

Table E.2.10 Point Pollution Load Effluent Flowing into Rivers

No.	Name of Municipality	Sewerage System					Industry				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	116.5	70.4	90.2	13.42	1.321					
2	Ubate	3,710.6	357.5	800.3	140.84	17.801					
3	Tausa	86.6	54.1	70.1	10.34	0.980	2.7	7.3	8.9	1.89	0.911
4	Sutatausa	51.2	29.1	36.5	5.53	0.582					
5	Cucunuba	102.2	9.5	21.3	3.74	0.473					
6	Lenguazaque	248.2	98.6	94.4	18.81	1.834					
7	Guacheta	460.8	175.8	223.2	33.48	3.396	2.7	7.3	8.9	1.89	0.911
8	San Miguel de Sema	140.3	10.5	23.6	4.14	0.524					
9	Fuquene	70.4	40.0	50.2	7.60	0.800	2.7	7.3	8.9	1.89	0.911
10	Susa	171.9	103.8	132.9	19.79	1.949					
11	Simijaca	820.1	342.9	426.7	73.28	19.234	92.5	74.0	90.6	19.17	9.250
12	Caldas	7.6	4.3	5.4	0.82	0.086					
13	Chiquinquirá	7,587.0	2,167.8	2,718.8	416.55	50.471					
14	Saboya	96.6	1.2	2.6	0.46	0.058					
Total		13,670.0	3,465.3	4,696.2	748.81	99.511	100.6	95.9	117.4	24.83	11.98

No.	Name of Municipality	Slaughterhouse					Total				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa						116.5	70.4	90.2	13.42	1.321
2	Ubate						3,710.6	357.5	800.3	140.84	17.801
3	Tausa						89.3	61.4	79.0	12.23	1.892
4	Sutatausa	1.6	4.1	6.5	0.81	0.016	52.8	33.2	43.0	6.34	0.598
5	Cucunuba						102.2	9.5	21.3	3.74	0.473
6	Lenguazaque						248.2	98.6	94.4	18.81	1.834
7	Guacheta						463.5	183.1	232.2	35.37	4.307
8	San Miguel de Sema	0.3	0.7	1.1	0.14	0.003	140.5	11.2	24.7	4.29	0.527
9	Fuquene	3.0	7.5	12.0	1.50	0.030	76.1	54.8	71.1	10.99	1.741
10	Susa						171.9	103.8	132.9	19.79	1.949
11	Simijaca	5.9	14.8	23.7	2.96	0.059	918.5	431.7	541.0	95.40	28.543
12	Caldas	4.0	10.0	16.0	2.00	0.040	11.6	14.3	21.4	2.82	0.126
13	Chiquinquirá	16.4	41.1	65.7	8.21	0.164	7,603.4	2,208.8	2,784.5	424.77	50.636
14	Saboya	3.0	7.5	12.0	1.50	0.030	99.6	8.7	14.6	1.96	0.088
Total		34.3	85.6	137.0	17.13	0.343	13,804.9	3,646.8	4,950.6	790.77	111.837

Table E.2.11 Future Domestic Pollution Load Generation

No.	Name of Municipality	Served Population by Sewerage	Per Capita Discharge (L/c/d)			Per Capita Load (g/c/d)			Return Factor	Wastewater Discharge (m ³ /day)	Generated Load (kg/day)				Discharging Points
			BOD	COD	T-N	T-P	BOD	COD			T-N	T-P			
1	Carmen de Carupa	2,192	110	62.8	9.5	1.0	0.8	192.9	109.6	137.6	20.82	2.192	Q. Suciniaca		
2	Ubate	22,883	225	62.8	9.5	1.0	0.8	4,118.9	1,144.2	1,436.1	217.39	22,883	Suta		
3	Tausa	1,074	110	62.8	9.5	1.0	0.8	94.5	53.7	67.4	10.20	1,074	Suta		
4	Sutatausa	1,476	110	62.8	9.5	1.0	0.8	129.9	73.8	92.6	14.02	1,476	Suta		
5	Cucumaba	2,048	110	62.8	9.5	1.0	0.8	180.2	102.4	128.5	19.46	2,048	San Isidro		
6	Lenguazaque	2,800	170	62.8	9.5	1.0	0.8	380.8	140.0	175.7	26.60	2,800	Lenguazaque		
7	Guatecha	4,602	170	62.8	9.5	1.0	0.8	625.9	230.1	288.8	43.72	4,602	Q. Gualacia		
8	San Miguel de Sema	730	110	62.8	9.5	1.0	0.8	64.2	36.5	45.8	6.94	0.730	Q. Santa Ana		
9	Fuquene	615	110	62.8	9.5	1.0	0.8	54.1	30.7	38.6	5.84	0.615	Irrigation		
	Capellania	517	110	62.8	9.5	1.0	0.8	45.5	25.9	32.5	4.92	0.517	Q. Bautista		
10	Susa	1,765	110	62.8	9.5	1.0	0.8	155.3	88.3	110.8	16.77	1,765	Susa		
11	Simijaca	5,048	170	62.8	9.5	1.0	0.8	686.5	252.4	316.8	47.96	5,048	Simijaca		
12	Caldas	621	110	62.8	9.5	1.0	0.8	54.6	31.1	39.0	5.90	0.621	Chiquinquira		
13	Chiquinquira	48,364	225	62.8	9.5	1.0	0.8	8,705.5	2,418.2	3,035.3	459.46	48,364	Suarez		
14	Saboya	1,616	110	62.8	9.5	1.0	0.8	142.2	80.8	101.4	15.35	1,616	Q. La Ruda		

Table E.2.12 Future Pollution Load Effluent from Slaughterhouses

No.	Name of Municipality	Animal	Number of Head (weak)	Wastewater (m ³ /day)	Generated BOD (kg/day)	Treatment Plant	Effluent Load (kg/day)			Discharging Point	
							BOD	COD	T-N		
1	Carmen de Carupa	Cow	17	2.36	17.70	W	5.9	9.4	1.18	0.024	Sewerage
		Cow	188								
2	Ubate	Pig	90	26.73	200.48	W	66.8	106.9	13.37	0.267	Sewerage
		Sheep	90								
3	Tausa	Cow	19	2.70	20.22	W	6.7	10.8	1.35	0.027	Sewerage
4	Sutatausa	Cow	13	1.83	13.75	W	4.6	7.3	0.92	0.018	Q. Chiritoque
5	Cucunuba	Cow	6	0.86	6.47	W	2.2	3.5	0.43	0.009	Sewerage
6	Lenguazaque	Cow	26	3.71	27.83	W	9.3	14.8	1.86	0.037	Sewerage
7	Guacheta	Cow	23	3.33	25.01	W	8.3	13.3	1.67	0.033	Sewerage
8	San Miguel de Sema	Cow	2	0.30	2.23	W	0.7	1.2	0.15	0.003	Q. Los Cerezos
9	Fuquene	Cow	23	3.30	24.74	W	8.2	13.2	1.65	0.033	Fuquene
10	Susa	Cow	23	3.35	25.11	W	8.4	13.4	1.67	0.033	Sewerage
11	Simijaca	Cow	39	5.92	44.38	W	14.8	23.7	2.96	0.059	Q. El Capitodio
12	Caldas	Cow	4	0.59	4.43	W	1.5	2.4	0.30	0.006	Q. La Praya
13	Chiquinquirá	Cow	133	19.00	142.47	W	47.5	76.0	9.50	0.190	Chiquinquirá
14	Saboya	Cow	19	2.76	20.71	W	6.9	11.0	1.38	0.028	Q. El Cantoco

Note: BOD=2,500mg/l, COD=4,000mg/l, T-N=500mg/l, T-P=10mg/l

Table E.2.13 Future Pollution Load Effluent from Dairy Industry (1/2)

No.	Name of Municipality	Activity*	Name of Point Source **	Discharging Point	Size ***	Milk Processed (l/day)	Wastewater Volume (m ³ /day)	Generated BOD (kg/day)	Effluent Load (kg/day)							
									Without Project			With Project				
									BOD	COD	T-N	T-P	BOD	COD	T-N	T-P
1	Ubate	D.P.	Lacteos el Manatíal	Irrigation	L	832	4.2	11.23	6.7	8.2	1.75	0.842	6.7	8.2	1.75	0.842
2	Ubate	D.P.	Lacteos San Andres	Irrigation	M	2,912	14.6	39.31	23.6	28.9	6.11	2.948	23.6	28.9	6.11	2.948
3	Ubate	D.P.	Quesos Villa Ubate	Irrigation	S	1,560	7.8	21.06	21.1	25.8	5.45	2.633	12.6	15.5	3.27	1.580
			Irrigation Sub-total			5,304	26.5	71.60	51.4	62.9	13.31	6.423	43.0	52.6	11.13	5.370
4	Ubate	D.P.	Dona Leche	Sewerage	L	62,400	312.0	842.40	505.4	618.7	130.91	63.180	505.4	618.7	130.91	63.180
5	Ubate	D.P.	Benedicto Murcia	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
6	Ubate	D.P.	Luis Cardenas	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
7	Ubate	D.P.	Onofre Trivino	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
8	Ubate	D.P.	Fabrica de Quesos Alesmar	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
9	Ubate	D.P.	Fabrica de Quesos San Jose	Sewerage	S	260	1.3	3.51	3.5	4.3	0.91	0.439	2.1	2.6	0.55	0.263
10	Ubate	D.P.	La Gran Vaquita	Sewerage	S	416	2.1	5.62	5.6	6.9	1.45	0.702	3.4	4.1	0.87	0.421
11	Ubate	D.P.	Lacteos Don Luis	Sewerage	S	832	4.2	11.23	11.2	13.7	2.91	1.404	6.7	8.2	1.75	0.842
12	Ubate	D.P.	Lacteos el Rusal	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
13	Ubate	D.P.	Lacteos el Venado	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
14	Ubate	D.P.	Lacteos Hato Clups	Sewerage	S	624	3.1	8.42	8.4	10.3	2.18	1.053	5.1	6.2	1.31	0.632
15	Ubate	D.P.	Lacteos La Esperanza	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
16	Ubate	D.P.	Lacteos la Pirinola	Sewerage	S	260	1.3	3.51	3.5	4.3	0.91	0.439	2.1	2.6	0.55	0.263
17	Ubate	D.P.	Lacteos la Superior	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
18	Ubate	D.P.	Lacteos Sello Dorado	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
19	Ubate	D.P.	Lacteos Ubate	Sewerage	M	4,160	20.8	56.16	33.7	41.2	8.73	4.212	33.7	41.2	8.73	4.212
20	Ubate	D.P.	Lacteos Villa Julia	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
21	Ubate	D.P.	Quesadillos la Chagrita	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
22	Ubate	D.P.	Quesadillos la Gaviote	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
23	Ubate	D.P.	Quesos el Candado	Sewerage	S	832	4.2	11.23	11.2	13.7	2.91	1.404	6.7	8.2	1.75	0.842
24	Ubate	D.P.	Quesos Gomur	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
25	Ubate	D.P.	Quesos las Margarita	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
26	Ubate	D.P.	Quesos los Alpes	Sewerage	S	416	2.1	5.62	5.6	6.9	1.45	0.702	3.4	4.1	0.87	0.421
27	Ubate	D.P.	Quesos San Jorge	Sewerage	S	562	2.8	7.58	7.6	9.3	1.96	0.948	4.5	5.6	1.18	0.569
28	Ubate	M.C.	Alqueria	Sewerage	L	83,200	208.0	166.40	166.4	203.7	43.10	20.800	99.8	122.2	25.86	12.480
29	Ubate	M.C.	Parmalat	Sewerage	M	40,040	100.1	80.08	48.0	58.8	12.44	6.006	48.0	58.8	12.44	6.006
			Sewerage Sub-total			201,864	701.22	1,307.90	916.4	1,121.8	237.36	114.556	784.7	960.6	203.25	98.093
			Total			207,168	727.74	1,379.51	967.8	1,184.7	250.67	120.979	827.7	1013.2	214.38	103.463

Table E.2.14 (1) Future Influent to Sewerage System without Project

No.	Name of Municipality	Domestic					Industrial				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	192.9	109.6	137.6	20.82	2.192					
2	Ubate	4,118.9	1,144.2	1,436.1	217.39	22.883	701.2	916.4	1,121.8	237.4	114.6
3	Tausa	94.5	53.7	67.4	10.20	1.074					
4	Sutatausa	129.9	73.8	92.6	14.02	1.476					
5	Cucunuba	180.2	102.4	128.5	19.46	2.048					
6	Lenguazaque	380.8	140.0	175.7	26.60	2.800					
7	Guacheta	625.9	230.1	288.8	43.72	4.602					
8	San Miguel de Sema	64.2	36.5	45.8	6.94	0.730	100.1	80.1	98.0	20.7	10.0
9	Fuquene	99.6	56.6	71.0	10.75	1.132					
10	Susa	155.3	88.3	110.8	16.77	1.765					
11	Simijaca	686.5	252.4	316.8	47.96	5.048	216.4	122.6	150.1	31.7	15.3
12	Caldas	54.6	31.1	39.0	5.90	0.621					
13	Chiquinquirá	8,705.5	2,418.2	3,035.3	459.46	48.364	26.7	69.4	85.0	18.0	8.7
14	Saboya	142.2	80.8	101.4	15.35	1.616					

No.	Name of Municipality	Slaughterhouse					Influent (Total)				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	2.4	5.9	9.4	1.18	0.024	195.3	115.5	147.0	22.00	2.216
2	Ubate	26.7	66.8	106.9	13.37	0.267	4,846.9	2,127.4	2,664.9	468.11	137.706
3	Tausa	2.7	6.7	10.8	1.35	0.027	97.2	60.4	78.2	11.55	1.101
4	Sutatausa						129.9	73.8	92.6	14.02	1.476
5	Cucunuba	0.9	2.2	3.5	0.43	0.009	181.1	104.6	132.0	19.89	2.057
6	Lenguazaque	3.7	9.3	14.8	1.86	0.037	384.5	149.3	190.6	28.46	2.837
7	Guacheta	3.3	8.3	13.3	1.67	0.033	629.2	238.4	302.2	45.39	4.635
8	San Miguel de Sema						164.3	116.6	143.8	27.68	10.740
9	Fuquene						99.6	56.6	71.0	10.75	1.132
10	Susa	3.3	8.4	13.4	1.67	0.033	158.7	96.6	124.2	18.44	1.798
11	Simijaca						903.0	375.0	466.9	79.71	20.371
12	Caldas						54.6	31.1	39.0	5.90	0.621
13	Chiquinquirá						8,751.2	2,535.1	3,196.2	486.93	57.230
14	Saboya						142.2	80.8	101.4	15.35	1.616

Table E.2.14 (2) Future Influent to Sewerage System with Project

No.	Name of Municipality	Domestic					Industrial				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	192.9	109.6	137.6	20.82	2.192					
2	Ubate	4,118.9	1,144.2	1,436.1	217.39	22.883	701.2	784.7	960.6	203.25	98.093
3	Tausa	94.5	53.7	67.4	10.20	1.074					
4	Sutatausa	129.9	73.8	92.6	14.02	1.476					
5	Cucunuba	180.2	102.4	128.5	19.46	2.048					
6	Lenguazaque	380.8	140.0	175.7	26.60	2.800					
7	Guacheta	625.9	230.1	288.8	43.72	4.602					
8	San Miguel de Sema	64.2	36.5	45.8	6.94	0.730	100.1	48.0	58.8	12.44	6.006
9	Fuquene	99.6	56.6	71.0	10.75	1.132					
10	Susa	155.3	88.3	110.8	16.77	1.765					
11	Simijaca	686.5	252.4	316.8	47.96	5.048	216.4	113.5	138.9	29.39	14.186
12	Caldas	54.6	31.1	39.0	5.90	0.621					
13	Chiquinquirá	8,705.5	2,418.2	3,035.3	459.46	48.364	26.7	41.6	51.0	10.79	5.206
14	Saboya	142.2	80.8	101.4	15.35	1.616					

No.	Name of Municipality	Slaughterhouse					Influent (Total)				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	2.4	5.9	9.4	1.18	0.024	195.3	115.5	147.0	22.00	2.216
2	Ubate	26.7	66.8	106.9	13.37	0.267	4,846.9	1,995.7	2,503.6	434.00	121.243
3	Tausa	2.7	6.7	10.8	1.35	0.027	97.2	60.4	78.2	11.55	1.101
4	Sutatausa						129.9	73.8	92.6	14.02	1.476
5	Cucunuba	0.9	2.2	3.5	0.43	0.009	181.1	104.6	132.0	19.89	2.057
6	Lenguazaque	3.7	9.3	14.8	1.86	0.037	384.5	149.3	190.6	28.46	2.837
7	Guacheta	3.3	8.3	13.3	1.67	0.033	629.2	238.4	302.2	45.39	4.635
8	San Miguel de Sema						164.3	84.5	104.6	19.38	6.736
9	Fuquene						99.6	56.6	71.0	10.75	1.132
10	Susa	3.3	8.4	13.4	1.67	0.033	158.7	96.6	124.2	18.44	1.798
11	Simijaca						903.0	365.9	455.7	77.35	19.234
12	Caldas						54.6	31.1	39.0	5.90	0.621
13	Chiquinquirá						8,751.2	2,507.3	3,162.2	479.74	53.759
14	Saboya						142.2	80.8	101.4	15.35	1.616

Table E.2.15 Future Pollution Load Effluent from Sewerage System

No.	Name of Municipality	Influent							
		Without Project (kg/day)				With Project (kg/day)			
		BOD	COD	T-N	T-P	BOD	COD	T-N	T-P
1	Carmen de Carupa	115.5	147.0	22.00	2.216	115.5	147.0	22.00	2.216
2	Ubate	2,127.4	2,664.9	468.11	137.706	1995.7	2503.6	434.00	121.243
3	Tausa	60.4	78.2	11.55	1.101	60.4	78.2	11.55	1.101
4	Sutatausa	73.8	92.6	14.02	1.476	73.8	92.6	14.02	1.476
5	Cucunuba	104.6	132.0	19.89	2.057	104.6	132.0	19.89	2.057
6	Lenguazaque	149.3	190.6	28.46	2.837	149.3	190.6	28.46	2.837
7	Guacheta	238.4	302.2	45.39	4.635	238.4	302.2	45.39	4.635
8	San Miguel de Sema	116.6	143.8	27.68	10.740	84.5	104.6	19.38	6.736
9	Fuquene	56.6	71.0	10.75	1.132	56.6	71.0	10.75	1.132
10	Susa	96.6	124.2	18.44	1.798	96.6	124.2	18.44	1.798
11	Simijaca	375.0	466.9	79.71	20.371	365.9	455.7	77.35	19.234
12	Caldas	31.1	39.0	5.90	0.621	31.1	39.0	5.90	0.621
13	Chiquinquirá	2,535.1	3,196.2	486.93	57.230	2507.3	3162.2	479.74	53.759
14	Saboya	80.8	101.4	15.35	1.616	80.8	101.4	15.35	1.616

No.	Name of Municipality	Effluent							
		Without Project (kg/day)				With Project (kg/day)			
		BOD	COD	T-N	T-P	BOD	COD	T-N	T-P
1	Carmen de Carupa	115.5	147.0	22.00	2.216	7.8	17.5	3.08	0.389
2	Ubate	676.4	1,514.4	266.50	33.684	193.9	434.1	76.39	9.655
3	Tausa	60.4	78.2	11.55	1.101	3.9	8.7	1.53	0.194
4	Sutatausa	73.8	92.6	14.02	1.476	5.2	11.6	2.05	0.259
5	Cucunuba	52.8	118.2	20.80	2.629	7.2	16.2	2.85	0.361
6	Lenguazaque	132.9	297.5	52.35	6.617	15.4	34.4	6.06	0.766
7	Guacheta	238.4	302.2	45.39	4.635	25.2	56.3	9.92	1.253
8	San Miguel de Sema	25.5	57.1	10.04	1.269	6.6	14.7	2.59	0.327
9	Fuquene	56.6	71.0	10.75	1.132	4.0	8.9	1.57	0.198
10	Susa	96.6	124.2	18.44	1.798	6.3	14.2	2.50	0.316
11	Simijaca	375.0	466.9	79.71	20.371	36.1	80.9	14.23	1.799
12	Caldas	31.1	39.0	5.90	0.621	2.2	4.9	0.86	0.109
13	Chiquinquirá	2,535.1	3,196.2	486.93	57.230	350.0	783.7	137.92	17.432
14	Saboya	2.5	5.6	0.98	0.124	2.5	5.6	0.98	0.124

Table E.2.16 (1) Future Point Pollution Load Effluent Flowing into Rivers without Project

No.	Name of Municipality	Sewerage System					Industry				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	195.3	115.5	147.0	22.00	2.216					
2	Ubate	4,846.9	676.4	1,514.4	266.50	33.684					
3	Tausa	97.2	60.4	78.2	11.55	1.101	2.8	7.6	9.3	1.96	0.948
4	Sutatausa	129.9	73.8	92.6	14.02	1.476					
5	Cucunuba	181.1	52.8	118.2	20.80	2.629					
6	Lenguazaque	384.5	132.9	297.5	52.35	6.617					
7	Guacheta	629.2	238.4	302.2	45.39	4.635	2.8	7.6	9.3	1.96	0.948
8	Sema	164.3	25.5	57.1	10.04	1.269					
9	Fuquene	99.6	56.6	71.0	10.75	1.132	2.8	7.6	9.3	1.96	0.948
10	Susa	158.7	96.6	124.2	18.44	1.798					
11	Simijaca	903.0	375.0	466.9	79.71	20.371	96.2	77.0	94.2	19.93	9.620
12	Caldas	54.6	31.1	39.0	5.90	0.621					
13	Chiquinquirá	8,751.2	2,535.1	3,196.2	486.93	57.230					
14	Saboya	142.2	2.5	5.6	0.98	0.124					
	Total	16,737.7	4,472.6	6,509.9	1,045.37	134.904	104.6	99.7	122.0	25.82	12.463

No.	Name of Municipality	Slaughterhouse					Total				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa						195.3	115.5	147.0	22.00	2.216
2	Ubate						4,846.9	676.4	1,514.4	266.50	33.684
3	Tausa						100.0	68.0	87.5	13.51	2.049
4	Sutatausa	1.8	4.6	7.3	0.92	0.018	131.7	78.4	100.0	14.94	1.494
5	Cucunuba						181.1	52.8	118.2	20.80	2.629
6	Lenguazaque						384.5	132.9	297.5	52.35	6.617
7	Guacheta						632.0	246.0	311.4	47.35	5.583
8	Sema	0.3	0.7	1.2	0.15	0.003	164.6	26.2	58.2	10.19	1.272
9	Fuquene	3.3	8.2	13.2	1.65	0.033	105.7	72.4	93.5	14.37	2.113
10	Susa						158.7	96.6	124.2	18.44	1.798
11	Simijaca	5.9	14.8	23.7	2.96	0.059	1,005.1	466.7	584.7	102.60	30.050
12	Caldas	4.1	10.3	16.5	2.07	0.041	58.8	41.4	55.5	7.97	0.662
13	Chiquinquirá	19.0	47.5	76.0	9.50	0.190	8,770.2	2,582.6	3,272.2	496.43	57.420
14	Saboya	2.8	6.9	11.0	1.38	0.028	145.0	9.4	16.6	2.36	0.151
	Total	37.2	93.1	149.0	18.62	0.372	16,879.6	4,665.4	6,780.9	1,089.81	147.739

Table E.2.16 (2) Future Point Pollution Load Effluent Flowing into Rivers with Project

No.	Name of Municipality	Sewerage System					Industry				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	195.3	7.8	17.5	3.08	0.389					
2	Ubate	4,846.9	193.9	434.1	76.39	9.655					
3	Tausa	97.2	3.9	8.7	1.53	0.194	2.8	4.5	5.6	1.18	0.569
4	Sutatausa	129.9	5.2	11.6	2.05	0.259					
5	Cucunuba	181.1	7.2	16.2	2.85	0.361					
6	Lenguazaque	384.5	15.4	34.4	6.06	0.766					
7	Guacheta	629.2	25.2	56.3	9.92	1.253	2.8	4.5	5.6	1.18	0.569
8	San Miguel de Sema	164.3	6.6	14.7	2.59	0.327					
9	Fuquene	99.6	4.0	8.9	1.57	0.198	2.8	4.5	5.6	1.18	0.569
10	Susa	158.7	6.3	14.2	2.50	0.316					
11	Simijaca	903.0	36.1	80.9	14.23	1.799	96.2	46.2	56.5	11.96	5.772
12	Caldas	54.6	2.2	4.9	0.86	0.109					
13	Chiquinquirá	8,751.2	350.0	783.7	137.92	17.432					
14	Saboya	142.2	2.5	5.6	0.98	0.124					
	Total	16,737.7	666.3	1,491.8	262.52	33.182	104.6	59.8	73.2	15.49	7.48

No.	Name of Municipality	Slaughterhouse					Total				
		Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)	Q (m ³ /d)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa						195.3	7.8	17.5	3.08	0.389
2	Ubate						4,846.9	193.9	434.1	76.39	9.655
3	Tausa						100.0	8.4	14.3	2.71	0.762
4	Sutatausa	1.8	4.6	7.3	0.92	0.018	131.7	9.8	19.0	2.96	0.277
5	Cucunuba						181.1	7.2	16.2	2.85	0.361
6	Lenguazaque						384.5	15.4	34.4	6.06	0.766
7	Guacheta						632.0	29.7	61.9	11.09	1.822
8	San Miguel de Sema	0.3	0.7	1.2	0.15	0.003	164.6	7.3	15.9	2.74	0.330
9	Fuquene	3.3	8.2	13.2	1.65	0.033	105.7	16.8	27.7	4.40	0.800
10	Susa						158.7	6.3	14.2	2.50	0.316
11	Simijaca	5.9	14.8	23.7	2.96	0.059	1,005.1	97.1	161.1	29.15	7.630
12	Caldas	4.1	10.3	16.5	2.07	0.041	58.8	12.5	21.4	2.93	0.150
13	Chiquinquirá	19.0	47.5	76.0	9.50	0.190	8,770.2	397.5	859.7	147.42	17.622
14	Saboya	2.8	6.9	11.0	1.38	0.028	145.0	9.4	16.6	2.36	0.151
	Total	37.2	93.1	149.0	18.62	0.372	16,879.6	819.2	1,714.0	296.64	41.032

Table E.3.1 Livestock, Land Area and Rural Population Data of Each Sub-Basin

Basin No.	Sub-Basin Name	Land Use and Livestock								
		Tributary Distance (km)	Sub-Basin Area (km ²)	Livestock (Heads)			Farmland Area (km ²)	Pasture Land Area (km ²)	Shrub/Forest Area (km ²)	Population of Rural Area
				Bovine	Pigs	Sheep				
1	Upper Ubate River (Pte Colorado)	19	225.19	16,792	7,594	11,774	132.75	56.93	32.66	18,481
2	Suta River	21	112.00	11,963	2,458	6,284	71.05	28.43	12.28	8,958
3	Cucunuba	16	92.00	4,858	2,051	6,119	35.97	42.22	11.49	9,277
4	Lenguazaque River	23	293.00	28,128	4,150	16,617	154.09	115.84	22.74	15,107
5	Fuquene Lake	-	269.82	31,537	1,668	10,859	81.76	142.99	17.52	14,612
6	Susa River	18	64.00	9,094	1,398	3,144	28.42	26.54	8.67	3,078
7	Simijaca River	31	153.00	17,423	2,233	4,629	85.37	47.55	19.33	6,949
8	Suarez River (From Fuquene Laka to Tolon Gate)	18	123.27	23,924	1,267	1,832	38.17	76.72	8.29	7,342
9	Chiquinquira River	19	130.00	10,286	3,092	1,883	105.06	6.49	14.44	7,677
Total		-	1,462	154,005	25,911	63,141	732.64	543.71	147.42	91,481

Table E. 3.2 Unit Pollution Load Generation of Non-point Sources

Sources		Parameter	Unit Load	Reference
Livestock	Bovines	BOD (g/head/day)	600	※-1
		COD (g/head/day)	1484	※-1
		T-N (g/head/day)	378	※-1
		T-P (g/head/day)	56	※-1
	Pigs	BOD (g/head/day)	200	※-1
		COD (g/head/day)	364	※-1
		T-N (g/head/day)	40	※-1
		T-P (g/head/day)	25	※-1
	Sheeps	BOD (g/head/day)	64	※-1
		COD (g/head/day)	148	※-1
		T-N (g/head/day)	38	※-1
		T-P (g/head/day)	6	※-1
Farmland		BOD (kg/km ² /day)	8.57	※-2
		COD (kg/km ² /day)	20.6	※-1
		T-N (kg/km ² /day)	18.8	※-1
		T-P (kg/km ² /day)	0.202	※-1
Pastureland		BOD (kg/km ² /day)	1.00	※-5
		COD (kg/km ² /day)	2.4	※-5
		T-N (kg/km ² /day)	2.19	※-4
		T-P (kg/km ² /day)	0.11	※-4
Shrub/Forest		BOD (kg/km ² /day)	0.75	※-3
		COD (kg/km ² /day)	13.9	※-1
		T-N (kg/km ² /day)	1.04	※-1
		T-P (kg/km ² /day)	0.082	※-1
Household (After Septic Tank Treatment)		BOD (g/person/day)	4.0	※-3
		COD (g/person/day)	6.5	※-5
		T-N (g/person/day)	0.67	※-5
		T-P (g/person/day)	0.108	※-5

Reference No.

※-1: :Guideline for Basin-wide Water Pollution Control Master Plan ,Japan Sewage Works Association,1996, p41. The standard COD in Japan is presented as COD(Mn), while COD(Cr) is used in Colombia. Then, the COD values for the study are obtained by multiply

※-2:Preparation of Unit Pollutant Load for Enviromental Assessment, Nomura Synthetic Institute Japan

※-3: Preparation of Unit Pollutant Load for Enviromental Assessment,Japan Sewage

※-4:Unit Pollutant Load of Grassland in Switzerland, Kolenbrander. G.J."The Eutrophication of Surbaca Waters by Agriculture and the urban

※-5: Assumed by the Study Team

Table E 3.3 Existing Pollution Load Generation -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	428	83	10	99	226	0	104	343	2,172	3,464
BOD (Industry)	0	11	0	0	23	0	0	89	51	174
BOD (Livestock)	12,347	8,071	3,717	18,770	19,951	14,725	5,935	11,197	6,911	101,624
BOD (Farmland)	1,138	609	308	1,321	701	327	244	732	900	6,279
BOD (Pastureland)	57	28	42	116	143	77	27	48	6	544
BOD (Shrub/Forest)	25	9	9	17	16	6	7	15	12	116
BOD (Household)	74	36	37	60	58	29	12	28	31	366
Total	14,069	8,848	4,122	20,383	21,118	15,164	6,328	12,450	10,084	112,567

Table E 3.3 Existing Pollution Load Generation -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	891	107	21	94	297	0	133	427	2,724	4,694
COD (Industry)	0	15	0	0	31	0	0	114	82	242
COD (Livestock)	29,425	19,577	8,862	45,712	49,016	27,354	14,465	27,354	16,669	238,433
COD (Farmland)	2,736	1,464	741	3,175	1,685	583	586	1,759	2,165	14,895
COD (Pastureland)	136	68	101	278	343	119	64	114	16	1,238
COD (Shrub/Forest)	521	195	180	357	330	114	140	310	256	2,402
COD (Household)	120	58	60	98	95	45	20	45	50	592
Total	33,829	21,484	9,966	49,715	51,796	28,215	15,407	30,123	21,961	262,496

Table E 3.3 Existing Pollution Load Generation -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	154	16	4	19	45	0	20	73	417	748
T-N (Industry)	0	3	0	0	5	0	0	22	10	40
T-N (Livestock)	7,098	4,859	2,151	11,430	12,400	9,164	3,613	6,851	4,083	61,650
T-N (Farmland)	2,496	1,336	676	2,897	1,537	718	534	1,605	1,975	13,774
T-N (Pastureland)	125	62	92	254	313	168	58	104	14	1,191
T-N (Shrub/Forest)	35	13	12	24	22	8	9	21	17	160
T-N (Household)	12	6	6	10	10	5	2	5	5	61
Total	9,920	6,295	2,942	14,633	14,333	10,062	4,236	8,681	6,523	77,625

Table E 3.3 Existing Pollution Load Generation -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	19	2	0	2	5	0	2	19	51	100
T-P (Industry)	0	1	0	0	1	0	0	9	0	11
T-P (Livestock)	1,201	769	360	1,779	1,873	1,382	563	1,059	695	9,682
T-P (Farmland)	27	14	7	31	17	8	6	17	21	148
T-P (Pastureland)	6	3	5	13	16	8	3	5	1	59
T-P (Shrub/Forest)	3	1	1	2	2	1	1	2	1	13
T-P (Household)	2	1	1	2	2	1	0	1	1	10
Total	1,258	791	374	1,828	1,914	1,400	575	1,113	770	10,023

Table E 3.4 Existing Pollution Load Runoff in Rainy Season -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	428	83	10	99	226	0	104	343	2,172	3,464
BOD (Industry)	0	4	0	0	23	0	0	89	51	167
BOD (Livestock)	418	323	46	830	1,190	400	396	697	457	4,757
BOD (Farmland)	39	24	0	54	42	9	16	46	60	289
BOD (Pastureland)	2	1	1	5	9	2	2	3	0	24
BOD (Shrub/Forest)	1	0	0	1	1	0	0	1	1	5
BOD (Household)	3	1	0	3	3	1	1	2	2	16
Total	890	438	57	992	1,493	412	519	1,180	2,743	8,722

Table E 3.4 Existing Pollution Load Runoff in Rainy Season -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	891	107	21	94	297	0	133	427	2,724	4,694
COD (Industry)	0	15	0	0	31	0	0	114	82	242
COD (Livestock)	2,648	1,762	798	4,114	4,411	3,261	1,302	2,462	1,500	22,258
COD (Farmland)	246	132	67	286	152	63	53	158	195	1,351
COD (Pastureland)	12	6	9	25	31	17	6	10	1	117
COD (Shrub/Forest)	47	18	16	32	30	10	13	28	23	216
COD (Household)	11	5	5	9	9	4	2	4	4	54
Total	3,855	2,044	916	4,560	4,960	3,356	1,508	3,203	4,530	28,932

Table E 3.4 Existing Pollution Load Runoff in Rainy Season -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	154	16	4	19	45	0	20	73	417	749
T-N (Industry)	0	3	0	0	5	0	0	22	10	40
T-N (Livestock)	163	112	49	263	285	211	83	158	74	1,398
T-N (Farmland)	57	31	16	67	35	17	12	37	45	317
T-N (Pastureland)	3	1	2	6	7	4	1	2	0	27
T-N (Shrub/Forest)	1	0	0	0	0	0	0	0	0	3
T-N (Household)	0	0	0	0	0	0	0	0	0	1
Total	379	163	71	355	379	231	117	293	547	2,535

Table E 3.4 Existing Pollution Load Runoff in Rainy Season -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	19	2	0	2	5	0	2	19	51	100
T-P (Industry)	0	1	0	0	1	0	0	9	0	11
T-P (Livestock)	28	18	8	41	43	32	13	24	16	223
T-P (Farmland)	1	0	0	1	0	0	0	0	0	3
T-P (Pastureland)	0	0	0	0	0	0	0	0	0	1
T-P (Shrub/Forest)	0	0	0	0	0	0	0	0	0	0
T-P (Household)	0	0	0	0	0	0	0	0	0	0
Total	48	21	9	44	50	32	15	53	67	339

Table E 3.5 Existing Pollution Load Runoff in Dry Season -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	428	83	10	99	226	0	104	343	2,172	3,464
BOD (Industry)	0	4	0	0	23	0	0	89	51	167
BOD (Livestock)	144	111	16	286	410	138	136	240	157	1,639
BOD (Farmland)	13	8	1	20	14	3	6	16	20	102
BOD (Pastureland)	1	0	0	2	3	1	1	1	0	8
BOD (Shrub/Forest)	0	0	0	0	0	0	0	0	0	2
BOD (Household)	1	0	0	1	1	0	0	1	1	5
Total	587	208	27	408	678	142	247	690	2,402	5,388

Table E 3.5 Existing Pollution Load Runoff in Dry Season -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	891	107	21	94	297	0	133	427	2,724	4,694
COD (Industry)	0	15	0	0	31	0	0	114	82	242
COD (Livestock)	912	607	275	1,417	1,519	1,123	448	848	517	7,667
COD (Farmland)	85	45	23	98	52	22	18	55	67	465
COD (Pastureland)	4	2	3	9	11	6	2	4	0	40
COD (Shrub/Forest)	16	6	6	11	10	4	4	10	8	74
COD (Household)	4	2	2	3	3	1	1	1	2	18
Total	1,912	784	330	1,633	1,923	1,156	606	1,458	3,400	13,201

Table E 3.5 Existing Pollution Load Runoff in Dry Season -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	154	16	4	19	45	0	20	73	417	749
T-N (Industry)	0	3	0	0	5	0	0	22	10	40
T-N (Livestock)	71	49	22	114	124	92	36	69	41	616
T-N (Farmland)	25	13	7	29	15	7	5	16	20	138
T-N (Pastureland)	1	1	1	3	3	2	1	1	0	12
T-N (Shrub/Forest)	0	0	0	0	0	0	0	0	0	2
T-N (Household)	0	0	0	0	0	0	0	0	0	1
Total	252	82	33	165	193	101	62	181	489	1,558

Table E 3.5 Existing Pollution Load Runoff in Dry Season -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	19	2	0	2	5	0	2	19	51	100
T-P (Industry)	0	1	0	0	1	0	0	9	0	11
T-P (Livestock)	12	8	4	18	19	14	6	11	7	97
T-P (Farmland)	0	0	0	0	0	0	0	0	0	1
T-P (Pastureland)	0	0	0	0	0	0	0	0	0	1
T-P (Shrub/Forest)	0	0	0	0	0	0	0	0	0	0
T-P (Household)	0	0	0	0	0	0	0	0	0	0
Total	32	10	4	20	25	14	8	39	58	210

Table E 3.6 Future Pollution Load Generation (Without Project) -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	792	134	53	133	321	0	97	375	2,566	4,470
BOD (Industry)	0	12	0	0	24	0	0	92	58	186
BOD (Livestock)	13,812	9,104	4,154	21,208	22,646	16,738	6,712	12,679	7,781	114,834
BOD (Farmland)	1,138	609	308	1,321	701	327	244	732	900	6,279
BOD (Pastureland)	57	28	42	116	143	77	27	48	6	544
BOD (Shrub/Forest)	25	9	9	17	16	6	7	15	12	116
BOD (Household)	79	38	39	64	62	31	13	30	33	389
Total	15,902	9,935	4,605	22,859	23,912	17,179	7,099	13,969	11,357	126,818

Table E 3.6 Future Pollution Load Generation (Without Project) -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	1,661	139	118	298	430	0	124	467	3,235	6,472
COD (Industry)	0	17	0	0	33	0	0	118	93	260
COD (Livestock)	33,038	22,127	9,938	51,729	55,673	41,213	16,385	31,016	18,821	279,939
COD (Farmland)	2,736	1,464	741	3,175	1,685	583	586	1,759	2,165	14,895
COD (Pastureland)	136	68	101	278	343	119	64	114	16	1,238
COD (Shrub/Forest)	521	195	180	357	330	114	140	310	256	2,402
COD (Household)	128	62	64	104	101	51	21	48	53	632
Total	38,220	24,071	11,143	55,941	58,594	42,079	17,319	33,832	24,638	305,838

Table E 3.6 Future Pollution Load Generation (Without Project) -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	289	26	21	52	66	0	18	80	493	1,044
T-N (Industry)	0	3	0	0	6	0	0	23	12	43
T-N (Livestock)	8,019	5,509	2,425	12,963	14,096	10,431	4,101	7,784	4,632	69,960
T-N (Farmland)	2,496	1,336	676	2,897	1,537	718	534	1,605	1,975	13,774
T-N (Pastureland)	125	62	92	254	313	168	58	104	14	1,191
T-N (Shrub/Forest)	35	13	12	24	22	8	9	21	17	160
T-N (Household)	13	6	7	11	10	5	2	5	5	65
Total	10,976	6,954	3,233	16,200	16,051	11,330	4,723	9,621	7,148	86,238

Table E 3.6 Future Pollution Load Generation (Without Project) -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	36	3	3	7	7	0	2	20	58	135
T-P (Industry)	0	1	0	0	2	0	0	10	0	13
T-P (Livestock)	1,338	865	401	2,006	2,125	1,570	635	1,198	746	10,883
T-P (Farmland)	27	14	7	31	17	8	6	17	21	148
T-P (Pastureland)	6	3	5	13	16	8	3	5	1	59
T-P (Shrub/Forest)	3	1	1	2	2	1	1	2	1	13
T-P (Household)	2	1	1	2	2	1	0	1	1	10
Total	1,411	889	417	2,060	2,169	1,588	647	1,253	828	11,262

Table E 3.7 Future Pollution Load Generation (With Project) -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	202	9	7	15	36	0	6	36	352	664
BOD (Industry)	0	9	0	0	18	0	0	89	58	174
BOD (Livestock)	13,812	9,104	4,154	21,208	22,646	16,738	6,712	12,679	7,781	114,834
BOD (Farmland)	1,138	609	308	1,321	701	327	244	732	900	6,279
BOD (Pastureland)	57	28	42	116	143	77	27	48	6	544
BOD (Shrub/Forest)	25	9	9	17	16	6	7	15	12	116
BOD (Household)	79	38	39	64	62	31	13	30	33	389
Total	15,312	9,807	4,560	22,742	23,621	17,179	7,008	13,627	9,143	122,999

Table E 3.7 Future Pollution Load Generation (With Project) -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	452	14	16	34	80	0	14	81	789	1,480
COD (Industry)	0	13	0	0	24	0	0	80	93	210
COD (Livestock)	33,038	22,127	9,938	51,729	55,673	41,213	16,385	31,016	18,821	279,939
COD (Farmland)	2,736	1,464	741	3,175	1,685	583	586	1,759	2,165	14,895
COD (Pastureland)	136	68	101	278	343	119	64	114	16	1,238
COD (Shrub/Forest)	521	195	180	357	330	114	140	310	256	2,402
COD (Household)	128	62	64	104	101	51	21	48	53	632
Total	37,010	23,943	11,041	55,678	58,235	42,079	17,209	33,408	22,192	300,796

Table E 3.7 Future Pollution Load Generation (With Project) -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	79	4	3	6	14	0	3	14	139	262
T-N (Industry)	0	2	0	0	4	0	0	15	12	33
T-N (Livestock)	8,019	5,509	2,425	12,963	14,096	10,431	4,101	7,784	4,632	69,960
T-N (Farmland)	2,496	1,336	676	2,897	1,537	718	534	1,605	1,975	13,774
T-N (Pastureland)	125	62	92	254	313	168	58	104	14	1,191
T-N (Shrub/Forest)	35	13	12	24	22	8	9	21	17	160
T-N (Household)	13	6	7	11	10	5	2	5	5	65
Total	10,767	6,932	3,215	16,154	15,997	11,330	4,707	9,548	6,794	85,445

Table E 3.7 Future Pollution Load Generation (With Project) -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	10	0	0	1	2	0	0	2	18	33
T-P (Industry)	0	1	0	0	1	0	0	6	0	8
T-P (Livestock)	1,338	865	401	2,006	2,125	1,570	635	1,198	746	10,883
T-P (Farmland)	27	14	7	31	17	8	6	17	21	148
T-P (Pastureland)	6	3	5	13	16	8	3	5	1	59
T-P (Shrub/Forest)	3	1	1	2	2	1	1	2	1	13
T-P (Household)	2	1	1	2	2	1	0	1	1	10
Total	1,386	886	415	2,054	2,163	1,588	645	1,230	788	11,155

Table E 3.8 Future Pollution Load Runoff in Rainy Season (Without Project) -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	792	134	53	133	321	0	97	375	2,566	4,470
BOD (Industry)	0	12	0	0	24	0	0	92	58	186
BOD (Livestock)	468	364	52	938	1,350	454	447	790	514	5,378
BOD (Farmland)	39	24	4	58	42	9	16	46	60	297
BOD (Pastureland)	2	1	1	5	9	2	2	3	0	24
BOD (Shrub/Forest)	1	0	0	1	1	0	0	1	1	5
BOD (Household)	3	2	0	3	4	1	1	2	2	17
Total	1,303	538	110	1,138	1,750	466	563	1,308	3,201	10,378

Table E 3.8 Future Pollution Load Runoff in Rainy Season (Without Project) -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	1,661	139	118	298	430	0	124	467	3,235	6,472
COD (Industry)	0	17	0	0	33	0	0	118	93	260
COD (Livestock)	2,973	1,991	894	4,656	5,011	3,709	1,475	2,791	1,694	25,195
COD (Farmland)	246	132	67	286	152	52	53	158	195	1,341
COD (Pastureland)	12	6	9	25	31	11	6	10	1	111
COD (Shrub/Forest)	47	18	16	32	30	10	13	28	23	216
COD (Household)	11	6	6	9	9	5	2	4	5	57
Total	4,952	2,308	1,110	5,305	5,695	3,787	1,672	3,577	5,246	33,652

Table E 3.8 Future Pollution Load Runoff in Rainy Season (Without Project) -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	289	26	21	52	66	0	18	80	493	1,044
T-N (Industry)	0	3	0	0	6	0	0	23	12	43
T-N (Livestock)	184	127	56	298	324	240	94	179	107	1,609
T-N (Farmland)	57	31	16	67	35	17	12	37	45	317
T-N (Pastureland)	3	1	2	6	7	4	1	2	0	27
T-N (Shrub/Forest)	1	0	0	1	1	0	0	0	0	4
T-N (Household)	0	0	0	0	0	0	0	0	0	1
Total	534	188	95	424	439	261	127	322	657	3,046

Table E 3.8 Future Pollution Load Runoff in Rainy Season (Without Project) -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	36	3	3	7	7	0	2	20	58	135
T-P (Industry)	0	1	0	0	2	0	0	10	0	13
T-P (Livestock)	31	20	9	46	49	36	15	28	17	250
T-P (Farmland)	1	0	0	1	0	0	0	0	0	3
T-P (Pastureland)	0	0	0	0	0	0	0	0	0	1
T-P (Shrub/Forest)	0	0	0	0	0	0	0	0	0	0
T-P (Household)	0	0	0	0	0	0	0	0	0	0
Total	68	24	12	54	59	37	17	58	76	403

Table E 3.9 Future Pollution Load Runoff in Dry Season (Without Project) -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Total
BOD (Sewerage)	792	134	53	133	321	0	97	375	2,566	4,470
BOD (Industry)	0	12	0	0	24	0	0	92	58	186
BOD (Livestock)	161	125	18	323	465	156	154	272	177	1,852
BOD (Farmland)	13	8	1	20	14	3	6	16	20	102
BOD (Pastureland)	1	0	0	2	3	1	1	1	0	8
BOD (Shrub/Forest)	0	0	0	0	0	0	0	0	0	2
BOD (Household)	1	1	0	1	1	0	0	1	2	7
Total	968	281	72	479	829	161	257	756	2,824	6,628

Table E 3.9 Future Pollution Load Runoff in Dry Season (Without Project) -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Total
COD (Sewerage)	1,661	139	118	298	430	0	124	467	3,235	6,472
COD (Industry)	0	17	0	0	33	0	0	118	93	260
COD (Livestock)	1,024	686	308	1,604	1,726	1,278	508	961	583	8,678
COD (Farmland)	85	45	23	98	52	18	18	55	67	462
COD (Pastureland)	4	2	3	9	11	4	2	4	0	38
COD (Shrub/Forest)	16	6	6	11	10	4	4	10	8	74
COD (Household)	4	2	2	3	3	2	1	1	2	20
Total	2,795	897	460	2,022	2,265	1,304	657	1,615	3,988	16,005

Table E 3.9 Future Pollution Load Runoff in Dry Season (Without Project) -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Total
T-N (Sewerage)	289	26	21	52	66	0	18	80	493	1,044
T-N (Industry)	0	3	0	0	6	0	0	23	12	43
T-N (Livestock)	80	55	24	130	141	104	41	78	46	700
T-N (Farmland)	25	13	7	29	15	7	5	16	20	138
T-N (Pastureland)	1	1	1	3	3	2	1	1	0	12
T-N (Shrub/Forest)	0	0	0	0	0	0	0	0	0	2
T-N (Household)	0	0	0	0	0	0	0	0	0	1
Total	395	98	53	214	232	113	65	198	571	1,939

Table E 3.9 Future Pollution Load Runoff in Dry Season (Without Project) -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucumuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Total
T-P (Sewerage)	36	3	3	7	7	0	2	20	58	135
T-P (Industry)	0	1	0	0	2	0	0	10	0	13
T-P (Livestock)	13	9	4	20	21	16	6	12	7	109
T-P (Farmland)	0	0	0	0	0	0	0	0	0	1
T-P (Pastureland)	0	0	0	0	0	0	0	0	0	1
T-P (Shrub/Forest)	0	0	0	0	0	0	0	0	0	0
T-P (Household)	0	0	0	0	0	0	0	0	0	0
Total	50	12	7	27	31	16	8	42	66	259

Table E 3.10 Future Pollution Load Runoff in Rainy Season (With Project) -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	202	9	7	15	36	0	6	36	352	664
BOD (Industry)	0	9	0	0	18	0	0	89	58	174
BOD (Livestock)	468	364	52	938	1,350	454	447	790	514	5,378
BOD (Farmland)	39	24	4	58	42	9	16	46	60	297
BOD (Pastureland)	2	1	1	5	9	2	2	3	0	24
BOD (Shrub/Forest)	1	0	0	1	1	0	0	1	1	5
BOD (Household)	3	2	0	3	4	1	1	2	2	17
Total	713	410	64	1,021	1,459	466	473	966	987	6,559

Table E 3.10 Future Pollution Load Runoff in Rainy Season (With Project) -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	452	14	16	34	80	0	14	81	789	1,480
COD (Industry)	0	13	0	0	24	0	0	80	93	210
COD (Livestock)	2,973	1,991	894	4,656	5,011	3,709	1,475	2,791	1,694	25,195
COD (Farmland)	246	132	67	286	152	52	53	158	195	1,341
COD (Pastureland)	12	6	9	25	31	11	6	10	1	111
COD (Shrub/Forest)	47	18	16	32	30	10	13	28	23	216
COD (Household)	11	6	6	9	9	5	2	4	5	57
Total	3,742	2,179	1,008	5,042	5,336	3,787	1,562	3,153	2,799	28,609

Table E 3.10 Future Pollution Load Runoff in Rainy Season (With Project) -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	79	4	3	6	14	0	3	14	139	262
T-N (Industry)	0	2	0	0	4	0	0	15	12	33
T-N (Livestock)	184	127	56	298	324	240	94	179	107	1,609
T-N (Farmland)	57	31	16	67	35	17	12	37	45	317
T-N (Pastureland)	3	1	2	6	7	4	1	2	0	27
T-N (Shrub/Forest)	1	0	0	1	1	0	0	0	0	4
T-N (Household)	0	0	0	0	0	0	0	0	0	1
Total	325	165	77	377	386	261	111	248	303	2,253

Table E 3.10 Future Pollution Load Runoff in Rainy Season (With Project) -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	10	0	0	1	2	0	0	2	18	33
T-P (Industry)	0	1	0	0	1	0	0	6	0	8
T-P (Livestock)	31	20	9	46	49	36	15	28	17	250
T-P (Farmland)	1	0	0	1	0	0	0	0	0	3
T-P (Pastureland)	0	0	0	0	0	0	0	0	0	1
T-P (Shrub/Forest)	0	0	0	0	0	0	0	0	0	0
T-P (Household)	0	0	0	0	0	0	0	0	0	0
Total	42	21	10	48	53	37	15	36	35	296

Table E 3.11 Future Pollution Load Runoff in Dry Season (With Project) -1/4 (BOD)

(Unit :kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
BOD (Sewerage)	202	9	7	15	36	0	6	36	352	664
BOD (Industry)	0	9	0	0	18	0	0	89	58	174
BOD (Livestock)	161	125	18	323	465	156	154	272	177	1,852
BOD (Farmland)	13	8	1	20	14	3	6	16	20	102
BOD (Pastureland)	1	0	0	2	3	1	1	1	0	8
BOD (Shrub/Forest)	0	0	0	0	0	0	0	0	0	2
BOD (Household)	1	1	0	1	1	0	0	1	2	7
Total	378	153	27	362	538	161	167	415	610	2,809

Table E 3.11 Future Pollution Load Runoff in Dry Season (With Project) -2/4 (COD)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
COD (Sewerage)	452	14	16	34	80	0	14	81	789	1,480
COD (Industry)	0	13	0	0	24	0	0	80	93	210
COD (Livestock)	1,024	686	308	1,604	1,726	1,278	508	961	583	8,678
COD (Farmland)	85	45	23	98	52	18	18	55	67	462
COD (Pastureland)	4	2	3	9	11	4	2	4	0	38
COD (Shrub/Forest)	16	6	6	11	10	4	4	10	8	74
COD (Household)	4	2	2	3	3	2	1	1	2	20
Total	1,585	768	358	1,759	1,906	1,304	547	1,192	1,542	10,962

Table E 3.11 Future Pollution Load Runoff in Dry Season (With Project) -3/4 (T-N)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-N (Sewerage)	79	4	3	6	14	0	3	14	139	262
T-N (Industry)	0	2	0	0	4	0	0	15	12	33
T-N (Livestock)	80	55	24	130	141	104	41	78	46	700
T-N (Farmland)	25	13	7	29	15	7	5	16	20	138
T-N (Pastureland)	1	1	1	3	3	2	1	1	0	12
T-N (Shrub/Forest)	0	0	0	0	0	0	0	0	0	2
T-N (Household)	0	0	0	0	0	0	0	0	0	1
Total	186	75	35	168	178	113	50	124	217	1,146

Table E.3.11 Future Pollution Load Runoff in Dry Season (With Project) -4/4 (T-P)

(Unit:kg/day)

Sub-Basin Name	Upper Ubate River (Pte Colorado)	Suta River	Cucunuba	Lenguazaque River	Fuquene Lake	Suarez River	Susa River	Simijaca River	Chiquinquirá River	Sub-Tptal
T-P (Sewerage)	10	0	0	1	2	0	0	2	18	33
T-P (Industry)	0	1	0	0	1	0	0	6	0	8
T-P (Livestock)	13	9	4	20	21	16	6	12	7	109
T-P (Farmland)	0	0	0	0	0	0	0	0	0	1
T-P (Pastureland)	0	0	0	0	0	0	0	0	0	1
T-P (Shrub/Forest)	0	0	0	0	0	0	0	0	0	0
T-P (Household)	0	0	0	0	0	0	0	0	0	0
Total	24	10	5	21	25	16	7	20	25	152