Appendix 1: ANOVA 2 Way Test for Physical, Chemical Characteristics of water, and Heavy Metal Concentrations in Water.

1.1. Surface water

Parameter	Month			Site		
	F value	Sig. of F	Sig.	F value	Sig. of F	Sig.
Temperature	80.1	0.00	sig	6.1	0.00	sig
PH	3.2	0.02	sig	4.2	0.02	sig
Conductivity	25	0.00	sig	72	0.00	sig
Total Dissolve Solid	18.3	0.00	sig	131.3	0.00	sig
Dissolved Oxygen	1.2	0.34	ns	1.6	0.21	ns
Alkalinity	0.2	0.97	ns	30.5	0.00	sig
Acidity	0.9	0.48	ns	41.7	0.00	sig
Hardness	1.9	0.11	ns	63.9	0.00	sig
Arsenic	2.3	0.06	ns	42.3	0.00	sig
Lead	1.0	0.44	ns	1.1	0.36	ns
Manganese	0.4	0.83	ns	11.6	0.00	sig
Iron	0.3	0.93	ns	6.9	0.00	sig

Sig.: Significance

ns: none significant at $P \leq 0.05$

sig: significant at $P \leq 0.05$

1.2. Ground water

Parameter	Month			Direction		
	F value	Sig. of F	Sig.	F value	Sig. of F	Sig.
Temperature	2.1	0.08	ns	65.5	0.00	sig
pH	0.9	0.52	ns	8.7	0.00	sig
Conductivity	1.7	0.15	ns	12.0	0.00	sig
Total Dissolve Solid	0.7	0.60	ns	14.4	0.00	sig
Dissolved Oxygen	4.6	0.00	sig	2.5	0.05	ns
Alkalinity	0.1	0.98	ns	17.5	0.00	sig
Acidity	0.3	0.89	ns	3.9	0.01	ns
Hardness	0.5	0.79	ns	18.3	0.00	sig
Arsenic	0.3	0.92	ns	35.7	0.00	sig
Lead	1.6	0.17	ns	0.7	0.59	ns
Manganese	0.3	0.88	ns	4.7	0.00	sig
Iron	0.8	0.57	ns	8.0	0.00	sig

Sig.: Significance

ns: none significant at $P \leq 0.05$

sig: significant at $P \leq 0.05$

1.3. Least-significant difference of surface water characteristics according to the study period

Parameter	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	30.8 c	30.8 c	30.5 bc	31.7 c	29.4 b	24.1 a
pH	8.0 c	7.8 bc	7.6 b	7.8 bc	7.8 bc	7.4 a
Conductivity (µS/cm)	740 a	343 a	626 a	782 a	1745 b	872 a
TDS(mg/l)	350 a	371 a	369 a	403 a	877 b	450 a

Following of rows, the different letters indicate for significant difference at $P \leq 0.05$

a, b, c is symbol of significant differences of mean value at $P \leq 0.05$. For example: Temperature in December is significant difference in comparing with other months at $P \leq 0.05$. Between August and September, even the number of value is different but in term of statistic is not significant difference at probability less than or equal 0.05 ($P \leq 0.05$). Other words, about 95 per cent temperature in August is not different with those in September. Similarly, it can be explained as the same way for Appendices 1.4, 1.5, 1.6 in part of Appendices.

1.4. Least-significant difference of surface water characteristics according to the reservoirs

Parameter	AR	MKR	MMR
pH	7.7 ab	7.9 b	7.5 a
Conductivity (µS/cm)	1135 ab	468 a	1504 b
Total Dissolved Solids (mg/l)	282 a	227 a	908 b
Alkalinity	91 a	163 c	124 b
Acidity	4 a	13 b	6 a
Hardness	91 a	193 a	780 b
Arsenic	0.1 a	1.0 a	6.0 b
Manganese	21 a	130 b	242 c
Iron	30 a	60 a	143 b

Following of rows, the different letters indicate for significant difference at $P \leq 0.05$

1.5. Least-significant difference of ground water characteristics according to the study period

Parameter	Jul	Aug	Sep	Oct	Nov	Dec
Dissolved oxygen (mg/l)	2.3 bc	3.1 c	1.9 ab	1.7 b	2.7 bc	1.0 a

Following of rows, the different letters indicate for significant difference at $P \leq 0.05$

1.6. Least-significant difference of ground water characteristics according to the directions

Parameter	N	SP	M	S	CT
Temperature (°C)	27.3 a	30.9 b	41.4 c	27.4 a	27.3a
pH	6.5 b	6.7 bc	7.5 c	7.0 bc	5.2 a
Conductivity (µS/cm)	708 a	2,149 b	1,710 b	761 a	720 a
Total Dissolved Solids (mg/l)	340 a	1,332 c	924 b	457 a	270 a
DO (mg/l)	2.27 bc	3.10 c	1.95 b	1.73 ab	1.04 a
Alkalinity (mg/l as $CaCO_3$)	215 a	707 b	990 c	258 a	30 a
Acidity (mg/l as $CaCO_3$)	39 a	63 b	36 a	32 a	61 b
Hardness (mg/l as $CaCO_3$)	280 b	710 c	89 a	259 b	38 a
Arsenic (µg/l)	1.5 a	2.8 a	307.8 b	0.6 a	<dl a
Manganese(µg/l)	458 b	445 b	13 a	108 a	63 a
Iron(µg/l)	3,890 b	477 a	677 a	462 a	70 a

Following of rows, the different letters indicate for significant difference at $P \leq 0.05$

Appendix 2: Average Values of Physical, Chemical Characteristics of water, and Heavy Metal Concentrations in Water.

2.1. Average values of physical, chemical characteristics, and heavy metal concentrations in surface water.

Parameter		Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	Control	33	32	30	32	29	24
	MKR	30	29	31	33	31	26
	MMR	30	31	30	31	29	23
pH	Control	8.4	8.1	7.2	7.7	7.9	7.0
	MKR	7.9	7.6	8.2	8.1	7.9	7.8
	MMR	7.7	7.7	7.3	7.6	7.6	7.4
Conductivity (µS/cm)	Control	185	3,605	195	203	2,407	212
	MKR	386	480	765	359	586	312
	MMR	1,649	338	919	1,784	2,241	2,092
TDS (mg/l)	Control	87	104	99	101	1,193	105
	MKR	193	188	378	182	296	158
	MMR	848	820	632	925	1,141	1,085
DO (mg/l)	Control	6.1	6.1	3.9	4.3	4.3	4.4
	MKR	4.1	4.8	5.0	4.7	5.1	5.2
	MMR	4.3	4.1	3.2	3.7	4.9	5.4
Alkalinity (mg/l as $CaCO_3$)	Control	87	90	91	86	92	101
	MKR	112	125	133	111	141	124
	MMR	167	170	161	164	154	162
Acidity (mg/l as $CaCO_3$)	Control	2	0	6	4	6	5
	MKR	8	7	4	2	6	6
	MMR	15	13	13	12	15	13
Total hardness (mg/l as $CaCO_3$)	Control	79	86	105	91	80	103
	MKR	154	158	319	179	219	153
	MMR	430	671	569	876	999	1,137

2.1. Average values of physical, chemical characteristics, and heavy metal concentrations in surface water (cont'.).

Parameter		Jul	Aug	Sep	Oct	Nov	Dec
Arsenic	Control	<dl	<dl	<dl	<dl	<dl	<dl
(µg/l)	MKR	1	2	1	1	<dl	1
	MMR	8	6	2	8	3	8
Lead	Control	12	6	<dl	<dl	5	<dl
(µg/l)	MKR	23	24	9	2	5	<dl
	MMR	<dl	6	<dl	10	7	<dl
Manganese	Control	27	25	15	23	18	17
(µg/l)	MKR	309	134	70	86	127	87
	MMR	128	220	171	273	391	268
Iron	Control	91	18	<dl	29	33	<dl
(µg/l)	MKR	72	154	32	50	33	19
	MMR	80	72	109	144	177	270

2.2. Average values of physical, chemical characteristics, and heavy metal concentrations in ground water.

Parameter		Jul	Aug	Sep	Oct	Nov	Dec
	CT	29	28	29	29	28	22
Temperature	N	27	27	27	29	28	26
(°C)	SP	30	32	31	32	31	29
	M	42	44	39	40	43	41
	S	28	27	28	29	28	24
pH	CT	5.5	5.5	5.0	5.4	4.8	4.9
	N	6.6	6.8	6.5	6.1	6.7	6.6
	SP	7.0	6.9	7.1	5.3	7.3	6.7
	M	7.5	7.5	7.4	7.7	7.6	7.0
	S	7.4	7.5	7.3	5.7	7.2	6.7
Conductivity	CT	185	1,371	260	203	2,091	210
(µS/cm)	N	685	893	646	636	766	623
	SP	2,866	791	2,336	2,241	2,513	2,468
	M	1,778	1,070	1,905	1,931	2,350	2,210
	S	766	537	838	699	971	757
TDS	CT	93	115	129	102	1,071	109
(mg/l)	N	353	347	323	321	383	313
	SP	1,427	1,603	1,159	1,136	1,286	1220
	M	999	559	934	927	1,197	1,069
	S	385	436	417	377	486	642
DO	CT	3.3	3.3	2.5	2.3	2.1	1.9
(mg/l)	N	2.3	2.9	1.4	1.5	1.4	0.8
	SP	2.3	3.0	2.3	2.1	2.5	0.1
	M	2.1	4.0	1.7	1.4	3.0	0.6
	S	1.6	2.5	1.8	1.4	1.5	1.3
Alkalinity	CT	27	34	37	40	17	26
(m g / l N		196	218	238	197	224	217
as$CaCO_3$)							
	SP	692	614	688	633	745	1,008
	M	976	954	1,041	864	1,148	1,021
	S	292	251	275	239	266	225

2.2. Average values of physical, chemical characteristics, and heavy metal concentrations in ground water (cont'.).

Parameter		Jul	Aug	Sep	Oct	Nov	Dec
Acidity	CT	57	66	53	85	37	70
(mg/l as $CaCO_3$)	N	39	39	42	45	34	34
	SP	59	55	77	52	60	88
	M	42	29	38	26	34	51
	S	18	25	32	33	46	38
Total hardness	CT	25	50	51	39	19	46
(mg/l as $CaCO_3$)	N	246	300	281	293	265	293
	SP	763	1,029	678	610	567	376
	M	63	87	89	94	81	130
	S	269	276	263	258	237	251
Arsenic	CT	<dl	<dl	<dl	<dl	<dl	<dl
(µg/l)	N	1	2	2	2	1	2
	SP	3	3	4	3	2	1
	M	349	326	366	300	198	253
	S	2	1	1	<dl	<dl	<dl
Lead	CT	<dl	<dl	2	2	6	<dl
(µg/l)	N	14	13	4	4	<dl	3
	SP	<dl	6	<dl	3	22	2
	M	10	7	2	2	16	<dl
	S	15	7	1	6	<dl	2
Manganese	CT	73	67	54	64	60	60
(µg/l)	N	734	537	517	287	330	342
	SP	193	175	846	727	682	111
	M	13	17	21	27	10	6
	S	148	84	176	110	104	137
Iron	CT	85	81	59	76	46	69
(µg/l)	N	2,187	2,115	4,914	6,740	3,791	3,577
	SP	106	75	1,088	654	1,037	<dl
	M	373	692	1,547	441	464	353
	S	448	516	788	328	468	228

Appendix 3: Statistical analysis of repeat measurement during the study period

3.1: Temperature (^{o}C) of surface and ground water during the study period

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	30 b	30 b	31 b	34 c	31 b	25 a
MKR2	28 b	28 b	30 c	33 d	31 cd	26 a
MKR3	31 bc	30 b	31 bc	32 c	30 b	26 a
MMR1	29 c	29 c	30 c	30 c	27 b	22 a
MMR2	31 bc	32 c	31 bc	31 bc	30 b	23 a
MMR3	31 d	33 d	30 bc	32 cd	29 b	23 a
AR1	32 d	32 d	30 c	32 d	29 b	24 a
AR2	33 d	32 cd	30 bc	32 cd	29 b	24 a
AR3	33 d	32 cd	31 c	32 cd	29 b	24 a
Ground water						
N1	27 b	27 b	27 b	28 c	28 c	26 a
N2	27 b	27 b	28 b	29 c	28 b	26 a
SP1	28 b	28 b	28 b	29 c	28 b	26 a
SP2	34 bc	35 c	34 b	35 c	35 c	31 a
SP3	28 a	32 c	30 b	33 d	30 b	*
SP4	30	32	*	*	*	*
M1	36 a	40 c	37 a	38 b	39 bc	36 a
M2	42 b	44 c	46 d	34 a	*	*
M3	47 b	48 b	35 a	46 b	47 b	46 b
S1	27 bc	27 bc	26 b	29 d	27 bc	24 a
S2	30 b	30 b	31 c	31 c	30 b	28 a
S3	27 c	26 b	26 b	28 d	29 d	21 a
S4	29 c	27 b	27 b	29 c	28 c	23 a
CT1	30 d	28 c	29 cd	29 cd	27 b	22 a
CT2	29 c	28 b	28 b	30 c	28 b	22 a
CT3	29 c	28 b	29 c	30 d	29 c	23 a

*: *No sample*

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.2: pH values of surface and ground water during the study period

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	8.7 d	8.1 b	8.5 c	8.5 c	8.1 b	7.8 a
MKR2	6.5 a	7.1 b	8.0 e	7.7 d	7.4 c	7.8 d
MKR3	8.4 d	7.5 a	8.1 bc	8.2 c	8.1 bc	7.9 b
MMR1	7.7 b	7.6 ab	7.5 a	7.9 c	7.7 b	7.6 ab
MMR2	7.8 d	7.5 c	7.0 a	7.4 bc	7.3 b	7.1 a
MMR3	7.6 b	8.0 c	7.5 a	7.6 b	7.8 b	7.4 a
AR1	8.3 e	8.3 e	7.2 b	7.4 c	7.9 d	6.8 a
AR2	8.5 d	8.3 d	7.2 b	7.8 c	7.8 c	7.1 a
AR3	8.5 c	7.9 b	7.3 b	8.0 b	7.9 b	7.1 a
Ground water						
N1	6.7 a	6.9 a	6.6 a	7.2 a	7.1 a	6.8 a
N2	6.4 b	6.7 b	6.5 b	5.1 a	6.4 b	6.4 b
SP1	6.7 b	7.0 b	6.8 b	4.3 a	7.1 b	6.5 b
SP2	7.1 b	7.0 b	6.9 b	4.3 a	7.5 b	6.9 b
SP3	7.2 a	7.1 a	7.5 a	7.4 a	7.4 a	*
SP4	6.8	6.7	*	*	*	*
M1	7.5 a	7.5 a	7.5 a	7.7 a	7.9 a	7.4 a
M2	7.9 b	7.5 ab	6.9 a	8.3 b	*	*
M3	7.1 a	7.4 ab	7.8 b	7.1 a	7.3 ab	6.7 a
S1	5.8 b	6.5 b	6.0 b	4.4 a	4.2 a	3.9 a
S2	10.0 a	9.3 a	9.5 a	9.6 a	9.7 a	9.4 a
S3	6.6 b	7.0 bc	6.6 b	4.3 a	7.5 c	7.0 bc
S4	7.1 b	7.3 b	7.0 b	4.5 a	7.2 b	6.8 b
CT1	5.2 a	5.1 a	5.2 a	5.2 a	4.5 a	4.4 a
CT2	5.8 ab	5.9 b	5.3 a	5.8 ab	5.3 a	5.5 a
CT3	5.4 a	5.5 a	4.6 a	5.3 a	4.6 a	4.7 a

*: *No sample*

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.3: Conductivity of surface and ground water during the study period (μ S/cm)

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	341 c	381 d	517 e	303 a	339 c	335 b
MKR2	579 c	714 d	1,304 f	474 b	1,076 e	328 a
MKR3	238 c	345 a	473 b	299 a	343 a	273 a
MMR1	2,210 f	616 a	1413 b	1,656 d	1,863 e	1,466 c
MMR2	1,356 c	196 a	427 b	1,897 d	2,360 e	2,430 f
MMR3	1,382 c	202 a	916 b	1,798 d	2,500 f	2,380 e
AR1	176 a	200 c	192 b	207 d	2,430 f	215 e
AR2	189 a	215 d	200 b	203 b	2,310 e	207 c
AR3	191 a	220 d	193 a	200 b	2,480 e	215 c
Ground water						
N1	791 e	372 a	625 b	720 c	857 f	737 d
N2	578 c	1413 f	666 d	551 b	674 e	509 a
SP1	795 b	213 a	865 e	862 e	838 d	826 c
SP2	4,020 c	986 a	4,300 e	3,830 b	4,690 f	4,110 d
SP3	1,517 b	840 a	1,842 c	2,030 e	2,010 d	*
SP4	5,130	1,123	*	*	*	*
M1	2,320 c	2,015 a	2,640 d	2,300 b	2,790 e	2,820 f
M2	1,485 b	446 a	1,523 c	1,552 d	*	*
M3	1,528 b	749 a	1,553 c	1,940 f	1,910 e	1,600 d
S1	578 c	913 e	628 d	560 b	957 f	436 a
S2	745 b	748 b	758 c	729 a	863 e	801 d
S3	879 b	233 a	1,095 e	1,152 f	972 d	950 c
S4	860 d	255 a	870 e	356 b	1,093 f	840 c
CT1	159 a	2,160 e	318 c	180 b	1,853 d	180 b
CT2	202 a	1,215 e	251 d	214 d	2,400 f	238 c
CT3	194 a	738 c	212 b	214 b	2,020 d	212 b

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.4: Total dissolved solids in surface and ground water during the study period (mg/l).

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	169 ab	186 c	249 d	152 a	172 b	168 a
MKR2	289 d	193 b	641 f	242 c	543 e	167 a
MKR3	120 a	185 e	245 f	153 c	172 d	140 b
MMR1	1180 f	730 a	746 c	833 d	933 e	735 b
MMR2	674 a	877 c	714 b	950 d	1210 e	1,240 f
MMR3	690 b	853 c	435 a	993 d	1,280 e	1,280 e
AR1	81 a	101 c	97 b	103 c	1130 d	107 c
AR2	84 a	106 b	101 b	101 b	1190 c	102 b
AR3	96 a	106 c	98 ab	100 b	1,260 d	107 c
Ground water						
N1	416 e	397 d	313 a	361 b	427 f	367 c
N2	289 c	297 d	333 e	280 b	339 f	259 a
SP1	400 a	460 d	440 c	438 c	458 d	410 b
SP2	1,980 b	2,330 e	2,110 d	1,910 a	2,370 f	2,030 c
SP3	758 a	1010 c	926 b	1060 e	1030 d	*
SP4	2,570	2,610	*	*	*	*
M1	1,500 b	1,220 a	1,260 ab	1,140 ab	1,450 b	1,340 b
M2	738 b	221 a	765 c	774 d	*	*
M3	758 b	235 a	777 c	866 e	943 f	797 d
S1	291 b	305 c	310 d	281 a	481 e	876 f
S2	376 b	430 e	400 d	369 a	433 e	393 c
S3	440 a	515 d	528 e	582 f	486 c	480 b
S4	431 b	494 c	430 b	276 a	543 d	817 e
CT1	80 a	96 c	158 d	91 b	903 e	90 b
CT2	101 a	117 c	126 c	107 b	1,230 d	124 c
CT3	99 a	131 d	104 b	107 b	1,080 e	113 c

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.5: Dissolved oxygen in surface and ground water during the study period (mg/l).

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	4.8 a	6.1 b	5.6 ab	5.2 a	5.1 a	5.0 a
MKR2	2.4 a	3.4 b	4.5 cd	3.8 bc	4.8 d	5.0 d
MKR3	5.2 a	4.8 a	4.9 a	5.0 a	5.4 a	5.6 a
MMR1	2.0 a	2.2 ab	3.6 c	3.0 bc	3.5 c	3.7 c
MMR2	6.0 d	3.0 b	1.7 a	3.8 bc	3.9 c	5.7 d
MMR3	4.9 a	7.0 b	4.2 a	4.2 a	7.2 b	6.7 b
AR1	6.0 b	6.2 b	4.4 a	4.4 a	4.6 a	4.4 a
AR2	6.2 b	6.0 b	3.7 a	4.0 a	4.0 a	4.3 a
AR3	6.0 c	6.0 c	3.6 a	4.5 b	4.4 ab	4.4 ab
Ground water						
N1	1.2 c	1.6 d	1.0 b	0.9 b	0.9 b	0.0 a
N2	3.3 d	4.2 e	1.7 b	2.1 c	1.8 b	1.5 a
SP1	1.8 d	2.3 e	1.6 c	1.1 b	1.0 b	0.0 a
SP2	1.0 cd	1.6 e	0.9 c	1.1 d	0.6 b	0.2 a
SP3	4.0 a	5.0 d	4.5 c	4.2 b	5.9 e	*
SP4	2.5	3.2	*	*	*	*
M1	1.1 b	2.5 c	1.0 b	1.1 b	4.1 d	0.8 a
M2	3.5 c	4.0 d	1.5 b	1.2 a	*	*
M3	1.8 b	5.5 d	2.5 c	1.8 b	1.8 b	0.3 a
S1	1.6 b	2.6 d	1.6 b	2.2 c	1.7 b	1.0 a
S2	1.8 c	2.8 d	1.8 c	0.7 a	1.1 b	0.6 a
S3	2.0 c	2.6 e	2.2 d	2.3 d	1.0 b	0.0 a
S4	0.9 b	1.8 d	1.4 c	0.4 a	2.1 e	3.5 f
CT1	4.1 e	4.2 e	1.1 a	3.0 d	2.6 b	2.8 c
CT2	4.0 e	4.1 e	3.4 d	2.5 a	3.1 c	2.8 b
CT3	1.8 d	1.7 d	3.0 e	1.3 c	0.5 b	0.0 a

**: No sample*

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.6: Total alkalinity of surface and ground water during the study period (mg/l as $CaCO_3$).

Time	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	112 b	126 e	121 c	104 a	124 d	125 de
MKR2	102 a	115 b	148 e	127 d	181 f	123 c
MKR3	121 c	133 f	131 e	101 a	119 b	123 d
MMR1	228 e	191 b	131 a	214 d	198 c	242 f
MMR2	141 d	162 e	180 f	133 c	120 a	125 b
MMR3	132 b	157 e	172 f	145 d	143 c	118 a
AR1	89 a	92 c	89 a	90 ab	91 bc	99 d
AR2	86 b	89 c	89 c	83 a	93 d	105 e
AR3	88 b	89 c	95 e	84 a	91 d	97 f
Ground water						
N1	234 a	251 b	267 d	234 a	255 c	233 a
N2	157 a	186 b	210 e	159 a	193 c	200 d
SP1	310 c	321 e	364 f	305 b	234 a	316 d
SP2	1,668 d	1,380 a	1,532 c	1,445 b	1,753 f	1,701 e
SP3	127 a	144 b	167 d	149 c	249 e	*
SP4	661	612	*	*	*	*
M1	1,393 d	1,351 c	1,491 e	1,212 a	1,528 f	1,305 b
M2	771 c	766 b	818 d	700 a	*	*
M3	763 d	745 c	814 f	680 a	768 e	736 b
S1	72 d	88 e	125 f	42 c	40 b	13 a
S2	414 d	230 b	278 c	229 b	273 c	194 a
S3	150 a	165 c	165 c	163 b	570 e	535 d
S4	535 d	521 c	534 d	521 c	181 b	157 a
CT1	8 a	15 c	21 d	23 e	13 c	11 b
CT2	42 b	49 c	49 c	54 d	21 a	47 c
CT3	30 c	38 d	42 e	42 e	17 a	21 b

** : No sample*

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.7: Acidity of surface and ground water during the study period (mg/l as $CaCO_3$)

Time	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	7 b	0 a	0 a	0 a	8 c	7 b
MKR2	12 d	13 d	8 b	7 a	10 c	7 a
MKR3	6 d	7 d	4 c	0 a	2 b	4 c
MMR1	16 d	15 cd	11 b	8 a	14 c	10 b
MMR2	11 a	16 c	19 d	14 b	20 d	14 b
MMR3	18 e	8 a	8 a	13 c	11 b	15 d
AR1	2 b	0 a	6 d	4 c	7 d	6 d
AR2	1 b	0 a	6 e	4 c	5 d	4 c
AR3	1 b	0 a	5 d	4 c	5 d	4 c
Ground water						
N1	44 c	43 c	42 c	27 b	22 a	22 a
N2	34 a	35 a	42 b	62 d	45 c	46 c
SP1	45 b	39 a	53 c	54 cd	55 d	44 b
SP2	81 b	49 a	166 e	84 c	83 c	133 d
SP3	13 b	11 a	12 ab	17 c	42 d	*
SP4	96	122	*	*	*	*
M1	73 d	44 c	48 bc	27 ab	20 a	49 c
M2	17 b	34 c	48 d	0 a	*	*
M3	35 c	10 a	17 b	51 e	47 d	53 f
S1	28 a	42 b	55 c	73 d	132 f	100 e
S2	0	0	0	0	0	0
S3	18 a	23 c	23 c	21 b	32 d	43 e
S4	26 c	34 d	48 f	38 e	22 b	8 a
CT1	36 a	66 d	46 b	74 e	45 b	54 c
CT2	52 d	43 b	51 d	58 e	36 a	48 c
CT3	83 c	90 d	61 b	122 f	31 a	109 e

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.8: Total hardness of surface and ground water during the study period (mg/l as $CaCO_3$).

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	130 a	149 c	173 d	145 b	131 a	147 c
MKR2	205 c	163 a	611 f	244 d	401 e	167 b
MKR3	126 a	163 bc	173 c	149 bc	124 ab	146 bc
MMR1	621 c	884 f	638 d	545 b	642 e	489 a
MMR2	184 a	704 c	660 b	1,021 d	1,190 e	1,356 f
MMR3	484 c	424 b	409 a	1,063 d	1,164 e	1,564 f
AR1	86 c	75 a	109 e	88 c	82 b	105 d
AR2	73 a	96 d	94 c	95 cd	84 b	105 e
AR3	79 b	88 c	113 f	91 d	75 a	99 e
Ground water						
N1	310 b	384 f	289 a	350 d	325 c	357 e
N2	183 a	216 c	274 f	236 e	204 b	229 d
SP1	343 a	417 c	476 e	453 d	410 b	419 c
SP2	340 a	616 b	600 b	396 a	358 a	334 a
SP3	718 a	1,363 e	956 c	979 d	934 b	*
SP4	1,653	1,721	*	*	*	*
M1	48 a	65 c	71 d	80 e	61 b	111 f
M2	62 a	90 c	109 d	69 b	*	*
M3	79 a	105 d	86 b	133 e	101 c	149 f
S1	177 a	227 b	236 c	229 b	260 d	279 e
S2	19 a	46 d	34 c	27 b	14 a	29 bc
S3	530 f	365 c	338 b	320 a	423 d	505 e
S4	350 c	467 c	446 c	457 c	252 b	190 a
CT1	20 a	55 c	56 c	27 b	17 a	54 c
CT2	32 a	61 c	49 b	50 b	32 a	58 c
CT3	22 b	33 c	49 e	42 d	6 a	25 b

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.9: Arsenic in surface and ground water during studied time (μg/l)

	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	1 a	2 b	1 a	1 a	1 a	1 a
MKR2	2 c	1 b	1 b	1 b	<dl a	1 b
MKR3	1 b	2 c	1 b	1 b	<dl a	1 b
MMR1	7 f	5 e	2 a	5 d	3 b	4 c
MMR2	8 c	6 b	2 a	16 e	2 a	14 d
MMR3	9 d	7 c	3 a	5 b	3 a	5 b
AR1	<dl	<dl	<dl	<dl	<dl	<dl
AR2	<dl a	<dl a	<dla	1 b	<dl a	<dl a
AR3	<dl	<dl	<dl	<dl	<dl	<dl
Ground water						
N1	3 b	3 b	3 b	3 b	2 a	3 b
N2	<dl a	1 b	1 b	<dl a	<dl a	<dl a
SP1	4 b	2 a	2 a	2 a	2 a	2 a
SP2	6 c	3 b	3 b	3 b	<dl a	<dl a
SP3	<dl a	4 c	5 d	3 b	4 c	*
SP4	4	3	*	*	*	*
M1	101 e	52 a	107 f	77 b	86 d	84 c
M2	452 b	482 c	502 d	400 a	*	*
M3	492 d	444 c	491 d	424 b	310 a	422 b
S1	6 c	3 b	3 b	<dl a	<dl a	<dl a
S2	1 b	1 b	<dl a	<dl a	<dl a	<dl a
S3	<dl a	<dl a	1 b	<dl a	<dl a	<dl a
S4	<dl	<dl	<dl	<dl	<dl	<dl
CT1	<dl	<dl	<dl	<dl	<dl	<dl
CT2	<dl	<dl	<dl	<dl	<dl	<dl
CT3	<dl	<dl	<dl	<dl	<dl	<dl

dl: detection limit = 0.7 μg As/l

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.10: Lead in surface and ground water during the study time (μg/l)

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	<dl a	<dl a	<dl a	<dl a	15 b	<dl a
MKR2	69 d	38 c	21 b	<dl a	<dl a	<dl a
MKR3	<dl a	33 d	7 c	5 b	<dl a	<dl a
MMR1	<dl a	<dl a	<dl a	21 b	<dl a	<dl a
MMR2	<dl a	18 c	<dl a	8 b	<dl a	<dl a
MMR3	<dl a	<dl a	<dl a	<dl a	22 b	<dl a
AR1	36 c	19 b	<dl a	<dl a	<dl a	<dl a
AR2	<dl	<dl	<dl	<dl	<dl	<dl
AR3	<dl a	<dl a	<dl a	<dl a	16 b	<dl a
Ground water						
N1	29 d	26 c	8 b	8 b	<dl a	7 b
N2	<dl	<dl	<dl	<dl	<dl	<dl
SP1	<dl a	25 d	<dl a	9 c	29 e	5 b
SP2	<dl a	<dl a	<dl a	<dl a	15 b	<dl a
SP3	<dl a	<dl a	<dl a	<dl a	23 b	*
SP4	<dl	<dl	*	*	*	*
M1	<dl a	<dl a	<dl a	5 b	32 c	<dl a
M2	31 b	<dl a	5 a	<dl a	*	*
M3	<dl a	20 b	<dl a	<dl a	<dl a	<dl a
S1	43 d	<dl a	<dl a	16 c	<dl a	4 b
S2	18 c	<dl a	5 a	5 a	<dl a	6 b
S3	<dl	<dl	<dl	<dl	<dl	<dl
S4	<dl a	29 c	<dl a	4 b	<dl a	<dl a
CT1	<dl	<dl	<dl	<dl	<dl	<dl
CT2	<dl	<dl	<dl	<dl	<dl	<dl
CT3	<dl a	<dl a	5 b	6 b	19 c	<dl a

dl: detection limit = 4 μg Pb/l

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.11: Manganese in surface and ground water during study time (μg/l)

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	48 c	36 bc	27 b	13 a	69 d	84 d
MKR2	824 e	276 d	146 b	231 c	274 d	114 a
MKR3	54 bc	89 d	37 b	13 a	39 b	64 c
MMR1	109 a	276 d	122 a	184 b	586 e	213 c
MMR2	128 a	213 c	322 f	265 d	304 e	190 b
MMR3	146 b	170 c	70 a	370 e	283 d	401 f
AR1	22 a	22 a	13 a	23 a	17 a	17 a
AR2	22 ab	27 b	13 a	23 ab	16 ab	17 ab
AR3	36 b	27 ab	18 a	23 a	22 a	17 a
Ground water						
N1	1,414 d	1,066 c	1,025 c	564 a	640 a	675 b
N2	54 b	8 a	9 a	9 a	19 a	9 a
SP1	202 a	204 a	217 b	217 b	186 a	185 a
SP2	72 b	94 c	131 d	70 b	54 a	36 a
SP3	226 b	141 a	2,189 e	1,893 d	1,807 c	*
SP4	272	261	*	*	*	*
M1	8 a	<dl a	18 b	23 b	10 a	6 a
M2	17 b	17 b	<dl a	18 b	*	*
M3	<dl a	<dl a	42 b	40 b	<dl a	<dl a
S1	128 b	70 a	165 c	289 d	277 d	285 d
S2	179 c	151 b	193 c	37 a	36 a	39 a
S3	<dl a	8 a	<dl a	9 a	81 b	86 b
S4	137 d	108 c	169 e	103 c	22 b	<dl a
CT1	31 ab	17 a	37 b	32 ab	30 ab	25 ab
CT2	22 ab	32 b	27 b	18 a	13 ab	12 a
CT3	165 c	151 b	98 a	141 b	138 b	142 b

dl: the detection limit =5 μg Mn/l

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Table 3.12: Iron (Fe) in surface and ground water during time of study (µg/l)

Site	Jul	Aug	Sep	Oct	Nov	Dec
Surface water						
MKR1	<dl a	31 b	<dl a	35 b	<dl a	57 c
MKR2	127 d	302 e	96 c	114 c	70 b	<dl a
MKR3	88 c	129 d	<dl a	<dl a	28 b	<dl a
MMR1	174 b	164 b	104 a	291 c	315 d	587 e
MMR2	65 b	51 ab	190 e	96 c	129 d	40 a
MMR3	<dl a	<dl a	34 b	44 c	87 d	182 e
AR1	88 c	31 b	<dl a	26 b	28 b	<dl a
AR2	34 bc	24 b	<dl a	26 bc	36 c	<dl a
AR3	151 c	<dl a	<dl a	35 b	36 b	<dl a
Ground water						
N1	4,374 b	4,178 a	9,827 e	13,480 f	7,582 d	7,154 c
N2	<dl a	51 b	<dl a	<dl a	<dl a	<dl a
SP1	<dl a	<dl a	<dl a	<dl a	28 b	<dl a
SP2	34 b	51 c	560 e	665 f	238 d	<dl a
SP3	65 a	121 b	2,704 d	1,297 c	2,844 e	*
SP4	325	129	*	*	*	*
M1	57 a	229 b	1888 f	407 c	883 e	706 d
M2	1,062 c	1,846 d	<dl a	863 b	*	*
M3	<dl a	<dl a	2,752 c	52 b	45 b	<dl a
S1	301 c	121 b	73 a	131 b	470 e	424 d
S2	576 b	1,776 e	2,199 f	1,077 d	1,054 c	487 a
S3	462 c	31 b	34 b	44 b	<dl a	<dl a
S4	454 e	136 c	845 f	61 b	349 d	<dl a
CT1	<dl	<dl	<dl	<dl	<dl	<dl
CT2	206 e	121 c	151 d	122 c	78 b	<dl a
CT3	50 b	121 c	26 a	105 c	61 b	208 d

dl = 20 µg Fe/l.

*: No sample

Following the rows, different letters indicate significant difference at $P \leq 0.05$

Appendix 4: Quality control analysis of selected elements

Element	% recovery
As	101.5 ± 2.01
Fe	99 ± 1.05
Mn	97.65 ± 2.62
Hg	104.05 ± 2.1
Pb	95 ± 4.5
Cr	97.05 ± 3.72

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