4.6 Water Quality Test for Wells

About 100 deep wells were selected for the water quality studies. Most of them were selected from 3,273 existing wells, on INGEOMINAS data base, available information at the beginning of this Study. Water quality studies were carried out regarding 48 general water quality items and 34 agricultural chemical items. This indicates that these studies covered a widest range of water quality items among the water quality tests ever performed in Columbia. However, the results of the studies revealed the distinctive underground environment in Bogotá Plain. The groundwater quality reflects the ground contamination and also provides useful suggestions regarding to the flow of groundwater.

4.6.1 Structure of Water Quality Tests for Wells

(1) Frequency of Water Quality Tests and Periods of Execution

The studies were carried out in three phases. The basic purpose of the water quality studies was to identify the distribution of groundwater quality in Bogotá Plain. Each study has the following characteristics:

Phase 1 study (February - March (semi-rainy season), 2001): The study began with no existing data to be compared with. However, it was very meaningful that groundwater in Bogotá Plain was observed as a whole for the first time.

Phase 2 study (October - November (rainy season), 2001): Based on the technical reviews of Phase 1 Study, this study would allow improving and complementing the reliability of the first results. Various analyses and discussions were made using the data gathered during this study.

Phase 3 study (August - September (semi-rainy season), 2002): This water quality test for wells allows a confirmation of the results on the Phases 1 and 2 studies. On the other hand, new efforts were made to analyze the river water quality in order to obtain fundamental data regarding water quality of environmental inventory and artificial recharge. For this reason, the number of water quality samples of wells was largely reduced mainly in the Quaternary aquifer whose data are abundant, resulting in 70 wells that have been studied.

(2) Sampling Wells for Studies

Based on the following lines, approximately 100 sampling wells were selected among the 7,081 existing wells belonging to the aquifers in various basins and land use conditions:

(i) To select the representative sampling wells from areas around the river, agricultural and industrial areas to confirm the influence of ground contamination on groundwater condition.
(ii) To select sampling wells widely in the whole study area for isotopic analysis.
(iii) To select wells as many as possible belonging to the Cretaceous or Tertiary aquifer that number is smaller among the existing wells, because these wells are valuable for the water quality data.

Number of sampling wells selected by purposes is summarized in Table-4.12. The list of basic items of study wells is shown in Table-4.11 and the distribution of the study wells is shown in Figure-4.18. This Figure is from Phase 2 study since it has the largest number of wells (Sampling well points of Phase 1 to 3 studies are shown in the supporting report.).

Table-4.11 Specifications and estimated aquifers of wells

	No.	No.	Well No.	Basin	NAME	TOWN	COORDINATES		AQUIFER SYSTEM	estimated aquifer			USE	DEPTH m	Ph-1	Ph-2	Ph-3
							EAST	NORTH		Quaternary	Tertiary	Cretaceous					
VILLAPINZON	0a	VI-0a	209-IV-A-004	20	EL ESPARTILLAL	CHOCONTA	1,042,680	1,059,900	F. Sabana	○			HUMAN	?	o	x	o
	1	VI-1	10-0015	8	COMPENSAR 1	BOGOTA	997,324	1,007,141		○				201	o	o	x
	2	VI-2	209-II-D-054	20	EL TABLON	CHOCONTA	1,045,760	1,062,640	F. Sabana	○			HUMAN	160	o	o	o
	3	VI-3	209-II-D-093	20	LA ESPERANZA	CHOCONTA	1,048,400	1,067,200	Guad-Gudlupe		○	○	IRRIGATION	100	o	o	o
BARANDILLAS	4	BA-1	209-III-C-032	15	BALSORA	ZIPAQUIRA	1,012,340	1,046,670	F. Sabana	○			IRRIGATION	70	o	o	x
	4a	BA-1a	209-III-B-077	15	LA RAMADA		1,020,780	1,054,660	F. Sabana	○			IRRIGATION	97	o	x	x
	5	BA-2	209-III-C-013	14	HDA. SUSASUCA	ZIPAQUIRA	1,009,040	1,042,630	F. Sabana	○			IRRIGATION	60	o	o	o
	6	BA-3	209-III-C-095	16	ZIPATOCA	TOCANCIPA	1,015,000	1,044,000	F. Sabana	○			IRRIGATION	70	o	o	x
	7	BA-4	209-III-C-069	15	SAN MIGUEL	ZIPAQUIRA	1,013,370	1,048,430	F. Sabana	○			HUMAN	120	o	o	x
	8	BA-5	209-III-D-077	16	ESC. PORVENIR	TOCANCIPA	1,017,880	1,043,860	F. Sabana	○			HUMAN		o	o	o
	9	BA-6	209-III-D-49	16	BGTA GOLF 1	TOCANCIPA	1,017,555	1,043,482	F. Sabana	○			HUMAN		o	o	o
JUAN AMARILLO	10	JU-1	227-IV-B-445	8	Flores Colombianas	BOGOTA	997,348	1,017,280	F. Sabana	○			FLOWERS		o	o	o
	11	JU-2	10-0020	8	SERVICENTRO EL RADAR	BOGOTA	993,495	1,012,038	F. Sabana	○				80	o	o	x
	12	JU-3	11-0106	8	TEXACO TIBABUYES	BOGOTA	997,600	1,016,150	F. Sabana	○				200	o	o	x
	13	JU-4	227-IV-B-361	8	ROSAS COTA	COTA	993,120	1,017,170	F. Sabana	○			FLOWERS	123	o	o	o
	14	JU-5	11-0138	8	INVERSIONES BELLO MONTE	BOGOTA	999,850	1,013,500	F. Sabana	○				143	o	o	x
	15	JU-6	11-0026	8	LOS LAGARTOS 2	BOGOTA	999,290	1,012,690	F. Sabana	○				60	o	o	x
	16	JU-7	10-0026	8	LUBRICENTRO EL MORISCO	BOGOTA	998,396	1,011,775	F. Sabana	○				85	o	o	x
TUNJUELITO RIVER	17	TU-1	227-IV-C-044	8	ISLA LA VUELTA		984,930	1,004,550		○					o	o	x
	18	TU-2	227-IV-C-51	8	LAS MERCEDES		984,660	1,003,250		○					o	o	o
	19	TU-3	227-IV-C-56	8	BOSATAMA		983,495	1,002,795		○					o	o	x
	20	TU-4	227-IV-C-80	7	RCN		984,995	1,001,940		○					o	o	o
	21	TU-5	07-0022	7	CLARETIANO	BOGOTA	988,721	1,001,657		○				63	o	o	x
	22	TU-6	07-0020	7	CONSULTECNICA	BOGOTA	988,701	1,002,829		○					o	o	o
	23	TU-7	17-0001	7	COTERPIEL	BOGOTA	991,350	998,460		○	○				o	o	x
	24	TU-8	07-0005	7	CARBOQUIMICA 2	BOGOTA	989,990	1,000,375	QUATERNARY	○					o	o	o
	25	TU-9	19-0009	7	INMACU 4	BOGOTA	989,842	999,552		○	○				o	o	o
BOGOYA RIVER	26	BO-1	246-II-A-104	3	Proteicol – 2	SIBATE	981,445	994,280	F. Sabana	○			INDUSTRY	95	o	o	x
	27	BO-2	246-II-A-143	2	Indumil	SOACHA	978,970	991,025	F. Sabana	○			INDUSTRY	65	o	o	x
	28	BO-3	246-II-A-177	2	Eternit de Colombia – 2		980,815	993,645	Guad-Gdlupe		○	○	INDUSTRY	450	o	o	x
	29	BO-4	246-II-A-135	2	Acción Comunal Chacua ISS	SIBATE	982,940	992,460	F. Sabana	○			HUMAN	64	o	o	o
	29a	BO-4a	246-II-A-087	3	TORINO	SOACHA	982,370	996,170	F. Cuaternario	○			INDUSTRY	92	o	x	o
	30	BO-5	246-II-A-190	3	INDUMIL 3	SOACHA	982,180	998,700	F. Cuaternario	○			INDUSTRY	101	o	o	o
AGRICULTURAL AREA	31	AG-1	227-II-D-605	9	HATO BLANCO	TENJO	989,275	1,028,640	F. Sabana	○			IRRIGATION	159	o	o	o
	32	AG-2	227-II-C-011(11)	5	E.A.A. FACATATIVA	FACATATIVA	971,790	1,020,500	G. Guadalupe			○	HUMAN	197	o	o	o
	33	AG-3	227-I-D-068	5	E.A.A. FACATATIVÁ	FACATATIVA	969,400	1,024,410	G. Guadalupe			○	HUMAN	396	o	o	o
	34	AG-4	227-IV-A-264	5	E.A.A. MADRID	MADRID	978,860	1,014,560	G. Guadalupe			○	HUMAN	394	o	o	o
	35	AG-5	227-II-B-181	9	CUCHARO 3	TENJO	998,825	1,032,430	F. Sabana	○			IRRIGATION	120	o	o	o
INDUSTRY AREA	36	IN-1	09-0011	8	Estación Esso avenida Boyacá	BOGOTA	995,706	1,005,505		○				190	o	o	o
	37	IN-2	09-0021	8	Hilacol No.2	BOGOTA	995,042	1,006,166		○				161	o	o	o
	38	IN-3	01-0011	8	PARMALAT	BOGOTA	1,003,747	1,017,976		○				80	o	o	x
	39	IN-4	08-0012	7	GASEOSAS COLOMBIANA 2	BOGOTA	992,233	1,000,120		○				165	o	o	o
	40	IN-5	228-I-A-510	13	LEONA	TOCANCIPA	1,015,040	1,038,530	F. Sabana	○			INDUSTRY	258	o	o	o
GUADALUPE	41	GU-1	227-IV-A-349	5	AGRICOLA LA MONTAÑA	MADRID	974,520	1,010,360	G. Guadalupe			○	IRRIGATION	387	o	o	o
	42	GU-2	227-IV-C-011	5	ACUED.VEREDAL LOS PUENTES	MOSQUERA	979,800	1,009,550	G. Guadalupe			○	HUMAN	200	o	o	o
	43	GU-3	227-II-D-1112	8	Acueducto La Punta	TENJO	985,450	1,022,565	Saban-Gdlupe	○	○	○	HUMAN	115	o	o	o
	44	GU-4	227-II-D-016	9	ALTAMIRA 1	TENJO	990,420	1,029,510	G. Guadalupe			○	FLOWERS	249	o	o	x
	45	GU-5	227-II-D-670	9	FLORES LA GAITANA	TENJO	991,908	1,020,934	G. Guadalupe			○	IRRIGATION	178	o	o	o
	46	GU-6	227-II-C-576	6	E.A.A. PUENTE PIEDRA	MADRID	984,641	1,023,670	G. Guadalupe			○	HUMAN	150	o	o	o
	47	GU-7	227-II-B-028	6	PROPAGAR PLANTAS S.A.	SUBACHOQUE	989,160	1,032,630	G. Guadalupe			○	IRRIGATION	70	o	o	o
	48	GU-8	227-IV-A-063	6	FLOREX S.A.	MADRID	978,150	1,018,820	G. Guadalupe			○	FLOWERS	448	o	o	o
	49	GU-9	227-II-C-094	5	ECOPETR. TERMINAL MANCILLA	FACATATIVA	970,818	1,027,100	G. Guadalupe			○	INDUSTRY	84	o	o	o
	50	GU-10	227-IV-A-102	5	HACIENDA ARGEL	BOJACA	973,400	1,017,080	G. Guadalupe			○	IRRIGATION	392	o	o	o
QUATERNARY	51	QU-1	227-IV-B-307	8	SOLLA S.A	MOSQUERA	985,535	1,011,140	F.CUATERNARIO	○			INDUSTRY	119	o	o	o
	52	QU-2	227-IV-A-441	6	FLORAMERICA 4	FUNZA	982,150	1,016,290	F. Subachoque	○			FLOWERS	370	o	o	o
	53	QU-3	227-IV-B-096	8	Flores de Funza	FUNZA	987,500	1,017,870	F. Sabana	○			FLOWERS	470	o	o	o
	54	QU-4	227-IV-B-456	10	Liceo Juan Ramón Jiménez	BOGOTA	999,170	1,019,540	F. Sabana	○			HUMAN	121	o	o	x
	55	QU-5	228-I-A-518	8	Polo Club de Bogotá	BOGOTA	1,004,510	1,019,700	F. Sabana	○			HUMAN	122	o	o	x
	56	QU-6	227-II-C-477	6	VIVERO TISQUESUSA CAR	SUBACHOQUE	977,100	1,022,060	F. Subachoque	○			IRRIGATION	293	o	o	o
	57	QU-7	228-I-C-247	10	Colegio Andino	BOGOTA	1,003,110	1,022,120	F. Sabana	○			HUMAN	60	o	o	o
	58	QU-8	228-I-C-041	10	Club Fontanar	CHIA	1,005,040	1,022,480	F. Sabana	○			HUMAN	118	o	o	o
	59	QU-9	227-II-D-749	9	EL AMOLADERO	TENJO	992,850	1,023,680	F. Sabana	○			IRRIGATION	147	o	o	x
	60	QU-10	228-I-C-018	13	San Prudencio		1,014,950	1,028,960	F. Sabana	○			IRRIGATION	68	o	o	o
	61	QU-11	227-II-D-802	9	LETICIA	TENJO	993,680	1,026,860	F. Sabana	○			IRRIGATION	100	o	o	o
	62	QU-12	228-I-D-003	13	Hacienda Ingruma	SOPO	1,015,440	1,029,620	F. Sabana	○			IRRIGATION	110	o	o	o
	63	QU-13	227-II-C-972	6	FLORES CONDOR -LA CONSTANCIA	SUBACHOQUE	979,630	1,026,770	F. Subachoque	○			FLOWERS	172	o	o	o
	64	QU-14	227-II-B-252	6	HDA. TIBAGOTA	SUBACHOQUE	986,000	1,033,600	F. Subachoque	○			IRRIGATION	172	o	o	o
	65	QU-15	227-II-C-007	6	FLORES MOCARI S.A.	SUBACHOQUE	981,500	1,025,100	F. Subachoque	○			FLOWERS	243	o	o	o
	66	QU-16	227-II-B-720	9	HACIENDA LOS SAUCES	TABIO	998,990	1,035,720	F. Sabana	○			IRRIGATION	80	o	o	o
	66a	QU-16a	227-II-B-255	6	CONDOMINIO EL VERDE	SUBACHOQUE	987,410	1,035,840	F. Subachoque	○			IRRIGATION	127	o	x	x
	67	QU-17	228-I-B-069	13	ALEJANDRIA	TOCANCIPA	1,015,040	1,037,815	Sab-Guaduas	○	○				o	o	x
	68	QU-18	209-Ⅱ-B-172	16	DANDY	SUESCA	1,029,150	1,052,100	F. Sabana	○			FLOWERS	100	o	o	o
	69	QU-19	228-I-A-512	11	JARDINES DEL ROSAL	CAJICA	1,004,350	1,033,600	Saban-Gdlupe	○		○	IRRIGATION		o	o	x
	70	QU-20	228-I-A-512-APOS	13	APOS	SOPO	1,011,750	1,038,250		○		○			x	o	o
	71	QU-21	228-I-A-515	11	VILLA SANT	CAJICA	1,004,130	1,035,120	F. Sabana	○			IRRIGATION	120	o	o	o
	72	QU-22	209-III-B-083	15	PACAYAL	NEMOCON	1,019,830	1,055,970	F. Sabana	○			FLOWERS	107	o	o	o
	73	QU-23	228-I-C-178	10	FLORES ASTRO	BOGOTA	1,000,370	1,023,600	F.CUATERNARIO	○			FLOWERS	118	o	o	o
	74	QU-24	227-II-D-1008	10	EL TESORO	COTA	996,640	1,023,530	F.CUATERNARIO	○			IRRIGATION	145	o	o	o
	75	QU-25	209-III-B-145	15	HDA. SUSASUCA	NEMOCON	1,023,500	1,058,800	F.CUATERNARIO	○			IRRIGATION	110	o	o	x
ISOTOPE	76	IS-1	246-II-A-061	3	Urbanización Compartir	BOGOTA	982,190	996,620	Saban-Gdlupe	○		○	HUMAN	357	o	o	x
	77	IS-2	227-II-D-587	9	CHITASUGA 2		990,886	1,029,950	G. Guadalupe			○	HUMAN	1000	o	o	o
	77a	IS-2a	227-IV-A-233	6	E.A.A. MADRID	MADRID	979,426	1,015,408	G. Guadalupe			○	HUMAN		o	x	x
	78	IS-3	227-IV-A-233 (Nuevo)	6	E.A.A. MADRID	MADRID	979,426	1,015,408		○					x	o	x
	79	IS-4	227-IV-A-299	6	Ponque Ramo 1	MOSQUERA	981,300	1,013,550	Sap-Subacho	○				500	o	o	x
	80	IS-5	228-I-C-252	10	MADRIGAL SUBA	BOGOTA	1,001,340	1,020,545		○			FLOWERS		o	o	x
	81	IS-6	08-0007	8	AUTOBOYACA	BOGOTA	994,111	1,005,719	Guadalupe			○		450	o	o	o
	82	IS-7	227-IV-B-561	8	BOMBA DE GASOLINA	BOGOTA	991,190	1,010,320	Sabana	○			INDUSTRY	115	o	o	x
	82a	IS-7a	11-0010	8	MAZUREN CAR WASH	BOGOTA	1,002,950	1,014,345		○				251.8	o	x	x
	83	IS-8	228-III-A-051	8	Armitage	BOGOTA	1,003,300	1,012,400		○					x	o	x
	84	IS-9	22-0078	10	GIMNASIO FONTANA 1	GUAYMARAL	1,001,600	1,022,900		○				252	o	o	x
	85	IS-10	228-I-C-019	13	La Gavia		1,013,480	1,020,460	F. Sabana	○			IRRIGATION	135	o	o	x
	86	IS-11	209-III-D-172	16	LEONA	TOCANCIPA	1,015,800	1,041,100	F. Sabana	○				253	o	o	x
	87	IS-12	228-I-A-509	13	SAN MARTIN	BOGOTA	1,013,250	1,034,560		○				112	o	o	x
	88	IS-13	209-III-D-036	16	AGROMONTE	GACHANCIPA	1,022,600	1,046,450	F. Sabana	○			IRRIGATION	82	o	o	o
	89	IS-14	209-III-B-170	15	CASUPA 2	NEMOCON	1,023,930	1,054,700	F. Cacho		○				o	o	o
	89a	IS-14a	227-II-D-1115	10	La Palma	COTA	998,100	1,025,500	Guadalupe			○			o	x	x
	90	IS-15	227-II-D-Noviciado	10	Noviciado	COTA	998,405	1,026,470		○		○			x	o	x
	91	IS-16	227-IV-A-442	6	San Francisco	MADRID	982,800	1,016,630	Sap-Subacho	○			IRRIGATION	353	o	o	o
	92	IS-17	227-IV-B-577	8	Uniabastos	COTA	993,310	1,016,350	F. Sabana	○			HUMAN	526	o	o	o
	92a	IS-17a	227-IV-A-X6	8	Mosquera 1 - EAMOS		983,480	1,012,100	Tilatá	○			HUMAN	581	o	x	o
	93	IS-18	227-IV-B-576	8	Empresa A.	Funza	985,210	1,013,525		○					x	o	o
	94	IS-19	16-0003	8	GASEOSAS LUX 1		996,280	1,003,018	F. Sabana	○			INDUSTRY	192	o	o	o
	95	IS-20	10-0011	8	LAVAUNTOS UNO A	BOGOTA	996,735	1,010,576	F.Sabana	○				120	o	o	x
EAAB	96	EAAB-1	EAAB-1 LA SALLE	8	EAAB-1	LA SALLE	1,006,000	1,017,000	Guadalupe			○	Test	270	x	o	o
	97	EAAB-2	EAAB-2 SUBA	8	EAAB-2	SUBA	999,700	1,017,700	Guadalupe			○	Test	389	x	o	o
	98		Vitelma 1-EAAB				996,000	1,001,850							x	x	o
JICA	99	JICA-1	GIBRALTAR	8	JICA-1	GIBRALTAR	1,005,845	988,439	Sabana	○			Test	196	o	o	o
	100	JICA-2	J-2 TISQUESUSA	6	JICA-2	TISQUESUSA	1,022,020	976,639	Sabana	○			Test	192	x	o	o
	101	JICA-3	J-3 SIBERIA	8	JICA-3	SIBERIA	1,017,974	991,462	Sabana	○			Test	173	x	o	o
	102	JICA-4	J-4 SOPO	13	JICA-4	SOPO	1,011,020	1,037,638	Sabana	○			Test	150	x	o	x
	103	JICA-5	J-5 LA DIANA	16	JICA-5	LA DIANA	1,038,429	1,013,170	Sabana	○			Test	188	x	o	o
	104	JICA-6	J-6 CHOCONTA	20	JICA-6	CHOCONTA	1,067,343	1,049,874	Tilata	○			Test	123	x	o	o
TERMALES	105	TE-1	Pozo Termales Tabio	9	Pozo Termales Tabio	Tabio	997,600	1,037,000				○	Recreation		x	o	x

■ Aquifers of wells are estimated by geographic maps and other data

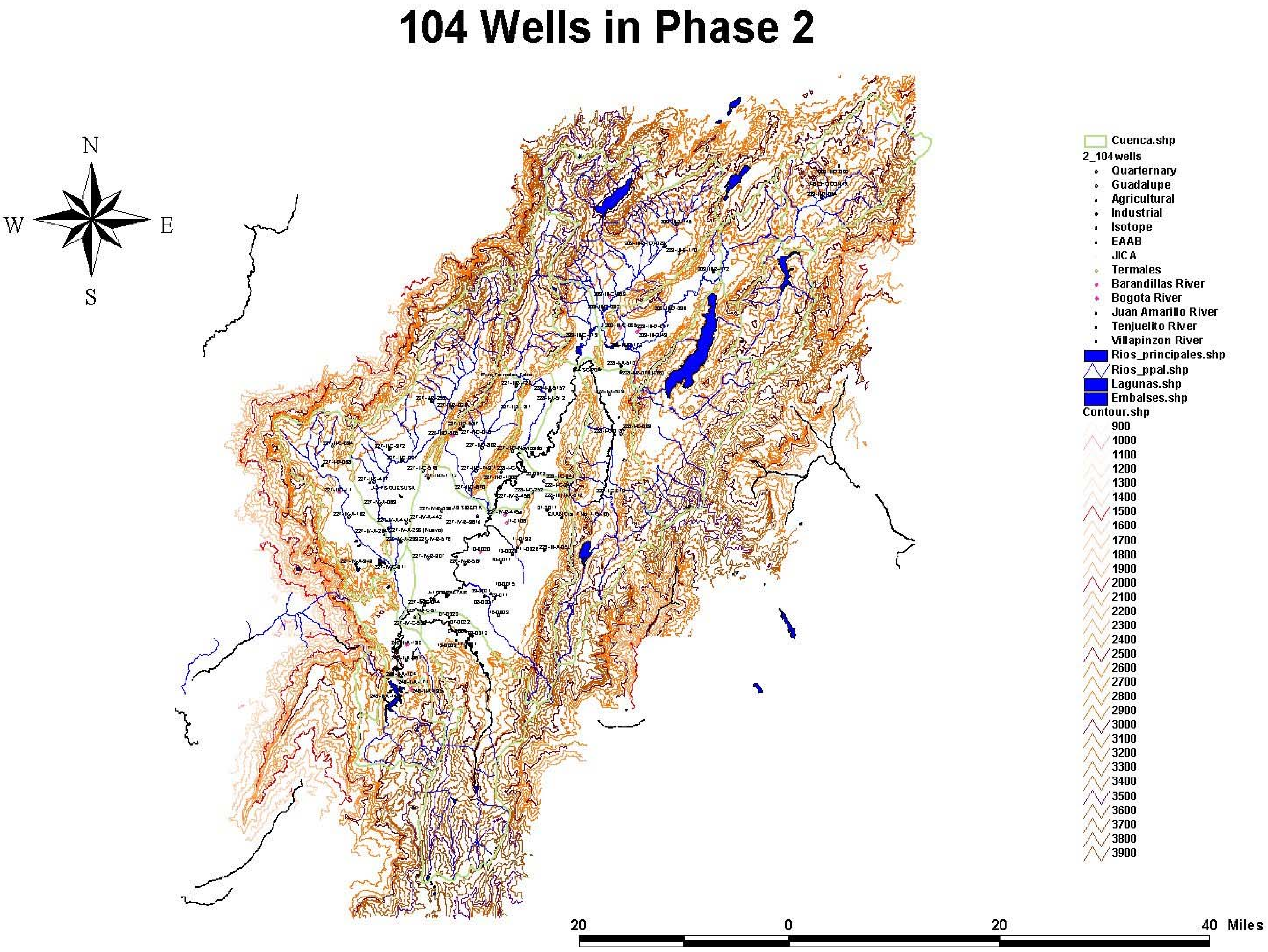


Figure-4.18 Well distribution map

4.6.2 Test Results

(1) Items of Water Quality Tests for Wells

Water quality items of this study covered the following two categories, and various kinds of items employed were far more than those used for usual water quality studies for groundwater development.

(i) Water quality items which can be compared with the raw water quality standard specified in Columbia

(ii) Water quality items to grasp the geochemical nature of groundwater and to approach the flow of groundwater and underground environment

The list of general items of water quality, including land use classification, is shown in Table-4.12.

Table-4.12 Number of well for water quality test and items

Items	Phase 1	Phase 2	Phase 3
1. Sampling Points (Total)	99	104	70
- Wells around Rivers	33	30	18
- Wells in Agricultural Areas	5	5	5
- Wells in Industrial Areas	5	5	5
- Wells for Isotopic Analysis	20	20	9
- Wells in Other Areas	36	44	33

2. Analysis Items	Around Rivers	Agricultural Area	Industrial Area	Isotopic Analysis	Other Areas
Chemical parameters related to human health	○	○	○	○	○
	Arsenic, Boron, Cadmium, Chromium, Cyanide, Fluorine, Lead, Total mercury, Nickel, Nitrates, Nitrites, Selenium, Antimony, Barium, Beryllium, Copper, Manganese, Molybdenum				
Physical & chemical parameters related to taste/odor/color	○	○	○	○	○
	Color, Odor, Turbidity, Temperature, Langelier index, Conductivity				
Inorganic parameters	○	○	○	○	○
	Aluminum, Ammonia, Chloride, Hardness, Hydrogen sulfide, Iron, Dissolved oxygen (Phase 2 only), pH, Sodium, Sulfates, Dissolved total solid, Zinc, Magnesium, Potassium, Bicarbonate Ion, Carbonate, Calcium, Alkalinity, Acidity				
Organic parameters	--	--	○	--	--
	Toluene, Xylems, Benzen				
Agrochemicals	--	○	--	--	--
	Aldicarb, Carbofuran, Aldrin, Endrin, Dieldrin, Chlordane, Linuron, P, p-DDT, o-p ' DDT, p-p ' DDT, Permetrina, 2-Clorofenol, 2, 4, 6-Triclorofenol, Endosulfan I, Endosulfan II, Endosulfan S042-, Heptachlor, Heptachlorepoxide, Lindane, Metolachlor, Atrazine, Bentazone, Profenofos, Clorpirifos, Triclorfos, 2, 4-D, Methoxychlor, Simazine, Trifluralin, 2, 4-DB, Dichlorprop, Malation, Etil Paration, Metil Paration, 2, 4, 5-T, PCP, Diazinon, Permethrin, 2, 4, 5-TP				
Bacteria	○	○	○	○	○
	Escherichia coli, Coliform bacteria				

(2) Summary of Test Results

Table-4.13, Table-4.14 and Table-4.15 show the results of water quality tests in Phase 1, 2 and 3, as a representative and the latest data. The excess of the standard value for raw water usable for drinking and living is shown in different color.

Test results indicate that groundwater in Bogotá Plain presents many problems as for quality as usable water. On the other hand, it was confirmed that the flow mechanism of groundwater is reflected in water quality, which is consistent with the descriptions regarding geology and aquifers in other chapters. Their summary is as follows.

1) The main characteristic is that the water quality items rarely detected in usual groundwater in deep strata were observed at high values widely in the study areas. The examples such as color, NH_4, H_2S, Ba and the *coliform bacilli* group. These

contamination was noticeable in Quaternary wells. On the other hand, H_2S concentration as well as the influence of Color, Fe and Mn, was lower in Cretaceous wells. It is important to emphasize that NH_4 concentration was far below the one in Quaternary well.

2) The influence of organic matter (BTX) used in the industrial areas was not identified in groundwater. Similarly, the influence of agricultural chemicals was not identified in groundwater.
3) By contrasting with the raw water quality standard in Colombia, the present situation of water quality items, which exceed the standard and the number of exceeded wells are as follows. Generally, groundwater in the study areas does not meet the water quality standard that can be usually expected for groundwater. Water cannot be used for drinking unless the purification process or more treatment is applied.

   (a) Situation of groundwater exceeding the quality standard for raw water usable for drinking and living if treated : Color, turbidity, the *coliform bacilli* group, ammonia and pH exceed the standard value in many wells. Though it cannot be said that hydrogen sulfide and iron content exceed the standard since there is no provisions regarding the national raw water standards, these exceed the standard value of drinking water applied internationally. Therefore, there is a high risk to drink such water without treatment applied, and the usual way of using supreme quality of groundwater cannot be expected in this study area.
   (b) Situation of groundwater exceeding the allowable quality standards for raw water usable for agriculture: It has been found in most of the study wells that manganese and iron exceed the standard value. As for matters, such as hydrogen sulfide and toxic ions are not included in the standard items in Colombia, these are discussed later.
   (c) Situation of groundwater exceeding the allowable quality standards for raw water usable for stock-raising: No well exceeds this standard value.
4) The concentrations of the main eight ions (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-, CO_3^{2-}) of water quality samples were expressed on tri-linear diagram and hexa diagram. As a result, the following geochemical characteristics of groundwater were found:
   (a) Groundwater in Quaternary aquifer has the quality of the $Na\text{-}HCO_3$ type that is typical of groundwater in deep-aquifer, which has experienced long underground-flow time, and ion exchange has advanced. On the other hand, the $Ca\text{-}HCO_3$ type without advancement of ion exchange, which appears in groundwater in shallow-aquifer, can be also observed but its number is small.
   (b) The Cretaceous groundwater does not have distinctive characteristics.
   (c) All study wells were classified by statistical cluster analysis according to total similarity of concentrations of the main eight ions. As a result, wells showing the $Na\text{-}HCO_3$-type quality of water, which is considered to have experienced long flow time, are over 65 %.

	POZO No.	As mg/L	B mg/L	Cd mg/L	Cr Total mg/L	CN Total mg/L	F- mg/L	Pb mg/L	Hg mg/L	Ni mg/L	NO3-N mg/L	NO2-N mg/L	Se mg/L	Sb mg/L	Ba mg/L	Be mg/L	Cu mg/L	Mn mg/L	Mo mg/L	Color HAZEN TCU	Turbiedad NTU	TEMPERATURA °C	Indice de Langelier -	CONDUCTIVIDAD a 25°C µS/cm	Al total mg/L	Amonio mg/L	Cl mg/l	DUREZA TOTAL $CaCO_3$ mg/L	Sulfuro de Hidrógeno mg/L	Fe TOTAL mg/L	pH Unidades -	Na mg/l	SO4 mg/l	Sólidos Disueltos Totales mg/L	Zn TOTAL mg/L	Mg mg/l	K mg/l	HCO_3^- mg/l	CO3 mg/l	Ca mg/l	ALCALINIDAD CaCO3 mg/L	N M P ESCHERICHIA COLI Microorganismos / 100 ml	N M P COLIFORMES TOTALES Microorganismos / 100 ml
VILLAPINZON	209-IV-A	0.0000	0.0000	0.0008	0.0000	0.0000	0.0333	0.0000	0.0000	0.0000	3.7400	0.0000	0.0000	0.0000	0.1780	0.0000	0.0023	0.0213	0.0000	10	0	18	-5.985	71	0.0000	0.0000	5.1000	93.1	0.20	0.420	5.4	6.500	44	95	0.350	2.40	2.20	10.0	0.0	33.30	8.2	0	0
	10-0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.1680	0.0000	0.0000	0.0000	0.4750	0.0165	0.0000	0.0000	0.3155	0.0000	0.0000	0.0427	0.0000	130	13	18.3	-2.180	318	0.0000	12.4300	0.0000	16.0	0.70	0.055	7.03	38.600	55	214	0.020	1.40	3.30	212.3	0.0	4.10	174.0	0	1
	209-II-D-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0392	0.0000	0.0000	0.0053	0.3712	0.0000	0.0000	0.0000	0.0755	0.0000	0.0000	0.7900	0.0000	25	9	19.0	-4.615	30	0.0000	0.0000	0.4800	10.3	1.10	2.048	5.7	1.177	0	30	0.039	1.30	0.80	17.5	0.0	2.00	14.4	0	0
	209-II-D-	0.0000	0.0000	0.0015	0.0019	0.0000	0.0735	0.0117	0.0000	0.0000	0.9891	0.0000	0.0000	0.0000	0.0840	0.0000	0.0000	0.0323	0.0000	10	1	18.0	3.856	47	0.0000	0.0000	0.3400	50.5	1.30	0.385	5.9	3.420	0	46	0.325	1.40	1.90	27.5	0.0	17.90	22.6	0	0
BARANDILLAS RIVER	209-III-C	0.0000	0.1321	0.0013	0.0022	0.0000	0.1010	0.0053	0.0000	0.0014	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0043	0.0700	0.0000	10	1	18	-1.920	566	0.0000	1.1500	171.6000	113.9	2.00	4.485	6.3	51.150	53	480	0.163	4.60	2.70	72.5	0.0	38.00	59.5	0	2
	209-III-C	0.0000	0.0000	0.0000	0.0000	0.1620	0.0435	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1305	0.0000	0.0000	0.0700	0.0000	20	6	17	-3.940	107	0.0000	0.0000	5.4000	13.4	0.70	12.382	5.9	8.900	67	97	0.120	0.70	1.00	47.5	0.0	4.20	39.0	0	0
	209-III-C	0.0000	0.1647	0.0030	0.0018	0.0000	0.0835	0.0000	0.0000	0.0000	1.1404	0.0000	0.0083	0.0000	0.5280	0.0000	0.0000	0.0900	0.0000	70	68	18	-1.600	1131	0.4500	1.8400	298.0000	61.6	1.80	7.972	7.3	78.520	53	710	0.105	3.60	2.00	151.3	0.0	18.70	125.1	0	0
	209-III-C	0.0000	0.0000	0.0000	0.0021	0.0000	0.0445	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1755	0.0000	0.0000	0.2300	0.0000	20	11	20	-2.460	109	0.0000	0.0000	0.2000	20.6	0.00	10.520	7.2	8.070	25	67	0.255	2.40	1.00	17.51	0.0	4.30	14.4	0	0
	209-III-C	0.0000	0.1900	0.0010	0.0055	0.0000	0.0917	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6000	0.0000	0.0012	0.2100	0.0000	30	14	19	-2.220	532	0.0000	4.9800	121.8000	79.3	1.40	13.850	6.3	45.000	33	359	0.113	5.30	3.60	130.1	0.0	23.00	106.6	0	89
	209-III-D	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0036	0.0000	0.0000	0.0000	0.0000	0.0000	0.0018	0.1730	0.0000	0.0000	0.0442	0.0000	20	7	16	-3.583	24	0.0000	0.0000	0.2000	6.0	0.00	1.058	6.9	2.650	0	38	0.060	0.30	0.90	67.53	0.0	1.90	55.4	0	0
	209-III-D	0.0000	0.0000	0.0000	0.0000	0.0000	0.2840	0.0000	0.0000	0.0000	0.2072	0.0000	0.0000	0.0016	0.2855	0.0000	0.0000	0.0900	0.0000	90	8	18	-0.724	151	0.0000	1.6600	1.3000	19.0	0.50	0.050	7.1	5.980	333	191	0.230	1.40	2.70	92.54	0.0	5.30	75.9	0	1
JUAN AMARILLO RIVER	227-IV-B	0.0000	0.1376	0.0000	0.0020	0.0000	0.0361	0.0000	0.0000	0.0000	0.3717	0.0000	0.0000	0.0028	0.4000	0.0000	0.0031	0.0800	0.0000	80	2	29.6	-2.930	655	0.0000	7.7700	1.5000	16.5	1.00	3.613	6.29	77.200	131	421	7.855	1.10	7.70	329.4	0.0	4.80	270.0	0	10
	10-0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4361	0.0151	0.0058	0.0016	0.1530	0.0000	0.0000	0.0380	0.0000	50	5	18.5	-4.120	175.8	0.0000	0.0000	16.2000	25.6	1.00	1.938	6.0	76.000	98	123	0.087	1.30	11.50	12.2	0.0	8.10	18.0	3000	480000
	11-0106	0.0000	0.0000	0.0000	0.0030	0.0000	0.0641	0.0000	0.0000	0.0000	1.1750	0.0937	0.0058	0.0000	0.3855	0.0000	0.0038	0.0400	0.0000	450	180	18.3	-1.660	680	1.0250	32.5500	0.0000	57.6	1.10	6.180	7.16	55.700	162	358	0.340	6.70	12.50	427.0	0.0	12.00	350.0	69	2000
	227-IV-B	0.0000	0.0000	0.0000	0.0027	0.0000	0.0629	0.0000	0.0000	0.0000	0.5250	0.0000	0.0000	0.0000	0.3155	0.0000	0.0000	0.0547	0.0000	200	50	20.9	-1.070	701	0.0000	38.1000	0.1300	79.9	0.20	3.330	7.57	41.300	225	338	0.310	9.70	11.10	398.9	0.0	16.00	328.0	0	0
	11-0138	0.0000	0.0000	0.0000	0.0027	0.0000	0.0660	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.5180	0.0000	0.0089	0.1100	0.0000	150	59	20.2	-1.670	225	0.0000	0.0000	0.4000	97.0	1.00	4.390	6.47	8.900	92	142	0.318	7.90	2.70	134.2	0.0	25.80	110.0	0	0
	11-0026	0.0000	0.0000	0.0000	0.0021	0.0000	0.1980	0.0000	0.0000	0.0000	0.0977	0.0000	0.0000	0.0013	0.6580	0.0000	0.0037	0.0700	0.0000	50	5	36.2	-1.690	266	0.0000	1.3000	5.6000	47.3	0.80	1.683	6.09	31.300	108	172	0.263	1.90	5.10	158.6	0.0	15.80	130.0	0	6
	10-0026	0.0000	0.0000	0.0000	0.0055	0.0000	0.0445	0.0000	0.0000	0.0000	1.4800	0.0592	0.0000	0.0000	0.2960	0.0000	0.0000	0.0500	0.0000	180	38	21.4	-1.320	430	0.0000	19.5400	0.0000	51.1	0.70	4.518	7.56	43.800	361	240	0.322	4.10	6.20	251.3	0.0	13.70	206.0	0	7
TUNJUELITO RIVER	227-IV-C	0.0000	0.0000	0.0005	0.0041	0.0000	0.1780	0.0000	0.0000	0.0000	0.6600	0.0000	0.0000	0.0000	0.1980	0.0000	0.0013	0.0400	0.0000	100	5	19.5	-2.150	385	0.0000	14.0000	7.4000	26.7	0.60	5.058	6.97	36.500	108	240	0.212	1.70	3.20	209.8	0.0	7.90	172.0	0	0
	227-IV-C	0.0000	0.0000	0.0000	0.0000	0.0000	0.2145	0.0000	0.0000	0.0000	0.4551	0.0000	0.0000	0.0000	0.1930	0.0000	0.0000	0.0454	0.0000	70	3	18.8	-1.350	383	0.0000	14.7300	5.7000	20.6	0.70	3.273	7.53	37.400	80	222	0.205	1.90	3.10	206.2	0.0	5.10	168.0	0	0
	227-IV-C	0.0000	0.0000	0.0000	0.0023	0.0000	0.1980	0.0000	0.0000	0.0000	0.5107	0.0000	0.0000	0.0000	0.2230	0.0000	0.0156	0.0400	0.0000	80	2	19	-1.090	391	0.0000	18.4200	5.5000	29.5	0.50	3.052	7.36	35.300	151	215	0.172	2.00	3.90	214.7	0.0	8.50	176.0	0	0
	227-IV-C	0.0000	0.0000	0.0000	0.0032	0.0000	0.1320	0.0000	0.0000	0.0000	0.4829	0.0000	0.0000	0.0000	0.3305	0.0000	0.0000	0.0400	0.0000	100	5	19.3	-2.070	399	0.0000	21.8700	4.4000	27.9	0.50	5.228	6.75	31.170	26	215	0.270	2.70	4.50	236.7	0.0	6.70	192.0	0	0
	07-0022	0.0000	0.0000	0.0000	0.0020	0.0000	0.1695	0.0000	0.0000	0.0000	0.3122	0.0000	0.0000	0.0000	0.3030	0.0000	0.0000	0.0400	0.0000	50	8	20.0	-1.940	266	0.0000	9.1700	0.0000	20.6	0.70	3.195	7.3	29.800	30	98	0.225	1.60	3.40	170.8	0.0	5.60	140.0	0	0
	07-0020	0.0000	0.1812	0.0000	0.0000	0.0000	0.1000	0.0000	0.0000	0.0000	0.6864	0.0128	0.0000	0.0000	0.2405	0.0000	0.0000	0.0114	0.0000	200	59	19.7	-2.250	408	0.0000	21.6400	2.2000	34.0	0.60	6.338	6.78	36.000	0	252	0.293	2.80	5.60	262.6	0.0	9.00	215.3	0	0
	17-0001	0.0000	0.0000	0.0000	0.0037	0.0000	0.2400	0.0000	0.0000	0.0000	0.7371	0.0000	0.0000	0.0016	0.2355	0.0000	0.0017	0.1500	0.0000	220	10	18.6	-3.070	188	0.0000	1.1500	2.4000	21.2	0.30	10.345	6.29	20.000	310	150	0.142	1.80	2.60	122.0	0.0	5.50	100.0	0	0
	07-0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.2160	0.0000	0.0000	0.0000	0.3165	0.0000	0.0058	0.0011	0.2530	0.0000	0.0000	0.0500	0.0000	120	6	20.8	-3.110	236	0.0000	1.0400	4.0000	29.8	1.60	6.312	6.14	31.500	31	212	0.405	1.60	2.00	145.1	0.0	9.30	118.9	0	0
	19-0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0753	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6000	0.0000	0.0000	0.1100	0.0000	20	16	24.0	-2.620	687	0.0000	0.0000	13.3000	50.1	0.50	6.343	6.72	31.400	246	162	0.085	4.70	2.00	139.1	0.0	12.30	114.0	0	0
BOGOTA RIVER	246-II-A-	0.0000	0.0000	0.0011	0.0000	0.0000	0.1685	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4730	0.0000	0.0011	0.1100	0.0000	30	23	20.8	-3.585	193.4	0.0000	0.0000	1.7000	68.0	1.90	1.950	6.41	1.190	0	41	0.233	2.30	3.20	123.8	0.0	23.40	102.5	0	70
	246-II-A-	0.0000	0.0000	0.0034	0.0000	0.0000	0.3320	0.0000	0.0000	0.0000	0.0950	0.0000	0.0058	0.0000	0.1855	0.0000	0.0000	0.0600	0.0000	5	1	19.9	-4.840	59.3	0.0000	0.2900	1.2000	23.1	0.60	1.550	5.05	1.600	0	53	0.293	0.70	2.20	28.8	0.0	8.10	22.6	0	0
	246-II-A-	0.0000	0.0000	0.0000	0.0062	0.0000	0.0571	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3955	0.0000	0.0000	0.0400	0.0000	30	14	24.4	-2.640	187	0.0000	0.0000	0.0000	67.0	0.40	0.068	6.52	0.820	0	110	0.095	2.30	2.70	119.6	0.0	23.00	98.0	0	0
	246-II-A-	0.0000	0.0000	0.0073	0.0000	0.0000	0.1140	0.0000	0.0000	0.0000	0.3333	0.0000	0.0000	0.0000	0.2240	0.0000	0.0084	0.1000	0.0000	30	166	18.1	-2.710	55.7	0.0000	0.5600	4.0000	18.1	1.50	8.135	5.33	5.470	31	99	0.183	1.00	2.00	25.0	0.0	5.60	20.5	0	13
	246-II-A-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0399	0.0000	0.0000	0.0057	0.3249	0.0000	0.0000	0.0016	0.1030	0.0000	0.0000	0.0277	0.0000	10	0	20.1	-7.570	20.8	0.0000	0.0000	0.6000	4.4	0.40	0.225	3.74	2.250	36	39	0.097	0.40	1.20	0	0.0	1.10	0.0	0	0
	246-II-A-	0.0000	0.0000	0.0000	0.0000	0.0000	0.3000	0.0000	0.0000	0.0083	0.0000	0.0000	0.0000	0.0000	0.1405	0.0000	0.0000	0.6900	0.0183	140	2	20.1	-4.560	198.7	0.0000	0.8600	11.8000	27.0	1.50	0.027	5.38	6.890	0	128	0.145	2.30	3.40	70.0	0.0	7.00	57.4	0	0
AGRICULTURAL AREA	227-II-D-	0.0000	0.0000	0.0000	0.0055	0.0000	0.1040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3455	0.0000	0.0000	0.0700	0.0000	40	17	20.2	-3.350	170	0.0000	0.0000	0.0000	74.5	0.80	2.898	6.19	0.570	0	179	0.340	1.40	2.40	114.7	0.0	27.50	94.0	0	1
	227-II-C-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0592	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.5410	0.0000	0.0000	0.0163	0.0000	20	7	21.2	-2.300	296	0.0000	0.0000	0.0000	132.1	0.00	0.688	6.64	2.650	243	182	0.303	2.20	3.70	206.3	0.0	49.20	166.1	0	1
	227-I-D-0	0.0000	0.0000	0.0000	0.0016	0.0000	0.0811	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3255	0.0000	0.0000	0.0400	0.0000	30	14	18.9	-2.220	141	0.0000	0.0000	0.4000	54.9	0.20	2.870	6.10	1.020	64	97	0.298	1.20	3.00	88.79	0.0	20.00	73.8	0	2
	227-IV-A	0.0000	0.0000	0.0000	0.0029	0.0000	1.2400	0.0000	0.0000	0.0000	0.4468	0.0000	0.0000	0.0000	0.1505	0.0000	0.0041	0.0690	0.0121	50	6	24.1	-2.240	394	0.0000	3.8100	50.6000	17.4	0.90	2.968	6.98	48.600	135	224	1.455	1.20	10.90	143.8	0.0	5.00	116.9	0	490
	227-II-B-	0.0000	0.1639	0.0000	0.0000	0.0856	0.4050	0.0000	0.0000	0.0000	0.4194	0.0000	0.0000	0.0000	0.2980	0.0000	0.0045	0.0500	0.0000	110	25	17.9	-2.120	413	0.0000	2.1800	5.5000	42.7	0.40	4.355	6.66	45.400	130	150	0.367	2.60	1.80	258.6	0.0	12.80	212.0	1	25
INDUSTRY AREA	09-011	0.0000	0.0000	0.0000	0.0049	0.0000	0.3060	0.0000	0.0000	0.0000	0.5226	0.0000	0.0000	0.0000	0.2205	0.0000	0.0000	0.0500	0.0000	130	15	17.8	-1.280	316	0.0000	10.4500	0.0000	16.7	0.50	0.313	7.72	39.800	178	207	0.070	1.20	3.40	214.7	0.0	4.70	176.0	0	35
	09-0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.1560	0.0000	0.0000	0.0000	0.9300	0.0000	0.0000	0.0000	0.3330	0.0000	0.0000	0.0400	0.0000	130	3	19.9	-2.540	391	0.0000	11.3600	3.8000	19.0	0.10	5.233	6.60	43.700	411	243	0.370	1.70	4.20	245.2	0.0	4.80	202.0	0	0
	01-0011	0.0000	0.0000	0.0000	0.0023	0.0000	0.0560	0.0000	0.0000	0.0000	0.1316	0.0000	0.0045	0.0000	0.2255	0.0000	0.0018	0.1200	0.0000	50	4	18.0	-2.790	134.0	0.0000	5.0500	0.0000	14.8	0.80	4.453	6.6	6.600	110	135	0.175	1.10	3.50	85.0	0.0	4.10	69.7	0	1
	08-0012	0.0000	0.0000	0.0007	0.0021	0.0000	0.1940	0.0000	0.0000	0.0000	0.8900	0.0000	0.0000	0.0000	0.2780	0.0000	0.0016	0.0900	0.0000	200	21	20.1	-2.500	288	0.0000	2.3900	14.3000	97.9	0.50	13.108	6.72	40.900	382	184	0.060	1.20	2.40	163.5	0.0	37.20	134.0	0	1
	228-I-A-5	0.0000	0.1321	0.0015	0.0000	0.0000	0.2300	0.0000	0.0000	0.0000	1.3600	0.0000	0.0000	0.0000	0.4000	0.0000	0.0016	0.1300	0.0000	40	15	22.9	-2.460	660	0.0000	7.9900	64.7000	47.2	2.30	7.820	6.40	64.870	210	398	0.085	4.00	6.10	126.3	0.0	12.30	102.5	0	15
GUADALUPE	227-IV-A	0.0000	0.0000	0.0000	0.0020	0.0000	0.0614	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4255	0.0000	0.0067	0.1600	0.0000	40	92	21.4	-0.100	275	0.0000	0.0000	0.4000	120.7	0.90	8.193	6.9	4.400	26	175	0.058	3.50	8.50	138.8	0.0	42.50	112.8	0	0
	227-IV-C	0.0000	0.0000	0.0000	0.0018	0.0000	0.1910	0.0000	0.0000	0.0000	2.0755	0.0000	0.0000	0.0011	0.3080	0.0000	0.0044	0.7900	0.0000	20	8	21.1	-3.348	206	0.0000	0.0000	23.8000	20.6	0.80	1.540	6.16	26.300	55	131	0.050	1.00	4.20	65.0	0.0	6.60	53.3	0	0
	227-II-D-	0.0000	0.0000	0.0000	0.0027	0.0000	0.0308	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0000	0.1355	0.0000	0.0038	0.0366	0.0000	110	1	19	-4.940	619	0.0000	0.0000	0.4200	5.8	1.00	0.213	7.9	2.800	12	33	0.057	1.10	3.70	5.0	0.0	0.50	4.1	0	0
	227-II-D-	0.0000	0.0000	0.0000	0.0000	0.0000	0.1060	0.0000	0.0000	0.0000	40.2700	0.5089	0.0000	0.0000	0.5440	0.0000	0.0103	0.0900	0.0000	30	17	18.9	-2.230	491	0.0000	3.6400	0.0000	179.4	0.20	1.800	6.67	4.500	0	423	0.070	2.90	7.60	92.7	0.0	67.00	76.0	3	820
	227-II-D-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0399	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2480	0.0000	0.0060	0.0400	0.0000	100	104	23.8	-1.310	410	0.0000	0.0000	54.9000	92.1	1.00	7.560	7.04	30.700	38	195	0.020	2.40	10.80	147.6	0.0	32.90	120.0	0	0
	227-II-C-	0.0000	0.0000	0.0000	0.0025	0.0000	0.1030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2580	0.0000	0.0140	0.0541	0.0000	10	4	17	-1.760	35	0.0000	0.0000	0.0000	11.3	0.80	1.313	7.2	2.020	33	51	0.150	0.20	1.30	15.0	0.0	4.20	12.3	0	0
	227-II-B-	0.0000	0.0000	0.0000	0.0023	0.0000	0.0000	0.0000	0.0000	0.0000	0.3161	0.0000	0.0000	0.0016	0.0555	0.0000	0.0102	0.0150	0.0000	10	3	16	-3.700	20	0.0000	0.0000	0.0000	3.7	1.00	0.373	6.8	8.300	0	24	0.145	0.10	0.60	7.5	0.0	1.30	6.2	0	0
	227-IV-A	0.0000	0.2293	0.0000	0.0000	0.0000	0.0940	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0016	0.5430	0.0000	0.0036	0.0172	0.0000	20	3	31.9	-0.640	702	0.0000	1.4700	3.9000	81.4	0.90	0.515	6.77	71.520	117	399	0.105	2.70	14.70	300.1	0.0	28.10	246.0	1	49
	227-II-C-	0.0000	0.0000	0.0009	0.0000	0.0000	0.0553	0.0041	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.1505	0.0000	0.0028	0.0133	0.0000	0	4	15.4	-0.265	33	0.0000	0.0000	0.2000	13.7	0.00	0.253	4.87	1.300	74	44	0.748	0.30	1.20	13.76	0.0	5.00	10.3	0	0
	227-IV-A	0.0000	0.0000	0.0082	0.0036	0.0000	0.0000	0.0000	0.0000	0.0000	1.7700	0.0000	0.0000	0.0013	0.3355	0.0000	0.0041	0.3400	0.0000	20	4	17.2	-5.530	577	0.0000	0.0000	72.0000	110.9	0.30	0.593	4.84	54.300	211	497	0.250	14.50	10.00	15.01	0.0	20.50	12.3	0	62
QUATERNARY	227-IV-B	0.0000	0.0000	0.0000	0.0027	0.0000	0.0791	0.0000	0.0000	0.0000	3.4600	0.0000	0.0000	0.0000	0.2755	0.0000	0.0059	0.0477	0.0000	220	14	21.5	-1.740	1115	0.0000	44.4300	0.6000	98.6	0.90	8.720	7.15	80.070	252	617	0.180	12.00	17.30	639.0	0.0	19.70	522.8	0	35
	227-IV-A	0.0000	0.0000	0.0000	0.0042	0.0000	0.5840	0.0000	0.0000	0.1436	0.2030	0.0000	0.0000	0.0000	0.8000	0.0000	0.0033	0.0600	0.0000	30	11	31.5	-2.950	568	0.0000	2.8900	0.7000	78.6	1.30	2.120	6.22	58.170	411	362	0.840	2.40	15.40	325.1	0.0	27.50	266.5	0	5
	227-IV-B	0.0000	0.1907	0.0000	0.0028	0.0000	0.3770	0.0000	0.0000	0.0000	0.2010	0.0000	0.0000	0.0000	0.5000	0.0000	0.0017	0.1000	0.0000	50	4	17.5	-2.320	618	0.0000	3.4500	72.5000	33.6	0.70	1.910	6.90	73.200	196	391	0.082	1.90	14.60	239.1	0.0	10.30	196.0	6	4100
	227-IV-B	0.0000	0.1250	0.0000	0.0039	0.0000	0.0510	0.0000	0.0000	0.0000	0.3757	0.0000	0.0045	0.0016	0.1780	0.0000	0.0030	0.1300	0.0000	130	11	17.8	-2.510	391	0.0000	20.8400	0.3000	37.3	1.10	5.245	6.70	27.920	337	211	0.048	3.60	6.30	242.8	0.0	9.00	200.0	0	24
	228-I-A-5	0.0000	0.0000	0.0000	0.0027	0.0000	0.0669	0.0000	0.0000	0.0000	0.1771	0.0000	0.0060	0.0000	0.1250	0.0000	0.0030	0.1300	0.0000	50	20	18.7	-2.970	99	0.0000	2.1200	0.5000	14.8	0.50	7.768	6.37	3.570	73	92	0.158	0.80	2.00	62.5	0.0	4.60	51.3	0	0
	227-II-C-	0.0000	0.0000	0.0000	0.0000	0.0000	0.2070	0.0000	0.0000	0.0000	0.1400	0.0000	0.0000	0.0000	0.5000	0.0000	0.0049	0.1000	0.0000	50	5	22.9	-2.020	517	0.0000	2.8200	9.6000	35.6	0.90	1.075	6.68	64.200	142	310	0.038	2.20	7.40	267.6	0.0	10.60	219.4	0	2
	228-I-C-2	0.0000	0.0000	0.0000	0.0022	0.0000	0.0934	0.0000	0.0000	0.0000	0.0979	0.0000	0.0000	0.0012	0.1630	0.0000	0.0051	0.1000	0.0000	60	7	20.4	-2.620	147.0	0.0000	4.7000	2.8000	12.7	0.80	3.075	7.07	14.970	99	125	0.075	0.90	3.00	87.5	0.0	3.60	71.8	0	4600
	228-I-C-0	0.0000	0.0000	0.0000	0.0021	0.0000	0.1300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0605	0.0000	0.0028	0.0500	0.0000	40	19	17.6	-3.927	63	0.2500	0.0000	1.4000	1.2	0.30	1.915	6.26	7.650	28	52	0.000	0.10	6.20	40.0	0.0	0.30	32.8	0	0
	227-II-D-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0391	0.0000	0.0000	0.0000	0.1800	0.0000	0.0000	0.0013	0.1255	0.0000	0.0037	0.1300	0.0000	70	55	16.7	-2.648	111.8	0.0000	1.4700	2.4000	24.7	1.80	4.398	7.25	8.200	0	119	0.040	2.30	1.80	79.3	0.0	6.10	66.0	0	0
	228-I-C-0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0970	0.0000	0.0000	0.0000	0.8562	0.0000	0.0000	0.0000	0.1355	0.0000	0.0029	0.0600	0.0000	770	450	17.6	-2.510	273	0.0000	4.6200	3.2000	13.9	0.70	15.338	6.77	33.900	266	184	0.061	1.80	2.50	175.7	0.0	2.60	144.0	0	0
	227-II-D-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0546	0.0000	0.0000	0.0000	1.5314	0.0000	0.0000	0.0016	0.2580	0.0000	0.0057	0.0900	0.0000	> 1000	> 1000	16.7	-2.072	1240	0.0000	18.6000	182.1000	108.4	6.80	18.218	6.7	84.700	248	703	0.240	14.50	14.90	477.0	0.0	19.50	390.0	0	0
	228-I-D-0	0.0000	0.0000	0.0000	0.0048	0.0000	0.0762	0.0000	0.0000	0.0000	0.1930	0.0000	0.0000	0.0000	0.2330	0.0000	0.0000	0.2000	0.0000	230	78	18	-2.940	159	0.0000	2.4900	0.8000	26.9	1.00	9.988	6.60	7.100	0	132	0.040	2.70	2.10	104.9	0.0	6.30	86.0	0	690
	227-II-C-	0.0000	0.0000	0.0000	0.0025	0.0000	0.1290	0.0000	0.0000	0.0000	0.2049	0.0000	0.0000	0.0000	0.5755	0.0000	0.0013	0.1800	0.0000	60	20	20.2	-1.490	311	0.0000	4.7900	0.0000	34.9	0.20	0.071	7.00	36.800	30	250	0.037	4.40	7.90	220.8	0.0	6.70	182.0	0	11
	227-II-B-	0.0000	0.0000	0.0000	0.0021	0.0730	0.0842	0.0000	0.0000	0.0000	0.7252	0.0000	0.0000	0.0000	0.3005	0.0000	0.0019	0.1100	0.0000	190	92	17.6	-2.800	291	0.0000	1.4300	0.5000	32.9	0.60	8.790	6.26	35.800	0	181	0.330	3.50	2.50	195.2	0.0	7.40	160.0	0	6
	227-II-C-	0.0000	0.0000	0.0000	0.0000	0.0000	0.1650	0.0000	0.0000	0.0000	0.2168	0.0000	0.0000	0.0000	0.4855	0.0000	0.0000	0.1100	0.0000	40	3	20.8	-2.120	333	0.0000	4.6600	6.8000	29.2	0.40	0.045	7.04	27.400	0	229	0.122	3.50	3.80	195.2	0.0	5.90	160.0	0	0
	227-II-B-	0.0000	0.0000	0.0000	0.0018	0.0000	0.2750	0.0000	0.0000	0.0000	0.1550	0.0000	0.0000	0.0000	1.1000	0.0000	0.0028	0.0479	0.0000	30	2	19	-0.800	619	0.0000	0.0000	129.9000	30.7	1.00	2.225	7.9	75.200	267	349	0.047	0.90	2.30	115.0	0.0	10.80	94.3	2	12
	227-II-B-	0.0000	0.0000	0.0000	0.0034	0.0000	0.0300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0070	0.0000	0.1080	0.0000	0.0025	0.0800	0.0000	80	62	17	-1.510	125	0.0000	0.0000	0.0000	15.4	0.90	6.568	8.2	18.370	0	74	0.075	1.20	0.90	83.8	0.0	4.20	67.7	0	0
	228-I-B-0	0.0000	0.0000	0.0000	0.0049	0.0000	0.3330	0.0000	0.0000	0.0000	0.9400	0.0000	0.0000	0.0000	0.2480	0.0000	0.0000	0.1000	0.0000	150	18	20.7	-2.370	455	0.0000	11.1900	21.7000	34.0	0.80	6.513	6.53	38.400	417	341	0.070	3.90	7.20	248.9	0.0	7.20	204.0	0	9200
	209-III-B	0.0000	0.0000	0.0000	0.0000	0.0000	0.3170	0.0077	0.0000	0.0000	1.6507	0.0000	0.0083	0.0015	0.1305	0.0000	0.0000	0.1400	0.0000	55	2	18	-3.160	171	0.0000	0.8500	16.9000	14.4	0.00	5.340	6.6	21.700	0	156	0.115	1.00	1.30	77.5	0.0	4.10	63.6	0	0
	228-I-A-5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0492	0.0000	0.0000	0.0000	0.5900	0.0000	0.0000	0.0000	0.3055	0.0000	0.0019	0.1200	0.0000	80	21	18.0	-2.540	175	0.0000	4.7000	0.0000	26.1	0.70	6.903	6.41	11.000	0	140	0.122	3.00	3.50	104.9	0.0	5.50	86.0	0	0
	228-I-A-5	0.0000	0.0000	0.0000	0.0048	0.0000	0.0895	0.0000	0.0000	0.0000	0.3207	0.0000	0.0000	0.0000	0.3380	0.0000	0.0105	0.1200	0.0000	40	4	17.0	-2.580	144	0.0000	1.1100	1.3000	36.9	0.90	5.915	7.1	4.800	36	159	0.085	2.60	2.40	92.5	0.0	10.50	75.9	0	48
	209-III-B	0.0000	0.0000	0.0000	0.0035	0.0000	0.2400	0.0000	0.0000	0.0000	0.7093	0.0000	0.0058	0.0000	0.3355	0.0000	0.0000	0.3400	0.0000	100	6	19	-1.560	175	0.0000	1.1400	3.6000	27.5	0.90	5.313	7.2	19.500	111	172	0.600	2.50	3.40	96.3	0.0	6.90	80.0	0	2
	228-I-C-1	0.0000	0.0000	0.0005	0.0018	0.0000	0.0852	0.0000	0.0000	0.0000	0.6600	0.0000	0.0000	0.0000	0.2230	0.0000	0.0024	0.0700	0.0000	120	2	18.8	-3.167	376	0.0000	15.7600	6.9000	23.7	1.00	4.572	6.53	41.700	174	243	0.035	2.00	5.80	222.6	0.0	6.20	182.5	0	5
	227-II-D-	0.0000	0.0000	0.0000	0.0034	0.0000	0.0660	0.0000	0.0000	0.0000	0.0000	0.0000	0.0045	0.0000	0.5700	0.0000	0.0054	0.0400	0.0000	130	98	18.6	-0.120	346	1.2250	1.2300	18.1000	79.0	1.10	2.000	7.7	37.350	84	209	0.033	2.80	2.20	203.8	0.0	27.00	164.0	0	0
	209-III-B	0.0000	0.0000	0.0007	0.0000	0.0000	0.0507	0.0000	0.0000	0.0000	0.0000	0.0000	0.0058	0.0022	0.2280	0.0000	0.0000	1.6500	0.0000	10	0	18	-3.640	67	0.0000	0.0000	1.6000	10.5	0.00	6.220	6.3	4.650	0	56	0.303	1.10	0.80	37.5	0.0	2.40	30.8	0	0
ISOTOPE	246-II-A-	0.0000	0.0000	0.0000	0.0000	0.0000	0.1500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.2605	0.0000	0.0000	0.1000	0.0000	20	6	22.4	-1.590	150	0.0000	0.0000	0.5000	66.2	0.20	3.230	6.76	3.350	0	97	0.663	2.00	3.20	95.0	0.0	23.20	75.9	0	6
	227-II-D-	0.0000	0.0000	0.0000	0.0000	0.0920	0.1980	0.0000	0.0000	0.0000	0.1568	0.0000	0.0000	0.0013	0.2255	0.0000	0.0000	0.1300	0.0000	40	13	20.7	-0.350	178.2	0.0000	0.0000	0.4000	77.0	0.00	7.588	7.0	1.520	0	113	0.480	0.80	1.80	122.5	0.0	29.50	100.5	0	0
	227-IV-A	0.0000	0.1483	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.1026	0.0000	0.0000	0.0011	0.1905	0.0000	0.0000	0.0400	0.0160	45	36	28.5	-1.250	455	0.0000	2.1200	42.6000	69.8	0.00	9.462	6.83	48.150	0	332	0.240	2.80	9.00	207.6	0.0	23.30	170.2	1	17
	227-IV-A	0.0000	0.2150	0.0000	0.0039	0.0000	0.5710	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000	0.0000	0.0000	0.0500	0.0000	50	7	29.7	-1.350	565	0.0000	2.9900	1.7000	60.0	0.80	1.903	7.07	51.700	212	340	0.097	5.40	10.20	317.2	0.0	15.10	260.0	0	10
	228-I-C-2	0.0000	0.1483	0.0000	0.0000	0.0000	0.4590	0.0000	0.0000	0.0000	0.0000	0.0000	0.0045	0.0013	1.3000	0.0000	0.0000	0.0336	0.0000	40	15	30.3	-0.720	696	0.0000	1.9500	79.9000	113.5	0.00	1.898	7.1	46.770	407	356	0.645	4.50	7.10	305.1	0.0	38.00	250.1	0	11
	08-0007	0.0000	0.0000	0.0000	0.0030	0.0000	0.2950	0.0000	0.0000	0.0000	1.1100	0.0092	0.0000	0.0000	0.2080	0.0000	0.0015	0.0000	0.0000	90	3	28.2	-1.140	1132	0.0000	8.6900	0.0000	23.6	0.60	2.110	7.34	87.600	244	675	0.110	1.90	5.10	651.5	0.0	6.30	535.1	0	0
	227-IV-B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0337	0.0000	0.0000	0.0000	1.2100	0.0000	0.0000	0.0000	0.3505	0.0000	0.0000	0.1400	0.0000	500	251	19.9	0.210	1027	0.6250	42.4500	1.2000	134.0	1.40	8.750	7.24	63.200	480	476	0.085	19.80	12.30	599.0	0.0	21.00	490.0	0	410
	11-0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.1300	0.0000	0.0000	0.0000	0.1050	0.0000	0.0000	0.0000	0.1805	0.0000	0.0114	0.0577	0.0000	100	21	18.4	-1.902	256	0.3000	15.2000	0.0000	36.9	2.00	0.158	7.58	20.800	271	161	0.158	1.50	4.70	157.6	0.0	12.30	129.2	0	0
	22-0078	0.0000	0.1550	0.0000	0.0000	0.0000	0.0635	0.0186	0.0000	0.0000	0.5603	0.0000	0.0000	0.0016	0.1930	0.0000	0.0000	0.1200	0.0000	320	54	24.2	-2.530	426	0.6500	19.0200	0.7000	64.2	1.40	6.606	6.47	23.900	81	306	0.130	7.70	6.70	131.3	0.0	13.00	106.6	0	2
	228-I-C-0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0495	0.0120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1255	0.0000	0.0000	0.2900	0.0000	405	25	15.2	-3.530	307	1.8250	1.0600	4.1000	20.7	1.00	23.252	6.28	12.850	0	123	0.075	2.00	1.50	128.8	0.0	5.00	106.6	0	11
	209-III-D	0.0000	0.0000	0.0000	0.0018	0.0000	0.1060	0.0000	0.0000	0.0000	1.3000	0.0110	0.0000	0.0000	0.1630	0.0000	0.0000	0.0600	0.0000	220	39	19	-1.910	433	0.0000	8.6600	7.0000	25.1	1.10	91.580	7.2	57.120	443	293	0.128	2.70	5.60	267.6	0.0	5.60	219.4	0	1
	228-I-A-5	0.0000	0.1321	0.0000	0.0000	0.0000	0.0632	0.0000	0.0000	0.0000	0.5900	0.0000	0.0000	0.0000	0.1430	0.0000	0.0014	0.2200	0.0000	390	42	17.8	-2.810	346	0.0000	9.9000	7.9000	37.1	0.30	15.212	6.50	27.650	96	274	0.082	4.40	4.30	216.3	0.0	7.60	178.4	0	0
	209-III-D	0.0000	0.0000	0.0020	0.0000	0.0000	0.0670	0.0000	0.0000	0.0053	0.0000	0.0000	0.0000	0.0013	0.0905	0.0000	0.0000	0.0600	0.0000	30	20	18.3	-3.360	93.0	0.0000	0.9000	7.0000	9.9	2.20	5.745	6.6	10.875	31	88	0.105	1.00	1.00	49.4	31.0	2.30	41.0	0	0
	209-III-B	0.0000	0.0000	0.0009	0.0000	0.0000	0.0694	0.0000	0.0000	0.0000	0.2030	0.0000	0.0000	0.0018	0.1355	0.0000	0.0012	0.0000	0.0000	10	2	17.1	-4.590	63.8	0.0000	0.0000	2.3000	10.1	1.60	0.195	5.14	8.920	0	56	0.223	1.30	0.70	21.3	0.0	1.90	16.4	0	1
	227-II-D-	0.0000	0.0000	0.0000	0.0048	0.0000	0.0757	0.0000	0.0000	0.0000	0.2850	0.0146	0.0000	0.0000	0.2230	0.0000	0.0031	0.0680	0.0000	> 1000	755	16	-2.370	144.7	0.0000	4.2900	4.1000	15.0	0.50	3.158	7.4	10.090	130	149	0.335	0.90	3.50	96.3	0.0	4.50	80.0	0	1
	227-IV-A	0.0000	0.1804	0.0000	0.0000	0.0000	0.8850	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8000	0.0000	0.0000	0.0521	0.0000	50	16	30.4	-1.700	505	0.0000	3.2100	1.6000	67.4	0.80	0.029	6.90	36.900	222	220	0.060	2.40	12.60	295.2	0.0	23.00	242.0	0	67
	227-IV-B	0.0000	0.2022	0.0000	0.0039	0.0000	0.9580	0.0000	0.0000	0.0000	1.4100	0.0101	0.0000	0.0000	0.4080	0.0000	0.0000	0.0000	0.0000	140	16	30.8	0.710	801	0.0000	9.0600	0.5000	54.9	0.10	3.020	7.01	80.000	155	536	0.230	2.70	8.60	438.9	0.0	17.50	360.8	1	14
	227-IV-A	0.0000	0.1475	0.0000	0.0000	0.0000	0.3580	0.0000	0.0000	0.0000	0.1851	0.0000	0.0000	0.0000	0.4000	0.0000	0.0000	0.0600	0.0000	50	3	30.4	-1.600	603	0.0000	4.2300	3.7000	28.4	1.00	1.688	7.18	55.400	188	337	0.115	2.70	6.40	292.8	0.0	6.90	240.0	0	0
	16-0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.2130	0.0000	0.0000	0.0000	0.8650	0.0000	0.0000	0.0000	0.1930	0.0000	0.0000	0.0800	0.0000	240	28	21.9	-2.560	4.44	0.0000	6.3800	36.9000	24.5	0.80	11.518	6.58	43.700	65	156	0.125	2.50	3.30	205.0	0.0	5.70	168.0	0	0
	10-0011	0.0000	0.0000	0.0005	0.0000	0.0000	0.1430	0.0000	0.0000	0.0000	1.1700	0.0146	0.0000	0.0000	0.2980	0.0000	0.0000	0.0244	0.0000	100	5	18.7	-1.490	556	0.0000	19.9100	0.0000	25.6	0.50	2.555	7.55	50.300	448	287	0.850	2.10	5.60	363.6	0.0	6.80	298.0	0	72
QUATERNARY	GIBRAL	0.0000	0.0000	0.0000	0.0045	0.0000	0.2500	0.0000	0.0000	0.0000	0.6200	0.0000	0.0000	0.0000	0.0330	0.0000	0.0028	0.0220	0.0000	480	290	21.2	-0.080	579	0.0000	14.8700	0.0000	15.8	0.00	3.052	7.5	7.340	0	513	0.175	1.30	4.90	325.7	0.0	4.20	266.0	0	580

※ 🟥 possible to utilize after normal treatment process 🟪 possible to utilize after chrolination 🟨 exceeding Colombian standard 🟩 exceeding WHO standard Blue currently utilized for drinking purpose Note: No test for Polichlorinated Biphenyl and Tensoactives were conducted

Table-4.13 Result of Water Quality Test (Phase 1)

Basin	POZO No.	As mg/L	B mg/L	Cd mg/L	Cr Total mg/L	CN Total mg/L	F- mg/L	Pb mg/L	Hg mg/L	Ni mg/L	NO3-N mg/L	NO2-N mg/L	Se mg/L	Sb mg/L	Ba mg/L	Be mg/L	Cu mg/L	Mn mg/L	Mo mg/L	Color HAZEN TCU	Turbiedad NTU	TEMPERATURA °C	Indice de Langelier -	CONDUCTIVIDAD a 25 ° C µS/cm	Al total mg/L	Amonio mg/L
Soacha	246-II-A-143	0.0000	0.0000	0.0000	0.0000	0.0000	0.2080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1580	0.0000	0.0000	0.0900	0.0000	5	0	18.3	-4.630	65.4	0.0000	0.6660
	246-II-A-177	0.0000	0.1716	0.0000	0.0015	0.0000	0.0584	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5320	0.0000	0.0000	0.0580	0.0000	5	0	23.6	-3.120	191.8	0.0000	0.4660
	246-II-A-135	0.0000	0.0000	0.0026	0.0000	0.0000	0.0736	0.0000	0.0000	0.0000	0.4300	0.0000	0.0000	0.0000	0.2000	0.0000	0.0000	0.1900	0.0000	5	1	18.1	-4.260	79.4	0.0000	0.4010
	Average	0.0000	0.0572	0.0009	0.0005	0.0000	0.1133	0.0000	0.0000	0.0000	0.1433	0.0000	0.0000	0.0000	0.2967	0.0000	0.0000	0.1127	0.0000	5.0000	0.4667	20.0000	-4.0033	112.2000	0.0000	0.5110
	STDEV	0.0000	0.0991	0.0015	0.0009	0.0000	0.0823	0.0000	0.0000	0.0000	0.2483	0.0000	0.0000	0.0000	0.2049	0.0000	0.0000	0.0689	0.0000	0.0000	0.2996	3.1193	0.7870	69.2901	0.0000	0.1381
Bogota(2)	246-II-A-104	0.0000	0.0000	0.0000	0.0000	0.0000	0.1455	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2110	0.0000	0.0000	0.1000	0.0000	0	0	19.1	-2.930	191.8	0.0000	1.1220
	246-II-A-190	0.0000	0.0000	0.0000	0.0000	0.0000	0.3010	0.0000	0.0000	0.0000	0.2700	0.0000	0.0000	0.0000	0.1060	0.0000	0.0000	0.6010	0.0000	5	0	19	-4.290	196.3	0.0000	2.0710
	246-II-A-061	0.0000	0.0000	0.0000	0.0000	0.0000	0.1305	0.0000	0.0000	0.0000	2.2400	0.0000	0.0000	0.0000	0.1764	0.0000	0.0000	0.1100	0.0000	5	0	22	-3.540	146.5	0.0000	0.1520
	Average	0.0000	0.0000	0.0000	0.0000	0.0000	0.1923	0.0000	0.0000	0.0000	0.8367	0.0000	0.0000	0.0000	0.1645	0.0000	0.0000	0.2703	0.0000	3.3333	0.3067	20.0333	-3.5867	178.2000	0.0000	1.1150
	STDEV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0944	0.0000	0.0000	0.0000	1.2228	0.0000	0.0000	0.0000	0.0535	0.0000	0.0000	0.2864	0.0000	2.8868	0.1201	1.7039	0.6812	27.5451	0.0000	0.9595
Bojaca	227-II-C-11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0913	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2660	0.0000	0.0000	0.0060	0.0000	5	0	22.4	-2.050	296	0.0000	0.1100
	227-I-D-068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0992	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1980	0.0000	0.0000	0.0770	0.0000	5	1	19	-3.300	149.5	0.0000	0.6390
	227-IV-A-264	0.0000	0.0000	0.0000	0.0000	0.0000	1.4600	0.0000	0.0000	0.0000	3.7900	0.0000	0.0000	0.0000	0.3880	0.0000	0.0000	0.0000	0.0000	10	2	26	-2.820	388	0.0000	3.7270
	227-IV-A-349	0.0000	0.1503	0.0000	0.0000	0.0000	0.1560	0.0000	0.0000	0.0000	0.1200	0.0000	0.0000	0.0000	0.1940	0.0000	0.0000	0.1500	0.0000	5	0	20.7	-3.390	295.0	0.0000	0.1480
	227-IV-C-011	0.0000	0.0000	0.0000	0.0000	0.0000	0.3450	0.0000	0.0000	0.0000	1.8700	0.0068	0.0000	0.0000	0.2940	0.0000	0.0000	0.8030	0.0000	5	0	23	-3.340	192	0.0000	0.1580
	227-II-C-094	0.0000	0.0000	0.0000	0.0000	0.0000	0.1060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2060	0.0000	0.0000	0.0080	0.0000	5	0	15.5	-5.480	36.5	0.0000	0.5690
	227-IV-A-102	0.0000	0.0000	0.0062	0.0040	0.0000	0.4825	0.0000	0.0000	0.0000	0.4700	0.0000	0.0000	0.0000	0.3500	0.0000	0.0000	0.4010	0.0000	5	0	16.1	-6.110	558	0.0000	0.7040
	Average	0.0000	0.0215	0.0009	0.0006	0.0000	0.3914	0.0000	0.0000	0.0000	0.8929	0.0010	0.0000	0.0000	0.2709	0.0000	0.0000	0.2064	0.0000	5.7143	0.5729	20.3857	-3.7843	273.5714	0.0000	0.8650
	STDEV	0.0000	0.0568	0.0023	0.0015	0.0000	0.4941	0.0000	0.0000	0.0000	1.4443	0.0026	0.0000	0.0000	0.0774	0.0000	0.0000	0.2988	0.0000	1.8898	0.6294	3.8006	1.4611	169.9050	0.0000	1.2871
Subachoque(2)	227-II-C-576	0.0000	0.1425	0.0019	0.0000	0.0000	0.1410	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1670	0.0000	0.0034	0.0660	0.0000	70	1	18.8	-5.100	37.1	0.0000	0.3070
	227-II-B-028	0.0000	0.0000	0.0000	0.0000	0.0000	0.0561	0.0000	0.0000	0.0000	0.1400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0110	0.0000	5	0	15.6	-5.600	23.3	0.0000	0.0680
	227-IV-A-063	0.0000	0.2144	0.0000	0.0000	0.0000	0.1520	0.0000	0.0000	0.0000	0.1300	0.0000	0.0000	0.0000	0.5750	0.0000	0.0000	0.0100	0.0000	5	0	31.8	-1.540	705	0.0000	0.4010
	227-IV-A-441	0.0000	0.2837	0.0000	0.0000	0.0000	0.6280	0.0000	0.0000	0.0000	0.1400	0.0000	0.0000	0.0000	0.9650	0.0000	0.0000	0.0900	0.0000	10	0	31.3	-2.460	563	0.0000	3.3000
	227-II-C-477	0.0000	0.1503	0.0000	0.0000	0.0000	0.2940	0.0000	0.0000	0.0000	1.1900	0.0000	0.0000	0.0000	0.5800	0.0000	0.0000	0.0900	0.0000	20	0	22.8	-2.100	489	0.0000	3.8600
	227-II-C-972	0.0000	0.0000	0.0000	0.0000	0.0000	0.6060	0.0000	0.0000	0.0000	1.4600	0.0000	0.0000	0.0000	0.4844	0.0000	0.0000	0.1200	0.0000	5	1	19.7	2.500	332	0.0000	3.8630
	227-II-B-252	0.0000	0.1347	0.0000	0.0000	0.0000	0.0928	0.0000	0.0000	0.0000	0.4700	0.0000	0.0000	0.0000	0.3304	0.0000	0.0000	0.1300	0.0000	30	7	17.3	-3.000	291	0.0000	1.8780
	227-II-C-007	0.0000	0.1503	0.0000	0.0000	0.0000	0.2080	0.0000	0.0000	0.0000	0.2700	0.0000	0.0000	0.0000	0.1144	0.0000	0.0000	0.0903	0.0000	30	4	20.6	-2.500	322	0.0000	4.1950
	227-IV-A-233 (Nuevo)	0.0000	0.2101	0.0000	0.0000	0.0000	0.1490	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1676	0.0000	0.0000	0.0270	0.0000	10	1	34.8	-1.580	586	0.0000	0.2240
	227-IV-A-299	0.0000	0.2988	0.0000	0.0000	0.0000	0.6700	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.4020	0.0000	0.0000	0.0600	0.0000	10	0	29.4	-1.900	564	0.0000	2.1940
	227-IV-A-442	0.0000	0.4155	0.0000	0.0000	0.0000	0.8860	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0430	0.0000	0.0000	0.0300	0.0000	10	0	31.6	-2.270	506	0.0000	1.7610
	J-2 TISQUESUSA	0.0000	0.1347	0.0000	0.0000	0.0000	0.1580	0.0000	0.0000	0.0000	0.2200	0.0000	0.0000	0.0000	0.5100	0.0000	0.0000	0.1000	0.0000	40	1	19.8	-2.300	514	0.0000	######
	Average	0.0000	0.1779	0.0002	0.0000	0.0000	0.3367	0.0000	0.0000	0.0000	0.4183	0.0000	0.0000	0.0000	0.4449	0.0000	0.0003	0.0687	0.0000	20.4167	1.2942	24.4583	-2.3208	411.0333	0.0000	2.8917
	STDEV	0.0000	0.1185	0.0005	0.0000	0.0000	0.2806	0.0000	0.0000	0.0000	0.5086	0.0000	0.0000	0.0000	0.3227	0.0000	0.0010	0.0414	0.0000	19.4771	2.0881	6.7876	1.9913	214.8925	0.0000	3.4340
Tunjuelito	227-IV-C-80	0.0000	0.0000	0.0000	0.0025	0.0000	0.1420	0.0000	0.0000	0.0000	6.4900	0.0000	0.0000	0.0000	0.3000	0.0000	0.0000	0.0620	0.0000	40	1	18.6	-3.000	401	0.0000	######
	07-0022	0.0000	0.1269	0.0000	0.0000	0.0000	0.1710	0.0000	0.0000	0.0000	3.0300	0.0000	0.0000	0.0000	0.2420	0.0000	0.0000	0.0800	0.0000	40	1	19.5	-2.690	270	0.0000	######
	07-0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.1050	0.0000	0.0000	0.0000	6.7800	0.0000	0.0000	0.0000	0.2020	0.0000	0.0000	0.0320	0.0000	40	2	18.9	-2.650	408	0.0000	7.2390
	17-0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.2370	0.0000	0.0000	0.0000	0.3200	0.0000	0.0000	0.0000	0.3320	0.0000	0.0000	0.1420	0.0000	70	29	17.6	-3.680	188	0.0000	1.4420
	07-0005	0.0000	0.1582	0.0000	0.0000	0.0000	0.1700	0.0000	0.0000	0.0000	0.2000	0.0000	0.0000	0.0000	0.2200	0.0000	0.0000	0.0980	0.0000	40	5	20.8	-3.340	239.6	0.0000	2.4500
	19-0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0870	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0250	0.0000	0.0000	0.1200	0.0000	5	0	28.1	-3.380	287	0.0000	0.7660
	08-0012	0.0000	0.1425	0.0000	0.0000	0.0000	0.3360	0.0000	0.0000	0.0000	0.2200	0.0000	0.0000	0.0000	0.2820	0.0000	0.0000	0.0800	0.0000	70	10	20.4	-3.170	289	0.0000	3.3720
	Average	0.0000	0.0611	0.0000	0.0004	0.0000	0.1783	0.0000	0.0000	0.0000	2.4343	0.0000	0.0000	0.0000	0.3719	0.0000	0.0000	0.0877	0.0000	43.5714	6.9143	20.5571	-3.1300	297.5000	0.0000	6.7851
	STDEV	0.0000	0.0767	0.0000	0.0009	0.0000	0.0851	0.0000	0.0000	0.0000	3.0545	0.0000	0.0000	0.0000	0.2916	0.0000	0.0000	0.0365	0.0000	22.1198	10.2264	3.4980	0.3767	80.8557	0.0000	7.4590
Bogota(3)	10-0015	0.0000	0.1582	0.0000	0.0000	0.0000	0.1130	0.0000	0.0000	0.0000	6.4700	0.0000	0.0000	0.0000	0.2400	0.0000	0.0000	0.1150	0.0000	100	5	18.4	-2.220	343	0.0000	6.0300
	227-IV-B-445	0.0000	0.0000	0.0000	0.0000	0.0000	0.4330	0.0000	0.0000	0.0000	0.3500	0.0000	0.0000	0.0000	0.3380	0.0000	0.0000	0.1010	0.0000	70	1	29.5	-5.200	648	0.0000	8.3270
	10-0020	0.0000	0.1699	0.0018	0.0000	0.0000	0.0529	0.0000	0.0000	0.0078	2.0000	0.0000	0.0000	0.0000	0.1720	0.0000	0.0000	0.0820	0.0000	10	1	17.2	-5.610	212	0.0000	1.0480
	11-0106	0.0000	0.0000	0.0000	0.0021	0.0000	0.0798	0.0000	0.0000	0.0000	22.7800	0.0472	0.0000	0.0000	0.2250	0.0000	0.0000	0.0330	0.0000	100	1	18	-1.300	635	0.0000	######
	227-IV-B-361	0.0000	0.1981	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000	0.0000	6.1300	0.0000	0.0000	0.0000	0.1900	0.0000	0.0000	0.0220	0.0000	70	0	21.0	-1.170	711	0.0000	######
	11-0138	0.0000	0.0000	0.0000	0.0000	0.0000	0.1420	0.0000	0.0000	0.0000	0.1500	0.0000	0.0000	0.0000	0.5550	0.0000	0.0000	0.0900	0.0000	50	13	19.5	-5.500	212	0.0000	0.5800
	11-0026	0.0000	0.1469	0.0000	0.0000	0.0000	0.3790	0.0000	0.0000	0.0000	0.1200	0.0000	0.0000	0.0000	0.4320	0.0000	0.0000	0.1510	0.0000	5	2	22.7	-2.860	240	0.0000	0.6160
	10-0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.2195	0.0000	0.0000	0.0000	15.6500	0.0179	0.0000	0.0000	0.1120	0.0000	0.0000	0.0350	0.0000	50	2	24.1	-1.750	444	0.0000	######
	227-IV-C-044	0.0000	0.0000	0.0000	0.0000	0.0000	0.0947	0.0000	0.0000	0.0000	5.1400	0.0000	0.0000	0.0000	0.1900	0.0000	0.0000	0.0830	0.0000	70	3	19.2	-3.120	405	0.0000	######
	227-IV-C-51	0.0000	0.0000	0.0000	0.0000	0.0000	0.2160	0.0000	0.0000	0.0000	4.7300	0.0000	0.0000	0.0000	0.1160	0.0000	0.0072	0.0350	0.0000	50	1	19.1	-2.480	382	0.0000	######
	227-IV-C-56	0.0000	0.1425	0.0000	0.0000	0.0000	0.2820	0.0000	0.0000	0.0000	17.4600	0.0000	0.0000	0.0000	0.1480	0.0000	0.0000	0.0840	0.0000	50	1	19.8	-1.910	389	0.0000	######
	09-011	0.0000	0.1425	0.0000	0.0043	0.0000	0.3370	0.0000	0.0000	0.0056	3.8700	0.0000	0.0000	0.0000	0.1630	0.0000	0.0000	0.0270	0.0000	70	54	18.3	-2.590	317	0.0000	6.9590
	09-0021	0.0000	0.1633	0.0000	0.0000	0.0000	0.2520	0.0000	0.0000	0.0000	3.8700	0.0000	0.0000	0.0000	0.2940	0.0000	0.0000	0.0580	0.0000	100	3	20.3	-2.930	446	0.0000	8.7260
	01-0011	0.0000	0.1582	0.0000	0.0000	0.0000	0.0828	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2420	0.0000	0.0000	0.1210	0.0000	40	3	19.2	-3.240	134	0.0000	7.7920
	227-II-D-1112	0.0000	0.0000	0.0000	0.0000	0.0000	0.0419	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0200	0.0000	0.0020	0.0200	0.0000	5	1	18.4	-5.500	25.8	0.0000	0.3260
	227-IV-B-307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0460	0.0000	0.0000	0.0000	8.9000	0.0000	0.0000	0.0000	0.2900	0.0000	0.0000	0.0390	0.0000	20	1	21.9	-1.830	1121	0.0000	9.4450
	227-IV-B-096	0.0000	0.2901	0.0000	0.0000	0.0000	0.5840	0.0000	0.0000	0.0000	1.5200	0.0000	0.0000	0.0000	0.5750	0.0000	0.0000	0.1000	0.0000	20	11	30.7	-2.550	545	0.0000	3.1330
	228-III (I)-A-518	0.0000	0.2143	0.0000	0.0000	0.0000	0.0968	0.0000	0.0000	0.0000	0.3500	0.0000	0.0000	0.0000	0.2020	0.0000	0.0000	0.1300	0.0000	40	5	18.2	-3.570	111.1	0.0000	2.7280
	08-0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.4740	0.0000	0.0000	0.0000	0.8700	0.0000	0.0000	0.0000	0.2700	0.0000	0.0000	0.0000	0.0000	50	1	26.6	-1.290	1138	0.0000	8.9630
	227-IV-B-561	0.0000	0.1355	0.0000	0.0081	0.1645	0.0830	0.0000	0.0000	0.0000	0.6600	0.0000	0.0000	0.0000	0.3100	0.0000	0.0000	0.4910	0.0000	30	2	19.3	-2.370	928	0.0000	######
	228-III-A-051	0.0000	0.0000	0.0000	0.0000	0.0000	0.0773	0.0000	0.0000	0.0000	15.8500	0.0992	0.0000	0.0000	0.2960	0.0000	0.0000	0.0200	0.0000	50	1	22.2	-2.240	462	0.0000	######
	227-IV-B-577	0.0000	0.2815	0.0000	0.0000	0.0000	0.2295	0.0000	0.0000	0.0000	3.4100	0.0077	0.0000	0.0000	0.5340	0.0000	0.0000	0.0000	0.0000	40	4	30.9	-1.550	700	0.0000	4.7140
	227-IV-B-576	0.0000	0.2057	0.0000	0.0000	0.0000	0.5795	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2670	0.0000	0.0000	0.0510	0.0000	5	5	33.1	-1.850	546	0.0000	2.2620
	16-0003	0.0000	0.1582	0.0000	0.0000	0.0000	0.2790	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2250	0.0000	0.0000	0.0600	0.0000	50	13	20.4	-2.870	415	0.0000	3.1710
	10-0011	0.0000	0.1503	0.0000	0.0000	0.0000	0.1530	0.0000	0.0000	0.0000	5.6100	0.0000	0.0000	0.0000	0.2780	0.0000	0.0000	0.0200	0.0000	70	1	18	-1.870	610	0.0000	8.0290
	EAAB(Cra. 7 No. 175-10)	0.0000	0.0000	0.0000	0.0000	0.0000	0.1470	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3200	0.0000	0.0000	0.0390	0.0000	5	1	19.1	-2.180	185.2	0.0000	1.0860
	EAAB(Cra. 93 No. 165-2)	0.0000	0.1748	0.0000	0.0000	0.0000	0.4590	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4020	0.0000	0.0000	0.0000	0.0000	5	0	20.1	-1.550	353	0.0000	1.0530
	J-1 GIBRALTAR	0.0000	0.1503	0.0000	0.0000	0.0000	0.2670	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2560	0.0000	0.0000	0.0360	0.0000	70	1	17.6	-2.000	413.0	0.0000	9.7330
	J-3 SIBERIA	0.0000	0.2144	0.0000	0.0036	0.0000	0.1300	0.0000	0.0000	0.0000	3.2000	0.0000	0.0000	0.0000	0.5240	0.0000	0.0000	0.1200	0.0000	70	0	19	-2.200	1173	0.0000	######
	Average	0.0000	0.1122	0.0001	0.0006	0.0057	0.2196	0.0000	0.0000	0.0005	4.4514	0.0059	0.0000	0.0000	0.2823	0.0000	0.0003	0.0746	0.0000	47.0690	4.7197	21.4414	-2.6655	491.1759	0.0000	8.0966
	STDEV	0.0000	0.0961	0.0003	0.0018	0.0305	0.1632	0.0000	0.0000	0.0018	6.1057	0.0202	0.0000	0.0000	0.1374	0.0000	0.0014	0.0907	0.0000	29.4448	10.0500	4.4313	1.2813	301.6259	0.0000	6.2214
Chicu	227-II-D-605	0.0000	0.1661	0.0000	0.0000	0.0000	0.1780	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2090	0.0000	0.0000	0.0700	0.0000	20	1	19.3	-2.920	167.5	0.0000	0.2240
	227-II-B-181	0.0000	0.1612	0.0000	0.0000	0.0000	0.5320	0.0000	0.0000	0.0000	0.1100	0.0000	0.0000	0.0000	0.1776	0.0000	0.0000	0.0000	0.0000	20	3	17.2	-2.700	406	0.0000	2.6810
	227-II-D-016	0.0000	0.2371	0.0000	0.0000	0.0000	0.1360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3400	0.0000	0.0000	0.0700	0.0000	70	4	18.9	-3.030	141.8	0.0000	0.3340
	227-II-D-670	0.0000	0.1425	0.0000	0.0000	0.0000	0.0966	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1800	0.0000	0.0000	0.0000	0.0000	5	0	22.8	-2.500	375	0.0000	0.1720
	227-II-D-749	0.0000	0.0000	0.0000	0.0000	0.0000	0.0603	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2580	0.0000	0.0000	0.1200	0.0000	5	0	17.1	-3.700	119.8	0.0000	0.5020
	227-II-D-802	0.0000	0.1347	0.0000	0.0150	0.0000	0.1285	0.0000	0.0000	0.0000	4.5600	0.0000	0.0000	0.0000	0.2044	0.0000	0.0000	0.0703	0.0000	40	1	17	-2.300	1195	0.0000	######
	227-II-B-720	0.0000	0.0000	0.0000	0.0000	0.0000	0.3435	0.0000	0.0000	0.0000	0.2300	0.0000	0.0000	0.0000	1.1392	0.0000	0.0000	0.0000	0.0000	40	1	18.6	-2.900	566	0.0000	0.7490
	227-II-D-587	0.0000	0.1820	0.0000	0.0022	0.0788	0.1780	0.0000	0.0000	0.0000	2.1100	0.0000	0.0000	0.0000	0.2204	0.0000	0.0000	0.2090	0.0000	5	0	19.7	-2.400	182.3	0.0000	0.3010
	Pozo Termales Tabio	0.0000	0.0000	0.0006	0.0314	0.0000	0.4720	0.0000	0.0000	0.0747	0.0000	0.0000	0.0000	0.0000	1.1350	0.0000	0.0000	0.0160	0.0000	5	0	>50	-1.300	271000	0.0000	1.4090
	Average	0.0000	0.1137	0.0001	0.0054	0.0088	0.2361	0.0000	0.0000	0.0083	0.7789	0.0000	0.0000	0.0000	0.4293	0.0000	0.0000	0.0617	0.0000	23.3333	1.3011	18.8250	-2.6389	30461.4889	0.0000	2.2064
	STDEV	0.0000	0.0901	0.0002	0.0109	0.0263	0.1708	0.0000	0.0000	0.0249	1.5752	0.0000	0.0000	0.0000	0.4043	0.0000	0.0000	0.0697	0.0000	22.6385	1.4518	1.9196	0.6532	90202.5698	0.0000	4.3059
Bogota(4)	227-IV-B-456	0.0000	0.1568	0.0000	0.0033	0.0000	0.1010	0.0000	0.0000	0.0000	2.5800	0.0000	0.0000	0.0000	0.2840	0.0000	0.0000	0.1200	0.0000	50	2	18	-2.900	376	0.0000	8.7300
	228-I-C-247	0.0000	0.0000	0.0000	0.0000	0.0000	0.1500	0.0000	0.0000	0.0050	4.2400	0.0077	0.0000	0.0000	0.0580	0.0000	0.0000	0.1100	0.0000	5	4	19.8	-2.830	147	0.0000	5.1660
	228-I-C-041	0.0000	0.0000	0.0000	0.0015	0.0000	0.1845	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0260	0.0000	0.0000	0.0640	0.0000	5	1	17.9	-4.350	61.9	0.0000	0.0060
	228-I-C-178	0.0000	0.2900	0.0000	0.0000	0.0000	0.1270	0.0000	0.0000	0.0000	5.2800	0.0000	0.0000	0.0000	0.2864	0.0000	0.0080	0.1000	0.0000	70	1	18.8	-3.300	403	0.0000	7.6370
	227-II-D-1008	0.0000	0.1740	0.0000	0.0000	0.0000	0.1012	0.0000	0.0000	0.0000	0.8800	0.0000	0.0000	0.0000	0.5476	0.0000	0.0000	0.0000	0.0000	5	0	18.3	-1.450	351	0.0000	1.3090
	228-I-C-252	0.0000	0.1388	0.0000	0.0000	0.0734	0.3710	0.0000	0.0000	0.0000	0.1400	0.0000	0.0000	0.0000	2.1380	0.0000	0.0000	0.0900	0.0000	5	0	29.4	-2.140	698	0.0000	2.1300
	22-0078	0.0000	0.1699	0.0000	0.0016	0.0000	0.0868	0.0000	0.0000	0.0000	0.4800	0.0000	0.0000	0.0000	0.0700	0.0000	0.0000	0.1500	0.0000	40	4	24.2	-2.780	423	0.0000	######
	227-II-D-Noviciado	0.0000	0.1456	0.0000	0.0000	0.0000	0.5680	0.0000	0.0000	0.0000	0.2000	0.0000	0.0000	0.0000	0.2560	0.0000	0.0000	0.1900	0.0000	5	0	18.4	-3.200	117	0.0000	0.5350
	Average	0.0000	0.1344	0.0000	0.0008	0.0092	0.2112	0.0000	0.0000	0.0006	1.7250	0.0010	0.0000	0.0000	0.4583	0.0000	0.0010	0.1030	0.0000	23.1250	1.6563	20.6000	-2.8688	322.1125	0.0000	4.6321
	STDEV	0.0000	0.0955	0.0000	0.0012	0.0260	0.1708	0.0000	0.0000	0.0018	2.0623	0.0027	0.0000	0.0000	0.6998	0.0000	0.0028	0.0566	0.0000	26.3137	1.4635	4.1137	0.8489	207.7763	0.0000	4.2990
Neusa(1)	228-I-A-512	0.0000	0.1503	0.0000	0.0000	0.0000	0.0754	0.0000	0.0000	0.0000	1.8600	0.0000	0.0000	0.0000	0.3536	0.0000	0.0000	0.0903	0.0000	50	6	17.5	-3.280	187	0.0000	5.0340
	228-I-A-515?	0.0000	0.0000	0.0000	0.0000	0.0000	0.1150	0.0000	0.0000	0.0000	0.3800	0.0000	0.0000	0.0000	0.2324	0.0000	0.0230	0.1110	0.0000	70	10	16.5	-3.520	141	0.0000	2.8000
	Average	0.0000	0.0752	0.0000	0.0000	0.0000	0.0952	0.0000	0.0000	0.0000	1.1200	0.0000	0.0000	0.0000	0.2930	0.0000	0.0115	0.1006	0.0000	60.0000	7.8150	17.0000	-3.4000	164.0000	0.0000	3.9170
	STDEV	0.0000	0.1063	0.0000	0.0000	0.0000	0.0280	0.0000	0.0000	0.0000	1.0465	0.0000	0.0000	0.0000	0.0857	0.0000	0.0163	0.0147	0.0000	14.1421	2.4961	0.7071	0.1697	32.5269	0.0000	1.5797
Teusaca	228-I-A-510	0.0000	0.4090	0.0000	0.0037	0.0000	0.1290	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3980	0.0000	0.0000	0.0810	0.0000	5	5	16.4	-4.590	136.2	0.0000	0.7020
	228-I-C-018	0.0000	0.0000	0.0000	0.0000	0.0000	0.1410	0.0000	0.0000	0.0000	1.8800	0.0000	0.0000	0.0000	0.0184	0.0000	0.0000	0.0900	0.0000	30	5	19.4	-2.870	310.0	0.0000	9.4110
	228-I-D-003	0.0000	0.1425	0.0000	0.0000	0.0000	0.2863	0.0000	0.0000	0.0000	1.4100	0.0000	0.0000	0.0000	0.1724	0.0000	0.0000	0.2300	0.0000	70	13	20.4	-3.100	247	0.0000	5.4790
	228-I-B-079 (069)	0.0000	0.1582	0.0000	0.0000	0.0000	0.4110	0.0000	0.0000	0.0000	0.5000	0.0000	0.0000	0.0000	0.0604	0.0000	0.0000	0.1100	0.0000	50	6	21.2	-2.900	450	0.0000	######
	228-I-A-512-APOS	0.0000	0.2518	0.0000	0.0000	0.0000	0.2525	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2736	0.0000	0.0000	0.2360	0.0000	5	1	24.4	-3.000	484	0.0000	0.6580
	228-I-C-019	0.0000	0.1661	0.0000	0.0000	0.0000	0.0733	0.0000	0.0000	0.0000	0.4500	0.0000	0.0000	0.0000	0.1820	0.0000	0.0000	0.2600	0.0000	30	5	16	-3.580	184.5	0.0000	2.6440
	228-I-A-509	0.0000	0.1901	0.0000	0.0000	0.0000	0.0975	0.0000	0.0000	0.0000	5.4400	0.0000	0.0000	0.0000	0.2060	0.0000	0.0000	0.1800	0.0000	70	26	20.4	-3.000	467	0.0000	######
	J-4 SOPO	0.0000	0.3163	0.0000	0.0000	0.0000	0.2200	0.0000	0.0000	0.0000	0.1800	0.0000	0.0000	0.0000	0.4710	0.0000	0.0000	0.0600	0.0000	20	2	19	-2.600	352	0.0000	0.8860
	Average	0.0000	0.2042	0.0000	0.0005	0.0000	0.2013	0.0000	0.0000	0.0000	1.2325	0.0000	0.0000	0.0000	0.2227	0.0000	0.0000	0.1559	0.0000	35.0000	7.9775	19.6500	-3.2050	328.8375	0.0000	7.0651
	STDEV	0.0000	0.1231	0.0000	0.0013	0.0000	0.1135	0.0000	0.0000	0.0000	1.8302	0.0000	0.0000	0.0000	0.1547	0.0000	0.0000	0.0798	0.0000	26.0494	8.1884	2.6849	0.6240	132.7597	0.0000	7.8033
Bogota(6)	209-III-C-013	0.0000	0.2478	0.0000	0.0030	0.0000	0.0907	0.0000	0.0000	0.0000	1.5200	0.0000	0.0000	0.0000	0.1340	0.0000	0.0000	0.1700	0.0000	10	1	17.2	-2.890	1158	0.0000	1.4150
Neusa(2)	209-III-C-032	0.0000	0.0000	0.0000	0.0000	0.0000	0.0633	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5380	0.0000	0.0000	0.1310	0.0000	20	22	18.3	-3.900	733	0.0000	2.8390
	209-III-C-069	0.0000	0.0000	0.0000	0.0056	0.0000	0.0659	0.0000	0.0000	0.0000	1.1300	0.0000	0.0000	0.0000	1.3300	0.0000	0.0000	0.2010	0.0000	50	22	19.1	-3.500	520	0.0000	4.7620
	209-III-B-(D)-083	0.0000	0.1551	0.0000	0.0000	0.0000	0.8240	0.0000	0.0000	0.0000	0.9500	0.0000	0.0000	0.0000	0.3064	0.0000	0.0070	0.3010	0.0000	30	1	20.7	-2.300	205	0.0000	4.7340
	209-III-B-145	0.0000	0.1582	0.0000	0.0000	0.0000	0.0690	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2084	0.0000	0.0000	1.6934	0.0000	5	1	18.4	-4.200	71	0.0000	0.6320
	209-III-B-170	0.0000	0.0000	0.0005	0.0000	0.0000	0.0450	0.0000	0.0000	0.0000	0.1300	0.0000	0.0000	0.0000	0.1480	0.0000	0.0000	0.0000	0.0000	5	1	17.6	-4.600	60	0.0000	0.0600
	Average	0.0000	0.0935	0.0001	0.0014	0.0000	0.1930	0.0000	0.0000	0.0000	0.6217	0.0000	0.0000	0.0000	0.7775	0.0000	0.0012	0.4161	0.0000	20.0000	7.9833	18.5500	-3.5650	457.8167	0.0000	2.4070
	STDEV	0.0000	0.1077	0.0002	0.0024	0.0000	0.3095	0.0000	0.0000	0.0000	0.6615	0.0000	0.0000	0.0000	0.9758	0.0000	0.0029	0.6334	0.0000	17.6068	10.7864	1.2438	0.8540	433.9881	0.0000	2.0392
Bogota(7)	209-III-C-095	0.0000	0.0000	0.0000	0.0018	0.0000	0.0507	0.0036	0.0000	0.0000	0.3200	0.0000	0.0000	0.0000	0.7280	0.0000	0.0000	0.0000	0.0000	5	1	17.2	-3.000	102.7	0.0000	0.3670
	209-III-D-077	0.0000	0.0000	0.0000	0.0000	0.0000	0.0442	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2070	0.0000	0.0000	0.0280	0.0000	5	1	16.5	-3.900	257	0.0000	0.4330
	209-III-D-49	0.0000	0.0000	0.0000	0.0000	0.0000	0.3775	0.0000	0.0000	0.0000	0.6600	0.0000	0.0000	0.0000	0.2020	0.0000	0.0015	0.1210	0.0000	50	5	18.1	-3.200	155.7	0.0000	3.7130
	209-III-B-172	0.0000	0.1820	0.0000	0.0000	0.0000	0.4460	0.0000	0.0000	0.0000	0.2400	0.0000	0.0000	0.0000	0.0244	0.0000	0.0000	0.2100	0.0000	30	2	17.7	-3.700	191.4	0.0000	2.3720
	209-III-D-172	0.0000	0.1820	0.0000	0.0000	0.0000	0.1760	0.0000	0.0000	0.0000	0.5000	0.0000	0.0000	0.0000	0.2220	0.0000	0.0000	0.0900	0.0000	50	5	19.7	-2.780	505	0.0000	7.0390
	209-III-D-036	0.0000	0.1269	0.0000	0.0000	0.0000	0.0874	0.0000	0.0000	0.0000	0.6000	0.0000	0.0000	0.0000	0.0540	0.0000	0.0000	0.0700	0.0000	40	2	16.1	-3.500	100.5	0.0000	2.9990
	J-5 LA DIANA	0.0000	0.0000	0.0000	0.0000	0.0000	0.2125	0.0000	0.0000	0.0000	0.1600	0.0000	0.0000	0.0000	0.4740	0.0000	0.0000	0.0600	0.0000	30	1	17.9	-2.700	271	0.0000	3.8160
	Average	0.0000	0.0701	0.0000	0.0003	0.0000	0.1992	0.0005	0.0000	0.0000	0.3543	0.0000	0.0000	0.0000	0.2731	0.0000	0.0002	0.0827	0.0000	30.0000	2.3286	17.6000	-3.2543	226.1857	0.0000	2.9627
	STDEV	0.0000	0.0894	0.0000	0.0007	0.0000	0.1592	0.0014	0.0000	0.0000	0.2424	0.0000	0.0000	0.0000	0.2481	0.0000	0.0006	0.0686	0.0000	18.9297	1.7374	1.1818	0.4611	140.1898	0.0000	2.2875
Bogota(9)	209-II-D-054	0.0000	0.0000	0.0000	0.0019	0.0000	0.0463	0.0000	0.0000	0.0060	0.0000	0.0000	0.0000	0.0000	0.0860	0.0000	0.0021	0.7910	0.0000	5	1	18.4	-4.900	59	0.0000	0.4600
	209-II-D-093	0.0000	0.0000	0.0008	0.0000	0.0000	0.0667	0.0000	0.0000	0.0052	0.8600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0210	0.0000	5	1	17.2	-4.700	50.2	0.0000	0.5380
	J-6 CHOCONTA	0.0000	0.1347	0.0000	0.0000	0.0000	0.0718	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3580	0.0000	0.0000	0.5930	0.0000	5	1	15.4	-4.800	413	0.0000	0.3510
	Average	0.0000	0.0449	0.0003	0.0006	0.0000	0.0616	0.0000	0.0000	0.0037	0.2867	0.0000	0.0000	0.0000	0.1480	0.0000	0.0007	0.4683	0.0000	5.0000	0.9633	17.0000	-4.8000	174.1333	0.0000	0.4497
	STDEV	0.0000	0.0778	0.0005	0.0011	0.0000	0.0135	0.0000	0.0000	0.0033	0.4965	0.0000	0.0000	0.0000	0.1869	0.0000	0.0012	0.3999	0.0000	0.0000	0.3915	1.5100	0.1000	206.9135	0.0000	0.0939

Basin	POZO No.	Cl mg/l	DUREZA TOTAL CaCO$_3$ mg/L	Sulfuro de Hidrógeno mg/L	Fe TOTAL mg/L	pH Unidades -	Na mg/l	SO4 mg/l	Sólidos Disueltos Totales mg/L	Zn TOTAL mg/L	Mg mg/l	K mg/l	HCO$_3^-$ mg/l	CO3 mg/l	Ca mg/l	ALCALINIDAD CaCO3 mg/L	N M P ESCHERICHIA COLI Microorganismos / 100 ml	N M P COLIFORMES TOTALES Microorganismos / 100 ml	OXIGENO DISUELTO mg/L	Olor	Aquifer System	Cluster	Land Use (%)								Population
																							Forest Area	Cultivated Area	Grass land	Bare Field	Water Area	Urban Area	Green House	Total	
Soacha	246-II-A-143	0.2700	20.8	1.40	0.400	5.87	1.500	5.7	58	0.007	0.50	2.10	29.9	0.0	7.50	24.5	0	0	2.750	No	1	2	0.82	42.26	46.72	5.39	0.00	4.57	0.25	100	270,217
	246-II-A-177	0.0000	81.8	0.79	0.000	6.38	5.900	0	108	0.020	2.90	2.60	124.0	0.0	28.00	102.0	0	1	4.000	No	2.3	4									
	246-II-A-135	3.1700	22.3	1.10	0.200	6.04	4.700	5.4	58	0.038	1.60	1.90	27.4	0.0	6.30	22.4	0	0	9.200	No	1	2									
	Average	1.1467	41.6225	1.0967	0.2000	6.0967	4.0333	3.7000	74.6667	0.0217	1.6667	2.2000	60.4333	0.0000	13.9333	49.6467	0.0000	0.3333	5.3167	Yes	1	2									
	STDEV	1.7575	34.7983	0.3050	0.2000	0.2597	2.2745	3.2078	28.8675	0.0156	1.2014	0.3606	55.0645	0.0000	12.1969	45.3510	0.0000	0.5774	3.4206	0.00	66.67	—									
Bogota(2)	246-II-A-104	1.4100	67.5	1.50	2.200	6.67	5.100	0	95	0.001	2.40	3.10	115.0	0.0	23.10	93.8	0	0	0.960	Yes	1	4	0.26	21.88	26.74	26.49	0.00	23.29	1.34	100	5,232,730
	246-II-A-190	9.8400	29.3	0.40	14.300	5.91	19.000	18.8	35	0.039	3.00	3.70	79.6	0.0	6.80	65.3	0	0	1.460	No	1	2									
	246-II-A-061	0.0000	60.1	0.59	1.300	6.26	2.000	0	75	0.018	1.70	2.90	94.6	0.0	21.30	77.5	0	2	4.440	No	1.3	4									
	Average	3.7500	52.3209	0.8300	5.9333	6.2800	8.7000	6.2667	68.3333	0.0193	2.3667	3.2333	96.4000	0.0000	17.0667	78.8667	0.0000	0.6667	2.2867	Yes	1	4			26.74	26.49	0.00	23.29	1.34	77.86	
	STDEV	5.3210	20.2645	0.5880	7.2597	0.3804	9.0537	10.8542	30.5505	0.0190	0.6506	0.4163	17.7685	0.0000	8.9366	14.2991	0.0000	1.1547	1.8815	33.33	83.33	—									
Bojaca	227-II-C-11	0.0000	139.3	0.83	0.000	7.25	3.300	2.1	163	0.008	3.30	2.80	197	0.0	50.40	161.2	0	0	5.470	No	3	4	0.66	42.14	34.40	17.79	0.03	0.79	4.18	100	171,874
	227-I-D-068	0.0000	64.4	0.56	1.200	6.4	1.700	5.7	352	0.100	2.00	2.40	82.1	0.0	22.50	67.3	0	0	5.680	No	3	4									
	227-IV-A-264	49.2062	18.9	0.03	0.000	6.68	62.300	0	211	0.024	1.80	8.60	129.0	0.0	4.60	106.1	0	23	3.150	No	3	1									
	227-IV-A-349	1.4100	111.1	0.86	8.100	6.01	6.100	36.6	153	0.008	4.20	5.00	154.0	0.0	37.60	126.5	0	0	1.630	No	3	4									
	227-IV-C-011	21.0900	21.6	0.79	1.400	6.56	26.200	2.1	98	0.019	1.50	3.20	63.5	0.0	6.20	52.0	0	0	3.250	No	3	2									
	227-II-C-094	0.0000	12.0	0.54	0.000	5.1	1.200	3	49	0.021	0.60	0.70	59.2	0.0	3.80	18.4	0	0	2.740	No	3	2									
	227-IV-A-102	59.2400	88.0	0.46	0.000	4.7	70.000	180.5	243	0.191	9.50	7.80	19.9	0.0	19.60	16.3	2	1000	1.250	No	3	9									
	Average	18.7066	65.0381	0.5814	1.5286	6.1014	24.4000	32.8571	181.2857	0.0530	3.2714	4.3571	100.6771	0.0000	20.6714	78.2514	0.2857	146.1429	3.3100	Yes	3	4		42.14	34.40	17.79	0.03	0.79	4.18	99.33	
	STDEV	25.5860	49.9996	0.2898	2.9624	0.9053	29.8682	66.3488	99.5033	0.0687	2.9921	2.9222	61.7695	0.0000	17.9221	55.0906	0.7559	376.6132	1.7177	0.00	100.00	—									
Subachoque(2)	227-II-C-576	0.0000	13.9	2.37	0.000	5.7	7.400	2.1	79	0.076	0.60	1.00	21.3	0.0	4.60	17.4	0	0	1.990	No	3	2	1.86	25.93	46.32	7.10	0.30	18.25	0.24	100	304,083
	227-II-B-028	2.8100	5.6	2.35	0.000	5.2	1.900	0	2	0.057	0.40	0.70	8.8	0.0	1.60	7.2	0	0	6.970	No	3	2									
	227-IV-A-063	76.5200	78.5	0.90	0.000	7.16	######	0	392	0.006	3.50	8.80	319.0	0.0	25.70	261.1	0	170	2.520	No	3	7									
	227-IV-A-441	26.7134	70.5	0.90	1.100	6.44	82.900	4.2	359	0.017	3.30	11.60	314.00	0.0	22.80	257.0	0	2	0.340	No	1	7									
	227-II-C-477	41.1700	44.8	0.63	0.400	7.20	88.900	2.7	300	0.028	3.60	5.30	258.0	0.0	12.00	211.8	0	13	0.690	sulfurous	1	1									
	227-II-C-972	0.0000	30.9	0.54	0.300	7.2	64.000	0	228	0.031	4.00	5.00	222.0	0.0	5.80	181.6	0	8	2.930	No	1	1									
	227-II-B-252	0.0000	31.1	0.64	10.300	6.6	46.800	0	11	0.027	3.00	2.00	192.0	0.0	7.50	157.6	0	0	1.490	No	1	1									
	227-II-C-007	9.8400	34.7	0.79	2.200	7.00	58.300	3	146	0.032	4.30	3.50	190.0	0.0	6.80	156.1	0	11	2.720	sulfurous	1	1									
	227-IV-A-233 (Nuevo)	46.3946	90.1	0.75	0.000	7.12	88.900	2.7	317	0.016	4.50	10.20	299.0	0.0	28.70	244.8	0	0	2.170	No	3	7									
	227-IV-A-299	1.9300	54.4	0.84	0.200	7.1	95.600	2.4	342	0.011	5.40	8.90	319.0	0.0	12.90	261.1	0	13	2.020	No	1	1									
	227-IV-A-442	19.6844	87.0	0.52	0.900	6.53	66.600	4.2	286	0.014	2.90	11.30	299.0	0.0	30.10	244.8	0	0	0.210	No	1	7									
	J-2 TISQUESUSA	28.1100	55.5	0.85	0.600	7.00	94.000	0	361	0.052	5.30	10.70	331.0	0.0	13.50	270.9	0	38	0.860	No	1	1									
	Average	21.0977	49.7536	1.0067	1.3333	6.6875	67.2750	1.7750	235.2500	0.0306	3.4000	6.5833	231.0917	0.0000	14.3333	189.2905	0.0000	21.2500	2.0758	Yes	1	1		25.93	46.32	7.10	0.30	18.25	0.24	98.14	
	STDEV	24.0475	27.8241	0.6454	2.8962	0.6454	34.4649	1.6848	140.6706	0.0211	1.5754	4.1361	112.4050	0.0000	9.9873	91.9824	0.0000	48.1024	1.7977	16.67	66.67	—									
Tunjuelito	227-IV-C-80	8.4400	35.2	1.23	1.900	6.4	38.000	0	212	0.015	3.40	4.00	219.0	0.0	8.50	179.5	0	0	6.660	No	1	1	0.77	62.60	25.66	7.35	0.04	0.18	3.41	100	5,205,790
	07-0022	1.5300	23.8	0.71	2.100	6.81	38.000	3.6	167	0.024	2.20	3.10	167.0	0.0	5.90	136.7	0	0	6.850	No	1	1									
	07-0020	1.4100	36.6	0.94	0.900	6.75	44.000	0	207	0.071	2.90	4.70	241.0	0.0	9.90	197.9	0	0	6.830	No	1	1									
	17-0001	1.4100	24.0	0.17	10.700	6.2	23.500	0	141	0.053	1.90	2.50	117.0	0.0	6.50	95.9	0	0	2.680	No	1.2	2									
	07-0005	1.4100	25.7	0.59	6.100	6.36	37.600	0	162	0.017	1.70	2.00	144.4	0.0	7.50	118.3	0	0	1.990	No	1	1									
	19-0009	15.9700	52.6	2.02	5.000	6.02	33.400	18	148	0.023	5.70	1.50	124.0	0.0	11.70	102.0	0	0	0.450	No	1.2	2									
	08-0012	14.8700	17.8	0.10	11.500	6.43	52.900	0	158	0.036	1.60	1.80	149.0	0.0	4.50	122.4	0	0	2.730	No	1	1									
	Average	6.4343	30.8305	0.8229	5.4571	6.4271	38.2000	3.0857	170.7143	0.0341	2.7714	2.8000	165.9143	0.0000	7.7857	136.0914	0.0000	0.0000	4.0271	Yes	1	1		62.60	25.66	7.35	0.04	0.18	3.41	99.24	
	STDEV	6.6570	11.6938	0.6619	4.2684	0.2783	9.0305	6.7120	27.9029	0.0208	1.4488	1.1944	47.1796	0.0000	2.4627	38.6990	0.0000	0.0000	2.6833	0.00	85.71	—									
Bogota(3)	10-0015	0.0000	28.5	0.70	6.500	7.28	46.800	0	235	0.036	2.80	4.10	208.0	0.0	6.80	170.3	0	5500	4.200	No	1	1	4.31	33.87	19.79	7.47	0.04	32.67	1.84	100	5,324,909
	227-IV-B-445	41.3200	18.8	0.88	3.100	7	######	0	480	0.067	1.90	5.30	352.00	0.0	4.40	288.8	0	28	0.670	sulfurous	1	1									
	10-0020	22.5000	26.4	0.25	0.000	5.19	18.800	42.3	314	0.083	2.10	10.20	10.60	0.0	7.10	8.7	3	2400	3.620	No	1	2									
	11-0106	0.5500	66.0	0.37	0.700	8.2	76.000	0	406	0.069	7.60	9.10	425.0	0.0	13.90	348.7	0	6100	6.530	No	1	7									
	227-IV-B-361	21.8000	76.4	0.24	0.000	7.9	66.000	0	305	0.014	9.90	9.30	409.0	0.0	14.30	335.6	0	14	6.440	sulfurous	1	7									
	11-0138	1.4100	83.1	0.03	3.100	7.1	10.600	9.8	132	0.596	6.80	2.20	128.0	0.0	22.10	105.1	0	3	3.800	No	1	4									
	11-0026	7.4300	55.0	0.61	2.100	6.94	23.000	0	152	0.015	1.90	3.80	149.0	0.0	18.90	122.4	0	0	1.390	No	1	4									
	10-0026	4.9500	24.1	0.97	0.300	7.6	74.000	0	302	0.355	2.40	3.80	251.0	0.0	5.70	238.2	0	1	5.830	sulfurous	1	1									
	227-IV-C-044	15.4000	26.7	0.68	1.800	6.28	52.800	4.2	233	0.235	2.30	3.10	217.0	0.0	6.90	177.5	0	0	0.310	Yes	1	1									
	227-IV-C-51	12.6600	25.3	0.09	1.400	6.92	54.700	0	221	0.041	2.50	3.10	207.0	0.0	6.00	169.3	0	0	6.940	No	1	1									
	227-IV-C-56	4.6800	30.8	0.33	1.700	7.49	46.000	0	223	0.007	2.40	3.10	214.0	0.0	8.40	175.4	0	0	6.650	No	1	1									
	09-011	0.0000	16.7	2.90	0.400	7.11	60.000	0	242	0.132	1.50	3.60	204.00	0.0	4.20	167.3	0	18000	6.800	Oil and gasoline	1	1									
	09-0021	4.2200	29.4	0.83	6.200	6.47	67.100	0	252	0.039	2.60	4.00	264.0	0.0	7.50	216.2	0	0	1.790	No	1	1									
	01-0011	0.0000	17.9	1.70	6.000	6.66	7.000	0	203	0.039	1.80	2.70	75.9	0.0	4.20	62.2	0	0	1.590	No	1	2									
	227-II-D-1112	0.0000	3.3	0.01	0.000	5.30	1.800	2.7	28	0.028	0.30	2.90	11.0	0.0	0.80	9.0	0	0	10.340	No	1.2.3	2									
	227-IV-B-307	47.8000	84.8	1.30	0.000	7.07	######	0	607	0.073	8.90	12.40	620.0	0.0	19.30	508.0	1	0	4.880	Rotten	1	6									
	227-IV-B-096	50.6120	37.7	1.12	0.500	6.55	89.600	2.4	344	0.025	2.80	11.30	254.00	0.0	10.50	208.1	0	110	0.830	No	1	1									
	228-III (I)-A-518	7.0300	34.4	0.39	7.600	6.53	4.700	0	85	0.032	5.20	2.30	63.5	0.0	5.20	52.0	0	0	1.430	No	1	2									
	08-0007	76.2500	26.5	0.03	0.000	7.51	######	0	457	0.017	2.80	4.30	611.0	0.0	6.00	500.8	0	150	1.090	No	3	6									
	227-IV-B-561	46.3946	103.1	0.65	4.300	6.93	######	39.9	670	0.024	11.60	5.20	367.0	0.0	22.20	300.9	0	1300	3.500	Yes	1	7									
	228-III-A-051	0.5500	29.6	0.83	0.300	7.36	45.000	0	271	0.012	2.40	5.60	269.0	0.0	7.90	220.3	0	0	3.380	No	1	1									
	227-IV-B-577	44.6500	20.5	0.03	0.300	7.45	######	0	388	0.019	2.20	4.70	368.0	0.0	4.60	301.9	0	140	1.510	Yes	1	1									
	227-IV-B-576	31.9500	39.1	0.09	0.600	7.15	90.000	0	320	0.012	2.70	9.00	313.6	0.0	11.20	257.0	0	0	1.900	sulfurous	1	1									
	16-0003	30.9308	25.9	1.17	8.800	6.63	58.500	0	265	0.043	2.60	2.80	188.0	0.0	6.10	154.0	0	87.1	1.410	No	1	1									
	10-0011	4.0400	39.4	0.53	0.300	7.53	88.400	0	331	0.040	3.70	5.80	378.0	0.0	9.70	310.1	0	39	6.340	No	1	1									
	EAAB(Cra. 7 No. 175-10)	3.5800	32.4	0.61	0.000	8.62	57.000	0	112	0.010	2.60	3.80	117.0	8.6	8.70	110.2	0	270	1.180	No	3	1									
	EAAB(Cra. 93 No. 165-2)	36.3600	77.8	0.08	0.000	8.15	5.800	0	171	0.011	2.00	1.40	160.5	0.0	27.90	137.7	0	490	0.950	No	3	4									
	J-1 GIBRALTAR	1.6500	31.7	0.95	3.700	7.4	62.000	0	250	0.077	2.60	4.30	286.0	0.0	8.40	234.2	0	1500	0.310	No	1	1									
	J-3 SIBERIA	48.4800	239.3	0.88	0.000	6.7	######	0	588	0.056	30.20	16.00	907.0	0.0	46.10	743.6	0	9	0.450	No	1	8									
	Average	19.5585	46.5678	0.6638	2.0586	7.0707	68.4345	3.4931	296.1034	0.0761	4.5207	5.4897	276.8310	0.2966	11.2069	228.7399	0.1379	1246.2448	3.3124	Yes	1	1		33.87	19.79	7.47	0.04	32.67	1.84	95.68	
	STDEV	21.2573	44.3207	0.6138	2.6357	0.7468	50.8514	10.6136	153.0701	0.1240	5.6335	3.5385	192.3987	1.5970	9.3058	157.1637	0.5809	3568.1964	2.6788	31.03	87.34	—									
Chicu	227-II-D-605	0.0000	75.7	0.53	3.400	6.78	1.800	4.5	101	0.052	1.60	2.30	118.0	0.0	27.70	97.1	0	0	1.380	sulfurous	1	4	1.52	61.54	31.99	2.37	0.00	0.05	2.53	100	5,113,493
	227-II-B-181	8.4400	45.9	0.61	0.900	7	72.200	3.6	319	0.046	3.20	1.50	264.0	0.0	13.10	216.2	0	72	1.940	No	1	1									
	227-II-D-016	0.0000	61.0	0.43	3.800	6.67	1.800	2.1	142	0.018	1.30	1.80	94.1	0.0	22.30	77.1	0	0	3.340	No	3	4									
	227-II-D-670	53.4236	93.6	1.65	0.000	7.00	31.300	0	195	0.038	3.40	7.50	135.0	0.0	31.90	110.8	0	0	6.040	No	3	4									
	227-II-D-749	0.0000	29.3	1.54	6.400	6.4	4.000	0	36	0.050	1.60	1.20	81.8	0.0	9.10	67.0	0	65	2.300	sulfurous	1	2									
	227-II-D-802	170.1050	105.8	1.84	0.000	7.2	######	0	767	0.022	15.40	10.00	471.0	0.0	17.00	386.1	0	3100	6.400	No	1	6									
	227-II-B-720	120.9020	31.5	0.13	0.800	6.50	######	3	331	0.046	1.60	1.60	121.0	0.0	10.00	99.6	0	13	1.260	No	1	3									
	227-II-D-587	0.0000	72.9	0.63	2.200	7.2	10.500	0	84	0.013	0.80	1.50	122.0	0.0	27.90	100.0	0	310	1.500	No	3	4									
	Pozo Termales Tabio	774.6000	139.9	0.42	0.000	7.5	######	0	1451	0.011	4.40	5.60	222	0.0	48.80	182.4	0	0	2.390	No	3	10									
	Average	125.2745	72.8333	0.8644	1.9444	6.9167	104.4000	1.4667	380.6667	0.0329	3.7000	3.6667	180.9889	0.0000	23.0889	148.4711	0.0000	395.5556	2.9500	Yes	1	4		61.54	31.99	2.37	0.00	0.05	2.53	98.48	
	STDEV	251.3066	36.2074	0.6307	2.2142	0.3597	163.0134	1.8459	457.9288	0.0167	4.5431	3.2334	124.1110	0.0000	12.6866	101.6889	0.0000	1019.0375	1.9616	22.22	55.56	—									
Bogota(4)	227-IV-B-456	1.4100	34.6	0.47	4.800	6.8	33.000	0	106	0.047	3.80	4.80	209.0	0.0	7.60	171.4	0	6	1.680	No	1	1	2.05	61.23	27.04	2.56	0.00	0.12	7.00	100	5,020,467
	228-I-C-247	2.8100	16.1	0.37	3.500	7.27	15.500	0	104	0.033	1.60	2.50	79.6	0.0	3.80	65.3	0	26	4.590	No	1	2									
	228-I-C-041	1.4100	3.0	0.81	0.200	6.15	8.000	0	23	0.015	0.30	4.80	33.6	0.0	0.70	27.5	0	0	6.500	No	1	2									
	228-I-C-178	6.0600	25.6	0.79	5.600	6.60	48.000	0	265	0.029	3.00	5.40	210.0	0.0	5.30	172.4	0	78	1.120	No	1	1									
	227-II-D-1008	17.9200	80.5	3.02	0.000	7.95	39.400	0	182	0.008	3.80	2.30	197.0	0.0	26.00	161.2	0	10	6.220	No	1	4									
	228-I-C-252	78.7280	106.2	0.08	2.400	7.1	93.800	4.8	666	0.670	5.00	5.80	282.0	0.0	34.30	231.5	0	0	1.220	Yes	1	7									
	22-0078	2.8100	38.9	0.52	1.300	6.52	84.000	5.4	209	0.049	4.60	5.20	248.0	0.0	8.00	203.5	0	7	0.750	No	1	1									
	227-II-D-Noviciado	2.2000	24.2	0.83	4.500	6.9	4.000	0	77	0.018	2.00	3.80	64.7	0.0	6.40	53.0	0	1	5.220	No	3	2									
	Average	14.1685	41.1209	0.8613	2.7875	6.9063	40.7125	1.2750	204.0000	0.1086	3.0125	4.3250	165.4875	0.0000	11.5125	135.7263	0.0000	16.0000	3.4125	Yes	1	2		61.23	27.04	2.56	0.00	0.12	7.00	97.95	
	STDEV	26.6581	34.7212	0.9095	2.1457	0.5440	33.5090	2.3663	202.1909	0.2273	1.6075	1.3231	92.7210	0.0000	11.9399	76.1042	0.0000	26.4521	2.4559	12.50	87.50	—									
Neusa(1)	228-I-A-512	0.0000	30.8	0.33	3.800	6.52	10.900	0	118	0.013	3.60	2.70	108.0	0.0	6.40	88.7	0	0	1.270	No	1.3	2	3.41	54.63	38.38	1.42	0.00	0.15	2.02	100	5,179,688
	228-I-A-515?	1.4100	37.4	1.87	7.800	6.38	5.700	2.4	138	0.053	3.20	2.20	66.4	0.0	9.70	72.4	0	4	1.820	No	1	2									
	Average	0.7050	34.0766	1.1000	5.8000	6.4500	8.3000	1.2000	128.0000	0.0330	3.4000	2.4500	87.2000	0.0000	8.0500	80.5800	0.0000	2.0000	1.5450	Yes	1	2		54.63	38.38	1.42	0.00	0.15	2.02	96.6	
	STDEV	0.9970	4.6580	1.0889	2.8284	0.0990	3.6770	1.6971	14.1421	0.0283	0.2828	0.3536	29.4156	0.0000	2.3335	11.5400	0.0000	2.8284	0.3889	0.00	75.00	—									
Teusaca	228-I-A-510	9.9100	30.3	1.22	5.600	6.21	9.700	33.8	120	0.108	2.40	2.20	11.0	0.0	8.20	9.0	2	2000	2.300	sulfurous	1	2	2.70	39.65	54.26	1.66	0.68	0.17	0.87	100	5,058,322
	228-I-C-018	1.5300	26.5	1.27	0.300	6.73	42.000	3	207	0.059	3.40	2.20	185.0	0.0	5.00	152.0	0	0	5.400	sulfurous	1	1									
	228-I-D-003	2.8100	28.6	1.73	11.900	6.50	29.100	3	206	0.016	3.00	2.30	151.0	0.0	6.50	123.4	0	270	0.960	Yes	1	1									
	228-I-B-079 (069)	21.0902	36.2	2.19	3.900	6.5	60.500	0	206	0.065	4.30	6.80	238.0	0.0	7.40	194.8	0	0	1.160	sulfurous	1.2	1									
	228-I-A-512-APOS	92.7860	57.3	0.02	10.100	6.6	58.800	0	248	0.536	2.70	4.90	109.0	0.0	18.50	89.3	0	0	1.420	Yes	1.3	3									
	228-I-C-019	1.4100	19.2	0.07	19.400	6.42	13.200	0	95	0.001	2.00	1.50	118.0	0.0	4.40	96.9	0	9	2.850	No	1	2									
	228-I-A-509	19.6844	41.2	0.38	5.200	6.4	66.000	0	284	0.017	5.40	5.00	248.0	0.0	7.60	203.0	0	120	1.160	No	1	1									
	J-4 SOPO	30.9308	55.1	0.69	0.900	6.9	50.300	6	161	0.015	4.00	2.90	163.0	0.0	15.50	133.8	0	220	0.840	No	1	3									
	Average	22.5189	36.7899	0.9463	7.1625	6.5325	41.2000	5.7250	190.8750	0.1021	3.4000	3.4750	152.8750	0.0000	9.1375	125.2688	0.2500	327.3750	2.0113	Yes	1	1		36.95	54.26	1.66	0.68	0.17	0.87	94.59	
	STDEV	30.3594	13.6308	0.7886	6.3705	0.2121	21.7236	11.5526	62.9749	0.1789	1.1199	1.8622	76.2542	0.0000	5.0839	62.4416	0.7071	684.3543	1.5375	62.50	87.50	—									
Bogota(6)	209-III-C-013	345.8300	63.6	0.46	0.200	6.91	######	3.6	746	0.031	4.00	2.30	156.0	0.0	18.90	127.9	0	0	6.750	No	1	5	7.51	54.11	26.00	2.01	0.31	6.70	3.36	100	-
Neusa(2)	209-III-C-032	189.0000	124.4	0.69	4.400	6.1	83.600	2.4	492	0.017	5.50	2.90	74.9	0.0	40.80	61.4	0	1	0.810	sulfurous	1	3	10.62	41.52	39.57	5.10	2.00	0.99	0.20	100	143,302
	209-III-C-069	97.7000	86.4	0.41	13.300	6.3	64.300	0	327	0.005	6.50	3.30	121.0	0.0	23.90	99.1	0	1	0.800	No	1	3									
	209-III-B-(D)-083	1.4100	31.9	0.53	1.700	7.2	24.100	0	195	0.014	3.20	3.70	119.0	0.0	7.50	97.1	0	0	6.590	sulfurous	1	2									
	209-III-B-145	0.0000	9.5	0.31	6.400	6.1	3.800	6	53	0.007	1.10	0.70	38.6	0.0	2.00	31.6	0	4	0.550	No	1	2									
	209-III-B-170	1.1000	7.4	0.82	0.000	5.9	9.300	10.2	31	0.017	1.00	0.80	19.9	0.0	1.30	16.3	0	7	2.340	No	2	2									
	Average	105.8400	53.8639	0.5367	4.3333	6.4183	68.8500	3.7000	307.3333	0.0152	3.5500	2.2833	88.2333	0.0000	15.7333	72.2413	0.0000	2.1667	2.9733	Yes	1	2									
	STDEV	139.7535	46.3565	0.1882	5.0492	0.5173	84.0800	3.9146	275.8918	0.0093	2.2510	1.2750	52.7698	0.0000	15.2956	43.2162	0.0000	2.7869	2.9333	40.00	80.00	—		41.52	39.57	5.10	2.00	0.99	0.20	89.38	
Bogota(7)	209-III-C-095	5.6300	10.1	0.06	0.000	7.2	12.000	0	100	0.007	0.20	1.30	45.0	0.0	3.70	36.9	0	0	7.060	No	1	2	4.13	46.87	40.16	3.82	0.02	0.76	4.24	100	132,857
	209-III-D-077	0.0000	6.5	0.30	0.500	6.4	1.600	0	36	0.022	0.50	0.80	16.10	0.0	1.80	13.2	1	1200	7.360	sulfurous	1	2									
	209-III-D-49	1.4100	23.2	0.18	4.300	6.6	19.300	0	161	0.494	2.30	2.30	97.4	0.0	5.50	79.9	0	1	1.790	sulfurous	1	2									
	209-III-B-172	14.7600	13.9	1.00	7.200	6.4	21.800	2.4	109	0.011	0.90	1.20	83.6	0.0	4.10	68.5	0	0	1.330	No	1	1									
	209-III-D-172	7.0300	38.7	0.91	2.200	6.62	77.600	0	283	0.024	4.30	4.60	321.0	0.0	8.40	263.2	0	100	0.790	No	1	2									
	209-III-D-036	4.2200	7.8	0.13	5.200	6.7	11.800	0	93	0.013	0.80	0.90	50.9	0.0	1.80	41.7	0	0	6.640	No	1	2									
	J-5 LA DIANA	5.6300	71.1	0.93	0.800	6.9	22.000	0	148	0.007	4.00	3.50	175.0	0.0	21.90	143.6	0	11	0.330	No	1	4									
	Average	5.5257	24.4661	0.5019	2.8857	6.6886	23.7286	0.3429	132.8571	0.0826	1.8571	2.0857	112.7143	0.0000	6.7429	92.4276	0.1429	187.4286	3.6143	Yes	1	2		46.87	40.16	3.82	0.02	0.76	4.24	95.87	
	STDEV	4.7738	23.4371	0.4229	2.7328	0.2845	24.8260	0.9071	77.6561	0.1815	1.7018	1.4622	104.9485	0.0000	7.0609	86.0502	0.3780	447.9985	3.2241	28.57	100.00	—									
Bogota(9)	209-II-D-054	1.4100	9.1	1.80	7.700	5.7	1.500	5.4	40	0.037	1.30	0.70	32.6	0.0	1.50	26.7	0	0	0.370	No	1	2	9.24	30.22	58.13	0.66	0.00	1.73	0.02	100	52,635
	209-II-D-093	1.4100	13.3	1.90	0.000	5.9	2.300	0	37	0.088	1.00	1.60	22.2	0.0	3.70	18.2	0	0	8.030	No	2.3	2									
	J-6 CHOCONTA	99.8150	106.1	0.57	10.900	5.9	23.600	0	90	0.067	13.00	4.20	36.0	0.0	21.10	29.5	0	46	0.990	No	1	3									
	Average	34.2117	42.8606	1.4233	6.2000	5.8333	9.1333	1.8000	55.6667	0.0640	5.1000	2.1667	30.2667	0.0000	8.7667	24.7780	0.0000	15.3333	3.1300	Yes	1	2		30.22	58.13	0.66	0.00	1.73	0.02	90.76	
	STDEV	56.8142	54.8452	0.7407	5.6027	0.1155	12.5349	3.1177	29.7714	0.0256	6.8432	1.8175	7.1898	0.0000	10.7375	5.9006	0.0000	26.5581	4.2548	0.00	66.67	—									

🟥	Wells exceeded the water quality standard for raw water usable for drinking and living if treated by the traditional treatment
🟪	Wells exceeded the water quality standard for raw water usable for drinking and living if treated by Chlorination
🟨	Wells exceeded the Colombian water quality standard for potable water
🟩	Wells exceeded WHO guideline for potable water (No standard value in Colombia)
Blue Letter	Wells in actual use for drinking

🟥	Wells exceeded the water quality standard for raw water usable for drinking and living if treated by the traditional treatment
🟪	Wells exceeded the water quality standard for raw water usable for drinking and living if treated by Chlorination
🟨	Wells exceeded the Colombian water quality standard for potable water
🟩	Wells exceeded WHO guideline for potable water (No standard value in Colombia)
Blue Letter	Wells in actual use for drinking

Table-4.14 Result of Water Quality Test (Phase 2)

Basin	No. POZO	As μg/L	B mg/L	Cd μg/L	Cr total μg/L	CN- mg/L	F- mg/L	Pb μg/L	Hg μg/L	Ni μg/L	NO3 -N mg/L	NO2 - N μg/L	Se μg/L	Sb μg/L	Ba μg/L	Be μg/L	Cu μg/L
Soacha	246-II-A-135	0.0000	0.0000	1.7000	0.0000	0.0000	0.1380	0.0000	0.0000	0.0000	0.5300	0.0000	0.0000	0.0000	121.0000	0.0000	0.0000
Bogota(2)	246-II-A-190	0.0000	0.0000	0.0000	0.0000	0.0000	0.3710	0.0000	0.0000	8.7000	0.6600	0.0000	0.0000	0.0000	165.0000	0.0000	0.0000
	246-II-A-087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0510	0.0000	0.0000	5.5000	0.5000	0.0000	0.0000	0.0000	189.0000	0.0000	0.0000
	Average	0.0000	0.0000	0.5667	0.0000	0.0000	0.1867	0.0000	0.0000	4.7333	0.5633	0.0000	0.0000	0.0000	158.3333	0.0000	0.0000
	STDEV	0.0000	0.0000	0.9815	0.0000	0.0000	0.1655	0.0000	0.0000	4.4004	0.0850	0.0000	0.0000	0.0000	34.4867	0.0000	0.0000
Bojaca	227-II-C-011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0940	0.0000	0.0000	0.0000	0.6100	0.0000	0.0000	0.0000	453.0000	0.0000	0.0000
	227-IV-A-264	0.0000	0.2100	0.0000	0.0000	0.0000	1.5000	0.0000	0.0000	0.0000	0.5200	0.0000	0.0000	0.0000	176.0000	0.0000	0.0000
	227-IV-A-349	0.0000	0.1900	0.0000	0.0000	0.0000	0.0840	0.0000	0.0000	0.0000	0.1500	8.0000	0.0000	0.0000	161.0000	0.0000	5.0000
	227-IV-C-011	0.0000	0.1600	0.0000	0.0000	0.0000	0.3580	0.0000	0.0000	0.0000	1.8400	0.0000	0.0000	0.0000	128.0000	0.0000	5.0000
	227-II-C-094	0.0000	0.1300	0.0000	0.0000	0.0000	0.0870	0.0000	0.0000	0.0000	0.2000	0.0000	0.0000	0.0000	127.0000	0.0000	0.0000
	227-IV-A-102	0.0000	0.2000	3.0000	8.3000	0.0000	0.0310	0.0000	0.0000	12.0000	7.0800	0.0000	0.0000	0.0000	492.0000	0.0000	9.8000
	227-I-D-068	0.0000	0.0000	0.0000	0.0000	0.0000	0.1280	0.0000	0.0000	0.0000	0.1100	0.0000	0.0000	0.0000	198.0000	0.0000	0.0000
	Average	0.0000	0.1271	0.4286	1.1857	0.0000	0.3260	0.0000	0.0000	1.7143	1.5014	1.1429	0.0000	0.0000	247.8571	0.0000	2.8286
	STDEV	0.0000	0.0909	1.1339	3.1371	0.0000	0.5284	0.0000	0.0000	4.5356	2.5314	3.0237	0.0000	0.0000	155.9139	0.0000	3.8737
Subachoque(2)	227-II-B-028	0.0000	0.0000	0.0000	0.0000	0.0000	0.0570	0.0000	0.0000	0.0000	0.4400	0.0000	0.0000	0.0000	73.0000	0.0000	5.7000
	227-IV-A-063	0.0000	0.3900	0.0000	0.0000	0.0000	0.1110	0.0000	0.0000	0.0000	0.1300	0.0000	0.0000	0.0000	453.0000	0.0000	0.0000
	227-IV-A-441	0.0000	0.0000	0.0000	0.0000	0.0000	0.6190	0.0000	0.0000	0.0000	0.2000	0.0000	0.0000	0.0000	166.0000	0.0000	0.0000
	227-II-C-477	0.0000	0.0000	0.0000	0.0000	0.0000	0.3050	0.0000	0.0000	0.0000	0.2100	0.0000	0.0000	0.0000	764.0000	0.0000	0.0000
	227-II-C-972	0.0000	0.0000	0.0000	0.0000	0.0000	0.5520	0.0000	0.0000	0.0000	0.1800	0.0000	0.0000	0.0000	191.0000	0.0000	0.0000
	227-II-B-252	0.0000	0.0000	0.0000	0.0000	0.0000	0.0890	0.0000	0.0000	0.0000	0.4500	0.0000	0.0000	0.0000	136.0000	0.0000	2.1000
	227-II-C-007	0.0000	0.0000	0.0000	0.0000	0.0000	0.2170	0.0000	0.0000	0.0000	0.3700	0.0000	0.0000	0.0000	201.0000	0.0000	0.0000
	227-IV-A-442	0.0000	0.2700	0.0000	0.0000	0.0000	0.8370	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1329.0000	0.0000	0.0000
	JICA-2	0.0000	0.1300	0.0000	0.0000	0.0000	0.1080	0.0000	0.0000	0.0000	0.3000	0.0000	0.0000	0.0000	260.0000	0.0000	0.0000
	Average	0.0000	0.0878	0.0000	0.0000	0.0000	0.3217	0.0000	0.0000	0.0000	0.2533	0.0000	0.0000	0.0000	397.0000	0.0000	0.8667
	STDEV	0.0000	0.1469	0.0000	0.0000	0.0000	0.2812	0.0000	0.0000	0.0000	0.1495	0.0000	0.0000	0.0000	408.1250	0.0000	1.9410
Tunjuelito	227-IV-C-80	0.0000	0.0000	0.0000	0.0000	0.0000	0.1590	0.0000	0.0000	0.0000	0.2800	0.0000	0.0000	0.0000	127.0000	0.0000	4.7000
	07-0020	0.0000	0.1341	0.0000	0.0000	0.0000	0.1330	0.0000	0.0000	0.0000	0.3800	0.0000	0.0000	0.0000	161.0000	0.0000	0.0000
	07-0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.2390	0.0000	0.0000	0.0000	0.3600	0.0000	0.0000	0.0000	205.0000	0.0000	0.0000
	19-0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.1150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	444.0000	0.0000	0.0000
	08-0012	0.0000	0.1700	0.0000	0.0000	0.0000	0.2850	3.6000	0.0000	0.0000	0.6100	0.0000	0.0000	0.0000	111.0000	0.0000	0.0000
	Average	0.0000	0.0608	0.0000	0.0000	0.0000	0.1862	0.7200	0.0000	0.0000	0.3260	0.0000	0.0000	0.0000	209.6000	0.0000	0.9400
	STDEV	0.0000	0.0842	0.0000	0.0000	0.0000	0.0728	1.6100	0.0000	0.0000	0.2197	0.0000	0.0000	0.0000	135.8963	0.0000	2.1019
Bogota(3)	227-II-C-576	0.0000	0.0000	2.1000	0.0000	0.0000	0.1310	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	87.0000	0.0000	3.9000
	227-IV-A-X6	0.0000	0.0000	0.0000	0.0000	0.0000	0.3480	0.0000	0.0000	0.0000	0.1500	0.0000	0.0000	0.0000	126.0000	0.0000	0.0000
	Vitelma 1-EAAB	0.0000	0.0000	0.0000	0.0000	0.0000	0.3260	0.0000	0.0000	0.0000	0.1300	0.0000	0.0000	0.0000	119.0000	0.0000	0.0000
	227-IV-B-576	0.0000	0.0000	0.0000	0.0000	0.0000	0.5800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	141.0000	0.0000	1.8000
	227-IV-C-51	0.0000	0.0000	0.0000	0.0000	0.0000	0.2670	0.0000	0.0000	0.0000	0.3300	0.0000	0.0000	0.0000	148.0000	0.0000	7.3000
	09-0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.3270	0.0000	0.0000	0.0000	0.7700	20.8760	0.0000	0.0000	140.0000	0.0000	4.6000
	09-0021	0.0000	0.2500	0.0000	0.0000	0.0000	0.2880	8.5000	0.0000	0.0000	0.4800	0.0000	0.0000	0.0000	151.0000	0.0000	1.8000
	08-0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.4080	0.0000	0.0000	0.0000	0.9400	0.0000	0.0000	0.0000	136.0000	0.0000	1.8000
	227-II-D-1112	0.0000	0.2000	0.0000	0.0000	0.0000	0.0580	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	82.0000	0.0000	6.3000
	227-IV-B-307	0.0000	0.2200	0.0000	0.0000	0.0000	0.0680	0.0000	0.0000	0.0000	1.8400	0.0000	0.0000	0.0000	297.0000	0.0000	0.0000
	227-IV-B-445	0.0000	0.2800	0.0000	0.0000	0.0000	0.4380	0.0000	0.0000	0.0000	0.4400	0.0000	0.0000	0.0000	151.0000	0.0000	0.0000
	16-0003	0.0000	0.1800	0.0000	0.0000	0.0000	0.2090	0.0000	0.0000	0.0000	1.1900	0.0000	0.0000	0.0000	142.0000	0.0000	0.0000
	E-2-EAAB	0.0000	0.2000	0.0000	0.0000	0.0000	0.1400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	387.0000	0.0000	0.0000
	JICA-1	0.0000	0.0000	0.0000	0.0000	0.0000	0.1960	0.0000	0.0000	0.0000	0.6500	0.0000	0.0000	0.0000	214.0000	0.0000	0.0000
	JICA-3	0.0000	0.0000	0.0000	2.7000	0.0890	0.0580	0.0000	0.0000	0.0000	1.3000	0.0000	0.0000	0.0000	419.0000	0.0000	0.0000
	E-1 EAAB	0.0000	0.0000	0.0000	0.0000	0.0000	0.1920	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	183.0000	0.0000	3.9000
	227-IV-B-361	0.0000	0.0000	0.0000	0.0000	0.0000	0.0890	0.0000	0.0000	0.0000	0.4200	0.0000	0.0000	0.0000	117.0000	0.0000	2.0000
	227-IV-B-577	0.0000	0.0000	0.0000	0.0000	0.0000	0.1760	0.0000	0.0000	0.0000	0.4000	19.0000	0.0000	0.0000	162.0000	0.0000	1.5000
	227-IV-B-096	0.0000	0.1700	0.0000	0.0000	0.0000	0.5400	0.0000	0.0000	0.0000	0.1900	0.0000	0.0000	0.0000	237.0000	0.0000	0.0000
	Average	0.0000	0.0789	0.1105	0.1421	0.0047	0.2547	0.4474	0.0000	0.0000	0.4858	2.0987	0.0000	0.0000	181.0000	0.0000	1.8368
	STDEV	0.0000	0.1086	0.4818	0.6194	0.0204	0.1578	1.9500	0.0000	0.0000	0.5192	6.2943	0.0000	0.0000	93.2273	0.0000	2.3145
Chicu	227-II-D-605	0.0000	0.0000	0.0000	0.0000	0.0000	0.1190	0.0000	0.0000	0.0000	0.2900	0.0000	0.0000	0.0000	142.0000	0.0000	1.8000
	227-II-B-181	0.0000	0.0000	0.8000	0.0000	0.0000	0.4440	0.0000	0.0000	0.0000	0.3200	0.0000	0.0000	0.0000	155.0000	0.0000	2.3000
	227-II-D-587	0.0000	0.1800	0.0000	0.0000	0.0000	0.1890	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	129.0000	0.0000	1.1000
	227-II-D-802	0.0000	0.0000	0.0000	0.0000	0.0000	0.1140	0.0000	0.0000	0.0000	1.1100	0.0000	0.0000	0.0000	123.0000	0.0000	0.0000
	227-II-B-720	0.0000	0.0000	0.0000	0.0000	0.0000	0.2820	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	367.0000	0.0000	1.7000
	227-II-D-670	0.0000	0.0000	0.0000	0.0000	0.0000	0.0890	0.0000	0.0000	0.0000	0.3300	0.0000	0.0000	0.0000	116.0000	0.0000	0.0000
	Average	0.0000	0.0300	0.1333	0.0000	0.0000	0.2062	0.0000	0.0000	0.0000	0.3417	0.0000	0.0000	0.0000	172.0000	0.0000	1.1500
	STDEV	0.0000	0.0735	0.3266	0.0000	0.0000	0.1360	0.0000	0.0000	0.0000	0.4067	0.0000	0.0000	0.0000	96.5401	0.0000	0.9690
Bogota(4)	228-I-C-247	0.0000	0.0000	0.0000	0.0000	0.0000	0.1030	0.0000	0.0000	0.0000	0.2800	0.0000	0.0000	0.0000	134.0000	0.0000	0.0000
	228-I-C-041	0.0000	0.0000	0.0000	2.3000	0.0000	0.1430	0.0000	0.0000	0.0000	0.1500	0.0000	0.0000	0.0000	83.0000	0.0000	0.0000
	228-I-C-178	0.0000	0.1600	0.0000	0.0000	0.0000	0.1020	0.0000	0.0000	0.0000	0.6500	0.0000	0.0000	0.0000	196.0000	0.0000	3.1000
	227-II-D-1008	0.0000	0.1600	0.0000	0.0000	0.0000	0.1140	0.0000	0.0000	0.0000	0.1100	0.0000	0.0000	0.0000	279.0000	0.0000	3.3000
	Average	0.0000	0.0800	0.0000	0.5750	0.0000	0.1155	0.0000	0.0000	0.0000	0.2975	0.0000	0.0000	0.0000	173.0000	0.0000	1.6000
	STDEV	0.0000	0.0924	0.0000	1.1500	0.0000	0.0191	0.0000	0.0000	0.0000	0.2460	0.0000	0.0000	0.0000	84.4314	0.0000	1.8493
Frio	228-I-A-515	0.0000	0.2000	0.0000	0.0000	0.0000	0.1290	0.0000	0.0000	0.0000	0.5300	0.0000	0.0000	0.0000	157.0000	0.0000	2.8000
Teusaca	228-I-C-018	0.0000	0.0000	0.0000	0.0000	0.0000	0.1510	0.0000	0.0000	0.0000	0.3600	0.0000	0.0000	0.0000	95.0000	0.0000	3.0000
	228-I-D-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.2700	0.0000	0.0000	0.0000	0.7100	0.0000	0.0000	0.0000	105.0000	0.0000	0.0000
	228-I-A-512-APOS	0.0000	0.0000	0.0000	0.0000	0.0000	0.1520	0.0000	0.0000	0.0000	0.5400	0.0000	0.0000	0.0000	214.0000	0.0000	0.0000
	Average	0.0000	0.0000	0.0000	0.0000	0.0000	0.1910	0.0000	0.0000	0.0000	0.5367	0.0000	0.0000	0.0000	138.0000	0.0000	1.0000
	STDEV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0684	0.0000	0.0000	0.0000	0.1750	0.0000	0.0000	0.0000	66.0076	0.0000	1.7321
Bogota(6)	209-III-C-013	0.0000	0.0000	0.0000	1.9000	0.0000	0.1010	0.0000	0.0000	0.0000	0.2300	0.0000	0.0000	0.0000	180.0000	0.0000	2.3000
Neusa	209-III-B-083	0.0000	0.1600	0.0000	0.0000	0.0000	1.0500	0.0000	0.0000	0.0000	0.9700	13.0000	0.0000	0.0000	228.0000	0.0000	2.9000
	209-III-B-170	0.0000	0.0000	0.0000	0.0000	0.0000	0.8720	0.0000	0.0000	0.0000	0.2200	0.0000	0.0000	0.0000	170.0000	0.0000	0.0000
	Average	0.0000	0.0800	0.0000	0.0000	0.0000	0.9610	0.0000	0.0000	0.0000	0.5950	6.5000	0.0000	0.0000	199.0000	0.0000	1.4500
	STDEV	0.0000	0.1131	0.0000	0.0000	0.0000	0.1259	0.0000	0.0000	0.0000	0.5303	9.1924	0.0000	0.0000	41.0122	0.0000	2.0506
Bogota(7)	209-III-D-077	0.0000	0.0000	0.0000	0.0000	0.0000	0.0380	0.0000	0.0000	0.0000	0.1200	0.0000	0.0000	0.0000	112.0000	0.0000	3.5000
	209-III-D-036	0.0000	0.0000	0.0000	0.0000	0.0000	0.1180	0.0000	0.0000	0.0000	0.4600	0.0000	0.0000	0.0000	69.0000	0.0000	0.0000
	209-III-D-49	0.0000	0.0000	0.0000	0.0000	0.0000	0.4230	0.0000	0.0000	0.0000	0.8600	0.0000	0.0000	0.0000	105.0000	0.0000	0.0000
	209-III-B-172	0.0000	0.0000	0.0000	0.0000	0.0000	0.3660	0.0000	0.0000	0.0000	0.2800	0.0000	0.0000	0.0000	152.0000	0.0000	0.0000
	JICA-5	0.0000	0.0000	0.0000	0.0000	0.0000	0.1830	0.0000	0.0000	0.0000	0.2400	0.0000	0.0000	0.0000	109.0000	0.0000	0.0000
	228-I-A-510	0.0000	0.0000	0.0000	1.8000	0.0000	0.1810	0.0000	0.0000	0.0000	1.9200	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000
	Average	0.0000	0.0000	0.0000	0.3000	0.0000	0.2182	0.0000	0.0000	0.0000	0.6467	0.0000	0.0000	0.0000	107.8333	0.0000	0.5833
	STDEV	0.0000	0.0000	0.0000	0.7348	0.0000	0.1476	0.0000	0.0000	0.0000	0.6751	0.0000	0.0000	0.0000	26.6339	0.0000	1.4289
Bogota(9)	209-IV-A-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0290	0.0000	0.0000	0.0000	3.3700	25.1461	0.0000	0.0000	132.0000	0.0000	6.1000
	209-II-D-054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0630	0.0000	0.0000	11.0000	0.1900	0.0000	0.0000	0.0000	83.0000	0.0000	4.1000
	209-II-D-093	0.0000	0.0000	1.7000	2.0000	0.0000	0.1080	0.0000	0.0000	0.0000	1.0400	0.0000	0.0000	0.0000	69.0000	0.0000	0.0000
	JICA-6	0.0000	0.0000	0.0000	1.7000	0.0000	0.0340	0.0000	0.0000	5.9000	0.0000	0.0000	0.0000	0.0000	256.0000	0.0000	0.0000
	Average	0.0000	0.0000	0.4250	0.9250	0.0000	0.0585	0.0000	0.0000	4.2250	1.1500	6.2865	0.0000	0.0000	135.0000	0.0000	2.5500
	STDEV	0.0000	0.0000	0.8500	1.0751	0.0000	0.0362	0.0000	0.0000	5.3043	1.5475	12.5730	0.0000	0.0000	85.0686	0.0000	3.0556

Basin	No. POZO	Mn μg/L	Mo μg/L	Color Aparente (Hazen).	Color Verdadero. (Hazen).	Turbiedad UNT	TEMPERATURA 0C	Índice	CONDUCTIVIDAD μS/cm (250C)	Aluminio mg/L	Amonio mg/L	Cl mg/L	Sólidos susp. Totales. mg/L	Sulfuro de Hidrógeno mg/L	Fe mg/L	pH Unidades	Na mg/L	SO4 mg/L	Sólidos Dis. mg/L
Soacha	246-II-A-135	77.0000	0.0000	10.0000	10.0000	3.0000	17.9000	-5.1000	51.4000	0.0000	0.0000	3.5500	3.0000	4.1250	0.0000	5.9000	2.2600	0.0000	67.0000
Bogota(2)	246-II-A-190	751.0000	19.0000	10.0000	5.0000	17.0000	21.1000	-3.8300	201.0000	0.0000	1.4533	11.4000	4.0000	0.0000	14.0000	6.5200	17.3000	23.8000	21.0000
	246-II-A-087	15.0000	0.0000	0.0000	0.0000	1.0000	19.3000	-6.5800	21.6000	0.0000	0.0000	1.4200	1.0000	4.1250	0.0000	5.2200	2.2600	0.0000	29.0000
	Average	281.0000	6.3333	6.6667	5.0000	7.0000	19.4333	-5.1700	91.3333	0.0000	0.4844	5.4567	2.6667	2.7500	4.6667	5.8800	7.2733	7.9333	39.0000
	STDEV	408.2107	10.9697	5.7735	5.0000	8.7178	1.6042	1.3763	96.1358	0.0000	0.8391	5.2561	1.5275	2.3816	8.0829	0.6502	8.6833	13.7409	24.5764
Bojaca	227-II-C-011	18.0000	0.0000	20.0000	20.0000	4.0000	20.2000	-2.7500	299.0000	0.0000	2.5900	0.0000	1.0000	4.1250	0.0000	7.1000	3.3600	0.0000	269.0000
	227-IV-A-264	60.0000	17.0000	40.0000	40.0000	4.0000	25.8000	-3.0000	398.0000	0.0000	4.2500	51.5000	1.0000	4.1250	3.6000	6.9000	62.7000	0.0000	206.0000
	227-IV-A-349	303.0000	0.0000	10.0000	10.0000	1.0000	17.9000	-0.7000	378.0000	0.0000	0.0000	0.7100	2.0000	4.1250	0.0000	7.2100	18.9000	20.9000	225.0000
	227-IV-C-011	932.0000	0.0000	30.0000	10.0000	14.0000	23.3000	-3.6000	214.0000	0.0000	0.0000	26.3000	13.0000	2.0625	1.5000	6.5000	30.0000	0.0000	124.0000
	227-II-C-094	22.0000	0.0000	60.0000	10.0000	21.0000	15.4000	-5.4500	36.8000	0.0000	0.0000	0.7100	19.0000	4.1250	0.3700	5.5000	1.0800	0.0000	23.0000
	227-IV-A-102	242.0000	0.0000	5.0000	5.0000	1.0000	15.5000	-4.9000	745.0000	0.0000	0.0000	87.0000	7.0000	4.1250	0.0000	5.5000	83.0000	134.0000	498.0000
	227-I-D-068	43.0000	0.0000	40.0000	40.0000	4.0000	18.1000	2.4	144.2000	0.0000	0.4430	0.0000	1.0000	4.1250	1.2800	6.7000	1.8200	3.0400	187.0000
	Average	231.4286	2.4286	29.2857	19.2857	7.0000	19.4571	-3.4000	316.4286	0.0000	1.0404	23.7457	6.2857	3.8304	0.9643	6.4871	28.6943	22.5629	218.8571
	STDEV	329.2263	6.4254	19.2416	14.8404	7.5719	3.9144	1.6950	228.3158	0.0000	1.7024	34.0757	7.1813	0.7796	1.3214	0.7145	32.4801	49.7301	146.6350
Subachoque(2)	227-II-B-028	9.1000	0.0000	5.0000	5.0000	16.0000	17.3000	-5.6600	24.0000	0.0000	0.0000	0.7100	7.0000	2.0625	0.0000	5.8400	1.9600	0.0000	50.0000
	227-IV-A-063	23.0000	0.0000	10.0000	10.0000	2.0000	23.8000	-1.2000	687.0000	0.0000	2.2300	82.2000	2.0000	4.1250	0.0000	7.4000	132.0000	0.0000	400.0000
	227-IV-A-441	87.0000	0.0000	120.0000	120.0000	52.0000	26.7000	-2.3000	572.0000	0.0000	0.0000	27.0000	42.0000	2.0625	2.3500	6.8000	88.0000	3.2100	337.0000
	227-II-C-477	90.0000	0.0000	30.0000	30.0000	1.0000	20.9000	-2.3000	521.0000	0.0000	4.3200	39.1000	3.0000	4.1250	0.5200	7.2500	90.0000	0.0000	340.0000
	227-II-C-972	98.0000	0.0000	20.0000	20.0000	6.0000	21.3000	-1.9800	336.0000	0.0000	0.0000	1.4200	6.0000	2.0625	0.6500	7.8700	57.0000	0.0000	844.0000
	227-II-B-252	107.0000	0.0000	300.0000	240.0000	52.0000	18.4000	-2.6200	276.0000	0.0000	1.3400	1.7800	26.0000	2.0625	3.6000	7.1300	48.0000	0.0000	170.0000
	227-II-C-007	98.0000	0.0000	40.0000	30.0000	3.0000	21.5000	2.35	338.0000	0.0080	0.0000	13.5000	2.0000	2.0625	2.5000	7.3500	55.0000	3.5600	218.0000
	227-IV-A-442	26.0000	0.0000	40.0000	20.0000	14.0000	31.7000	-1.1700	514.0000	0.0000	2.4500	22.0000	4.0000	4.1250	1.0000	6.9800	71.0000	0.0000	314.0000
	JICA-2	110.0000	0.0000	70.0000	50.0000	10.0000	19.5000	-2.3500	560.0000	0.0000	10.4340	30.5000	27.0000	4.1250	0.7500	7.3500	98.0000	0.0000	466.0000
	Average	72.0111	0.0000	70.5556	58.3333	17.3333	22.3444	-2.4475	425.3333	0.0009	2.3082	24.2456	13.2222	2.9792	1.2633	7.1078	71.2178	0.7522	348.7778
	STDEV	40.3785	0.0000	92.9531	76.3217	20.3286	4.4945	1.4046	201.2790	0.0027	3.3976	25.8027	14.6354	1.0870	1.2562	0.5616	36.8224	1.4952	223.9887
Tunjuelito	227-IV-C-80	49.0000	0.0000	160.0000	100.0000	8.0000	18.3000	-2.6200	413.0000	0.0000	21.7860	9.9400	3.0000	2.0625	1.7800	7.1800	35.0000	0.0000	235.0000
	07-0020	38.0000	0.0000	120.0000	100.0000	14.0000	18.3000	-2.6000	414.0000	0.0000	41.9780	0.0000	87.0000	4.1250	1.6300	7.1000	43.1000	0.0000	205.0000
	07-0005	71.0000	0.0000	70.0000	70.0000	4.0000	21.5000	-3.2800	237.0000	0.0000	1.9500	4.9700	1.0000	4.1250	6.3000	6.7200	37.0000	0.0000	170.0000
	19-0009	126.0000	0.0000	140.0000	70.0000	40.0000	24.0000	-3.0600	290.0000	0.0000	0.9000	16.0000	13.0000	4.1250	5.2000	6.4900	36.7000	17.5000	152.0000
	08-0012	101.0000	0.0000	200.0000	200.0000	17.0000	20.2000	-2.7500	349.0000	0.0000	2.9900	24.5000	1.0000	4.1250	13.6000	7.2000	61.0000	17.4000	230.0000
	Average	77.0000	0.0000	138.0000	108.0000	16.6000	20.4600	-2.8620	340.6000	0.0000	13.9208	11.0820	21.0000	3.7125	5.7020	6.9380	42.5600	6.9800	198.4000
	STDEV	36.4623	0.0000	48.1664	53.5724	14.0285	2.3985	0.2974	77.4487	0.0000	17.8983	9.5617	37.2290	0.9224	4.8721	0.3169	10.7556	9.5578	36.5418
Bogota(3)	227-II-C-576	51.0000	0.0000		11.0200	9.0000	17.8000	-5.1800	29.6000	0.0000	0.5400	0.0000	10.0000	2.0625	0.0000	5.8700	0.7800	0.0000	25.0000
	227-IV-A-X6	64.0000	0.0000	30.0000	30.0000	3.0000	32.4000	-2.3500	601.0000	0.0000	0.0000	43.3000	1.0000	2.0625	0.0000	7.1000	118.0000	0.0000	371.0000
	Vitelma 1-EAAB	422.0000	0.0000	240.0000	120.0000	48.0000	12.5000	-2.9000	132.0000	0.0000	0.0000	3.5500	18.0000	2.0625	0.6800	6.9600	8.4000	6.3100	61.0000
	227-IV-B-576	45.0000	0.0000	40.0000	40.0000	7.0000	33.6000	-2.2000	551.0000	0.0000	0.0000	29.8000	4.0000	2.0625	0.0000	7.0000	98.0000	0.0000	331.0000
	227-IV-C-51	36.0000	0.0000	70.0000	50.0000	3.0000	21.0000	-2.3500	386.0000	0.0000	17.5800	12.1000	6.0000	4.1250	1.3100	7.5000	51.0000	0.0000	364.0000
	09-0011	20.0000	0.0000	160.0000	160.0000	43.0000	17.6000	-2.4000	307.0000	0.0000	3.4420	0.0000	120.0000	2.0625	2.9000	7.6000	50.0000	4.8800	215.0000
	09-0021	39.0000	0.0000	90.0000	90.0000	3.0000	19.0000	-3.0000	350.0000	0.0000	0.0000	0.0000	3.0000	4.1250	5.8000	6.8000	54.0000	0.0000	217.0000
	08-0007	26.0000	0.0000	100.0000	100.0000	4.0000	24.6000	-1.8900	1132.0000	0.0000	10.6150	83.4000	10.0000	2.0625	0.0000	7.4100	246.0000	5.1500	687.0000
	227-II-D-1112	21.0000	0.0000	0.0000	0.0000	0.3000	18.7000	-5.6200	28.0000	0.0000	0.0000	0.0000	2.0000	2.0625	0.0000	5.7800	1.8000	0.0000	28.0000
	227-IV-B-307	38.0000	0.0000	120.0000	90.0000	16.0000	20.8000	-1.6800	1135.0000	0.0000	0.8659	50.4000	14.0000	6.1875	0.3500	7.3700	144.0000	0.0000	562.0000
	227-IV-B-445	69.0000	0.0000	70.0000	70.0000	9.0000	26.7000	-2.5000	664.0000	0.0000	0.0590	40.5000	4.0000	0.0000	1.5600	7.2000	124.0000	0.0000	415.0000
	16-0003	82.0000	0.0000	70.0000	30.0000	34.0000	20.7000	-3.3900	379.0000	0.0000	6.1600	28.4000	11.0000	4.1250	9.1000	6.5100	58.0000	0.0000	227.0000
	E-2-EAAB	203.0000	0.0000	210.0000	10.0000	17.0000	21.0000	-1.6500	227.0000	0.0000	0.2060	9.2300	16.0000	4.1250	0.0000	7.9000	19.2000	0.0000	95.0000
	JICA-1	20.0000	0.0000	210.0000	150.0000	17.0000	19.1000	-1.2800	426.0000	0.0000	21.7800	3.5500	35.0000	4.1250	1.9400	7.8700	62.0000	0.0000	387.0000
	JICA-3	107.0000	16.0000	200.0000	200.0000	81.0000	18.9000	-0.9500	1223.0000	0.0000	13.0660	37.3000	25.0000	4.1250	0.3400	7.2000	127.0000	0.0000	85.0000
	E-1 EAAB	27.0000	0.0000	20.0000	5.0000	0.0000	18.3000	-0.3500	163.0000	0.0000	0.0000	4.9700	4.0000	2.0625	0.0000	8.7500	5.1000	0.0000	76.0000
	227-IV-B-361	34.0000	0.0000	200.0000	180.0000	64.0000	20.6000	-1.4500	712.0000	0.0110	0.0000	21.3000	149.0000	2.0625	0.0000	7.9000	64.0000	0.0000	356.0000
	227-IV-B-577	88.0000	0.0000	700.0000	150.0000	9.0000	30.6000	-2.1500	724.0000	0.0000	0.0000	49.7000	4.0000	2.0625	1.2600	7.3500	151.0000	0.0000	475.0000
	227-IV-B-096	107.0000	0.0000	40.0000	40.0000	5.0000	31.2000	-2.6500	565.0000	0.0000	0.0000	54.6000	4.0000	2.0625	1.0800	6.9000	94.0000	0.0000	389.0000
	Average	78.8947	0.8421	142.7778	80.3168	19.5947	22.3737	-2.4179	512.3474	0.0006	3.9113	24.8474	23.1579	2.8224	1.3853	7.2089	77.6989	0.8600	282.4211
	STDEV	94.2638	3.6707	158.3297	63.9797	23.4106	5.8379	1.2837	359.1633	0.0025	6.7784	24.2129	40.4753	1.4107	2.3543	0.6990	63.6861	2.0562	189.9875
Chicu	227-II-D-605	80.0000	0.0000	50.0000	30.0000	20.0000	19.7000	-1.3000	171.2000	0.0000	0.9300	0.0000	4.0000	2.0625	3.5000	7.1000	1.7800	0.0000	91.0000
	227-II-B-181	99.0000	0.0000	90.0000	70.0000	18.0000	17.2000	-2.2000	411.0000	0.0000	0.0000	10.7000	12.0000	2.0625	2.9500	7.2000	71.0000	3.8200	250.0000
	227-II-D-587	82.0000	0.0000	300.0000	300.0000	96.0000	20.2000	-1.8000	156.9000	0.0000	2.0000	0.0000	48.0000	2.0625	0.0000	7.1000	1.3700	0.0000	88.0000
	227-II-D-802	80.0000	0.0000	280.0000	210.0000	130.0000	16.7000	-2.0100	1267.0000	0.0000	1.4500	172.0000	2448.0000	6.1875	0.0000	7.4400	201.0000	0.0000	473.0000
	227-II-B-720	38.0000	0.0000	50.0000	40.0000	12.0000	16.1000	-3.0000	710.0000	0.0000	0.1300	153.0000	18.0000	2.0625	1.7900	6.6300	125.0000	0.0000	379.0000
	227-II-D-670	35.0000	0.0000	140.0000	40.0000	58.0000	24.1000	-1.4500	414.0000	0.0000	0.0800	53.1000	19.0000	4.1250	6.3000	6.9000	32.0000	0.0000	199.0000
	Average	69.0000	0.0000	151.6667	115.0000	55.6667	19.0000	-1.9600	521.6833	0.0000	0.7650	64.8000	424.8333	3.0938	2.4233	7.0617	72.0250	0.6367	246.6667
	STDEV	26.1840	0.0000	112.3239	112.9159	48.4878	2.9960	0.6104	417.3037	0.0000	0.8342	78.4001	991.2571	1.7256	2.3921	0.2748	78.7025	1.5595	155.1962
Bogota(4)	228-I-C-247	194.0000	0.0000	200.0000	200.0000	46.0000	20.3000	-2.4700	178.0000	0.0000	0.0000	1.4200	4.0000	2.0625	9.3000	6.9800	11.3000	0.0000	173.0000
	228-I-C-041	109.0000	0.0000	60.0000	40.0000	33.0000	18.7000	-4.1300	60.0000	0.0000	0.0000	1.7800	33.0000	4.1250	2.2200	6.6700	6.5000	0.0000	13.0000
	228-I-C-178	83.0000	0.0000	120.0000	120.0000	2.0000	18.4000	-3.1000	416.0000	0.0000	2.8000	6.3900	3.0000	4.1250	5.9500	6.8000	45.0000	0.0000	253.0000
	227-II-D-1008	43.0000	0.0000	90.0000	60.0000	45.0000	18.2000	-0.4700	414.0000	0.0000	0.0000	25.9000	2384.0000	2.0625	0.0000	8.1800	43.0000	0.0000	1638.0000
	Average	107.2500	0.0000	117.5000	105.0000	31.5000	18.9000	-2.5425	267.0000	0.0000	0.7000	8.8725	606.0000	3.0938	4.3675	7.1575	26.4500	0.0000	519.2500
	STDEV	63.8873	0.0000	60.2080	71.8795	20.5345	0.9557	1.5418	177.5575	0.0000	1.4000	11.5750	1185.4150	1.1908	4.1037	0.6934	20.3759	0.0000	752.4779
Frio	228-I-A-515	98.0000	0.0000	120.0000	120.0000	31.0000	17.3000	-3.0800	132.0000	0.0000	0.0000	1.4200	5.0000	2.0625	7.7000	7.0200	6.2000	0.0000	131.0000
Teusaca	228-I-C-018	78.0000	0.0000	600.0000	600.0000	615.0000	16.9000	-2.9400	302.0000	0.0000	0.3700	3.5500	1213.0000	8.2500	0.4200	7.0600	38.0000	0.0000	196.0000
	228-I-D-003	223.0000	0.0000	350.0000	350.0000	72.0000	17.6000	-2.8900	228.0000	0.0000	0.0000	3.5500	19.0000	2.0625	13.7000	7.1600	23.2000	0.0000	149.0000
	228-I-A-512-APOS	251.0000	0.0000	150.0000	20.0000	53.0000	23.6000	2.18	435.0000	0.0000	1.7100	88.9000	18.0000	2.0625	10.2000	7.2200	67.0000	0.0000	445.0000
	Average	184.0000	0.0000	366.6667	323.3333	246.6667	19.3667	-2.9150	321.6667	0.0000	0.6933	32.0000	416.6667	4.1250	8.1067	7.1467	42.7333	0.0000	263.3333
	STDEV	92.8601	0.0000	225.4625	290.9181	319.1275	3.6828	0.0354	104.8920	0.0000	0.8997	49.2768	689.6451	3.5724	6.8830	0.0808	22.2803	0.0000	159.0734
Bogota(6)	209-III-C-013	128.0000	0.0000	150.0000	150.0000	31.0000	18.9000	-1.6600	1148.0000	0.0000	0.3660	360.0000	42.0000	4.1250	0.4400	7.8900	263.0000	0.0000	771.0000
Neusa	209-III-B-083	234.0000	0.0000	70.0000	40.0000	5.0000	17.2000	-2.0600	206.0000	0.0000	3.3900	1.7800	10.0000	4.1250	0.3400	8.0900	26.3000	0.0000	177.0000
	209-III-B-170	0.0000	0.0000	0.0000	0.0000	0.5000	17.8000	-4.6800	74.0000	0.0000	0.4000	2.8400	1.0000	2.0625	0.0000	6.3700	9.7000	7.0300	31.0000
	Average	117.0000	0.0000	35.0000	20.0000	2.7500	17.5000	-3.3700	140.0000	0.0000	1.8950	2.3100	5.5000	3.0938	0.1700	7.2300	18.0000	3.5150	104.0000
	STDEV	165.4630	0.0000	49.4975	28.2843	3.1820	0.4243	1.8526	93.3381	0.0000	2.1142	0.7495	6.3640	1.4584	0.2404	1.2162	11.7380	4.9710	103.2376
Bogota(7)	209-III-D-077	24.0000	0.0000	5.0000	5.0000	2.0000	17.7000	-4.4800	42.7000	0.0000	0.0000	0.0000	3.0000	0.0000	0.3000	6.6200	1.8900	0.0000	19.0000
	209-III-D-036	61.0000	0.0000	70.0000	60.0000	4.0000	16.0000	-3.8500	97.8000	0.0000	0.3389	2.4900	3.0000	2.0625	5.2000	6.7530	12.2000	0.0000	81.0000
	209-III-D-49	115.0000	0.0000	60.0000	50.0000	15.0000	18.3000	-3.1000	144.0000	0.0000	0.0000	0.0000	16.0000	2.0625	5.1000	7.1000	19.8000	0.0000	153.0000
	209-III-B-172	194.0000	0.0000	100.0000	70.0000	20.0000	17.9000	-3.2000	180.0000	0.0000	1.7100	17.0000	2.0000	2.0625	6.2000	7.1500	26.4000	0.0000	116.0000
	JICA-5	91.0000	0.0000	70.0000	50.0000	9.0000	18.4000	-2.6500	297.0000	0.0000	4.6100	9.9400	27.0000	4.1250	1.7200	7.2500	22.8000	0.0000	186.0000
	228-I-A-510	123.0000	0.0000	200.0000	200.0000	60.0000	20.0000	-3.2500	459.0000	0.0000	10.9400	39.1000	52.0000	4.1250	7.4500	6.6000	63.0000	2.5200	251.0000
	Average	101.3333	0.0000	84.1667	72.5000	18.3333	18.0500	-3.4217	203.4167	0.0000	2.9332	11.4217	17.1667	2.4063	4.3283	6.9122	24.3483	0.4200	134.3333
	STDEV	58.2363	0.0000	64.6851	66.3136	21.4911	1.2911	0.6451	151.7525	0.0000	4.2978	15.1002	19.7121	1.5526	2.7435	0.2878	20.8480	1.0288	81.3773
Bogota(9)	209-IV-A-004	20.0000	0.0000	5.0000	5.0000	1.0000	16.8000	-3.9000	79.7000	0.0000	0.9900	6.7500	1.0000	2.0625	0.0000	7.1000	7.4000	0.0000	42.0000
	209-II-D-054	793.0000	0.0000	150.0000	100.0000	160.0000	20.6000	-3.9200	110.0000	0.0000	0.0000	0.7100	105.0000	6.1875	13.5000	6.7800	1.2900	4.0800	153.0000
	209-II-D-093	31.0000	0.0000	20.0000	15.0000	4.0000	15.1000	-4.3800	39.4000	0.0000	0.3672	0.7100	4.0000	2.0625	0.0000	6.6200	2.0800	0.0000	24.0000
	JICA-6	564.0000	0.0000	150.0000	120.0000	33.0000	17.5000	-3.6000	473.0000	0.0000	1.1000	107.0000	19.0000	4.1250	6.0000	6.3000	27.6000	20.5000	359.0000
	Average	352.0000	0.0000	81.2500	60.0000	49.5000	17.5000	-3.9500	175.5250	0.0000	0.6143	28.7925	32.2500	3.6094	4.8750	6.7000	9.5925	6.1450	144.5000
	STDEV	388.4542	0.0000	79.6215	58.4523	75.0666	2.2993	0.3219	200.4140	0.0000	0.5214	52.2160	49.1350	1.9747	6.4080	0.3331	12.3078	9.7614	153.9578

Basin	No. POZO	Zinc mg/L	Mg mg/L	K mg/L	HCO3 mg/L	CO3 mg/L	Ca mg/L	ALCALINIDAD CaCO3 mg/L	NMP Escherichia coli μorg./100cm3	NMP Coliformes Totales μorg./100cm3	O2 DISUELTO mg/L	OLOR	Aquifer System	Land Use (%)								Population
														Forest Area	Cultivated Area	Grass land	Bare Field	Water Area	Urban Area	Green House	Total	
Soacha	246-II-A-135	0.0270	0.6000	1.8700	22.7988	0.0000	4.7500	18.6875	63.0000	160.0000	3.3000	Inolora	1	1	42.26	46.72	5.39	0	4.57	0.25	100	270,217
Bogota(2)	246-II-A-190	0.0340	2.4900	3.0000	70.2202	0.0000	6.5000	57.5575	0.0000	0.0000	1.6700	Algo Fétido	1	0	22	27	26	0	23	1	100	5,232,730
	246-II-A-087	0.0080	0.1400	1.2900	4.5598	0.0000	0.3700	3.7375	0.0000	0.0000	2.5000	Inolora	1									
	Average	0.0230	1.0767	2.0533	32.5262	0.0000	3.8733	26.6608	21.0000	53.3333	2.4900	yes	1									
	STDEV	0.0135	1.2454	0.8696	33.8938	0.0000	3.1576	27.7818	36.3731	92.3760	0.8150	50.0000	100.00									
Bojaca	227-II-C-011	0.0750	3.3400	2.8000	202.2705	0.0000	55.0000	165.7955	0.0000	0.0000	6.0900	Inolora	3	1	42	34	18	0	1	4	100	171,874
	227-IV-A-264	0.0360	1.7800	8.3000	136.7925	0.0000	4.1500	112.1250	0.0000	3.1000	2.9400	Ligéramente azufrada	3									
	227-IV-A-349	0.0200	6.7000	5.7000	229.8114	0.0000	47.0000	188.3700	0.0000	24000.0000	1.6000	Inolora	3									
	227-IV-C-011	0.0240	1.7800	3.3600	73.8680	0.0000	6.8400	60.5475	0.0000	0.0000	2.5000	Inolora	3									
	227-II-C-094	0.0380	0.5800	1.0700	20.9749	0.0000	4.0000	17.1925	0.0000	0.0000	2.5000	Inolora	3									
	227-IV-A-102	0.2940	12.7000	15.9000	21.8868	0.0000	26.9000	17.9400	2.0000	120.0000	2.0000	Inolora	3									
	227-I-D-068	0.0270	2.0000	2.2600	92.2893	0.0000	22.2000	75.6470	0.0000	0.0000	6.3100	Ligéramente azufrada	3									
	Average	0.0734	4.1257	5.6271	111.1276	0.0000	23.7271	91.0882	0.2857	3446.1571	3.4200	yes	3									
	STDEV	0.0990	4.2595	5.1303	82.5491	0.0000	20.7751	67.6632	0.7559	9063.5020	1.9465	28.5714	100.00									
Subachoque(2)	227-II-B-028	0.0360	0.2300	0.9300	9.1195	0.0000	1.5600	7.4750	0.0000	0.0000	2.4200	Inolora	3	2	26	46	7	0	18	0	100	304,083
	227-IV-A-063	0.0250	3.2100	9.2000	292.7360	0.0000	22.3000	239.9475	0.0000	200.0000	0.4000	Inolora	3									
	227-IV-A-441	0.0080	3.2700	11.8000	328.3020	0.0000	17.4000	269.1000	0.0000	0.0000	0.4000	Inolora	1									
	227-II-C-477		3.7000	6.4000	269.9372	0.0000	11.8000	221.2600	0.0000	5.3000	1.0000	Azufrado	1									
	227-II-C-972	0.0090	4.0000	5.9000	220.6919	0.0000	5.6200	180.8950	0.0000	0.0000	4.8400	Inolora	1									
	227-II-B-252	0.0220	2.9700	1.9600	196.9812	0.0000	7.2000	161.4600	0.0000	0.0000	3.2300	Azufrado	1									
	227-II-C-007	0.2640	4.0100	3.1400	199.7171	0.0000	6.5600	163.7025	0.0000	0.0000	2.4200	Azufrado	1									
	227-IV-A-442	0.0340	3.0100	11.5000	296.3838	0.0000	31.5000	242.9375	0.0000	0.0000	0.4000	Inolora	1									
	JICA-2	0.0240	5.2000	10.8000	312.7989	0.0000	12.6000	256.3925	0.0000	31.0000	0.0000	Inolora	1									
	Average	0.0528	3.2889	6.8478	236.2964	0.0000	12.9489	193.6856	0.0000	26.2556	1.6789	yes	1									
	STDEV	0.0860	1.3412	4.1994	98.0955	0.0000	9.4216	80.4062	0.0000	65.9402	1.6463	33.3333	77.78									
Tunjuelito	227-IV-C-80	0.1000	3.1500	3.9300	235.2831	0.0000	7.3200	192.8550	0.0000	0.0000	5.0000	Inolora	1	1	63	26	7	0	0	3	100	5,205,790
	07-0020	0.0160	2.9100	5.4000	265.3775	0.0000	7.0000	217.5225	0.0000	0.0000	5.0000	Inolora	1									
	07-0005	0.0230	1.5700	1.9800	150.4718	0.0000	7.6000	123.3375	0.0000	0.0000	0.6000	Inolora	1									
	19-0009	0.0000	5.8200	1.6300	135.8806	0.0000	12.3000	111.3775	0.0000	0.0000	1.6000	Inolora	1.2									
	08-0012	0.0040	1.7800	2.8600	176.6447	0.0000	5.2600	144.7908	0.0000	0.0000	4.2100	Azufrado	1									
	Average	0.0286	3.0460	3.1600	192.7315	0.0000	7.8960	157.9767	0.0000	0.0000	3.2820	yes	1									
	STDEV	0.0410	1.6960	1.5357	55.5985	0.0000	2.6252	45.5725	0.0000	0.0000	2.0486	20.0000	90.00									
Bogota(3)	227-II-C-576	0.0870	0.3200	1.0900	18.2390	0.0000	3.3200	14.9500	0.0000	0.0000	2.0000	Inolora	3	4	34	20	7	0	33	2	100	5,324,909
	227-IV-A-X6	0.0050	3.4800	6.1000	316.4467	0.0000	8.3200	259.3825	0.0000	0.0000	0.5000	Inolora	1									
	Vitelma 1-EAAB	0.0000	1.5300	1.3600	71.1321	0.0000	10.8000	58.3050	0.0000	0.0000	1.2000	Inolora										
	227-IV-B-576	0.0140	3.8300	9.7000	318.2706	0.0000	11.4000	260.8775	0.0000	0.0000	0.9000	Inolora	1									
	227-IV-C-51	0.0320	2.2500	2.9000	220.6919	0.0000	5.5000	180.8950	0.0000	0.0000	5.1000	Inolora	1									
	09-0011	0.0450	1.2200	3.0000	202.2705	0.0000	3.0500	165.7955	0.0000	60.0000	7.7800	A combustible	1									
	09-0021	0.0160	1.6600	2.9700	219.9623	0.0000	4.9500	180.2970	0.0000	0.0000	2.0200	Azufrado	1									
	08-0007	0.0280	3.0100	4.1200	474.0000	0.0000	7.1000	389.0000	0.0000	8.7000	2.9200	Azufrado	3									
	227-II-D-1112	0.0250	0.3100	3.0100	14.5912	0.0000	0.7400	11.9600	0.0000	0.0000	4.4000	Inolora	1.2.3									
	227-IV-B-307	0.0360	9.1000	12.0000	645.6606	0.0000	18.9000	529.2300	0.0000	0.0000	4.0000	Inolora	1									
	227-IV-B-445	0.0270	1.9000	6.0000	326.4781	0.0000	4.7400	267.6050	0.0000	6900.0000	0.4000	Inolora	1									
	16-0003	0.0310	2.3600	2.3000	186.9498	0.0000	5.4000	153.2375	0.0000	0.0000	1.0000	Inolora	1									
	E-2-EAAB	0.0220	4.2000	2.6000	101.2265	0.0000	9.3000	82.9725	0.0000	0.0000	0.4000	Inolora	3									
	JICA-1		2.3900	3.6500	271.7611	0.0000	5.9000	222.7550	0.0000	200.0000	0.4000	Azufrado	1									
	JICA-3		27.2000	19.4000	861.7928	0.0000	45.0000	706.3875	0.0000	4700.0000	0.0000	Azufrado	1									
	E-1 EAAB	0.0330	2.8700	1.8000	63.8400	11.7000	23.0000	71.7600	0.0000	15.0000	0.7000	Inolora	3									
	227-IV-B-361	0.6730	10.2000	9.7000	402.1700	0.0000	15.2000	329.6475	0.0000	2.0000	4.3000	Fétido	1									
	227-IV-B-577	0.0070	2.5100	4.1100	391.2266	0.0000	5.5800	320.6775	0.0000	22000.0000	0.0000	Inolora	1									
	227-IV-B-096	0.0070	2.8300	10.9000	257.1699	0.0000	10.8000	210.7950	0.0000	31.0000	0.6000	Inolora	1									
	Average	0.0640	4.3774	5.6163	282.3094	0.6158	10.4737	232.4489	0.0000	1785.0895	2.0326	yes	1									
	STDEV	0.1582	6.0800	4.7261	214.1726	2.6842	10.0569	174.5272	0.0000	5234.5037	2.1515	31.5789	70.00									
Chicu	227-II-D-605	0.0050	1.6700	2.1400	114.4497	0.0000	27.8000	93.8113	0.0000	0.0000	1.7000	Azufrado	1	2	62	32	2	0	0	3	100	5,113,493
	227-II-B-181	0.0000	3.4800	1.7700	264.9215	0.0000	14.4000	217.1488	0.0000	15.0000	2.7300	Inolora	1									
	227-II-D-587		1.1200	1.7900	99.4026	0.0000	26.4000	81.4775	0.0000	1.0000	3.5000	Inolora	3									
	227-II-D-802	0.0200	15.8000	10.5000	466.0065	0.0000	17.4000	381.9725	0.0000	0.0000	4.8400	Azufrado	1									
	227-II-B-720	0.0120	1.9200	1.8000	127.6730	0.0000	14.4000	104.6500	10.0000	450.0000	1.8000	Inolora	1									
	227-II-D-670	0.0120	3.4500	7.7000	139.5284	0.0000	32.2000	114.3675	0.0000	0.0000	1.8100	Inolora	3									
	Average	0.0098	4.5733	4.2833	201.9969	0.0000	22.1000	165.5713	1.6667	77.6667	2.7300	yes	1									
	STDEV	0.0076	5.5837	3.8371	142.3215	0.0000	7.6637	116.6569	4.0825	182.5011	1.2504	33.3333	66.67									
Bogota(4)	228-I-C-247	0.0280	2.7100	2.9300	105.0000	0.0000	6.3400	86.0000	0.0000	1.0000	0.6000	Azufrado	1	2	61	27	3	0	0	7	100	5,020,467
	228-I-C-041	0.0190	0.3300	5.0000	34.6541	0.0000	0.6900	28.4050	0.0000	2.0000	2.4200	Inolora	1									
	228-I-C-178	0.0260	3.1000	5.1000	228.8995	0.0000	5.4000	187.6225	0.0000	45.0000	0.2000	Inolora	1									
	227-II-D-1008	0.0240	4.3000	2.5100	218.8680	0.0000	28.0000	179.4000	0.0000	1.0000	6.4500	Azufrado	1									
	Average	0.0243	2.6100	3.8850	146.8554	0.0000	10.1075	120.3569	0.0000	12.2500	2.4175	yes	1									
	STDEV	0.0039	1.6638	1.3567	93.5558	0.0000	12.1818	76.6948	0.0000	21.8384	2.8567	50.0000	100.00									
Frio	228-I-A-515	0.0070	3.2200	2.0500	91.1950	0.0000	10.6000	74.7500	0.0000	120.0000	1.8100	Inolora	1	3	54.63	38.38	1.42	0	0.15	2.02	100	5,179,688
Teusaca	228-I-C-018	0.0390	3.0100	2.9300	182.3900	0.0000	3.9100	149.5000	0.0000	0.0000	0.6000	Azufrado	1	3	37	54	2	1	0	1	97	5,058,322
	228-I-D-003	0.0080	2.9000	1.8800	139.5284	0.0000	6.2400	114.3675	0.0000	380.0000	0.2000	Inolora	1									
	228-I-A-512-APOS	0.0190	2.7500	5.0000	115.3617	0.0000	17.8000	94.5588	0.0000	2.0000	0.0000	Inolora	1.3									
	Average	0.0220	2.8867	3.2700	145.7600	0.0000	9.3167	119.4754	0.0000	127.3333	0.2667	yes	1									
	STDEV	0.0157	0.1305	1.5875	33.9459	0.0000	7.4386	27.8245	0.0000	218.8180	0.3055	33.3333	83.33									
Bogota(6)	209-III-C-013	0.0740	4.5000	2.1700	154.1196	0.0000	22.9000	126.3275	0.0000	0.0000	5.8500	Inolora	1	8	54.11	26	2.01	0.31	6.7	3.36	100	-
Neusa	209-III-B-083	0.0290	3.1800	3.6000	115.8177	0.0000	7.8000	94.9325	2.0000	160.0000	5.2400	Inolora	1	11	42	40	5	2	1	0	100	143,302
	209-III-B-170	0.0110	0.9400	0.5700	20.9749	0.0000	0.7700	17.1925	0.0000	5.3000	4.2300	Inolora	2									
	Average	0.0200	2.0600	2.0850	68.3963	0.0000	4.2850	56.0625	1.0000	82.6500	4.7350	yes	2									
	STDEV	0.0127	1.5839	2.1425	67.0640	0.0000	4.9710	54.9705	1.4142	109.3894	0.7142	0.0000	50.00									
Bogota(7)	209-III-D-077	0.0170	0.4700	0.8700	17.3271	0.0000	1.7700	14.2025	0.0000	0.0000	7.4600	Inolora	1	4	47	40	4	0	1	4	100	132,857
	209-III-D-036	0.0160	0.7300	1.1800	54.7170	0.0000	1.6400	44.8500	0.0000	160.0000	5.6400	Inolora	1									
	209-III-D-49	0.0240	2.2200	2.3400	95.7548	0.0000	5.4800	78.4875	0.0000	0.0000	0.0000	Inolora	1									
	209-III-B-172	0.0430	0.8000	1.0800	91.2000	0.0000	3.4600	74.8000	3.1000	62.0000	0.6000	Azufrado	1									
	JICA-5	0.0440	4.2100	3.2000	186.9498	0.0000	22.0000	153.2375	0.0000	1800.0000	0.2000	Inolora	1									
	228-I-A-510	0.0190	4.3000	5.8000	210.0221	0.0000	8.7800	172.1493	0.0000	0.0000	1.5800	Ligéramente azufrada	1									
	Average	0.0272	2.1217	2.4117	109.3284	0.0000	7.1883	89.6211	0.5167	337.0000	2.5800	yes	1									
	STDEV	0.0130	1.7622	1.8854	74.9984	0.0000	7.7315	61.4719	1.2656	719.4484	3.1755	33.3333	100.00									
Bogota(9)	209-IV-A-004	0.0350	1.4100	2.0500	17.7830	0.0000	3.3000	14.5763	0.0000	100.0000	8.4700	Inolora	1	9	30	58	1	0	2	0	100	52,635
	209-II-D-054	0.0330	1.1700	0.6300	40.5818	0.0000	0.9800	33.2638	0.0000	0.0000	-	Azufrado	1									
	209-II-D-093	0.1080	0.8900	1.7900	17.3271	0.0000	2.7800	14.2025	0.0000	0.0000	-	Inolora	2.3									
	JICA-6	0.0440	14.3000	4.3500	27.3585	0.0000	28.0000	22.4250	0.0000	860.0000	0.2000	Inolora	1									
	Average	0.0550	4.4425	2.2050	25.7626	0.0000	8.7650	21.1169	0.0000	240.0000	4.3350	yes	1									
	STDEV	0.0357	6.5751	1.5576	10.9085	0.0000	12.8618	8.9414	0.0000	416.0128	5.8478	33.3333	75.00									

🟥	Wells exceeded the water quality standard for raw water usable for drinking and living if treated by the traditional treatment
🟪	Wells exceeded the water quality standard for raw water usable for drinking and living if treated by Chlorination
🟨	Wells exceeded the Colombian water quality standard for potable water
🟩	Wells exceeded WHO guideline for potable water (No standard value in Colombia)
Blue Letter	Wells in actual use for drinking

Wells exceeded the water quality standard for raw water usable for drinking and living if treated by the traditional treatment
🟪 Wells exceeded the water quality standard for raw water usable for drinking and living if treated by Chlorination
🟨 Wells exceeded the Colombian water quality standard for potable water
🟩 Wells exceeded WHO guideline for potable water (No standard value in Colombia)
Blue Letter Wells in actual use for drinking

Table-4.15 Result of Water Quality Test (Phase 3 test)

(3) Examination of test results

<Characteristics of water quality from the standpoint of water supply>

The significant characteristics of groundwater quality in the study area are shown in Table-4.16. According to this table, the mean concentration in the entire wells studied in this study and the degree of overall dispersion are summarized.

Figure-4.19 shows the average main water quality of each basin, in which the data in the Phase 2 are used as the typical case.

Table-4.16 Significant Characteristics of Groundwater

	Average value (mg/l)	Standard deviation	Variation coefficient (standard deviation/mean)	Dispersion among the entire wells studied
Chromaticity	30.28	26.48	0.87	Small dispersion
Ammonium-nitrogen	4.67	5.47	1.17	Slightly large dispersion
Iron	3.11	3.83	1.23	Large dispersion
Manganese	0.14	0.22	1.57	Large dispersion
Hydrogen sulfide	0.80	0.64	0.79	Small dispersion
Nitrogen nitrate	1.88	3.75	2.00	Large dispersion

The main items are examined below.

Chromaticity

As the chromaticity is related to the human sense like the odor or taste, high chromaticity causes significant trouble when using water. The standard value of raw water generally to be chlorine sterilized is 20 TCU, but almost 80% of the basins exceed this value in terms of the average chromaticity of basins. The water in deep well rarely indicates a high chromaticity in a wide range of areas. Therefore, the two following causes are considered for the high chromaticity.

(a) The iron and the manganese widely existing in the ground usually dissolve in water in the reduced state. However, when they are air oxidized, they are suspended and increase chromaticity. Many cases of this kind can be found all over the world.

(b) Anaerobically decomposed plant colored organic matters such as humic acid dissolve and increase the chromaticity. This case is found quite often in the bottom of marsh zone or closed water area.

In order to examine Item (a) first, a correlation between the chromaticity and the concentrations of iron and manganese that can be obtained from the water quality data are examined using the dispersion diagram and the statistical method. As a result, no correlation was confirmed. In order to determine the possibility of Item (b), the chromaticities of groundwater in the wells in the Quaternary strata mainly consisting of old lake deposit and may contain with high probability a large amount of plant organic matters are compared with those in the wells in the Cretaceous strata consisting of marine sand-stone with low probability of containing plant organic matters. As a result, the chromaticity was extremely high in the wells in the Quaternary aquifer.

- Quaternary aquifer (25 wells): Average chromaticity was 30 TCU.
- Cretaceous aquifer (10 wells): Average chromaticity was 17 TCU.
  (The chromaticity that human beings can recognize is 15 TCU.)

This fact may indirectly suggest that the chromaticity represents the humus organic matters originating from underground.

Ammonium-nitrogen

According to the results of the analysis of water quality, Ammonium-nitrogen of high concentration was widely detected in the study area. The quality standard of the raw water for drinking and living was 1.0 mg/l, but the average concentrations of 70% basins exceeded this standard. The average concentration of 25 wells in the Quaternary aquifer was 4.91 mg/l and the average of 17 wells in the Cretaceous aquifer was 1.12 mg/l. In deep wells, nitrate nitrogen is usually detected more often than ammonium. However, in the study area, this common sense does not work at all. From the concentration of the detected Ammonium-nitrogen, a large stock of nitrogen may exist in the deep groundwater. To explain this fact entirely by the nitrogen discharge accompanying local human activities on the ground surface may not be appropriate for the following reasons.

- From the quantitative viewpoint, the penetration of nitrogen from the fertilizers and animal excretions on the ground surface into underground is extremely small compared with the enormous amount of nitrogen stocked in the groundwater.
- So that the nitrogen on the ground surface reaches and spreads in the deep groundwater, a long period of time would be necessary. Furthermore, in that case, a highly oxidized nitrogen nitrate becomes dominant.

Probably, it will be more appropriate to conclude that nitrogen in the humus organic matters contained in the lake deposit in the Quaternary strata mentioned before turns into ammonium in the reductive atmosphere. From the data analysis, we can assume that the chromaticity and the concentration of Ammonium-nitrogen have a good correlation in the entire wells of study area (correlational coefficient of 0.58), which is considered to indirectly support the above-mentioned supposition.

Hydrogen sulfide

As shown in Table-4.17, hydrogen sulfide is distributed in the entire study area at high concentrations. With reference to the WHO standard of 0.03 mg/l, almost all wells exceeded this standard. This fact is extremely abnormal for the deep groundwater. The mean concentration of hydrogen sulfide of all studied wells was 0.804 mg/l and a similar value was indicated for each aquifer.

Table-4.17 Distribution of Hydrogen sulfide of each aquifer

	Hydrogen sulfide (mg/l)
Average value of 25 wells in the Quaternary aquifer	0.988
Average value of 15 wells in the Cretaceous aquifer	0.813
Average value of 104 wells studied	0.804

In generally, there is no global guideline or standard of hydrogen sulfide for the drinking water in Colombia. This may be due to the fact that there is almost no case in which the hydrogen sulfide is dissolved in the raw water for drinking. Although no decision can be made at present, the scarcely available information suggests that the concentration of the detected hydrogen sulfide is not found at normal level.

The main sources generating the hydrogen sulfide on the ground surface of study area are the discharge of animal protein and organic matters containing sulfur, the eluviation of fertilizers containing sulfides such as ammonium sulfate, or the discharge of sodium sulfate used in the leather industry. However, just like in the case of nitrogen mentioned before and as examined in Section 4.2 of this Chapter, the penetration from the ground surface is not in the scale of the amount of sulfur as the hydrogen sulfate stocked in the groundwater. In addition, as hydrogen sulfide is generated locally, an explanation of the concentration of hydrogen sulfide extending to the entire study area cannot be given by assuming that it is originated from the ground. A more natural explanation may be considered by stating that the main cause lies in the anaerobic decomposition of organic matters containing sulfur under the ground or the hydrolysis of inorganic sulfide, or the decomposition by bacteria.

Iron and manganese

It is clear that both iron and manganese are affected by geological features. They are widely distributed over the entire study area. The concentrations are high in the Quaternary aquifer.

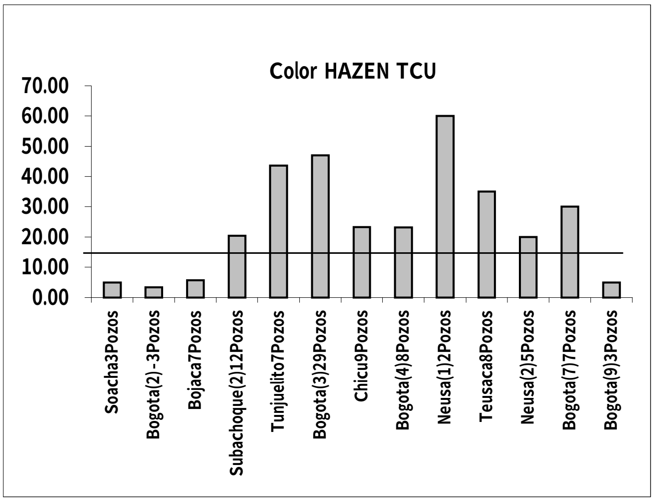
Table-4.18 Distribution of iron and manganese of each aquifer

	Iron (mg/l)	Manganese (mg/l)
Average value of 25 wells in the Quaternary aquifer	4.20	0.210
Average value of 15 wells in the Cretaceous aquifer	1.06	0.115
Average value of 104 wells studied	3.11	0.141

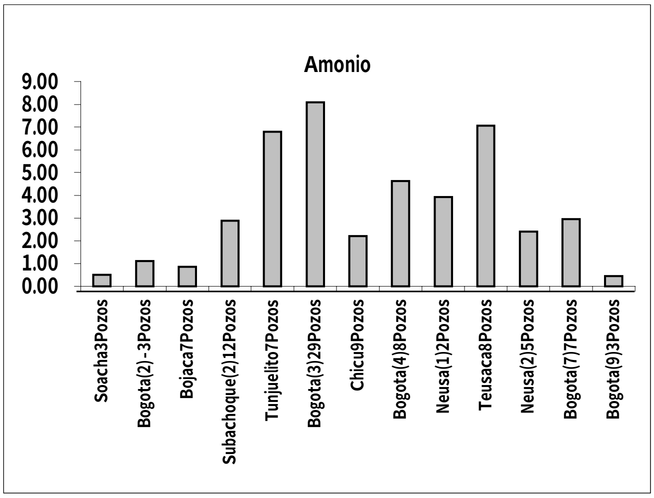
The detected concentration of iron exceeded significantly the standard for drinking water of 0.3 mg/l used in many countries. This may be caused by the increase of water-soluble iron due to the reductive atmosphere under the ground, which is extreme in the Quaternary aquifer.

Coliform bacillus

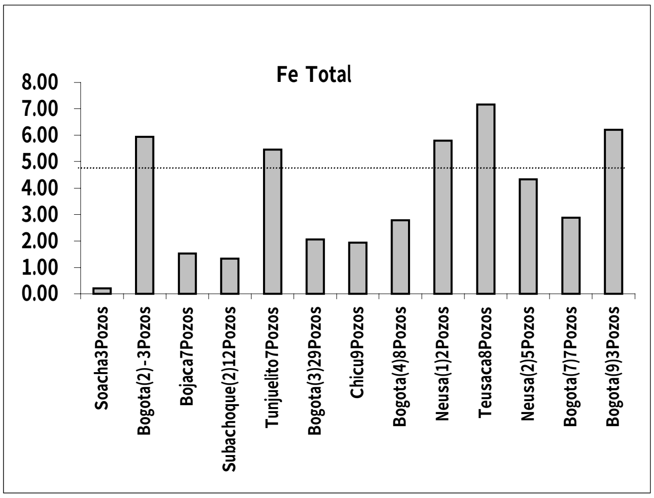
The *coliform bacillus* from excretion was detected in more than half basins. The number of basins from which *coliform bacillus* was detected in more than 40% of wells in the basin exceeded 75%. Probably this is caused by the fact that the structural problem of wells facilitates the invasion of *coliform bacillus* from ground surface.



Criteria of allowable raw water quality	
Traditional treatment	Chlorination
75mg/l	20mg/l

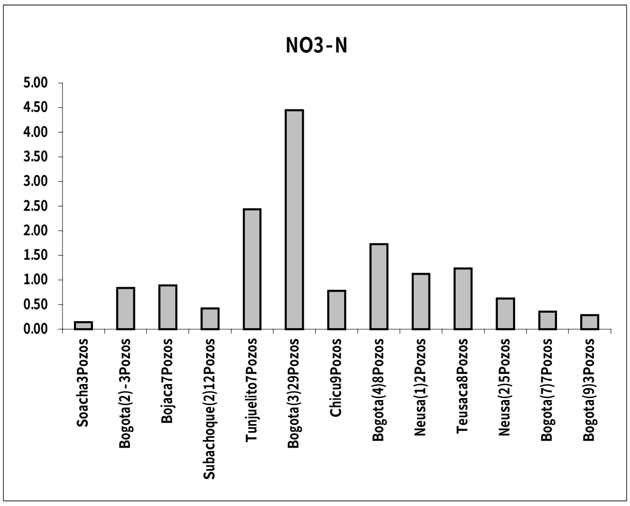


Criteria of allowable raw water quality	
Traditional treatment	Chlorination
1.0mg/l	1.0mg/l

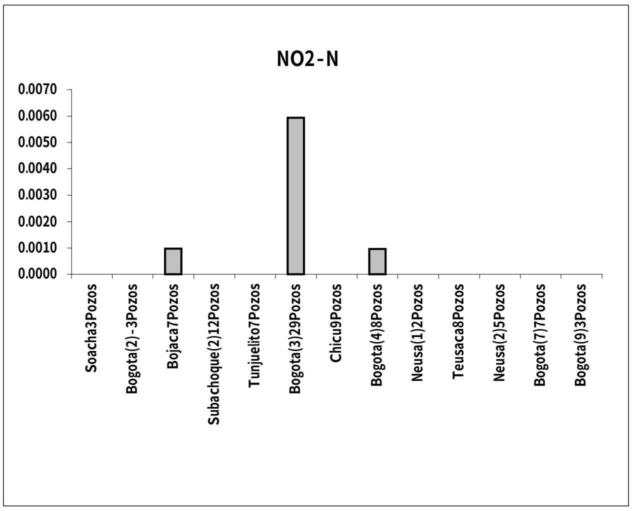


Agricltual raw water standard
5.0mg/l

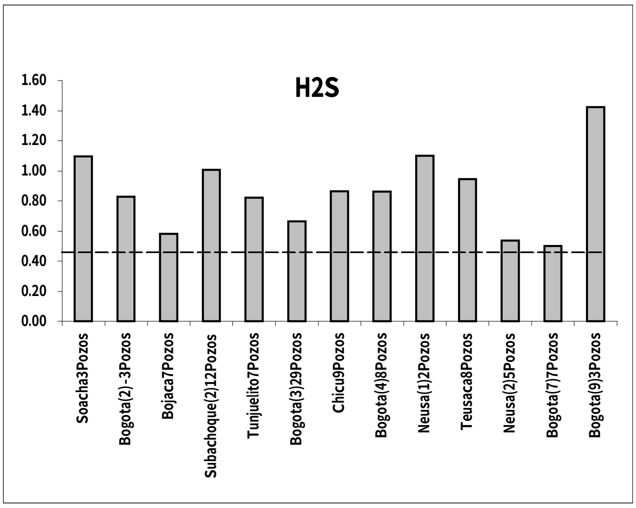
Figure-4.19 Average main water quality of each basin



Stock-raising raw water standard
100mg/l

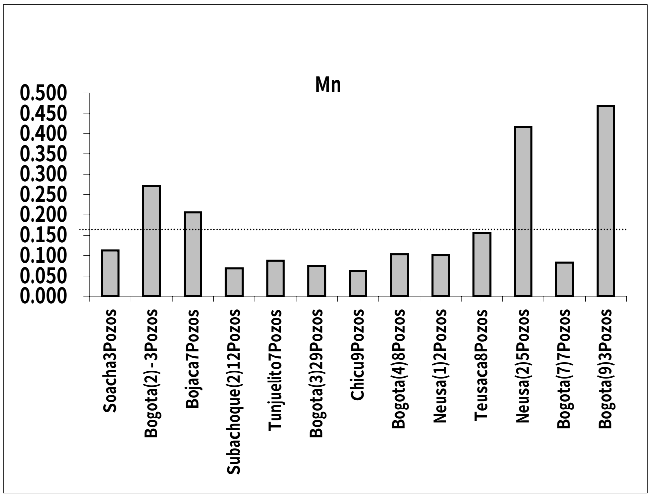


Stock-raising raw water standard
10mg/l

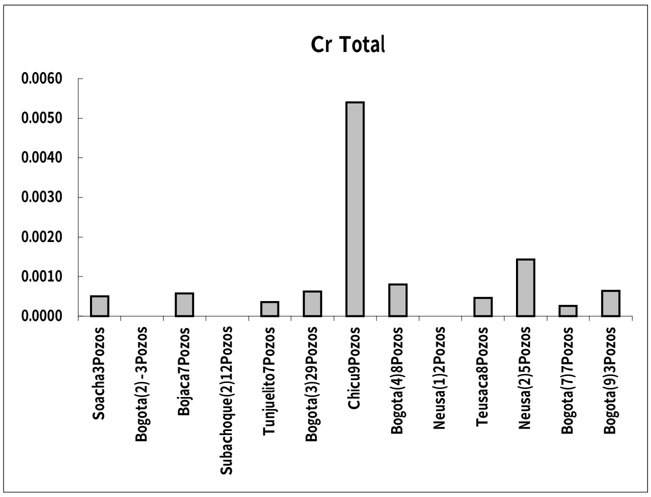


Stock-raising raw water standard (WHO)
0.05mg/l

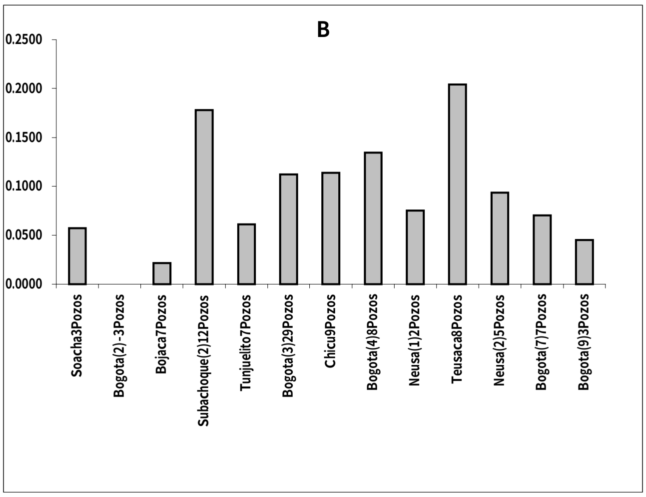
Figure-4.19 Average main water quality of each basin (continued)



Agricltual raw water standard
0.2mg/l

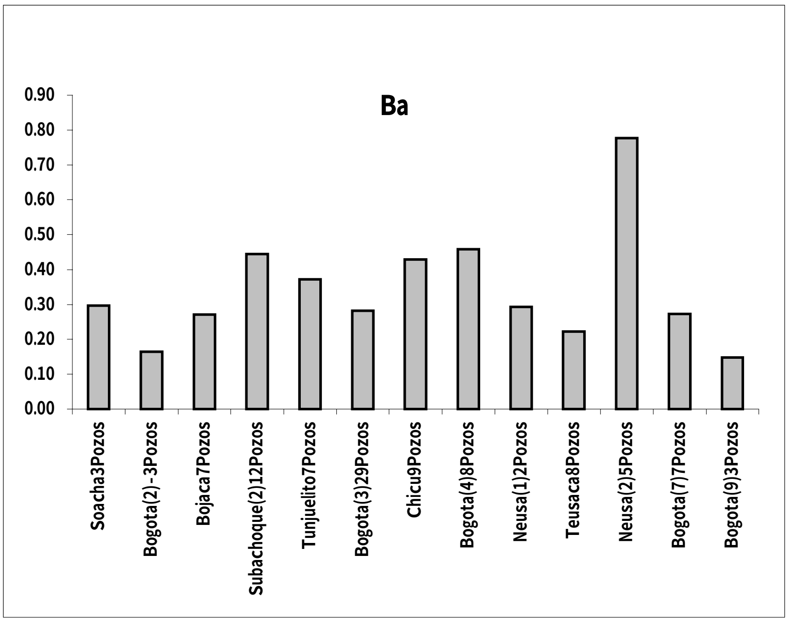


Criteria of allowable raw water quality	
Traditional treatment	Chlorinatio
0.05mg/l	0.05mg/l

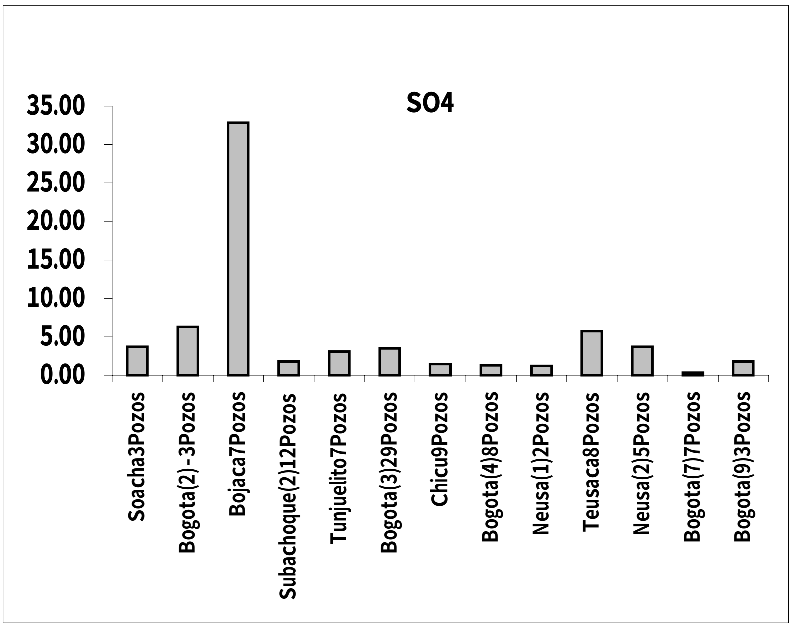


Stock-raising raw water standard
5mg/l

Figure- 4.19 Average main water quality of each basin (continued)



Criteria of allowable raw water quality	
Traditional	Chlorination
1.0mg/l	1.0mg/l



Criteria of allowable raw water quality	
Traditional	Chlorination
400mg/l	400mg/l

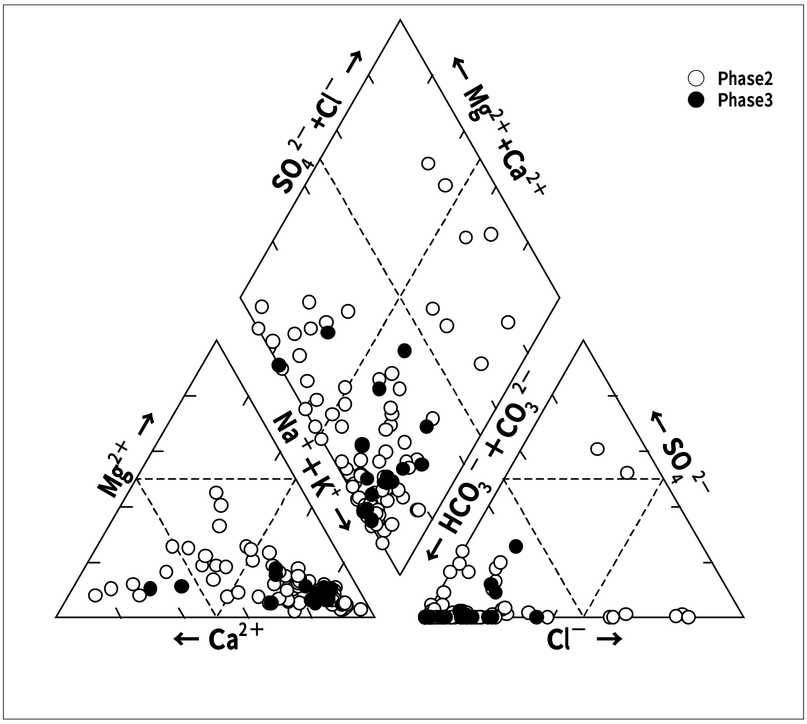
Figure-4.19 Average main water quality of each basin (continued)

(4) Geochemical Review of Groundwater Quality

(a) Review by tri-linear diagram

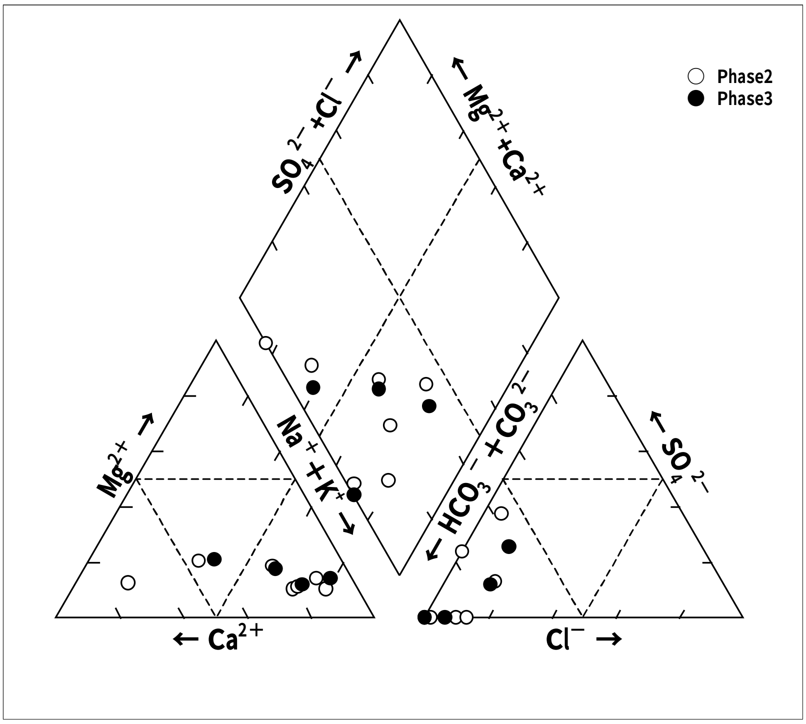
With respect to the Phase 2 test whose analysis results are deemed to be rather reliable, we have prepared a tri-linear diagram for major eight ion components and reviewed it. The results are shown in Figure-4.20. These diagrams indicate that the groundwater in Quaternary aquifer largely consists of Na-HCO_3 type, a type that is frequently found in deep-aquifer groundwater, and it includes small amount of Ca-HCO_3 type frequently found in shallow-aquifer groundwater.

The Na-Cl type found in the seawater and fossil water, and the Ca-Cl type found in volcanic stones, could be observed in a small quantity. With respect to the Cretaceous aquifer, significant characteristics are not observed and the Ca-HCO_3 type is included slightly more, but the water quality composition does not vary much among different aquifers.

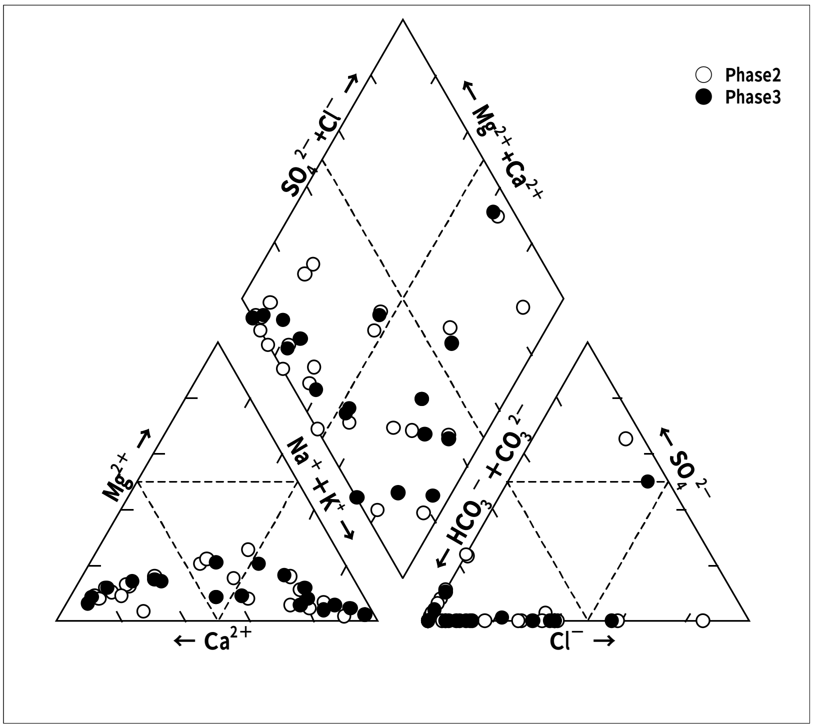


Tri-linear diagram (Quaternary aquifer)

Figure-4.20 Tri-linear diagram



(2) Tri-linear diagram （Tertiary aquifer）



(3) Tri-linear diagram（Cretaceous aquifer）

Figure-4.20 Tri-linear diagram (Continured)

(b) Review by hexa diagram

A hexa diagrams by well according to major eight ion components obtained in the Phase II and II test results were prepared. The hexa diagrams, which were drawn in the topographic map is shown in Figure 4.21, as the typical sample. Other hexa diagrams by aquifer in Phase-II and III are included in the supporting report, for reference.

Further, all the hexa diagrams were classified into similar groups by the concentration of eight components through cluster analysis. From the results, all the samples were classified into ten clusters (Refer to the supporting report). The cluster numbers of each well are shown in Table-4.14 and Table-4.15. The water quality characteristics of major cluster are as follows: Cluster 1 indicates the water of Na-HCO_3 type, Cluster 2 indicates the same type of water with low concentration, Cluster 6 and 7 show the same type of water but high concentration and Cluster 4 indicates Ca-HCO_3 type water. Considering that the ion exchange with the clay, etc. occurs in groundwater as water stays longer at underground and that it will change to the water type containing much Na･K from Ca-HCO_3 type, the water quality would evolve from Cluster 4 (rather young Ca-HCO_3 type groundwater) to Cluster 1 (groundwater evolved to Na-HCO_3 type) and to Cluster 6 and 7 (groundwater evolved to Na-HCO_3 type with higher concentration).

From the water quality of Quaternary aquifer, it is suggested that groundwater flows from the periphery of basin to the center of basin in terms of water quality. Similar results have been obtained in the Cretaceous aquifer. These facts support the results from analysis of groundwater flow system, which were conducted separately.

A more detailed review is described in the supporting report for reference.

4.7 Isotopic Analysis

Isotopic analysis was carried out based on the samples collected from existing 20 wells in February 2001 (Phase 1) and 10 wells in August 2002 (Phase 3) to estimate the groundwater recharge and its flow mechanism.

4.7.1 Items of isotopic analysis

The items of isotopic analysis are shown together with the aim of analysis and the criterion of selection of wells in Table-4.19. The distribution of wells covered by isotopic analysis is shown in Figure-4.21 (The color of the sampling points of the Phase 1 study in Figure-4.21 is the same color of water type in Figure-4.22). In the Phase 3 study, the analysis of tritium was omitted. The reason is that it had been found from the Phase 1 study that there was no groundwater of the new age valid for analysis of tritium.

Table-4.19 Selected sampling wells for isotopic analysis (Phase 1and 3)

Item		^{14}C	^{3}H	D and ^{1}H	^{18}O and ^{16}O
Aim for analysis		Age determination of ground water older than 5000 years	Confirmation of groundwater of young age about 40 years	Examine the origin, mixture and flow of groundwater	
Selection standard		・Select in all aquifer but mainly Cretaceous ・Select wells in the central area of basin	・Select in all aquifer but mainly Quaternary ・Select wells distributed widely in the Study area		
Number of selected wells	Quaternary	1, 5	14, 0	14, 0	14, 5
	Tertiary	1, 0	3, 0	3, 0	3, 0
	Cretaceous	3, 4	3, 0	3, 0	3, 4
Total		5, 9	20, 0	20, 0	20, 9

(Number of samples in Phase-I and III respectively)

4.7.2 Results of Isotopic Test

The summary of results of isotopic tests is as follows:

i) Test result of Carbon 14: The age of groundwater estimated with Carbon 14 is between 1,690 and 33,170 years. Aquifers from which water was collected are mainly Quaternary and Cretaceous strata. The above-mentioned age indicates the flow time from the recharge area to the Cretaceous stratum at the point of water sampling.

ii) Test result of tritium: All measured concentrations of tritium were below the detection limit, 0.7 TU. Considering from the fact that the half-life period of tritium is 12.35 years, the age of groundwater in Bogotá Plain certainly exceeds 40 years at least.

iii) Test result of Deuterium and Oxygen 18: Data were plotted on the "$\delta D-\delta ^{18}O$" diagram and were compared with the global meteorological line. As a result, it was suggested that groundwater in the study areas is basically groundwater with meteoric water as the origin and circulating in the study areas.

4.7.3 Review by isotopic analysis

The results of isotopic analysis are shown in Table-4.20 and the detail is illustrated in the supporting report. The summary of each analysis item is described below.

Table-4.20 Result of isotopic analysis (Phase 1 and 3)

No.	Well ID	Basin	Aquifer	Depth (m)	^{14}C Age (year)	TR	δ ^{18}O(‰)	δ D(‰)
	<Phase I>							
1	246-Ⅱ-A-061	BOGOTÁ(1)	Saban-Gdlupe	357	14140±50	0.41	-10.67	-60.76
2	227-Ⅱ-D-587	CHICU	G. Guadalupe	1000	8230±40	0.50	-11.61	-78.50
3	227-Ⅳ-A-233	SUBACHOQUE	Sabana	-	27150±150	0.37	-11.29	-74.16
4	227 Ⅳ A-299	SUBACHOQUE	Sap-Subacho	500	23650±100	0.39	-8.82	-69.81
5	228-Ⅰ C-252	BOGOTÁ(2)	Tertiary	170	24180±110	0.38	-10.97	-63.66
6	08-0007	BOGOTÁ(2)	Guadalupe	450	-	0.40	-11.77	-73.94
7	227-Ⅳ-B-561	BOGOTÁ(2)	Sabana	115	-	Na	-10.95	-43.13
8	11-0010	BOGOTÁ(2)	Sabana	251.8	-	0.45	-10.22	-86.52
9	22-0078	BOGOTÁ(2)	Sabana	252	-	0.45	-10.36	-61.42
10	228-Ⅰ-C-019	TUESACA	F. Sabana	135	-	0.49	-10.82	-33.07
11	209-Ⅲ-D-172	BOGOTÁ(3)	F. Sabana	253	-	0.35	-10.78	-70.70
12	228-Ⅰ-A-509	TUESACA	Sabana	112	-	0.33	-11.00	-70.03
13	209-Ⅲ-D-036	BOGOTÁ(3)	F. Sabana	82	-	0.56	-11.47	-70.38
14	209-Ⅲ-B-170	NUESA	F. Cacho	-	-	0.42	-10.67	-66.14
15	227-Ⅱ-D-1115?	BOGOTÁ(2)	Guadalupe	-	-	0.44	-11.48	-41.79
16	227-Ⅳ-A-442?	SUBACHOQUE	Sap-Subacho	353	-	0.57	-10.68	-73.77
17	227-Ⅳ-B-577?	BOGOTÁ(2)	F. Sabana	526	-	0.44	-12.49	-68.08
18	227 Ⅳ A-X6	SUBACHOQUE	Tilata	581	-	0.41	-11.91	-75.35
19	16-0003	BOGOTÁ(2)	F. Sabana	192	-	0.47	-11.36	-66.90
20	10-0011	BOGOTÁ(2)	F. Sabana	120	-	0.44	-11.55	-54.54
	<Phase 3>							
21	227-Ⅱ-B-028	SUBACHOQUE(2)	G. Guadalupe	70	3630±40		-10.46	
22	227-Ⅵ-A-063	SUBACHOQUE(2)	G. Guadalupe	448	33170±380		-10.71	
23	227-Ⅱ-D-802	CHICU	F. Sabana	100	32380±350		-10.51	
24	Vitelma1 EAAB	BOGOTÁ(3)	Guadalupe ?		4620±40		-10.39	
25	E-2 EAAB	BOGOTÁ(3)	Guadalupe	389	9430±40		-9.55	
26	JICA1 EAAB	BOGOTÁ(3)	Sabana	196	29750±270		-10.31	
27	JICA2	SUBACHOQUE(2)	Sabana	192	33110±380		-10.37	
28	JICA5	BOGOTÁ(7)	Sabana	188	20640±90		-9.51	
29	JICA6	BOGOTÁ(9)	Tilata	188	1690±40		-10.54	
30	Rio BOGOTÁ				-		-9.99	

TR: Tritium unit (1 in 1,018 hydrogen atom), Na: Below detection limit, δ : it is represented in parts per thousand in the ratio to SNOW (standard seawater) and + or – shows if it is higher or lower than SNOW.

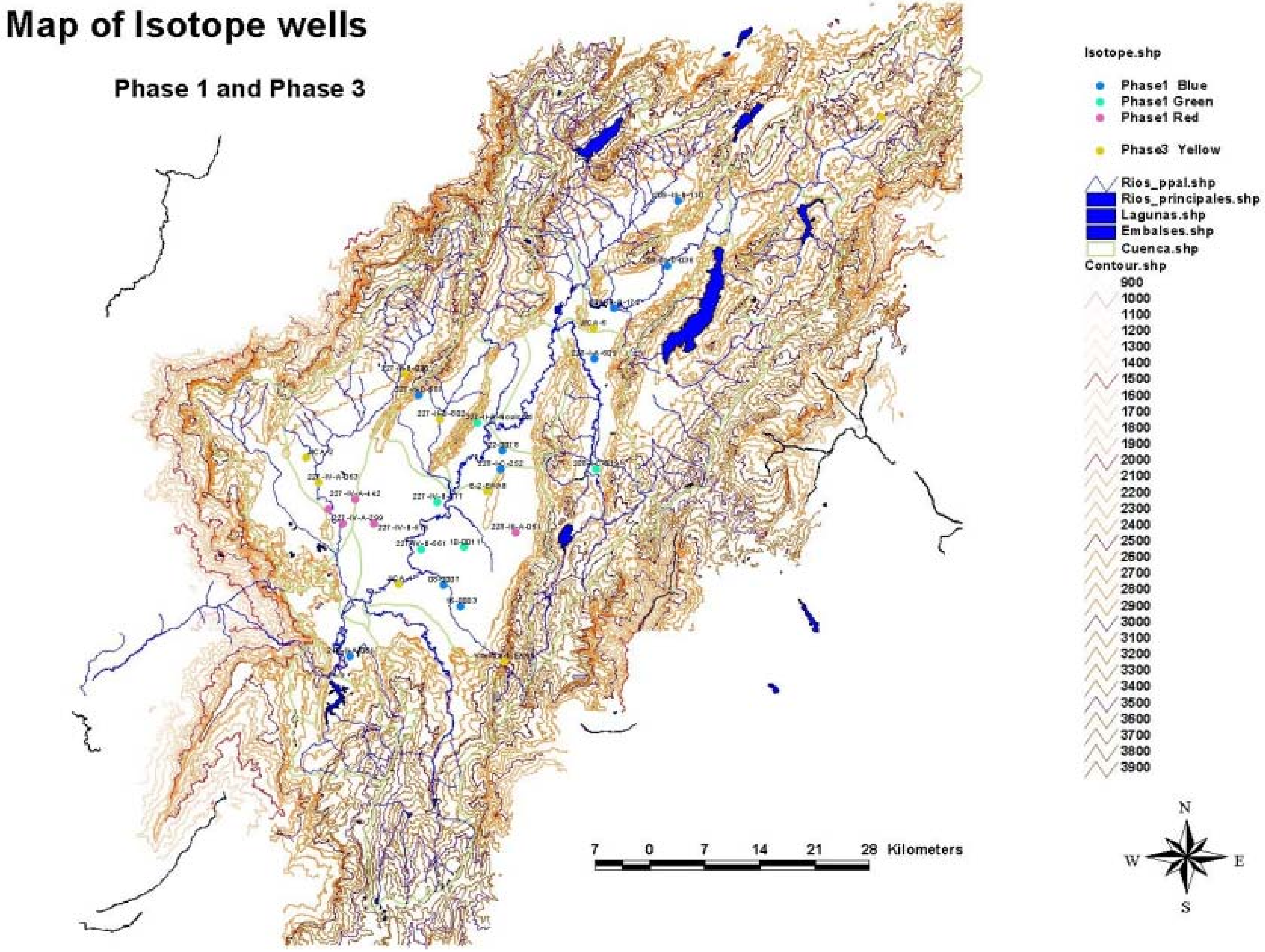


Figure-4.21 Distribution map of wells for isotopic analysis

(a) ^{14}C (Carbon 14)

The concentration of carbon 14 is affected by dissolved carbonic acid, which is provided by various reactions while rainwater penetrates and fluidizes. Since any carbon in carbon dioxide and hydrogen carbonate ions is “Dead carbon” from which ^{14}C is completely lost, the supply of these substances in aquifers lowers the ^{14}C concentration in the groundwater, and the groundwater might be older. Therefore, the age of groundwater can be younger than 1,690 to 33,170 years. It is concluded the groundwater in Cretaceous is relatively newer than the one in Quaternary when the both water is compared. The Cretaceous layer surveyed in this study locates in mountainous regions and is easily recharged by precipitation in a short period. On the contrary, the Quaternary layer places in the center of the plain and thick impermeable layer covers the aquifer. Therefore, it takes a long time that groundwater recharged by rainfall reaches in the aquifer. In addition, permeability and the activity of groundwater traveling in Cretaceous layer are higher than the ones in Quaternary strata. By contrasting to the result of water quality test, Quaternary groundwater shows the characteristic of deep aquifer ($Na\text{-}HCO_3$ type) than Cretaceous water and this meets the result of the isotopic carbon analysis. The groundwater in Vitelma, where artificial recharge test have been conducted is categolozed as the newest water among 15 samples.

(b) ^{3}H (Tritium)

Twenty samples have been analyzed in order to determine the tritium concentration. The results showed that all the tritium concentration were less than 0.7 TU, the limit of detection. Considering that the half-life period of tritium is 12.35 years, the groundwater of Bogotá Plain is assumed to be older than 40 years. This result seems appropriate in view of the distance from the recharge area to the sampling wells and the depth of the aquifers (GL- 80m to GL-1,000 m). Generally, artificial tritium, generated in thermonuclear explosion test, is found more on the Northern Hemisphere and less on the Southern Hemisphere as the test fields are mostly located in the Northern Hemisphere. Also the higher the altitude from the sea level is, the lower the concentration will be. Considering that the Study Area is 2,600 m to 3,000 m above the sea level, since new information is unlikely to be obtained, the tritium analysis was omitted in the Phase 3 study.

(c) D and ^{18}O (Deuterium and Oxygen 18)

The analysis results of deuterium and oxygen 18 in Phase 1 are shown in Figure-4.22. According to the results, water can be classified into the following three types.

The isotope composition of water in the wells No. 1, 2, 5, 6, 9, 11, 12, 13, 14 and 19 are plotted along the approximate line $\delta D = 9.3868\ \delta^{18}O + 35.631$ which is nearly parallel with the global meteorological line ($\delta D = 8\ \delta^{18}O + 10$) as shown in Figure-4.22. The global meteorological line in Bogotá area is not clear, but this line may be approximate to the global meteorological line in this area.

On the other hand, Wells No. 3, 4, 16 and 18 in Madrid district show the approximate line of $\delta D = 1.7844\,\delta^{18}O - 54.224$ that has a low inclination and intersects with the global meteorological line. As this district belongs to the subterranean heat zone, the penetrated rainwater was warmed by the underground heat source and reacted with the surrounding rocks in isotopic exchange. (The rocks contain approximately 60% of oxygen in atomic composition. Through the reaction of isotopic exchange between water and rocks in this condition, the isotopic ratio of oxygen in water is drawn toward the value of rocks, resulting in the increase of ^{18}O. On the other hand, the hydrogen content in the rocks is very low compared with that in water, so that the isotopic ratio of hydrogen in isotopic exchange reaction shows little change.

Thus, the inclination of the approximate line is low.)

Moreover, water in Wells No. 7, 8, 10, 15, 17, and 20 is plotted far away in the above of the global meteorological line in the graph of Figure-4.22. Wells No. 10 and 15 are located near recharge area, which are plotted at the top, and Wells No. 7,17, 20 and 8, which are plotted below them, are located in the city center. D and ^{18}O concentration has become high through filtering by minerals of groundwater during its movement in the geological layer and mixing with deeper groundwater.

Sampling locations for oxygen 18 analysis in Phase 3 was distributed in the rim of the Study Area in comparison to Phase 1 study. The result matches in Phase 3 to the one in Phase 1, but the average concentration of ^{18}O is higher in Phase 3. This is probably because many sampling locations are in the area of rock layer of Cretaceous and the groundwater might be under the influenced of rock-rainwater reaction.

From the above analysis results of hydrogen and oxygen isotope, groundwater in the Study Area is basically recycling, originating from the meteoric water in the Study Area, although partial mixing of deeper groundwater might be possible.

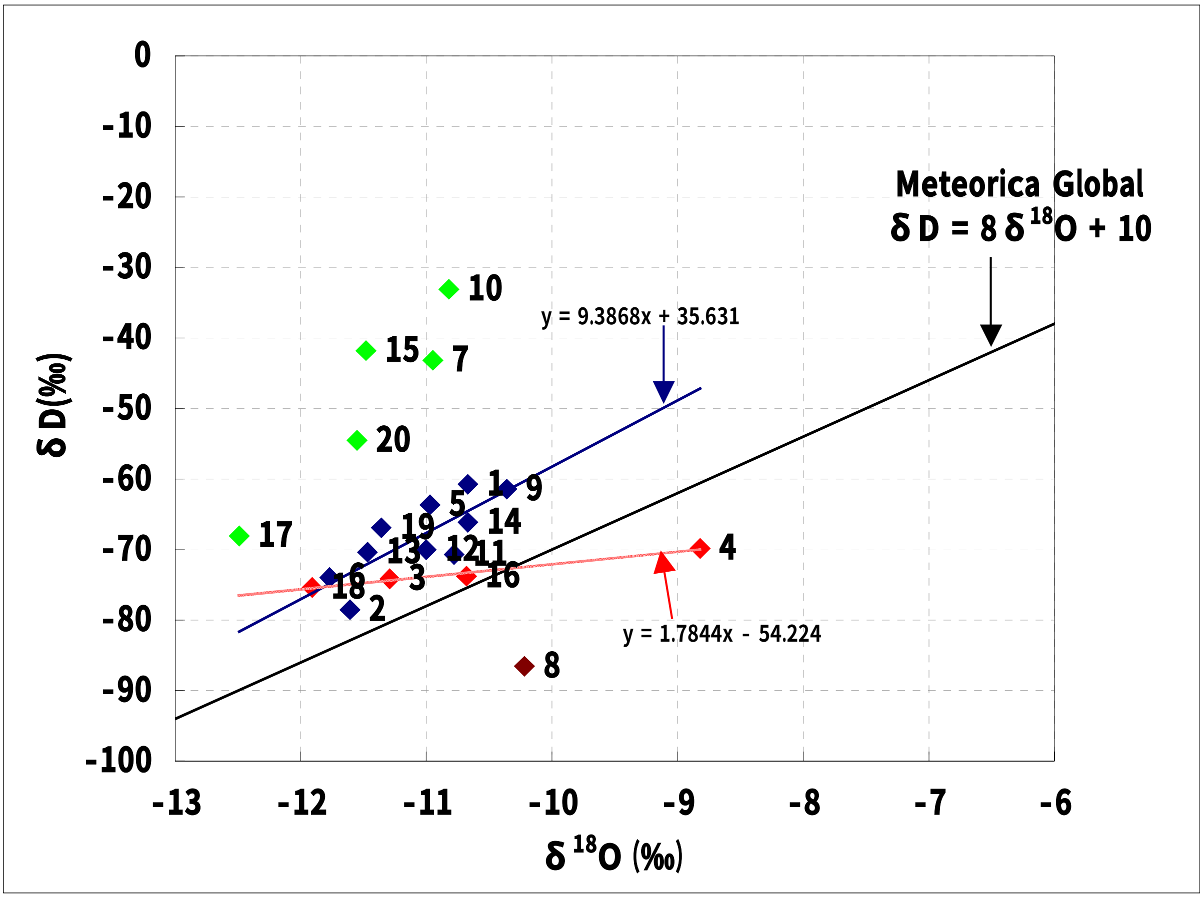


Figure-4.22 Relations between δ D and δ ^{18}O

4.8 Well Inventory

(1) Outline of Well Inventory

The Study Team carried out Well Inventory survey for all the wells in Study Area. The Study Team collected well data that was stored in well Data-base of INGEOMINAS and well data registered to CAR and DAMA. It is possible to compile most of the wells that exist in the Study Area by putting all the data together. The number of wells that was collected by the Study Team is shown in Table-4.21. The total number of wells in the Study Area is estimated around 7,081 as shown in Table-4.21.

Table-4.21 The Number of Wells in the Study Area

Classification	Well Number	
	Well data with location	Well data without location
Wells recorded in well data-base of INGEOMINAS	3,027	694
Wells registered to CAR	1,672	1,439
Wells registered to DAMA	248	1
Sub Total	4,947	2,134
Total	7,081	

Well Inventory items by the Study Team are shown in Table-4.22.

Table-4.22 Well Inventory Items by the Study Team

Items	Items	Item
Location of well	Electric logging result	Recharge (mm/Year)
Ownership	Gamma logging result	Water quality concentration (mg/L)
Address of well	Coordinate of well location	Date of drilling
Map coordinates of well	Depth of well (m)	Soil type
Grand elevation of well top	Grand water level	Results of water quality test
Installed year	Pumping rate (m^3/Day)	The position of screen
Equipment description	Aquifer for pumping	Geological cross section
Well observation item	Conductivity (m/s)	-

(2) Current Yield from Pumping Wells in the Study Area

Based on this database, the current yield from pumping wells in the Study Area was estimated. This database has 7,081 well data, most of which has information on yield. Situation of well data is as follows.

Information type of the data-base	Well Number	Total Yield (m^3/day)
Date with unit yield and operation hours	2,644	162,900
Data without unit yield or without operation hours.	4,437	unknown
Total	7,081	unknown

Daily yield of well is calculated from unit yield and daily operation hours. Daily yield of well was calculated from relation below: Daily yield from well =Unit yield (m^3/day) × Daily well operation hours (hours/day)

On the other hand, unit yield or operation hours must be assumed for wells without these information. To estimate total yield of pumping wells, unit yield and operation hours were assumed for wells without these information. Method and result of this analysis are explained below.

(a) Estimation of Unit Yield

Histogram of yield is shown in Figure-4.23. This histogram was made from well data with yield information. The average of this distribution is 1.54(l/s). Hence, unit yield of 1.54(l/s) was assumed for wells data without unit yields information.

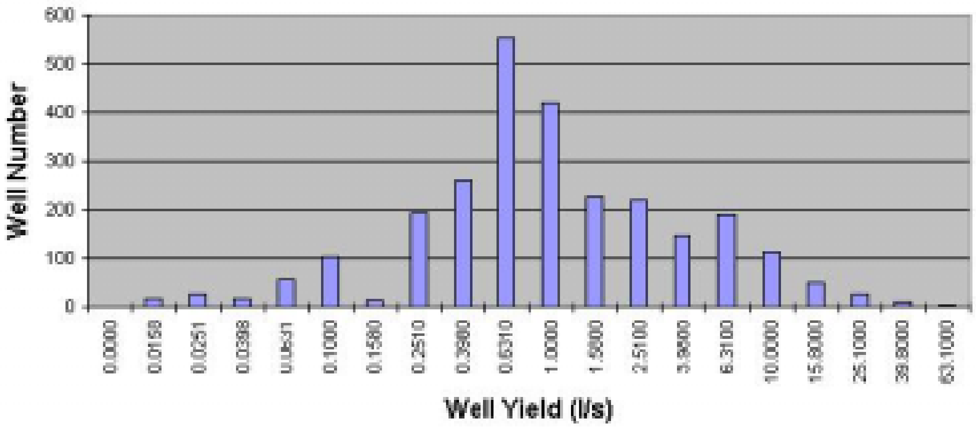


Figure-4.23 Histogram of Unit Yield

(b) Daily Well Operation Hours

Histogram of daily operation hour is shown in Figure-4.24. This histogram was made from well data with information on daily operation hour, and average operation hours are 6.54 hours/day. As shown in Figure-4.25, there is not clear relation between unit yield and daily operation hours. Hence, daily operation hour was assumed as 6.54 hours for wells without information on daily operation hours.

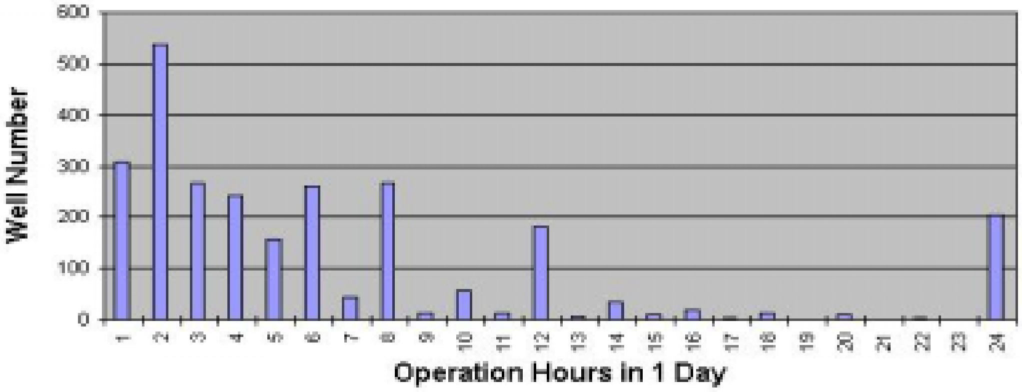


Figure-4.24 Histogram of Daily Operation Hour of Wells

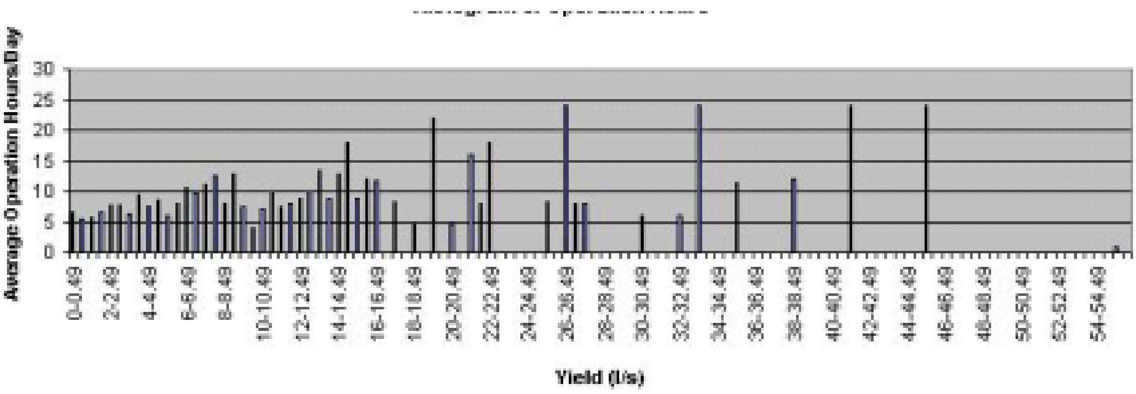


Figure-4.25 Histogram of Unit Yield and Average Daily Operation Hours

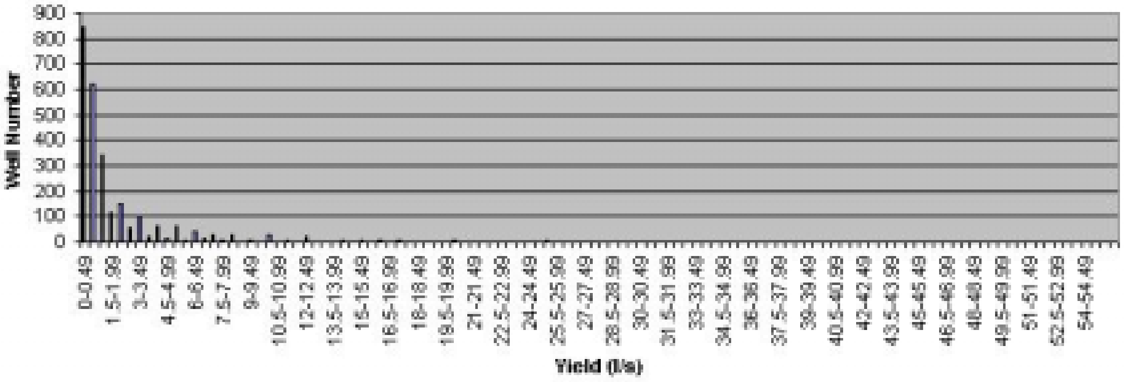


Figure-4.25 Histogram of Unit Yield and Average Daily Operation Hours (continued)

(c) Total Yield in Study Area

Total yield from the current wells in the Study Area was estimated based on the assumption explained above. The result is shown in Table-4.23.

Table-4.23 Total Yield of Study Area

Classification of Well Data	Well Number	Estimated unit yield (l/s)	Well operation hours in 1 day (hours)	Total yield (m^3/day)
Date with unit yield and daily operation hours	2,644	Known	Known	158,690
Data without unit yield or without operation hours.	4,437	1.54(l/s)	6.54 (hours)	160,800
Total	7,081	-	-	320,490

As shown in Table-4.23, total yield from pumping wells in the Study Area is estimated 323,700m^3/day. The estimated total yield is expressed by other unit below.

Total Yield of the Study Area

323,700m^3/day	$117 \times 10^6 m^3$/year	3.7m^3/s	27mm/year

Annual yield of 27.7mm/year above is calculated from total area of 4,268km^2.

(3) Well Number and Yield by Geology

Well Database by the Study Team has information on aquifer type of wells. Most of INGEOMINAS well data of the Well Data-base has information on aquifer. Based on this information, well number and aquifer of well is analyzed by geology type. The result is shown in Table-4.24.

Table-4.24 The Number and Aquifer of Wells by Geological Type

Geology of aquifer		The number of well		Yield of well	
		Well number	% of total number	Yield (m^3/day)	% of total yield
Quaternary		6,570	92.9	248,830	77.6
Tertiary	Cacho	60	0.8	4,200	1.3
	Guaduas	50	0.7	3,900	1.2
	Other Tertiary	50	0.7	700	0.2
Cretaceous	Labor y Tierna	246	3.5	48,060	15.0
	Pleaners and Dura	90	0.13	14,400	4.5
	Chipaque	15	0.02	400	0.1
Total		7,081	100	320,490	100

Of 7,081 wells in the Database, around 3,400 wells have information on aquifer geology. As shown in Table-4.24, 93% of wells of the Study Area take groundwater from Quaternary aquifer, 2.2% from Tertiary aquifer, 3.7% from Cretaceous aquifer. As shown in Table-4.24, wells in the Study Area pump up groundwater, 78% from Quaternary aquifer, 3% from Tertiary aquifer and 19% from Cretaceous aquifer. As explained above, most of groundwater is currently pumped up from Quaternary aquifer, and groundwater pumped up from Cretaceous is only little. Groundwater pumped up from Tertiary aquifer is extremely little.

(4) Well Distribution by River Basin

Well number and well yield by river basin were calculated based on Well Inventory Result. The results are shown in Table-4.25 and in Figure-4.26. In Figure-4.26 well yields were summed up for every 1km×1km mesh. As shown in Figure-4.26, distribution of wells is partially concentrated. There are many wells concentrating especially in the west of Bogotá City, Subachoque River Basin, and Chicu River Basin.

Table-4.25 Total number and yield of Wells by River Basin

Basin	Catchment Area (km^2)	Well number	Well number per area (No/km^2)	Yield (m^3/day)	Yield per area (m^3/day/km^2)
Bogotá1 –Bogotá3	678	1,559	2.3	77,651	114.5
Bogotá4 –Bogotá6	232	1,141	4.9	45,797	197.4
Bogotá7 –Bogotá9	557	429	0.8	27,451	49.3
Bojaca	219	311	1.4	21,549	98.4
Chicu	134	1,620	12.0	44,636	333.1
Frio	194	320	1.6	12,476	64.3
Neusa	432	185	0.4	8,333	19.3
Sisga	152	1	0.0	30	0.2
Muna	128	40	0.3	1,298	10.1
Subachoque 1	32	18	0.6	293	9.2
Subachoque 2	386	1,078	2.8	54,751	141.8
Teusaca	353	256	0.7	14,467	41.0
Tomine	368	21	0.7	719	2.0
Tunjuelito	404	103	0.3	11,038	27.3
Total	4,269	7,081	1.7	320,490	75.1

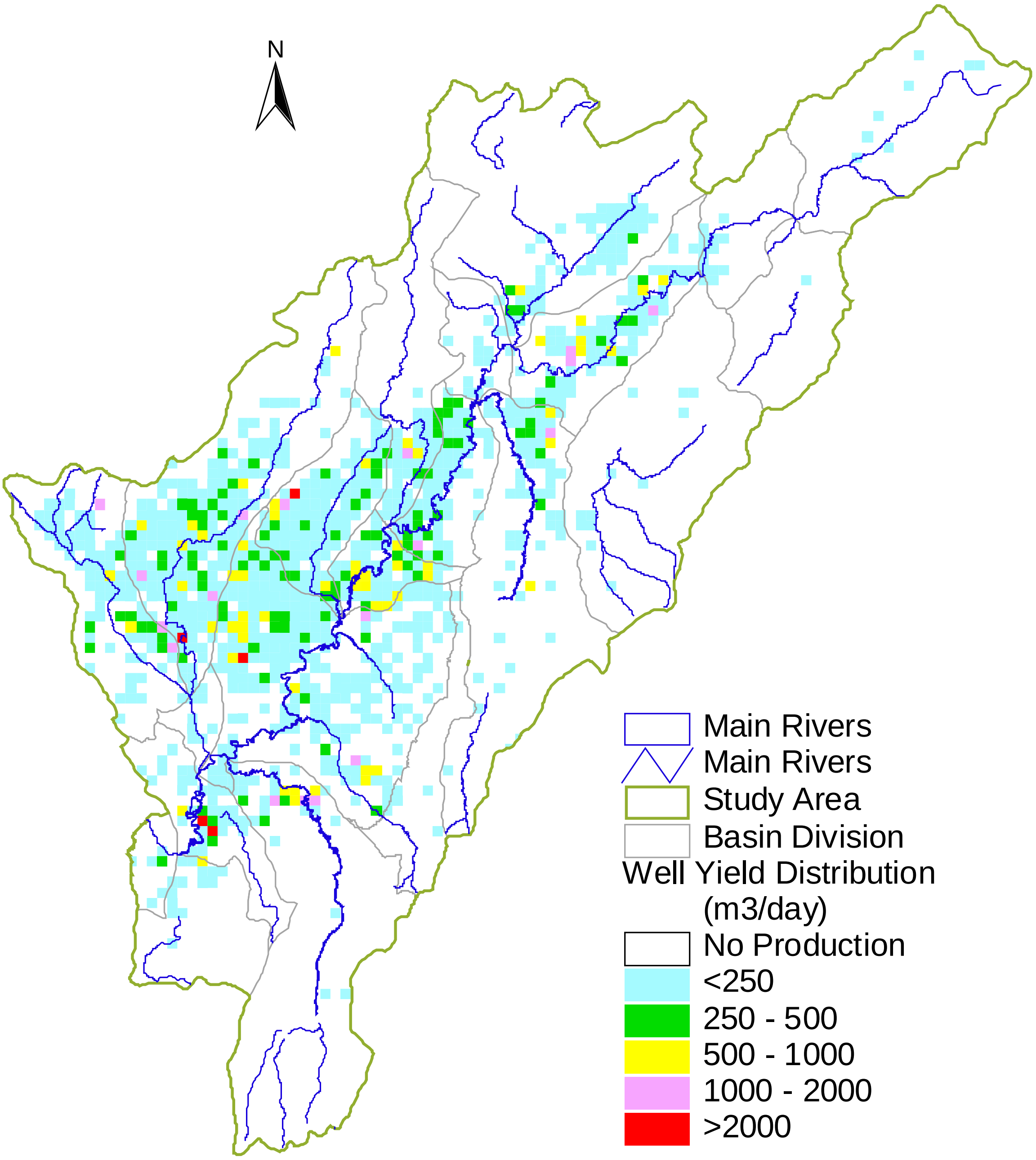


Figure-4.26 Distribution of Yield of Study Area

4.9 Meteorological Observation

The Study Team installed eleven meteorological stations for the purpose of meteorological observation of the Study Area.

(1) Sites for Installation of Meteorological Stations

Meteorological observation stations were installed in eleven sites listed below, and these sites are shown in Figure-4.27. These sites were selected after close discussion among the Study Team, EAAB, CAR, IDEAM, and INGEOMINAS. Eleven sites were finally installed in hills and mountains in the Study Area, where meteorological data has not obtained fully up-to now. Installed meteorological stations by the Study Team are involved in the existing meteorological observation network, and observed result is used by all the relating organizations. In the selection of the sites for the installation, it was examined that sites should have not only importance in meteorological observation but also security against theft and destruction.

1) Tomine
2) Suesca
3) Casa Loma
4) EL tablazo
5) El Vino
6) Cruz verde (Bojaca)
7) Paramo de Guerrero
8) Siecha
9) Aguas claras (Muna)
10) Dona Juana
11) Manjui (Chia)

(2) Items for meteorological observation and Instruments

Items to be observed are listed below.

1) Wind speed and direction
2) Precipitation
3) Humidity
4) Temperature
5) Sunshine Hour
6) Evaporation
7) Solar Radiation

AHLBOR Company in Germany produced instruments for the meteorological observation. Type, purpose and the number of instruments are shown in Table-4.26.

Table-4.26 Instruments of Meteorological Observation by JICA Study Team

Instrument	No	Instrument	No
Sensors		**Energy system**	
a)Wind speed/ direction （windmill type）	11	a)Solar panel	11
b)Temperature/ Humidity	11	b)Battery	11
c)Solar radiation	11	c)Stabilizer	11
d)Evaporation（Tank type and micro-wave sensor）	11		
Data recording unit		**Others**	
a)Digital Precipitation meter (Balance type)	11	a)Software for data input and data operation	4
b)Data recording unit	11		
c)Data collection unit	4		
d)Portable personal computer unit （Data input and programming）	4		

(3) Meteorological Observation

Installation of meteorological stations was completed at the end of February 2002, and then observation stared. The result of observation was used efficiently for climate analysis of the Study.

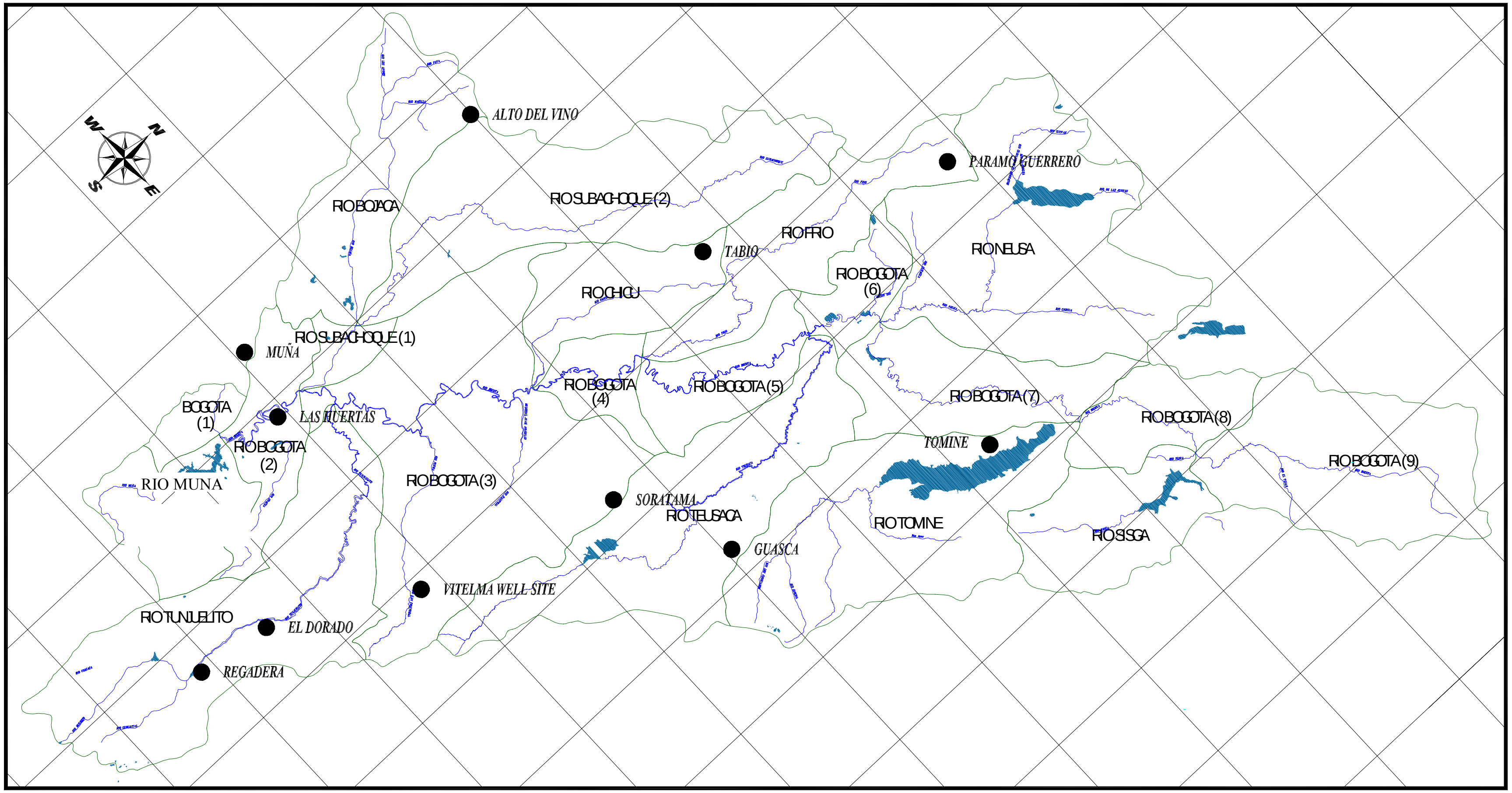


Figure-4.27 Sites for Installation of Meteorological Stations