

Table E.1.13 Results of Water Quality Observation at the Principal River Stations/Ground-water in Dry Season 1/4

Sample No.	1	2	3	4	5	6	7
River Name	Hato Dam	Ubate River	Lenguazaque River	Ubate River	Suarez River	Chiquinquirá River	Suarez River
Sampling Site	Outlet of Dam	Downstream of Ubate City	Verda Punta Gande	Colorado	Balsa Bridge	Upstream of Chiquinquirá City	Before Tolon Gate
Remarks							
Code No.	QS-4	QR-1	QR-2	QR-3	QR-4	QR-5	QR-6
Sampling Date	1999/7/15	1999/7/13	1999/7/15	1999/7/13	1999/7/14	1999/7/14	1999/7/14
Sampling Time	14:25	13:10	12:10	14:20	13:30	11:15	10:25
Climate							
Discharge(m ³ /s)	0.001	0.226	0.00			0.540	
Water Level (m)							
Water Depth (m)							
Water Temperature(°C)	13.2	14.9	16.9	17.5	16.7	15.8	17.1
Color							
Odor							
EC(mS/m)	394	163	141	260	216	116	304
Turbidity	4.2	3.8	2.8	4.8	20.0	15.0	55.0
pH	7.5	7.5	7.2	6.7	7.1	7.0	6.7
Dissolved O ₂ (mg/l)	5.2	6.2	5.2	1.0	1.0	6.8	1.4
BOD (mg/l)	1.0	2.0	8.0	7.0	3.0	6.1	2.0
COD(Cr) (mg/l)	22.0	15.0	28.3	33.2	50.0	18.5	51.8
COD(Mn) (mg/l)	5.3	7.7	6.1	10.1	12.1	7.3	12.1
TOC (mg/l)	2.3	2.8	3.4	2.1	6.2	1.6	5.6
Humic acid (mg/l)	4.4	7.0	4.3	6.3	2.2	1.9	11.1
T-N(mg/l)	2.4	2.1	2.0	6.5	2.0	1.8	2.2
NH ₄ ⁺ -N (mg/l)	0.21	0.23	0.56	0.67	0.09	0.06	0.31
NO ₃ ⁻ -N(mg/l)	0.4	ND	0.2	0.1	0.3	0.3	0.1
NO ₂ ⁻ -N(mg/l)	0.013	0.001	0.001	0.001	0.001	ND	ND
T-P(mg/l)	0.13	0.05	0.11	0.74	0.05	0.05	0.03
PO ₄ ³⁻ -P(mg/l)	0.01	0.02	0.01	0.50	0.05	ND	0.03
SS (mg/l)	5.0	3.0	7.5	10.7	13.0	8.0	28.6
Particle size distribution(% 400-38micron)							
V-SS (mg/l)	0.0	0.0	0.0	0.0	12.0	0.0	27.1
Phenol (mg/l)	-	0.000	-	0.000	0.000	-	0.000
Arsenic (mg/l)	-	0.000	-	0.000	0.000	-	0.000
Cadmium (mg/l)	-	0.00	-	0.00	0.00	-	0.00
Cyanide (mg/l)	-	0.0	-	0.0	0.0	-	0.0
Cr6+ (mg/l)	-	0.00	-	0.00	0.00	-	0.00
Copper (mg/l)	-	0.00	-	0.00	0.00	-	0.00
Hg (mg/l)	-	0.0000	-	0.0000	0.0000	-	0.0000
Ni2+ (mg/l)	-	0.00	-	0.00	0.00	-	0.00
Lead (mg/l)	-	0.00	-	0.00	0.00	-	0.00
Zinc (mg/l)	-	0.00	-	0.00	0.00	-	0.00
Iron(mg/l)	0.59	1.28	2.77	2.91	1.75	2.48	8.65
Manganese(mg/l)							
Organo-chlorine Pesticide (mg/l)	-	0.000	-	0.000	0.000	-	0.000
Organo-phosphorus Pesticide (mg/l)	-	0.000	-	0.000	0.000	-	0.000
Organo-carbonate Pesticide (mg/l)	-	0.000	-	0.000	0.000	-	0.000
Total Coliform (MPN)	<30X10 ²	30X10 ²	<30X10 ²	11X10 ⁴	11X10 ⁴	36X10 ²	30X10 ²
Facal Coliform (MPN)	<30X10 ²	30X10 ²	<30X10 ²	11X10 ⁴	61X10 ³	36X10 ²	30X10 ²

Table E.1.13 Results of Water Quality Observation at the Principal River Stations/Ground-water in Dry Season 2/4

Sample No.	8	9	10	11	12		
River/Ground W Name	Suarez River	Susa River	Simijaca River	Ground Water (Ubate River Sub-Basin)	Ground Water (Suarez River Sub-Basin)		
Sampling Site	Estacion Sarabita	Pte Reralonso	PTE GUZMAN	ALBAIDA II (pozo # 4)	SUGAMUXI POZO		
Remarks							
Code No.	QR-7	QR-8	QR-9	QU-1	QU-2		
Sampling Date	1999/7/14	1999/7/13	1999/7/13	1999/7/13	1999/7/14/16		
Sampling Time	10:00	15:30	14:00	14:00	9:10		
Climate							
Discharge(m ³ /s)	0.474	0.093	0.271	-	-		
Water Level (m)				-1.20	0.60		
Water Depth (m)							
Water Temperature(°C)	15.3	16.3	16.3	18.1	16.6		
Color							
Odor							
EC(mS/m)	150	92.0	99.0	906	200		
Turbidity	26.0	3.4	15.0	460	610		
pH	7.2	6.8	7.1	6.3	6.9		
Dissolved O ₂ (mg/l)	5.4	4.6	4.6	0.0	1.2		
BOD (mg/l)	2.0	5.0	8.0	34.0	1.0		
COD(Cr) (mg/l)	26.1	22.1	41.3	300	20.3		
COD(Mn) (mg/l)	34.6	23.5	4.1	-	-		
TOC (mg/l)				-	-		
Humic acid (mg/l)	12.6	13.3	1.5	-	-		
T-N(mg/l)	2.6	3.6	13.6	33.7	2.7		
NH ₄ ⁺ -N (mg/l)	0.15	0.24	0.07	30.13	2.27		
NO ₃ ⁻ -N(mg/l)	0.3	ND	0.2	0.4	ND		
NO ₂ ⁻ -N(mg/l)	0.008	0.004	ND	ND	ND		
T-P(mg/l)	0.17	ND	0.26	5.51	0.43		
PO ₄ ³⁻ -P(mg/l)	0.05	ND	0.05	ND	ND		
SS (mg/l)	25.0	7.0	7.1	573	270		
Particle size distribution(% 400-38micron)							
V-SS (mg/l)	17.0	0.0	0.0	313	68.3		
Phenol (mg/l)	0.000	-	-	0.000	0.000		
Arsenic (mg/l)	0.000	-	-	0.000	0.000		
Cadmium (mg/l)	0.00	-	-	0.00	0.00		
Cyanide (mg/l)	0.0	-	-	0.0	0.0		
Cr6+ (mg/l)	0.00	-	-	0.00	0.00		
Copper (mg/l)	0.00	-	-	0.00	0.00		
Hg (mg/l)	0.0000	-	-	0.0000	0.0000		
Ni2+ (mg/l)	0.00	-	-	0.00	0.00		
Lead (mg/l)	0.00	-	-	0.00	0.00		
Zinc (mg/l)	0.00	-	-	0.00	0.00		
Iron(mg/l)	1.28	1.47	1.87	91.80	73.4		
Manganese(mg/l)				1.18	0.60		
Organo-chlorine Pesticide (mg/l)	0.000	-	-	0.000	0.000		
Organo-phosphorus Pesticide (mg/l)	0.000	-	-	0.000	0.000		
Organo-carbonate Pesticide (mg/l)	0.000	-	-	0.000	0.000		
Total Coliform (MPN)	93X10 ³	11X10 ⁵	21X10 ²	23X10	30X10 ³		
Facal Coliform (MPN)	23X10 ³	11X10 ⁵	15X10 ²	30.00	30X10 ³		

**Table E.1.13 Results of Water Quality Observation at the Principal River Stations/Ground-water
in Dry Season 3/4**

Sample No.	1	2	3	4	5	6	7
River Name	Hato Dam	Ubate River	Lenguazaque River	Ubate River	Suarez River	Chiquinquirá River	Suarez River
Sampling Site	Outlet of Dam	Downstream of Ubate City	Verda Punta Gande	Colorado	Balsa Bridge	Upstream of Chiquinquirá City	Before Tolón Gate
Remarks							
Code No.	QS-4	QR-1	QR-2	QR-3	QR-4	QR-5	QR-6
Sampling Date	1999/7/27	1999/7/27	1999/7/28	1999/7/28	1999/7/27	1999/7/27	1999/7/27
Sampling Time	10:20	13:10	12:25	14:10	11:15	10:55	10:35
Climate							
Discharge(m ³ /s)	0.407	-	0.09	-	-	0.217	-
Water Level (m)							
Water Depth (m)	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial
Water Temperature(°C)	15.6	17.3	16.3	19.2	18.1	14.1	19.3
Color							
Odor							
EC(mS/m)	124	175	164	422	332	176	362
Turbidity	10.0	7.7	5.6	6.6	5.0	5.2	27.0
pH	7.7	7.8	8.3	7.2	7.0	7.2	6.7
Dissolved O ₂ (mg/l)	5.2	7.0	3.9	0.3	4.0	7.0	3.2
BOD (mg/l)	1.0	1.0	2.1	5.3	1.0	6.5	2.6
COD(Cr) (mg/l)	21.0	20.6	42.5	94.8	85.5	38.7	30.3
COD(Mn) (mg/l)							
TOC (mg/l)							
Humic acid (mg/l)							
T-N(mg/l)	4.1	4.5	2.4	7.3	2.0	1.7	2.8
NH ₄ ⁺ -N (mg/l)	0.64	0.10	0.59	4.00	1.13	0.73	0.74
NO ₃ ⁻ -N(mg/l)	0.1	0.1	0.2	0.7	0.6	0.4	0.4
NO ₂ ⁻ -N(mg/l)	0.000	0.004	0.003	0.000	0.001	0.001	0.001
T-P(mg/l)	0.14	0.09	0.08	0.81	0.03	0.06	0.11
PO ₄ ³⁻ -P(mg/l)	0.04	0.02	0.07	0.57	0.02	0.01	0.01
SS (mg/l)	9.0	13.0	6.0	18.0	9.0	8.0	10.0
Particle size distribution(% 400-38micron)							
V-SS (mg/l)	2.0	10.0	0.0	0.0	0.0	0.0	0.0
Phenol (mg/l)	-	-	-	-	-	-	-
Arsenic (mg/l)	-	-	-	-	-	-	-
Cadmium (mg/l)	-	-	-	-	-	-	-
Cyanide (mg/l)	-	-	-	-	-	-	-
Cr6+ (mg/l)	-	-	-	-	-	-	-
Copper (mg/l)	-	-	-	-	-	-	-
Hg (mg/l)	-	-	-	-	-	-	-
Ni2+ (mg/l)	-	-	-	-	-	-	-
Lead (mg/l)	-	-	-	-	-	-	-
Zinc (mg/l)	-	-	-	-	-	-	-
Iron(mg/l)	2.33	1.09	1.65	2.77	1.84	2.03	3.13
Manganese(mg/l)							
Organo-chlorine Pesticide (mg/l)	-	-	-	-	-	-	-
Organo-phosphorus Pesticide (mg/l)	-	-	-	-	-	-	-
Organo-carbonate Pesticide (mg/l)	-	-	-	-	-	-	-
Total Cloakroom (MAN)	7	43X10 ²	24X10 ²	21X10 ⁴	<30X10 ³	93X10	38X10
Facial Cloakroom (MAN)	4	43X10 ²	43X10	11X10 ⁴	<30X10 ³	<30	20X10

Table E.1.13 Results of Water Quality Observation at the Principal River Stations/Ground-water in Dry Season 4/4

Sample No.	8	9	10	11	12		
River/Ground W Name	Sears River	USA River	Simijaca River	Ground Water (Ubate River Sub-Basin)	Ground Water (Suarez River Sub-Basin)		
Sampling Site	Estacion Sarabita	Pte Reralonso	PTE GUZMAN	ALBAIDA II (pozo # 4)	SUGAMUXI POZO		
Remarks							
Code No.	QR-7	QR-8	QR-9	QU-1	QU-2		
Sampling Date	1999/7/27	1999/7/26	1999/7/27	1999/7/26	1999/7/27		
Sampling Time	10:10	15:15	14:05	13:40	9:30		
Climate							
Discharge(m ³ /s)	0.289	0.053	0.140	-	-		
Water Level (m)				-1.38	-0.84		
Water Depth (m)	Superficial	Superficial	Superficial	Superficial	Superficial		
Water Temperature(°C)	14.9	15.9	15.3	18.2	18.4		
Color							
Odor							
EC(mS/m)	248	151.0	172.0	1409	412		
Turbidity	37.0	7.0	15.0	1800	800		
pH	7.1	7.3	6.8	6.5	6.8		
Dissolved O ₂ (mg/l)	4.8	2.7	3.2	0.0	0.5		
BOD (mg/l)	2.5	6.3	7.5	13.4	2.1		
COD(Cr) (mg/l)	35.6	19.0	22.0	219	67.6		
COD(Mn) (mg/l)							
TOC (mg/l)							
Humic acid (mg/l)							
T-N(mg/l)	2.7	3.4	3.0	38.4	3.00		
NH ₄ ⁺ -N (mg/l)	1.26	1.25	1.87	29.40	2.18		
NO ₃ ⁻ -N(mg/l)	0.1	0.1	0.2	0.6	0.30		
NO ₂ ⁻ -N(mg/l)	0.019	0.006	0.003	0.006	ND		
T-P(mg/l)	0.19	0.33	0.40	0.53	0.36		
PO ₄ ³⁻ -P(mg/l)	0.07	0.14	0.14	ND	ND		
SS (mg/l)	32.0	20.0	13.0	371	213		
Particle size distribution(% 400-38micron)							
V-SS (mg/l)	22.0	0.0	0.0	100	55.0		
Phenol (mg/l)	-	-	-	-	-		
Arsenic (mg/l)	-	-	-	-	-		
Cadmium (mg/l)	-	-	-	-	-		
Cyanide (mg/l)	-	-	-	-	-		
Cr6+ (mg/l)	-	-	-	-	-		
Copper (mg/l)	-	-	-	-	-		
Hg (mg/l)	-	-	-	-	-		
Ni2+ (mg/l)	-	-	-	-	-		
Lead (mg/l)	-	-	-	-	-		
Zinc (mg/l)	-	-	-	-	-		
Iron(mg/l)	3.07	1.39	1.69	96.20	60.4		
Manganese(mg/l)				0.91	0.60		
Organo-chlorine Pesticide (mg/l)	-	-	-	-	-		
Organo-phosphorus Pesticide (mg/l)	-	-	-	-	-		
Organo-carbonate Pesticide (mg/l)	-	-	-	-	-		
Total Coliform	24X10 ⁴	23X10 ³	93X10 ⁴	43X10	23X10		
Facal Coliform	24X10 ⁴	23X10 ³	15X10 ⁴	30	91		

Table E 1.14 Results of Water Quality Observation at the Secondary River Stations in Dry Season-1/2

Sample No.	1	2	3	4	5	6	7	8	9	10
River Name	Lenguazaque	Q. Obejeras	Q. Mojica	Suta	Q. La Playa	Fuquene	Q. Honda	Q. Mina	Ubate	Vallado Madre
Sampling Site	Lowest	Lowest	Lowest	Lowest	La Malilla	Chinzaque	Fuquene	Tica.Muna	La.Baiero	Vereda Taquila
Remarks										
Code No.	AD-1	AD-2	AD-3	AD-4	AD-6	AD-8	AD-9	AD-10	AD-11	QS-3
Sampling Date	1999/7/15	1999/7/15	1999/7/15	1999/7/15	1999/7/16	1999/7/16	1999/7/16	1999/7/16	1999/7/16	1999/7/16
Sampling Time	10:55	10:45	11:35	12:45	14:00	15:05	15:50	15:40	15:15	14:30
Climate										
Discharge(m ³ /s)	0.248	0.000	0.001	0.001	0.167	0.0003	0.018	0.0003	0.273	0.003
Water Level (m)										
Water Depth (m)	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial
Water Temperature(°C)	13.3	13.2	12.8	16.9	15.9	16.2	17.7	16.6	19.6	16.6
Color	Beige	Light Gray	Light Beige	Light Yellow	Light Gray	Light Gray	Colorless	Colorless	Grayish Yellow	Light Yellow
Odor	Odorless	Soft Anaerobic	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Light Fish
EC(mS/m)	87	252	65	412	89	61	63	455	142	185
Turbidity	4.3	3.2	4.7	40.3	2.3	5.3	5.5	3.7	3.3	4.8
pH	7.1	7.0	7.1	7.0	8.1	7.2	7.6	8.0	8.3	6.8
BOD (mg/l)	3.0	1.0	5.0	26.6	8.4	1.0	1.0	2.0	2.0	4.0
COD(Cr) (mg/l)	11.0	31.0	39.3	118.0	11.0	22.1	10.9	28.3	8.8	50.2
T-N(mg/l)	2.30	2.80	2.70	3.30	2.00	2.6	5.00	1.1	2.3	2.3
T-P(mg/l)	0.11	0.16	0.1	0.72	0.14	0.04	0.05	0.22	0.07	0.22
SS (mg/l)	1	3	3	288	3	6	7	11	1	16
V-SS (mg/l)	0.0	0.0	0.0	60.0	0.0	0.0	0.0	5.0	0.0	0.0

Table E 1.14 Results of Water Quality Observation at the Secondary River Stations in Dry Season-2/2

Sample No.	1	2	3	4	5	6	7	8	9	10
River Name	Lenguazaque	Q. Obejeras	Q. Mojica	Suta	Q. La Playa	Fuquene	Q. Honda	Q. Mina	Ubate	Vallado Madre
Sampling Site	Lowest	Lowest	Lowest	Lowest	La Malilla	Chinzaque	Fuquene	Tica.Muna	La.Baiero	Vereda Taquila
Remarks										
Code No.	AD-1	AD-2	AD-3	AD-4	AD-6	AD-8	AD-9	AD-10	AD-11	QS-3
Sampling Date	1999/7/28	1999/7/28	1999/7/28	1999/7/28	1999/7/28	1999/7/28	1999/7/28	1999/7/28	1999/7/28	1999/7/28
Sampling Time	11:05	10:45	11:45	12:50	11:00	14:50	14:30	14:55	11:40	13:55
Climate										
Discharge(m ³ /s)	0.229	0.000	0.111	0.0002	0.157	0.004	0.162	0.227	0.641	0.0012
Water Level (m)						0.10				
Water Depth (m)	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial	Superficial
Water Temperature(°C)	13.9	13.8	13.7	16.7	13.7	16.0	15.7	16.2	14.9	16.5
Color	Light Yellow	Colorless	Light Brown	Honey	Light Gray	Light Yellow	Light Gray	Light Gray	Grayish Yellow	Light Yellow
Odor	Odorless	Soft Anaerobic	Odorless	Iron odor	Odorless	Odorless	Odorless	Odorless	Odorless	Light Fish
EC(mS/m)	114.0	371.0	27.5	647.0	133.0	90.1	30.5	478.0	155.0	177.0
Turbidity	5.7	4.4	18.0	40.0	3.9	9.4	20.0	15.2	8.4	25
pH	7.1	6.9	6.9	7.1	7.6	6.8	6.4	7.6	7.6	6.6
BOD (mg/l)	2.6	1.0	1.2	6.2	1.0	1.0	1.0	2.0	1.0	16.0
COD(Cr) (mg/l)	11.0	17.0	19.5	109.0	1.3	7.7	8.7	40.0	8.8	42.5
T-N(mg/l)	2.00	2.40	1.50	2.80	2.30	3.2	1.8	1.1	2.5	1.5
T-P(mg/l)	0.08	0.04	0.08	0.36	0.13	0.02	0.13	0.17	0.09	0.32
SS (mg/l)	22	5	10	29	9	12	17	7	15	63
V-SS (mg/l)	0	0	0	0	2	0	0	0	4	0

Table E.1.15 Results of Biological Observation in the Lake in Dry Season (Phytoplankton)-1/4

Sample No.	1	2	3	4	5	6	7	8
Lake Name	Fuquene Lake		Fuquene Lake		Fuquene Lake		Fuquene Lake	
Sampling Site	Near Ubate Mouth		Near Port		Center		Near Suarez Outlet	
Remarks								
Code No.	QL-1		QL-2		QL-3		QL-4	
Sampling Layer	Upper Layer	Deep Layer	Upper Layer	Deep Layer	Upper Layer	Deep Layer	Upper Layer	Deep Layer
Sampling Date	1999/8/26	1999/8/26	1999/8/26	1999/8/26	1999/8/26	1999/8/26	1999/8/26	1999/8/26
Sampling Time	13:50	13:50	14:10	14:10	15:10	15:10	16:40	16:40
Chlorophyll-a (mg/m ³)	0.30	0.45	0.25	0.36	0.23	0.28	2.15	4.55
Density (Cells/ml)	1520	2700	1550	2800	1950	1350	12700	9750
Taxonomy Description (Genera, species)	<i>Nitzschia sp.</i>	<i>Nitzschia sp.</i>	<i>Nitzschia sp.</i>	<i>Nitzschia sp.</i>	<i>Navicula sp.</i>	<i>Navicula sp.</i>	<i>Tabellaria fenestrata.</i>	<i>Tabellaria fenestrata.</i>
	<i>Synedra ilne.</i>	<i>Synedra ilne.</i>	<i>Cymbella sp.</i>	<i>Navicula sp.</i>	<i>Cosmarium sp.</i>	<i>Closterium sp.</i>	<i>Dratoma sp.</i>	<i>Cymbella sp.</i>
	<i>Microspora sp 1.</i>	<i>Microspora sp 1.</i>	<i>Navicula sp.</i>	<i>Navicula sp2.</i>	<i>Oscillatoria sp 1.</i>	<i>Peridinium sp.</i>	<i>Synedra ilne.</i>	<i>Synedra ilne.</i>
	<i>Spyrogyra sp.</i>	<i>Microspora sp 2.</i>	<i>Panium sp.</i>	<i>Spirataenia sp.</i>			<i>Gomphoriema sp.</i>	<i>Gomphoriema acuminatum</i>
	<i>Spyrogyra sp2.</i>	<i>Spyrogyra sp.</i>	<i>Cosmirium sp2.</i>	<i>Closterium sp.</i>			<i>Microspora sp 2.</i>	<i>Gomphoriema sp.</i>
	<i>Trachetomona-</i>	<i>Closterium sp.</i>					<i>Selenastrum sp.</i>	<i>Navicula sp2.</i>
	<i>volvocina.</i>	<i>Trachetomona-</i>					<i>Cosmarium sp.</i>	<i>Microspora sp 2.</i>
		<i>volvocina.</i>					<i>Cosmarium sp 2.</i>	<i>Panium sp.</i>
							<i>Scenedesmus ecomis.]</i>	<i>Cosmirium sp 1.</i>
							<i>Ulothrix sp.</i>	<i>Cosmirium sp2.</i>
							<i>Lynbye sp.</i>	<i>Scenedesmus ecomis.]</i>
							<i>Oscillatoria sp 1.</i>	<i>Ulothrix sp.</i>
							<i>Oscillatoria sp 2.</i>	<i>Oscillatoria sp 1.</i>
							<i>Phacus sp.</i>	<i>Anabena sp.</i>

Table E.1.15 Results of Biological Observation in the Lake in Dry Season (Macrobenthos) -3/4

Sample No.	1	2	3	4
Code No.	QL-1	QL-2	QL-3	QL-4
Sampling Date	1999/8/26	1999/8/26	1999/8/26	1999/8/26
Sampling Time	13:40	14:20	15:20	17:00
Specimen Numbers	0.0	0.0	0.0	0.0

Table E.1.15 Results of Biological Observation in the Lake in Dry Season (Microbenthos) -4/4

Sample No.	1	2	3	4
Code No.	QL-1	QL-2	QL-3	QL-4
Sampling Date	1999/8/26	1999/8/26	1999/8/26	1999/8/26
Sampling Time	13:40	14:20	15:20	17:00
Specimen Numbers	0.0	0.0	0.0	0.0

Table E.1.16 Results of Production Test in Dry Season -1/4 (Code No.:QL-1)

Sample No.	1	2	3	4	5	6	Remarks
Sampling Time	14:05		16:48		16:48		
Time from Start (hour)	0.00		3.51		3.51		
Dark or Light Bottle	Dark Bottle	Light Bottle	Dark Bottle-1	Dark Bottle-2	Light Bottle-1	Light Bottle-2	
Upper Layer DO(mg/l)	6.4	6.8	5.9	5.6	7.0	7.4	
Deep Layer DO(mg/l)	6.0	5.9	5.5	5.1	6.5	6.3	

Table E.1.16 Results of Production Test in Dry Season-2/4 (Code No.:QL-2)

Sample No.	1	2	3	4	5	6	Remarks
Sampling Time	11:45		16:17		16:17		
Time from Start (hour)	0.00		4.53		4.53		
Dark or Light Bottle	Dark Bottle	Light Bottle	Dark Bottle-1	Dark Bottle-2	Light Bottle-1	Light Bottle-2	
Upper Layer DO(mg/l)	3.6	3.6	3.8	3.6	4.5	4.8	
Deep Layer DO(mg/l)	2.6	2.3	2.6	2.2	2.7	2.9	

Table E.1.16 Results of Production Test in Dry Season -3/4 (Code No.:QL-3)

Sample No.	1	2	3	4	5	6	Remarks
Sampling Time	15:05		17:08		17:08		
Time from Start (hour)	0.00		2.05		2.05		
Dark or Light Bottle	Dark Bottle	Light Bottle	Dark Bottle-1	Dark Bottle-2	Light Bottle-1	Light Bottle-2	
Upper Layer DO(mg/l)	6.6	6.4	6.3	6.0	7.5	7.9	
Deep Layer DO(mg/l)	6.1	6.1	5.7	5.9	6.2	6.4	

Table E.1.16 Results of Production Test in Dry Season -4/4 (Code No.:QL-4)

Sample No.	1	2	3	4	5	6	Remarks
Sampling Time	10:30		16:30		16:30		
Time from Start (hour)	0.00		6.00		6.00		
Dark or Light Bottle	Dark Bottle	Light Bottle	Dark Bottle-1	Dark Bottle-2	Light Bottle-1	Light Bottle-2	
Upper Layer DO(mg/l)	1.3	1.6	0.0	0.0	2.0	2.0	
Deep Layer DO(mg/l)	0.4	0.5	0.0	0.0	0.0	0.0	

Table E.1.17 Results of Settling Test in the Lake in Dry Season

Sample No.	1		2		3		4	
Lake Name	Fuquene Lake		Fuquene Lake		Fuquene Lake		Fuquene Lake	
Sampling Site	Near Ubate Mouth		Near Port		Center		Near Suarez Outlet	
Remarks								
Code No.	QL-1		QL-2		QL-3		QL-4	
Setting Date	1999/9/23		1999/9/23		1999/9/23		1999/9/23	
Sampling Date	1999/10/7		1999/10/7		1999/10/7		1999/10/7	
Test Period (d)	14		14		14		14	
Point Depth (m)	1.90		2.00		4.30		1.80	
Setting Depth (m)	0.50	1.50	0.50	1.50	0.50	3.50	0.50	1.30
SS (mg/l)	Not Observed		Not Observed		161		318	
Particulate size distribution(% 400-38micron)	Not Observed		Not Observed		100		100	
V-SS (mg/l)	Not Observed		Not Observed		38		144	
SS (g/m ² .d)	Not Observed		Not Observed		0.73		1.45	
V-SS (g/m ² .d)	Not Observed		Not Observed		0.17		0.29	

Table E.1.18 Results of Wastewater Quality Observation of Sewerage and Factories in Dry Season -1/2

Sample No.	1	2	3	4	5	6	7	8	9	10
Name of Factory or Sewerage	Lacteos San Andres	Lacteos Ubate	Ubate Slaughterhouse	Parmalat	Dona Leche	Ubate Sewerage System				Colfrance
Sampling Site	Effluent Point QW-1	Affluent Point QW-2	Effluent Point QW-2	Outlet QW-3	Outlet QW-4	Outlet QW-5	Affluent Point QW-6	Effluent Point QW-6	Affluent Point QW-7	Effluent Point QW-7
Sampling Date	1999/9/22	1999/9/22	1999/9/22	1999/9/23	1999/9/22	1999/9/22	Not Work	Not Work	1999/9/22	1999/9/22
Sampling Time	11:00	11:20	11:25	6:45	14:00	14:20			16:10	16:20
Climate										
Discharge(m ³ /s)	30*	160*	650*	650*	500*	650*			100*	
Water Temperature(°C)	17.1	23.1	18.8	19.7	18.2	18.8			23.2	17.8
Color	Milky Gray	Colorless	Gray	Greenish	White	white			white	white Graish
EC(mS/m)	1200	5000	900	125	332	2600			2000	Anaerobic
Turbidity (UNT)	270.0	950.0	5.5	82.0	320	600			360	320
pH	5.30	4.60	6.80	6.60	5.30	5.10			4.00	4.50
BOD (mg/l)	990.0	15000	159.0	51.0	710.0	1620			3000	2520
COD(Cr) (mg/l)	1015	34600	264.0	105.0	824.0	2820			17115	3320
T-N(mg/l)	29.4	691.2	16.50	8.60	25.1	83.1			98.8	79.3
NH ₄ ⁺ -N (mg/l)	19.6	149.2	16.10	1.48	2.28	13.1			20.2	50.3
NO ₂ -N(mg/l)	1.37	1.02	0.61	0.61	1.83	0.94			1.19	1.83
NO ₃ -N(mg/l)	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00
T-P(mg/l)	9.53	30.3	13.4	1.88	3.49	76.9			82.1	32.9
PO ₄ ³⁻ -P(mg/l)	9.03	15.7	10.38	1.05	2.89	75.9			51.6	25.7
SS (mg/l)	250	3440.0	120	300	325	2100			850	330
Total Coliform (MPN)	-	-	-	-	-	-			-	-
Fecal Coliform (MPN)	-	-	-	-	-	-			-	-

Table E.1.18 Results of Wastewater Quality Observation of Sewerage and Factories in Dry Season -2/2

Sample No.	11	12	13	14	15	16	17	18	19
Name of Factory or Sewerage	Alpina	Delcy	Simijaca Slaughterhouse	Cucunuba Sewerage System	Saboya Sewerage System	Ubate Sewerage System			
Sampling Site	Outlet QW-8	Outlet QW-9	Affluent Point QW-10	Effluent Point QW-10	Affluent Point QW-11	Effluent Point QW-11	Affluent Point QW-12	Effluent Point QW-12	Effluent Point QW-13
Sampling Date	1999/9/22	1999/9/22	1999/9/22	1999/9/22	1999/9/23	1999/9/23	1999/9/23	1999/9/23	1999/9/22
Sampling Time	9:20	9:45	10:10	10:15	8:50	9:00	16:00	16:05	14:30
Climate									
Discharge(m ³ /s)	936*	750*	180*		0.0027		0.0008		0.033
Water Temperature(°C)	18.6	22.1	16.5	17.4	17.5	18.3	15.4	15.8	17.5
Color	White	Colorless	Red	Dark red	Milky Gray	Black	Light Gray	Light Green	Milky Gray
Odor	Rancid Milk	Odorless	Blood	Fetid	Waste	Anaerobic	Waste	Odorless	Strong Waste
EC(mS/m)	6000	260	1500	1200	500	500	380	220	675
Turbidity (UNT)	68	350	45	7.5	16	38	44	32	150
pH	12.6	5.50	6.70	6.80	7.00	7.10	6.50	6.80	5.90
BOD (mg/l)	5.0	900.0	1200	390.0	69.0	62.0	115.0	25.0	720.0
COD(Cr) (mg/l)	319.0	1507	8460	575.0	148.0	78.0	175.0	105.0	872.0
T-N(mg/l)	9.5	29.7	613.6	49.8	13.9	18.0	16.3	11.4	7.70
NH ₄ ⁺ -N (mg/l)	0.99	0.73	32.5	2.18	6.22	8.06	6.22	1.23	6.81
NO ₂ -N(mg/l)	1.02	0.94	1.18	2.15	0.22	0.61	0.77	0.86	0.86
NO ₃ -N(mg/l)	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-P(mg/l)	1.51	11.5	8.27	3.27	2.87	1.97	3.02	1.42	11.8
PO ₄ ³⁻ -P(mg/l)	0.53	9.41	4.56	6.00	2.23	1.75	2.59	1.15	8.36
SS (mg/l)	267	260	1080	190	153	70	188	78	230
Total Coliform (MPN)	-	-	-	-	-	24X10 ⁶	-	15	-
Fecal Coliform (MPN)	-	-	-	-	-	24X10 ⁶	-	7	-

* .m³/month

Table E.1.1.19 Standards of Surface Water Quality and Wastewater Effluents (National Standards) -1/2

No.	Item (Quality Parameter)	Unit	Permissible Concentration					Remarks
			For Drinking Water with Disinfecting	For Drinking Water with Conventional Treatment	Agriculture	Stockbreeding	Recreation (Primary Water Contact)	
1	Water temperature	°C	6.5-8.5	5.0-9.0	4.5-9.0	5.0-9.0	5.0-9.0	※ >70.0% ※ ratio of saturation
3	DO	O ₂ mg/l						
4	BOD ₅ (BOD ₅)	O ₂ mg/l						
5	Suspended Solid	SS mg/l						
6	Lead	Pb mg/l	0.05	0.05	5.0	0.1		
7	Zinc	Zn mg/l	15.0	15.0	2.0	25.0		
8	Copper	Cu mg/l	1.0	1.0	0.2	0.5		
9	Chromium	Cr ⁶⁺ mg/l	0.05	0.05	0.1	1.0		
10	Nickel	Ni mg/l			0.2			
11	Cobalt	Co mg/l			0.05			
12	Mercury	Hg mg/l	0.002	0.002		0.01		
13	Arsenic	As mg/l	0.05	0.05	0.1	0.2		
14	Barium	Ba mg/l	1.0	1.0				
15	Cadmium	Cd mg/l	0.01	0.01	0.01	0.05		
16	Cyanide	CN mg/l	0.2	0.2				
17	Polychlorobiphenyl	PCB mg/l	N.D.	N.D.				
18	Molybdenum	Mo mg/l			0.01			
19	Silver	Ag mg/l	0.05	0.05				
20	Selenium	Se mg/l	0.01	0.01	0.02			
21	Vanadium	V mg/l			0.1			
22	Boron	B mg/l				5.0		
23	Fluorine	F mg/l			1.0			
24	Phenol	C ₆ H ₅ OH mg/l	0.002	0.002		0.002		
25	Organomercury Compounds	Hg mg/l						
26	Trichloroethylene	C ₂ H ₃ Cl ₃ mg/l						
27	Chloroform	CHCl ₃ mg/l						
28	Tetrachloroethane	CCl ₄ mg/l						
29	Dichloroethylene	C ₂ H ₂ Cl ₂ mg/l						
30	Carbon disulfide	CS ₂ mg/l						
31	Other organochlorine compounds	mg/l						
32	Other organophosphoric compounds	mg/l						
33	Carbamate	mg/l						
34	Iron	Fe mg/l			5.0			
35	Manganese	Mn mg/l			0.2			
36	Lithium	Li mg/l			2.5			
37	Beryllium	Be mg/l			0.1			
38	Aluminum	Al mg/l			5.0	5.0		
39	Ammonium	NH ₄ -N mg/l	1.0	1.0				
40	Nitrate	NO ₃ -N mg/l	10.0	10.0				
41	Nitrite	NO ₂ -N mg/l	1.0	1.0				
42	Nitrate + Nitrite	N mg/l				10.0		
43	Salt	Weight mg/l				100.0		
44	Floating Material	mg/l				3,000		
45	SVI	ml/l						
46	N-hexane extract substance	mg/l						
47	Oil/Grease	mg/l						
48	Chloride	Cl mg/l	250.0	250.0				
49	Color	Real Color	20	75				
50	Sulfate	SO ₄ ⁻ mg/l	400.0	400.0				
51	Methylene blue active substance	mg/l	0.5	0.5				
52	Turbidity	UJT	10					
53	Total coliform	MPN	<1,000	<20,000				
54	Fecal coliform	MPN		<1,000				
55	Acid, Inflammable Substance			<200				

Table E.1.19 Standards of Surface Water Quality and Wastewater Effluents (National Standards) -2/2

No.	Item (Quality Parameter)	Unit	Permissible Concentration			
			Existing User	New User	Existing User	New User
1	Wattertemperature	°C	<40°C	<40°C	<40°C	<40°C
2	pH	()	5.0-9.0	5.0-9.0	5.0-9.0	5.0-9.0
3	DO	O ₂ mg/l				
4	BOD ₅ (BOD ₅)	O ₂ mg/l	Removal >30% in Pollutant Load	Removal >80% in Pollutant Load	Removal >20% in Pollutant Load	Removal >80% in Pollutant Load
5	Suspended Solid	SS mg/l	Removal >50% in Pollutant Load	Removal >80% in Pollutant Load	Removal >50% in Pollutant Load	Removal >80% in Pollutant Load
6	Lead	Pb mg/l				0.5
7	Zinc	Zn mg/l				
8	Copper	Cu mg/l				3.0
9	Chromium	Cr ₆₊ mg/l				
10	Nickel	Ni mg/l				2.0
11	Cobalt	Co mg/l				
12	Mercury	Hg mg/l				0.02
13	Arsenic	As mg/l				0.5
14	Barium	Ba mg/l				5.0
15	Cadmium	Cd mg/l				0.1
16	Cyanide	CN mg/l				1.0
17	Polychlorobiphenyl	PCB mg/l				N.D.>
18	Molybdenum	Mo mg/l				
19	Silver	Ag mg/l				0.5
20	Selenium	Se mg/l				0.5
21	Vanadium	V mg/l				
22	Boron	B mg/l				
23	Fluorine	F mg/l				
24	Phenol	C ₆ H ₅ OH mg/l				0.2
25	Organicmercury Compounds	Hg mg/l				N.D.
26	Trichloroethylene	C ₂ H ₃ Cl ₃ mg/l				1.0
27	Chloroform	CHCl ₃ mg/l				1.0
28	Tetrachloroethane	CCl ₄ mg/l				1.0
29	Dichloroethylene	C ₂ H ₂ Cl ₂ mg/l				1.0
30	Carbon disulfide	CS ₂ mg/l				1.0
31	Other organochloric compounds	mg/l				0.05
32	Other organophosphoric compound:	mg/l				0.1
33	Carbamate	mg/l				0.1
34	Iron	Fe mg/l				
35	Manganese	Mn mg/l				
36	Lithium	Li mg/l				
37	Beryllium	Be mg/l				
38	Aluminum	Al mg/l				
39	Ammonium	NH ₄ -N mg/l				
40	Nitrate	NO ₃ -N mg/l				
41	Nitrite	NO ₂ -N mg/l				
42	Nitrate + Nitrite	N mg/l				
43	Salt	Weight mg/l				
44	Floating Material	mg/l	absent	absent		
45	SVI	ml/l			10	10
46	N-hexane extract substance	mg/l			100.0	100.0
47	Oil/Grease	mg/l				
48	Chloride	Cl mg/l				
49	Color	Real Color				
50	Sulfate	SO ₄ mg/l				
51	Methylene blue active substance	mg/l				
52	Turbidity	UJT				
53	Total coliform	MPN				
54	Fecal coliform	MPN				
55	Acrid, Inflammable Substance				absent	absent

Table E.1.20 Standards of Surface Water Quality (CAR Standards)

No.	Item (Quality Parameter)	Unit	Permissible Concentration					Remarks
			For Drinking Water with Disinfecting	For Drinking Water with Conventional Treatment	Agriculture	Stockbreeding	Recreation (Primary Water Contact)	
1	Water temperature	°C						
2	pH	(-)	6.5-8.5	5.0-9.0	4.5-9.0	5.0-9.0	5.0-9.0	
3	DO	O ₂ mg/l	>6.0	>4.0		>70.0%	>70.0%	ratio of saturation
4	BOD ₅ (BOD ₅)	O ₂ mg/l	5.0	7.0				
5	Suspended Solid	SS mg/l						
6	Lead	Pb mg/l	0.05	0.05	5.0	0.1		
7	Zinc	Zn mg/l	15.0	15.0	2.0	25.0		
8	Copper	Cu mg/l	1.0	1.0	0.2	0.5		
9	Chromium	Cr ⁶⁺ mg/l	0.05	0.05	0.1	1.0		
10	Nickel	Ni mg/l			0.2			
11	Cobalt	Co mg/l			0.05			
12	Mercury	Hg mg/l	0.002	0.002		0.01		
13	Arsenic	As mg/l	0.05	0.05	0.1	0.2		
14	Barium	Ba mg/l	1.0	1.0				
15	Cadmium	Cd mg/l	0.01	0.01	0.01	0.05		
16	Cyanide	CN mg/l	0.2	0.2				
17	Polychlorobiphenyl	PCB mg/l	N.D.	N.D.				
18	Molybdenum	Mo mg/l			0.01			
19	Silver	Ag mg/l	0.05	0.05				
20	Selenium	Se mg/l	0.01	0.01	0.02			
21	Vanadium	V mg/l			0.1			
22	Boron	B mg/l				5.0		
23	Fluorine	F mg/l			1.0			
24	Phenol	C ₆ H ₅ OH mg/l	0.002	0.002			0.002	
25	Organomercury Compounds	Hg mg/l						
26	Trichloroethylene	C ₂ H ₃ Cl ₃ mg/l						
27	Chloroform	CHCl ₃ mg/l						
28	Tetrachloroethane	CCl ₄ mg/l						
29	Dichloroethylene	C ₂ H ₂ Cl ₂ mg/l						
30	Carbon disulfide	CS ₂ mg/l						
31	Other organochlorine compounds	mg/l						
32	Other organophosphoric compounds	mg/l						
33	Carbamate	mg/l						
34	Iron	Fe mg/l			5.0			
35	Manganese	Mn mg/l			0.2			
36	Lithium	Li mg/l			2.5			
37	Beryllium	Be mg/l			0.1			
38	Aluminum	Al mg/l			5.0		5.0	
39	Ammonium	NH ₄ -N mg/l	1.0	1.0				
40	Nitrate	NO ₃ -N mg/l	10.0	10.0			10.0	
41	Nitrite	NO ₂ -N mg/l	1.0	1.0			100.0	
42	Nitrate + Nitrite	N mg/l					3,000	
43	Salt	Weight mg/l						
44	Floating Material	mg/l						
45	SVI	ml/l						
46	N-hexane extract substance	mg/l						
47	Oil/Grease	mg/l						
48	Chloride	Cl mg/l	250.0	250.0				
49	Color	Real Color	20	75				Scale of platinum and cobalt
50	Sulfate	SO ₄ ⁻² mg/l	400.0	400.0				
51	Methylene blue active substance	mg/l	0.5	0.5			0.5	Active Substance to Methylene Blue
52	Turbidity	UJT	10	20				
53	Total coliform	MPN	<1,000	<20,000			<1,000	
54	Fecal coliform	MPN		<2,000			<200	
55	Acids, Inflammable Substance	-						

Table E.2.1 Sewerage System in Study Area

No. Name of Municipality	Population in 1998		Sewerage System										Collection System					
	Urban	Rural	Type of Toilet		Flush Toilet to Sewerage	Flush Toilet to Septic Tank	Latrine	None	Service Population*	Service Area (ha.)	No. of Factories	Pipe Length (km)		Diameter(cm)		Treatment Method	Completion Year	River Name
			Max.	Min														
1 Carmen de Carupa	1,511	8,259	1,300	20	0	1,300	(300)	38	0	No Data	30.48	15.24	None	Q. Sucinica	Combined			
2 Ubate	16,883	22,592	16,750	4,000	2,500	16,750	(3350)	158	88	36	60.96	20.32	R.A.P	Suta	Combined			
3 Tausa	955	6,462	955	240	240	955	(191)	25	2	No Data	40.64	20.32	None	Suta	Separate			
4 Sutatausa	1,104	3,438	582	53	92	582	(155)	35	0	3.5	25.4	15.24	None	Suta	Combined			
5 Cucumbra	1,226	7,991	1,153	0	0	1,153	(310)	26	13.5	25.4	15.24	3 Lagoons	1992	San Isidro	Combined			
6 Lenguazaque	2,133	7,764	1,800	0	835	6,814	(410)	49	0	5.1	25.4	20.32	Activated Sludge	1998	Lenguazaque	Separate		
7 Guacheta	3,621	8,717	3,366	4,893	3,262	3,366	(625)	57	7	6	60.96	20.32	None	Q. Gualacia	Combined			
8 San Miguel de Sema	525	3,967	500	20	4,700	500	(116)	31	1	2.8	25.4	20.32	Stabilization Pond	1995	Q. Santa Ana			
9 Fuquene	348	4,629	300	440	3,960	300	(45)	15	0	1.5	30.48	20.32	None	Irrigation	Separate			
Capellania	500		500			500	(150)			4	30.48	20.32	None	Q. Bautista	Separate			
10 Susa	1,368	4,893				1,300	(400)	60	1	2.5	40.64	20.32	None	Susa	Separate			
11 Simijaca	4,215	5,556	4,500	310	5,740	4,500	(1340)	85	1	19	40.64	20.32	None	Simijaca	Combined			
12 Caldas	275	5,501	86	4	10	86	(43)	14	0	1	30.48	20.32	None	Chiquinquirá	Combined			
13 Chiquinquirá	41,021	8,154	42,000	5,000	1,000	42,000	(8400)	458	12	60	147	25.4	None	Suarez	Combined			
14 Saboya	979	13,099	1,098	228		1,098	(183)	40	0	12	40.64	20.32	Stabilization Ponds	1992	Q. La Ruda	Separate		

* Figure in parentheses is number of households.

Table E.2.2 List of Industrial Establishment in Study Area

No.	Name of Factory	Activity	Municipality	Treat-ment	Discharging Point	Size	Question-naire	Observa-tion
1	Dona Leche	Dairy Processing	Ubate	W	Sewerage	Large	x	x
2	Fabrica de Quesos San Jose	Dairy Processing	Ubate		Sewerage	Midium	x	
3	Lacteos San Andres	Dairy Processing	Ubate	W	Irrigation	Midium	x	x
4	Lacteos Ubate	Dairy Processing	Ubate	W	Sewerage	Midium	x	x
5	Fabrica de Quesos (Benedicto Murcia)	Dairy Processing	Ubate		Sewerage	Small		
6	Fabrica de Quesos (Luis Cardenas)	Dairy Processing	Ubate		Sewerage	Small		
7	Fabrica de Quesos (Onofre Trivino)	Dairy Processing	Ubate		Sewerage	Small		
8	Fabrica de Quesos Alesmar	Dairy Processing	Ubate		Sewerage	Small		
9	La Gran Vaquita	Dairy Processing	Ubate		Sewerage	Small	x	
10	Lacteos Don Luis	Dairy Processing	Ubate		Sewerage	Small	x	
11	Lacteos el Manatial	Dairy Processing	Ubate	W	Irrigation	Small	x	
12	Lacteos el Rusal	Dairy Processing	Ubate		Sewerage	Small		
13	Lacteos el Venado	Dairy Processing	Ubate		Sewerage	Small		
14	Lacteos Hato Chips	Dairy Processing	Ubate		Sewerage	Small	x	
15	Lacteos La Esperanza	Dairy Processing	Ubate		Sewerage	Small		
16	Lacteos la Pirinola	Dairy Processing	Ubate		Sewerage	Small	x	
17	Lacteos la Superior	Dairy Processing	Ubate		Sewerage	Small		
18	Lacteos Sello Dorado	Dairy Processing	Ubate		Sewerage	Small		
19	Lacteos Villa Julia	Dairy Processing	Ubate		Sewerage	Small		
20	Quesadillos la Chagrita	Dairy Processing	Ubate		Sewerage	Small		
21	Quesadillos la Gaviote	Dairy Processing	Ubate		Sewerage	Small		
22	Quesos el Candado	Dairy Processing	Ubate		Sewerage	Small		
23	Quesos Gomur	Dairy Processing	Ubate		Sewerage	Small	x	
24	Quesos las Margarita	Dairy Processing	Ubate		Sewerage	Small		
25	Quesos los Alpes	Dairy Processing	Ubate		Sewerage	Small	x	
26	Quesos San Jorge	Dairy Processing	Ubate		Sewerage	Small		
27	Quesos Villa Ubate	Dairy Processing	Ubate		Irrigation	Small	x	
28	Lacteos Levelma	Dairy Processing	Tausa		Q.Aguaclara	Small		
29	Lacteos Cestagalli	Dairy Processing	Guacheta		Q.Mina	Small		
30	Colfrance	Dairy Processing	Fuquene	W	Irrigation	Large	x	x
31	Quesos Real	Dairy Processing	Fuquene		Fuquene	Small		
32	Incolacteos	Dairy Processing	Simijaca	W	Irrigation	Large	x	
33	Lacteos el Becerro	Dairy Processing	Simijaca		Sewerage	Small		
34	Lacteos La Libertad	Dairy Processing	Simijaca		Sewerage	Small		
35	Productora La Cuajada	Dairy Processing	Simijaca		Sewerage	Small		
36	Lacteos Coagroleche	Dairy Processing	Chiquinquira		Sewerage	Small		
37	Lacteos del Mund	Dairy Processing	Chiquinquira		Sewerage	Small		
38	Lacteos La Competencia	Dairy Processing	Chiquinquira		Sewerage	Small		
39	Lacteos la Quince	Dairy Processing	Chiquinquira		Sewerage	Small		
40	Lacteos Pedro F. Ortiz	Dairy Processing	Chiquinquira		Sewerage	Small		
41	Lacteos Pedro Ruiz	Dairy Processing	Chiquinquira		Sewerage	Small		
42	Lacteos Tirso Garcia	Dairy Processing	Chiquinquira		Sewerage	Small		
43	Lacteos Victor Cuervo	Dairy Processing	Chiquinquira		Sewerage	Small		
44	Quesos Chiquinquira	Dairy Processing	Chiquinquira		Sewerage	Small		
45	Alqueria	Milk Cooling	Ubate		Sewerage	Large	x	
46	Parmalat	Milk Cooling	Ubate	W	Sewerage	Midium	x	x
47	Parmalat	Milk Cooling	San Miguel	W	Sewerage	Midium		
48	Alpina	Milk Cooling	Simijaca	W	Sewerage	Large	x	x
49	Delay	Milk Cooling	Simijaca		Q. Capitolio	Midium	x	x
50	Acopio de lecho Julio Murcia	Milk Cooling	Chiquinquira		Sewerage	Small		
51	Taxis Furatena	Taxi	Chiquinquira		Sewerage	Small		
52	Gaseosa Postobon S.A.	Beverage	Chiquinquira		Sewerage	Small		
53	La Sabana	Flower	Simijaca	W	Simijaca	Small		
54	Flores/Jardin de Saboya	Flower	Saboya		Q. La Raya	Small		
55	Jardines del Valle	Flower	Saboya		Q. La Raya	Small		
56	Mobil	Gas Station	Tausa			Small		
57	Capellania	Gas Station	Fuquene			Small		
58	Portugal	Gas Station	Fuquene			Small		
59	Tarpel	Gas Station	Susa			Small		
60	Enfriadora Coposa	Gas Station	Simijaca		Sewerage	Small		
61	La Colina	Gas Station	Simijaca	W		Small		
62	Picos del Sicuara	Gas Station	Simijaca	W		Small		
63	Inversiones Roncacio	Gas Station	Chiquinquira		Sewerage	Small		

Table E.2.3 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	BOD	COD	T-N	T-P	
1	Carmen de Carupa	1,300	110	50	62.8	9.5	1.0	0.8	114.4	65.0	81.6	12.35	1.30	Q. Suciniaca		
2	Ubate	16,750	225	50	62.8	9.5	1.0	0.8	3,015.0	837.5	1,051.2	159.13	16.75	Suta		
3	Tausa	955	110	50	62.8	9.5	1.0	0.8	84.0	47.8	59.9	9.07	0.96	Suta		
4	Sutatausa	582	110	50	62.8	9.5	1.0	0.8	51.2	29.1	36.5	5.53	0.58	Suta		
5	Cucumaba	1,153	110	50	62.8	9.5	1.0	0.8	101.5	57.7	72.4	10.95	1.15	San Isidro		
6	Lenguazaque	1,800	170	50	62.8	9.5	1.0	0.8	244.8	90.0	113.0	17.10	1.80	Lenguazaque		
7	Guatecha	3,366	170	50	62.8	9.5	1.0	0.8	457.8	168.3	211.2	31.98	3.37	Q. Gualacia		
8	San Miguel de Sema	500	110	50	62.8	9.5	1.0	0.8	44.0	25.0	31.4	4.75	0.50	Q. Santa Ana		
9	Fuquene	300	110	50	62.8	9.5	1.0	0.8	26.4	15.0	18.8	2.85	0.30	Irrigation		
	Capellania	500	110	50	62.8	9.5	1.0	0.8	44.0	25.0	31.4	4.75	0.50	Q. Bautista		
10	Susa	1,918	110	50	62.8	9.5	1.0	0.8	168.8	95.9	120.4	18.22	1.92	Susa		
11	Simijaca	4,500	170	50	62.8	9.5	1.0	0.8	612.0	225.0	282.4	42.75	4.50	Simijaca		
12	Caldas	86	110	50	62.8	9.5	1.0	0.8	7.6	4.3	5.4	0.82	0.09	Chiquinquira		
13	Chiquinquira	42,000	225	50	62.8	9.5	1.0	0.8	7,560.0	2,100.0	2,635.9	399.00	42.00	Suarez		
14	Saboya	1,098	110	50	62.8	9.5	1.0	0.8	96.6	54.9	68.9	10.43	1.10	Q. La Ruda		

Table E.2.4 Unit Generation Load in Jurisdiction Area of CAR

Activity	Contents	Water Use	Unit Load
Slaughter-house	- Slaughter of cows, pigs and chicken	- Equipment washing	<u>Cow</u>
		- Installation washing	- Wastewater Volume = 1,000 L/head
			- BOD = 7,500 mg/L
	- Selection of sub-products		<u>Pig</u>
			- Wastewater Volume = 500 L/head
			- BOD = 7,500 mg/L
			<u>Chicken</u>
			- Wastewater Volume = 2.5 L/head
			- BOD = 7,500 mg/L
Milk cooling	- Cooling	- Equipment washing	- Wastewater Volume = 2.5 L/L of milk
		- Installation washing	- BOD = 800 mg/L
		- Car washing	
Milk bottling	- Cooling and bottling	- Equipment washing	- Wastewater Volume = 3.0 L/L of milk
		- Installation washing	- BOD = 1,000 mg/L
		- Car washing	
Milk processing	- Processing of milk	- Equipment washing	- Wastewater Volume = 5.0 L/L of milk
		- Installation washing	- BOD = 2,700 mg/L
		- Car washing	
Meat industry	- Slaughter of animals	- Equipment washing	<u>Cow</u>
		- Installation washing	- Wastewater Volume = 2,250 L/head
			- BOD = 2,000 mg/L
	- Selection of sub-products		<u>Pig</u>
			- Wastewater Volume = 1,000 L/head
			- BOD = 2,000 mg/L
	- Processing of meats		

Source: Aguas Residuales en El Area CAR (Ing. Urialdo Pawlowsky, 1982)

Table E.2.5 Effluent Quality of Slaughterhouse

Parameter	Unit	Chocontá		El Colegio	Cachipay	Agua de Dios
		1998.4.21	1999.4.14	1998.12.10	1998.12.15	1999.3.10
Water Temperature	°C	20.7	15.0			
Air Temperature	°C	19.0	12.0			
Conductivity	μ S/cm		727.0			
Oil and Grease	mg/l	226.4	128.0	2.5	195.0	144.0
COD	mg/l	702	2,684	7,503	5,028	7,420
BOD	mg/l	540	2,157	5,420	2,380	3,280
SS	mg/l	407	350	260	1,280	1,008
Total Solids	mg/l	4,068	1,800	5,284	2,794	5,508
Turbidity	NTU	1,000		5,544	4,074	6,516
pH			7.6			7.1
NH ₄ -N	mg/l	47.50	35.99			
NO ₃ -N	mg/l	4.00	3.80			
NO ₂ -N	mg/l	0.0				
Organic N	mg/l	288.0				
Kjeldahl N	mg/l	336.0				811.0
Orto-P	mg/l	10.7				
T-P	mg/l	13.0	5.2			
SO ₄ ²⁻	mg/l	67.0				

Parameter	Unit	Sesquilé	Suesca	Gachancipá	Tocancipá	Average
		1999.4.21	1999.4.21	1999.5.12	1999.5.19	
Water Temperature	°C	15.0	17.0	12.0	16.0	17.9
Air Temperature	°C	14.0	14.0	12.0	12.0	15.5
Conductivity	μ S/cm	3,540	862	1,354		727.0
Oil and Grease	mg/l	2,509	627	388	378	139.2
COD	mg/l	4,792	5,856	6,876	5,018	4,667.4
BOD	mg/l	3,510	2,900	4,280	2,380	2,755.4
SS	mg/l	190	267	1,250	1,157	661.0
Total Solids	mg/l	7,874	4,436	5,550	5,648	3,890.8
Turbidity	NTU					4,283.5
pH		8.30	7.30	8.00	8.10	7.35
NH ₄ -N	mg/l	37.29	35.86	24.61	29.30	41.75
NO ₃ -N	mg/l	15.20	20.80	15.50	20.50	3.90
NO ₂ -N	mg/l					0.00
Organic N	mg/l					288
Kjeldahl N	mg/l					574
Orto-P	mg/l					10.70
T-P	mg/l	32.51	7.33	25.24	47.78	9.09
SO ₄ ²⁻	mg/l					67.0

Table E.2.6 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	15	2.14	16.07	W	5.4	8.6	1.07	0.021	Sewerage
		Cow	150								
2	Ubate	Pig	72	21.37	160.26	W	53.4	85.5	10.68	0.214	Sewerage
		Sheep	72								
3	Tausa	Cow	18	2.54	19.05	W	6.4	10.2	1.27	0.025	Sewerage
4	Sutatausa	Cow	11	1.63	12.19	W	4.1	6.5	0.81	0.016	Q. Chiritoque
5	Cucumuba	Cow	5	0.71	5.36	W	1.8	2.9	0.36	0.007	Sewerage
6	Lenguazaque	Cow	24	3.43	25.71	W	8.6	13.7	1.71	0.034	Sewerage
7	Guacheta	Cow	21	3.00	22.50	W	7.5	12.0	1.50	0.030	Sewerage
8	San Miguel de Sema	Cow	2	0.29	2.14	W	0.7	1.1	0.14	0.003	Q. Los Cerezos
9	Fuquene	Cow	21	3.00	22.50	W	7.5	12.0	1.50	0.030	Fuquene
10	Susa	Cow	22	3.14	23.57	W	7.9	12.6	1.57	0.031	Sewerage
11	Simijaca	Cow	35	5.92	44.38	W	14.8	23.7	2.96	0.059	Q. El Capitodio
12	Caldas	Cow	4	0.57	4.29	W	1.4	2.3	0.29	0.006	Q. La Praya
13	Chiquinquira	Cow	115	16.43	123.21	W	41.1	65.7	8.21	0.164	Chiquinquira
14	Saboya	Cow	21	3.00	22.50	W	7.5	12.0	1.50	0.030	Q. El Cantoco

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

Table E.2.7 Pollution Load Effluent from Dairy Industry (1/2)

No.	Name of Municipality	Activity	Name of Point Source	Treatment	Discharging Point	Size	Milk Processed (L/day)	Wastewater		Removal Ratio	Effluent Load (kg/day)					
								Volume (m ³ /day)	Generated BOD (kg/day)		BOD	COD	T-N	T-P		
1	Ubate	Dairy Processing	Lacteos el Manatíal	W	Irrigation	Large	800	4.0	10.80	0.4	6.5	7.9	1.68	0.810		
2	Ubate	Dairy Processing	Lacteos San Andres	W	Irrigation	Medium	2,800	14.0	37.80	0.4	22.7	27.8	5.87	2.835		
3	Ubate	Dairy Processing	Quesos Villa Ubate		Irrigation	Small	1,500	7.5	20.25	0.0	20.3	24.8	5.24	2.531		
Irrigation Sub-total													49.4	60.5	12.80	6.176
4	Ubate	Dairy Processing	Dona Leche	W	Sewerage	Large	60,000	300.0	810.00	0.4	486.0	594.9	125.87	60.750		
5	Ubate	Dairy Processing	Benedicto Murcia		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
6	Ubate	Dairy Processing	Luis Cardenas		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
7	Ubate	Dairy Processing	Onofre Trivino		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
8	Ubate	Dairy Processing	Fabrica de Quesos Alesmar		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
9	Ubate	Dairy Processing	Fabrica de Quesos San Jose		Sewerage	Small	250	1.3	3.38	0.0	3.4	4.1	0.87	0.422		
10	Ubate	Dairy Processing	La Gran Vaquita		Sewerage	Small	400	2.0	5.40	0.0	5.4	6.6	1.40	0.675		
11	Ubate	Dairy Processing	Lacteos Don Luis		Sewerage	Small	800	4.0	10.80	0.0	10.8	13.2	2.80	1.350		
12	Ubate	Dairy Processing	Lacteos el Rusal		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
13	Ubate	Dairy Processing	Lacteos el Venado		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
14	Ubate	Dairy Processing	Lacteos Hato Chips		Sewerage	Small	600	3.0	8.10	0.0	8.1	9.9	2.10	1.013		
15	Ubate	Dairy Processing	Lacteos La Esperanza		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
16	Ubate	Dairy Processing	Lacteos la Primola		Sewerage	Small	250	1.3	3.38	0.0	3.4	4.1	0.87	0.422		
17	Ubate	Dairy Processing	Lacteos la Superior		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
18	Ubate	Dairy Processing	Lacteos Sello Dorado		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
19	Ubate	Dairy Processing	Lacteos Ubate	W	Sewerage	Medium	4,000	20.0	54.00	0.4	32.4	39.7	8.39	4.050		
20	Ubate	Dairy Processing	Lacteos Villa Julia		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
21	Ubate	Dairy Processing	Quesadillos la Chagrita		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
22	Ubate	Dairy Processing	Quesadillos la Gaviote		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
23	Ubate	Dairy Processing	Quesos el Candado		Sewerage	Small	800	4.0	10.80	0.0	10.8	13.2	2.80	1.350		
24	Ubate	Dairy Processing	Quesos Gomur		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
25	Ubate	Dairy Processing	Quesos las Margarita		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
26	Ubate	Dairy Processing	Quesos los Alpes		Sewerage	Small	400	2.0	5.40	0.0	5.4	6.6	1.40	0.675		
27	Ubate	Dairy Processing	Quesos San Jorge		Sewerage	Small	540	2.7	7.29	0.0	7.3	8.9	1.89	0.911		
28	Ubate	Milk Cooling	Alqueria		Sewerage	Large	80,000	200.0	160.00	0.0	160.0	195.9	41.44	20.000		
29	Ubate	Milk Cooling	Parmalat	W	Sewerage	Medium	38,500	96.3	77.00	0.4	46.2	56.6	11.97	5.775		
Sewerage Sub-total											881.2	1,078.7	228.23	110.150		
Total								194,100	674.25	1257.60		930.6	1,139.2	241.03	116.326	

Table E.2.7 Pollution Load Effluent from Dairy Industry (2/2)

No.	Name of Municipality	Activity	Name of Point Source	Treatment	Discharging Point	Size	Milk Processed (L/day)	Wastewater Volume (m ³ /day)	Generated BOD (kg/day)	Removal Ratio	Effluent Load (kg/day)			
											BOD	COD	T-N	T-P
30	Tausa	Dairy Processing	Lacteos Levelma		Q. Aguacilara	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
31	Gnacheta	Dairy Processing	Lacteos Cestagalli		Q. Mina	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
32	San Miguel de Sema	Milk Cooling	Parmalat		Sewerage	Medium	38,500	96.25	77.00	0.0	77.0	94.3	19.94	9.625
33	Fuquene	Dairy Processing	Colfrance	W	Irrigation	Large	8,000	40.00	108.00	0.4	64.8	79.3	16.78	8.100
34	Fuquene	Dairy Processing	Quesos Real		Fuquene	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
			Total				8,540	42.70	115.29		72.1	88.2	18.67	9.011
35	Simijaca	Dairy Processing	Incolacteos	W	Irrigation	Large	180,000	900.00	2,430.00	0.4	1,458.0	1,784.7	377.62	182.250
36	Simijaca	Dairy Processing	Lacteos el Becerro		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
37	Simijaca	Dairy Processing	Lacteos La Libertad		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
38	Simijaca	Dairy Processing	Productora La Cujajada		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
39	Simijaca	Milk Cooling	Alpina	W	Sewerage	Large	80,000	200.00	160.00	0.4	96.0	117.5	24.86	12.000
			Sewerage Sub-total				81,620	208.10	181.87		117.9	144.3	30.53	14.734
40	Simijaca	Milk Cooling	Delay		Q. Capitolio	Medium	37,000	92.50	74.00	0.0	74.0	90.6	19.17	9.250
			Total				298,620	1,201	2,685.87		1,649.9	2,019.6	427.32	206.234
41	Chiquinquirá	Dairy Processing	Lacteos Coagroleche		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
42	Chiquinquirá	Dairy Processing	Lacteos del Mund		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
43	Chiquinquirá	Dairy Processing	Lacteos La Competencia		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
44	Chiquinquirá	Dairy Processing	Lacteos la Quince		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
45	Chiquinquirá	Dairy Processing	Lacteos Pedro F. Ortíz		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
46	Chiquinquirá	Dairy Processing	Lacteos Pedro Ruiz		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
47	Chiquinquirá	Dairy Processing	Lacteos Tirso Garcia		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
48	Chiquinquirá	Dairy Processing	Lacteos Victor Cuervo		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
49	Chiquinquirá	Dairy Processing	Quesos Chiquinquirá		Sewerage	Small	540	2.70	7.29	0.0	7.3	8.9	1.89	0.911
50	Chiquinquirá	Milk Cooling	Murcia		Sewerage	Small	540	1.35	2.16	0.0	2.2	2.6	0.56	0.270
			Sewerage Sub-total				5,400	25.65	67.77		67.8	83.0	17.55	8.471

Table E.2.8 Influent to Sewerage System in Study Area

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	114.4	65.0	81.6	12.35	1.300					
2	Ubate	3,015.0	837.5	1,051.2	159.13	16.750	674.3	881.2	1078.7	228.23	110.150
3	Tausa	84.0	47.8	59.9	9.07	0.955					
4	Sutatausa	51.2	29.1	36.5	5.53	0.582					
5	Cucunuba	101.5	57.7	72.4	10.95	1.153					
6	Lenguazaque	244.8	90.0	80.6	17.10	1.800					
7	Guacheta	457.8	168.3	211.2	31.98	3.366					
8	San Miguel de Sema	44.0	25.0	31.4	4.75	0.500	96.3	77.0	94.3	19.94	9.625
9	Fuquene	70.4	40.0	50.2	7.60	0.800					
10	Susa	168.8	95.9	120.4	18.22	1.918					
11	Simijaca	612.0	225.0	282.4	42.75	4.500	208.1	117.9	144.3	30.53	14.734
12	Caldas	7.6	4.3	5.4	0.82	0.086					
13	Chiquinquirá	7,560.0	2,100.0	2,635.9	399.00	42.000	27.0	67.8	83.0	17.55	8.471
14	Saboya	96.6	54.9	68.9	10.43	1.098					

No.	Name of Town	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	2.1	5.4	8.6	1.07	0.021	116.5	70.4	90.2	13.42	1.321
2	Ubate	21.4	53.4	85.5	10.68	0.214	3,710.6	1,772.1	2,215.4	398.04	127.114
3	Tausa	2.5	6.4	10.2	1.27	0.025	86.6	54.1	70.1	10.34	0.980
4	Sutatausa						51.2	29.1	36.5	5.53	0.582
5	Cucunuba	0.7	1.8	2.9	0.36	0.007	102.2	59.4	75.2	11.31	1.160
6	Lenguazaque	3.4	8.6	13.7	1.71	0.034	248.2	98.6	94.4	18.81	1.834
7	Guacheta	3.0	7.5	12.0	1.50	0.030	460.8	175.8	223.2	33.48	3.396
8	San Miguel de Sema						140.3	102.0	125.6	24.69	10.125
9	Fuquene						70.4	40.0	50.2	7.60	0.800
10	Susa	3.1	7.9	12.6	1.57	0.031	171.9	103.8	132.9	19.79	1.949
11	Simijaca						820.1	342.9	426.7	73.28	19.234
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	54.9	68.9	10.43	1.098

Table E.2.9 Pollution Load Effluent from Sewerage System

No.	Name of Municipality	Influent				
		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	1,772.1	2,215.4	398.04	127.114
3	Tausa	86.6	54.1	70.1	10.34	0.980
4	Sutatausa	51.2	29.1	36.5	5.53	0.582
5	Cucunuba	102.2	59.4	75.2	11.31	1.160
6	Lenguazaque	248.2	98.6	94.4	18.81	1.834
7	Guacheta	460.8	175.8	223.2	33.48	3.396
8	San Miguel de Sema	140.3	102.0	125.6	24.69	10.125
9	Fuquene	70.4	40.0	50.2	7.60	0.800
10	Susa	171.9	103.8	132.9	19.79	1.949
11	Simijaca	820.1	342.9	426.7	73.28	19.234
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	54.9	68.9	10.43	1.098

No.	Name of Municipality	Effluent				
		BOD (mg/L)	BOD (kg/d)	COD (kg/d)	T-N (kg/d)	T-P (kg/d)
1	Carmen de Carupa	-	70.4	90.2	13.42	1.321
2	Ubate	96.3	357.5	800.3	140.8	17.8
3	Tausa	-	54.1	70.1	10.34	0.980
4	Sutatausa	-	29.1	36.5	5.53	0.582
5	Cucunuba	93.0	9.5	21.3	3.7	0.5
6	Lenguazaque	-	98.6	94.4	18.81	1.834
7	Guacheta	-	175.8	223.2	33.48	3.396
8	Sema	75.0	10.5	23.6	4.1	0.5
9	Fuquene	-	40.0	50.2	7.60	0.800
10	Susa	-	103.8	132.9	19.79	1.949
11	Simijaca	-	342.9	426.7	73.28	19.234
12	Caldas	-	4.3	5.4	0.82	0.086
13	Chiquinquirá	-	2,167.8	2,718.8	416.55	50.471
14	Saboya	12.0	1.2	2.6	0.5	0.1