thousand Kyats/annum)     39,168     5,875       Average amount allocated to water borne diseases in Yangon     (Note 2)     (Note 2)       ** Ministry of Health.     (Note 2)     (Note 2)       Water Borne Diseases in Yangon     (Note 2)     (Inproved ratio of water borne diseases by improvement of water environment consisting of 2004 24,331     30%       1991     28,808     19,686     749     244     49,487       1992     24,552     15,355     657     161     40,725       1993     26,431     14,469     600     236     41,978       1994     30,711     11,826     821     193     43,551       1995     28,449     8,209     444     210     35,512       1997     20,253     8,112     489     196     29,050       1998     17,988     7,040     386     161     25,575       1999     15,615     5,787     300     156     1,858       2000     14,721     6,399     338     194     21,652       Average     Average     23,64     8,01     (days/annu											
Average amount allocated to water borne diseases (Thousand Kysts/annum)       39,168       5,875         ** Hospital Statistics Annual Report 1998, Ministry of Health.       ** Ministry of Health.       (Note 2)         ** Ministry of Health.       improved ratio of water borne diseases by improvement of water environment consisting of 1991       28,808       19,686       749       244       49,487       improved ratio of water borne diseases by improvement of water environment consisting of 214,552       30%         1991       28,808       19,686       749       244       49,487       improved ratio of water borne diseases by improvement of water environment consisting of 214,978       improved ratio of water borne diseases by improvement of water borne fiseases by 24,552       15,355       657       161       40,725         1993       26,433       14,649       660       236       41,978       improved ratio of water borne diseases by clean water supply: of the abov         1995       28,349       10,380       670       224       39,623       improved ratio of water supply: of the abov         1996       24,649       8,209       444       210       33,512       improved ratio of stay of inpatients:         1999       15,615       5,787       300       156       21,858       2000       idy annual         Note) ** In Myanumer, they have no health insuran				1000/00							
Source:       * Hospital Statistics Annual Report 1998, Ministry of Health.       (Note 1)         ** Ministry of Health.       ** Ministry of Health.       Improved ratio of water borne         Year       Diarnhoea       Dysentery       Viral         hepatitis       Typhoid       Total         1991       28,808       19,686       749       244       49,487         1992       24,532       15,355       657       161       40,725         1993       26,433       14,649       660       236       41,978         1994       30,711       11,826       821       193       43,551         1995       28,449       10,380       670       224       39,623         1996       24,649       8,209       444       210       33,512         1997       20,253       8,112       489       196       29,050         1998       15,615       5,787       300       156       21,858         2000       14,721       6,399       338       194       21,652         Average duration of stay of inpatients:       Total number of algos of outpatients:       37,573         Average number of days of outpatient attendances:       576,756					···· (T1 ····						
** Ministry of Health.         Improved ratio of water borne diseases by improvement of water environment consisting of clean water supply and sewerage treatment systems based on similar projects in developing.       30%         Year       Diarrhoea       Dysentery hepatitis       Yiral hepatitis       Typhoid       Total         1991       28,808       19,686       749       244       49,487         1992       24,552       15,355       657       161       40,725         1993       26,433       14,649       660       236       41,978         1994       30,711       11,826       821       193       43,551         1995       28,349       10,380       670       224       39,623         1996       24,649       8,209       444       210       33,512         1997       20,253       8,112       489       166       25,575         1999       15,615       5,787       300       156       21,858         2000       14,721       6,399       33,81       94       21,652         Average       23,208       10,744       551       198       34,701         Source: Ministry of Health.         Note 1								(Mate 2)	39,108	5	513
Note 1)       Water Borne Diseases in Yangon       diseases by improvement of water supply and sewerage treatment systems based on similar projects in developing       30%         1991       28,808       19,686       749       244       49,487       similar projects in developing       30%         1992       24,552       15,355       657       161       40,725       indexer supply and sewerage treatment systems based on similar projects in developing       30%         1994       30,711       11,826       821       193       43,551       Improved ratio of water borne       50%         1995       28,349       10,380       670       224       39,623       Improved ratio of water borne       50%         1996       24,649       8,209       444       210       33,512       Improved ratio of water supply: of the abov         1997       20,253       8,112       489       196       29,050       Improved ratio of water supply: of the abov         1998       17,988       7,040       386       161       25,575       Improved ratio of stay of inpatients:       Source: Ministry of Health.         Note) ** In Myammer, they have no health insurance systems until present time.       3.400       Average duration of stay of inpatients:       8.01 (days/annut Average number of outpatient stisted to hospitals:				пиат керот	1 1998, Minis	ary of Heatt	n.		d ratio of w	ter borne	·····
Water Borne Diseases in Yangonwater environment consisting of clean water supply and severage treatment systems based on similar projects in developing30%199128,80819,68674924449,487(dam water supply and severage treatment systems based on similar projects in developing30%199224,55215,35565716140,725Improved ratio of water borne diseases by clean water supply: of the abov50%199326,43314,64966023641,978Improved ratio of water borne diseases by clean water supply: of the abov199430,71111,82682119343,512Improved ratio of water borne diseases by clean water supply: of the abov199528,54910,38067022439,623Improved ratio of water borne diseases50%199720,2538,11248919629,050Improved ratio of water supply: of the abov199720,2538,11248919621,652Average per year23,20810,74455119834,701Source: Ministry of Health.Insurance systems until present time.8.8.Raverage duration of stay of inpatie8.01 (days/annuVerage duration of stay of outpatient attendances: Days of outpatient systed to hospitals: Total number of outpatient set of hospitals: Total number of outpatient attendances: Days and deaths:576,756Average number of outpatient attendances: Basic unit of income to be decreased caused by water		winnstry (	л пеани.								
YearDiarrhoeaDysentery hepatitisViral hepatitisTyphoidTotal treatment systems based on199128,80819,68674924449,487199224,55215,35565716140,725199326,43314,64966023641,978199430,71111,82682119343,551199528,34910,38067022439,623199624,6498,20944421033,512199720,2538,11248919629,050199817,9887,04038616125,575199915,6155,78730015621,858200014,7216,39933819421,652Average per year23,20810,74455119834,701Source: Ministry of Health.Note) ** In Myammer, they have no health insurance systems until present time.3.3. Saved Amount of Income to be decreased by water borne disease40/482Vverage number of atient days:1,903,482Number of odischarges and deaths:237,573Average number of outpatient svisited to hospitals: Total number of outpatient attendances:576,756Average number of outpatient attendances:2,383Total number of outpatient attendances:2,383Total number of outpatient per day:2,324 (Kyats/working person per annum)2.38 clays/mont3.148 (Kyats/working person per annum)36sic unit of income per perso	Note 1)	Water Bo	mo Dicoucou	in Vanco							
YearDiarrhoea Dysentery hepatitisTypholdTotalTotal199128,80819,68674924449,487199224,55215,35565716140,725199326,43314,64966023641,978199430,71111,82682119343,551199528,34910,38067022439,623199624,6498,20944421033,512199720,2538,11248919629,050199817,9887,04038616125,575199915,6155,78730015621,858200014,7216,39933819421,652Average23,20810,74455119834,701Source: Ministry of Health.503,482Number of patient days:1,903,482Number of fatend tays:1,903,4821,903,482Number of days of outpatients visited to hospitals:Total number of outpatient attendances:576,7562,383Average number of days of outpatients per day:2,3832,383Total number of outpatient attendances:23,6342,383Cotal number of outpatient per day:2,364(Kyats/working person per annum)Basic unit of saved amount of income to be decreased caused by water borne diseases:1,017Basic unit of saved amount of income to be decreased caused by water borne diseases:2,384Basic unit of income per person*:2,3641,017 <td>··· .</td> <td>Water BO</td> <td>ine Diseases</td> <td>s ni i angoi</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td>30%</td>	··· .	Water BO	ine Diseases	s ni i angoi						-	30%
1991       28,808       19,686       749       244       49,487       similar projects in developing         1992       24,552       15,355       657       161       40,725       Improved ratio of water borne       50%         1993       26,433       14,649       660       236       41,978       Improved ratio of water borne       50%         1994       30,711       11,826       821       193       43,551       Improved ratio of water supply:       of the abov         1995       28,349       10,380       670       224       39,623       Improved ratio of water supply:       of the abov         1997       20,253       8,112       489       196       29,050       Improved ratio of water supply:       of the abov         1998       17,988       7,040       386       161       25,575       Improved ratio of supply:       of the abov         Average       23,208       10,744       551       198       34,701         Source: Ministry of Health.       Source: Ministry of Health.       Note) ** In Myammer, they have no health insurance systems until present time.         8. Saved Amount of Income to be decreased by water borne disease       40,6756       Average number of outpatients visited to hospitals:         Total number of o		Year	Diarrhoea	Dysentery	,	Typhoid	Total				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1001	28.808	10.686	الناسب المستحالية ا	244	10 187		2		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								sinnar_p	rojects in a	eveloping	50%
1994       30,711       11,826       821       193       43,551       Indexes by clean water supply: of the above the abo								Improved	d ratio of wa	ater borne	30%
1995       28,349       10,380       670       224       39,623         1996       24,649       8,209       444       210       33,512         1997       20,253       8,112       489       196       29,050         1998       17,988       7,908       7,998       7,999       336       161       25,575         1999       15,615       5,787       300       156       21,858         2000       14,721       6,399       338       194       21,652         Average       23,208       10,744       551       198       34,701         Source: Ministry of Health.       Source: Ministry of Health.       Note) ** In Myammer, they have no health insurance systems until present time.         8. Saved Amount of Income to be decreased by water borne disease            Verage duration of stay of inpatients:       Total number of patient days:       1,903,482          Number of days of outpatients visited to hospitals:       Total number of outpatient attendances:       576,756         Average number of outpatient attendances:       576,756        2,383         Total number of outpatient attendances caused by water borne disease:       2,383        2.38       (days/annu								diseases t	oy clean wat	er supply:	of the abov
$\frac{1996}{1997} 20,253 \ 8,112 \ 489 \ 196 \ 29,050 \ 29,050 \ 1998 \ 17,988 \ 7,040 \ 386 \ 161 \ 25,575 \ 1999 \ 15,615 \ 5,787 \ 300 \ 156 \ 21,858 \ 2000 \ 14,721 \ 6,399 \ 338 \ 194 \ 21,652 \ Average \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,208 \ 10,744 \ 551 \ 198 \ 34,701 \ ger year \ 23,753 \ Average \ 40 \ 40 \ 40 \ 40 \ 40 \ 40 \ 40 \ 4$											
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$											
$\frac{1998}{17,988} \frac{17,988}{7,040} \frac{386}{161} \frac{25,575}{25,755}$ $\frac{1999}{15,615} \frac{5,787}{300} \frac{156}{21,858}$ $\frac{2000}{14,721} \frac{6,399}{338} \frac{194}{21,652}$ Average 23,208 10,744 551 198 34,701 Source: Ministry of Health. Note) ** In Myammer, they have no health insurance systems until present time. 3. Saved Amount of Income to be decreased by water borne disease Average duration of stay of inpatients: Total number of patient days: 1,903,482 Number of discharges and deaths: 237,573 Average number of outpatients visited to hospitals: Total number of outpatients visited to hospitals: Total number of outpatient attendances: 576,756 Average number of outpatient attendances caused by water borne disease 241,871 Average number of days of outpatient attendances caused by water borne disease: Basic unit of income to be decreased caused by water borne diseases: Basic unit of income to be decreased caused by water borne diseases: Basic unit of income to be decreased caused by water borne diseases: Basic unit of income to be decreased caused by water borne diseases: Basic unit of income per person*: 22,364 (Kyats/month) = 1,017 (Kyats/day', (22 working days/mont) - Total income loss of inpatient per annum: 2,424 (Kyats/working person per annum there of working person per annum there of working person per annum the start and on working person per annum there of working person per annum there of working person per annum there of working person per annum the start attendances the person set the start attendance to the start attendance to the decreased caused by water borne diseases: Basic unit of income per person*: 22,364 (Kyats/working person per annum the start attendance to the person set the start attendance to											
$\frac{1999  15,615  5,787  300  156  21,858}{2000  14,721  6,399  338  194  21,652}$ Average 23,208 10,744 551 198 34,701 per year 23,208 10,744 551 198 34,701 Source: Ministry of Health. Note) ** In Myammer, they have no health insurance systems until present time. 3. Saved Amount of Income to be decreased by water borne disease Average duration of stay of inpatients: Total number of patient days: 1,903,482 Number of days of outpatients visited to hospitals: Total number of outpatient strendances: 576,756 Average number of outpatient attendances: 576,756 Average number of outpatient attendances: 2383 Total number of outpatient attendances caused by water borne disease 241,871 Average number of income to be decreased caused by water borne disease: Basic unit of saved amount of income to be decreased caused by water borne diseases: Basic unit of income per person*: 22,364 (Kyats/month) = 1,017 (Kyats/day, (22 working days/monther of the top inpatient per annum: 7,012 lincome loss of outpatient per annum: 2,424 (Kyats/working person per annum) Share rate of working persons per HH*(%): 32.29%											
2000       14,721       6,399       338       194       21,652         Average       23,208       10,744       551       198       34,701         Source: Ministry of Health.       Source: Ministry of Health.       Note) ** In Myammer, they have no health insurance systems until present time.         3. Saved Amount of Income to be decreased by water borne disease       Average duration of stay of inpatients:         Total number of patient days:       1,903,482         Number of discharges and deaths:       237,573         Average number of days of outpatients visited to hospitals:       Total number of outpatient attendances:         Total number of outpatient attendances:       576,756         Average number of outpatient attendances:       2,383         Total number of outpatient attendances caused by water borne disease       2,383         Total number of outpatient attendances caused by water borne disease       2,383         Total number of outpatient attendances caused by water borne diseases:       2,383         Basic unit of income to be decreased caused by water borne diseases:       2,384 (days/annumer)         Basic unit of income per person*:       22,364 (Kyats/month) =       1,017 (Kyats/day) (22 working days/month)         Total income loss of inpatient per annum:       2,424 (Kyats/working person per annum)       2,424 (Kyats/working person per annum)				•					. *		
Average       23,208       10,744       551       198       34,701         Source: Ministry of Health.       Source: Ministry of Health.       Note) ** In Myammer, they have no health insurance systems until present time.         3. Saved Amount of Income to be decreased by water borne disease       Average duration of stay of inpatients:       Total number of patient days:       1,903,482         Number of discharges and deaths:       237,573       Average duration of stay of inpatie       8.01 (days/annu         Average number of days of outpatients visited to hospitals:       Total number of outpatient attendances:       576,756         Average number of outpatient attendances caused by water borne disease       2,383       2.38 (days/annu         Basic unit of saved amount of income to be decreased caused by water borne diseases:       Basic unit of income to be decreased caused by water borne diseases:       1,017 (Kyats/day) (22 working days/mon 8,145 (Kyats/working person per annum)         Total income loss of inpatient per annum:       2,29%       32.29%       32.29%								•		: .	
per year       23,208       10,744       551       198       34,701         Source: Ministry of Health.       Source: Ministry of Health.         Note) ** In Myammer, they have no health insurance systems until present time.         3. Saved Amount of Income to be decreased by water borne disease         Average duration of stay of inpatients:         Total number of patient days:       1,903,482         Number of discharges and deaths:       237,573         Average duration of stay of outpatients visited to hospitals:       576,756         Total number of outpatients per day:       2,383         Total number of outpatient attendances:       576,756         Average number of outpatient attendances caused by water borne disease       241,871         Average number of outpatient attendances caused by water borne disease       241,871         Average number of income to be decreased caused by water borne diseases:       2.38 (days/annu)         Basic unit of saved amount of income to be decreased caused by water borne diseases:       1,017 (Kyats/day, (22 working days/mon         Basic unit of income per person*:       22,364 (Kyats/working person per annum);       2,424 (Kyats/working person per annum);         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum);         Share rate of working person per HH*(%):       32.29%       32.29%			· · · · · · · · · · · · · · · · · · ·					-		1	
Source: Ministry of Health.         Note) ** In Myammer, they have no health insurance systems until present time. <b>8. Saved Amount of Income to be decreased by water borne disease</b> Average duration of stay of inpatients:         Total number of patient days:       1,903,482         Number of discharges and deaths:       237,573         Average duration of stay of inpatie       8.01 (days/annul         Average number of days of outpatients visited to hospitals:       576,756         Total number of outpatients per day:       2,383         Total number of outpatient attendances:       576,756         Average number of outpatient attendances caused by water borne disease       241,871         Average number of outpatient attendances caused by water borne disease       2.38 (days/annul         Basic unit of income to be decreased caused by water borne diseases:       Basic unit of income to be decreased caused by water borne diseases:         Basic unit of income per person*:       22,364 (Kyats/month) =       1,017 (Kyats/day) (22 working days/monthola income loss of inpatient per annum:         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)			23,208	10,744	551	198	34,701				
Note) ** In Myammer, they have no health insurance systems until present time.         3. Saved Amount of Income to be decreased by water borne disease         Average duration of stay of inpatients:         Total number of patient days:       1,903,482         Number of discharges and deaths:       237,573         Average duration of stay of inpatients visited to hospitals:       Average duration of stay of inpatie       8.01 (days/annul         Average number of days of outpatients visited to hospitals:       576,756         Average number of outpatient attendances:       576,756         Average number of outpatient attendances caused by water borne disease       241,871         Average number of outpatient attendances caused by water borne disease       241,871         Average number of days of outpatient per annum:       2,383         Total number of outpatient per person*:       22,364 (Kyats/month) =         Basic unit of income per person*:       22,364 (Kyats/month) =         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%			finistry of H	lealth	·····						
3. Saved Amount of Income to be decreased by water borne disease         Average duration of stay of inpatients:         Total number of patient days:       1,903,482         Number of discharges and deaths:       237,573         Average duration of stay of inpatie       8.01 (days/annul         Average number of days of outpatients visited to hospitals:       576,756         Total number of outpatient attendances:       576,756         Average number of outpatient attendances caused by water borne disease       241,871         Average number of days of outpatient attendances caused by water borne disease       241,871         Average number of days of outpatient attendances caused by water borne disease       2.38 (days/annul         Basic unit of saved amount of income to be decreased caused by water borne diseases:       1,017 (Kyats/day) (22 working days/mon         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%	Note) ** In				nsurance syste	ems until or	sent time	·····		· · ·	
Average number of days of outpatients visited to hospitals:       576,756         Total number of outpatient attendances:       2,383         Total number of outpatient attendances caused by water borne disease       241,871         Average number of outpatient attendances caused by water borne disease       241,871         Average number of outpatient attendances caused by water borne disease       2.38 (days/annul         Basic unit of saved amount of income to be decreased caused by water borne diseases:       2.38 (days/annul         Basic unit of income per person*:       22,364 (Kyats/month) =       1,017 (Kyats/day) (22 working days/month)         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%       32.29%		ation of sta Total num	y of inpatie	ents: ent days:		1,903,482	<u>e</u>				
Total number of outpatient attendances:       576,756         Average number of outpatients per day:       2,383         Total number of outpatient attendances caused by water borne disease       241,871         Average number of outpatient attendances caused by water borne disease       241,871         Average number of days of outpatients visited to hospitals       2.38 (days/annue)         Basic unit of saved amount of income to be decreased caused by water borne diseases:       32,29%         Basic unit of income loss of outpatient per annum:       1,017 (Kyats/day) (22 working days/mon         Total income loss of outpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%							Average d	luration of sta	iy of inpatie	8.01	(days/annui
Average number of outpatients per day:       2,383         Total number of outpatient attendances caused by water borne disease       241,871         Average number of days of outpatients visited to hospitals       2.38 (days/annut)         Basic unit of saved amount of income to be decreased caused by water borne diseases:       2.38 (days/annut)         Basic unit of income per person*:       22,364 (Kyats/month) =       1,017 (Kyats/day) (22 working days/month)         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%	verage nur										· · · · ·
Total number of outpatient attendances caused by water borne disease       241,871         Average number of days of outpatients visited to hospitals         2.38 (days/annul         Basic unit of saved amount of income to be decreased caused by water borne diseases:         Basic unit of income per person*:       22,364 (Kyats/month) =         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%								576,756			
Average number of days of outpatients visited to hospitals         2.38 (days/annul         Basic unit of saved amount of income to be decreased caused by water borne diseases:         Basic unit of income per person*:       22,364 (Kyats/month) =         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%										÷	
Basic unit of saved amount of income to be decreased caused by water borne diseases:       2.38 (days/annul         Basic unit of income per person*:       22,364 (Kyats/month) =         Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%		Total nun	iber of outp	atient atten	dances caused	l by water b	orne diseas	se 241,871		· · · ·	
Basic unit of saved amount of income to be decreased caused by water borne diseases: Basic unit of income per person*: 22,364 (Kyats/month) = 1,017 (Kyats/day) (22 working days/mon Total income loss of inpatient per annum: 8,145 (Kyats/working person per annum) Total income loss of outpatient per annum: 2,424 (Kyats/working person per annum) Share rate of working persons per HH*(%): 32.29%					2		Average n	number of day	s of outpati		•
Total income loss of inpatient per annum:8,145 (Kyats/working person per annum)Total income loss of outpatient per annum:2,424 (Kyats/working person per annum)Share rate of working persons per HH*(%):32.29%		f saved am	ount of inco	me to be d	ecreased caus	ed by water	borne dise	ases:			
Total income loss of inpatient per annum:       8,145 (Kyats/working person per annum)         Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%	Basic unit o					22,364	(Kyats/month)	)= 1,017	(Kyats/day	) (22 workin	g days/mont
Total income loss of outpatient per annum:       2,424 (Kyats/working person per annum)         Share rate of working persons per HH*(%):       32.29%	Basic unit o		ome loss of i	inpatient pe	er annum:						
Share rate of working persons per HH*(%): 32.29%	Basic unit o										
		Total inco	ome loss of		per annum:			2,424	(Kyats/wor	king person	per annum)

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																4		sbursement	(Phase 1)														
Cost item		2001			2002			2003			2004			2005			2006			2007	···· · •		2008			2009			_2010		·· ·	Total	
	FC	ic s	Sob-Islat	æ	LC	Sub-cotal	R <sup>-</sup>	LC	Sub-total	RC	ιc	Sale-total	RC	LC	Sub-Intal	- RC	LC	Sub-(otal	PC	LC L	Sub-coat	RC .	LC	Sub-true	8C	2.0	Schungel	R	LC	Sub-total	PC:	ιc	Schule
Construction works	_																																
Direct cosi	0	0	0	0	0	. 0	1	0 0	0				25,086					100,574			69,504	110,790				16,594	102,994	110,979		130,067	511,583	78,193	
Intirect cost	0	. 0	0	0	0	0		0 0	0	5,565	415	5.981	5,770	510	6,280			23,132	14,606		15,986					3.817	23.689	25,525		29,915	117,664	17,984	
Sub-total	0	0	0.	0	0	0		0 0	0	29,759	_		30,856		33.584	111.472		123,706	78,112		B5,490	136,272		163,995		20.411	126.683			159,982	629,247		
Engineering cost	<u> </u>		0	0	0			0 0		0	<u></u>	0	<u> </u>	0	0		0	0	7,694	0	7,694	34,760	0	14,760	11,401	0	11,401	14,398	0	14,398	48,253	- 0	48.2
Compensation cost	<u> </u>	0	0	0	0	0		0 0	0	0	0	0	0	0	6	0	0	0	0	•	0		0			0	138.084			0	677,501	96,177	
Sub total	<u> </u>	0	0		0	0		0 0		29,759		the statement of the st	30.856	_	33,384	111,472	14,434	123,706	85,806		93,184	151,031	21,123	178,754	117,673	20,411	138.084		23,476	174,581		90.111 A	
Administration	<u> </u>	<u> </u>	0	0	<u>0</u>	0		0 0	0	0	0	0	0	0	0	0	0	0	0	7.270	01.100	161 031	1 11	100 744	0	10 411	138.085	0	77 470	174.391	672.601	96,181	
Sub total Physical contingency	0	0	<u> </u>	0	0	0		0 0	0			31,985	30,856			111.472		123,706	85,806		93,185	151,031			117,673		6,904		1,174	174,381	677,501 33,875	4,809	
Paysical contingency Financial cost	0		<u> </u>			0		0 0		1,488	111	1,599	1,543	136	1.679	5,574	612	6.185	4,290	369	4,659	7,552		8,938	5,884 123,557	1.021	144,989	158,448		183.101	711,376		
iconomic cost		0	<u> </u>	0	<u>_</u>			<u>e o</u>	0	31,247			32,399			117,046						128.363			123.557		121,934	142.603		154,949	640,238	50,575	
Paconomic cost		0	0	0	0	0		0 0	0	28,122	1,171	29,293	29,159	1,435	30,394	105,341	0,433	111,774	81,087	3,860	84,907	144,725	14,578	157,592	111,201	10,755	121,954	142,003	12.340	134,949	040,238	30,373	0.0.2
																																(	USSI
																7		shuesement	(Phase 2)														_
Cost item		2011			2012			2013			2014			2015			2016			2017			2018			2019			2020		····	Total	
	PC	LC S	Sub-total	PC	LC	Sub-total	RC	LC	Sub-tutal	PC	ιc	ડાનન્લ્સ	PC	LC	Sub-tetal	FC	ι¢	Sub-total	PC	LC	Sub-court	R.	LC	Sub-total	37	ιc	Sub-cotal	FC	LC	Sch-total	PC*	١C	Solw
Construction works		·····																					~										
Direct cost	31,851	6,560	38,471	29,333			20,79	8 2,645	23.443	6,961	1,818	8,779	15,438	4,021	19,459	15,299	4,674	19,973	59,462	11,345	70,807	83,915	18,872	102,787	114,456	21.033	135,489		1.758	8,609	384_64		
Indirect cost	7,326	1,509		6,747	1.524	8,271	4,78	4 608	5,392	1,601		2,019	3,551	925	4,476	3,519	1,075	4,594	13,676	2.609	16,286	19,300	4,341	23,641	26.325	4.878	31,162	1,576	404	1,980	88,404	18.251	
Sub-total	39,177	8,069		36,080	8,151	44,231		2 3,253	28,835	8,562	2,236	10,798	18,989	4,946	23,935	18,818	5,749	24,567	73,138	13,954	87,093	103,215	23,213	126.428	140,781	25.871	166.651		2,162	10,589		97.604	
Engineering cost	4,252	0	4,252	3,981	0	3,981	2,59	5 0	2,595	972	0	972	2,154	0	2.154	2,211	0	2,211	7,838	0	7,838	11,379	0	11,379	14,999	0	14,999	953	0	953	51,333	U	<u>_ 5i.</u>
Compensation cost	0	Ó	0	0	0	0		0 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sub total	43,429	8,069	51,498	40,060	8,151	48,212	28.17	7 3,253	31,430	9.534	2,236	11,770	21,143	4,946	26,089	21,029	5,749	26,778	80.977	13,954	94,931	114,594	23,213	137,807	155,780	25,871	181,650	9,380	2,162	11.542		97,604	621,
Administration	0	1	1	0	0	0		0 0	0	0	0	0	0	0	0	0	0	0	0	1	1	Ô	1	1	0	1	1	0	1	1	0	3	
Sub total	43,429	8,069		40,060													5,749	26,778	80,977			114,594			155,780		181,651		2,163		524,101		
Physical contingency	2,171		2,575	2,003	408	2,411	1,409			477	112	589	1,057	247	1.304	1,051	287	1,339	4,049	698		5,730	[,16]	6,890	7,789		9,083	-469	108	577	26,205	4,880	
Financial cost	45.600	8,473		42,063								12,359	22.200			22,080	6,037	28,117			99,678	120,324			163,568		190,733	9,849		12.120	550,306		
Economic cost	41,040	4,243	45,284	37,857	4,286	42,143	26,623	7 1,711	28,338	9,010	1.176	10,186	19,980	2,601	22.581	19,872	3.023	22,895	76,523	7.338	83,861	108,291	12,206	120,497	147,212	13.604	160,815	8,364	1,138	10,001	495,276	51,326	. 46.0
Remarks:															· · -																		
<ol> <li>Price share rates:</li> </ol>	FC	LC	6.	Operation		nienance o																	(000,12		Price : As o								
- Labour	0.0%	80.0%		OM work			200	04 2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		2019					.00 = 500 X						
<ul> <li>Equipment and</li> </ul>	100.0%	20.0%		Personal o			4		5	5	6	6	6	6	7	7	7	. 7	7	7	7	9	9		Physical co					of the abov	·c)		
<ol><li>Tax for construction</li></ol>	and engine		es	Electricity			10		89	117	144	144		16	216	233	233	233	239	239	239	239	295	10.	Indirect cos	::		23%	(of direc	Leost)			
		10%		Chemical			19	2 192	605	600	928	928	8,666	8,666	8,666	8,666		8,677	8,677	8,677		8,677											
<ol> <li>Contractor's overheat</li> </ol>		10%		Inspection		ing cost					791			345	1.076		989	401	1,076		989	7,301			(Equivalent		Kyats)			cial cost i			
4. Standard conversion				Financial				7 207	694		1,869	1,078						9,318	9,999	8,923		16.225		12.	Engineering	COST:		9%	(of direc	and indire	set conit.)		
5. Shadow wage raic (c	conomic w			Economic	cost		10	4 104	348	362	936	540	4,451	4,624	4,990	4.460	4,955	4,666	5,007	4,468	4.964	8,126	15.483										
		50%		Remarks:																													
				Gyobyu:			Phugyi									Ngamoyeil			CBDTE		4,708												
				East Block				ul to CB:		Hlaing W			Transmi	aion:	7,042	₩est Bloc	k N:	875	East Bloc	k N:	558												
				West Bloc	ck S:	225	East B	lock C:	900	West Blo	ick C:	217																					

# Appendix M.3 Annual Disbursement of Construction Cost and Estimation of Its Economic Cost

#### Appendix M.4 Calculation of Economic Internal Rate of Return in Phase-1

car		a an	E	conomic (	cosl	alar ya mana dalaraka dalar <sub>al</sub> anta da		Economi	c benefit	******	<u>(US\$1,00</u>
n.	Year ·	Construc	tion cost		Replace	· · · · ·	Potable	Saving of			Cash
u der	i cai ·	F/C	L/C	OM cost	ment	Total	water	medical	income	Total	balanc
		portion	portion		cost		supply	expenditur	loss		
	2001	0	0	0	0	0	0	0	0	0	0
0		0	0	0	0	0	0	0	0	0	0
	2003	0	0	0	0	0	· · · 0	0	0	0	0
2		28,122	1,171	104	0	29,397	8,705	. 3	6	8,713	-20,68
3		29,159	1,435	104	0	30,698	11,631	3	8	11,643	-19,05
4		105,341	6,433	348	0	112,122	24,635	7	17	24,659	-87,46
5	2007	81,087	3,880	362	0	85,329	25,648	8	17	25,673	-59,65
6		142,725	14,578	936	0	158,238	26,660	8	18	26,686	-131,55
7	2009 2010	111,201 142,603	10,733	540	0	122,474	27,678	8	19	27,705	-94,76
9	2010	142,003	12,346	4,451 4,451	0	159,400	43,318	13	29	43,361	-116,03
10		0	0 0	4,847	0	4,451 4,847	43,318 43,318	13 13	29 29	43,361	38,910
10		ő	0	4,847	0	4,647 4,451	43,318	13	29	43,361 43,361	38,51
12		ŏ	0	4,451	0	4,451	43,318	13 ~	29	•	38,910
	2015	õ	Ő	4,451	0	4,451	43,318	13	- 29	43,361 43,361	38,910 38,910
14	2016	Ő	Ŭ	4,847	0	4,847	43,318	13	29	43,361	38,51
15		ŏ	· Ő	4,451	0	4,451	43,318	13	29	43,361	38,91
16		Ŏ	Õ	4,451	ŏ	4,451	43,318	13	29	43,361	38,91
17	2019	Ŭ j	õ	4,451	õ	4,451	43,318	13	29	43,361	38,91
18	2020	0	Ō	4,847	Õ	4,847	43,318	13	29	43,361	38,51
19	2021	0	0	4,451	0	4,451	43,318	13	29	43,361	38,91
20	2022	0	0	4,451	0	4,451	43,318	13	29	43,361	38,910
21	2023	0	0	4,451	0	4,451	43,318	13	29	43,361	38,910
22		0	0	4,847	0	4,847	43,318	13	29	43,361	38,51
23		0	0	4,451	0	4,451	43,318	13	29	43,361	38,91
24	2026	0	0	4,451	0	4,451	43,318	13	29	43,361	38,91
	2027	0	0	4,451	0	4,451	43,318	13	29	43,361	38,91
26				4,847	0	4,847	43,318	13	29	43,361	38,513
27				4,451	0	4,451	43,318	13	29	43,361	- 38,910
28				4,451	241,785	246,235	43,318	13	29	43,361	-202,83
29				4,451	0	4,451	43,318	13	29	43,361	38,91
30				4,847	0	4,847	43,318	13	29	43,361	38,51
31	2033 2034			4,451	0	4,451	43,318	13	. 29	43,361	38,91
33				4,451	0	4,451	43,318	13	29	43,361	38,910
34				4,451 4,847	0	4,451 4,847	43,318	13	29 29	43,361	38,910
	2037			4,451	Ö	4,451	43,318 43,318	13	29	43,361	38,51
36				4,451	Ő	4,451	43,318	13	29	43,361	38,910
	2039			4,451	ŏ	4,451	43,318	13	29	43,361 43,361	38,91
	2040			4,847	Ö	4,847	43,318	13	29	43,361	38,910
	2041			4,451	Õ	4,451	43,318	13	29	43,361	38,910
	2042			4,451	õ	4,451	43,318	13	29	43,361	38,910
	2043			4,451	Ō	4,451	43,318	13	29	43,361	38,910
	2044			4,847	0	4,847	43,318	13	29	43,361	38,51
	2045			4,451	0	4,451	43,318	13	29	43,361	38,910
	2046			4,451	0	4,451	43,318	13	29	43,361	38,91
	2047			4,451	0	4,451	43,318	13	29	43,361	38,910
	2048			4,847	0	4,847	43,318	13	29	43,361	38,51
	2049			4,451	0	4,451	43,318	13	29	43,361	38,916
	2050				241,785	246,235	43,318	13	29	43,361	-202,87
	2051			4,451	0	4,451	43,318	13	29	43,361	38,910
	2052	•		4,847	0	4,847	43,318	13	29	43,361	38,51
	2053			4,451	0	4,451	43,318	13	29	43,361	38,910
	2054			4,451	0	4,451	43,318	13	29	43,361	38,910
	2055			4,451	0	4,451	43,318	13	29	43,361	38,910
	2056			4,847	. 0	4,847	43,318	13	29	43,361	- 38,513
	2057			4,451	0	4,451	43,318	13	29	43,361	38,910
	2058			4,451	0	4,451	43,318	13	29	43,361	38,910
	2059			4,451	0	4,451	43,318	13	29	43,361	38,910
	2060	(10 000	60 575	4,847	0	4,847	43,318	13	29	43,361	38,51
tal		640,238 ion of disc	50,575	234,538	483,569	1,408,920	2,334,193	691	1,584	2,336,467	927,54

Internal rate of return (EIRR):

B/C:

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## Appendix M.5 Calculation of Economic Internal Rate of Return in Phase-2

(Note) Sunk cost is assumed at 0.5 % of replacement cost until the year 2020. (US\$1,000)

Yea	ar	-	Constant		conomic	cust	·	Potable	Economic Service of			Cash
in	i Y	car -	Construc F/C	L/C	·	Replace-	<b>m</b> 1		Saving of	-	m . I	Cast
orde	er				OM cost	ment cost	Total	water	medical	income	Total	balan
			portion	portion	~			supply	expenditur	loss		
		001	0	0	0	0	0	0	0	0	0	0
	0 20		0	0	. 0	0	0	0	0	0	0	0
	1 20		0	0	0	0	0	0	0	0	0	0
	2 20		0	0	0	0	0	0	0	0	0	0
		005	0	0	0	0	0	0	0	0	0	0
•		006	0	0	0	0	0	0	0	0	0	0
		007	0	0	. 0	0	0	0	0	0	0	0
		800	0	0	0	0	0	0	0	0	0	0
	7 20		0	0	0	0	0	0	. 0	0	0	0
	8 2		0	0	0	0	0	0	0	0	0	0
		011	41,040	4,243	173	0	45,457	1,257	0	1	1,258	-44,1
	10 20		37,857	4,286	143	0	42,286	2,514	1	1	2,516	-39,7
	11 20		26,627	1,711	9	0	28,347	3,770	I	2	3,773	-24,5
	12 20		9,010	1,176	504	0	10,690	5,027	1	3	5,030	-5,6
		015	19,980	2,601	216	0	22,796	7,183	2	4	7,189	-15,6
		016	19,872	3,023	160	0	23,056	9,196	• 2	5	9,203	-13,8
	15 20		76,523	7,338	18	0	83,878	11,213	3	6	11,222	-72,6
	16 20		108,291	12,206	513	0	121,010	13,225	3	7		-107,7
	17 2		147,212	13,604	3,675	0	164,490	15,242	4	8		-149,2
	18 20		8,864	1,138	10,635	0	20,637	26,478	6	14	26,498	5,8
	19 20		0	0	8,327	0	8,327	26,478	6	14	26,498	18,1
	20 20		0	· 0	8,822	0	8,822	26,478	6	14	26,498	17,6
	21 20		0	0	11,983	0	11,983	26,478	6	14	26,498	14,5
	22 20		0	0	10,635	0	10,635	26,478	6	14	26,498	15,8
	23 20		0	0	8,327	0	8,327	26,478	6	14	26,498	18,1
	24 20		0	0	8,822	0	8,822	26,478	6	14	26,498	17,6
	25 20		0	0	11,983	0	11,983	26,478	6	14	26,498	14,5
	26 20				10,635	0	10,635	26,478	6	14	26,498	. 15,8
	27 20				8,327	0	8,327	26,478	6	14	26,498	18,1
	28 20				8,822	0	8,822	26,478	6	14	26,498	17,6
	29 20				11,983	0	11,983	26,478	6	14	26,498	14,5
	30 20				10,635	• 0 •	10,635	26,478	6	14	26,498	15,8
	31 20		·		8,327	0	8,327	26,478	6	14	26,498	18,1
	32 2				8,822	0	8,822	26,478	6	14	26,498	17,6
	33 24		1		11,983	0	11,983	26,478	6	14	26,498	14,5
	34 2				10,635	0	10,635	26,478	. 6	14	26,498	15,8
	35 2				8,327	0	8,327	26,478	6	14	26,498	18,1
	36 2				: 8,822	0	8,822	26,478	6	14	26,498	17,6
	37 2				11,983	0	11,983	26,478	6	14	26,498	14,5
	38 2		1.1		10,635	191,311	201,946	26,478	6	14		-175,4
	39 2				8,327	0	8,327	26,478	6	14	26,498	18,1
	40 2				8,822	0	8,822	26,478	6	14	26,498	17,6
	41 2				11,983	0	11,983	26,478	6	14	26,498	14,5
	42 20				10,635	. 0	10,635	26,478	6	14	26,498	15,8
	43 20				8,327	0	8,327	26,478	6	14	26,498	18,1
	44 2				8,822	0	8,822	26,478	6	14	26,498	17,6
	45 2				11,983	. 0	11,983	26,478	6	14	26,498	14,5
	46 2				10,635	0	10,635	26,478	6	14	26,498	15,8
	47 2				8,327	0	8,327	26,478	6	14	26,498	18,1
	48 2				8,822	0	8,822	26,478	6	14	26,498	17,6
	49 2			· .	11,983	0	11,983	26,478	6	14	26,498	14,5
	50 2			•	10,635	. 0	10,635	26,478	6	4	26,498	15,8
	51 2		· · ·		8,327	0	8,327	26,478	6	14	26,498	18,1
	52 2				8,822	0	8,822	26,478	6	14	26,498	17,6
	53 2			•	11,983	0	11,983	26,478	6	14	26,498	14,5
	54 2		-		10,635	0	10,635	26,478	6	14	26,498	15,8
	55 2				8,327	0	8,327	26,478	6	14	26,498	18,1
	56 2				8,822	0	8,822	26,478	6	14	26,498	17,6
	57 2				11,983	0	11,983	26,478	6	14	26,498	14,5
	58 2		1.1		10,635	191,311	201,946	26,478	6	14		-175,4
	592				8,327	0	8,327	26,478	6	14	26,498	18,1
	60 2		· · · · ;		8,822	.0	8,822	26,478	6	14	26,498	17,6
. (	612	063			11,983	0	11,983	26,478	6	14	26,498	14,5
	622				10,635	0	10,635	26,478	6	14	26,498	15,8
	63 2				8,327	0	8,327	26,478	6	14	26,498	18,1
	642				8,822	0	8,822	26,478	6	14	26,498	17,6
	65 2			1.1	11,983	0	11,983	26,478	6	14	26,498	14,5
	66 2				10,635	0	10,635	26,478	6	14	26,498	15,8
	67 2		· · · ·		8,327	. Õ	8,327	26,478	6	14	26,498	18,1
	68 2		18 12	10 20	8,822	<sup>1</sup> 0	8,822	26,478	· 6	14	26,498	17,6
Tot			495,276	51,326	#######	382,621	1,439,625	1,419,000		762	1,420,094	-19,5
_		ondit	ion of disc					-, .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	<u></u>			
	sent						138,554		н., ст. 15 1		57,470	-81,0
			of return (	EIRR):					-		,	-0.1
												0
B/C							M - 5					

ppendix M.6 Calculation of Economic Internal Rate of Return for Overall Project

				•							(US\$1,000)
Үсаг	-			Economic	cost			Economi		······································	
in	Year -	Construct F/C	L/C	OM cost	Replace-	Total	Potable	Saving of medical	Saving of	Tatal	Cash
order		portion	portion	OM COST	ment cost	Total	water supply	expenditur	income loss	Total	balance
-1	2001	0	0	. Û	0	0	0	0	0	0	0
		0	0	0	0	· 0	0	0	0	0	0
1	2003	0	0	0	0	0	0	0	0	0	0
2 3	2004 2005	28,122 29,159	1,171 1,435	· 104 104	0 0	29,397 30,698	8,705 11,631	2 3	5 7	8,712 11,642	-20,684 -19,056
4	2005	105,341	6,433	348	0	112,122	24,635	7	15	24,657	-19,050
5	2007	81,087	3,880	362	0	85,329	25,648	7	16	25,671	-59,658
6	2008	142,725	14,578	936	0	158,238	26,660	7	17	26,684	-131,554
7	2009	111,201	10,733	540	0	122,474	27,678	8	17	27,703	-94,771
8 9	2010 2011	142,603 41,040	12,346	4,451 4,624	0 0	159,400 49,907	43,318 44,575	12	27 28	43,357 44,615	-116,042 -5,292
10	2012	37,857	4,286	4,990	ŏ	47,134	45,832	12	29	45,873	-1,260
11	2013	26,627	1,711	4,460	0	32,798	47,089	13	29	47,131	14,333
	2014	9,010	1,176	4,955	0	15,141	48,345	13	30	48,388	33,248
13		19,980 19,872	2,601	4,666 5,007	0	27,247	50,501	14	32	50,547	23,300
14		76,523	3,023 7,338	4,468	0	27,903 88,329	52,514 54,531	14 15	33 34	52,561 54,580	24,658 -33,749
	2018	108,291	12,206	4,964	. 0	125,461	56,543	15	35	56,594	-68,867
17	2019	147,212	13,604	8,126	0	168,941	58,560	16	37	58,613	-110,328
		8,864	1,138	15,483	0	25,484	69,796	19	44	69,859	44,375
	2021 2022	0 0	· 0 0	8,327 8,822	· 0 0	8,327 8,822	69,796 69,796	19 19	44 44	69,859 69,859	61,532 61,037
	2023	· 0	0	11,983	0	11,983	69,796	19	44 44	69,859	57,876
22	2024	0	0	15,483	. 0	15,483	69,796	19	44	69,859	54,376
	2025	. 0	0	8,327	0	8,327	69,796	19	44	69,859	61,532
24	2026	0	0	8,822	0	8,822	69,796	19	44	69,859	61,037
	2027 2028	U	U	11,983 15,483	· · 0	11,983 15,483	69,796 69,796	19 19	44 44	69,859 69,859	57,876 54,376
27	2029			8,327	ŏ	8,327	69,796	19	44	69,859	61,532
	2030			8,822	243,565	252,387	69,796	19	44	69,859	-182,528
29	2031			11,983	0	11,983	69,796	19	44	69,859	57,876
30	2032 2033			15,483 8,327	0	15,483	69,796	19	44	69,859	54,376
				8,822	· 0 0	8,327 8,822	69,796 69,796	19 19	44 44	69,859 69,859	61,532 61,037
				11,983	ŏ	11,983	69,796	19	44	69,859	57,876
34				15,483	0	15,483	69,796	19	44	69,859	54,376
	2037			8,327	0	8,327	69,796	19	44	69,859	61,532
	2038 2039			8,822 11,983	0	8,822 11,983	69,796 69,796	19 19	44 44	69,859 69,859	61,037 57,876
	2040			15,483	191,311	206,793	69,796	19	44	69,859	-136,934
. 39	2041			8,327	0	8,327	69,796	19	44	69,859	61,532
	2042			8,822	0	8,822	69,796	19	44	69,859	61,037
	2043 2044	÷		11,983	0	11,983	69,796	19	44	69,859	57,876
	2044			15,483 8,327	0 0	15,483 8,327	69,796 69,796	19 - 19	44	69,859 69,859	54,376 61,532
	2046			8,822	· Ö	8,822	69,796	19	44	69,859	61,037
	2047			11,983	0	11,983	69,796	19	44	69,859	57,876
	2048			15,483	0	15,483	69,796	19	44	69,859	54,376
	2049 2050			8,327 8,822	0 241,785	8,327	69,796 69.796	19	44	69,859 60,850	61,532
	2050			11,983	241,765	250,607 11,983	69,796 69,796	19 19	44 44	69,859 69,859	-180,748 57,876
50	2052			15,483	Ő	15,483	69,796	19	44	69,859	54,376
	2053			8,327	. 0	8,327	69,796	19	44	69,859	61,532
	2054 2055			8,822	· 0	8,822	69,796	19	44	69,859	61,037
	2055			11,983 15,483	0 0	11,983 15,483	69,796 69,796	19 19	44 44	69,859 69,859	57,876 54,376
55	2057			8,327	0	8,327	69,796	19	44	69,859	54,570 61,532
56	2058			8,822	0	8,822	69,796	19	44	69,859	61,037
	2059			11,983	0	11,983	69,796	19	44	69,859	57,876
	2060 2061	· ·		15,483 8,327	191,311	206,793	69,796 60 706	19	44	69,859	-136,934
	2061			8,822	· 0 0	8,327 8,822	69,796 69,796	19 19	44 44	69,859 69,859	61,532 61,037
61	2063			11,983	. 0	11,983	69,796	19	44	69,859	57,876
62	2064			15,483	0	15,483	69,796	19	44	69,859	54,376
	2065			8,327	. 0	8,327	69,796	19	44	69,859	61,532
	2066 2067			8,822 11,983	0	8,822	69,796 60 706	19	44	69,859	61,037
	2067			15,483	0	11,983 15,483	69,796 69,796	19 19	44 44	69,859 69,859	57,876 54,376
	2069			8,327	0	8,327	69,796	19	44	69,859	54,370 61,532
	2070			8,822	241,785	250,607	69,796	19	44	69,859	-180,748
Total		########	No. of Concession, Name		1,109,755	2,968,279	4,186,376	1,141	2,616	4,190,133	
	condit nt valu	ion of disc	ount rate a	u 10%:		500 665				205 070	100 200
		e: of return (I	EIRR):			500,662				305,273	-195,389 3.73%
B/C:						N (					0.61
						M - 6					0.01

Name of township	Average family	Working	Average HH income		ness to pay o water suppl				of HHs v connect w water	ess to pay /ho do not /ith YCDC supply tems
	size (persons)	(persons)	(Kyat/ month)	Clean water supply	Drinkable water supply	24 hours water supply	24 hours clean water supply	24 hours drinkable water supply	Clean water not drinkable	Drinkable water supply
01 Ahlone	5.00	1.71	29,586	0	0	0	143	155	0	0
02 Bahan	4.91	1,73	85,464	280	290	310	243	282	200	300
03 Botataung	4.63	1,63	47,125	155	155	194	206		.0	0
04 Dagon	6.43	1.14	24,971	0	0	0	650	720	0	0
05 Dagon Myothit East	6.44	2.33	48,144	0	0	0	0	0	1,200	1,667
06 Dagon Myothit North	5.23	2.69	49,947	0	0	0	0	0	577	1,000
07 Dagon Myothit Seikkan	5.20	1.60	70,240	0	. 0	0	0	0	1,300	2,100
08 Dagon Myothit South	6.11	2.64	28,404	0	0	0	0	0	589	1,082
09 Dala	5.13	2.06	13,844		0	0	260	0	0	200
10 Dawbon	6.00	1.27	32,055	0	. 0	200	0	633	0	764
11 Hlaing	4.83	1.43	31,841	- Ö	0	0	0	655.	0	944
12 Hlaingthaya	6.71	2.29	29,492	0	0	0	0	0	1,000	268
13 Inscin	5,93	1,93	40,413	0	0	0	339	367	333	467
14. Kamayut	6.36	2.07	34,321	0	. 0		342	238	0	0
15 Kyauklada	5.17	1.33	45,233	0		0	400	460	0	0
16 Kyeemyindaing	5.81	1.25	39,088	0	0	• 0 :	160	181		300
17 Lanmadaw	4.14	1.14	69,443	0	500	. 0	640	600	0	0
18 Latha	3.20	1.60	30,400	0	0	0	. 283		0	0
19 Mayangone	5,17	1.00	37,079	0		0	511	450	0	560
20 Mingalardon	5.50	2.00	34,257	0	Q	0	490	1,200	126	224
21 Mingalartaungnyunt	5.56	1.56	31,125	170	177	201	228		0	0
22 North Okkalapa	6.27	2,16	45,876	267	367	0	432	517	320	506
23 Pabedan	5.25	2.50	39,350	0	0	. 0	0	363	0	0
24 Pazundaung	4.29	1.57	18,100	151	159	189	200	242	0	<b>0</b>
25 Sanchaung	3,62	1.08	42,615	100	120	140	175	208	0	0
26 Seikan Port										
27 Seikkyi Kanaungto	6.67	1.33	19,575	0	G	0	0	0	0	800
28 Shwepyiiha	4.67	1.48		0	0	0, .	350	0	264	414
29 South Okkalapa	5.58	2.17	19,541	100	200	0	340	150	500	520
30 Tamwe	5.67	2.00	36,461	189	194	229	246	264	0	0
31 Thaketa	6.05	1.74	19,861	150	156	194	203	253	0	0
32 Thingangyun	5.97	1,72	83,015	0	0	600	617	985	834	1,309
33 Yankin	6.50	2.00	48,750	150	150	200	200	250	0	0
Effective number of samples	<u> </u>	1.7/	20.240	73	74	72	241	175	123	169
Overall simple average	5.44	1.76	39,260	171	224	246	333	418	576	746
Average in HHs both who connect with and without YCDC water	5.41	1.78	36,404	171	185	222	321	383	150	300

#### Appendix M.7 Willingness of People to Pay by Case and Township

connect with YCDC water supply Per capita income in overall average

Average in HHs who do not

supply systems

Average in HHs who connect with YCDC water supply 

Average in HHs both who connect and do not connect with 380

Average in HHs who do not connect with YCDC water supply

Sources: Result of Consumer Survey made by JICA Study Team, July 2001.

6.01

1.95

38,692

22,364

0

0

0

0

0

.

559

797

<sup>(</sup>Note 1)

					Conve	ntional V	Vay for	Phase-1			~	
8X (18.83 A.1.80)				Financial d	cost		Fina	ancial ben	efit	(	( Cash balance	US\$1,000)
Year in	Ycar	Construc	tion cost		Replace-		Ontion	Option-	Ontion-			
order	) cai	F/C portion	L/C portion	OM cost	ment cost	Total	1	2	3	Option-1	Option-2	Option-3
- ]	2001	0	0		6 m. g. g. af an an a star and a said of the second second second second second second second second second se	0	0	0	0	0	0	0
0	2002	0	0			0	0	0	0	0	0	0
1 2	2003 2004	0 31,247	0 2,338	0 207	· .	0 33,792	0 2,170	0 3,941	0 4,569	-31,622	-29,851	-29,223
3	2005	32,399	2,865	207		35,471	2,590	4,703	5,452	-32,881	-30,768	-30,019
4	2006	117,046	12,846		•	130,586	4,772	8,664	10,045	-125,815	-121,922	-120,541
5	2007	90,097	7,747	723		98,567	4,856	8,818	10,224	-93,711	-89,749	-88,343
6 7		158,583 123,557	29,110 21,432			189,562 146,067	4,941 5,027	8,972 9,128	10,402 10,583	-184,621 -141,040	-180,590 -136,939	-179,159
8		158,448	24,653			191,988	7,670	13,927	16,147	-184,318	-178,061	-135,484 -175,841
9	2011	0	0			8,888	7,670	13,927	16,147	-1,218	5,039	7,259
10	2012	0	0	9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
11	2013	0	0	-,		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
12 13	2014 2015			8,888 8,888		8,888 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-1,218 -1,218	5,039 5,039	7,259 7,259
13	2015			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
15	2017			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
16	2018			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
17	2019			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
18 19	2020 2021			9,963 8,888		9,963 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-2,294 -1,218	3,963 5,039	6,184 7,259
20	2022			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
21	2023			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
22	2024			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
23	2025			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
24 25	2026 2027			8,888 8,888		8,888 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-1,218 -1,218	5,039 5,039	7,259 7,259
26	2028	·		9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
27	2029			8,888	· · · · ·	8,888	7,670	13,927	16,147	-1,218	5,039	7,259
28	2030			8,888	284,328	293,215	7,670	13,927	16,147	-285,546	-279,289	-277,068
. 29	2031			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
30 31	2032 2033			9,963 8,888		9,963 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-2,294 -1,218	3,963 5,039	6,184 7,259
32	2034			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
33	2035			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
34	2036			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
35	2037 2038			8,888 8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
36 37	2038			0,000 8,888		8,888 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-1,218 -1,218	5,039 5,039	7,259 7,259
38	2040			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
39	2041			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
40	2042			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
41 42	2043 2044			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
42 43	2044			9,963 8,888		9,963 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-2,294 -1,218	3,963 5,039	6,184 7,259
44	2046			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
45	2047			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
46	2048			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
47 48	2049 2050			8,888	004 200	8,888	7,670	13,927	16,147	-1,218	5,039	7,259
40 49	2050			8,888 8,888	284,328	293,215 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-285,546 -1,218	-279,289 5,039	-277,068 7,259
50	2052			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
51	2053			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
52	2054			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
53 54	2055			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
54 55	2056 2057			9,963 8,888		9,963 8,888	7,670 7,670	13,927 13,927	16,147 16,147	-2,294 -1,218	3,963	6,184
56	2058			8,888		8,888	7,670	13,927	16,147	-1,218	5,039 5,039	7,259 7,259
57	2059			8,888		8,888	7,670	13,927	16,147	-1,218	5,039	7,259
58	2060			9,963		9,963	7,670	13,927	16,147	-2,294	3,963	6,184
	otal				568,656	1,853,049	415,517	754,492	874,773	-1,437,532	-1,098,558	-978,276
In the Preser			count rat	e at 10%:		447,560	44 090	81,690	04 712	403 571	166 070	350 027
		of return	(FIRR):			11,000	77,709	01,070	24,713	-402,571 #DIV/0!	-365,870 #DIV/0!	-352,847 #DIV/0!
B/C;						14	0			0.10	0.18	

#### Appendix M.8 Calculation of Financial Internal Rate of Return in Conventional Way for Phase-1

0.10

0.18

0.21

In         Year         F/C           order         F/C         portior           -1         2001         0           0         2002         1           1         2003         2           2         2004         3           3         2005         4           3         2006         5           5         2007         6           6         2008         7           7         2009         8           2010         9         2011           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         222           24         2026         25	ction cost L/C portion 0 0 0 0 0 0 0 0 0 0 0 0 0	Ninancial c           OM cost           0           320           35           1,024           7,338           21,237	Replace- ment cost	Total 0 0 0 0 0 0 0 0 0 0 54,419 50,908 33,020 13,366 27,824		ncial ber Option- 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Option- 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Option-1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Cash balance Option-2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Option-3
In         Year         F/C           order         F/C         portior           -1         2001         0           0         2002         1           1         2003         2           2         2004         3           3         2005         4           3         2006         5           5         2007         6           6         2008         7           7         2009         8           2010         9         2011           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         222           24         2026         25	L/C portion 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ment	0 0 0 0 0 0 0 0 54,419 50,908 33,020 13,366 27,824	i 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5,832 5,928	3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
-1         2001           0         2002           1         2003           2         2004           3         2005           4         2006           5         2007           6         2008           7         2009           8         2010           9         2011           45,60           10         2012           2013         29,58           12         2014           13         2015           22,20         14           14         2016           2017         85,02           16         2018           17         2019           163,56         18           2020         9,84           19         2021           202         2022           21         2023           22         2024           23         2025           24         2026           25         2027           26         2028           27         2029	0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 54,419 50,908 33,020 13,366 27,824	0 0 0 0 0 0 3,212 3,265 3,317	0 0 0 0 0 0 5,832 5,928	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 -48,586	
1       2003         2       2004         3       2005         4       2006         5       2007         6       2008         7       2009         8       2010         9       2011         4       2016         10       2012         42,06         11       2013         29,58         12       2014         13       2015         2016       20,88         15       2017         85,02       16         16       2018         17       2019         163,56       18         18       2020         2021       2021         202       2022         21       2023         22       2024         23       2025         24       2026         25       2027         26       2028         27       2029	0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         3,416           2,348         5,193           0         6,037           14,653         24,374           27,165	0 0 0 0 0 0 0 0 0 0 0 3 3 6 1,007 4 3 20 3 5 1,024 7,338		0 0 0 0 0 54,419 50,908 33,020 13,366 27,824	0 0 0 0 0 3,212 3,265 3,317	0 0 0 0 0 0 5,832 5,928	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 -51,207	0 0 0 0 0 0 -48,586	
2         2004           3         2005           4         2006           5         2007           6         2008           7         2009           8         2010           9         2011           45,60         10           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2015         22,03           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           201         2023         222           21         2023         2024           23         2025         24           24         2026         25           25         2027         26           26         2028         27           27         2029         2029	) 0 ) 0 ) 0 ) 0 ) 0 ) 0 ) 0 ) 0 ) 0 ) 0	0 0 0 0 0 346 286 18 1,007 430 320 35 1,024 7,338		0 0 0 0 54,419 50,908 33,020 13,366 27,824	0 0 0 0 3,212 3,265 3,317	0 0 0 0 0 5,832 5,928	0 0 0 0 0 0 0 0 6,762	0 0 0 0 0 -51,207	0 0 0 0 0 -48,586	
3         2005           4         2006           5         2007           6         2008           7         2009           8         2010           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2015         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         222           21         2023         22           22         2024         23           23         2025         24           24         2026         25           25         2027         26           26         2028         27	)         0           )         0           )         0           )         0           )         0           )         0           )         0           )         0           )         0           )         3,416           2,348         5,193           )         6,037           :         14,653           :         24,374           :         27,165	0 0 0 0 346 286 18 1,007 430 320 35 1,024 7,338		0 0 0 0 54,419 50,908 33,020 13,366 27,824	0 0 0 0 3,212 3,265 3,317	0 0 0 0 5,832 5,928	0 0 0 0 0 6,762	0 0 0 0 -51,207	0 0 0 0 -48,586	
4         2006           5         2007           6         2008           7         2009           8         2010           9         2011           45,60           10         2012           42,06           11         2013           2014         10,01           13         2015           22,00         14           13         2015           2010         22,08           15         2017           85,02         16           16         2018           17         2019           18         2020           19         2021           20         2022           21         2023           22         2024           23         2025           24         2026           25         2027           26         2028           27         2029	0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         8,473           3         3,416           2,348         5,193           0         6,037           1         14,653           24,374         27,165	0 0 0 346 286 18 1,007 430 320 35 1,024 7,338		0 0 0 54,419 50,908 33,020 13,366 27,824	0 0 0 3,212 3,265 3,317	0 0 0 5,832 5,928	0 0 0 0 6,762	0 0 0 0 -51,207	0 0 0 0 -48,586	( ( ( (
5         2007           6         2008           7         2009           8         2010           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2012         201           16         2020         9,84           19         2021         2022           21         2023         222           21         2023         222           24         2026         25           25         2027         26           26         2028         27           26         2028         27	0         0           0         0           0         0           0         0           0         8,559           5         3,416           2,348         5,193           0         5,193           0         6,037           5         14,653           4         24,374           27,165         27,165	0 0 0 346 286 18 1,007 430 320 35 1,024 7,338		0 0 0 54,419 50,908 33,020 13,366 27,824	0 0 0 3,212 3,265 3,317	0 0 0 5,832 5,928	0 0 0 6,762	0 0 0 -51,207	0 0 0 -48,586	(
6         2008           7         2009           8         2010           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         222           21         2023         22           24         2026         25           25         2027         26           26         2028         27           26         2028         27	0 0 0 0 0 8,473 8 8,559 6 3,416 2,348 0 5,193 0 6,037 6 4,653 4 24,374 8 27,165	0 0 346 286 18 1,007 430 320 35 1,024 7,338		0 0 54,419 50,908 33,020 13,366 27,824	0 0 3,212 3,265 3,317	0 0 5,832 5,928	0 0 0 6,762	0 0 -51,207	0 0 -48,586	(
7         2009           8         2010           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2020         9,84           19         2021           20         2022           21         2023           22         2024           23         2025           24         2026           25         2027           26         2028           27         2029	0 0 0 8,473 8 8,559 6 3,416 2,348 0 5,193 0 6,037 6 14,653 4 24,374 8 27,165	0 0 346 286 18 1,007 430 320 35 1,024 7,338		0 0 54,419 50,908 33,020 13,366 27,824	0 0 3,212 3,265 3,317	0 0 5,832 5,928	0 0 6,762	0 0 -51,207	0 0 -48,586	(
8         2010           9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         20           20         2022         21           2023         2024         23           225         2027         24           23         2025         24           24         2026         25           25         2027         26           262         2028         27           27         2029         2029	0 0 8,473 8,559 6 3,416 2,348 0 5,193 0 6,037 5 14,653 4 24,374 8 27,165	0 346 286 18 1,007 430 320 35 1,024 7,338		0 54,419 50,908 33,020 13,366 27,824	0 3,212 3,265 3,317	0 5,832 5,928	0 6,762	0 -51,207	0 -48,586	(
9         2011         45,60           10         2012         42,06           11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         22           21         2023         22           22         2024         2025           24         2026         25           25         2027         26           2028         27         2029	8,473           8,559           3,416           2,348           5,193           6,037           14,653           24,374           27,165	346 286 18 1,007 430 320 35 1,024 7,338		54,419 50,908 33,020 13,366 27,824	3,212 3,265 3,317	5,832 5,928	6,762	-51,207	-48,586	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 8,559 3,416 2,348 5,193 6,037 14,653 4 24,374 8 27,165	286 18 1,007 430 320 35 1,024 7,338		50,908 33,020 13,366 27,824	3,265 3,317	5,928				-4/55
11         2013         29,58           12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         2024           23         2025         24           24         2026         25           25         2027         26           26         2028         27           202         2028         27	5 3,416 2,348 5,193 6,037 5 14,653 24,374 8 27,165	18 1,007 430 320 35 1,024 7,338		33,020 13,366 27,824	3,317	-		AT 6 A A	11 000	
12         2014         10,01           13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         222           22         2024         2025           24         2026         25           25         2027         26           26         2028         27           26         2028         27	2,348 5,193 6,037 14,653 24,374 27,165	1,007 430 320 35 1,024 7,338		13,366 27,824			6,873 6,984	-47,644 -29,703	-44,980 -26,997	-44,03: -26,03(
13         2015         22,20           14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           21         2023         222           21         2023         222           24         2025         24           25         2027         26           26         2028         27           26         2028         27	5,193 6,037 14,653 24,374 27,165	430 320 35 1,024 7,338		27,824		6,023 6,119	7,094	-29,703	-20,997 -7,247	-20,03
14         2016         22,08           15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         20           20         2022         21           20         2022         22           21         2023         2024           23         2025         24           24         2026         25           25         2027         26           26         2028         27           26         2028         27	6,037 14,653 24,374 27,165	320 35 1,024 7,338	•		3,487	6,332	7,342	-24,337	-21,492	-20,48
15         2017         85,02           16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         20           20         2022         21           20         2022         21           21         2023         22           22         2024         23           23         2025         24           24         2026         25           25         2027         26           26         2028         27           2029         2029         2029	14,653 24,374 27,165	35 1,024 7,338		28,437	3,594	6,527	7,567	-24,842	-21,910	-20,870
16         2018         120,32           17         2019         163,56           18         2020         9,84           19         2021         2022           20         2022         2023           22         2024         2025           23         2025         224           25         2027         26           26         2028         27	24,374 27,165	1,024 7,338		99,713	3,702	6,722	7,793	-96,011	-92,991	-91,920
17         2019         163,56           18         2020         9,84           19         2021         2022           20         2022         2024           22         2024         2025           24         2026         25         2027           25         2027         26         2028           27         2029         2029         2029	27,165	7,338		145,721	3,809	6,916	8,019	-141,912	-138,805	-137,70
18         2020         9,84           19         2021				198,071	3,916	7,111	8,245	-194,155	-190,959	189,82
19         2021           20         2022           21         2023           22         2024           23         2025           24         2026           25         2027           26         2028           27         2029	,			33,357	4,688	8,513	9,870	-28,669	-24,844	-23,48
20       2022         21       2023         22       2024         23       2025         24       2026         25       2027         26       2028         27       2029		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
21         2023           22         2024           23         2025           24         2026           25         2027           26         2028           27         2029		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
23       2025         24       2026         25       2027         26       2028         27       2029	1900 - A	23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
24       2026         25       2027         26       2028         27       2029		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
25 2027 26 2028 27 2029		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
26 2028 27 2029		17,616	1990 - A. A. A.	17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
27 2029		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,361
70 7070		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
28 2030		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
29 2031		23,928	· · · ·	23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
30 2032		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
31 2033		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
32 2034	· · ·	17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
33 2035		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
34 2036		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
35 2037 36 2038		16,627		16,627	4,688 4,688	8,513	9,870	-11,939	-8,115	-6,75 -7,74
36 2038 37 2039	· · ·	17,616 23,928		17,616 23,928	4,688	8,513 8,513	9,870 9,870	-12,928 -19,240	-9,103 -15,415	-14,05
38 2040		21,237	228,478	249,715	4,688	8,513	9,870	-245,027	-241,203	-239,84
39 2041		16,627	220,410	16,627	4,688	8,513	9,870	-11,939	-241,205	-255,040
40 2042		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
41 2043		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
42 2044		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
43 2045		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
44 2046		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
45 2047		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
46 2048		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
47 2049		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
48 2050		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
49 2051		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
50 2052	1.11	21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
51 2053		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
52 2054		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
53 2055		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
54 2056		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
55 2057		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
56 2058		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
57 2059		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
58 2060		21,237	228,478	249,715	4,688	8,513	9,870	-245,027	-241,203	-239,84
59 2061		16,627	-	16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
60 2062		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
61 2063		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
62 2064 63 2065		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
63 2065		16,627		16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
64 2066		17,616		17,616	4,688	8,513	9,870	-12,928	-9,103	-7,74
65 2067		23,928		23,928	4,688	8,513	9,870	-19,240	-15,415	-14,05
66 2068		21,237		21,237	4,688	8,513	9,870	-16,549	-12,725	-11,36
67 2069 Total 550.20	6 100 200	16,627	۰. ــــــــــــــــــــــــــــــــــــ	16,627	4,688	8,513	9,870	-11,939	-8,115	-6,75
	5 102,489	#REF!		2,111,317	200,078	485,141	560,164	-1,845,239	-1,628,175	-1,551,15
	ISCOURT Fait	e at 10%:		179,178	15,289	77 767	32,188	142 000	161 410	-146,99
the condition of e							JZ_100			
the condition of c resent value: iternal rate of retur	in the second	· · · · ·		112,170	,207	21,702	, 100	-163,889 #DIV/0!	-151,416 #DIV/0!	#DIV/(

#### Appendix M.9 Calculation of Financial Internal Rate of Return in Conventional Way for Phase-2

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Appendix M.10 Calculation of Financial Internal Rate of Return in Conventional Way for Overall Project

1. I De 10 ( ) C	and manage		nen andre br>Externa andre an	inancial co	e demonstrationete de la composition de La composition de la c			(US\$1,000) Cash balance				
'ear	-			manciai co	51		······	inancial ber			Jasn balance	
in Ider	Year _	Constructi F/C portion	Direction	OM cost	Replace- ment cost	Total	Option- 1	Option-2	Option-3	Option-1	Option-2	Option-3
-1	2001	0	0	0	0	0	0	0	Ó	0	0	
0	2002	0	0	0	0	0	0	0	0	0	· 0	
1	2003	0	0	0	0	0	0	0.	0	0	0	20.02
2 3	2004 2005	31,247 32,399	2,338 2,865	207 207	0 0	33,792 35,471	2,357 2,812	4,280 5,106	4,962 5,920	-31,435 -32,659	-29,513 -30,365	-28,83 -29,55
í.	2006	117,046	12,846	694	ŏ	130,586	5,181	9,408	10,908	-125,405	-121,178	-119,67
5	2007	90,097	7,747	723	0	98,567	5,273	9,575	11,102	-93,294	-88,992	-87,46
6	2008	158,583	29,110	1,869	0	189,562	5,365	9,742	11,295	-184,196	-179,819	-178,26
7 8	2009	123,557	21,432	1,078	0	146,067	5,458	9,911	11,491	-140,608	-136,155	-134,57
) }	2010 2011	158,448 45,600	24,653 8,473	8,888 9,233	· 0 0	191,988 63,306	8,328 8,467	15,123 15,374	17,533 17,825	-183,660 -54,839	-176,865 -47,932	-174,45 -45,48
0	2012	42,063	8,559	9,964	· Õ	60,587	8,606	15,626	18,117	-51,981	-44,961	-42,47
I	2013	29,586	3,416	8,906	0	41,908	8,744	15,878	18,409	-33,163	-26,030	-23,49
2	2014	10,011	2,348	9,894	0	22,253	8,883	16,129	18,701	-13,370	-6,124	-3,55
3	2015	22,200	5,193	9,318	. 0	36,711	9,193	16,692	19,353	-27,519	-20,020	-17,35
4	2016 2017	22,080 85,025	6,037 14,653	9,999 8,923	· 0	38,116 108,601	9,475 9,758	17,204 17,719	19,947 20,544	-28,641 -98,843	-20,911	-18,16 -88,05
6	2018	120,324	24,374	9,911	0	154,609	10,041	18,232	21,138	-144,568	-90,882 -136,377	-133,47
7	2019	163,568	27,165	16,225	0	206,958	10,324	18,746	21,735	-196,635	-188,212	-185,22
8	2020	9,849	2,271	30,916	0	43,036	12,358	22,439	26,017	-30,678	-20,596	-17,01
9	2021			23,760	0	23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
0	2022 2023			17,616	. 0	17,616	12,358	22,439	26,017	-5,258	4,824	8,40
1 2	2023			23,928 30,916	0	23,928	12,358 12,358	22,439 22,439	26,017 26,017	-11,570 -18,558	-1,489 -8,476	2,0 -4,8
3 -	2025			23,760	0	23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
4	2026			17,616	. 0	17,616	12,358	22,439	26,017	-5,258	4,824	8,40
5	2027			23,928	0	23,928	12,358	22,439	26,017	-11,570	-1,489	2,0
6	2028			30,916	0	30,916	12,358	22,439	26,017	-18,558	-8,476	-4,8
7 8	2029 2030			23,760	0	23,760 301,944	12,358	22,439	26,017	-11,402	-1,321	2,2;
9	2030			17,616 23,928	284,328 0	23,928	12,358 12,358	22,439 22,439	26,017 26,017	-289,586 -11,570	-279,504 -1,489	-275,9: 2,0:
0	2032			30,916	· õ	30,916	12,358	22,439	26,017	-18,558	-8,476	-4,8
1	2033			23,760	• 0	23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
2	2034		÷	17,616	0	17,616	12,358	22,439	26,017	-5,258	4,824	8,40
3	2035			23,928	• 0	23,928	12,358	22,439	26,017	-11,570	-1,489	2,0
4 5	2036 2037			30,916 23,760	0	30,916 23,760	12,358 12,358	22,439 22,439	26,017 26,017	-18,558 -11,402	-8,476	-4,8
6	2038			17,616	. 0	17,616	12,358	22,439	26,017	-5,258	-1,321 4,824	2,2 8,40
7	2039			23,928	0	23,928	12,358	22,439	26,017	-11,570	-1,489	2,0
8	2040				228,478	259,394	12,358	22,439	26,017	-247,036	-236,955	-233,3
9	2041			23,760	0	23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
0	2042 2043			17,616 23,928	0 0	17,616 23,928	12,358	22,439	26,017	-5,258	4,824	8,40
2	2045	•		30,916	0	30,916	12,358 12,358	22,439 22,439	26,017 26,017	-11,570 -18,558	-1,489 -8,476	2,0 4,8
3	2045			23,760	ů	23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
4	2046			17,616	0	17,616	12,358	22,439	26,017	-5,258	4,824	8,4
5	2047			23,928		23,928	12,358	22,439	26,017	-11,570	-1,489	2,0
6 7	2048 2049			30,916		30,916	12,358	22,439	26,017	-18,558	-8,476	-4,8
8	2049			23,760	0 284,328	23,760 301,944	12,358 12,358	22,439 22,439	26,017 26,017	-11,402 -289,586	-1,321 -279,504	2,2. -275,9
9	2051			23,928		23,928	12,358	22,439	26,017	-11,570	-1,489	-273,9
0	2052			30,916		30,916	12,358	22,439	26,017	-18,558	-8,476	-4,8
1	2053			23,760		23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
2	2054			17,616		17,616	12,358	22,439	26,017	-5,258	4,824	8,4
3 4	2055 2056			23,928		23,928 30,916	12,358 12.358	22,439 22,439	26,017	-11,570	-1,489	2,0
5	2057			23,760		23,760	12,358	22,439	26,017 26,017	-18,558 -11,402	-8,476 -1,321	-4,8 2,2
6	2058			17,616		17,616	12,358	22,439	26,017	-5,258	4,824	8,4
7	2059			23,928		23,928	12,358	22,439	26,017	-11,570	-1,489	2,0
8	2060				228,478	259,394	12,358	22,439	26,017	-247,036	-236,955	-233,3
9 0	2061 2062			23,760		23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
1	2062			17,616 23,928		17,616 23,928	12,358 12,358	22,439 22,439	26,017 26,017	-5,258 -11,570	4,824 -1,489	- 8,4 2,0
2	2064			30,916		30,916	12,358	22,439	26,017	-11,570	-1,489 -8,476	2,0 -4,8
3	2065			23,760		23,760	12,358	22,439	26,017	-11,402	-1,321	2,2
4	2066			17,616		17,616		22,439	26,017	-5,258	4,824	8,4
5	2067			23,928		23,928	12,358	-	26,017	-11,570	-1,489	2,0
6 57	2068 2069	. •		30,916		30,916	12,358	22,439	26,017	-18,558	-8,476	-4,8
	2069 tal	1.261 682	203 470	23,760		23,760	12,358	22,439	26,017 1,549,814	-11,402	-1,321 -2,469,413	2,2
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eser	t value	e sale				619,374	57,318	104,078	120,670	-562,056	-515,296	-498,70
		A										
ern: C:	al rate o	of return (FI	RR):			1. A. A.				#DIV/0!	#DIV/0!	#DIV/

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	Initial	Initial	Cost for	·	Designed wate
Year		investment cost	Operation and	Total	volume to be
	in FC portion	in LC portion	Maintenance	(US\$1,000)	supplied
	(US\$1,000)	(US\$1,000)	(US\$1,000)		(m <sup>3</sup> /annum)
2001	0	0	0	0	
2002	0	0	0	0	.*
2003	0	0	0	0	
2004	31,247	2,338	207	33,792	59,620,93
2005	32,399	2,865	207	35,471	79,666,04
2006	117,046	12,846	694	130,586	168,730,85
2007	90,097	7,747	723	98,567	175,668,85
2008	158,583	29,110	1,869	189,562	182,605,05
2009	123,557	21,432	1,078	146,067	189,575,95
2010	158,448	24,653	8,888	191,988	296,701,05
2011	45,600	8,473	9,233	63,306	305,310,85
2012	42,063	8,559	9,964	60,587	313,918,86
2013	29,586	3,416	8,906	41,908	322,525,08
2014	10,011	2,348	9,894	22,253	331,129,51
2015	22,200	5,193	9,318	36,711	345,900,65
2016	22,080	6,037	9,999	38,116	359,684,50
2017	85,025	14,653	8,923	108,601	373,503,06
2018	120,324	24,374	9,911	154,609	387,283,35
2019	163,568	27,165	16,225	206,958	401,098,35
2020	9,849	2,271	30,916	43,036	478,056,57
2021	5,015	2,271	23,760	23,760	478,056,57
2022			17,616	17,616	478,056,57
2023			23,928	23,928	478,056,57
2023			30,916	30,916	478,056,57
2024			23,760	23,760	478,056,57
2025			17,616	17,616	478,056,57
2020			23,928	23,928	478,056,57
2027			30,916	30,916	478,056,57
2028		•	23,760	23,760	478,056,57
2029					478,056,57
			17,616	17,616	
2031			23,928	23,928	478,056,57
2032			30,916	30,916	478,056,57
2033	· · · ·		23,760	23,760	478,056,57
2034			17,616	17,616	478,056,57
2035	· .		23,928	23,928	478,056,57
2036			30,916	30,916	478,056,57
2037			23,760	23,760	478,056,57
2038			17,616	17,616	478,056,57
2039			23,928	23,928	478,056,57
2040		· · · · · · · · · · · · · · · · · · ·	30,916	30,916	478,056,57
otal			· .	2,083,216	14,332,111,00
resent value*				589,945	1,989,462,14
evelized cost	(US¢/m³)			<u></u>	29.6
quivalent to c	lomestic currency		·		14
	enditure for water	(Kyats/month pe	г НН)		4,35

### Appendix M.11 Levelized Cost of Capital and Necessary Expenditure for Water Supply per Household

Average family size: 7 persons/HH.

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Discount rate: 10 %

	Appendix M.12 Calculation of Financial Internal Rate of Ret Case of Recommended Pricing Schedule for Phase-1								
Water price to be applied (USc/m <sup>3</sup> ):	2005	<u>2010</u>	<u>2015</u>	<u>20</u>					
Domestic sector	. 847	12.65	15.62	17					

•			·.	Domestic Public sec Industrial	sector	l (US¢/m³): al sector		2005 8.47 5.65 38.11	<u>2010</u> 12.65 8.43 56.93	<u>2015</u> 15.62 10.41 70.29	2020 17.92 11.95 80.65	<u>Share</u> 709 109 209
			F	inancial co	ost		Annual water		Financ	ial benefit		1,000 L
Year in order	Year	Construct	tion cost	OM cost	Replace- ment	Total	volume to be supplied	Domestic	Public	Industrial/ commercial	Total	Cas balar
		F/C portion	portion		cost	· .	(m <sup>3</sup> /annum)	sector	sector	sector		
-1	2001	0	0	0		0		0	0	0	0	alamatan dan basa
0	2002	. 0	. 0	0		0		0	0	0	0	
1 2	2003 2004	0 31,247	0 2,338	0 207	0	0 33,792	59,620,938	551	0 52	0 708	0 1,312	-32,
3	2005	32,399	2,358	207	0	35,471	79,666,047	4,723	450	6,073	11,246	-24,
4	2006	117,046	12,846	694	Ö		168,730,851	10,004	953	12,862	23,818	-106,
5	2007	90,097	7,747	723	0	98,567	175,668,851	10,415	992	13,391	24,797	-73,
6	2008	158,583	29,110	1,869	0		182,605,050	10,826	1,031	13,919	25,777	-163,
7	2009	123,557	21,432	1,078	0	-	189,575,950	11,239	1,070	14,451	26,761	-119,
. 8 9	2010 2011	158,448 0	24,653 0	8,888 8,888	0 0		296,701,051 296,701,051	26,277 26,277	2,503	33,785 33,785	62,564 62,564	-129, 53,
10	2012	Ő	ů 0	9,963	0	-	296,701,051	26,277	2,503	33,785	62,564	52,
11	2013	0	0	8,888	0		296,701,051	26,277	2,503	33,785	62,564	53,
12	2014			8,888	0	8,888	296,701,051	26,277	2,503	33,785	62,564	53,
13	2015			8,888	0		296,701,051	32,440	3,090	41,708	77,238	68,
14 15	2016			9,963 8,888	· · 0		296,701,051 296,701,051	32,440 32,440	3,090	41,708	77,238	67,
15	2017 2018			0,000 8,888	0	-	296,701,051	32,440	3,090 3,090	41,708 41,708	77,238	68, 68,
17	2019			8,888	Ő		296,701,051	32,440	3,090	41,708	77,238	68,
18	2020			9,963	0	9,963	296,701,051	37,221	3,545	47,855	88,620	78,
19	2021			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
20	2022			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
21 22	2023 2024			8,888 9,963	0 0		296,701,051 296,701,051	37,221 37,221	3,545 3,545	47,855 47,855	88,620 88,620	79, 78,
23	2025			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
24	2026		· .	8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
25	2027			8,888	0	8,888	296,701,051	37,221	3,545	47,855	88,620	79,
26	2028			9,963	0		296,701,051	37,221	3,545	47,855	88,620	78,
27 28	2029 2030			8,888 8,888	0 284,328		296,701,051	37,221	3,545	47,855	88,620	79,
29	2030			8,888	204,328 0		296,701,051	37,221 37,221	3,545 3,545	47,855	88,620 88,620	-204, 79,
30	2032			9,963	0		296,701,051	37,221	3,545	47,855	88,620	78,
31	2033			8,888	0	8,888	296,701,051	37,221	3,545	47,855	88,620	79
32	2034			8,888	0	•	296,701,051	37,221	3,545	47,855	88,620	79,
33 34	2035 2036			8,888	• 0		296,701,051	37,221	3,545	47,855	88,620	79,
35	2030			9,963 8,888	0		296,701,051 296,701,051	37,221 37,221	3,545 3,545	47,855 47,855	88,620 88,620	78, 79,
36	2038			8,888	0 0		296,701,051	37,221	3,545	47,855	88,620	79,
37	2039			8,888	0	8,888	296,701,051	37,221	3,545	47,855	88,620	79,
38	2040			9,963	0		296,701,051	37,221	3,545	47,855	88,620	78,
39 40	2041			8,888	0		296,701,051	37,221	3,545	47,855	88,620	- 79,
40 4 I	2042 2043			8,888 8,888	0		296,701,051 296,701,051	37,221 37,221	3,545 3,545	47,855 47,855	88,620 88,620	79, 79,
42	2044			9,963	ŏ		296,701,051	37,221	3,545	47,855	88,620	. 78,
43	2045			8,888	0	8,888	296,701,051	37,221	3,545	47,855	88,620	79,
44	2046			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
45 46	2047 2048			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
40	2048			9,963 8,888	0		296,701,051 296,701,051	37,221 37,221	3,545 3,545	47,855 47,855	88,620 88,620	78, 79,
48	2050			8,888			296,701,051	37,221	3,545	47,855	88,620	-204,
49	2051			8,888	0	-	296,701,051	37,221	3,545	47,855	88,620	79,
50	2052			9,963	0		296,701,051	37,221	3,545	47,855	88,620	78,
51	2053			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79.
52 53	2054 2055			8,888 8,888	0		296,701,051 296,701,051	37,221 37,221	3,545	47,855	88,620	79,
54	2055			9,963	0		296,701,051	37,221	3,545 3,545	47,855 47,855	88,620 88,620	79. 78.
55	2057			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
56	2058			8,888	0		296,701,051	37 221	3,545	47,855	88,620	79,
57	2059			8,888	0		296,701,051	37,221	3,545	47,855	88,620	79,
58	2060 xal	711 276	100 000	9,963	0		296,701,051	37,221	3,545	47,855	88,620	78,
		711,376 on of disce		472,028	<u> </u>	1,853,049		1,867,385	177,846	2,400,921	4,446,151	2,393,
	it value					417 660		160 201	15.004		177 001	50
riesel	11 14102					447,560		158,381	15,084	203,632	377,096	-70,

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#### Appendix M.13 Calculation of Financial Internal Rate of Return in Case of Recommended Pricing Schedule for Phase-2

					Water prio Domestic se Public secto Industrial/c	ector or	lied (US¢/m³):	<u>2005</u> 8.47 5.65 38.11	2010 12.65 8.43 56.93	<u>2015</u> 15.62 10.41 70.29	2020 17.92 11.95 80.65	Share rai 70% 10% 20%
				:		Main Charles						1,000 US
Year				Financial co	ost	··· <u>·</u> · · ·	Annual water volume to be	<u></u>	Financi	al benefit		Carb
in order	Year	Construct F/C portion	L/C portion	OM cost	Replace- ment cost	Total	supplied (m <sup>3</sup> /annum)	Domestic sector	Public sector	Industrial/ commercial sector	Total	Cash balance
-1	2001	0	0	0		0		0	0	0	0	i faik i dearing
0	2002 2003	0	0	0		0		· 0	0 0	0 0	0 0	
2	2004	ŏ	· Õ	0		0		Ő	ŏ	Ő	Ő	
3	2005	0	0	0		. 0		0	0	. 0	0	
4 5	2006 2007	0	0	0 0		0 0		0 0	0 0	0	0 0	
6	2007	0	ŏ	0		Ū Ū		. 0	ő	. 0	0	
7	2009	0	0	. 0		0		0	0	0	0	
8	2010	0	• 0	0	•	0	. D (00 000	0	0	0	0	ED (1
9 10	2011 2012	45,600 42,063	8,473 8,559	346 286	0 0	54,419 50,908	8,609,805 17,217,816	763 1,525	73 145	980 1,961	1,816 3,631	-52,60
11	2013	29,586	3,416	18	ŏ	33,020	25,824,035	2,287	218	2,941	5,445	-27,57
12	2014	10,011	2,348	1,007	0	13,366	34,428,462	3,049	290	3,920	7,260	-6,10
13	2015	22,200	5,193	430	. 0	27,824	49,199,601	5,379	512	6,916	12,808	-15,01
14 15	2016 2017	22,080 85,025	6,037 14,653	320	0	28,437 99,713	62,983,452 76,802,018	6,886 8,397	656 800	8,854 10,796	16,396 19,993	-12,04 -79,72
16	2018		24,374	1,024	. 0	145,721	90,582,300	9,904	943	12,734	23,581	122,1
17	2019	163,568	27,165	7,338	. 0	198,071	104,397,301	11,414	1,087	14,676	27,177	170,8
18	2020	9,849	2,271	21,237	0	33,357	181,355,521	22,751	2,167	29,251	54,168	20,8
19 20	2021 2022	ч.		16,627 17,616	· 0	16,627 17,616	181,355,521 181,355,521	22,751 22,751	2,167	29,251 29,251	54,168 54,168	37,5 36,5:
21	2023			23,928	ŏ	23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
22	2024	•		21,237	0	21,237	181,355,521	22,751	2,167	29,251	54,168	32,9
23	2025			16,627	. 0	16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
24 25	2026 2027			17,616 23,928	. 0	17,616 23,928	181,355,521 181,355,521	22,751 22,751	2,167	29,251 29,251	54,168 54,168	36,5 30,2
26	2028	· · · ·		21,237	- Ŭ	21,237	181,355,521	22,751	2,167	29,251	54,168	32,9
27	2029	•		16,627	0	16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
28	2030	i.	· .	17,616	. 0	17,616	181,355,521	22,751	2,167	29,251	54,168	36,5
29 30	2031 2032		· · ·	23,928 21,237	· 0	23,928 21,237	181,355,521 181,355,521	22,751 22,751	2,167 2,167	29,251 29,251	54,168 54,168	30,2 32,9
31	2033		1 - E	16,627	õ	16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
32	2034			17,616		17,616	181,355,521	22,751	2,167	29,251	54,168	36,5
33	2035			23,928		23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
34 35	2036 2037			21,237 16,627	0 0	21,237 16,627	181,355,521 181,355,521	22,751 22,751	2,167 2,167	29,251 29,251	54,168 54,168	32,9 37,5
36	2038			17,616		17,616	181,355,521	22,751	2,167	29,251	34,168	36,5
37	2039			23,928	· . 0	23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
38	2040	÷.		21,237		249,715	181,355,521	22,751	2,167	29,251	54,168	-195,5
39 40	2041 2042			16,627 17,616	0	16,627 17,616	181,355,521 181,355,521	22,751 22,751	2,167 2,167	29,251 29,251	54,168 54,168	37,5
41	2043			23,928		23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
42	2044			21,237	0	21,237	181,355,521	22,751	2,167	29,251	54,168	32,9
43	2045			16,627	0	16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
44 45	2046 2047			17,616 23,928		17,616 23,928	181,355,521 181,355,521	22,751 22,751	2,167 2,167	29,251 29,251	54,168 54,168	36,5 30,2
46	2048		÷	21,237		21,237	181,355,521	22,751	2,167	29,251	54,168	32,9
47	2049	÷.,.		16,627	0	16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
48	2050			17,616		17,616	181,355,521	22,751	2,167	29,251	54,168	36,5
49 50	2051			23,928	0 0	23,928 21,237	181,355,521 181,355,521	22,751 22,751	2,167 2,167	29,251 29,251	54,168 54,168	30,2 32,9
51	2052			16,627		16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
52	2054			17,616	. 0	17,616	181,355,521	22,751	2,167	29,251	54,168	36,5
53	2055			23,928		23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
54 55	2056 2057	· .		21,237 16,627		21,237 16,627	181,355,521 181,355,521	22,751	2,167 2,167	29,251 29,251	54,168 54,168	32,9 37,5
56	2058		•	17,616		17,616	181,355,521	22,751	2,167	29,251	54,168	36,5
57	2059			23,928	. 0	23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
58	2060			21,237		249,715	181,355,521	22,751	2,167	29,251	54,168	-195,5
59 60	2061 2062			16,627 17,616		16,627 17,616	181,355,521 181,355,521	22,751 22,751	· 2,167 2,167	29,251 29,251	54,168 54,168	37,5 36,5
61	2062			23,928		23,928	181,355,521	22,751	2,167	29,251	54,168	30,2
62	2064			21,237	0	21,237	181,355,521	22,751	2,167	29,251	54,168	32,9
63	2065		а с с а	16,627		16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
64 65	2066			17,616		17,616	181,355,521	22,751	2,167	29,251	54,168	36,5
65 66	2067 2068			23,928		23,928	181,355,521 181,355,521	22,751 22,751	2,167 2,167	29,251 29,251	54,168 54,168	30,2
67	2008		· · ·	16,627		16,627	181,355,521	22,751	2,167	29,251	54,168	37,5
T	otal			1,001,565		2,111.317		1,187,138	113,061	1,526,320	2,826,518	715,2
rese	nt valu	ion of disc e: of return (l		at 10%:	•	179,178	•	47,196	4,495	60,681	112,372	-66,8 3.8

# Appendix M.14 Calculation of Financial Internal Rate of Return in Case of Recommended Pricing Schedule for Overall Project

					Domestic se Public sector Industrial/co	ctor r	olied (US¢/m³): ctor	<u>2005</u> 8.47 5.65 38.11	<u>2010</u> 12.65 8.43 56.93	2015 15.62 10.41 70.29	<u>2020</u> 17.92 11.95 80.65	<u>Share rat</u> 70% 10% 20%
ear			F	Financial co:	3t		Annual water		Financ	ial benefit		(1,000 US
n der	Year	Constructi	on cost	OM cost	Replace- ment cost	Total	volume to be supplied (m <sup>3</sup> /aonum)	Domestic sector	Public sector	IndustriaV commercial	Total	Cash balance
		F/C portion	portion							Sector		
1 )	2001 2002	0	0 0	0	0 0	0 0		0	0	0 0	0	
	2002	. 0	ő	. 0	0	0		0	0	0	0	
2	2004	31,247	2,338	207	0	33,792	59,620,938	551	52	708	1,312	-32,48
3	2005	32,399	2,865	207	0	35,471	79,666,047	4,723	450	6,073	11,246	-24,22
1	2006	117,046	12,846	694	· 0	130,586	168,730,851	10,004	953	12,862	23,818	-106,76
5 5	2007 2008	90,097 158,583	7,747 29,110	723 1,869	0	98,567	175,668,851 182,605,050	10,415	992	13,391	24,797	-73,76
,	2009	123,557	21,432	1,009	. 0	189,562 146,067	189,575,950	10,826 11,239	1.031	13,919 14,451	25,777 26,761	-163,78 -119,30
3	2010	158,448	24,653	8,888	Ő	191,988	296,701,051	26,277	2,503	33,785	62,564	-129,42
	2011	45,600	8 473	9,233	0	63,306	305,310,856	27,040	2,575	34,765	64,380	1,07
0	2012	42,063	8,559	9,964	0	60,587	313,918,867	27,802	2,648	35,745	66,195	5,60
1	2013	29,586	3,416	8,906	. 0	41,908	322,525,086	28,564	2,720	36,725	68,009	26,10
2	2014	10,011	2,348	9,894	0	22,253	331,129,513	29,326	2,793	37,705	69,824	47,57
3 4	2015 2016	22,200 22,080	5,193 6,037	9,318 9,999	0	36,711 38,116	345,900,652 359,684,503	37,819	3,602 3,745	48,625 50 562	90,046	53,33
4 5	2010	85,025	14,653	8,923	0	108,601	373,503,069	39,326 40,837	3,745	50,562 52,505	93,634 97,231	-55,51 -11,36
6	2018	120,324	24,374	9,911	· . 0	154,609	387,283,351	40,837	4,033	54,442	100,819	-53,79
7	2019	163,568	27,165	16,225	· 0	206,958	401,098,352	43,854	4,177	56,384	104,415	-102,54
8	2020	9,849	2,271	30,916	0	43,036	478,056,572	59,971	5,712	77,106	142,789	99,75
9	2021			23,760	0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,02
0	2022			17,616	0	17,616	478,056,572	59,971	5,712	77,106	142,789	125,17
1 2	2023 2024	1. A.		23,928 30,916	0 0	23,928 30,916	478,056,572 478,056,572	59,971 59,971	5,712 5,712	77,106 77,106	142,789 142,789	118,80 111,81
3	2025			23,760	. 0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,02
4	2026			17,616	Ő	17,616	478,056,572	59,971	5,712	77,106	142,789	125,17
5	2027			23,928	0	23,928	478,056,572	59,971	5,712	77,106	142,789	118,86
6	2028			30,916	0	30,916	478,056,572	59,971	5.712	77,106	142,789	111,87
7	2029			23,760	0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,02
8 9	2030 2031			17,616	284,328	301,944	478,056,572	59,971	5,712	77,106	142,789	-159,15
0	2032			23,928 30,916	0	23,928 30,916	478,056,572 478,056,572	59,971 59,971	5,712	77,106	142,789 142,789	118,86 111,87
i.	2033	÷ .		23,760	. 0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,02
2	2034			17,616	0	17,616	478,056,572	59,971	5,712	77,106	142,789	125,17
3	2035			23,928	0	23,928	478,056,572	59,971	5,712	77,106	142,789	118,80
34	2036			30,916	0	30,916	478,056,572	59,971	5,712	77,106	142,789	111,87
15 16	2037 2038		×.	23,760	0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,02
37	2038			17,616	0 0	17,616 23,928	478,056,572 478,056,572	59,971 59,971	5,712 5,712	77,106	142,789 142,789	125,17 118,86
8	2040			30,916	228,478	259,394	478,056,572	59,971	5,712	77,106	142,789	-116,60
9	2041			23,760	0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,0
0	2042			17,616	0	17,616	478.056.572	59,971	5,712	77,106	142,789	125,17
11	2043			23,928	0	23,928	478,056,572	59,971	5,712	77,106	142,789	118,80
2 13	2044			30,916 23,760	. 0	30,916	478,056,572	59,971	5,712	77,106	142,789	111,8
13 14	2045 2046			23,760	0	23,760 17,616	478,056,572 478,056,572	59,971 59,971	5,712 5,712	77,106 77,106	142,789 142,789	119,02 125,17
15	2047			23,928	. 0	23,928	478,056,572	59,971	5,712	77,106	142,789	125,1
16	2048			30,916	Ő	30,916	478,056,572		5,712	77,106	142,789	111,8
17	2049			23,760	0	23,760	478,056,572	59,971	5,712	77,106	142,789	119,02
8	2050			17,616		301,944	478,056,572		5,712	77,106	142,789	-159,15
9 .0	2051			23,928	0	23,928	478,056,572		5,712	77,106	142,789	118,86
50 51	2052 2053			30,916 23,760	0	30,916 23,760	478,056,572 478,056,572		5,712	77,106	142,789	111,87
52	2055			17,616	0	23,700	478,056,572		5,712 5,712	77,106 77,106	142,789 142,789	119,02 125,17
53	2055			23,928	Ő	23,928	478,056,572		5,712	77,106	142,789	118,80
54	2056			30,916	0	30,916	478,056,572		5,712	77,106	142,789	111,87
55	2057			23,760	0	23,760	478,056,572		5,712	77,106	142,789	119,0
56	2058			17,616	0	17,616	478,056,572		5,712		142,789	125,1
i7 i8	2059 2060			23,928	238 478	23,928	478,056,572		5,712	77,106	142,789	118,86
8 9	2060			30,916 23,760	228,478 0	259,394 23,760	478,056,572 478,056,572		5,712 5,712	77,106	142,789	-116,60
ō.	2062			17,616	0	17,616	478,056,572		5,712	77,106	142,789 142,789	119,02 125,17
61	2063			23,928	ò	23,928	478,056,572		5,712	77,106	142,789	118,86
52	2064			30,916	0	30,916	478,056,572		5,712	77,106	142,789	111,83
53	2065			23,760	0	23,760	478,056,572		5,712	77,105	142,789	119,02
54	2066			17,616	0	17,616	478,056,572		5,712		142,789	125,12
55 56	2067 2068			23,928	0	23,928	478,056,572		5,712		142,789	118,80
90 57	2068			30,916 23,760	0	30,916 23,760	478,056,572 478,056,572	59,971 59,971	5,712 5,712	77,106	142,789 142,789	111,87
	al	1,261,682	203,479		1,025,613	3,806,128	410,000,012	3,389,507	322,810	77,106 4.357,935	8,070,252	119.02
the	condi	ion of discour						1				
	nt valu al rate	e: of return (FIF	(R):	ан. Сталар		619,374		206,281	19,646	265,218	491,144	-128,2 7.24

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	i i companya ang sa		Antoine ann ann ann ann ann ann ann ann ann a	Ou	tflow			1717-1 (PERCONTINUE) (COL 2017)	In flow	(U)	<u>S\$1,000)</u>	<u>(US\$1,000)</u> Subsidy to
Year		Construc	tion cost	Foreig	n borrow						Cash	the Project
in	Year		·			OM	Total	Foreign	Revenu e in	In flow	Cash balance	from YCDC or Central
order		Loan	Local	Interest	Principal	cost	1 Otta	borrow	total	in total	ouunee	Government
		portion	portion	· · · ·	-							of Myanmar
-1	2001	0	0	0	0	0	0	0	0	0	0	
0 1	2002 2003	0 0	0 0	0	0	0 0	0	0 0	0 0	0	0 0	0 0
2	2003	31,875	2,361	0	0	207	34,444	31,875	1,312	33,186	-1,257	1,257
3	2005	33,380	2,908	414	0	207	36,910	33,380	11,246	44,626	7,716	
4	2006	121,799	13,105	848	0	694 723	136,446 105,790	121,799	23,818	145,617	9,171	
5	2007 2008	94,693 168,339	7,943 29,994	2,432 3,663	0	1,869	203,865	94,693 168,339	24,797 25,777	119,490 194,115	13,700 -9,749	9,749
ž	2009	132,470	22,193	5,851	Õ	1,078	161,592	132,470	26,761	159,230	-2,362	2,362
8		171,576	25,656	7,573	0	8,888	213,693	171,576	62,564	234,140	20,447	
9 10	2011 2012			9,804 9,804	0 0	8,888 9,963	18,691 19,767		62,564 62,564	62,564 62,564	43,873 42,797	
11	2012			9,804	33,260	8,888	51,951		62,564	62,564	10,613	
12	2014			9,371	33,692	8,888	51,951		62,564	62,564	10,613	
13	2015			8,933	34,130	8,888	51,951		77,238	77,238	25,287	
14 15	2016 2017			8,490 8,040	34,574 35,024	9,963 8,888	53,027 51,951		77,238 77,238	77,238 77,238	24,211 25,287	
16	2018		÷	7,585	35,479	8,888	51,951		77,238	77,238	25,287	
17	2019			7,124	35,940	8,888	51,951		77,238	77,238	25,287	
18 19	2020 2021			6,656	36,407 36,881	9,963 8,888	53,027 51,951		88,620 88,620	88,620 88,620	35,593 36,669	
20	2021			6,183 5,704	37,360	8,888	51,951		88,620	88,620	36,669	
21	2023			5,218	37,846	8,888	51,951		88,620	88,620	36,669	
22	2024			4,726	38,338	9,963	53,027		88,620	88,620	35,593	
23 24	2025 2026			4,228 3,723	38,836 39,341	8,888 8,888	51,951 51,951		88,620 88,620	88,620 88,620	36,669 36,669	
25	2027			3,211	39,852	8,888	51,951		88,620	88,620	36,669	
26	2028			2,693	40,371	9,963	53,027		88,620	88,620	35,593	
27 28	2029 2030			2,168 1,637	40,895 41,427	8,888 8,888	51,951 51,951		88,620 88,620	88,620 88,620	36,669 36,669	
20	2030			1,098	41,966	8,888	51,951		88,620	88,620	36,669	
30	2032			553	42,511	9,963	53,027		88,620	88,620	35,593	
31	2033					8,888	8,888		88,620	88,620		
32 33	2034 2035					8,888 8,888	8,888 8,888		88,620 88,620	88,620 88,620		
34	2036					9,963	9,963		88,620	88,620		
35	2037					8,888	8,888		88,620	88,620		
36 37	2038 2039					8,888 8,888	8,888 8,888		88,620 88,620	88,620 88,620	79,733 79,733	
38	2039					8,888 9,963	9,963		88,620	88,620		
39	2041		· .			8,888	8,888		88,620	88,620	79,733	
40	2042					8,888	8,888	-	88,620	88,620	79,733	
41 42	2043 2044					8,888 9,963	8,888 9,963		88,620 88,620	88,620 88,620	79,733 78,657	
43	2045					8,888	8,888		88,620	88,620	79,733	
44	2046					8,888	8,888		88,620	88,620		
45 46	2047					8,888 9,963	8,888 9,963		88,620 88,620	88,620 88,620	79,733 78,657	
47	2048					8,888	8,888		88,620	88,620	79,733	
48	2050				· .	8,888	8,888		88,620	88,620	79,733	
49	2051					8,888	8,888		88,620		79,733	
50 51	2052 2053					9,963 8,888	9,963 8,888		88,620 88,620	88,620 88,620		
52	2055					8,888	8,888		88,620	88,620	79,733	
53	2055					8,888	8,888		88,620	88,620	79,733	
54	2056					9,963 8 888	9,963		88,620	88,620		
55 56	2057 2058				·	8,888 8,888	8,888 8,888		88,620 88,620	88,620 88,620	79,733 79,733	
57	2059					8,888	8,888		88,620	88,620	79,733	
58	2060		:			9,963	9,963	751 101	88,620	88,620	78,657	
Total (Note)		754,131					<u> </u>	754,131				

#### Appendix M.15 Repayment Ability of Loan for Phase 1

(Note) (1) Interest rate of foreign loan: (2) Equal annual repayment amount of capital for foreign loan (US\$1,000)):

1.30% 43,064