Table V.2.43 Cash flow and P/L calculation for Alternative I

Project expenditure estimation					-										•		•		•			•		·			(Unit : S/.00	(Ō)
	Total(99-25)	1999FY	2000FY	2001FY	2002FY	2003FY	2004FY	2005FY   2	006FY	2007FY	2008FY 2	009FY 201	0FY 2	011FY 201	2FY 201	FY 20	014FY 120	015FY 2	2016EY   2	017FY 12	0018FY	2019FY	2020EY	2021FY	022FY			
Land Acquisition	0																····				-	20171	20201	20211		1202011		
Proposed project administration expense	601		22	22	22	22	22	22	22	22	22	29	29	29	29	29	29	29	20	20	20	20	20	20	20	20	20	20
Construction work (a)	59,984		2,586	18,268	2,586								1,447			447	1,447	1,447	1,375	6,465	1,375	1,375		1,375	1,375			1,375
Contingency (15%) (b)=(a) x 0.15	8,998		388	2,740	388								217	217		217	217	217	206	970	206	206		206	206		206	206
GST (18%) (c)= $(a+b) \times 0.18$	12,417		535	3,781	535							1,868	300	. 300	300	300	300	300	285	1,338	285			285			285	285
Maintenance Equipment (d)	21,587		15	3,701	234	173	377					114	15		8,670	173	377	300	20.7	1,336		285		203	285 8,670		377	203
	3,238		12		35	26	377					17	-13		1,301	26		<del></del>	·		188	2,016		ļ		1/3	377 57	
Contingency (15%) (e)=(d) x 0.15 GST (18%) (f) =(d+e) x 0.18	4,469				33	· 36	78					24	2		1,795	36	78				28	302			1,301	36	78	
	5,999	1 402		010	40	- 30				~ <del>~~</del>		1,062			1,793	30					39	417	3		1,795	30	78	
Engineering Service (g)		1,406		938				<del></del>						708		-			1,131		754					<u> </u>		
Contingency (15%) (h)=(g) x 0.15	900	211 291		141								159		106					170		113					ļ		
GST (18%) (I) = (g+h) x 0.18	1,242		225	194		574	* ***			(0/	725	220	000	147	1 174	316	1255	1 202	234	1.200	156			1.5.15	1.600	1 (20)	1.770	1 212
Maintenance (with GST)	28,646	317	335	354	550	574	599	623	659	696	735		1,096					1,297	1,338	1,379	1,418	1,464		1,547	1,588			1,713
Total	148,079	2,225	3,887	26,439	4,399	831	1,133	645	681	718	757	14,646 3	3,109	4,088 1	4,932 3	442	3,759	3,290	4,759	10,172	4,582	6,086	3,413	3,433	15,239	3,750	4,067	3,599
5		· : · · .					•			- : :					4							•						
Donation, Loan & Local Fund		1.000	0.500	16 2601	<u> </u>		·				<del></del>													·				
Donation up to S/.21,180 ( DM12MIL)	21,180	1,908	3,509	15,763	00234	<u> </u>	<u>`</u>	<u>V</u> ]	<u>0</u>	0	U U	10075	<u>, , , , , , , , , , , , , , , , , , , </u>	- U	. U	<u> U</u>	- 0	0	이	0	0]	0	0	0	0	0	<u> </u>	U
Loan available for construction work	50,245	- 0	0	5,245	2,974	0	0	0	0	0	U		1,664			664	1,664	1,664	1,581	7,435	1,581	1,581	1,581	1,581	1,581		, ,	1,581
Local Fund of non-construction expense	76,655	317	378	5,431	1,425		1,133	645	681	718	757				3,268 1	778	2,095	1,626	3,177	2.737	3,001	4,504			13,658			2,018
Total	148,079	2,225	3,887	26,439	4,399	831	1,133	645	681	718	757	14,646	3,109	4,088 1	4,932 3	442	3,759	3,290	4,759	10,172	4,582	6,086	3,413	3,433	15,239	3,750	4,067	3,599
Loan transaction									4. * *																			
Loan Receipt	50,245	01	·	5,245	2 024	n n	- 0	<u>-</u>	<u>-</u> 01		۸۱	10 275	1,664	1,664	1,664 1	664	1,664	1 ((4)	1 601	7.426	1 (01)	1 601	1 601	1 501	1 (01	1 501	1 5011	1,581
	11,394		0	3,243	2,774		<u>`</u>	~ ~		. 0		10,317	1,004	262			411	1,664 411	1,581	7,435	1,581 411	1,581 930		1,581 1,096	1,581 1,179			1,429
Loan Repayment Loan Balance	38,850	<u>0</u>		5,245	8,219	8,219	8,219	8,219	8,219	8,219	8,219	18,594 20	1258	21,660 2					27,843				1,013 37,257				38,698 3	
Loan Dalance	30,630[			7,2,7]	0,217	0,217	0,217	0,217	0,217	0,212	0,217	10,334 20	3,230	21,000 2	2,713 24	100] .	23,415	20,072	21,043	34,007	30,037	30,000	31,231	31,742	30,144	30,403	20,0301 20	امدهره
Interest			• :			•				4. 7. 4		raine Carrier	in							· .		1.5		1.				
															and the second of the second				The first section of	at the second		the second second	and the second		4 4 4 4			
Unterest ( 5 % )	29 352	0	n	262	411	411	4111	411	411	411	411	930 1	1013	1.083	1 146] 1	208	1 271	1 3341	1 302	1 743	1.802	1 224	1 863	1 227	1 007	1 023	1 035	1 0 13
Interest (5%)	29,352	0	0	262	411	411	411	411	411	411	411	930 1	1,013	1,083	1,146] 1	208	1,271	1,334	1,392	1,743	1,802	1,834	1,863	1,887	1,907	1,923	1,935	1,943
	29,352	0	0	262	411	411	411	411	411	411	411	930 1	1,013]	1,083	1,146] 1	208	1,271]	1,334	1,392	1,743	1,802	1,834	1,863	1,887	1,907	1,923	1,935	1,943
Cash Flow	29,352	0	0	262	411	411	411	411]	411	411	411	930 1	1,013	1,083	1,146 1	208	1,271	1,334]	1,392	1,743	1,802	1,834	1,863	1,887]	1,907	1,923	1,935	1,943
Cash Flow Cash - In:		1 908	3 500		411	411	411	411	411	411	411	930 1	1,013	1,083	1,146 1	208	1,271	1,334	1,392	1,743	1,802	1,834	1,863	1,887	1,907	1,923	1,935	1,943
Cash Flow Cash - In: Donation	21,180	1,908	3,509	15,763	0	0	0 0	411] 0	411 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Flow Cash - In : Donation Loan for Project Disbursement	21,180 50,245	0	. 0	15,763 5,245	0 2,974	0 0	0	0 0	0	0	0 0	0 10,375 1	0	0 1,664	0 1,664 1	0 664	0 1,664	0	0 1,581	0 7,435	0	0 1,581	0	0 1,581	0 1,581	0 1,581	0	0
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement	21,180 50,245 76,655	1,908 0 317	. 0	15,763	0	0 0 831	0	0 0 645	0 0 681	0 0 718	0	0 10,375 1	0	0 1,664 2,424 1	0 1,664 1 3,268 1	0 664 778	0 1,664 2,095	0 1,664 1,626	0 1,581 3,177	0 7,435 2,737	0 1,581 3,001	0 1,581 4,504	0 1,581 1,832	0 1,581 1,852	0 1,581 13,658	0 1,581 2,168	0 1,581 2,486	0 1,581 2,018
Cash Flow Cash - In : Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment	21,180 50,245 76,655 11,394	0 317 0	0 378 0	15,763 5,245 5,431 0	0 2,974 1,425	0 0 831	0 0 1,133	0 0 645 0	0 0 681	0 0 718	0 0 757 0	0 10,375 1 4,270 1	0 1,664 1,445	0 1,664 2,424 1 262	0 1,664 1 3,268 1	0 ,664 ,778 411	0 1,664 2,095 411	0 1,664 1,626 411	0 1,581 3,177 411	0 7,435 2,737 411	0 1,581 3,001 411	0 1,581 4,504 930	0 1,581 1,832 1,013	0 1,581 1,852 1,096	0 1,581 13,658 1,179	0 1,581 2,168 1,263	0 1,581 2,486	0 1,581 2,018 1,429
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold	21,180 50,245 76,655 11,394 171,559	0	0 378 0	15,763 5,245 5,431 0 1,903	0 2,974 1,425 0 2,025	0 0 831 0 2,259	0 0 1,133 0 2,399	0 0 645 0 2,542	0 0 681 0 2,875	0 0 718 0 3,095	0 0 757 0 3,322	0 10,375 1 4,270 1 0 3,740 4	0 1,664 1,445 0	0 1,664 2,424 1 262 4,181	0 1,664 1 3,268 1 411 4,584 4	0 664 778 411 781	0 1,664 2,095 411 4,983	0 1,664 1,626 411 5,456	0 1,581 3,177 411 5,674	0 7,435 2,737 411 5,900	0 1,581 3,001 411 6,426	0 1,581 4,504 930 6,689	0 1,581 1,832 1,013 6,948	0 1,581 1,852 1,096 7,548	0 1,581 13,658 1,179 7,809	0 1,581 2,168 1,263 8,077	0 1,581 2,486 1,346 8,771 52	0 1,581 2,018 1,429 2,208
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment	21,180 50,245 76,655 11,394	0 317 0	0 378 0	15,763 5,245 5,431 0	0 2,974 1,425	0 0 831 0 2,259	0 0 1,133 0 2,399	0 0 645 0	0 0 681	0 0 718	0 0 757 0	0 10,375 1 4,270 1 0 3,740 4	0 1,664 1,445	0 1,664 2,424 1 262 4,181	0 1,664 1 3,268 1 411 4,584 4	0 ,664 ,778 411	0 1,664 2,095 411	0 1,664 1,626 411	0 1,581 3,177 411	0 7,435 2,737 411	0 1,581 3,001 411	0 1,581 4,504 930	0 1,581 1,832 1,013 6,948	0 1,581 1,852 1,096	0 1,581 13,658 1,179	0 1,581 2,168 1,263	0 1,581 2,486 1,346 8,771 52	0 1,581 2,018 1,429
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:	21,180 50,245 76,655 11,394 171,559 29,352	0 317 0 1,572 0	0 378 0 1,783 0	15,763 5,245 5,431 0 1,903 262	0 2,974 1,425 0 2,025 411	0 0 831 0 2,259 411	0 0 1,133 0 2,399 411	0 0 645 0 2,542 411	0 681 0 2,875 411	0 0 718 0 3,095 411	0 0 757 0 3,322 411	0 10,375 1 4,270 1 0 3,740 4 930 1	0 1,664 1,445 0 4,006 1,013	0 1,664 2,424 1 262 4,181 1,083	0 1,664 1 3,268 1 411 4,584 4 1,146 1	0 664 778 411 781 208	0 1,664 2,095 411 4,983 1,271	0 1,664 1,626 411 5,456 1,334	0 1,581 3,177 411 5,674 1,392	0 7,435 2,737 411 5,900 1,743	0 1,581 3,001 411 6,426 1,802	0 1,581 4,504 930 6,689 1,834	0 1,581 1,832 1,013 6,948 1,863	0 1,581 1,852 1,096 7,548 1,887	0 1,581 13,658 1,179 7,809 1,907	0 1,581 2,168 1,263 8,077 1,923	0 1,581 2,486 1,346 8,771 52 1,935	0 1,581 2,018 1,429 2,208 1,943
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement	21,180 50,245 76,655 11,394 171,559 29,352 148,079	0 317 0	0 378 0 1,783 0	15,763 5,245 5,431 0 1,903 262	0 2,974 1,425 0 2,025	0 0 831 0 2,259	0 0 1,133 0 2,399 411	0 0 645 0 2,542	0 0 681 0 2,875	0 0 718 0 3,095	0 0 757 0 3,322 411	0 10,375 1 4,270 1 0 3,740 4 930 1	0 1,664 1,445 0	0 1,664 2,424 1 262 4,181 1,083	0 1,664 1 3,268 1 411 4,584 4 1,146 1	0 664 778 411 781 208	0 1,664 2,095 411 4,983 1,271	0 1,664 1,626 411 5,456 1,334 3,290	0 1,581 3,177 411 5,674 1,392	0 7,435 2,737 411 5,900 1,743	0 1,581 3,001 411 6,426 1,802 4,582	0 1,581 4,504 930 6,689 1,834 6,086	0 1,581 1,832 1,013 6,948 1,863	0 1,581 1,852 1,096 7,548 1,887	0 1,581 13,658 1,179 7,809 1,907	0 1,581 2,168 1,263 8,077 1,923	0 1,581 2,486 1,346 8,771 5 1,935	0 1,581 2,018 1,429 2,208 1,943 3,599
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394	0 317 0 1,572 0	0 378 0 1,783 0	15,763 5,245 5,431 0 1,903 262 26,439 0	0 2,974 1,425 0 2,025 411 4,399 0	0 0 831 0 2,259 411 831	0 0 1,133 0 2,399 411 1,133	0 0 645 0 2,542 411	0 0 681 0 2,875 411	0 0 718 0 3,095 411	0 0 757 0 3,322 411	0 10,375 1 4,270 1 0 3,740 4 930 1 14,646 3	0 1,664 1,445 0 4,006 1,013 3,109	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3	0 664 778 411 781 208 442 411	0 1,664 2,095 411 4,983 1,271 3,759 411	0 1,664 1,626 411 5,456 1,334 3,290 411	0 1,581 3,177 411 5,674 1,392 4,759 411	0 7,435 2,737 411 5,900 1,743 10,172 411	0 1,581 3,001 411 6,426 1,802 4,582 411	0 1,581 4,504 930 6,689 1,834 6,086	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263	0 1,581 2,486 1,346 8,771 5 1,935 4,067	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment  Interest Payment	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352	0 317 0 1,572 0 2,225 0	0 378 0 1,783 0 3,887 0	15,763 5,245 5,431 0 1,903 262 26,439 0 262	0 2,974 1,425 0 2,025 411 4,399 0 411	0 0 831 0 2,259 411 831 0 411	0 0 1,133 0 2,399 411 1,133 0 411	0 0 645 0 2,542 411 645 0 411	0 0 681 0 2,875 411 681 0 411	0 0 718 0 3,095 411 718 0 411	0 0 757 0 3,322 411 757 0 411	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   1	0 1,664 1,445 0 4,006 1,013 3,109 0	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1	0 664 778 411 781 208 442 411 208	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment  Interest Payment  EMSAPUNO existing expense	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249	0 317 0 1,572 0 2,225 0 0 787	378 0 1,783 0 3,887 0 0 787	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787	0 2,974 1,425 0 2,025 411 4,399 0 411 787	0 0 831 0 2,259 411 831 0 411 787	0 0 1,133 0 2,399 411 1,133 0 411 787	0 0 645 0 2,542 411 645 0 411 787	0 0 681 0 2,875 411 681 0 4111 787	0 0 718 0 3,095 411 718 0 411	0 0 757 0 3,322 411 757 0 411 787	0 10,375   4,270   0 3,740   4 930   1 14,646   3 930   787	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787	0 664 778 411 781 208 442 411 208 787	3,759 411 1,271 3,759 411 1,271	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310	0 317 0 1,572 0 2,225 0 0 787 785	3,887 0 3,887 0 0 787 996	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238	831 0 2,259 411 831 0 411 787	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612	0 0 645 0 2,542 411 645 0 411 787 1,755	0 0 681 0 2,875 411 681 0 411 787 2,088	718 0 3,095 411 718 0 411 787 2,308	0 0 757 0 3,322 411 757 0 411 787 2,535	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3	0 664 778 411 781 208 442 411 208 787 994	3,759 411 1,271 3,759 411 1,271 787 4,196	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787 7,984 5	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249	0 317 0 1,572 0 2,225 0 0 787	378 0 1,783 0 3,887 0 0 787	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238	831 0 2,259 411 831 0 411 787	0 0 1,133 0 2,399 411 1,133 0 411 787	0 0 645 0 2,542 411 645 0 411 787	0 0 681 0 2,875 411 681 0 4111 787	718 0 3,095 411 718 0 411 787 2,308	757 0 3,322 411 757 0 411 787 2,535	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3	0 664 778 411 781 208 442 411 208 787	3,759 411 1,271 3,759 411 1,271	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787 7,984 5	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / Local Fund	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310	0 317 0 1,572 0 2,225 0 0 787 785	3,887 0 3,887 0 0 787 996	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238	831 0 2,259 411 831 0 411 787	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612	0 0 645 0 2,542 411 645 0 411 787 1,755	0 0 681 0 2,875 411 681 0 411 787 2,088	718 0 3,095 411 718 0 411 787 2,308	0 0 757 0 3,322 411 757 0 411 787 2,535	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3	0 664 778 411 781 208 442 411 208 787 994	3,759 411 1,271 3,759 411 1,271 787 4,196	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787 7,984 5	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909	0 317 0 1,572 0 2,225 0 0 787 785 468	378 0 1,783 0 3,887 0 0 787 996 618	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598	831 0 2,259 411 831 0 411 787 1,472 230	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612 69	0 0 645 0 2,542 411 645 0 411 787 1,755 699	0 0 681 0 2,875 411 681 0 411 787 2,088 996	718 0 3,095 411 718 0 411 787 2,308 1,179	757 0 3,322 411 757 0 411 787 2,535 1,367	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3 -2,247	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219 761	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3 1,027	0 6664 778 411 781 208 442 411 208 787 994 596	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902 -1,366	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022 -9,722	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936	0 1,581 2,486 1,346 8,771 5: 1,935 4,067 1,346 1,935 787 7,984 5: 2,217 40	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund P/L ESTIMATION Revenue	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909	0 317 0 1,572 0 2,225 0 0 787 785 468	0 378 0 1,783 0 3,887 0 0 787 996 618	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598	831 0 2,259 411 831 0 411 787 1,472 230	1,133 0 2,399 411 1,133 0 411 787 1,612 69	0 0 645 0 2,542 411 645 0 411 787 1,755 699	0 0 681 0 2,875 411 681 0 411 787 2,088 996	718 0 3,095 411 718 0 411 787 2,308 1,179	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367	0 10,375 4,270 0 3,740 4 930 14,646 0 930 787 2,953 -2,247	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219 761	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3 1,027	0 6664 778 411 781 208 442 411 208 787 994 596	3,759 411 4,983 1,271 3,759 411 1,271 787 4,196 419	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298	1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902 -1,366	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022 -9,722	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936	0 1,581 2,486 1,346 8,771 5: 1,935 4,067 1,346 1,935 787 7,984 5: 2,217 40	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / Local Fund P/L ESTIMATION Revenue Expense: 1. Administration	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909	0 317 0 1,572 0 2,225 0 0 787 785 468	378 0 1,783 0 3,887 0 0 787 996 618	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598	831 0 2,259 411 831 0 411 787 1,472 230	1,133 0 2,399 411 1,133 0 411 787 1,612 69	0 0 645 0 2,542 411 645 0 411 787 1,755 699	0 0 681 0 2,875 411 681 0 411 787 2,088 996	718 0 3,095 411 718 0 411 787 2,308 1,179	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3 -2,247   4 971	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219 761	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3 1,027	0 6664 778 411 781 208 442 411 208 787 994 596	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298	1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902 -1,366	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	0 1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022 -9,722	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936	0 1,581 2,486 1,346 8,771 5: 1,935 4,067 1,346 1,935 787 7,984 5: 2,217 40	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / Local Fund P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909 128,420 22,577 8,141	0 317 0 1,572 0 2,225 0 0 787 785 468	0 378 0 1,783 0 3,887 0 0 787 996 618	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598	831 0 2,259 411 831 0 411 787 1,472 230 809 0	1,133 0 2,399 411 1,133 0 411 787 1,612 69	0 0 645 0 2,542 411 645 0 411 787 1,755 699	0 0 681 0 2,875 411 681 0 411 787 2,088 996	0 0 718 0 3,095 411 718 0 411 787 2,308 1,179	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3 -2,247   3,740   4 971   1,441	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219 761 4,006 816 0	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1	0 1,664 1 3,268 1 411 4,584 4 1,146 1 4,932 3 411 1,146 1 787 3,797 3 1,027	0 6664 778 411 781 208 442 411 208 787 994 596	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298 5,456 816 0	1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221 5,900 807 0	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426 6,426 1,062 1,023	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902 -1,366 6,689 807 0	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	1,179 1,581 1,179 7,809 1,907 1,907 7,809 1,179 7,022 -9,722 7,809 807	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787 7,984 5 2,217 40	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032
Cash Flow Cash - In: Donation Loan for Project Disbursement Local Fund for Project Disbursement Local Fund for Loan Repayment Revenue + F/A sold Local Fund for Interest Payment Cash - Out: Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / Local Fund P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909 128,420 22,577 8,141 28,646	0 317 0 1,572 0 2,225 0 0 787 785 468	0 378 0 1,783 0 3,887 0 0 787 996 618	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598	831 0 2,259 411 831 0 411 787 1,472 230 809 0 574	1,133 0 2,399 411 1,133 0 411 787 1,612 69 2,399 809 0 599	0 0 645 0 2,542 411 645 0 411 787 1,755 699	0 0 681 0 2,875 411 681 0 411 787 2,088 996 2,875 809 0 659	0 0 718 0 3,095 411 718 0 411 787 2,308 1,179 3,095 809 0	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367	0 10,375   4,270   0 3,740   4 930   1 14,646   3 0 930   787 2,953   3 -2,247   3,740   4 971   1,441   778   1	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219 761 4,006 816 0 1,096	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1 4,181 816 961 1,135	0 1,664 1 3,268 1 411 4,584 4 1,146 1 1,146 1 787 3,797 3 1,027	0 6664 778 411 781 208 442 411 208 787 994 596	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419 4,983 816 0 1,255	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298 5,456 816 0 1,297	1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221 5,900 807 0 1,379	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426 6,426 1,062 1,023 1,418	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902 -1,366 6,689 807 0 1,464	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	1,581 13,658 1,179 7,809 1,907 15,239 1,179 1,907 787 7,022 -9,722 7,809 807 0	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787 7,984 5 2,217 40 8,771 5 807 0 1,670	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment  Interest Payment  EMSAPUNO existing expense  Repayment of Local Fund  Balance of Cash Fund / Local Fund  P/L ESTIMATION  Revenue  Expense: 1. Administration  2. Engineering service  3. Maintenance  4. Interest expense	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909 128,420 22,577 8,141 28,646 29,352	0 317 0 1,572 0 2,225 0 0 787 785 468	0 378 0 1,783 0 3,887 0 0 787 996 618	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598	0 0 831 0 2,259 411 831 0 411 787 1,472 230 809 0 574 411	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612 69 2,399 809 0 599	0 0 645 0 2,542 411 645 0 411 787 1,755 699	0 0 681 0 2,875 411 681 0 411 787 2,088 996 2,875 809 0 659	0 0 718 0 3,095 411 718 0 411 787 2,308 1,179 3,095 809 0 696	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367	0 10,375 4,270 0 3,740 4 930 1 14,646 3 930 787 2,953 2,247 3,740 4 971 1,441 778 930	0 1,664 1,445 0 4,006 1,013 3,109 0 1,013 787 3,219 761 4,006 816 0 1,096 1,013	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1 4,181 816 961 1,135 1,083	0 1,664 1 3,268 1 411 4,584 4 1,146 1 1,146 1 787 3,797 3 1,027	0 6664 778 411 781 208 442 411 208 787 994 596	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419 4,983 816 0 1,255 1,271	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298 5,456 816 0 1,297 1,334	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93 5,674 807 1,535 1,338 1,392	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221 5,900 807 0 1,379 1,743	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426 6,426 1,062 1,023 1,418 1,802	0 1,581 4,504 930 6,689 1,834 6,086 930 1,834 787 5,902 -1,366 6,689 807 0 1,464 1,834	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453 6,948 807 0 1,507 1,863	0 1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	7,809 7,809 1,581 13,658 1,179 7,809 1,907 787 7,022 -9,722 7,809 807 0 1,588 1,907	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936 8,077 807 0 1,629 1,629	0 1,581 2,486 1,346 8,771 5: 1,935 4,067 1,346 1,935 787 7,984 5: 2,217 40 8,771 5: 807 0 1,670 1,935	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032 9,069 807 0 1,713 1,943
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment  Interest Payment  EMSAPUNO existing expense  Repayment of Local Fund  Balance of Cash Fund / Local Fund  P/L ESTIMATION  Revenue  Expense: 1. Administration  2. Engincering service  3. Maintenance  4. Interest expense  5. Depreciation (proposed)	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909 128,420 22,577 8,141 28,646 29,352 57,789	0 317 0 1,572 0 0 0 787 785 468 1,572 787 1,908 317 0	0 378 0 1,783 0 3,887 0 0 787 996 618 1,783 809 0 335	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577 354 262 0	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598 2,025 1,127 0 550 411	0 0 831 0 2,259 411 831 0 411 787 1,472 230 809 0 574 411 1,678	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612 69 2,399 809 0 599 411 1,678	0 0 645 0 2,542 411 645 0 411 787 1,755 699 2,542 809 0 623 411 1,678	0 0 681 0 2,875 411 681 0 411 787 2,088 996 2,875 809 0 659 411 1,678	3,095 3,095 411 718 0 411 787 2,308 1,179 3,095 809 0 696 411 1,678	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367 3,322 809 0 735 411 1,678	0 10,375 4,270 0 3,740 4 930 1 14,646 3 0 930 787 2,953 3,740 971 1,441 778 930 1,678	0 1,664 1,445 0 4,006 1,013 787 3,219 761 4,006 816 0 1,096 1,013 2,189	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1 4,181 816 961 1,135 1,083 2,238	0 1,664 1 3,268 1 411 4,584 4 1,146 1 1,146 1 787 3,797 3 1,027 4,584 4 816 0 1,174 1 1,146 1 2,287 2	0 6664 778 411 781 208 442 411 208 787 994 596 781 816 0 215 208 336	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419 4,983 816 0 1,255 1,271 2,385	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298 5,456 816 0 1,297 1,334 2,434	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93 5,674 807 1,535 1,338 1,392 2,483	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221 5,900 807 0 1,379 1,743 2,530	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426 6,426 1,062 1,023 1,418 1,802 3,232	0 1,581 4,504 930 6,689 1,834 787 5,902 -1,366 6,689 807 0 1,464 1,834 3,279	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453 6,948 807 0 1,507 1,863 3,325	7,548 807 0,1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	7,809 807 0,1581 13,658 1,179 7,809 1,907 787 7,022 -9,722 7,809 807 0 1,588 1,907 3,419	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936 8,077 807 0 1,629 1,923 3,465	0 1,581 2,486 1,346 8,771 5 1,935 4,067 1,346 1,935 787 7,984 5 2,217 40 8,771 5 807 0 1,670 1,935 3,512	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032 9,069 807 0 1,713 1,943 3,559
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment  Interest Payment  EMSAPUNO existing expense  Repayment of Local Fund  Balance of Cash Fund / Local Fund  P/L ESTIMATION  Revenue  Expense: 1. Administration  2. Engincering service  3. Maintenance  4. Interest expense  5. Depreciation ( proposed )  6. Depreciation ( existing )	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909 128,420 22,577 8,141 28,646 29,352 57,789 9,765	0 317 0 1,572 0 0 787 785 468 1,572 787 1,908 317 0 0	0 378 0 1,783 0 3,887 0 0 787 996 618 1,783 809 0 335 0 0	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577 1,903 809 1,273 354 262 0 362	0 2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598 2,025 1,127 0 550 411 0 362	0 0 831 0 2,259 411 831 0 411 787 1,472 230 809 0 574 411 1,678 362	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612 69 2,399 809 0 599 411 1,678 362	0 0 645 0 2,542 411 645 0 411 787 1,755 699 0 623 411 1,678 362	0 0 681 0 2,875 411 681 0 411 787 2,088 996 2,875 809 0 659 411 1,678 362	3,095 3,095 411 718 0 411 787 2,308 1,179 3,095 809 696 411 1,678 362	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367 3,322 809 0 735 411 1,678 362	0 10,375 4,270 0 3,740 4 930 1 14,646 3 930 787 2,953 3,740 971 1,441 778 930 1,678 362	0 1,664 1,445 0 4,006 1,013 787 3,219 761 4,006 816 0 1,096 1,013 2,189 3,62	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1 4,181 816 961 1,135 1,083 2,238 362	0 1,664 1 3,268 1 411 4,584 4 1,146 1 1,146 1 787 3,797 3 1,027 4,584 4 816 0 1,174 1 1,146 1 2,287 2	0 6664 778 411 781 208 442 411 208 787 994 596 781 816 0 215 208 336 362	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419 4,983 816 0 1,255 1,271 2,385 362	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298 5,456 816 0 1,297 1,334 2,434 3,62	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93 5,674 807 1,535 1,338 1,392 2,483 362	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221 5,900 807 0 1,379 1,743 2,530 362	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426 6,426 1,062 1,023 1,418 1,802 3,232 362	0 1,581 4,504 930 6,689 1,834 787 5,902 -1,366 6,689 807 0 1,464 1,834 3,279 362	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453 6,948 807 0 1,507 1,863 3,325 362	7,548 807 0,1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	7,809 7,809 1,581 13,658 1,179 7,809 1,907 787 7,022 -9,722 7,809 807 0 1,588 1,907 3,419	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936 8,077 807 0 1,629 1,923 3,465 362	0 1,581 2,486 1,346 8,771 5: 1,935 4,067 1,346 1,935 787 7,984 5: 2,217 40 8,771 5: 807 0 1,670 1,935 3,512 362	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032 9,069 807 0 1,713 1,943 3,559 362
Cash Flow  Cash - In:  Donation  Loan for Project Disbursement  Local Fund for Project Disbursement  Local Fund for Loan Repayment  Revenue + F/A sold  Local Fund for Interest Payment  Cash - Out:  Project Disbursement  Loan Repayment  Interest Payment  EMSAPUNO existing expense  Repayment of Local Fund  Balance of Cash Fund / Local Fund  P/L ESTIMATION  Revenue  Expense: 1. Administration  2. Engincering service  3. Maintenance  4. Interest expense  5. Depreciation (proposed)	21,180 50,245 76,655 11,394 171,559 29,352 148,079 11,394 29,352 21,249 150,310 32,909 128,420 22,577 8,141 28,646 29,352 57,789	0 317 0 1,572 0 0 787 785 468 1,572 787 1,908 317 0 0 362 3,374	0 378 0 1,783 0 3,887 0 0 787 996 618 1,783 809 0 335	15,763 5,245 5,431 0 1,903 262 26,439 0 262 787 1,116 -4,577 354 262 0 362 3,060	2,974 1,425 0 2,025 411 4,399 0 411 787 1,238 -598 2,025 1,127 0 550 411 0 362 2,449	0 0 831 0 2,259 411 787 1,472 230 2,259 809 0 574 411 1,678 362 3,833	0 0 1,133 0 2,399 411 1,133 0 411 787 1,612 69 2,399 809 0 599 411 1,678	0 0 645 0 2,542 411 645 0 411 787 1,755 699 0 623 411 1,678 362 3,882	0 0 681 0 2,875 411 681 0 411 787 2,088 996 2,875 809 0 659 411 1,678	3,095 3,095 411 718 0 411 787 2,308 1,179 3,095 809 696 411 1,678 362	0 0 757 0 3,322 411 757 0 411 787 2,535 1,367 3,322 809 0 735 411 1,678 362 3,994	0 10,375 4,270 0 3,740 4 930 1 14,646 3 0 930 787 2,953 3,740 971 1,441 778 930 1,678 362 6,159	0 1,664 1,445 0 4,006 1,013 787 3,219 761 4,006 816 0 1,096 1,013 2,189 362 5,475	0 1,664 2,424 1 262 4,181 1,083 4,088 1 262 1,083 787 3,394 -375 -1 4,181 816 961 1,135 1,083 2,238 362 6,594	0 1,664 1 3,268 1 411 4,584 4 1,146 1 1,146 1 787 3,797 3 1,027 4,584 4 816 0 1,174 1 1,146 1 2,287 2 362 5,784 5	0 6664 778 411 781 208 442 411 208 787 994 596 781 816 0 215 208 336 362 937	0 1,664 2,095 411 4,983 1,271 3,759 411 1,271 787 4,196 419 4,983 816 0 1,255 1,271 2,385	0 1,664 1,626 411 5,456 1,334 3,290 411 1,334 787 4,669 1,298 5,456 816 0 1,297 1,334 2,434	0 1,581 3,177 411 5,674 1,392 4,759 411 1,392 787 4,887 -93 5,674 807 1,535 1,338 1,392 2,483	0 7,435 2,737 411 5,900 1,743 10,172 411 1,743 787 5,113 221 5,900 807 0 1,379 1,743 2,530	0 1,581 3,001 411 6,426 1,802 4,582 411 1,802 787 5,639 426 6,426 1,062 1,023 1,418 1,802 3,232	0 1,581 4,504 930 6,689 1,834 787 5,902 -1,366 6,689 807 0 1,464 1,834 3,279	0 1,581 1,832 1,013 6,948 1,863 3,413 1,013 1,863 787 6,161 1,453 6,948 807 0 1,507 1,863 3,325 362	7,548 807 0,1,581 1,852 1,096 7,548 1,887 3,433 1,096 1,887 787 6,761 1,927	7,809 807 0,1581 13,658 1,179 7,809 1,907 787 7,022 -9,722 7,809 807 0 1,588 1,907 3,419	0 1,581 2,168 1,263 8,077 1,923 3,750 1,263 1,923 787 7,290 1,936 8,077 807 0 1,629 1,923 3,465 362 8,186	0 1,581 2,486 1,346 8,771 5: 1,935 4,067 1,346 1,935 787 7,984 5: 2,217 40 8,771 5: 807 0 1,670 1,935 3,512 362 8,286	0 1,581 2,018 1,429 2,208 1,943 3,599 1,429 1,943 787 1,421 6,032 9,069 807 0 1,713 1,943 3,559

- 1. Revenue: The rate will be revised every 3 years and 5 % increase is expected. Fee collection rate will be increased by 1% annually.
- 2. Depreciation (construction) civil work will be depreciated for 40 years (every year 2.5 % of acquisition cost is depreciated.) mechanical/electrical will be depreciated for 10 years.
- 3. Depreciation ( equipment ) items will be depreciated for 10 years ( every year 10 % of acquisition cost is depreciated.)
- Depreciation (EMSAPUNO) Existing fixed asset is for water and sewerage business. According
  to the 1998 FY detail expense information, 66% of depreciation was for water business, 34% of depreciation was for sewerage business.
- 5. Local Fund: Non-construction expense loan principal payment & interest payment are funded by Peru/Puno government without interest.

			<u> </u>			14.14					· · · · · · · · · · · · · · · · · · ·					•						•					(Unit : S/,000)
Depreciation of proposed fixed asset		1999F/Y	2000F/Y	2001F/Y	2002F/Y	2003F/Y	2004F/Y	2005F/Y	2006F/Y	2007F/Y	2008F/Y	2009F/Y	2010F/Y	2011F/Y	2012F/Y	2013F/Y	014F/Y	2015F/Y	2016F/Y	2017F/Y	2018F/Y	2019F/Y	2020F/Y	2021F/Y	2022F/Y	2023F/Y	2024F/Y 2025F/Y
sewer civil work ( 2000-2FY )	6,054]			14.		263	263	263	263	263	263	263	263	263	263	263	263	263	263	263		263	263	263	263	263	263 263
sewer civil work ( 2009-15FY )	4,468				1,4 4							-	49	98	147	196	246	295	344	344	344	344	344	344	344	344	344 344
sewer civil work ( 2016-25FY )	2,099			100									100					100 100	T	47	93	140	187	233	280	327	373 420
pump civil work ( 2001FY )	2,772					1	i	1	1	1	1	1	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173 173
plant civil work (2001FY)	5,445					237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237 237
plant civil work ( 2009FY )	268	- A .				. 5.5		1.0					17	17	17	17	17	17	17	17		17	17	17	17		17 17
plant civil work (2017FY)	94			•			7, 1														12	12	12	12	12		12 12
pump mechanical (2001FY, 2017FY)	3,366					25	25	25	25	25	25	. 25	187	187	187	187	187	187	187	187	212	212	212	212	212		212 212
plant mechanical ( 2001FY )	26,496					1,152	1,152				1,152		1,152	1,152		1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152		1,152 1,152
plant mechanical ( 2009FY )	1,774	· · · · · ·						- 11.22	.,	,	.,	1,102	111	111	111	111	111	111	111	111	111	111	111	111	111		111 111
plant mechanical (2017FY)	4,953					1.00	· · · · ·	9 5 5			<del></del> -		<del></del>					- '''	- '''		619	619	619	619	619	619	619 619
total depreciation of proposed F/A	57,789	100				1,678	1,678	1,678	1.678	1,678	1,678	1,678	2,189	2,238	2,287	2,336	2,385	2,434	2,483	2,530	3,232	3,279	3,325	3,372	3,419	3,465	3,512 3,559
					L	,,,,,	1,510	1,070	1,070	1,010	1,010	1,070	2,103	2,2001	2,201	2,000	2,000	2,707	2,700]	2,000	1 3,232	3,273	0,020]	3,372	3,413	3,403	3,012  3,003
Depreciation for existing (EMSAPUNO) fixed	asset		1 8 7 3	P 3.		Salata Li			13.20																		
Building, Construction (S/.23449 +S/.12450) x 34	8,239	305 30	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305 305
Machine (S/. 874) x 34%	802	30	30	30	30	30	30	30	30	30	30		30	30	30	30	30	30	30	- 30		30	30	30	30	30	30 30
Transportation equipment (S/. 236) x 34%	217	8	8	8	8	8	8	8	8	8	8	8	- 8	8	8	- 8	8	8	- 8	8	8	8	- 8	8	8	8	8 8
Equipment (S/. 43) x 34%	39	1	i	1	ī	1	1	1	1	25 2 1	<u>_</u>	1	1	1	1	a 1	1	T il	1	1	<del>                                     </del>	<u>i</u> l	1	<del></del>	<u></u>	i	
Other (S/. 510) x 34%	468	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17 17
total of depreciation of existing F/A	9,765	362	362	362	362	362	362	362	362		362			362	362	362	362	362	362	362		362	362	362	362	362	362 362
REVENUE ESTIMATION wastewater flow estimation (61.3 l/s in 98FY) increase rate of wastewater (each year / 98FY)A		65.8 1.0734	70.4 1.1485	74.4 1.2137	78.4 1.2790	82.5 1.3458	86.8 1.4160	91.1 1.4861	97.2 1.5856	103.7 1.6917	110.3 1.7993			128.7		137.7	142.3	147.1	151.7	156.4	160.9	166.1	171.1	175.6	180.2	184.9	189.7 194.6
increase rate of sewerage fee (each year / 98FY)B		1.00	1.05	1.05	1.05	1.10							2.0294	2.0995			2.3214			2.5514		2.7096				3.0163	3.0946 3.1746
increase of collection rate (annually 1%) C	<u> </u>	1.01	1.02	1.03	1.03		1.10		1.16		1.16	1.22		1.22		1.28	1.28	1.34	1.34	1.34		1.41	1.41	1.48	1.48	1.48	1.55 1.55
estimated revenue (S/. 1450 in 1998 x A x B x C)		1,572	1,783	1,903	2,025	1.05	1.06		1.08		1.10	1.11	1.12	1.13		1.15	1.16	1.17	1.18	1.19		1.21	1.22	1.23	1.24	1.25	1.26 1.27
communication (37. 1430 in 1338 X A X B X C )		1,372	1,763]	1,903	2,025	2,259	2,399	2,542	2,875	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077	8,771 9,069
Administration detail(without contingency and																											en de la companya de
EMSAPUNO existing administration expense	21,249	787	787	787	787	787	787	787	787	<i>7</i> 87	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787 787
Proposed project administration expense	601	0	22	22	22	22	22	22	22	22	22		29	29	29	29	29	29	20	20	20	20	20	20	20		20 20
Proposed project maintenance equipment	727	- 0	0	0	318	0	0	0	0	0	0	155	0	. 0	0	0	0	0	0	0	255	0	Ō	0	0		0 0
total	22,577	787	809	809	1,127	809	809	809	809	809	809	971	816	816	816	816	816	816	807	807	1,062	807	807	807	807	807	807 807
IRR (Internal Rate of Return) Cash Flow In (Donation + Revenue + F/A sold)	103 7301	2 400	6 2021	18 2221	0.000				vita i j		<u> </u>														. 10 - 1		
	192,739	3,480		17,666	2,025	2,259	2,399	2,542				3,740	4,006	4,181		4,781	4,983	5,456	5,674	5,900		6,689	6,948	7,548	7,809	8,077	8,771 52,208
Cash Flow Out ( Project dis + EMSAPUNO ) Balance	169,328	3,012		27,226	5,186	1,618	1,920		1,468		1,544		3,896		15,719	4,229	4,546	4,077	5,546	10,959		6,873	4,200		16,026	4,537	4,854 4,386
	23,411	468	618	-9,560	-3,161	641	480	1,110	1,407	1,590	1,778	-11,692	110	-694	-11,135	551	437	1,379	129	-5,059	1,057	-183	2,747	3,328	-8,217	3,541	3,917 47,822
IRR	3.532	100				A	* *											- :	100								
NPR(12%)	-8,367		1. de 1. e. i. e.						e girtis								. •	1000		** *		-		•		-	
NPR(10%)	-8,339		$S_{k} = \sum_{i=1}^{k} S_{i} = \sum_{i=1}^{k} S_{i$									1 21 .	Style -										1		•	•	
NPR(8%)	-7,666									100							1		: .		1.1			•		-	
NPR(6%)	-5,750					1:5	te agrica							15. July 1										* . *			
NPR(5%)	-4,018		4.0						11.32	Security facilities																	

Table V.2.44 Cash flow and P/L calculation for Alternative I-A

Project expenditure estimation		•																										
Fiscal Year	Total(00.25)	100002	2000EV	2001EV	Γολοσέν Ι	2003EV	200 IEV	JANSEV I	200467	200250	nnoev In	MODE V	20105.0	3011EV	1013EV	lantarie!	201 (51)		********		<del> </del>				·	(	Unit : S/.00	)(0)
Land Acquisition	Total(99-25)	19996 1	20001	200111	2002F1	20031-1	20041.1	2003F I	2000F I	20071	2006F1 [2	00911	201011	201111	ZUIZIY	2013FY	2014FY 2	015FY	2016FY	2017FY	2018FY   2	019FY	2020FY	2021FY	2022FY	2023FY 2	024FY 20	25FY
			- 23	22																								
Proposed project administration expense	601		22	10 270	22	22	22	22	22	22	22	29	29	29	29		29	29	20	20	20	20	20	20	20	20	20	20
Construction work (a)	53,720		2,586	18,268	2,586				·			2,758	1,447	1,447	1,447		1,447	1,447	1,375	6,465	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Contingency (15%) (b)=(a) x 0.15	8,058		388	2,740	388	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					414	217	217	217	217	217	217	206	970	206	206	206	206	206	206	206	206
GST (18%) (c)= $(a+b) \times 0.18$	11,120		535	3,781	535							571	300	300	300	300	300	300	285	1,338	285	285	285	285	285	285	285	285
Maintenance Equipment (d)	20,389		15	1.4	234	173	377					114	15		8,670	173	377				188	817	15		8,670	173	377	
Contingency (15%) (c)=(d) x 0.15	3,058		2		35	- 26	57					17	2		1,301	26	57				28	123	2		1,301	26	57	
GST (18%) (f) = $(d+e) \times 0.18$	4,221		3		48	36	78			· · · · · · · · · · · · · · · · · · ·		24	3		1,795	36	78				39	169	3		1,795	36	78	
Engineering Service (g)	5,373	1,406		938								686		458		·			1,131		754							
Contingency (15%) (h)=(g) x 0.15	806	211		141								103		69					170		113							
GST (18%) (1) = (g+h) x 0.18	1,112	291		194								142		95					234		156			<del>-</del>			<del></del>	
Maintenance (with GST)	24,901	317	335	354		574	599	623	659	696	735	778	913	945	978	1,012	1,046	1,081	1,114	1,149	1,181	1,219	1,256	1,289	1,322	1,357	1,391	1,427
Total	133,359	2,225	3,887	26,439	4,399	831	1,133	645	681	718	757	5,635	2,925	3,559	14,736	3,240	3,551	3,074	4,535	9,942	4,345	4,214	3,162		14,973			3,313
	4		٠										• .					<del></del>							,,,,,,	0,110		
Donation, Loan & Local Fund			<u> </u>	1,41		W		14.					: :	1000	1 .	1		i.						:				
Donation up to S/.21,180 ( DM12MIL)	21,180	1,617	2,974	16,589		0	0	0	0	0	0	0	0	0	0	Ō	ol	01	0	ol	ōl	01	n	- 01	ol	n n	n n	n
Loan available for construction work	42,215	0	0	4,419		0	0	0	0	0	0	3,172	1,664	1,664	1,664	1,664	1,664	1,664	1,581	7,435	1,581	1,581	1,581	1,581	1,581	1,581	1,581	1,581
Local Fund of non-construction expense	69,964	608	913	5,431	1,425	831		645	681	718	757	2,464	1,261		13,072	1,576	1,887	1,410	2,953	2,507	2,764	2,632	1.580	1,594	13,392	1,897		1,732
Total	133,359	2,225	3,887	26,439	4,399	831	1,133	645	681	718	757	5,635	2,925	3,559	14,736		3,551	3,074	4,535	9,942	4,345	4,214	3,162					3,313
			ı								· · · · · · · · · · · · · · · · · · ·	·	· · · · · · · · · · · · · · · · · · ·			L					- 1,0 101		0,102	L		0,1101	0,103	0,010
Loan transaction		entropy of the second	1000		*. i		1 1							Land Care		. 1. 1	10 mg											,
Loan Receipt	42,215	0	0	4,419	2,974	0	0	0	0	0	. 0	3,172	1,664	1,664	1,664	1,664	1,664	1,664	1,581	7,435	1,581	1,581	1,581	1,581	1,581	1,581	1,581	1,581
Loan Repayment	8,253	. 0	0	0	0	0	0	0	0	0	0	0	0	221	370		370	370		370	370	528	611	695	778			1,027
Loan Balance	33,962	0	0	4,419	7,393	7,393	7,393	7,393	7,393	7,393	7,393	10,565	12,229		14,966						28,338		30 361			32,771		3,962
				1.1			· .					·. ·					,	10,0 17		27,120	20,000	27,371		31,217	32,031	32,111	33,400	,,,,,,,
Interest			ta a fili			A Teach		1.4.1								40								1, 1, 1				
Interest (5%)	22,949	0	0	221	370	370	370	370	370	370	370	528	611	684	748	813	878	942	1,003	1 356	1,417	1,470	1,518	1 562	1,603	1,639	1.670	1,698
					٠.														,000				1,510]	,5021	1,005	1,037	1,070	1,076
Cash Flow		100		11 11 11			· · ·				1000	11.							100									
Cash - In :										-				- T			T		<u> </u>	т			I	ГТ		т		<del></del>
Donation	21,180	1,617	2,974	16,589	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	<del></del>	ñ		<u> </u>	- 0	0		0
Loan for Project Disbursement	42,215	0	0	4,419	2,974	0	0	Ō	0	0	0	3,172	1,664	1,664	1,664	1,664	1,664	1,664	1,581	7,435	1,581	1,581	1,581	1,581	1,581	1,581	1,581	1,581
Local Fund for Project Disbursement	69,964	608	913	5,431	1,425	831	1,133	645	681	718	757	2,464	1,261		13,072		1,887	1,410	2,953	2,507	2,764	2,632	1,580	1,594	13,392	1,897		1,732
Local Fund for Loan Repayment	8,253	0	0	0	0	0	0	. 0	0	0	0	0	0	221	370	370	370	370	370	370	370	528	611	695	13,392	861		1,027
Revenue + F/A sold	166,671	1,572	1,783	1,903	2,025	2,259	2,399	2,542	2,875	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077		7,320
Local Fund for Interest Payment	22,949	0	0	221	370	370	370		370	370	370	528	611	684	748		878	942	1,003	1,356	1,417	1,470	1,518	1,562	1,603	1,639		1,698
Cash - Out:			200															7.2		1,330	1,111	1,470	1,510	1,502	1,003	1,039	1,070	1,070
Project Disbursement	133,359	2,225	3,887	26,439	4,399	831	1,133	645	681	718	757	5,635	2,925	3,559	14,736	3,240	3,551	3,074	4,535	9,942	4,345	4,214	3,162	3,175	14,973	3,478	2 790	2 212
Loan Repayment																	2,221	3,017		7,742		7.6141	3,102	3,173	14,773	3,470		3,313
	8,253	0	0	Õ	0	0	0]	. 0	01	. 0	0	0	0	221	3701	3701		370					611	605		961	0441	1 027
Interest Payment		0	0	0 221	0 370	0 370	0 370	370	0 370	0 370	0 370	0 528	611	221 684	370 748	370 813	370	370 942	370	370	370	528	611	695	778	861		1,027
Interest Payment	8,253 22,949	0 0 787	0 0 787	221				370 787	0 370 787	0 370 787	0 370 787	528 787	0 611 787	684	748	813	370 878	942	370 1,003	370 1,356	370 1,417	528 1,470	1,518	1,562	778 1,603	1,639	1,670	1,698
	8,253 22,949 21,249	0 0 787 785	0 0 787 996	221 787	787	787	787	787	787	787	787	787	787	684 787	748 787	813 787	370 878 787	942 787	370 1,003 787	370 1,356 787	370 1,417 787	528 1,470 787	1,518 787	1,562 787	778 1,603 787	1,639 787	1,670 787	1,698 787
Interest Payment EMSAPUNO existing expense Repayment of Local Fund	8,253 22,949 21,249 145,422	785	996	787 1,116	787 1,238	787 1,472	787 1,612	787 1,755	787 2,088	787 2,308	787 2,535	787 2,953	787 3,219	684 787 3,394	748 787 3,797	813 787 3,994	370 878 787 4,196	942 787 4,669	370 1,003 787 4,887	370 1,356 787 5,113	370 1,417 787 5,639	528 1,470 787 5,902	1,518 787 6,161	1,562 787 6,761	778 1,603 787 7,022	1,639 787 7,290	787 7,984 4	1,698 787 6,533
Interest Payment EMSAPUNO existing expense Repayment of Local Fund	8,253 22,949 21,249	0 787 785 177		787 1,116	787 1,238	787	787	787 1,755	787 2,088	787	787 2,535	787 2,953	787	684 787 3,394	748 787	813 787 3,994	370 878 787	942 787	370 1,003 787	370 1,356 787 5,113	370 1,417 787	528 1,470 787	1,518 787 6,161	1,562 787 6,761	778 1,603 787 7,022	1,639 787 7,290	1,670 787	1,698 787 6,533
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund	8,253 22,949 21,249 145,422	785	996	787 1,116	787 1,238	787 1,472	787 1,612	787 1,755	787 2,088	787 2,308	787 2,535	787 2,953	787 3,219	684 787 3,394	748 787 3,797	813 787 3,994	370 878 787 4,196	942 787 4,669	370 1,003 787 4,887	370 1,356 787 5,113	370 1,417 787 5,639	528 1,470 787 5,902	1,518 787 6,161	1,562 787 6,761	778 1,603 787 7,022	1,639 787 7,290	787 7,984 4	1,698 787 6,533
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund	8,253 22,949 21,249 145,422 44,255	785 177	996 84	0 221 787 1,116 -4,536	787 1,238 -556	787 1,472 271	787 1,612 110	787 1,755 740	787 2,088 1,037	787 2,308 1,220	787 2,535 1,409	787 2,953 -38	787 3,219 1,346	684 787 3,394 595	748 787 3.797 -10,392	813 787 3,994 1,235	370 878 787 4,196 1,062	942 787 4,669 1,947	370 1,003 787 4,887 561	370 1,356 787 5,113 879	370 1,417 787 5,639 1,089	528 1,470 787 5,902 1,272	1,518 787 6,161 2,451	1,562 787 6,761 2,911	778 1,603 787 7,022 -8,750	1,639 787 7,290 2,894	1,670 787 7,984 4 3,162 4	1,698 787 6,533 2,076
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION	8,253 22,949 21,249 145,422 44,255	785 177 1,572	996 84 1,783	0 221 787 1,116 -4,536	787 1,238 -556	787 1,472 271 2,259	787 1,612 110 2,399	787 1,755 740 2,542	787 2,088 1,037	787 2,308 1,220 3,095	787 2,535 1,409	787 2,953 -38 3,740	787 3,219 1,346 4,006	684 787 3,394 595	748 787 3.797 -10,392	813 787 3,994 1,235	370 878 787 4,196 1,062	942 787 4,669 1,947	370 1,003 787 4,887 561	370 1,356 787 5,113 879	370 1,417 787 5,639 1,089	528 1,470 787 5,902 1,272	1,518 787 6,161 2,451	1,562 787 6,761 2,911 7,548	778 1,603 787 7,022 -8,750	1,639 787 7,290 2,894	1,670 787 7,984 4 3,162 4	1,698 787 6,533 2,076 9,069
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration	8,253 22,949 21,249 145,422 44,255 128,420 22,577	785 177 1,572 787	996 84	0 221 787 1,116 -4,536 1,903 809	787 1,238 -556	787 1,472 271	787 1,612 110	787 1,755 740	787 2,088 1,037	787 2,308 1,220	787 2,535 1,409	787 2,953 -38 3,740 971	787 3,219 1,346	684 787 3,394 595 4,181 816	748 787 3,797	813 787 3,994 1,235	370 878 787 4,196 1,062	942 787 4,669 1,947	370 1,003 787 4,887 561 5,674 807	370 1,356 787 5,113 879	370 1,417 787 5,639 1,089 6,426 1,062	528 1,470 787 5,902 1,272	1,518 787 6,161 2,451	1,562 787 6,761 2,911	778 1,603 787 7,022 -8,750	1,639 787 7,290 2,894	1,670 787 7,984 4 3,162 4	1,698 787 6,533 2,076
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service	8,253 22,949 21,249 145,422 44,255 128,420 22,577 7,291	785 177 1,572 787 1,908	996 84 1,783 809	1,903 809 1,273	787 1,238 -556 2,025 1,127	787 1,472 271 2,259 809 0	787 1,612 110 2,399 809 0	787 1,755 740 2,542 809 0	787 2,088 1,037 2,875 809 0	787 2,308 1,220 3,095 809 0	787 2,535 1,409 3,322 809 0	787 2,953 -38 3,740 971 931	787 3,219 1,346 4,006 816 0	684 787 3,394 595 4,181 816 622	748 787 3,797 -10,392 4,584 816 0	813 787 3,994 1,235 4,781 816 0	370 878 787 4,196 1,062 4,983 816 0	942 787 4,669 1,947 5,456 816 0	370 1,003 787 4,887 561 5,674 807 1,535	370 1,356 787 5,113 879 5,900 807 0	370 1,417 787 5,639 1,089 6,426 1,062 1,023	528 1,470 787 5,902 1,272 6,689 807 0	1,518 787 6,161 2,451 6,948 807 0	7,548 807	778 1,603 787 7,022 -8,750 7,809 807 0	1,639 787 7,290 2,894 8,077 807	1,670 787 7,984 4 3,162 4 8,771 807 0	1,698 787 6,533 2,076 9,069 807 0
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance	8,253 22,949 21,249 145,422 44,255 128,420 22,577 7,291 24,901	785 177 1,572 787	996 84 1,783	1,903 809 1,273 354	787 1,238 -556 2,025 1,127 0 550	787 1,472 271 2,259 809 0 574	787 1,612 110 2,399 809 0 599	787 1,755 740 2,542 809 0 623	787 2,088 1,037 2,875 809 0 659	787 2,308 1,220 3,095 809 0 696	787 2,535 1,409 3,322 809 0 735	787 2,953 -38 3,740 971 931 778	787 3,219 1,346 4,006 816 0 913	684 787 3,394 595 4,181 816 622 945	748 787 3,797 -10,392 4,584 816 0 978	813 787 3,994 1,235 4,781 816 0 1,012	370 878 787 4,196 1,062 4,983 816 0	942 787 4,669 1,947 5,456 816 0 1,081	370 1,003 787 4,887 561 5,674 807 1,535 1,114	370 1,356 787 5,113 879 5,900 807 0 1,149	370 1,417 787 5,639 1,089 6,426 1,062 1,023 1,181	528 1,470 787 5,902 1,272 6,689 807 0 1,219	1,518 787 6,161 2,451 6,948 807 0	7,548 807 0 1,289	778 1,603 787 7,022 -8,750 7,809 807 0 1,322	1,639 787 7,290 2,894 8,077 807 0	1,670 787 7,984 4 3,162 4 8,771 807 0 1,391	1,698 787 6,533 2,076 9,069 807 0 1,427
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense	8,253 22,949 21,249 145,422 44,255 128,420 22,577 7,291 24,901 22,949	785 177 1,572 787 1,908	996 84 1,783 809	1,903 809 1,273	787 1,238 -556 2,025 1,127	787 1,472 271 2,259 809 0 574 370	787 1,612 110 2,399 809 0 599 370	787 1,755 740 2,542 809 0 623 370	787 2,088 1,037 2,875 809 0 659 370	787 2,308 1,220 3,095 809 0 696 370	787 2,535 1,409 3,322 809 0 735 370	787 2,953 -38 3,740 971 931 778 528	787 3,219 1,346 4,006 816 0 913 611	684 787 3,394 595 4,181 816 622 945 684	748 787 3,797 -10,392 4,584 816 0 978 748	813 787 3,994 1,235 4,781 816 0 1,012 813	370 878 787 4,196 1,062 4,983 816 0 1,046 878	942 787 4,669 1,947 5,456 816 0 1,981 942	370 1,003 787 4,887 561 5,674 807 1,535 1,114 1,003	370 1,356 787 5,113 879 5,900 807 0 1,149 1,356	370 1,417 787 5,639 1,089 6,426 1,062 1,023 1,181 1,417	528 1,470 787 5,902 1,272 6,689 807 0 1,219 1,470	1,518 787 6,161 2,451 6,948 807 0 1,256 1,518	7,548 807 0 1,289 1,562	778 1,603 787 7,022 -8,750 7,809 807 0 1,322 1,603	8,077 807 0 1,357 1,639	1,670 787 7,984 4 3,162 4 8,771 5 807 0 1,391 1,670	1,698 787 6,533 2,076 9,069 807 0 1,427 1,698
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Gash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed )	8,253 22,949 21,249 145,422 44,255 128,420 22,577 7,291 24,901 22,949 52,437	785 177 1,572 787 1,908 317 0	996 84 1,783 809 0 335 0	1,903 809 1,273 221 0	787 1,238 -556 2,025 1,127 0 550 370 0	787 1,472 271 2,259 809 0 574 370 1,678	787 1,612 110 2,399 809 0 599 370 1,678	787 1,755 740 2,542 809 0 623 370 1,678	787 2,088 1,037 2,875 809 0 659 370 1,678	3,095 809 0 696 370 1,678	787 2,535 1,409 3,322 809 0 735 370 1,678	787 2,953 -38 3,740 971 931 778 528 1,678	787 3,219 1,346 4,006 816 0 913 611 1,854	684 787 3,394 595 4,181 816 622 945 684 1,903	748 787 3,797 -10,392 4,584 816 0 978 748 1,952	813 787 3,994 1,235 4,781 816 0 1,012 813 2,002	370 878 787 4,196 1,062 4,983 816 0 1,046 878 2,051	942 787 4,669 1,947 5,456 816 0 1,081 942 2,100	370 1,003 787 4,887 561 5,674 807 1,535 1,114 1,003 2,149	370 1,356 787 5,113 879 5,900 807 0 1,149 1,356 2,196	370 1,417 787 5,639 1,089 6,426 1,062 1,023 1,181 1,417 2,898	528 1,470 787 5,902 1,272 6,689 807 0 1,219 1,470 2,944	1,518 787 6,161 2,451 6,948 807 0 1,256 1,518 2,991	7,548 807 0 1,289 1,562 3,038	778 1,603 787 7,022 -8,750 7,809 807 0 1,322 1,603 3,084	8,077 807 0 1,357 1,639 3,131	1,670 787 7,984 4 3,162 4 8,771 807 0 1,391 1,670 3,178	787 (6,533 2,076 9,069 807 0 1,427 1,698 3,224
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed ) 6. Depreciation ( existing )	8,253 22,949 21,249 145,422 44,255 128,420 22,577 7,291 24,901 22,949 52,437 9,771	785 177 1,572 787 1,908 317 0 0 362	996 84 1,783 809 0 335 0 0 362	1,903 1,273 1,116 1,903 809 1,273 354 221 0	787 1,238 -556 2,025 1,127 0 550 370 0 362	787 1,472 271 2,259 809 0 574 370 1,678	787 1,612 110 2,399 809 0 599 370 1,678 362	787 1,755 740 2,542 809 0 623 370 1,678 362	2,875 809 0 659 370 1,678 362	3,095 809 0 696 370 1,678	787 2,535 1,409 3,322 809 0 735 370 1,678 362	787 2,953 -38 3,740 971 931 778 528 1,678 362	787 3,219 1,346 4,006 816 0 913 611 1,854 362	684 787 3,394 595 4,181 816 622 945 684 1,903 362	748 787 3,797 -10,392 4,584 816 0 978 748 1,952 362	813 787 3,994 1,235 4,781 816 0 1,012 813 2,002 362	370 878 787 4,196 1,062 4,983 816 0 1,046 878 2,051 362	942 787 4,669 1,947 5,456 816 0 1,081 942 2,100 362	370 1,003 787 4,887 561 5,674 807 1,535 1,114 1,003 2,149 362	370 1,356 787 5,113 879 5,900 807 0 1,149 1,356 2,196 362	370 1,417 787 5,639 1,089 6,426 1,062 1,023 1,181 1,417 2,898 362	528 1,470 787 5,902 1,272 6,689 807 0 1,219 1,470 2,944 362	1,518 787 6,161 2,451 6,948 807 0 1,256 1,518 2,991 362	7,548 807 0 1,289 1,562 3,038 362	778 1,603 787 7,022 -8,750 7,809 807 0 1,322 1,603 3,084 362	8,077 807 0 1,357 1,639 3,131 362	1,670 787 7,984 4 3,162 4 8,771 807 0 1,391 1,670 3,178 362	787 6,533 2,076 9,069 807 0 1,427 1,698 3,224 362
Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed )	8,253 22,949 21,249 145,422 44,255 128,420 22,577 7,291 24,901 22,949 52,437	785 177 1,572 787 1,908 317 0 0 362 3,374	996 84 1,783 809 0 335 0	1,903 1,116 1,903 809 1,273 354 221 0 362 3,019	787 1,238 -556 2,025 1,127 0 550 370 0 362 2,408	787 1,472 271 2,259 809 0 574 370 1,678 362 3,792	787 1,612 110 2,399 809 0 599 370 1,678	787 1,755 740 2,542 809 0 623 370 1,678 362 3,841	787 2,088 1,037 2,875 809 0 659 370 1,678 362 3,877	3,095 809 0 696 370 1,678	787 2,535 1,409 3,322 809 0 735 370 1,678 362 3,953	787 2,953 -38 3,740 971 931 778 528 1,678	787 3,219 1,346 4,006 816 0 913 611 1,854	684 787 3,394 595 4,181 816 622 945 684 1,903	748 787 3,797 -10,392 4,584 816 0 978 748 1,952	813 787 3,994 1,235 4,781 816 0 1,012 813 2,002	370 878 787 4,196 1,062 4,983 816 0 1,046 878 2,051	942 787 4,669 1,947 5,456 816 0 1,081 942 2,100	370 1,003 787 4,887 561 5,674 807 1,535 1,114 1,003 2,149 362	370 1,356 787 5,113 879 5,900 807 0 1,149 1,356 2,196 362 5,870	370 1,417 787 5,639 1,089 6,426 1,062 1,023 1,181 1,417 2,898	528 1,470 787 5,902 1,272 6,689 807 0 1,219 1,470 2,944	1,518 787 6,161 2,451 6,948 807 0 1,256 1,518 2,991 362	7,548 807 0 1,289 1,562 3,038 362	778 1,603 787 7,022 -8,750 7,809 807 0 1,322 1,603 3,084	8,077 807 0 1,357 1,639 3,131 362 7,295	1,670 787 7,984 4 3,162 4 8,771 807 0 1,391 1,670 3,178 362 7,408	787 (6,533 2,076 9,069 807 0 1,427 1,698 3,224

- 1. Revenue: The rate will be revised every 3 years and 5 % increase is expected. Fee collection rate will be increased by 1% annually.
- 2. Depreciation (construction) civil work will be depreciated for 40 years (every year 2.5 % of acquisition cost is depreciated.) mechanical/electrical will be depreciated for 10 years.
- 3. Depreciation (equipment) items will be depreciated for 10 years (every year 10 % of acquisition cost is depreciated.)

- 4. Depreciation (EMSAPUNO) Existing fixed asset is for water and sewerage business. According to the 1998 FY detail expense information, 66% of depreciation was for water business, 34% of depreciation was for sewerage business.
- 5. Local Fund: Non-construction expense loan principal payment & interest payment are funded by Peru/Puno government without interest.

Depreciation of proposed fixed asset		1999F/YI	2000F/Y	200 F/Y	2002F/Y	003F/Y	001E/Y	2005F/Y	000E/YI	2007F/YI	2008F/Yl	000E/VI	2010E/\{2	011F/Y	2012F/Yl	2013F/YI	014F/Y	2015F/Y	0166/1	2017F/YI	018F/YI	2019F/Y	2020F/Y	2021F/Y12	022F/Y[2		(Unit : S/.0 2024F/Y 2	
sewer civil work ( 2000-2FY )	6,054					263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263		263	263	263	263	263
sewer civil work ( 2009-15FY )	4,468												49	98	147	196	246	295	344	344	344	344		344	344	344	344	344
sewer civil work (2016-25FY)	2,099									7.5										47	93	140		233	280	327	373	420
pump civil work ( 2001FY )	23					1		1											- 1	- 1	1	1			1	1	1	1
plant civil work (2001FY)	5,445				<del>-</del>	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237
plant civil work (2009FY)	268		-										17	17	17	17	17	17	17	17	17	17		17	17	17	17	17
plant civil work (2017FY)	94						- 77				7						7				12	12		12	12	12	12	12
pump mechanical ( 2001FY. 2017FY )	763					25	25	25	25	25	25	25	25	25	25	25	25	25	· 25	25	49	- 49	49	49	49	49	49	49
plant mechanical ( 2001FY )	26,496					1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152
plant mechanical (2009FY)	1,774				. 7								111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111
plant mechanical (2017FY)	4,953								i								11.				619	619	619	619	619	619	619	619
total depreciation of proposed F/A	52,437					1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,854	1,903	1,952	2,002	2,051	2,100	2,149	2,196	2,898	2,944	2,991	3,038	3,084	3,131	3,178	3,224
				•			4,					•				,												
Depreciation for existing (EMSAPUNO) fixed			2051	205										··					2021					2021				200
Building, Construction (S/.23449 +S/.12450) x 34	8,239	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305		305	305	305	305	305
Machine (S/. 874) x 34 %	803	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Transportation equipment (S/. 236) x 34%	216	8	8	8	8	8	8	8	- 8	- 8	- 8	- 8	8	- 8	- 8	- 8	- 8	- 8	8	8	8	8	8		8	8	8	8
Equipment (S/. 43) x 34%	39			1	1	1		1	1	1	1		1		<u>.</u> ]	!			I			- 1		1	10		- 1	;:
Other (S/. 510) x 34%	468	17	17	17	17	2/2	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17		17	17 362	17	1/	17
total depreciation of proposed F/A	9,771	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	362	302	362	362	362
REVENUE ESTIMATION [wastewater flow estimation (61.3 Vs in 98FY)]		65.8	70.41	74.4	78.4	82.5	86.8	91.1	97.2	103.7	110.3	117.2	124.4	128.7	133.2	137.7	142.3	147.1	151.7	156.4	160.9	166.1	171.[[	175.6	180.2	184.91	189.7	194.6
increase rate of wastewater (each year / 98FY)A		1.0734	1.1485	1.2137	1.2790		1.4160		1.5856	1.6917				2.0995		2.2463					2.6248	2.7096			2.9396	3.0163		3.1746
increase rate of sewerage fee (each year / 98FY)B		1.00	1.05	1.05	1.05	1.10	1.10		1.16	1.16	1.16	1.22		1.22	1.28	1.28	1.28	1.34	1.34	1.34	1.41	1.41		1.48	1.48	1.48	1.55	1.55
increase of collection rate (annually 1%) C		1.01	1.02	1.03	1.04	1.05	1.06		1.08	1.09	1.10	1.11		1.13	1.14	1.15	1.16		1.18	1.19	1.20	1.21		1.23	1.24	1.25	1.26	1.27
estimated revenue (S/. 1450 in 1998 x A x B x C)		1,572	1,783	1,903		2,259	2,399		2,875	3,095		3,740		4,181	4,584		4,983		5,674	5,900	6,426			7,548	7,809	8,077		9,069
	L	1,012	1,,00		230231		-,,,,,	2,3 (2)		3,0731			1,000	1,1011		-,,,,,,,	1,703	3,1301	3,07.1	5,500	0,120		1 0,5 101	.,,,,,,,	1,007	<u> </u>	0,,,,,	
											e Barton						1.2											
Administration detail(without contingency and	GST)		1.5	<u> </u>	1111		2000												1.1.1									
EMSAPUNO existing administration expense	21,249	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787		787	787	787	787	787
Proposed project administration expense	601	0	22	22	22	22	22	22	22	22	22	29	29	29	29	29	- 29	29	20	20	20	20		20	20	20	20	20
Proposed project maintenance equipment	727	0	0	0	318	0	0	0	0	0	0	155	0	0	0	0	0	0	0	0	255	. 0	0	0	0	0	0	0
total	22,577	787	809	809	1,127	809	809	809	809	809	809	971	816	816	816	816	816	816	807	807	1,062	807	807	807	807	807	807	807
IRR (Internal Rate of Return)									: 3AZ (																			
Cash Flow In ( Donation + Revenue + F/A sold )	187,851	3,189	4,757	18,492	2,025	2,259	2,399	2,542	2,875	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077	8,771	47,320]
Cash Flow Out ( Project dis + EMSAPUNO )	154,608	3,012			5,186	1,618	1,920		1,468	1,505	1,544	6,422		4,346		4,027	4,338	3,861	5,322	10,729	5,132				15,760	4,265		4,100
Balance	33,243	177				641	479		1,407	1,590	1,778	2,682	294	-165		754	646		353	-4,829	1,294			3,586	-7,951	3,812	4,195	
IRR	5.883	***	. जा	0,734	-5,101	0111	1/2	1,110[	1,107	1,270]	1,770]	2,002	474]	-103	-10,737	194		1,777	333	74,027	1,274	1,007	2,777	3,300	-1,731	2,012	7,1/3	13,220
NPR(12%)	-5,438				4.	1.30	1 1 2	Jan San		1.4							\$ 1				, .						:	
NPR(10%)	-4,717					egit skir	12 11 1 1 P.	e e e e e e e e e e e e e e e e e e e		in a second	11.1				×					100	:							
					1000		and the second			4 1 1 1 1 1 1 1		400 100	100	1.4		100												
NPR(X%)	-1.191			1.5				4	and the second	4.5		et a la company	The state of the s					· · · · · · · · · · · · · · · · · · ·		~ .								
NPR(8%) NPR(6%)	-3,191 -236	4 1																										
NPR(8%) NPR(6%) NPR(5%)	-3,191 -236 2,094																											

Table V.2.45 Cash flow and P/L calculation for Alternative II

																											,
Project expenditure estimation	150 . USA SEL			r Nacional de la company		r <del></del>																					Unit : S/.000)
Fiscal Year	Total(99-25)	1999FY	2000FY	2001FY	2002FY	2003FY	2004FY	2005FY	2006FY	2007FY	2008FY 2	009FY	2010FY	2011FY	2012FY	2013FY [	2014FY	2015FY	2016FY	2017FY 2	2018FY 2	019FY	2020FY	2021FY	2022FY	2023FY	(Unit : S7.000) 2024FY   2025FY
Land Acquisition	10/		100								Ll_								67								
Proposed project administration expense	396		22	22		22	22	22	22	22	22	14	14	14	14	14	14	14	10	10	10	10	101	10	10	10	10 1
Construction work (a)	56,541		2,586	20,168	2,586							1,447	1,447	1,447	1,447	1,447	1,447	1,447	8,697	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375 1,37
Contingency (15%) (b)=(a) x 0.15	8,481	0	388	3,025	388		0	0	0	0	0	217	217	217	217	217	217	217	1,305	206	206	206	206	206	206		
GST (18%) (c)=(a+b) x 0.18	11,704	. 0	535	4,175	535		0	0	0	0	0	300	300	300	300	300	300	300	1,800	285	285	285	285	285	285		206 20 285 28
Maintenance Equipment (d)	10,039		15	206		173	377					101	15		3,931	173	377		175				15		3,931		377
Contingency (15%) (e)=(d) x 0.15	1,506	0	2	31	0	26	57	0	0	- 0	0	15	2	0	590	26	57	0	26	0	0	0	2	0	590		57
GST (18%) (f) = $(d+e) \times 0.18$	2,078	0	3	43	0	36	78	0	0	0	0	21	3	0	814	36	78	0	36	0	0	0	3	0	814	<u>1</u>	78
Engineering Service (g)	5,615	1,507		1,005					,	L		608		405					1,254		836						
Contingency (15%) (h)=(g) x 0.15	842	226		151								91		61					188		125						
GST (18%) (I) =(g+h) x 0.18	1,162	312		208	4 6 7 5							126		84					260		173	····					
Maintenance (with GST)	41,605	317	335	354	1,013		1,102		1,213	1,281		1,432	1,515	1,569	1,623	1,679	1,736	1,793	1,849	1,906	1,961	2,024	2,084	2,139	2,195	2,251	2,309 2,36
[Total	140,136	2,362	3,987	29,388	4,544	1,314	1,636	1,169	1,235	1,303	1,374	4,372	3,513	4,096	8,935	3,891	4,225	3,771	15,667	3,782	4,971	3,900	3,980	4,015	9,405		4,696 4,24
Donation, Loan & Local Fund																•								<del> </del>			: 1
Donation up to S/21,180 ( DM12MIL)	21,180	2,362	3,509	16 200	Á											<u>-</u>		3	1 11					100			
Loan available for construction work	46,739	2,002	9,009	15,309 7,884	2,974	<u> </u>	U	<u> </u>	0		<u>                                   </u>	<u> </u>	1.004	1 00	0	0	0	0]	0	0	0	0	0	0	0	0	0
Local Fund of non-construction expense	72,217	- 0	478	6,195	1,570	1,314	1,636	1 100	1 225	1 000	1 224	1,664	1,664	1.664	1,664	1.664	1,664	1,664	10,002	1,581	1,581	1,581	1,581	1,581	1,581		1,581 1,58
Total	140,136	2,362							1,235 1,235	1,303		2,708	1,849	2,432	7,271	2,227	2,561	2,107	5,665	2,201	3,390	2,319	2,399	2,434	7,824		3,115 2,66
	1 170,1301	2,302	3,701	27,300	4,3,44	1,314	1,030	1,109	1,233	1,303	1,374	4,372	3,513	4,096	8,935	3,891	4,225	3,771	15,667	3,782	4,971	3,900	3,980	4,015	9,405	4,362	4,696 4,24
Loan transaction		- 1				٠.						100							10 Sp. 1	1.		3.00	•			40.00	
Loan Receipt	46,739	0	0	7,884	2,974	0)	0	n		<u> </u>	<u> </u>	1,664	1,664	1,664	1,664	1,664	1 664	LCCAL	10.0001	1.60.1	1 601					· · · · · · · · · · · · · · · · · · ·	
Loan Repayment	10,324	0	0	0	Ō	0	0	0	- 0	0	<u> </u>	.,,,,,	1,004	394	543	543	1,664 543	1,664	10,002	1,581	1,581	1,581	1,581	1,581	1,581		1,581 1,58
Loan Balance	36,415	0	Ó	7,884	10,858	10,858	10,858	10,858	10,858	10,858	10,858	12,522	14,186					19,940	20 200	543 30,437	543 31,476	626	709	793	876		1,042 1,12:
		— <del></del>				, , , , , , , , , , , , , , , , , , , ,				10,000	10,000		11,100	13,130	10,577	17,070]	10,017	12,210	27,377	30,4371	31,470	32,431]	33,303	34,092	34,797	35,420	35,959 36,41
Interest	<u> </u>		1	10 miles	1.0	11 11 11 14	7.7	1000			100	12.								15.00							
Interest (5%)	26,641	0	0	394	543	543	543	543	543	543	543	626	709	773	829	885	941	997	1,470	1,522	1,574	1,622	1,665	1,705	1,740	1,771	1,798 1,82
6.15		1.0																				-31			.,, .,,	.,,,,,	1,1701 1,02
Cash Flow	<del></del> -								1 1			· .										13		19.00			
Cash - In : Donation	21.100	0.260	- 2 500	15.000					,		4.5														I		
Loan for Project Disbursement	21,180	2,362	3,509	15,309	. 0	0	0	0	0	0	0	0	0	0	0	0	0	0	. 0	0	0	O	0	0	0	0	0 0
Local Fund for Project Disbursement	46,739	U	420	7,884	2,974	1214	0	0	0	0	0	1,664	1,664	1,664	1,664	1,664	1,664	1,661	10,002	1,581	1,581	1,581	1,581	1,581	1,581	1,581	1,581 1,58
Local Fund for Loan Repayment	72,217	U	478	6,195	1,570	1,314	1,636	1,169	1,235	1,303	1,374	2,708	1,849	2,432	7,271	2,227	2,561	2 103			2 200		2 200			2,780	3,115 2,663
Revenue + F/A sold	10,324 170,599		U	U	U	U												2,107	5,665	2,201	3,390	2,319	2,399	2,434	7,824	2,700	
Local Fund for Interest Payment	1 170.3371		1 703	1 002	2.025	2 260	2 300	0	0	0	0	0	0	394	543	543	543	543	543	543	543	626	709	793	7,824 876		1,042 1,12
Cash - Out :		1,572	1,783	1,903	2,025	2,259	2,399	2,542	0 2,875	3,095	3,322	0 3,740	0 4,006	394 4,181	543 4,584	543 4,781	543 4,983	543 5,456	543 5,674	543 5,900	543 6,426	626 6,689	709 6,948	793 7,548			
	26,641	1,372	1,783 0	1,903 394	2,025 543	2,259 543		2,542 543	2,875 543	3,095 543	3,322	0	0	394	543	543	543	543	543	543	543	626	709	793	876	959 8,077	1,042 1,125
	26,641	0	0	394	543	543	543	543	543	543	3,322 543	0 3,740 626	0 4,006 709	394 4,181 773	543 4,584 829	543 4,781 885	543 4,983 941	543 5,456 997	543 5,674 1,470	543 5,900 1,522	543 6,426 1,574	626 6,689 1,622	709 6,948 1,665	793 7,548 1,705	876 7,809 1,740	959 8,077 1,771	1,042 1,125 8,771 51,248
Project Disbursement	26,641 140,136	2,362	1,783 0 3,987	394				543			3,322	0 3,740	0 4,006	394 4,181 773 4,096	543 4,584 829 8,935	543 4,781 885 3,891	543 4,983 941 4,225	543 5,456 997 3,771	543 5,674 1,470	543 5,900 1,522 3,782	543 6,426 1,574 4,971	626 6,689 1,622 3,900	709 6,948 1,665	793 7,548 1,705 4,015	876 7,809 1,740 9,405	959 8,077 1,771 4,362	1,042 1,125 8,771 51,248 1,798 1,821 4,696 4,244
Project Disbursement Loan Repayment	26,641 140,136 10,324	0	0	394 29,388 0	543 4,544 0	543 1,314 0	543 1,636 0	543 1,169 0	543 1,235 0	543 1,303 0	3,322 543 1,374	0 3,740 626 4,372 0	0 4,006 709 3,513 0	394 4,181 773 4,096 394	543 4,584 829 8,935 543	543 4,781 885 3,891 543	543 4,983 941 4,225 543	543 5,456 997 3,771 543	543 5,674 1,470 15,667 543	543 5,900 1,522 3,782 543	543 6,426 1,574 4,971 543	626 6,689 1,622 3,900 626	709 6,948 1,665 3,980 709	793 7,548 1,705 4,015 793	9,405 876	959 8,077 1,771 4,362 959	1,042 1,129 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,129
Project Disbursement Loan Repayment Interest Payment	26,641 140,136 10,324 26,641	2,362 0 0	3,987 0	394 29,388 0 394	543 4,544 0 543	1,314 0 543	543 1,636 0 543	1,169 0 543	1,235 0 543	1,303 0 543	3,322 543 1,374 0 543	0 3,740 626 4,372 0 626	3,513 0 709	394 4,181 773 4,096 394 773	543 4,584 829 8,935 543 829	543 4,781 885 3,891 543 885	543 4,983 941 4,225 543 941	543 5,456 997 3,771 543 997	543 5,674 1,470 15,667 543 1,470	543 5,900 1,522 3,782 543 1,522	543 6,426 1,574 4,971 543 1,574	626 6,689 1,622 3,900 626 1,622	709 6,948 1,665 3,980 709 1,665	793 7,548 1,705 4,015 793 1,705	9,405 876 1,740	959 8,077 1,771 4,362 959 1,771	1,042 1,122 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,125 1,798 1,821
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense	26,641 140,136 10,324 26,641 21,249	2,362 0 0 787	3,987 0 0 787	394 29,388 0 394 787	543 4,544 0 543 787	1,314 0 543 787	543 1,636 0 543 787	1,169 0 543 787	1,235 0 543 787	1,303 0 543 787	0 3,322 543 1,374 0 543 787	0 3,740 626 4,372 0 626 787	3,513 0 709 709 787	394 4,181 773 4,096 394 773 787	543 4,584 829 8,935 543 829 787	543 4,781 885 3,891 543 885 787	543 4,983 941 4,225 543 941 787	543 5,456 997 3,771 543 997 787	543 5,674 1,470 15,667 543 1,470 787	543 5,900 1,522 3,782 543 1,522 787	543 6,426 1,574 4,971 543 1,574 787	626 6,689 1,622 3,900 626 1,622 787	709 6,948 1,665 3,980 709 1,665 787	793 7,548 1,705 4,015 793 1,705 787	9,405 876 9,405 876 1,740 787	959 8,077 1,771 4,362 959 1,771 787	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,123 1,798 1,821 787 787
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund	26,641 140,136 10,324 26,641 21,249 149,350	2,362 0 0 787 785	3,987 0 0 787 996	394 29,388 0 394 787 1,116	543 4,544 0 543 787 1,238	543 1,314 0 543 787 1,472	1,636 0 543 787 1,612	543 1,169 0 543 787 1,755	1,235 0 543 787 2,088	1,303 0 543 787 2,308	0 3,322 543 1,374 0 543 787 2,535	0 3,740 626 4,372 0 626 787 2,953	0 4,006 709 3,513 0 709 787 3,219	394 4,181 773 4,096 394 773 787 3,394	543 4,584 829 8,935 543 829 787 3,797	543 4,781 885 3,891 543 885 787 3,994	543 4,983 941 4,225 543 941 787 4,196	543 5,456 997 3,771 543 997 787 4,669	543 5,674 1,470 15,667 543 1,470 787 4,887	543 5,900 1,522 3,782 543 1,522 787 5,113	543 6,426 1,574 4,971 543 1,574 787 5,639	626 6,689 1,622 3,900 626 1,622 787 5,902	709 6,948 1,665 3,980 709 1,665 787 6,161	793 7,548 1,705 4,015 793 1,705 787 6,761	876 7,809 1,740 9,405 876 1,740 787 7,022	959 8,077 1,771 4,362 959 1,771 787 7,290	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,122 1,798 1,821 787 787 7,984 50,461
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense	26,641 140,136 10,324 26,641 21,249	2,362 0 0 787	3,987 0 0 787	394 29,388 0 394 787 1,116	543 4,544 0 543 787	543 1,314 0 543 787 1,472	1,636 0 543 787 1,612	1,169 0 543 787	1,235 0 543 787	1,303 0 543 787	0 3,322 543 1,374 0 543 787 2,535	0 3,740 626 4,372 0 626 787	3,513 0 709 709 787	394 4,181 773 4,096 394 773 787 3,394	543 4,584 829 8,935 543 829 787	543 4,781 885 3,891 543 885 787	543 4,983 941 4,225 543 941 787 4,196	543 5,456 997 3,771 543 997 787 4,669	543 5,674 1,470 15,667 543 1,470 787	543 5,900 1,522 3,782 543 1,522 787	543 6,426 1,574 4,971 543 1,574 787	626 6,689 1,622 3,900 626 1,622 787	709 6,948 1,665 3,980 709 1,665 787	793 7,548 1,705 4,015 793 1,705 787 6,761	9,405 876 9,405 876 1,740 787	959 8,077 1,771 4,362 959 1,771 787 7,290	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,123 1,798 1,821 787 787
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund	26,641 140,136 10,324 26,641 21,249 149,350	2,362 0 0 787 785	3,987 0 0 787 996	394 29,388 0 394 787 1,116	543 4,544 0 543 787 1,238	543 1,314 0 543 787 1,472	1,636 0 543 787 1,612	543 1,169 0 543 787 1,755	1,235 0 543 787 2,088	1,303 0 543 787 2,308	0 3,322 543 1,374 0 543 787 2,535	0 3,740 626 4,372 0 626 787 2,953	0 4,006 709 3,513 0 709 787 3,219	394 4,181 773 4,096 394 773 787 3,394	543 4,584 829 8,935 543 829 787 3,797	543 4,781 885 3,891 543 885 787 3,994	543 4,983 941 4,225 543 941 787 4,196	543 5,456 997 3,771 543 997 787 4,669	543 5,674 1,470 15,667 543 1,470 787 4,887	543 5,900 1,522 3,782 543 1,522 787 5,113	543 6,426 1,574 4,971 543 1,574 787 5,639	626 6,689 1,622 3,900 626 1,622 787 5,902	709 6,948 1,665 3,980 709 1,665 787 6,161	793 7,548 1,705 4,015 793 1,705 787 6,761	876 7,809 1,740 9,405 876 1,740 787 7,022	959 8,077 1,771 4,362 959 1,771 787 7,290	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,122 1,798 1,821 787 787 7,984 50,461
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund P/L ESTIMATION Revenue	26,641 140,136 10,324 26,641 21,249 149,350 40,167	2,362 0 0 787 785	3,987 0 0 787 996 519	394 29,388 0 394 787 1,116 -5,473	543 4,544 0 543 787 1,238 -875	1,314 0 543 787 1,472 -385	1,636 0 543 787 1,612 -566	1,169 0 543 787 1,755 43	1,235 0 543 787 2,088 310	1,303 0 543 787 2,308 462	0 3,322 543 1,374 0 543 787 2,535 618	0 3,740 626 4,372 0 626 787 2,953 -380	0 4,006 709 3,513 0 709 787 3,219 661	394 4,181 773 4,096 394 773 787 3,394 -205	543 4,584 829 8,935 543 829 787 3,797 -4,845	543 4,781 885 3,891 543 885 787 3,994 339	543 4,983 941 4,225 543 941 787 4,196 151	543 5,456 997 3,771 543 997 787 4,669 1,022	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791	543 5,900 1,522 3,782 543 1,522 787 5,113 847	543 6,426 1,574 4,971 543 1,574 787 5,639 133	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831	876 7,809 1,740 9,405 876 1,740 787 7,022 -3,418	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,125 1,798 1,821 787 787 7,984 50,461 2,029 44,852
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: I. Administration	26,641 140,136 10,324 26,641 21,249 149,350 40,167	0 2,362 0 0 787 785 785 785	3,987 0 0 787 996	394 29,388 0 394 787 1,116 -5,473	543 4,544 0 543 787 1,238	1,314 0 543 787 1,472 -385	1,636 0 543 787 1,612	1,169 0 543 787 1,755 43	1,235 0 543 787 2,088 310	1,303 0 543 787 2,308 462	0 3,322 543 1,374 0 543 787 2,535 618	0 3,740 626 4,372 0 626 787 2,953 -380	0 4,006 709 3,513 0 709 787 3,219 661	394 4,181 773 4,096 394 773 787 3,394 -205	543 4,584 829 8,935 543 829 787 3,797 -4,845	543 4,781 885 3,891 543 885 787 3,994 339	543 4,983 941 4,225 543 941 787 4,196 151	543 5,456 997 3,771 543 997 787 4,669 1,022	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791	543 5,900 1,522 3,782 543 1,522 787 5,113 847	543 6,426 1,574 4,971 543 1,574 787 5,639 133	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831	876 7,809 1,740 9,405 876 1,740 787 7,022 -3,418	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,122 1,798 1,821 787 787 7,984 50,461 2,029 44,852
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service	26,641 140,136 10,324 26,641 21,249 149,350 40,167 128,420 22,299 7,620	2,362 0 0 787 785 785 785	3,987 0 0 787 996 519 1,783 809	394 29,388 0 394 787 1,116 -5,473	543 4,544 0 543 787 1,238 -875	1,314 0 543 787 1,472 -385	1,636 0 543 787 1,612 -566	1,169 0 543 787 1,755 43	1,235 0 543 787 2,088 310	1,303 0 543 787 2,308 462	0 3,322 543 1,374 0 543 787 2,535 618	0 3,740 626 4,372 0 626 787 2,953 -380	0 4,006 709 3,513 0 709 787 3,219 661	394 4,181 773 4,096 394 773 787 3,394 -205	543 4,584 829 8,935 543 829 787 3,797 -4,845	543 4,781 885 3,891 543 885 787 3,994 339	543 4,983 941 4,225 543 941 787 4,196 151	543 5,456 997 3,771 543 997 787 4,669 1,022	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791	543 5,900 1,522 3,782 543 1,522 787 5,113 847	543 6,426 1,574 4,971 543 1,574 787 5,639 133	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831	876 7,809 1,740 9,405 876 1,740 787 7,022 -3,418	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780	1,042 1,12 8,771 51,248 1,798 1,821 4,696 4,244 1,042 1,125 1,798 1,821 787 787 7,984 50,461 2,029 44,852
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance	26,641 140,136 10,324 26,641 21,249 149,350 40,167	0 2,362 0 0 787 785 785 785	3,987 0 0 787 996 519	394 29,388 0 394 787 1,116 -5,473 1,903 1,089	543 4,544 0 543 787 1,238 -875	1,314 0 543 787 1,472 -385 2,259 809 0	1,636 0 543 787 1,612 -566 2,399 0	543 1,169 0 543 787 1,755 43 2,542 809 0	1,235 0 543 787 2,088 310 2,875 809	3,095 0 0 543 787 2,308 462	0 3,322 543 1,374 0 543 787 2,535 618	0 3,740 626 4,372 0 626 787 2,953 -380 3,740 938 825	0 4,006 709 3,513 0 709 787 3,219 661 4,006 801	394 4,181 773 4,096 394 773 787 3,394 -205	543 4,584 829 8,935 543 829 787 3,797 -4,845	543 4,781 885 3,891 543 885 787 3,994 339 4,781 801 0	543 4,983 941 4,225 543 941 787 4,196 151 4,983 801 0	543 5,456 997 3,771 543 997 787 4,669 1,022 5,456 801	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791 5,674 1,034 1,702	543 5,900 1,522 3,782 543 1,522 787 5,113 847 5,900 797	543 6,426 1,574 4,971 543 1,574 787 5,639 133 6,426 797 1,134	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336 6,689 797 0	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831 7,548 797	876 7,809 1,740 9,405 876 1,740 787 7,022 -3,418 7,809 797	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780 8,077 797	1,042 1,12: 8,771 51,248 1,798 1,82: 4,696 4,244 1,042 1,12: 1,798 1,82: 787 787 7,984 50,46: 2,029 44,852 8,771 9,069 797 797
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense	26,641 140,136 10,324 26,641 21,249 149,350 40,167 128,420 22,299 7,620 41,605 26,641	2,362 0 0 787 785 785 785	3,987 0 0 787 996 519 1,783 809	394 29,388 0 394 787 1,116 -5,473 1,903 1,089 1,364	543 4,544 0 543 787 1,238 -875 2,025 809	1,314 0 543 787 1,472 -385	1,636 0 543 787 1,612 -566	1,169 0 543 787 1,755 43	1,235 0 543 787 2,088 310	3,095 809 1,281	3,322 543 1,374 0 543 787 2,535 618 3,322 809 0 1,352	0 3,740 626 4,372 0 626 787 2,953 -380 3,740 938	0 4,006 709 3,513 0 709 787 3,219 661 4,006 801	394 4,181 773 4,096 394 773 787 3,394 -205 4,181 801 550 1,569	543 4,584 829 8,935 543 829 787 3,797 -4,845 4,584 801 0 1,623	543 4,781 885 3,891 543 885 787 3,994 339 4,781 801 0	543 4,983 941 4,225 543 941 787 4,196 151 4,983 801 0	543 5,456 997 3,771 543 997 787 4,669 1,022 5,456 801 0 1,793	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791 5,674 1,034 1,702 1,849	543 5,900 1,522 3,782 543 1,522 787 5,113 847 5,900 797 0	543 6,426 1,574 4,971 543 1,574 787 5,639 133 6,426 797 1,134 1,961	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336 6,689 797 0 2,024	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387 6,948 797 0	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831 7,548 797 0	7,809 7,809 1,740 9,405 876 1,740 787 7,022 -3,418 7,809 797 0 2,195	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780 8,077 797 0 2,251	1,042 1,12: 8,771 51,248 1,798 1,82: 4,696 4,244 1,042 1,12: 1,798 1,82: 787 787 7,984 50,461 2,029 44,852 8,771 9,069 797 797 0 0 2,309 2,368
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed )	26,641 140,136 10,324 26,641 21,249 149,350 40,167 128,420 22,299 7,620 41,605 26,641 38,405	2,362 0 0 787 785 785 785	3,987 0 0 787 996 519 1,783 809	394 29,388 0 394 787 1,116 -5,473 1,903 1,089 1,364 354	543 4,544 0 543 787 1,238 -875 2,025 809 0 1,013	343 1,314 0 543 787 1,472 -385 2,259 809 0 1,057 543	1,636 0 543 787 1,612 -566 2,399 809 0 1,102 543	543 1,169 0 543 787 1,755 43 2,542 809 0 1,147 543	1,235 0 543 787 2,088 310 2,875 809 0 1,213 543	3,095 809 1,281 543 787 2,308 462	3,322 543 1,374 0 543 787 2,535 618 3,322 809 0 1,352 543	0 3,740 626 4,372 0 626 787 2,953 -380 3,740 938 825 1,432 626	0 4,006 709 3,513 0 709 787 3,219 661 4,006 801 0 1,515 709	394 4,181 773 4,096 394 773 787 3,394 -205 4,181 801 550 1,569 773	543 4,584 829 8,935 543 829 787 3,797 -4,845 4,584 801 0 1,623 829	543 4,781 885 3,891 543 885 787 3,994 339 4,781 801 0 1,679 885	543 4,983 941 4,225 543 941 787 4,196 151 4,983 801 0 1,736 941	543 5,456 997 3,771 543 997 787 4,669 1,022 5,456 801 0 1,793 997	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791 5,674 1,034 1,702 1,849 1,470	543 5,900 1,522 3,782 543 1,522 787 5,113 847 5,900 797 0 1,906 1,522	543 6,426 1,574 4,971 543 1,574 787 5,639 133 6,426 797 1,134 1,961 1,574	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336 6,689 797 0 2,024 1,622	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387 6,948 797 0 2,084 1,665	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831 7,548 797 0 2,139 1,705	7,809 7,809 1,740 9,405 876 1,740 787 7,022 -3,418 7,809 797 0 2,195 1,740	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780 8,077 797 0 2,251 1,771	1,042 1,12: 8,771 51,248 1,798 1,82: 4,696 4,244 1,042 1,12: 1,798 1,82: 787 787 7,984 50,46: 2,029 44,852  8,771 9,069 797 797 0 0 2,309 2,368 1,798 1,82:
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed ) 6. Depreciation ( existing )	26,641 140,136 10,324 26,641 21,249 149,350 40,167 128,420 22,299 7,620 41,605 26,641 38,405 9,765	2,362 0 0 787 785 785 785 1,572 787 2,045 317 0 0	3,987 0 787 996 519 1,783 809 0 335 0 0	394 29,388 0 394 787 1,116 -5,473 1,903 1,089 1,364 354 394 0	543 4,544 0 543 787 1,238 -875 2,025 809 0 1,013	343 1,314 0 543 787 1,472 -385 2,259 809 0 1,057	1,636 0 543 787 1,612 -566 2,399 809 0 1,102	543 1,169 0 543 787 1,755 43 2,542 809 0 1,147	1,235 0 543 787 2,088 310 2,875 809 0 1,213	3,095 809 1,281 1,260	3,322 543 1,374 0 543 787 2,535 618 3,322 809 0 1,352 543	3,740 626 4,372 0 626 787 2,953 -380 3,740 938 825 1,432 626 1,260	4,006 709 3,513 0 709 787 3,219 661 4,006 801 0 1,515 709 1,309	394 4,181 773 4,096 394 773 787 3,394 -205 4,181 801 550 1,569 773 1,358	543 4,584 829 8,935 543 829 787 3,797 -4,845 4,584 801 0 1,623 829 1,407	543 4,781 885 3,891 543 885 787 3,994 339 4,781 801 0 1,679 885 1,456	543 4,983 941 4,225 543 941 787 4,196 151 4,983 801 0 1,736 941 1,505	543 5,456 997 3,771 543 997 4,669 1,022 5,456 801 0 1,793 997 1,554	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791 5,674 1,034 1,702 1,849 1,470 1,603	543 5,900 1,522 3,782 543 1,522 787 5,113 847 5,900 797 0 1,906 1,522 1,968	543 6,426 1,574 4,971 543 1,574 787 5,639 133 6,426 797 1,134 1,961 1,574 2,015	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336 6,689 797 0 2,024 1,622 2,062	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387 6,948 797 0 2,084 1,665 2,108	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831 7,548 797 0 2,139 1,705 2,155	7,809 7,809 1,740 9,405 876 1,740 7,022 -3,418 7,809 797 0 2,195 1,740 2,202	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780 8,077 797 0 2,251 1,771 2,248	1,042 1,12: 8,771 51,248 1,798 1,82: 4,696 4,244 1,042 1,12: 1,798 1,82: 787 787 7,984 50,46: 2,029 44,852  8,771 9,069 797 797 0 0 2,309 2,368 1,798 1,82: 2,295 2,342
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed ) 6. Depreciation ( existing ) Expense total	26,641 140,136 10,324 26,641 21,249 149,350 40,167 128,420 22,299 7,620 41,605 26,641 38,405 9,765 146,335	2,362 0 0 787 785 785 785 1,572 787 2,045 317 0	3,987 0 787 996 519 1,783 809 0 335 0 0 362 1,506	394 29,388 0 394 787 1,116 -5,473 1,903 1,089 1,364 354 394 0 362 3,563	543 4,544 0 543 787 1,238 -875 2,025 809 0 1,013 543	343 1,314 0 543 787 1,472 -385 2,259 809 0 1,057 543 1,260 362	1,636 0 543 787 1,612 -566 2,399 809 0 1,102 543 1,260 362	543 1,169 0 543 787 1,755 43 2,542 809 0 1,147 543 1,260 362	1,235 0 543 787 2,088 310 2,875 809 0 1,213 543 1,260 362	3,095 3,095 1,281 1,260 363	3,322 543 1,374 0 543 787 2,535 618 3,322 809 0 1,352 543 1,260 362	3,740 626 787 2,953 -380 3,740 938 825 1,432 626 1,260 362	0 4,006 709 3,513 0 709 787 3,219 661 4,006 801 0 1,515 709 1,309 362	394 4,181 773 4,096 394 773 787 3,394 -205 4,181 801 550 1,569 773 1,358 362	543 4,584 829 8,935 543 829 787 3,797 -4,845 4,584 801 0 1,623 829 1,407 362	543 4,781 885 3,891 543 885 787 3,994 339 4,781 801 0 1,679 885 1,456 362	543 4,983 941 4,225 543 941 787 4,196 151 4,983 801 0 1,736 941 1,505 362	543 5,456 997 3,771 543 997 787 4,669 1,022 5,456 801 0 1,793 997 1,554 362	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791 5,674 1,034 1,702 1,849 1,470 1,603 362	543 5,900 1,522 3,782 543 1,522 787 5,113 847 5,900 797 0 1,906 1,522 1,968 362	543 6,426 1,574 4,971 543 1,574 787 5,639 133 6,426 797 1,134 1,961 1,574 2,015	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336 6,689 797 0 2,024 1,622 2,062 362	709 6,948 1,665 709 1,665 787 6,161 1,387 6,948 797 0 2,084 1,665 2,108 362	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831 7,548 797 0 2,139 1,705 2,155 362	7,809 7,809 1,740 876 1,740 787 7,022 -3,418 7,809 797 0 2,195 1,740 2,202 362	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780 8,077 797 0 2,251 1,771 2,248 362	1,042 1,12: 8,771 51,248 1,798 1,82: 1,042 1,12: 1,798 1,82: 1,798 1,82: 787 787 7,984 50,46: 2,029 44,852  8,771 9,069 797 797 0 0 2,309 2,368 1,798 1,82: 2,295 2,342 362 362
Project Disbursement Loan Repayment Interest Payment EMSAPUNO existing expense Repayment of Local Fund Balance of Cash Fund / - Local Fund  P/L ESTIMATION Revenue Expense: 1. Administration 2. Engineering service 3. Maintenance 4. Interest expense 5. Depreciation ( proposed ) 6. Depreciation ( existing )	26,641 140,136 10,324 26,641 21,249 149,350 40,167 128,420 22,299 7,620 41,605 26,641 38,405 9,765	2,362 0 0 787 785 785 785 1,572 787 2,045 317 0 0	3,987 0 787 996 519 1,783 809 0 335 0 0	394 29,388 0 394 787 1,116 -5,473 1,903 1,089 1,364 354 394 0	543 4,544 0 543 787 1,238 -875 2,025 809 0 1,013 543 0 362	343 1,314 0 543 787 1,472 -385 2,259 809 0 1,057 543 1,260 362 4,030	1,636 0 543 787 1,612 -566 2,399 809 0 1,102 543 1,260 362 4,075	543 1,169 0 543 787 1,755 43 2,542 809 0 1,147 543 1,260	1,235 0 543 787 2,088 310 2,875 809 0 1,213 543 1,260	3,095 809 1,281 2,362 4,254	3,322 543 1,374 0 543 787 2,535 618 3,322 809 0 1,352 543 1,260 362 4,325	3,740 626 4,372 0 626 787 2,953 -380 3,740 938 825 1,432 626 1,260	0 4,006 709 3,513 0 709 787 3,219 661 4,006 801 0 1,515 709 1,309 362 4,696	394 4,181 773 4,096 394 773 787 3,394 -205 4,181 801 550 1,569 773 1,358	543 4,584 829 8,935 543 829 787 3,797 -4,845 4,584 801 0 1,623 829 1,407	543 4,781 885 3,891 543 885 787 3,994 339 4,781 801 0 1,679 885 1,456	543 4,983 941 4,225 543 941 787 4,196 151 4,983 801 0 1,736 941 1,505	543 5,456 997 3,771 543 997 4,669 1,022 5,456 801 0 1,793 997 1,554	543 5,674 1,470 15,667 543 1,470 787 4,887 -2,791 5,674 1,034 1,702 1,849 1,470 1,603	543 5,900 1,522 3,782 543 1,522 787 5,113 847 5,900 797 0 1,906 1,522 1,968 362 6,555	543 6,426 1,574 4,971 543 1,574 787 5,639 133 6,426 797 1,134 1,961 1,574 2,015	626 6,689 1,622 3,900 626 1,622 787 5,902 1,336 6,689 797 0 2,024 1,622 2,062	709 6,948 1,665 3,980 709 1,665 787 6,161 1,387 6,948 797 0 2,084 1,665 2,108	793 7,548 1,705 4,015 793 1,705 787 6,761 1,831 7,548 797 0 2,139 1,705 2,155	7,809 7,809 1,740 9,405 876 1,740 7,022 -3,418 7,809 797 0 2,195 1,740 2,202	959 8,077 1,771 4,362 959 1,771 787 7,290 1,780 8,077 797 0 2,251 1,771 2,248 362	1,042 1,12: 8,771 51,248 1,798 1,82: 4,696 4,244 1,042 1,12: 1,798 1,82: 787 787 7,984 50,46: 2,029 44,852  8,771 9,069 797 797 0 0 2,309 2,368 1,798 1,82: 2,295 2,342

- 1. Revenue: The rate will be revised every 3 years and 5 % increase is expected. Fee collection rate will be increased by 1% annually.
- 2. Depreciation (construction) civil work will be depreciated for 40 years (every year 2.5 % of acquisition cost is depreciated.) mechanical/electrical will be depreciated for 10 years.
- , 3. Depreciation (equipment) items will be depreciated for 10 years (every year 10 % of acquisition cost is depreciated.)
- 4. Depreciation (EMSAPUNO) Existing fixed asset is for water and sewerage business. According to the 1998 FY detail expense information, 66% of depreciation was for water business, 34% of depreciation was for sewerage business.
- 5. Local Fund: Non-construction expense loan principal payment & interest payment are funded by Peru/Puno government without interest.

		(188888)			, , , , , , , , , , , , , , , , , , ,											· ·				·	r	<del> </del>	)		inanauli		Unit : S/.	
Depreciation of proposed fixed asset	270.0	1999F/Y	2000F7Y	2001F/Y	2002F/Y										2012F/Y													.02367
sewer civil work ( 2000-2FY )	6,054			·		263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	26
sewer civil work ( 2009-15FY )	4,468			· · · · ·					1 252 5				49	98	147	196	246	295	344	344	344	344	344	344	344	344	344	34
sewer civil work ( 2016-25FY )	2,099			- 4 1										1. 1		- 25				47	93	140	187	233	280	327	373	42
pump civil work ( 2001FY )	1,408					61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	6
plant civil work ( 2001FY )	9,243		· · · · ·	1 4		402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	40
plant civil work (2009FY )	0					7.						100		1.00				* .		*		. 11						
plant civil work ( 2017FY )	2,026		5 5			17			-		1.				: .		4 4 4 1			225	225	225	225	225	225	225	225	22
pump mechanical ( 2001FY. 2017FY )	13,107					533	533	533	533	533	533	533	533	533	533	533	533	533	533	627	627	627	627	627	627	627	627	62
plant mechanical ( 2001FY )	0			:	- 1								44.5.3		1,4													
plant mechanical ( 2009FY )	0														3.45													
plant mechanical ( 2017FY )	0			1.																								
total depreciation of proposed F/A	38,405					1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,309	1,358	1,407	1,456	1,505	1,554	1,603	1,968	2,015	2,062	2,108	2,155	2,202	2,248	2,295	2,34
Depreciation for existing (EMSAPUNO) fixed:	assel																				•							
Building, Construction (23449 +12450)	8,239	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	30
Machine (S/. 874)	802	30	30	30	30	30		30	30	303	30	303	30	30	303	30	30	30	30	30	30	30		30	30	30	30	3
Transportation equipment (S/. 236)	217		8	8	, °°	8	8	- 30	9			8		8	8	- 30	8	- 30	8	<u>8</u>	8	8	8	- 8	- 8	8		<u>-</u>
Equipment (S/. 43)	39	<sub>1</sub>		<del>-</del>		1		1	- 1					- 0	1	1	1		1			- 1		<del>-</del> }}	. 1	1	i	<del></del>
Other (S/. 510)	468		17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	. 1
total depreciation of proposed F/A	9,765		362	362				362	362	362	362	362	362	362		362	362	362	362	362	362	362		362	362	362	362	36
																					· .				<b>-</b>	•	· · - <b>-1</b> -	
REVENUE ESTIMATION		1.5			<u> </u>	- 1 1	1.15	1 1		100	112			1.5							1.5					·		
wastewater flow estimation (61.3 l/s in 98FY)		65.8	70.4	74.4	78.4	82.5		91.1	97.2	103.7	110.3	117.2		128.7		137.7	142.3	147.1	151.7		160.9	166.1		175.6	180.2	184.9	189.7	194.
increase rate of wastewater (each year / 98FY)A		1.0734	1.1485	1.2137	1.2790	1.3458		1.4861	1.5856	1.6917	1.7993			2.0995			2.3214		2.4747	2.5514	2.6248	2.7096	2.7912		2.9396	3.0163	3.0946	3.174
increase rate of sewerage fee (each year / 98FY)B		1.00	1.05	1.05	1.05			1.10	1.16	1.16	1.16	1.22	1.22	1.22		1.28	1.28	1.34	1.34	1.34	1.41	1.41		1.48	1.48	1.48	1.55	1.5
increase of collection rate (annually 1%) C	:	·· 1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21		1.23	1.24	1.25	1.26	1.2
estimated revenue (S/. 1450 in 1998 x A x B x C)		1,572	1,783	1,903	2,025	2,259	2,399	2,542	2,875	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077	8,771	9,06
Administration detail(without contingency and	GST)										100								s 1 1		4	14.						
EMSAPUNO existing administration expense	21,249	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	78
Proposed project administration expense	396	107	22	22				22	22		22	14	14	14		14	14	14	10	10	10	10		10	10	10	10	
Proposed project maintenance equipment	654	<u> </u>	- 22	280	- 22	- 22	0	- 22	- 22	22	22	137	14	0	14	17	- 7	<u> </u>	237		0		10				- 10	1
total	22,299	787	809	1,089		809	809	809	809	809	809	938	801	801	801	801	801	801	1,034	797	797	797	797	797	797	797	797	
	22,277	107	- 0021	1,002		007		- 6071	607	607	- 007	750	- 0011	801		001		991	1,031	- '''				:				
IRR (Internal Rate of Return)	1	+ *				$(\cdot,\cdot)_{s\in[-1,1]}$		Mark the													<u> </u>	<u> </u>						
Cash Flow In ( Donation + Revenue + F/A sold )	191,779		5,293	17,212	2,025	2,259	2,399	2,542	2,875	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077	8,771	
Cash Flow Out ( Project dis + EMSAPUNO )	161,385	3,149	4,774	30,175	5,331	2,101	2,423	1,956	2,022		2,161	5,159		4,883	9,722	4,678	5,012	4,558	16,454	4,569	5,758	4,687	4,767	4,802	10,192	5,149	5,483	5,03
Balance	30,394	785			-3,306			586	853	1,005	1,161			-702		102	-29		-10,780	1,331	668	2,003		2,746	-2,383	2,929	3,288	46,21
IRR	4.428	·			•		7 11 1	1 14 4 3								i j										•		
NPR(12%)	-8,594	100		*.		tik, ko .		. A 12			4								100			1.1						
NPR(10%)	8,095							700	3.3				1-2-57								1							
NPR(8%)	6,775					+ 1 · · ·													100	•					1	100		
NPR(6%)	-3,975																100		1	100								
NPR(5%)	-1,683		÷		- 1						** *				ula di					* * *		1	.*					
14114(370)	- 1,000					4			n na a la la			100	the second second		100		1.		٠.									

Table V.2.46 Cash flow and P/L calculation for Alternative III

<b></b>							-																					
Project expenditure estimation	TT + 1/00 2/0	Liconsia	Iagorest	lacouru	laggary	la coarie	langueu	Taggerrie	Laggery	Taggary	Tangery	laggery	LOLOCY	hours	201200	Lagrany	301 (51/	20156111	in chief	 <del></del>					********	r <del>a a a a a a</del> a	(Unit:S/	(000)
Fiscal Year	Total(99-25)	1999FY	20001 Y	2001FY	2002FY	2003FY	2004FY	2005FY	2006F Y	2007F Y	2008F Y	ZUUSFY	ZUTUFY	2011F Y	2012FY	2013FY	2014FY	20151 Y	2016FY	2017FY	2018FY	2019FY 2	2020FY	2021FY	2022FY	2023FY	2024FY	2025FY
Land Acquisition	0			<u> </u>			ļ	ļ		<u> </u>	ļ	L			•													
Proposed project administration expense	601		22		22	22	22	22	27	2 22	22	<del></del>					29	29	20		20	20	20	20	20	20	20	20
Construction work (a)	83,426		2,586		2,586					<u> </u>		1,447	<b></b>		1,447		1,447	1,447	1,375	3,303	8,978		1,375	1,375	1,375	1,375	1,375	1,375
Contingency (15%) (b)=(a) x 0.15	12,514	0	388	5,592	388	0	0	0		0	0	217		1,352	217		217	217	206	495	1,347	206	206	206	206	206	206	206
GST (18%) $(c)=(a+b) \times 0.18$	17,269	0	535	7,717	535	0	0	0			0	300	300	1,865	300	300	300	300	285	684	1,858	285	285	285	285	285	285	285
Maintenance Equipment (d)	53,926				425					1		<u>l</u>			23,945						233	- 1	-	5,555	23,768	<b>i</b>	Ì	
Contingency (15%) (e)=(d) x 0.15	8,089	0	0	0	64	0	0	0	. (		0	0	0	Ô	3,592	0	0	0	Ō	0	35	0	Ö	833	3,565	0	0	0
GST (18%) (f) = $(d+e) \times 0.18$	11,163	0	0	0	88	0	0	0			0	0	0	Ö	4,957	0	0	0	0	0	48	0	0	1,150	4,920	0	0	0
Engineering Service (g)	8,342	2,547		1,698						T		1,061		708			· · · · · · · · · · · · · · · · · · ·		1,397		931							
Contingency (15%) (h)=(g) x 0.15	1,251	382		255	1.75			1		1	T	159		106	. **				210		140					[		
GST (18%) (1) = $(g+h) \times 0.18$	1,727			351				<del> </del>		†	l	220		147					289		193				<del></del>			
Maintenance (with GST)	32,330	317			781	815	850	885	930	988	1,043	1,105	1,169	1,211	1,253	1,295	1,339	1,384	1,427	1,471	1,513	1,561	1,608	1,650	1,693	1,737	1,782	1,827
Total	230,638														35,739		3,332	3,377	5,209				3,494	11,074	35,832	3,623	3,668	
	_1	,	1	1 00,270	.,,,,,,		L	1	1		12		1	1 1,712.	00,.55	1	3,332	2,511	3,207		13,2701			11,07.1	33,032	3,023	2,000	
Donation, Loan & Local Fund		2	34 J			1.7		100										** .	** *									- 1
Donation up to S/.21,180 ( DM12MIL)	21,180	3,773	3,509	13,898	- 0	0	<u> </u>	0	F	01 0	0	0	0	[	n	0		01	n!	n	- តា	n	กเ	ሰ	<u></u>	ា	ρl	6
Loan available for construction work	95,802		0	36,693	3,509	Ŏ	Ì	j			0	1,964	1,964	12,227	1,964	1,964	1,964	1,964	1.866	4.482	12,183	1,866	1,866	1,866	1,866	1,866	1,866	1,866
Local Fund of non-construction expense	113,655	n	357	<u> </u>	1,380	837	872	907	95	1,010	1,065	+			33,775		1,368	1,413	3,343		3,113		1,628		33,966	1,757	1,802	1,847
Total	230,638	3,773													35,739			3,377	5,209				3,494		35,832	3,623		
				1					L		1	1	L	L		1 . 0,200	0,00-			3,7,5	10,2001	3,117		11,011		1 3,0231	3,000	3,.13
Loan transaction		121					100			100	- 21						100		1 1									
Loan Receipt	95,802	1 0	1 0	36,693	3.509	0		1 0		01 (	1 0	1,964	1.964	12,227	1,964	1,964	1,964	1,964	1,866	4,482	12,183	1,866	1,866	1,866	1,866	1,866	1,866	1,866
Loan Repayment	35,291	0	0	0	0	0	<del>                                     </del>	i o			0	0	0	1,835	2,010			2,010	2,010		2,010		2,206	2,818	2,916	3,014	3,112	3,211
Loan Balance	60,512	0	0	36.693	40,202	40,202	40.202	40,202	40.20	2 40,202	40.202	42,166	44.129		54,475			54,335	54 191	56,663			66,253	65,301	64,251			
		L	<u> </u>	1		1	1	1		1	1,	1.,,,,,,	1 11,122		- 1,112	,	2 1,002	,555		30,003	00,000	00,575	. 00,233	03,301	01,231	03,103	01,0301	
Interest										11									i de di		2.0					100	2	
Interest (5%)	65,105	0	1 0	1,835	2,010	2,010	2,010	2,010	2,01	2,010	2,010	2,108	2,206	2,726	2,724	2,721	2,719	2,717	2,710	2,833	3,342	3,330	3,313	3,265	3,213	3.155	3,093	3,026
		-	•						<u></u>						· <del></del> :					L——				L		1		
Cash Flow			1.4		4.73						1 1 1	1. 4. 1. 1.	: .					<u>.</u>										
Cash - In:				10.00		<u> </u>		T		T	1.0		44 1		3 P.	1												1, 11
Donation	21,180	3,773	3,509	13,898	0	0	. 0	0		0 (	) 0	0	0	Ô	0	0	0	0	0	Ö	0	0	0	0	0	0	0	0
Loan for Project Disbursement	95,802	0	0	36,693	3,509	0	0	0	3 Te 1	0 0	) 0	1,964	1,964	12,227	1,964	1,964	1,964	1,964	1,866	4,482	12,183	1,866	1,866	1,866	1,866	1,866	1,866	1,866
Local Fund for Project Disbursement	113,655	0	357	2,681	1,380	837	872	907	95	1,010	1,065	2,574	1,198	2,201	33,775	1,324	1,368	1,413	3,343	1,491	3,113		1,628	9,208	33,966	1,757	1,802	1,847
Local Fund for Loan Repayment	35,291	0	0	: 0	. 0	0	0	. 0	2.5	0 0	0	0	0	1,835	2,010	2,010	2,010	2,010	2,010	2,010	2,010		2,206	2,818	2,916	3,014	3,112	3,211
Revenue + F/A sold	128,420	1,572	1,783	1,903	2,025	2,259	2,399	2,542	2,87	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077	8,771	70,967
Local Fund for Interest Payment	65,105	0	0	1,835	2,010	2,010	2,010	2,010	2,01	0 2,010	2,010	2,108	2,206	2,726	2,724	2,721	2,719	2,717	2,710	2,833	3,342		3,313	3,265	3,213	3,155	3,093	3,026
Cash - Out:			1 44			. 4					* *.								* * 4.									
Project Disbursement	230,638	3,773	3,867	53,271	4,889	837	872	907	95	1,010	1,065	4,537	3,162	14,427	35,739		3,332	3,377	5,209	5,973	15,296	3,447	3,494	11,074	35,832	3,623	3,668	3,713
Loan Repayment	35,291	0	0	0	. 0	0	0	0			) 0	0	0	1,835	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,108	2,206		2,916	3,014	3,112	3,211
Interest Payment	65,105		0	1,835	2,010	2,010	2,010	2,010	2,01	0 2,010	2,010	1 -						2,717	2,710		3,342		3,313		3,213			3,026
EMSAPUNO existing expense	21,249			787											787		787	787	787	787	787		787	787	787	787	787	787
Repayment of Local Fund	169,069							1,755	2,08	3,308	2,535	2,953			3,797	3,994		4,669	4,887	5,113	5,639	5,902	6,161		7,022	7,290	7,984	70,180
Balance of Cash Fund / - Local Fund	-44,982	785	639	-3,399	-2,152	-1,375	-1,270	-1,162		1 -712		-1,729		-3,367					-3,175	-1,222			-986		-33,073		-23	62,097
			14.37.4	1000					<u> </u>				*.	1	1 1 1	1.50			· · · · ·		·							
P/L ESTIMATION	<u></u>					5.50			er e e	1 - 1 1 - 1										- 1.1	1 1 10		• • • • •	(1) (4) 7.				1000
Revenue	128,420	1,572		1,903	2,025	2,259	2,399	2,542	2,87	3,095	3,322	3,740	4,006	4,181	4,584	4,781	4,983	5,456	5,674	5,900	6,426	6,689	6,948	7,548	7,809	8,077	8,771	9,069
Expense: 1. Administration	22,983	787	809	809	1,386			809									816	816	807		1,123		807	807	807	807		807
2. Engineering service	11,320		0	2,304	0	0	C	0		0 (	0	1,440		961	0	0	0	0	1,896	0	1,263	. 0	ő	0	0	ó	0	0
3. Maintenance	32,330	317		354	781	815	850	885	93	6 988	1,043			1,211	1,253	1,295	1,339	1,384	1,427	1,471	1,513	1,561	1,608	1,650	1,693	1,737	1,782	1,827
4. Interest expense	65,105	0	0	1,835												2,721		2,717	2,710	2,833	3,342		3,313		3,213	3,155		3,026
5. Depreciation ( proposed )	114,724	0	0	0	0	3,859												4,976	5,025		5,202		6,327	6,373	6,420			6,560
6. Depreciation (existing)	9,765	362	362	362	362		362							362	362		362	362	362	362	362	362	362	362	362		362	362
Expense total	256,228																10,162		12,226				12,416		12,494			12,581
Profit / Loss	-127,808				-2.513	-5,596													6,551		6,378		-5,468					
1	121,000	2,000	L 211	, ,,,,,	داری	1,,,,,		1 2,203	2,10	7,733	7,700	1 2,7 17	7,100	1 ,0,1	7,037	7,471	2,117	,, 70	0,771	1,011	0,210	-2,030	-2,100	1,707	-7,003	7,7 <i>7</i> V	-2,100	2,214

- 1. Revenue: The rate will be revised every 3 years and 5 % increase is expected. Fee collection rate will be increased by 1% annually.
- 2. Depreciation (construction) civil work will be depreciated for 40 years (every year 2.5 % of acquisition cost is depreciated.) mechanical/electrical will be depreciated for 10 years.
- 3. Depreciation ( equipment ) items will be depreciated for 10 years ( every year 10 % of acquisition cost is depreciated.)
- 4. Depreciation (EMSAPUNO) Existing fixed asset is for water and sewerage business. According to the 1998 FY detail expense information, 66% of depreciation was for water business, 34% of depreciation was for sewerage business.
- 5. Local Fund: Non-construction expense loan principal payment & interest payment are funded by Peru/Puno government without interest.

		1000544	2000000	2001644	Σάργεστ	2002544	2004074	MASEAVI	MATANA	2007074	MATRIA	20001277	MARKE	MILEAN	2012577	2012644	2014667	20150/1/	2016644	201750	201900	201064	2020F/Y	2021574	202257		(Unit:S/	
epreciation of proposed fixed asset		1999171	2000171	20017/1	2002111	263	263	263	263	263	263	263	263	263		263	263	263	263	263	263	263			263	263	263	20236
wer civil work ( 2000-2FY )	6,053					203	203	203	203	203	203	203	49	98	263	196	245		344	344	344	344			344	344	344	3
wer civil work ( 2009-15FY )	4,467												49	96	147	190	243	293	344	47	93	140			280	327	373	42
wer civil work (2016-25FY)	2,099						- 1		1								· ·			47	93	140	107	233	200	321	3/3	4.
imp civil work (2001FY)	23															- (0	<u>I</u>	1				68	(0	68	68		(0)	
imp civil work ( 2011FY )	954					270	240	270	370	370		370	200	200	68	270	68	68	68	68	68				370	68	68	
ant civil work ( 2001FY )	8,500					370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370					370	370	3
ant civil work (2017FY)	474					0.5		- 05													59				59	59	59	
imp mechanical ( 2001FY )	565					25	25	25	25	25	25	25	25	- 25	25	25	25	25		25	25				25 754	25 754	25	
imp mechanical (2011FY)	10,553														754	754	754	754	754	754	754						754	7
imp mechanical (2017FY)	196		·															0.001	2.201		25				25	25	25	2.0
ant mechanical ( 2001FY )	73,617					3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,201	3,2
ant mechanical (2009FY)																			``	1								
ant mechanical ( 2018FY )		- 1					- 8 a.								100							1,032		1,032	1,032	1,032		1,0
tal depreciation of proposed F/A	114,724		•		i	3,859	3,859	3,859	3,859	3,859	3,859	3,859	3,908	3,957	4,828	4,877	4,926	4,976	5,025	5,071	5,202	6,280	6,327	6,373	6,420	6,467	6,513	6,5
epreciation for existing (EMSAPUNO) fixed a	isset				100																1800	<u> </u>						
uilding, Construction (S/. 23,449 +S/. 12,450)	8,239	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	- 3
Tachine (S/. 874)	802	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	: 30	30	30				30	30	30	
ransportation equipment (S/. 236)	217	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	
quipment (S/. 43)	39		1	1	1	1	1	1	1	1		1		1	1	1	1	i	1	1	ī	1	1	1	i	1	ī	
ther (S/. 510)	468	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
tal depreciation of proposed F/A	9,765	362	362			362		362	362	362	362	362	362	362	362	362	362		362	362	362	362			362	362	362	
EVENUE ESTIMATION  astewater flow estimation (61.3 Vs in 98FY)  crease rate of wastewater (each year / 98FY)A  crease rate of sewerage fee (each year / 98FY)B  crease of collection rate (annually 1 %) C  stimated revenue (S/. 1450 in 1998 x A x B x C	2)	65.8 1.0734 1.00 1.01 1,572	70.4 1.1485 1.05 1.02 1,783	1.05 1.03		1.10 1.05	1.4160 1.10 1.06	91.1 1.4861 1.10 1.07 2,542	97.2 1.5856 1.16 1.08 2,875	1.16 1.09	110.3 1.7993 1.16 1.10 3,322	1.11	124.4 2.0294 1.22 1.12 4,006	128.7 2.0995 1.22 1.13 4,181	133.2 2.1729 1.28 1.14 4,584	1.28 1.15	1.28 1.16	1.34 1.17	1.34 1.18	1.34 1.19	160.9 2.6248 1.41 1.20 6,426	1.4	2.7912 - 1.41 1.22	1.48 1.23	180.2 2.9396 1.48 1.24 7,809	184.9 3.0163 1.48 1.25 8,077	189.7 3.0946 1.55 1.26 8,771	1
						· . : .											100	1 to 1										
dministration detail(without contingency and (	GST)	. 17.																										
MSAPUNO existing administration expense	21,249	787	787				787	787	787		787	787	787	787	787		787			787	787				787	787	787	
roposed project administration expense	601		- 22	22	22	22	22	22	22	. 22	22	29	29	29	29	29	- 29	29	20	20	20		20	20	20	20	20	
roposed project maintenance equipment	1,133				577	14 A.		2.115	11.	10 10 10		1.00		1.00	240	2.0	The said	3.73		1.0	316		2.2				-	
otal	22,983	787	809	809	1,386	809	809	809	809	809	809	816	816	816	1,056	816	816	816	807	807	1,123	807	807	807	807	807	807	8
RR (Internal Rate of Return )																					100							
cash Flow In ( Donation + Revenue + F/A sold )	211,498	5,345	5 203	15,801	2,025	2,259	2,399	2,542	2,875	3.005	3 322	3.740	4,006	4,181	4,584	4,781	4,983	5 456	5,674	5 900	6 426	6.689	6,948	7 548	7 809	8 077	8 771	70.9
ash Flow Out ( Project dis + EMSAPUNO )	251,887				5,676			1,694		3,095 1,797	3,322	3,740 5,324	3 0/0	15,214	36,526	4,075	4,119								36,619			
alance	-40,389	785	639	38 257	-3,651	635				1,298			3,717	11 033	-31,942	706				-861	-9,656				-28,810			
IRR	-3.462		L	1 30,23,	1 3,031			0.01	- 1,150			1,30.1	3.1	11,055	31,712	300	14 .5	1,272				1 1 2	, -,,,,	,,,,,,,,				
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Table V.2.47 Internal Return Rate (IRR) and Net Present Value (NPV)

		IRR (%)	NPV (5%)
	. :.1		(1,000 soles)
Alternative I		3.5	- 4,018
Alternative I-A	160 17	6.0	2,277
Alternative II		4.4	- 1,183
Alternative III		- 3.5	- 34,222

# Summary of financial evaluation

From the above financial analysis, only alternative I-A is regarded as financially feasible unless additional financial resources are available for the project.

#### (4) Overall evaluation

)

Four alternative plans are evaluated from environmental, technical and financial aspects. Environmental evaluation indicates that although Alternative I and II have maximized pollution reduction for Puno inner bay, those may rise concern over the environment to which treated water is finally discharged. Especially, Alternative I discharges treated water to the Puno outer bay. Its discharge point is not so far from the drinking water intake. This drinking water source is most important for the residents of Puno City and should be protected at all cost. Failure for this may result in increased treatment cost for water supply.

Technical evaluation shows all four alternative plans are feasible for the Puno city although staff training is required for the all the alternatives, especially for Alternative III.

Financial evaluation shows that only alternative I-A, which costs minimum among the alternatives, is financially feasible. Other alternatives required substantial rise in sewerage rates or subsidies from the municipality or the government.

From the above evaluation, the study team concludes that Alternative I-A is feasible for the Puno city, especially from the financial point of view. Alternative I-A is further analyzed for optimum performance. An appropriate plan is proposed in section 2.4.

Advantages and disadvantages of alternative plans are summarized in Table V.2.48.

Table V.2.48 Advantages and disadvantages for alternative plans

Alternative	Advantages	Disadvantages
1 · · · · · · · · · · · · · · · · · · ·	- high flexibility for changing load	- low compatibility with land use
	- low O & M cost	plans the state of
	- low skill requirement	- high land requirement
т .	- low vulnerability for power failure	- possibility for lake contamination
I	- low construction cost (for I-A)	(medium nutrient removal
I-A	Property Continues the	efficiency) was very vir and
:	ethic et in de assamper v	- possibility for drinking water source
		contamination (for I)
:		- eyesore for tourists and residents
Arra di Arra	- maximum contaminant reduction to	- susceptible for disasters (power
	Titicaca lake	failure etc.) (contaminant release to
	- compatibility with land use plans	Titicaca lake)
	(possible use of the surrounding	- high land requirement (outside
	area of the existing Espinar	the catchment area of the interior
ma <b>H</b> est	stabilization in the stabiliza	bay of Puno)
* **	for tourism development)	- possibility for ground water
	- water reuse for forestation	contamination
gus fortulfs	A Baker State and Control	- odor release
	to vicini jedana a koji sistema (k. j.	- eyesore for tourists
	- high contaminant removal	- high construction cost
. 1.7. 1	- low land requirements	- high skill requirement for O & M
Spirit	- high compatibility with land use	- susceptible for power failure
	plans(possible use of the existing	(reduction in treatment
Ш	Espinar stabilization lagoon and	efficiency)
	surrounding area for tourism	The Art Halv Hatty Cont. M. m. f.
	development)	
	- water reuse for landscaping/wet-	
	land restoration and enhancement	

#### 2.4 PROPOSED PLANS

#### 2.4.1 STRUCTURAL MEASURES

## (1) On-site system

On-site wastewater treatment/disposal is important, not only for small rural communities, but also for urban/semi-urban households which are not served by the public sewerage system. The study of on-site treatment/disposal was undertaken to offer alternatives from the viewpoints of low-cost sanitation and technical aspects, corresponding to the differences among the locations such as a cluster of households, apartments and individual households. The study also looked into technical options as an intermediate countermeasure for those unsewered households situated in the transitional areas for on-site treatment.

As on-site wastewater treatment/disposal, Pit Latrine, by standard design for sanitary toilet will be adopted. Sludge will be collected by Small Pit Emptying Machine. Collected sludge will be transferred by dump truck and will be disposed to the forest area.

# a) Proposed on-site wastewater treatment/disposal system

Pit I	atrine		
	Pit Capacity:	$0.7 \text{ W} \times 0.7 \text{ L} \times 1.5 \text{ H} = 0.74 \text{ m}3$	
	Sludge Collection:	Every 3 years	
O	Installation:	Each house	
Sma	II Pit Emptying Machin	es	
	Capacity:	500 L/unit	
Q	Performance:	4.2 pits/day $\times$ 250days/year = 1,050	pits/year
0	Economic Life:	4 years	
Truc	ks for Sludge Transfer		
Q	Loading Capacity:	<b>2 ton</b>	
	Economic Life:	8 years	
<b>.</b>	Economic Lite:	o years	

Required number of small pit emptying machine and trucks are shown in Table V.2.49.

## b) Sludge collection cost for on-site system

Total operation cost for sludge collection is calculated as shown in *Table V.2.50*. Average cost per collection is 78 soles. Since the above cost calculation does not include administration cost and interests on capital cost, actual tariff may be set slightly higher.

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Table V. 2.49 Number of Small Pit Emptying Machines and Trucks
Small Pit Emptying Machine
Capacity
Economic Life
4 years 1,050 houses/year
4 years

3 years/pit Pit Latrine Sludge Collection Interval

П		· A		٦	Ī	T	٦	ণ	0	Ö	ျ	ণ	0	0	ပ	4	ণ	ণ	9	0	Ó	ା	ণ	'n	0	0	0	০	ं	Ö	Ö	2	
Ę		Scrap	:	(unit)			١	١	١		١												İ					ĺ					
2 ton	Number	Shace	Total	(unit)	Phase I	L			J	<b>.</b> :	J		!		4	Phase 2	1	l	1		<b>!</b>	2	Phase 3	1	1				1		1	S	
J	Purchase Number	-	Yearly	(unit)				4	0	٥	٥	0	0	0	0	3	0	0	٥	0	0	٥	0	3	0	0	0	0	0	0	0	7	12
Truck		Kednired	Number	(unit)				4	4	4	4	4	4	3	3	3	S	က	က	9	3	3	3	100	m	3	3.	3	C)	3	2	2	
	L		0.05 m3/p/year	(m3/day)	8.0	7.9	7.7	7.5	7.3	7.1	8.9	9.9	6.3	0.9	5.7	5.3	5.0	4.9	4.9	4.9	4.8	4.8	4.7	4.6	4.5	4.5	4.4	4.3	4.2	4.0	3.9	3.8	
Of day	Sludge Amount		0,05 m	(m3/ycar)	2,917	2,866	2,807	2,741	2,668	2,587	2,498	2,403	2,300	2 190	2,072	1.947	1.815	1,804	1,791	1.775	1,758	1,739	1,714	1,688	1,660	1,630	1.598	1,558	1,518	1,476	1,432	1,388	
ine		Scran		(unit)				0	0	0	0	5	0	0	0	4	0	0	0	3	0	0	0	3	0	0	0	m	0	0	0	3	
ying Mach	Number	2	Total	(unit)	Phase 1		-:							1	6	Phase 2						·	Phase 3									6	
Small Pit Emptying Machine	Purchase Number		Yearly	(unit)			-	5	0	0	0	4	0	0	0	3	0	0	0	E.)	0	0	0		0	0	0	m	0	0	0	3	24
Sm		Required	Number	(unit)				5	5	5	4	4	4	4	4	4	m	٣	3	ď	3	3	3	3	3	3	3	3	ď	3	3	3	
,	Number of	Served	Family	(HH)	14,060	13,896	13,694	13,450	13,166	12,843	12,480	12,075	11.628	11,138	10,605	10,027	9,404	9.400	9.385	9.359	9,322	9,274	9,197	9.109	9.010	8,900	8.778	8,615	8.442	8,259	8,065	7,861	
Average		Family	Member	(HH/dod)	4.15	4.13	4.10	4.08	4.05	4,03	4.00	3.98	3.96	3.93	3.91	3.88	3.86	3.84	3.82	3.79	3.77	3.75	3.73	3.71	3.68	3.66	42	3.62	3,60	3.57	3.55	3.53	
	Served	Population		(dod)	58.350	57,320	56,144	54,821	53,351	51.734	49,970	48,059	46,001	43.796	41,445	38,946	36,300	36,077	35.813	35,509	35.163	34.777	34,285	33,757	33,192	32.591	31.953	31,169	30,358	29,517	28,648	27,751	
	Total	Population		(000)	108,457	111,518	114,579	117,641	120.703	123,764	126,826	129,888	132,951	136,013	139,076	142,138	. 145.201	148,262	151.324	154,385	157,447	160,508	163,264	166,020	168,775	171.531	174.287	176,430	178.574	180,717	182,861	185,004	
		>	1		1998	198	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total

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Table V. 2.50 Pit Emp	

Small Pit Emptying M	Small Pit Emptying Machine	Sludge Transfer (truck)	er (truck)	
Capacity	1,050 houses/year	Capacity	- 2	
Economic Life	4 years	4 years	steps 8 8 years	
Price	22,000 soles	Price	60,000 soles	
Fuel (petrol)	858 l/year	Fuel (diesel)	3587 Uyear	
Fuel cost	1,587 solex/year			
Maintenance	2,200 soles/year	Maintenance	3,000 soles/year	
done about 6/ 2000 rode !	74.000 22	I share sare ( ) age	I show same by managed to a sale of the same of the sa	

	all Die Emm	Small Die Emmerine Machine						1	1000							1	Toroff Calculation		
	4	Purchase			Operation and Maintenance	Maintenance			1	Purchase			Operation and Maintenan	faintenance				Family second	100
Z Z		Yearly	Cost	Depreciation	Fuel		Maintenanco	Sub-total	Number	Vearly	Cost	Deprociation	Fuel	Labour	Maintenance	Sub-total.	Total cost	neck Jack	collection
: •	(nuit)	(חשוג)	(1,000 soles)	(1,000 soles)		(1,000 soles) (1,000 soles) (1,000 sole	(1,000 soles)	(1,000 soles)	(unit) ~	(nwit)	(1,000 soles)	(1,000 soles)	(1,000 soles)	(1,000 soles)	(1,000 votes) (1,000 soles)		(1,000 noles)		(soles)
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2000	٥	ō			0			٥	0	٥	0		0	O					ō
2001	٠,	v.	011	27.5	8.9	180		861	4	4	240	30	8.7.1	7	ŀ			4483	WO.
2002	5	0	0		99	1.80		801	4	0	0		17.3	72					7.1
2003	5	0	0	27.5	6.5	180			4	0	jo		16.8	72					83
2004	7	0	0	5.62	€'9	144			7	ò	0		16.2	27					76
2005	4	4	88	22	1.0	144			P .	0	0		15.6	77					77
2006	4	-10	0		6.5				7	·jo	0		14.9	77					×o
2002	4	ю	0		9.5	144			i i	o	٥		14.2	54					77
2008	4	jo	0	ដ	5.3	144			1	0	0		13.4	54					*1
2009	4	3	99	16.5	5.1				3	3	081		12.6	×					82
2010	3	0	0	16.5		1901			(C	0	0		1.1 X	\$41			,		74
2011	3	0	0	16.5	4.7	801	9.9		3	0	0	3.25	11.7	*	0	75	233	3133	74
2012	31	0.	0	16.5	4.7	801	9.9	119	ıc .	٥	0		11.6	4.					7.4
2013	3	(C)	99		47		9.0		3	0	o		11.5	54					75
2014	3	0	0	16.5	4.7				10	0	0		11.4	54					75
2015	3)	0	0	16.51	4.7	108			3	0	0		11.3	34					7.5
2016	3	0	0	16.5	4.6	X01	6.6	110	6 3	ļo	0		11.11	3.4					76
2017	3	· 3	99						3	3(	180		10,9	24					76
2018	es	0	٥	16.5	4.5	101	6.6		е.	0	0		10.8	28					77
2019	3	0	0	16.5	4.5		6.6		3	0	0		10.0	¥					78
2020	3	0	0	16.5	4.4	108	6.6	119	31.	0	0		10.4	54					70
1202	3	. 3	99	16.5	4.3		9'9		1	0	0		101	24					80
2022	3	0	0	15.91	4.3	108	6.6		3	0	0		9.8	\$4					82
2023	3	0.	0	16.5	4.2	108	6.6		3)	0	0		9.6	*					*
2024	3	0	o	16.5	4.1		9.9		2	0	0		6.3	36					7.8
2025	3	3	8	16.5	4.0	10%	6.6		. 2	2	120	18	0.6	36					77
Total		24	528	478.5	125.8	3132	191.4	3449		[21	720		309.7	1422				Average	7.8

## (2) Off-site system

General layout of proposed sewerage system in Puno City is shown in Figure V.2.18.

## 1. Wastewater collection system

a) Sanitary sewer system:

Separate system

b) Piping Materials

Diameter of 150 mm:

RC (service connection)

Diameter of 150 to 400mm:

**PVC** 

Diameter of more than 450 mm:

RC

c) Wastewater collection facilities

The sewer and a pump station, which will be implemented in future plan, are as follows.

#### 1) Sewer

Sewer pipes have already been installed by EMSAPUNO. Although, a large part of the study area is already sewered, additional pipes shall be installed in future to cover the non-served population. Table V.2.52 shows the breakdown of pipes by several categories, namely areas, existing sewers and future plan. In future plan, new installation length and replacement length are tabulated by phases.

## 2) Pump Station

Table V.2.51 Summary of Pump Station Plan

Name	Specification	
E.B. EL PUERTO	Submersible pump, 5.25 l/s, 8.6 m, 1.2 kW, 1 set(+1)	

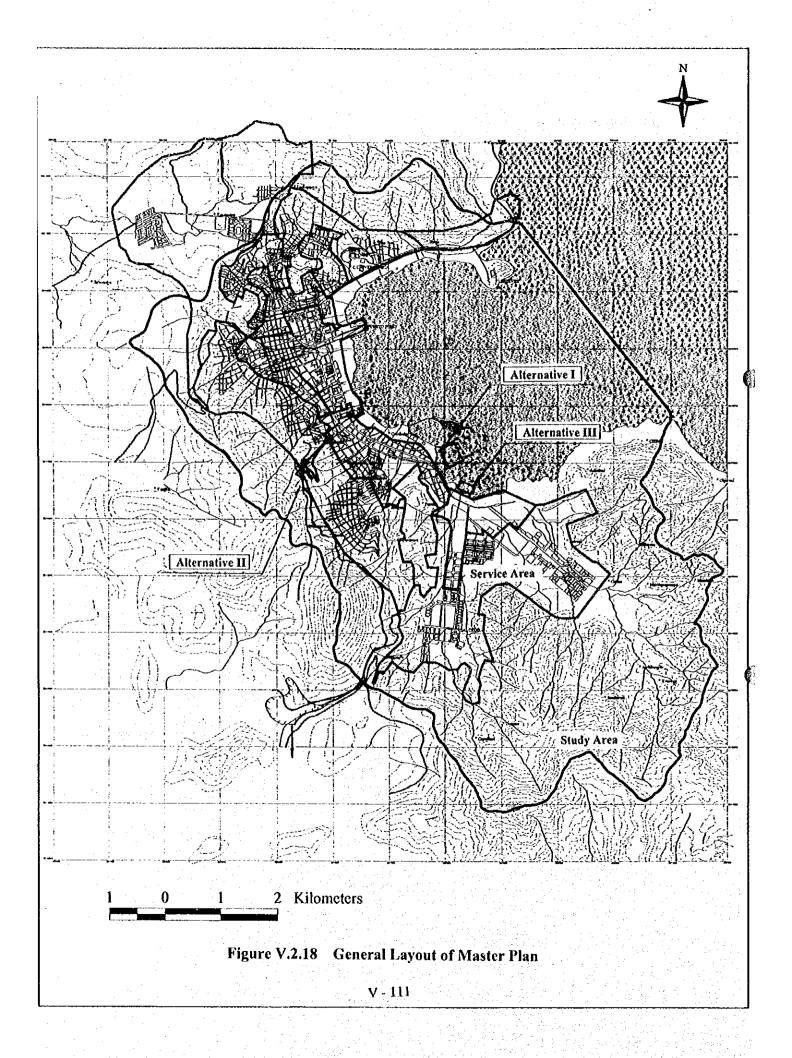


Table V.2.52 Summary of Sewer Plan

	Exis	ting '1)			1 - 15	Future Pla	ın			
Агеа No.	Area	Length	20	008	20	)15	20	)25	, i	Total
7 Hearto.	(ha)	(m)	Length (m)	Service Ratio '2)	Length (m)	Service Ratio <sup>'2)</sup>	Length (m)	Service Ratio <sup>*2)</sup>	Total	Length
	1000	00.001			(111)		(11)	144410	1.701	00.000
①	155.0	29,081	4,691	100.0%	·	100.0%		100.0%	4,691	33,772
2	57.0	11,252		100.0%	1	100.0%		100.0%	0	11,252
3	87.0	13,800		100.0%		100.0%		100.0%	0	13,800
<b>①</b>	123.7	23,856	10,857	100.0%		100.0%	27.3	100.0%	10,857	34,713
⑤	69.6	8,850		27.2%	14,039	70.3%		70,3%	14,039	22,889
6	120.7	14,536		47.5%	5,335	65.0%	:	65.0%	- 5,335	19,871
7	44.6	7,710	7,848	100.0%		100.0%		100.0%	7,848	15,557
8	27.3	7,673	i,	47.9%	6,380	87.7%		87.7%	6,380	14,053
9	42.0	3,634		21.5%		21.5%	10,383	83.1%	10,383	14,017
(10)	116.9	21,243		19.8%	N. F.	19.8%	55,624	71.8%	55,624	76,867
(1)	27.4	1,040		3.8%	12,240	48.1%		48.1%	12,240	13,280
12	25.9	3,505		25.9%	5,968	70.0%		70.0%	5,968	9,474
<b>(1)</b>	0.0	0	25	0.0%	2,870	59.3%		59.3%	2,870	2,870
Subtotal	897	146,179	23,396		46,832	1 1	66,007		136,234	282,413
Replacement		i z Vista 💂	1,827		: ::::::::::::::::::::::::::::::::::::		-		1,827	1,827
Total	897	146,179	25,223		46,832		66,007		138,062	284,241

<sup>1)</sup> Existing : Service area,

# 2. Wastewater treatment plant

Alternative I-A is further evaluated for its nutrient removal to propose optimum plan.

# a) Mass balance of the wastewater treatment plant

The mass balance of the treatment plant (Alternative I-A) is estimated for organic matter (BOD<sub>s</sub>), suspended solids (SS), nitrogen (T-N) and phosphorus (T-P). For the performance of the facultative lagoons, the following figures are used.

Table V.2.53 Pollutants removal by facultative lagoons by various standards

	BOD	T-N	TP
Source	Removal (%)	Removal (%)	Removal (%)
ASCE/WEF (1998)		40 – 90 %	< 40 %
MOC, Japan (1993)	70 %	-	
Mara and Pearson (1998)	70 – 80 %	47 %'1	< 45 %
Proposed value <sup>12</sup>	70 %	45 %	40 %

<sup>\*1</sup> water temperature = 10 °C, pH = 8.2

<sup>\*2)</sup> Service Ratio: Area ratio

<sup>\*2</sup> values used for the mass balance calculations

The results are shown in *Table V.2.54*, 2.55, 2.56 and 2.57. The serious accumulation of solids is expected in the first facultative lagoon after the installation of aerated lagoons as substantial amount of suspended solids flows into the lagoon. Accumulated solids should be removed to maintain treatment capacity of facultative lagoons. Phosphorus is further removed by coagulant addition from year 2010. The target effluent concentration of T-P is less than 3 mg/l.

#### b) Possible improvement for Alternative I-A

#### Sedimentation lagoons

As required removal of accumulated solids from the facultative lagoons is quite difficult while continuous operation is required, installation of sedimentation lagoons is proposed. Two lagoons are to be constructed at Phase 2, which operate alternatively as a sedimentation lagoon and a sludge pond. Another lagoon is constructed at the start of Phase 3. At year 2025, each sedimentation lagoon has 12-hour retention time and 2 lagoons operate simultaneously while one is used as a sludge pond. Accumulated sludge in the aerated lagoons will be pumped to the sedimentation pond while it is used as a sludge pond. Suspended solid and sludge generation projection is shown in *Table V.2.55*.

#### Inlets for facultative lagoons

Inlets for the facultative lagoons are modified as shown in Figure V.2.20b to maximize the average retention time of the lagoons.

#### Outlet facility for the second facultative lagoons

At present, a large amount algae is observed in the effluent of facultative lagoons. In order to minimize the release of algae into the effluent, outlet structure such as *Figure V.2.19* is to be installed.

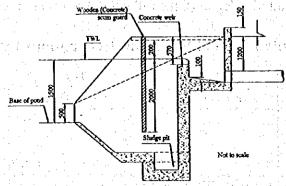


Figure V.2.19 Proposed outlet weir structure

<sup>\*</sup> Source: Mara and Pearson, 1998

onds + Facultative lagoons + Constructed wetlands
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BOD, projection for the proposed plan
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										-
	Effluent. BOD load	(k=/d)	844448821188895555555555555555555555555555555	P						
	Efficient BOD conc.	(mg/l)	4 2 2 3 3 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	BOD, removal by sub-surface constructed wetland		(mg/l) (mg/l)				-,
	Ketention	(dwy)	200004444685555555 4000055546085555555555555555555555555555	e construc	:	effluent BOD, concentration (mg/l) influent BOD, concentration (mg/l)				
I	Flow	(m/d)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ub-surfac	DB)	SOD, cond				
	Area	(ha)		oval by si	4.4 (NA	effluent i	٠.	•		
	removal Aer.+Fac.)	(%).	\$	8OD, rem	C = 0.33C +1,4 (NADB)	ΰΰ 				
	Effluent BOD load	(kg/d)	25 x 8 2 1 8 4 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2							
	Effluent BOD conc.	(mg/l)	GG477-7-7-8-9-8-11-8-4-8-4-8-4-8-4-8-4-8-4-8-4-8-4-8-				(86 8			
	Retention	(day)	88.28.28.28.49888889999999999999 88.28.28.28.28.4989899999999999999999	(Peru)			ctcalf & Eddy, Inc., 1990) Required area for facultative lagoons (Mara, 1998) , e <sup>(1-20)</sup>			 -
	Area	(h.e.)	ក្រុកក្រុកក្រុកក្រុកក្រុកក្រុកក្រុកក្រុ	c lagoons		( (kg)	lagoons:	T) 72%)	! (kg)	
	Required area(Mara)	9	7,444,444,38,488,882,444,43,36,43,38,77,7 4,66,44,48,48,48,48,48,48,48,48,48,48,48,48,	(acultativ	( <sub>2, 50</sub> )	area (ha) 3OD, load	acultative	07 - 0.002	rea (ha) 3OD, load	١.
	Minimum area (Peru) a	â		Minimum area for facultative lagoons (Peru)	Amn - L, / (250 + 1,051-20	A <sub>mir</sub> : Minimum area (ha) L: Incoming BOD, load (kg)	arcs for t	- L, / (350 * (1,107 - 0,002T) <sup>T-20</sup> )	Required area (ha) Incoming BOD <sub>s</sub> load (kg)	
	۵ ر	(K)	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Kinimum	Amm 1.	A E :	Required	A L./(	₹	
	Effluent	9 (g) (g) (g)	<u> </u>				nc. 1990)]			
	Effluent BOD total	(mg/l)	± <u>xxxxxxxxxxxxxxxxxxxxxxxxx</u>	erated lagoons		mg/l) 6 - 0.7)	क्ष Eddy, I		, '	
		Come (mg/t)	<u>4 \$800%20 23 255 4465 28 88 88 88 88 29 29 33 86 28 88</u>	•	'RT)	intration (m Ficient (0.6 rate (1/day)	(Metenlf	from cel		
	Effluent	1 (Sa)	<u> </u>	Cell concentration in	X - Y (C,-C)/(1+b,*RT	X: cell concentration (mg/l) Y: yield coefficient (0.6 - 0.7) b; autolysis rate (1/day)	k <sub>20</sub> = 0.07 (M	Effluent solid BOD, fr	X**\$6	
	Уовите	Ē		Cell conc	ک <u>۲</u> (۲	ž ž ž		EMuent	BOD, - 0.95"X	
	BOD load BOD conc.	(mg/l)	25.50 25.50				<u>چ</u>			
	BOD lead	(kg/d)			i.,.		tant (1/da			
	Average daily flow	(§	2000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			£ £	rate consi			
	Served		2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4	suoo		ration (m <sub>2</sub> ration (m <sub>2</sub>	s, removal	,	(Q) sur	?
	Service	Ê	\$ - 5 4 4 2 2 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	rated lag		S, concent S, concent P (day)	order BOE tealt & Ea	35(1-20)	temperati	:
	Total S population		88 88 775 88 87 775 88 88 777 88 88 777 88 88 777 88 88 777 88 88	BOD removal by nerated lagoons	+k*RT)	C. effluent BODs concentration (mg/l) C; influent BODs concentration (mg/l) RT: retention time (day)	k; overall first-order BOD, removal rate constant (1/day)	k, = k <sub>20</sub> x 1.085 <sup>(1-20)</sup>	T: lagoon water temperature (°C)	
	Year Pop		1998 1998 1998 1998 1998 1998 1998 1998	OD remo	C/C, = 1/(1+k*RT)	C.C. C. E. F.	, ove		T: lags	
_		· ·	V-114		J	. *				

Table V.2.55 SS projection for the proposed plan (Aerated lagoons + Sedimentation ponds + Facultative lagoons + Constructed wetlands)

Embert   Required   School						Influent	ľ	Aeruted lagoons	ons			Water temp.=	10.7	Sedimentation ponds	spuod uor				
The population   100   200		Total	Service	Served	Average	;	1		Effluent non-		Effluent	Effluent non-		┡	30		3	Sindge	Proposed
12,   12,   12,   12,   12,   12,   12,   12,   12,   12,	ខ្ម	population	ratio	population	daily flow	SS load	SS conc.	Ě	biodegradable SS (40 % mf.)		SS total	biodegradable SS load					accumulated per year	(40%solid)	volume
1.00   1.00			(%)		(1/s)	(kg/d)	(mg/l)		(mg/l)		(mg/l)	(kg/d)	(kg/d)	(m)		(kg/d)	æ	(,EE)	(m)
Conference   Con	န်	100,802	39.0		64.3	3,184		32,928	229				:				164	1,228	
## 5.00   1.50	9 5	103,656	4.0		08.7	3,470	•	32.628	200									1 4	
4.65   84.55   84.55   4.390   65.5   22.59   25.6   16.5   4.15   1.355   2.518   7.56   100   2.359   7.57   1.350   2.58   1.375   2.518		108 457	46.2		77.2	4 0 0 0	:	32 028	243									1,575	
\$10, \$1.00   \$	2	111,518	48.6	-	81.7			32,928	249			-	•	•		2,213		1 707	
\$25, \$2,220	0	114,579	51.0	* .	86.3	4		32,928	254	-	•	-		:		2,399		1.843	
8.23		117,641	53.4	•	91.5	'n	\$	32,928	258		•	7				2.587		1,983	
Contentration (mg/l)		120,703	55.8	i iv	7.96	'n	653	32,928	761				• •		, .	2,781		2,128	
6.5   88.550   105.3   6.503   702   22.528   22.81   183   4.65   2.581   4.450   10.535   10.00   2.579     7.5		123,764	282		8,00		0/9	32,928	7.08							3 200		2.436	
655 (8.959 C) 11.05 (7.407) (1.25 C) 12.05 (1.25 C)	e vo	129.888	63.0		109,3	: "		32,928	281	·.		:		. • .		3,432		2,597	
75.0 103.12 12.6 7.470 709 32.223 224 122 446 3.148 4.000 10.532 12.8 1.200 10.3 1.200 1		132,951	65.4	86.950	115.5			32,928	282	 	٠.		٠.		-	3,643		2.759	·
7.05 (1970) (1871) (187		136,013	67.8	92.217	121.9			32,928	282									2,924	•••
7.57 (1828) 1450 (1870) 1450 (	× q	134,076	3 C	103 192	136.1	1	÷	32,928	282				100					3.266	
7.57   112,185   149.0   9.536   703   22.928   232   175   445   456   13,12   100   4,518   1,457   3,441   1,457		145,201	75.0	108,901	143.9		1, 1, 1,	32,928	282		1 <sup>7</sup> 2 1		:					3,441	14,522
12.22   15.52   15.50   15.5	(	148,262	75.7	112,185	149.0	N 2 3	1 17	32,928	282							ř.		3,5	14,522
12.22   15.25   15.2		154.385	77.0	118 877	593		٠.	32,928	382	-			i.					3,743	14,522
773   122.73   1700   1700   151.44   659   32.928   277   151.45   100   51.005   1.57   51.045   5		157,447	7.77	122,284	164,6			32,928	279						_	- 3	<b>P</b> ~ 1	3,845	14,522
122.546   185.66		160,508	78.3	125,73	70.0	.,	6 8 8 8	32,928	777									3,948	14,522
8.0.5 138.545 168.8 10.982 684 4.5922 274 176 4.46 4.502 1738 17.39 17.38 17.38 17.39 17.38 17.38 17.38 17.39 17.38 17.39 17.38 17.39 17.38 17.39 17.38 17.39 17.39 17.38 17.39 17.3		166,020	79.7	132,262	180,6	2.	989	32,928	233		4			_		8,38		4,142	14,522
81.7 12.334 1974 11.559 678 49.392 267 17.4 4.50 7.592 17.4 4.50 7.5 4.5 4.5 4.5 4.5 4.5 4.5 4.4 4.5 4.5 4		168,775	80.3	135,583	85.8			49 392	27.5		\$ 45 \$ 5					5.608		8 2 4 4	19,362
823 14226 2078 17766 677 49.372 266 167 433 277 1758 100 5.594 1.831 4.577 1758 1882 100 6.042 1.866 4.578 1882 1.206 6.669 49.372 267 169 4.892 18.81 18.82 1.00 6.042 1.866 4.532 267 169 4.392 267 169 4.892 1.882 1.00 6.042 1.90 6.249 1.90 6		174.287	81.7	142,334	107.4			49.392	270		443		ě.			5.843		4,489	19,362
S3.70   15.72.01   2.0.01	1.1	176,430	82.3	145.261	202.5		672	49,392	269		94					5,942		4,577	19,362
Second   S		178,574	83.0	148,216	207.8		8 3	767.64	9 %	6	754					0,042		4,000	100.01
serated lagoons  Cell concentration (effluent biosolid) in aerated lagoons  Sedimentation ponds operation (1 day retention time)  X = Y (C,-C)/(1+b,*RT)  X = Y (C,-C)/(1+b,*R	- 1.	182,861	\$ 2	184,212	218.6	17.	<u>\$</u>	49,392	38.	<u>8</u>	430	4,996			<del></del>	6.240		4,843	19,362
serated lagoons  Cell concentration (effluent biosolid) in acrated lagoons  X = Y (C <sub>1</sub> -C)/(1+b <sub>1</sub> *RT)  D <sub>2</sub> concentration (mg/l)  X: cell concentration (mg/l)  Y: yield coefficient (0.6 - 0.7)  To (day)  S <sub>2</sub> autolysis rate (1/day)  A <sub>20</sub> = 0.07 (Metcalf & Eddy, Inc., 1990)  Acrealf & Eddy, Inc., 1990)  R <sub>4</sub> = k <sub>20</sub> x 1.085 (T-20)  A <sub>20</sub> x 1.085 (T-20)  To temperature (°C)  A <sub>20</sub> x 1.085 (T-20)  A <sub>21</sub> x 1.085 (T-20)  A <sub>22</sub> x 1.085 (T-20)  A <sub>32</sub> x 1.085 (T-20)  A <sub>40</sub> x 1.085 (T-20)  A <sub>40</sub> x 1.085 (T-20)	⊣	185,004	85.0	157,253	224.1	12,738	658	49,392	263	<u>3</u>	427	5,095	8.27.		8	6,339	1,973	4,933	19,362
Y = Y (C <sub>1</sub> -C)/(1+b <sub>1</sub> *RT)  2 D <sub>2</sub> concentration (mg/l)  X: cell concentration (mg/l)  Y: yield coefficient (0.6 - 0.7)  Ne (day)  b <sub>1</sub> : autolysis rate (1/day)  k <sub>20</sub> = 0.07 (Metcalf & Eddy, Inc., 1990)  k <sub>1</sub> = k <sub>20</sub> x 1.085 <sup>(7-20)</sup> 085 <sup>(7-20)</sup> 40% of SS is non-biodegradable and carried over to sedimentation pone	ĭ	emoval by	aerated la	goons			Cell conce	ntration	(effluent bic	solid) in	aerated 12	rgoons		Sediment	tation pond	ls operation	on (I day re	tention tim	-2. 1 •
entration (mg/l)  X: cell concentration (mg/l)  Y: yield coefficient (0.6 - 0.7)  Y: yield coefficient (0.6 - 0.7)  b; autolysis rate (1/day)  k <sub>20</sub> = 0.07 (Metcalf & Eddy, Inc., 1990)  Eddy, Inc., 1990)  k <sub>1</sub> = k <sub>20</sub> x 1.085 <sup>(T-20)</sup> rature (°C)  40% of SS is non-biodegradable and carried over to sedimentation pone	B	1/(1+k*RT)					X = Y (C.		RT)					Year 20	10 - 2017:	s in Suite			
centration (mg/l)  Y: yield coefficient (0.6 - 0.7)  Year 2018 - 2025:  Year 2018 - 2025:  Year 2018 - 2025:  Sedimentation ponds with 9,681m³  ODs removal rate constant (1/day)  k <sub>1</sub> = k <sub>20</sub> × 1.085 <sup>(7-20)</sup> Eddy, Inc., 1990)  75% of accumulated biosolid de rature (°C)  40% of SS is non-biodegradable and carried over to sedimentation ponds														2 sedimen	ntation pond	ds with 9,¢	581m³ capac	ity each are	proposed
r: yield cocunicien (0.0 - 0.7)  b; autolysis rate (1/day)  COD5 removal rate constant (1/day)  k;= k;0 x 1.085 (7:20)  T5% of accumulated biosolid de rate (0.0)  75% of accumulated biosolid de rate (0.0)	8	effluent BO	D, concer	ntration (m	g/l)		ž ×	concernation of	ntration (mg	€ €				(operation	n cycle: 1 y	car operat	ion - 6 mont	h rest(sludg	c drying))
Sedimentation ponds with 9,681m <sup>3</sup> ODs removal rate constant (1/day)  k <sub>20</sub> = 0.07 (Metcalf & Eddy, Inc., 1990)  Eddy, Inc., 1990)  75% of accumulated biosolid de rature (°C)  40% of SS is non-biodegradable and carried over to sedimentation ponds	-	influent BC	C conce	m) nontant	g/1)			אכום כסכבו	netent (0.6 -	( )				rear 70	.c707 - 91				
k, = k <sub>20</sub> x 1.085 <sup>(7-20)</sup> 75% of accumulated biosolic 40% of SS is non-biodegradable and carried over to sedimentation ponds	i j	retention tir overall first	me (day) -order BO	D, removal	rate const	ant (1/day	<u>خ</u>	autolysis r $c_{20} = 0.07$	ate (1/day) (Metcalf & 1	Eddy, Inc.	. 1990)			3 sedimer (operation	ntation pone	ds with 9,( ear operati	581m² capac ion - 6 mont	iry each are h rest(sludg	proposed e drying))
(°C) 40% of SS is non-biodegradable and carried over to sedimentation ponds		$k_{20} = 2.5 \text{ (N)}$	1etcalf & 1	3ddy, Inc.,	(0661			$\varsigma = k_{20} \times 1$	.085(T-20)										
(°C) 40% of SS		$k_t = k_{20} \times 1.$	085(1-20)											75%	of accumu	lated bios	olid degrade	d within on	e year
	Ë	lagoon wate	er tempera	(၂) (၂)			40%		n-biodegrad	lable and c	carried ov.	er to sedimer	ntation p	spuo			,		

Table V.2.56 T-N projection for the proposed plan (Aerated lagoons + Sedimentation ponds + Facultative lagoons + Constructed wedands)

Served daily flow Table         Average daily flow Table           20         39,313         64,3         64,3         68,2         68,3 <th></th> <th></th> <th></th> <th></th> <th></th> <th>Influent</th> <th>F</th> <th>acultative</th> <th>Facultative lagoons (45% T-N removal)</th> <th>% T-N remo</th> <th></th> <th>Constructed wetland</th> <th>wetland</th> <th></th> <th></th> <th>Temp.("C)= 10</th> <th>10</th>						Influent	F	acultative	Facultative lagoons (45% T-N removal)	% T-N remo		Constructed wetland	wetland			Temp.("C)= 10	10
This contribution   This population   This pop	:	Total	Service	Served	Average		т —		Retention	Effluent	Effluent		Flow	Retention	Background	EtHuent	Effluent
100.557   100.577   100.	13	population	ogr.	population	datiy 110w	DROI VY	Duon N-T		_	T-N conc.	-	ž č	velocity	time	T-N	T-N conc.	T-N load
10,056.5			8		(s/1)	(kg/d)	(mg/J)	·	ay)	(L/#m)		(ha)	(p/w)	(day)			(kg/d)
10,00,550   4.13   4.0,5914   5.65   5.77   5.11   5.12   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.14   5.25   5.15   5.14   5.25   5.15   5.14   5.25   5.15   5.14   5.25   5.15   5.14   5.25   5.15	5661	100,802	39.0	39,313	64.3	432	77.9	21.5	58.2	42.8		17.2	0.032	6.4			\$
106.55  4.6.85	9661	103.656	4.4	42.914	68.2	472	80.1	21.5	\$4.8	6,4	•	17.2	0.034	6.0			78
108,457   4.6   5.0   1.7   1.2   2.5   1.5	1001	106.591	43.8	46.687	72.3	514	82.3	21.5	51.7	45.2	282	17.2	0.036	5.6	_		<del></del>
11.575   54,198   5	800	108 457	46.2	50.107	77.2	551	82.7	2.5	48,4	45.5	303	17.2	0.039	5.3			101
14,579   55.4   6.220   91.5   644   86.2   215   45.3   47.4   354   17.2   0.045   4.7   1.50   17.6   1.50   1.7   1.50   1.7   1.50   1.5	000	111 518	48.4	\$4 108	2 2	ý	24	21.5	45.8	46.5	328	17.2	0.041	5.0	1.50		115
17, 241   55,4 62,820   91,5 691   97,4   18,7   21,5 40,9 4,8   380   722   0,046   4,5   1,50   1,8   1,50   1,5   1	2000	114 579	510	58.435	863	553	86.2	21.5	43,3	47.4	354	17.2	0.043	47	1.50		131
120,703         55.8         67,352         96,7         741         88,7         21,5         48,8         407         172         0.049         42         150         20.1           128,774         60.6         78,83         67,352         96,7         741         88,7         21,5         55.6         51,2         465         172         0.051         40         150         22,3           126,888         65.0         67,8         78,2         10,9         96,9         21,5         35,4         52,4         465         172         0.053         37         150         22,8           126,888         65.0         10,9         96,9         21,5         32,4         52,7         50         172         0.053         37         150         22,8           130,90         67,8         96,9         21,5         30,7         52,0         172         0.065         37         150         22,3           150,00         10,0         96,3         21,5         30,7         52,0         172         0.065         37         150         22,1           150,00         10,0         96,3         21,5         22,1         22,1         172 <t< td=""><td>2001</td><td>17.64</td><td>53.4</td><td>62.820</td><td>918</td><td>169</td><td>87.4</td><td>21.5</td><td>40.9</td><td>48.1</td><td>380</td><td>17.2</td><td>0.046</td><td>4.5</td><td>1.50</td><td></td><td>149</td></t<>	2001	17.64	53.4	62.820	918	169	87.4	21.5	40.9	48.1	380	17.2	0.046	4.5	1.50		149
123.754         58.2         72.031         100.8         772         91.0         21.5         37.1         50.0         436         172         0.051         4.0         130         22.3           125.886         63.06         76.887         105.0         98.4         99.2         21.5         32.4         466         17.2         0.053         3.9         1.50         22.5           125.888         63.0         115.5         96.6         95.3         21.5         32.4         466         17.2         0.053         3.7         1.50         22.5           135.015         70.2         97.631         128.6         10.4         96.7         21.5         22.7         52.0         17.2         0.058         3.7         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50         22.5         1.50	2002	120 703	55.8	67 352	96.7	74	88.7	21.5	38.7	48.8	407	17.2	0.049	4.2	1.50		168
126,826         606         76,887         105         845         93,2         21,5         556         51,2         465         172         0.053         3.9         1.50         22,5           122,938         654,0         86,200         115,2         900         953         21,5         35,4         22,4         32,5         32,4 <t< td=""><td>2003</td><td>23.78</td><td>58.2</td><td>72 031</td><td>100.8</td><td>792</td><td>91.0</td><td>21.5</td><td>37.1</td><td>50.0</td><td>436</td><td>17.2</td><td>0.051</td><td>0,4</td><td>1.50</td><td>:</td><td>185</td></t<>	2003	23.78	58.2	72 031	100.8	792	91.0	21.5	37.1	50.0	436	17.2	0.051	0,4	1.50	:	185
129,888         65.0         81,829         109.3         900         95.3         21.5         34.2         52.4         455         17.2         0.058         3.7         1.50         24.9           152,031         65.4         98.5950         11.5         96.6         95.9         21.5         20.4         55.0         17.2         0.058         3.5         1.50         24.9           150,075         70.2         19.6         10.7         96.3         21.5         20.1         55.0         17.2         0.058         3.5         1.50         26.9         17.2         0.058         3.5         1.50         25.0         17.2         0.058         3.5         1.50         25.0         17.2         0.058         3.5         1.50         25.0         27.1         17.2         0.058         3.5         1.50         25.0         25.0         27.1         17.2         0.058         3.2         1.50         25.0         25.0         27.1         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2         27.2	2004	126,826	9.09	76.857	105.0	845	93.2	21.5	35.6	51.2	465	17.2	0.053	3.9	1.50		202
152.951         65.4         86.950         115.5         956         95.9         21.5         32.4         52.0         172         0.058         3.5         1.50         24.9           139.076         70.2         97.237         121.9         1014         96.3         21.5         20.7         53.0         65.0         17.2         0.058         3.5         1.50         24.9           139.076         70.2         97.631         128.6         1074         96.3         21.5         22.5         53.1         624         17.2         0.058         3.0         15.0         28.1           142.138         72.0         103.90         17.2         0.072         2.8         1.50         28.1           143.2         12.6         21.5         22.5         53.0         659         17.2         0.058         22.8           143.2         12.4         95.5         21.5         22.1         52.7         17.2         0.072         2.8         15.0         28.9           15.1.2         22.1         22.1         22.1         22.1         22.1         22.1         17.2         0.072         2.8         15.0         28.1           15.2.2	2005	129,888	63.0	81.829	109.3	8	95.3	21.5	34.2	52.4	495	17.2	0.055	3.7	8.		224
136,013   67.8 92,217   121.9   1014   96.3   21.5   30.7   55.0   17.2   0.064   3.3   1.50   26.0   13.	2006	132,951	65.4	86,950	115.5	926	6.56	21.5	32.4	52.7	526	17.2	0.058	3.5	.50		249
139,076         70.2         97,631         128.6         1074         96.7         21.5         25.1         53.2         591         172         0.068         3.2         1.50         27.1           142,138         72.6         103,192         135.9         135.9         21.5         22.6         53.0         659         172         0.068         3.2         150         29.0           142,138         143.0         135.9         135.1         134.0         123.4         55.2         21.5         25.1         659         172         0.073         2.8         150         29.0           151,324         16.6         134.0         123.4         95.5         21.5         22.3         740         172         0.007         2.7         150         29.0         150         29.0         150         29.0	2007	136,013	67.8	92,217	121.9	1014	96.3	21.5	30.7	53.0	558	17.2	0.061	3.3	1.50		274
142,138         72,6         103,192         135         96.5         21.5         25.5         53.1         624         172         0.068         3.0         1.50         28.1           145,201         75.0         163,90         17.2         0.072         2.8         1.50         29.0           145,201         75.0         163,90         17.2         0.072         2.8         1.50         29.0           145,201         75.1         162,80         17.2         0.072         2.8         1.50         29.0           145,202         75.1         162,80         17.2         0.075         2.6         150         29.0           151,324         77.0         118,877         120.2         21.5         22.7         52.3         719         17.2         0.083         2.6         150         29.0           157,447         77.7         122,234         164.6         134.5         94.2         21.5         22.0         740         17.2         0.083         2.6         13.0           165,224         17.2         10.8         77.1         17.2         0.083         2.1         15.0         17.2         0.083         2.1         15.0         17.2<	2008	139,076	70,2	97.631	128.6	1074	7.96	21.5	29.1	53.2	591	17.2	0.065	32	 S.		ନ୍ଧି
145.201         75.0         108.901         143.9         1198         96.3         21.5         25.0         659         17.2         0.072         2.8         1.50         29.4           148.202         75.7         115.118         149.0         1234         95.9         21.5         25.1         679         17.2         0.077         2.7         1.50         29.4           154.324         77.0         118.877         122.284         134.6         94.6         21.5         22.3         740         17.2         0.080         2.6         150         29.4           160,508         77.0         118.877         122.284         164.6         134.5         21.5         22.7         740         17.2         0.083         2.6         150         30.3           160,508         77.0         118.877         1419         93.7         21.3         51.8         761         17.2         0.083         2.2         11.6         15.0         30.3         11.4         11.4         11.5         11.5         11.4         11.4         11.5         11.5         11.6         11.5         11.6         11.5         11.6         11.6         11.6         11.6         11.6 <td< td=""><td>5002</td><td>142,138</td><td>72.6</td><td>103,192</td><td>136.1</td><td>1135</td><td>96.5</td><td>21.5</td><td>27.5</td><td>53.1</td><td>624</td><td>17.2</td><td>0.068</td><td>30</td><td></td><td></td><td>330</td></td<>	5002	142,138	72.6	103,192	136.1	1135	96.5	21.5	27.5	53.1	624	17.2	0.068	30			330
143,262         75,7         112,185         149,0         1234         95,9         21.5         25,1         25,1         25,1         25,1         25,1         25,1         25,1         25,2         25,1         25,2         27,2         172         0.077         26         150         29,9           151,324         76,3         115,511         134,1         127         24,3         25,5         21,5         22,3         740         172         0.080         26         150         30.3           154,385         77,7         122,84         77,7         122,84         77,7         122,83         24         150         30.3         31.0         30.3         31.0         30.3         31.0         30.3         31.0         30.3         31.0         30.3         31.0         30.3         31.0         30.3         31.0         30.3         31.0	2010	145,201	75.0	108,901	143.9	1198	8	21.5	26.0	53.0	629	17.2	0.072	12.8	.50		360
151,324         76.3         115,511         154,1         1271         95.5         21.5         24.3         52.5         699         172         0.007         2.6         150         25.9           154,385         770         118,877         154.6         136.9         95.0         21.5         22.7         740         17.2         0.080         2.6         150         30.3           157,447         77.7         78.3         125,731         170.0         133.4         150         30.3         31.4         30.3	2011	148,262	75.7	112,185	149.0	1234	95.9	21.5	25.1	52.7	629	17.2	0.075	2.7	.50	_	379
154,385         77,0         118,877         159,3         1308         95.0         21.5         23.5         719         172         0.080         2.6         150         30.3           157,447         77.7         122,284         164.6         1345         94.6         21.5         22.7         52.0         740         172         0.083         2.5         150         30.7           160,508         79.0         125,731         170.0         1383         94.2         21.5         22.0         51.8         761         17.2         0.088         2.3         13.0         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.7         31.4         30.3         31.4         30.7         31.4         30.2         31.4         30.2         31.4         30.2         31.4         30.2         31.4         30.2         31.4         30.2         31.4         30.2         31.4         30.2	2012	151,324	76.3	115,511	154.1	1271	95.5	215	24.3	52.5	669	17.2	0.077	2.6	1.50		397
157.447         77.7         122.284         164.6         1345         94.6         21.5         22.7         740         172         0.033         2.5         150         30.7           160,508         78.3         125.731         170.0         138.3         94.2         21.5         22.0         51.8         761         17.2         0.088         2.4         150         31.4           160,508         79.1         128.578         175.3         1419         92.7         21.5         22.0         17.2         0.088         2.3         15.0         31.4           166,020         79.7         128.578         185.8         92.2         21.5         20.7         51.3         800         17.2         0.088         2.3         15.0         31.4           166,020         79.7         128.578         197.4         152.8         20.3         21.5         80.0         17.2         0.099         2.1         150         32.2           174,234         197.4         156.6         91.8         21.5         18.5         50.2         87.1         17.2         0.099         2.1         150         32.7           174,330         181.2         15.2         1	2013	154,385	77.0	118.877	159.3	1308	95.0	21 5	23.5	52.3	719	17.2	0.080	2.6	.50		4 7
160,508         78.3         125,731         170.0         1383         94.2         21.5         22.0         51.8         761         172         0.085         2.4         150         31.0           163,264         79.0         128,578         175.3         1419         93.7         21.5         21.3         780         17.2         0.088         2.3         150         31.4           166,020         79.7         12.56         1419         93.7         21.5         20.1         51.3         800         17.2         0.088         2.3         15.0         31.7           166,020         79.7         12.262         185.8         149.1         92.2         20.1         51.1         800         17.2         0.099         2.2         15.0         31.7           16,53         80.1         142,334         197.4         1566         91.8         21.5         18.9         80.5         861         17.2         0.099         2.1         150         32.5           174,230         82.3         148,216         20.7         15.2         18.9         80.5         861         17.2         0.099         2.1         150         32.9           174,30	2014	157,447	77.7	122,284	164.6	1345	946	215	22.7	52.0	740	17.2	0.083	2.5	.50		436
163.264         79.0         128.978         175.3         1419         93.7         21.3         51.5         780         172         0.088         2.3         150         31.4           166,020         79.7         135.262         180.6         1455         93.7         21.5         20.7         51.3         800         17.2         0.088         2.3         15.0         32.0         31.7         32.0         32.2         1.50	2015	160,508	78.3	125,731	170.0	-	\$ 2	21.5	22.0	\$1.8	19/	17.2	0.085	2.4	1.50		456
166,020         79,7         132,262         180,6         1455         93,2         21,5         20,7         51,3         800         172         0,091         2.3         1,50         31,7           168,775         80.3         135,583         185,8         1491         92.9         21,5         20,1         81,7         0,093         2.2         1,50         32.0           171,531         81,0         138,940         197,4         156         91,8         21,5         18,9         80,5         861         17,2         0,099         2.1         150         32.5           174,287         81,7         145,261         20.5         1598         91,8         21,5         18,9         80,1         17,2         0,099         2.1         150         32.7           174,387         83.0         148,216         207,8         1659         90,3         21,5         18,9         89,9         87         17,2         0,102         2.0         150         32.0           182,861         84,2         83.0         182,86         10,02         20,1         150         32.0         150         32.0         150         150         32.0         150         32.0	2016	163,264	79.0	128.978	175.3		93.7	21.5	21.3	51.5	780	17.2	0.088	23	1.50		475
168,775         80.3         135,583         185,8         1491         92.9         21.5         20.1         51.1         820         17.2         0.053         2.2         150         32.0           171,531         81.0         138,940         191.7         152.8         841         17.2         0.096         2.1         1.50         32.2           174,287         81.7         42,334         197.4         1566         91.8         21.5         861         17.2         0.099         2.1         150         32.7           176,430         82.3         148,261         207.8         1630         90.3         21.5         18.0         49.9         879         17.2         0.102         2.0         1.50         32.7           178,574         83.0         148,216         207.8         1630         90.3         21.5         17.5         0.104         2.0         1.5         150         32.9           182,861         84.3         151,20         20.10         1.9         91.5         17.2         0.104         1.9         1.5         1.5         1.5         1.5         1.5         1.5         1.5         1.5         1.5         1.5         1.5	2017	166,020	79.7	132,262	180.6		93.2	21.5		51.3	88	17.2	160.0	23	1.50		494
171,531         81.0         138,940         191.7         1528         92.3         21.5         19.5         50.8         841         17.2         0.096         2.1         1.50         32.2           174,287         81.7         142,334         1974         1566         91.8         21.5         18.9         50.5         861         17.2         0.099         2.1         1.50         32.7           176,430         82.3         148,261         207.8         1630         90.3         21.5         18.9         879         17.2         0.102         2.0         1.50         32.7           178,574         83.0         148,216         207.8         1630         90.3         21.5         17.5         91.9         17.2         0.104         2.0         1.50         33.0           180,717         83.7         151,20         21.6         16.7         49.4         933         17.2         0.104         1.9         1.50         33.2           182,004         84.3         154,212         224.1         1730         89.3         17.1         49.1         951         17.2         0.110         1.9         1.50         33.3           185,004         85	2018	168,775	80.3	135,583	8.581	-	92.9	21.5	20.1	51.1	820	17.2	0.093	2.2	1,50		513
174,287         81,7         142,334         197,4         1566         91.8         21,5         18,9         50,5         861         17,2         0.099         2.1         150         32.5           176,430         82.3         145,261         200.5         158         91.3         21.5         18.5         50.2         879         17.2         0.102         2.0         1.50         32.7           178,574         83.0         148,216         207.8         1630         90.8         21.5         17.5         49.7         915         17.2         0.104         1.9         150         32.9           182,617         84.3         154,212         218.1         1656         89.3         21.5         17.1         49.1         931         17.2         0.110         1.9         150         33.2           185,004         85.0         157,253         224.1         1730         89.3         21.5         16.7         49.1         951         17.2         0.110         1.9         150         33.3	2019	171,531	0.18	138,940	191.7	•	92.3	21.5	19.5	50.8	841	17.2	0.096		.50		534
176,430         82.3         145,261         202.5         1598         91.3         21.5         18.5         50.2         879         17.2         0.102         2.0         1.50         32.7           178,574         83.0         148,216         207.8         1630         90.8         21.5         18.0         49.9         897         17.2         0.104         2.0         1.50         32.9           180,717         83.7         151,20         213.1         1666         89.3         21.5         17.1         49.7         933         17.2         0.107         1.9         1.50         33.2           185,004         85.0         157,253         224.1         1730         89.3         21.5         16.7         49.1         951         17.2         0.113         1.8         1.50         33.3	2020	174,287	81.7	142,334	197.4	_	91.8	21.5	18.9	50.5	198	17.2	0.00	7.	1.50		554
178,574         83.0         148,216         207.8         1630         90.8         21.5         18.0         49.9         897         17.2         0.104         2.0         1.50         32.9           180,717         83.7         151,200         213.1         1663         90.3         21.5         17.5         915         17.2         0.107         1.9         1.50         33.0           182,861         84.3         154,212         218.6         169.8         89.8         21.5         17.1         49.4         933         17.2         0.110         1.9         1.50         33.2           185,004         85.0         157,253         224.1         1730         89.3         21.5         16.7         49.1         951         17.2         0.113         1.8         1.50         33.3	202	176,430	82.3	145,261	202.5		91.3	21.5	18,5	50.2	879	17.2	0.102	20	.50		572
180,717     83.7     151,200     213.1     1663     90.3     21.5     17.5     49.7     915     17.2     0.107     1.9     1.50     33.0       182,861     84.3     154,212     218.6     169.8     89.8     21.5     17.1     49.4     933     17.2     0.110     1.9     1.50     33.2       185,004     85.0     157,253     224.1     1730     89.3     21.5     16.7     49.1     951     17.2     0.113     1.8     1.50     33.3	2022	178,574	83.0	148,216	207.8	_	8.06	21.5	18,0	6.64	897	17.2	0.0	20	8	32.9	290
182,861 84.3 154,212 218.6 1696 89.8 21.5 17.1 49.4 933 17.2 0.110 1.9 1.50 33.2 185,004 85.0 157,253 224.1 1730 89.3 21.5 1.6.7 49.1 951 17.2 0.113 1.8 1.50 33.3	- 2023	180,717	83.7	151,200	213.1	-	8	21.5	17.5	49.7	915	17.2	0.107	6	1.50	33.0	809
185,004 85.0 157,253 224.1 1730 89.3 21.5 16.7 49.1 951 17.2 0.113 1.8 1.50 33.3	2024	182,861	84.3	154,212	218.6		8 68	21.5	17.1	40.4	933	17.2	0.110	9.	05.1	33.2	627
	2025	185,004	85.0	157,253	224.1		89.3	21.5	16.7	49.1	951	17.2	0.113	1.8	1.50	33.3	245

T-N removal by constructed wetlands (Subsurface flow)

 $C = C_b + (C_i - C_b)e^{(4k/q)}$ 

C: effluent T-N concentration (mg/l)
C; influent T-N concentration (mg/l)
C<sub>6</sub>: background T-N concentration (1.5 mg/l)

k; areal rate constant at t°C  $(k_{20}=27 \text{ m/year})$   $k_1=k_{20} \times 1.05^{(T-20)}$ 

q: hydraulic loading (m/day)

Table V.2.57 T-P projection for the proposed plan (Aerated lagoons + Sedimentation ponds + Facultative lagoons + Constructed wetlands)

		_	_	Influent	34	acultative	Facultative lagoons (40% T-P removal)	6 T-P remov	(IR		Construct	Constructed wetland				
Total	_	Served	Average		-		Retention	Effluent	Effluent	T-P removal		Flow	Retention	Backgroun	Effluent	Effluent
population	ation ratio		daily flow	T-P load	T-P conc.	Arg	time	T-P conc.	T-P load	(Acr.+Fac.)	A D	velocity	time	d T-P conc.	T-P conc.	T-P load
	3		(I/s)	(kg/d)	(mg/l)	(Page	(day)	(mg/l)	(Jeg/d)	(%)	(ha)	(m/d)	(day)	(LXu)	(mg/l)	(kg/d)
8	3 3	9,0 39,313	543	65	6'8	21.5	58.2	5.3	55	07	17.	2 0.032		0.02	ġ.	
103		1,4 42,914	68.2	54	9.1	21.5	\$4.8	5.5	32	3	7	2 0.034	•	0.02	[1	걸
8	-1 -1 -1	43.8 46.687	72.3	58	9.3	21.5	51.7	56	35	9	12	2 0.036	v,	0.02	2.3	4.
108	:		77.2	63	9.4	21.5	48.4	5,6	38	40	17	2 0.039	5.3	0.02	2,4	16
		48 6 54 198	81.7	89	9.6	21.5	45.8	5.8	41	3	17.	0.041	5.0	0.02	. 2.6	18
7			863	3	86	21.5	43.3	5.9	4	40	17.	2 0.043	4.7	0.02	6.1 00	21
113	•		918	70	66	21.5	40.9	0.9	47	4	17.	0.046	4.5	0.02	2.9	53
22		55.8 67.352	7.96	\$	1.01	21.5	38.7	0.9	51	9	17.	2 0.049	4	0.02	3.1	ጸ
123			100.8	8	10.3	21.5	37.1	6.2	4	\$	.7.	0.051	4.0	0.02	3.3	28
122		0,6 76,857	105.0	8	10.6	21.5	35.6	9.9	58	3		2 0.053	3.9	0.02	3.4	31
129			109.3	102	10.8	21.5	34.2	6.5	19	3	-2	2 0.055	3.7	0.02	3.6	X
55			115.5	601	10.9	21.5	32.4	6.5	65	3	7	2 0 0 5 8	3.5	0 00	3.7	37
136		_:_	121,9	115	10.9	215	30.7	9'9	69	40		2 0 0 6 1	33	0.02	3.8	4
139		70.2 97,631	128.6	122	0   -	21.5	29.1	9.9	5	4	<u>-</u>	2 0 065	3.2	0.05	4.0	2
142			136.1	129	11.0	215	27.5	99	77	4	. 17	2 0.068	3.0	0.02	4.1	48
145	• • • • • • • • • • • • • • • • • • • •	75.0 108,901	143.9	136	10.9	21.5	26.0	9.9	82	4	7.	2 0.072		0.02	4. Si	S,
148		٠.:	149.0	140	10.9	21.5	ห	6.5	\$	<del>4</del>		2 0.075	2.7	0.02	4.2	<b>2</b>
151	-		154.1	4	10.8	21.5	24.3	6.5	87	\$	<u>.</u>	2 0.077	12.0	0.02	4.3	57
154		77.0 118,877	159.3	149	8.01	21,5	23.5	6.5	<b>&amp;</b>	64		0.080	1.0	0.05	4.3	SS:
157			8	153	10.7	21.5	22.7	6.4	22	4		0.083	2.5	0.05	4.3	62
8			0.07	157	10.7	21.5	8	4.0	8	9		2 0.085	- 24	0 02	4.4	8
3			75.3	161	10.6	21.5	213	4.0	44	<del>4</del>	7	0.088		0.02	44	67
38		= .	180.6	165	901	21.5	20 7	6.4	\$	04	.7.	0.091	23	0.02	4	69
168		_	8 5 8	169	10.6	21.5	8	63	102	4	.7.	2 0.093	55	0.02	4.5	72
171			191.7	174	10.5	215	19.5	6.3	104	40	-2	2 0.096		0.02	4.5	74
174		81.7 142,334	4 76	178	10.4	21.5	18.9	6.3	107	3	. 17	0.099		0.02	4.5	7
176	176,430 8	82,3 145,261	202.5	182	10.4	21.5	18.5	6.2	8	4		0.102	- 50	0.02	4.5	2
178	-		207.8	185	10.3	21.5	18.0	6,2		4		0.104	20	0.02	2.4	∞
180	80,717	83.7 151,200	213.1	189	10.3	21.5	17.5	6.2	113	<del>3</del>		2 0.107	-	0.02	2.5	35
182		1	218.6	193	10.2	215	17.1	6.1	1.6	4	. 1	0110		0.02	4.5	8
185		85.0	224	197	10.2	21.5	16.7	6.1	118	04	17.	2 0.113	8	000	4.6	88

T-P removal by constructed wetlands (Subsurface flow)

\*T-P concentration will be further reduced to 3 mg/l at the outlet of the constructed wetlands with coagulant addition from 2010 \*Coagulant can be added at outlet of acrated lagoons

 $C = C_b + (C_1 - C_b)e^{(+b/q)}$ 

C: effluent T-P concentration (mg/l)
C; influent T-P concentration (mg/l)
C<sub>b</sub>: background T-P concentration (0.02 mg/l)

 $k_i$ , areal rate constant at t °C ( $k_{20}$ = 12 m/year)  $k_i$ =  $k_{20}$  × 1.0<sup>(T-20)</sup>

T: Temperature (°C) q: hydraulic loading (m/day)

#### Alternative for constructed wetland

Use of the existing natural wetland for the treatment of facultative lagoon is evaluated. Recommended minimum pretreatment levels to natural wetland discharge are shown in *Table V.2.58*. Those levels are much lower than the expected nutrient level of the facultative lagoon effluent. At least, solid removal facilities such as rock filters are required before discharge to the natural wetland as large amount of algae is expected in the facultative lagoon effluent. This option is not included in the proposed plan since further study of totora culture and careful examination of flow in the wetland are required for the use of natural wetland.

Table V.2.58 Recommended minimum wastewater pretreatment levels prior to natural wetland discharge

Constituent	Suggested Pretreatment Level	Potential Harmful Effect
BOD <sub>5</sub>	Minimum of secondary (20-30 mg/L)	Oxygen depletion; odor; mosquito production
TSS (11) (11) (1	Minimum of secondary (30-50 mg/L); mineral solids should be reduced to < 10 mg/L	Oxygen depletion; smothering of plant roots and elimination of woody plant species
NH <sub>4</sub> ·N	Nitrification is highly desirable; maximum of 5 mg/L	Oxygen depletion; un-ionized ammonia toxicity
Total N	Less than 20 mg/L	Eutrophication; selection of fast growing species
Total P	Less than 1.0 mg/L	Eutrophication; selection of fast growing species
TDS	Site specific; dependent on available natural wetland type	Toxic to unadapted plant and animal species
Metals and other toxins	Below chronic toxicity levels	Accumulation to toxic concen- trations; food chain biomag-
		nification for a few constituents

<sup>\*</sup> Source: Kadlee and Knight, 1995

# Treated water irrigation for the inner bay area

The relatively large amount of Nitrogen (T-N) will be discharged to the inner bay. Further Nitrogen removal is difficult with the proposed treatment system. Biological Nitrogen removal is possible with the treatment system like Alternative III. Nitrogen level may decrease when treated water is used for agricultural and forest irrigation. Treated water reuse for the outside of catchment area required a large capital investment, such as Alternative II, irrigation for the inner Puno bay can be considered.

# c) Proposed wastewater treatment plant

Schematic of the proposed wastewater treatment plant is shown in Figure V.2.20a.

Layout for the proposed wastewater treatment plant is shown in Figure V.2.20b.

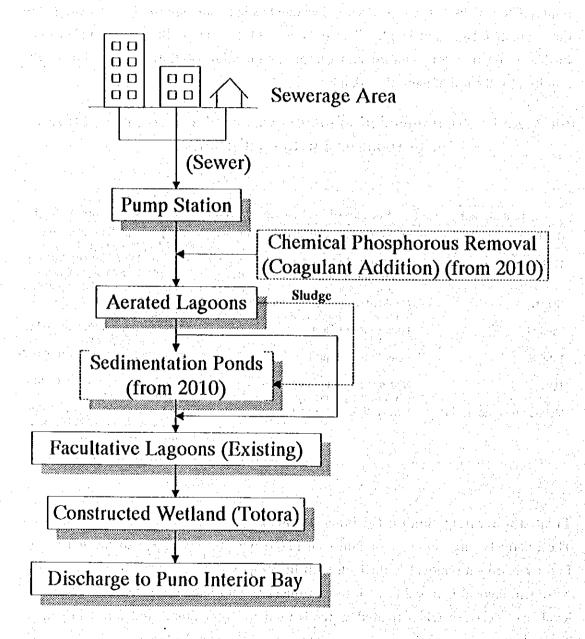
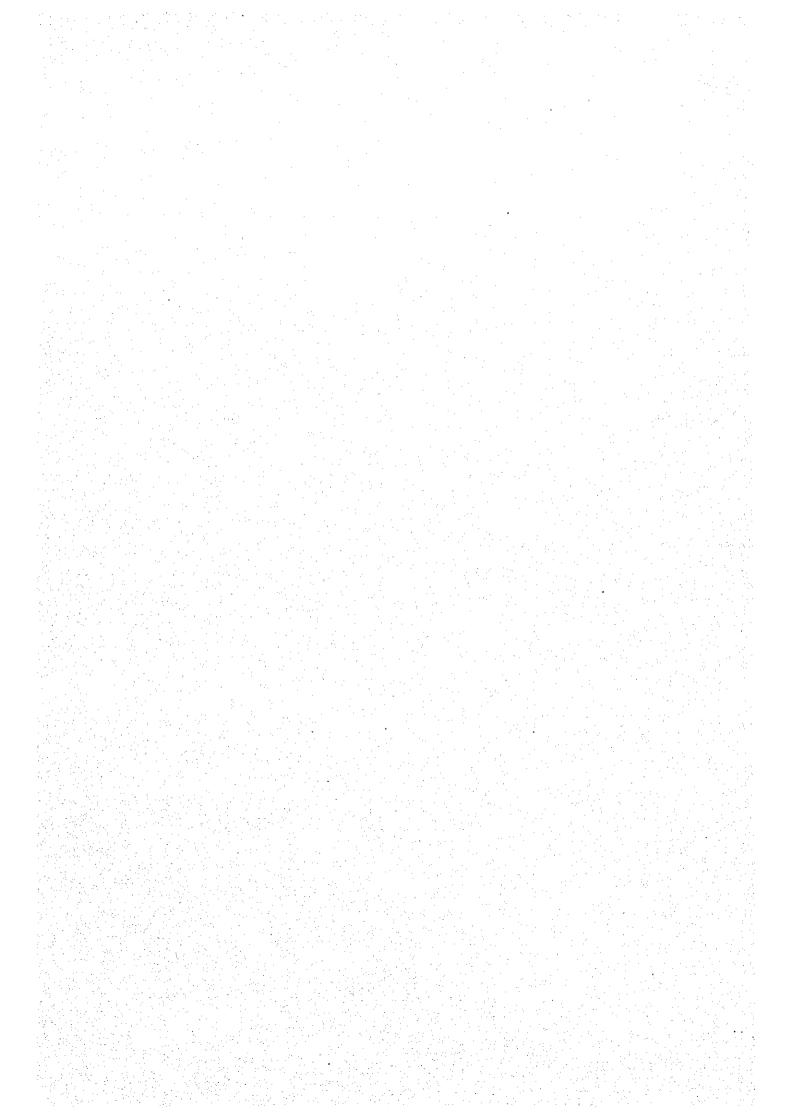
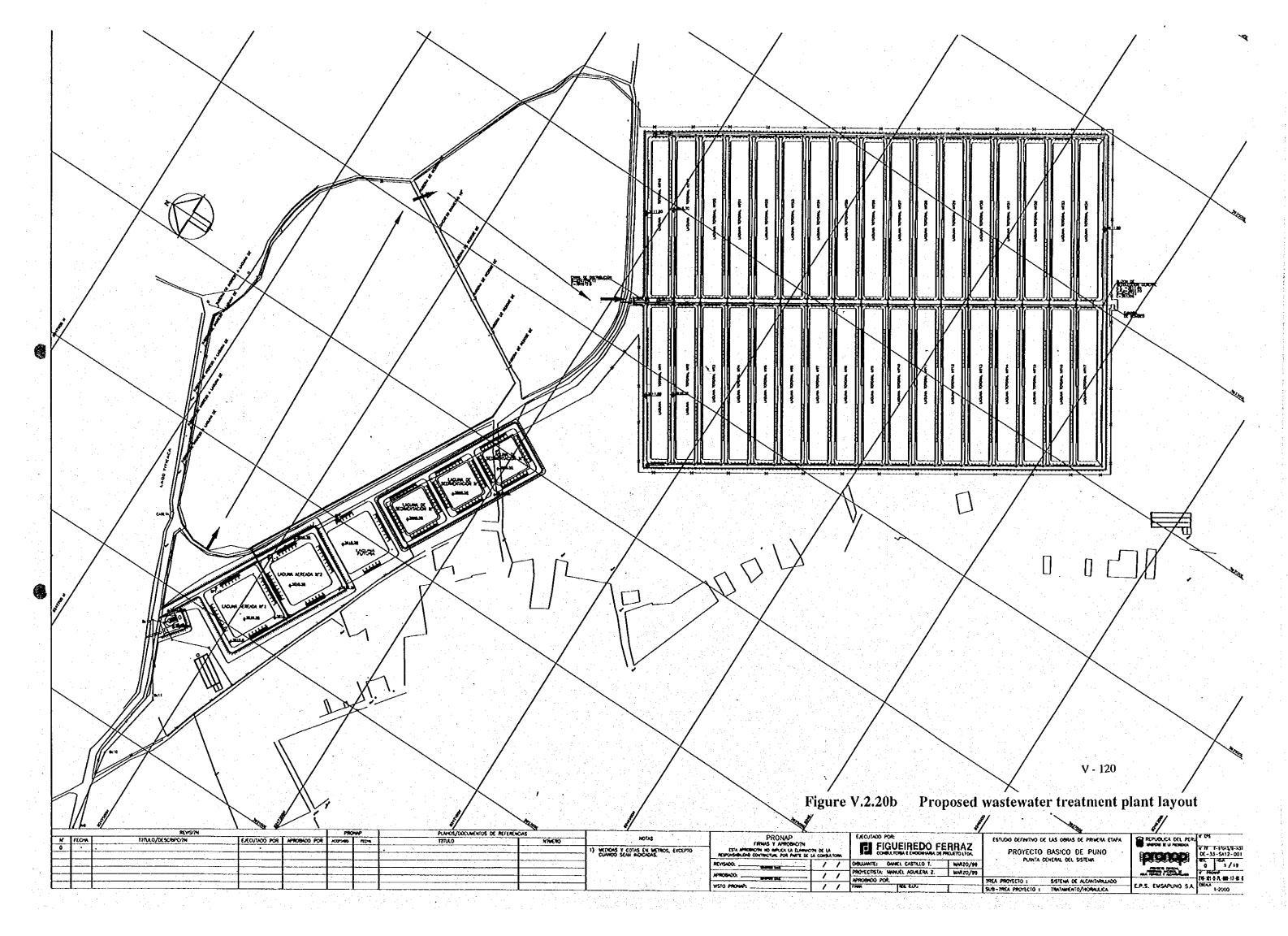
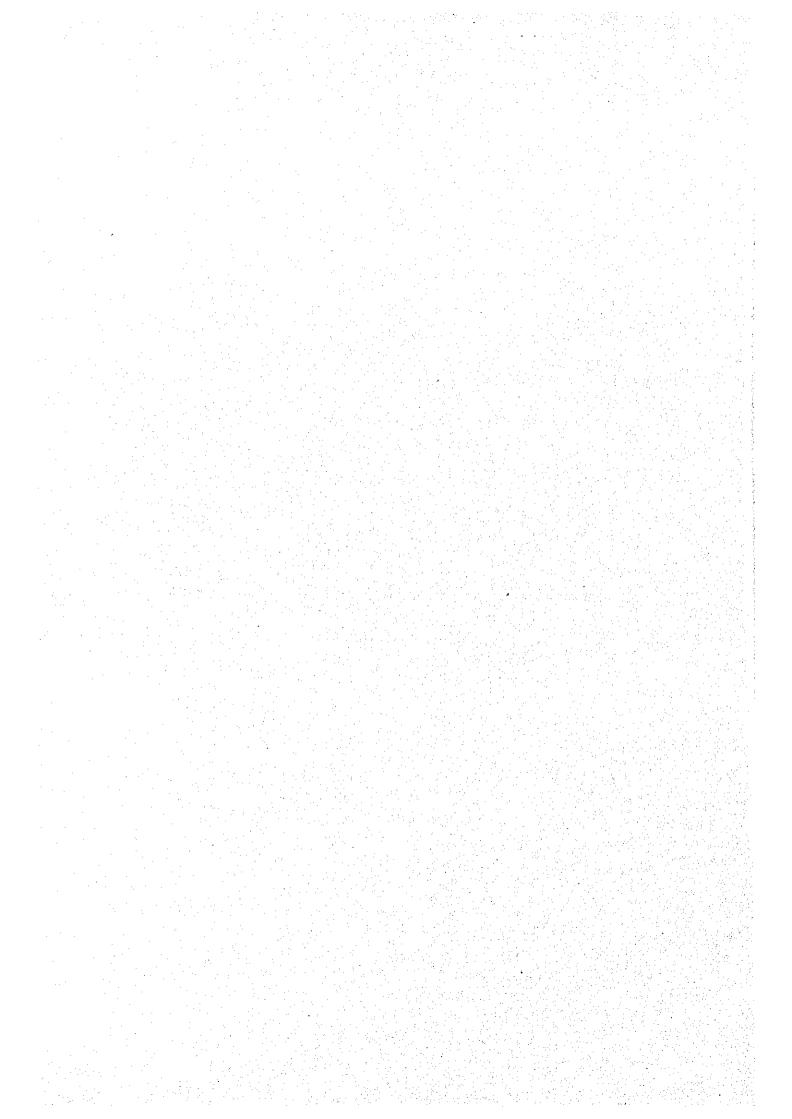


Figure V.2.20a Schematic of proposed wastewater treatment process







# d) Specifications for wastewater treatment facilities

Specifications for major wastewater treatment facilities are as follows:

Table V.2.59 Specifications of proposed wastewater treatment plant

Facilities	Specifications
1.Pump Station	
EB Puno	Submersible Pump, 200 l/s, 8.6 m, 30 kW, 2 sets(+1)
2. Aerated Lagoon	3 basins
Туре	Rectangular Type
Dimension	64.0 m W × 80.0 m L × 4.0 m D
Aeration Power Level	22.35 kW (4 per Basin)
Retention Time	2.43 days
3. Existing Primary Lagoon	1 basins
Туре	Facultative lagoon
Area	13.4 ha
Depth Average	1.5 m - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 -
Volume	204,600 m3
4. Existing Secondary Lagoon	1 basins
Туре	Facultative lagoon
Area	7.9 ha
Depth Average	1.5 m
Volume	118,350 m3
5. Constructed Wetland	34 basins
Туре	Sub-surface flow
Dimension	23.0 m W × 203.0 m L
Depth Average	0.3 - 0.5 m
6. Sedimentation ponds	3 basins
Туре	Rectangular Type
Dimension	63.0 m W × 63.0 m L x 4.0 m D
Retention Time	2 days in year 2025

#### 2.4.2 Non-structural measures

# (1) Institutional and operative capacity strengthening of EMSAPUNO

The on-going "Program MIO" of EMSAPUNO, scheduled to complete in year 2001, shall be further extended towards the future to effectively implement the proposed Master Plan. In addition to the above program, staff training program shall be established to provide the existing and future staff to upgrade their knowledge and skills for organization management, operation & maintenance of the facilities.

#### Training program may include:

- on the job training at various facilities by experienced personnel of EMSAPUNO or other organizations
- training at other water companies, such as SEDAPAL for familiarizing with new management practices and technologies.

Requirement of operation and maintenance staff will be discussed in Section 2.7.

# (2) Sanitation promotion

In order to achieve improvement of public health, sanitation promotion among the residents of Puno City is essential. Possible strategies of sanitation promotion are as follows:

- Community management: Community members played a key role in managing the project.
- Involvement of women: The active participation of women in each stage of the project was ensured.
- Latrine construction: Household latrines were constructed by family or community personnel.
- Community contribution towards investment costs: This facilitated local ownership of the program although the program may need state subsidies.
- Hygiene and sanitation education and training: This key activity ensured the
  effective and sustained use of services. Training materials, such as Figure
  V.2.21, shall be developed for teachers and health workers.

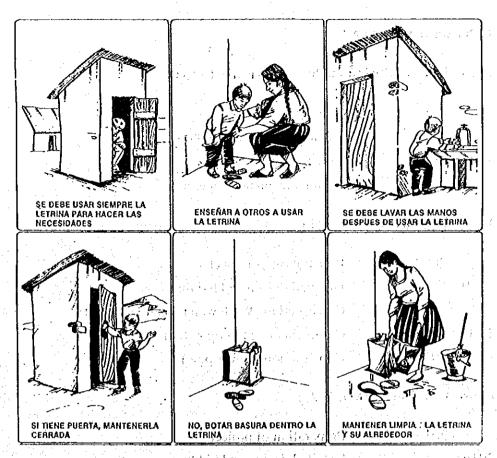


Figure V.2.21 Rules for correctly using a latrine – Reglas para buen uso de letrinas

Source: WHO (1998)

# (3) Control of sewerage system use

Sewerage systems are often damaged through public misuse. This results from a public misconception that a sewerage system can be used to carry away any unwanted object. Adequate regulations setting forth proper uses of the system and public cooperation are required to properly maintain and control the sewerage system.

## Regulations shall prohibit:

- discharge of explosive or flammable substances into the sanitary sewer
- discharge of corrosive or abrasive wastes
- roof drain connections to the sanitary sewer

Appropriate regulations shall be adopted and enforced by Puno Provincial Municipality, EMSAPUNO and communities.

#### 2.5 IMPLEMENTATION PLAN

# Phase 1 (Year 1998 to 2008) - Priority Project

-1997 Preparation of project

1998 - 2000 Detailed design and bidding

2000 - 2002 Construction

2004 - Commencement of operation

# Phase 2 (Year 2009 to 2015)

- 2008 Preparation of project

2009 Detailed design and bidding

Construction (Wastewater treatment plant)

2010 Commencement of operation

- 2015 Construction (Sewer pipe)

# Phase 3 (Year 2016 to 2025)

- 2015 Preparation of project

2016 Detailed design and bidding

2016 - 2017 Construction (Wastewater treatment plant, Pump station)

2018 Commencement of operation

- 2025 Construction (Sewer pipe)

#### Construction works according to the phases are as follows:

ſ	Facilities	Sewer Pipe	Pump Station	Wastewater Treatment Plant			
I	Year	2000-2002	2000-2002	2000-2002			
Ĭ	Phase 1	φ 150-900, L =25,223m	EB EL PUERTO	EB Puno Aerated Lagoon×2 Constructed Wetland×34			
	Phase 2	$\phi$ 150-300, L = 46,832m		<2009> Sedimentation Ponds × 2			
	Phase 3	φ 150-300, L = 66,007m	<2017> EB EL PUERTO (Pump equipment renewal)	<2016-2017> BB Puno (Pump equipment renewal) Aerated Lagoon × 1 Sedimentation Pond × 1			

#### 2.6 COST ESTIMATE

Construction cost for the proposed project is estimated following the same procedure explained in section 2.3.3.

Table V.2.60 Construction cost for proposed project

Unit: Thousand S/.

	Phase 1 (1998-2008)		Phase 2 (2009-2015)		Phase 3 (2016-2025)	
(1) Construction Cost		23,431		11,172		18,950
(2) Procurement of Maintenance Equipment		234		112	a a legite	189
(3) Engineering Cost		4 4 1				
1) Detailed Design	1,406		670		1,137	
2) Construction Supervision	937		447		758	1
Sub-Total		2,343		1,117		1,895
(4) Common Expenses				*		
1) General/Administration Expenses	200	\$ 1.75°	200	1	200	
2) Land Acquisition	0		0	1 11 1	0	
Sub-Total		200		200		200
(5) Contingency		3,901		1,860		3,155
(6) GST 18%		5,384		2,567		4,354
Total		35,494		17,028	***	28,743
				Grand Total		81,265

#### 2.7 ORGANIZATION FOR OPERATION AND MAINTENANCE

# 2.7.1 GENERAL

The appropriate operation and maintenance (O & M) of the sewerage facilities is vital not only to maintain the performance of the system, but also to prolong its service life. The minimum requirements to attain satisfactory levels of O & M practice are described and the further development of O & M activities will be subject to the progress of human resource development in this particular field.