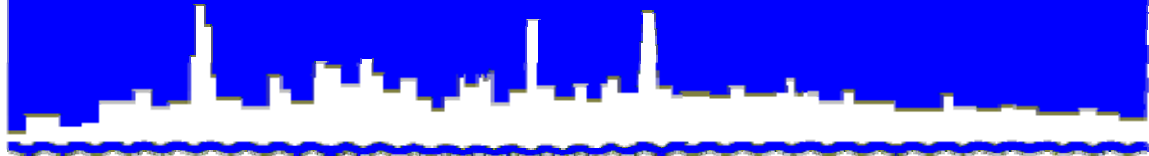


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 09-37

***TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2008 ANNUAL GROUNDWATER MONITORING REPORT***

JUNE 2009

Metropolitan Water Reclamation District of Greater Chicago

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June 17, 2009

Ms. Marcia Willhite, Chief
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Ms. Willhite:

Subject: Tunnel and Reservoir Plan, Calumet Tunnel System, 2008 Annual
Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Calumet Tunnel System, 2008
Annual Groundwater Monitoring Report."

Very truly yours,

Louis Kollias
Director
Monitoring and Research

LK:HZ:lmf
Enclosures

cc w/enc: Ms. Sally K. Swanson (USEPA Region V—WC15J) (2)
Mr. Sobanski
Dr. Granato
Dr. O'Connor
Dr. Zhang
Mr. MacDonald
Library
cc w/o enc: Mr. Jamjun
Mr. Cohen

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TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2008 ANNUAL GROUNDWATER MONITORING REPORT

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INTRODUCTION

This report contains 2008 data for the Tunnel and Reservoir Plan Calumet Tunnel System compiled from the monitoring of the groundwater level elevations in the observation wells and monitoring of water quality in the water quality monitoring wells. The observation and monitoring wells are located along the Calumet Tunnel System. The tunnel between Crawford Avenue and the Calumet Water Reclamation Plant has four water quality monitoring wells (QC-1, QC-2, QC-2.1, and QC-2.2) and 11 observation wells (OC-1 through OC-11). The tunnel between 140th Street and Indiana Avenue has 17 water quality monitoring wells (QC-3 through QC-19). The tunnel on the Torrence Avenue leg has nine water quality monitoring wells (QC-20 through QC-28). The tunnel along the Little Calumet leg has nine water quality monitoring wells (QC-29 through QC-37).

Water quality monitoring wells QC-1, QC-2, and QC-29 through QC-37 are sampled six times per year (Illinois Environmental Protection Agency [IEPA] memorandum July 9, 2004). Water quality monitoring wells QC-2.1, QC-2.2, QC-3 through QC-7 (QC-8.1 is a dry well), and QC-9 through QC-28 are sampled three times per year (IEPA memoranda July 9, 2004, and February 23, 2006). Water level readings are taken at the water quality monitoring wells at the same frequency. Groundwater observation wells OC-1 through OC-11 are sampled once every two weeks.

MONITORING DATA

Appendix AI contains a location map of observation wells OC-1 through OC-11 located along the Calumet Tunnel System.

Table AII-1 in Appendix AII contains groundwater elevation data for 2008 for observation wells OC-1 through OC-11 shown in Appendix AI. Table AII-1 also contains the yearly minimum, mean, and maximum water level elevations of each observation well.

Appendix AIII contains a location map of water quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 through QC-7, QC-8.1, and QC-9 through QC-37 located along the Calumet Tunnel System.

Tables AIV-1 and AIV-2 in Appendix AIV contain the 2008 water quality monitoring data for wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 (except for QC-8.1 which is a dry well) along the Calumet Tunnel System shown in Appendix AIII.

All of the wells in the Calumet system were visited for the required number of samples. However, in some instances the samples could not be collected. Water quality monitoring well QC-2.1 could not be sampled on January 8, 2008, because the pump failed. Water quality monitoring well QC-2.2 could not be sampled on August 21, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QC-13 could not be sampled on January 23, 2008, because snow blocked access to the well. Water quality monitoring well QC-20 was not sampled on January 31, 2008, or October 9, 2008, because the pump fell into the well and could not be retrieved. Water quality monitoring wells QC-25, QC-26, and QC-28 could not be sampled on January 31, 2008, because there was insufficient water in each well to collect a sample. Water quality monitoring well QC-30 could not be sampled on March 20, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QC-32 could not be sampled on January 17, 2008, March 20, 2008, August 7, 2008, or December 11, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QC-33 could not be sampled on January 17, 2008, March 20, 2008, June 5, 2008, August 7, 2008, or October 1, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QC-34 could not be sampled on January 17, 2008, March 20, 2008, June 5, 2008, or August 7, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QC-35 could not be sampled on January 17, 2008, March 20, 2008, June 5, 2008, October 16, 2008, or December 11, 2008, because there was insufficient water in the wells to collect a sample. Water quality monitoring well QC-36 could not be sampled on June 5, 2008, August 7, 2008, October 16, 2008, or December 11, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QC-37 could not be sampled on March 20, 2008, June 5, 2008, August 7, 2008, or December 11, 2008, because there was insufficient water in the well to collect a sample.

SUMMARY OF DATA

Observation Well Water Level Elevation Data

In Figure 1, the 2008 groundwater level elevation data for the observation wells (OC-1 through OC-11) of the Calumet Tunnel System have been plotted. In this figure, yearly minimum, mean, and maximum water level elevations of all 11 wells are plotted to show fluctuations in the water level elevations during 2008. Table AII-1 in Appendix AII contains the entire groundwater level elevation data for 2008 for all the observation wells in the Calumet Tunnel System.

Water Quality Monitoring Well Data

Tables 1 through 8 contain summary statistics of the water quality parameters for 2008 for water quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 (except for well QC-8.1 which is a dry well) in the Calumet Tunnel System. The summary statistics include minimum, mean, maximum, standard deviation (Std. Dev.), median and coefficient of variation (Coeff. Var.) for eight of the nine water quality parameters analyzed during 2008. The nine water quality parameters are: chloride (Cl), conductivity (Cond.), fecal coliform (FC), hardness as CaCO₃ (Hard.), ammonia nitrogen (NH₃-N), pH, sulfate (SO₄), total dissolved solids (TDS), and total organic carbon (TOC). The summary statistics for FC are minimum, geometric mean (Geo. Mean), maximum, and median. Median values were calculated using the Microsoft[®] Excel function MEDIAN. In instances where an even number of samples were collected and analyzed, the reported median is the average of the two numbers in the middle of the series.

FIGURE 1: 2008 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE CALUMET TUNNEL SYSTEM OBSERVATION WELLS

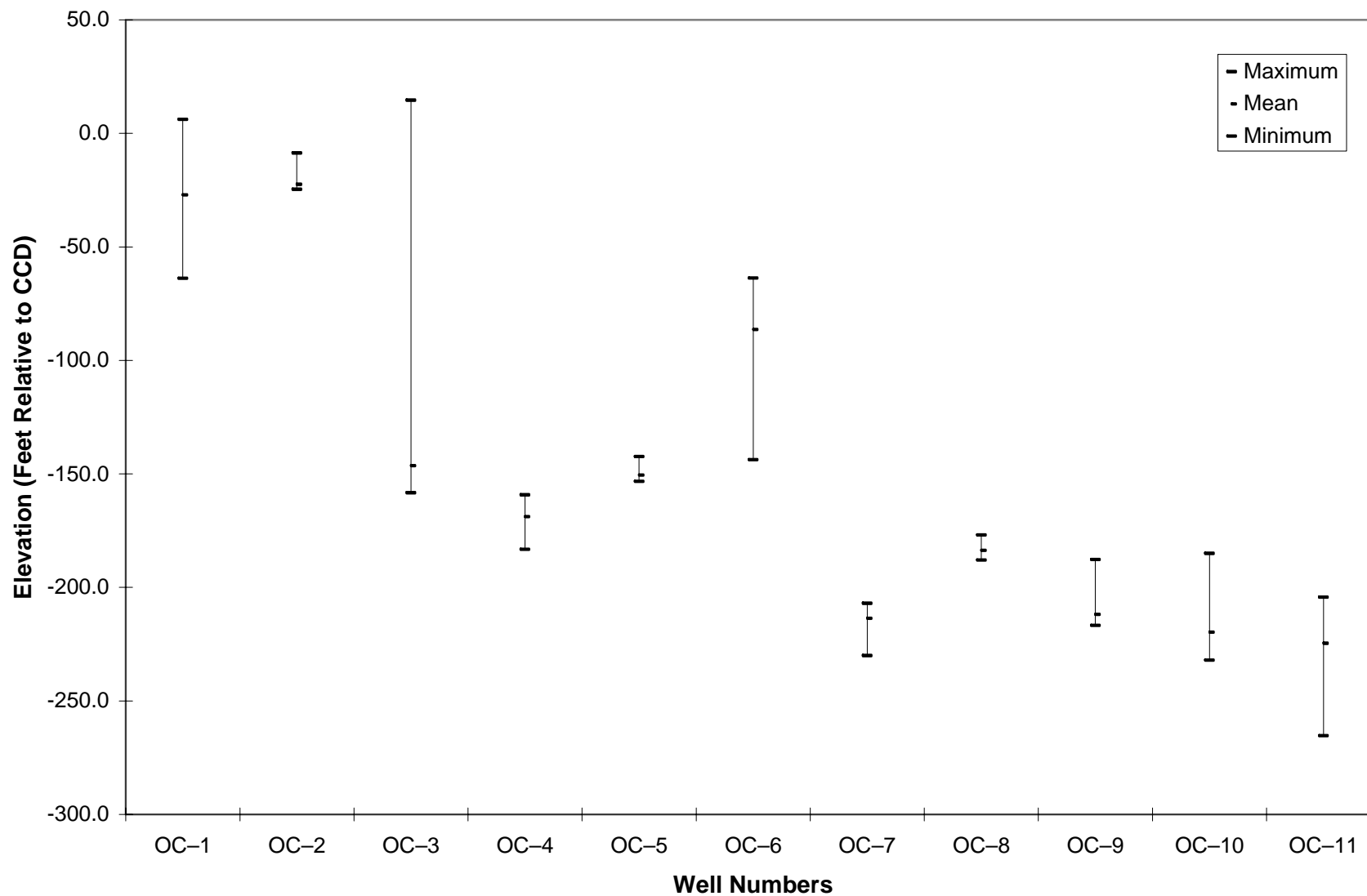


TABLE 1: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter ¹		Well Number				
		QC-1	QC-2	QC-2.1	QC-2.2	QC-3
Cl mg/L	Minimum	70.0	22.4	12.0	13.0	12.0
	Mean	75.0	33.9	23.0	22.5	12.2
	Maximum	79.0	47.0	34.0	31.9	12.6
	Std. Dev.	3.4	8.1	15.6	13.4	0.3
	Median	76.1	33.5	23.0	22.5	12.0
	Coeff. Var. (%)	4.5	23.9	67.6	59.5	2.8
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.0	38.4	1.0	3.2	1.0
	Maximum	1.0	3,000.0	1.0	10.0	1.0
	Median	1.0	18.0	1.0	5.5	1.0
SO ₄ mg/L	Minimum	229.2	26.2	2.0	26.4	22.8
	Mean	237.8	29.8	17.4	29.7	25.2
	Maximum	250.0	35.5	32.7	32.9	26.7
	Std. Dev.	8.5	3.5	21.7	4.6	2.1
	Median	235.8	29.0	17.4	29.7	26.1
	Coeff. Var. (%)	3.6	11.7	125.1	15.4	8.4
NH ₃ -N mg/L	Minimum	0.34	0.31	0.26	0.29	0.38
	Mean	0.37	0.63	0.50	0.33	0.42
	Maximum	0.41	0.77	0.74	0.36	0.45
	Std. Dev.	0.03	0.17	0.34	0.05	0.04
	Median	0.37	0.67	0.50	0.33	0.42
	Coeff. Var. (%)	7.05	26.55	67.88	15.23	8.43
TOC mg/L	Minimum	1.00	1.00	1.00	1.00	1.00
	Mean	1.33	1.15	1.00	1.25	1.00
	Maximum	1.60	1.30	1.00	1.50	1.00
	Std. Dev.	0.22	0.14	0.00	0.35	0.00
	Median	1.35	1.15	1.00	1.25	1.00
	Coeff. Var. (%)	16.20	11.99	0.00	28.28	0.00

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter ¹		Well Number				
		QC-1	QC-2	QC-2.1	QC-2.2	QC-3
TDS mg/L	Minimum	850	352	406	350	420
	Mean	890	387	488	372	462
	Maximum	936	436	570	394	528
	Std. Dev.	32	29	116	31	58
	Median	884	383	488	372	438
	Coeff. Var. (%)	4	8	24	8	13
Hard. mg/L	Minimum	487	47	47	45	59
	Mean	535	80	48	65	63
	Maximum	558	97	48	85	66
	Std. Dev.	25	17	1	28	4
	Median	544	85	48	65	65
	Coeff. Var. (%)	5	22	1	44	6
Cond. µmhos/cm	Minimum	535	393	467	382	426
	Mean	774	448	506	402	450
	Maximum	1,019	562	544	422	479
	Std. Dev.	177	68	54	28	27
	Median	776	419	506	402	446
	Coeff. Var. (%)	23	15	11	7	6
pH unit	Minimum	7.4	7.5	8.0	7.9	8.0
	Mean	7.5	7.8	8.3	8.2	8.0
	Maximum	7.8	8.2	8.6	8.5	8.1
	Std. Dev.	0.2	0.3	0.4	0.4	0.0
	Median	7.4	7.8	8.3	8.2	8.0
	Coeff. Var. (%)	2.2	3.2	5.1	4.8	0.4

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 2: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-4, QC-5, QC-6, QC-7, AND QC-9

Parameter ¹		Well Number				
		QC-4	QC-5	QC-6	QC-7	QC-9
Cl mg/L	Minimum	10.0	24.0	13.0	10.0	10.0
	Mean	10.0	25.3	13.3	10.3	10.0
	Maximum	10.0	28.0	14.0	11.0	10.0
	Std. Dev.	0.0	2.3	0.6	0.6	0.0
	Median	10.0	24.0	13.0	10.0	10.0
	Coeff. Var. (%)	0.0	9.1	4.3	5.6	0.0
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.0	1.0	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0	1.0	1.0
	Median	1.0	1.0	1.0	1.0	1.0
SO ₄ mg/L	Minimum	11.5	7.1	6.8	2.0	29.9
	Mean	14.8	1,380.5	10.2	2.0	31.6
	Maximum	17.1	4,120.0	13.8	2.0	32.6
	Std. Dev.	3.0	2,372.4	3.5	0.0	1.5
	Median	16.0	14.6	10.1	2.0	32.4
	Coeff. Var. (%)	20.0	171.8	33.9	0.0	4.8
NH ₃ -N mg/L	Minimum	0.09	0.06	0.27	0.22	0.12
	Mean	0.12	0.10	0.31	0.25	0.29
	Maximum	0.13	0.12	0.33	0.27	0.60
	Std. Dev.	0.02	0.03	0.03	0.03	0.27
	Median	0.13	0.11	0.32	0.25	0.15
	Coeff. Var. (%)	19.79	33.25	10.48	10.20	92.72
TOC mg/L	Minimum	1.00	1.00	1.00	1.00	1.00
	Mean	1.00	1.00	1.03	1.10	1.00
	Maximum	1.00	1.00	1.10	1.30	1.00
	Std. Dev.	0.00	0.00	0.06	0.17	0.00
	Median	1.00	1.00	1.00	1.00	1.00
	Coeff. Var. (%)	0.00	0.00	5.59	15.75	0.00

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-4, QC-5, QC-6, QC-7, AND QC-9

Parameter ¹		Well Number				
		QC-4	QC-5	QC-6	QC-7	QC-9
TDS mg/L	Minimum	422	602	464	414	288
	Mean	447	617	483	469	320
	Maximum	482	644	514	558	342
	Std. Dev.	31	23	27	78	28
	Median	436	606	472	436	330
	Coeff. Var. (%)	7	4	6	17	9
Hard. mg/L	Minimum	9	11	15	11	55
	Mean	10	19	17	12	58
	Maximum	11	32	18	15	60
	Std. Dev.	1	12	2	2	3
	Median	11	13	17	11	58
	Coeff. Var. (%)	11	62	9	19	4
Cond. µmhos/cm	Minimum	462	661	504	446	340
	Mean	523	799	572	498	399
	Maximum	601	884	701	573	444
	Std. Dev.	71	121	112	66	53
	Median	506	853	510	476	413
	Coeff. Var. (%)	14	15	20	13	13
pH unit	Minimum	7.4	7.3	7.7	7.5	7.4
	Mean	7.9	7.7	7.9	7.8	7.6
	Maximum	8.1	8.1	8.0	8.0	7.8
	Std. Dev.	0.4	0.4	0.2	0.3	0.2
	Median	8.1	7.6	7.9	7.8	7.5
	Coeff. Var. (%)	5.1	5.3	1.9	3.2	2.8

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 3: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-10 THROUGH QC-14

Parameter ¹		Well Number				
		QC-10	QC-11	QC-12	QC-13	QC-14
Cl mg/L	Minimum	30.0	21.0	37.0	48.0	110.0
	Mean	31.4	22.6	38.7	52.0	117.5
	Maximum	33.2	24.7	41.1	56.0	127.6
	Std. Dev.	1.6	1.9	2.1	5.7	9.1
	Median	31.0	22.0	38.0	52.0	115.0
	Coeff. Var. (%)	5.2	8.5	5.5	10.9	7.7
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.0	1.0	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0	1.0	1.0
	Median	1.0	1.0	1.0	1.0	1.0
SO ₄ mg/L	Minimum	2.0	2.0	328.7	44.1	2.0
	Mean	2.0	2.0	345.9	46.5	2.0
	Maximum	2.0	2.0	371.0	49.0	2.0
	Std. Dev.	0.0	0.0	22.2	3.4	0.0
	Median	2.0	2.0	338.1	46.5	2.0
	Coeff. Var. (%)	0.0	0.0	6.4	7.4	0.0
NH ₃ -N mg/L	Minimum	0.07	0.11	0.31	0.16	0.20
	Mean	0.09	0.12	0.32	0.17	0.25
	Maximum	0.10	0.13	0.32	0.18	0.29
	Std. Dev.	0.02	0.01	0.01	0.01	0.05
	Median	0.09	0.12	0.32	0.17	0.26
	Coeff. Var. (%)	17.63	8.33	1.82	8.32	18.33
TOC mg/L	Minimum	1.00	1.00	1.00	1.00	1.90
	Mean	1.00	1.00	1.00	1.00	2.10
	Maximum	1.00	1.00	1.00	1.00	2.40
	Std. Dev.	0.00	0.00	0.00	0.00	0.26
	Median	1.00	1.00	1.00	1.00	2.00
	Coeff. Var. (%)	0.00	0.00	0.00	0.00	12.60

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-10 THROUGH QC-14

Parameter ¹		Well Number				
		QC-10	QC-11	QC-12	QC-13	QC-14
TDS mg/L	Minimum	378	286	948	432	706
	Mean	396	294	970	434	715
	Maximum	410	306	990	436	728
	Std. Dev.	16	11	21	3	12
	Median	400	290	972	434	710
	Coeff. Var. (%)	4	4	2	1	2
Hard. mg/L	Minimum	10	20	21	39	129
	Mean	11	21	87	1,366	134
	Maximum	12	22	203	2,692	139
	Std. Dev.	1	1	101	1,876	5
	Median	11	21	38	1,366	134
	Coeff. Var. (%)	9	5	115	137	4
Cond. µmhos/cm	Minimum	371	302	594	630	668
	Mean	505	424	1,098	688	777
	Maximum	642	485	1,490	745	890
	Std. Dev.	136	105	458	81	111
	Median	501	484	1,210	688	773
	Coeff. Var. (%)	27	25	42	12	14
pH unit	Minimum	7.7	7.3	7.6	7.4	7.6
	Mean	8.2	7.9	7.7	7.8	7.7
	Maximum	8.9	8.8	7.7	8.1	7.9
	Std. Dev.	0.6	0.8	0.1	0.5	0.2
	Median	8.0	7.6	7.7	7.8	7.6
	Coeff. Var. (%)	7.6	10.0	0.8	6.4	2.2

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 4: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-15 THROUGH QC-19

Parameter ¹		Well Number				
		QC-15	QC-16	QC-17	QC-18	QC-19
Cl mg/L	Minimum	12.0	21.0	10.0	10.0	10.0
	Mean	14.1	23.0	11.0	48.0	10.0
	Maximum	17.4	26.0	13.0	124.0	10.0
	Std. Dev.	2.9	2.6	1.7	65.8	0.0
	Median	13.0	22.0	10.0	10.0	10.0
	Coeff. Var. (%)	20.3	11.5	15.7	137.1	0.0
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.0	1.0	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0	1.0	1.0
	Median	1.0	1.0	1.0	1.0	1.0
SO ₄ mg/L	Minimum	2.0	61.0	186.0	33.9	149.0
	Mean	2.2	65.2	189.7	35.5	153.6
	Maximum	2.6	68.2	192.0	37.4	159.1
	Std. Dev.	0.3	3.7	3.2	1.8	5.1
	Median	2.0	66.3	191.0	35.1	152.7
	Coeff. Var. (%)	15.5	5.7	1.7	5.0	3.3
NH ₃ -N mg/L	Minimum	0.15	0.02	0.26	0.07	0.22
	Mean	0.17	0.07	0.27	0.10	0.25
	Maximum	0.20	0.12	0.29	0.12	0.26
	Std. Dev.	0.03	0.05	0.02	0.03	0.02
	Median	0.17	0.08	0.27	0.11	0.26
	Coeff. Var. (%)	14.52	68.63	5.59	26.46	9.36
TOC mg/L	Minimum	1.00	1.00	1.00	1.00	1.00
	Mean	1.00	1.00	1.00	1.00	1.00
	Maximum	1.00	1.00	1.00	1.00	1.00
	Std. Dev.	0.00	0.00	0.00	0.00	0.00
	Median	1.00	1.00	1.00	1.00	1.00
	Coeff. Var. (%)	0.00	0.00	0.00	0.00	0.00

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-15 THROUGH QC-19

Parameter ¹		Well Number				
		QC-15	QC-16	QC-17	QC-18	QC-19
TDS mg/L	Minimum	312	510	530	440	460
	Mean	333	556	534	471	462
	Maximum	356	606	538	508	466
	Std. Dev.	22	48	4	34	3
	Median	332	552	534	466	460
	Coeff. Var. (%)	7	9	1	7	1
Hard. mg/L	Minimum	14	76	174	8	103
	Mean	15	83	179	8	104
	Maximum	15	88	187	8	105
	Std. Dev.	1	6	7	0	1
	Median	15	84	176	8	104
	Coeff. Var. (%)	4	7	4	0	1
Cond. µmhos/cm	Minimum	362	421	492	396	466
	Mean	439	667	536	417	515
	Maximum	490	999	590	453	589
	Std. Dev.	68	298	50	31	65
	Median	464	582	527	402	489
	Coeff. Var. (%)	15	45	9	8	13
pH unit	Minimum	7.2	7.5	7.7	7.7	7.3
	Mean	7.5	7.8	7.8	8.0	7.6
	Maximum	7.9	8.1	8.0	8.2	7.9
	Std. Dev.	0.4	0.3	0.2	0.3	0.3
	Median	7.4	7.9	7.7	8.2	7.6
	Coeff. Var. (%)	4.8	3.9	2.2	3.6	3.9

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 5: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-20 THROUGH QC-24

Parameter ¹		Well Number				
		QC-20	QC-21	QC-22	QC-23	QC-24
Cl mg/L	Minimum	17.0	15.0	13.0	18.0	25.0
	Mean	17.0	19.0	16.0	19.7	28.5
	Maximum	17.0	22.9	19.0	22.0	34.6
	Std. Dev.	NC	4.0	3.0	2.1	5.3
	Median	17.0	19.0	16.0	19.0	26.0
	Coeff. Var. (%)	NC	20.8	18.8	10.6	18.5
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.0	1.0	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0	1.0	1.0
	Median	1.0	1.0	1.0	1.0	1.0
SO ₄ mg/L	Minimum	64.7	2.0	2.0	2.0	2.0
	Mean	64.7	43.4	5.3	2.0	2.0
	Maximum	64.7	126.1	11.8	2.0	2.0
	Std. Dev.	NC	71.7	5.7	0.0	0.0
	Median	64.7	2.0	2.0	2.0	2.0
	Coeff. Var. (%)	NC	165.2	107.4	0.0	0.0
NH ₃ -N mg/L	Minimum	0.08	0.02	0.08	0.02	0.09
	Mean	0.08	0.06	0.15	0.09	0.13
	Maximum	0.08	0.11	0.19	0.16	0.17
	Std. Dev.	NC	0.05	0.06	0.07	0.04
	Median	0.08	0.04	0.18	0.08	0.12
	Coeff. Var. (%)	NC	83.40	40.55	81.04	31.91
TOC mg/L	Minimum	1.00	1.00	1.00	1.00	1.00
	Mean	1.00	4.57	1.07	1.00	1.00
	Maximum	1.00	11.70	1.10	1.00	1.00
	Std. Dev.	NC	6.18	0.06	0.00	0.00
	Median	1.00	1.00	1.10	1.00	1.00
	Coeff. Var. (%)	NC	135.28	5.41	0.00	0.00

TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-20 THROUGH QC-24

Parameter ¹		Well Number				
		QC-20	QC-21	QC-22	QC-23	QC-24
TDS mg/L	Minimum	392	328	250	322	238
	Mean	392	406	272	330	261
	Maximum	392	556	306	342	282
	Std. Dev.	NC	130	30	11	22
	Median	392	334	260	326	262
	Coeff. Var. (%)	NC	32	11	3	8
Hard. mg/L	Minimum	65	13	26	6	12
	Mean	65	47	31	6	13
	Maximum	65	114	40	6	15
	Std. Dev.	NC	58	8	0	2
	Median	65	14	27	6	12
	Coeff. Var. (%)	NC	123	25	0	13
Cond. µmhos/cm	Minimum	589	212	261	370	312
	Mean	589	432	363	436	343
	Maximum	589	645	430	471	362
	Std. Dev.	NC	217	90	57	27
	Median	589	440	399	468	355
	Coeff. Var. (%)	NC	50	25	13	8
pH unit	Minimum	7.5	7.4	7.3	7.3	7.5
	Mean	7.5	7.6	7.5	7.8	7.7
	Maximum	7.5	7.7	7.6	8.3	7.8
	Std. Dev.	NC	0.2	0.2	0.5	0.2
	Median	7.5	7.7	7.5	7.8	7.7
	Coeff. Var. (%)	NC	2.3	2.0	6.4	2.0

NC = No calculation was performed because there was only one data point.

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 6: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-25 THROUGH QC-29

Parameter ¹		Well Number				
		QC-25	QC-26	QC-27	QC-28	QC-29
Cl mg/L	Minimum	13.0	11.0	27.0	13.0	142.0
	Mean	13.5	12.0	32.1	13.5	153.4
	Maximum	14.0	13.0	37.4	14.0	167.1
	Std. Dev.	0.7	1.4	5.2	0.7	9.9
	Median	13.5	12.0	32.0	13.5	152.5
	Coeff. Var. (%)	5.2	11.8	16.2	5.2	6.5
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.0	1.0	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0	1.0	1.0
	Median	1.0	1.0	1.0	1.0	1.0
SO ₄ mg/L	Minimum	2.5	2.0	2.0	2.1	119.8
	Mean	13.9	2.6	2.0	2.5	133.4
	Maximum	25.2	3.3	2.0	2.9	145.0
	Std. Dev.	16.1	0.9	0.0	0.6	8.6
	Median	13.9	2.6	2.0	2.5	134.9
	Coeff. Var. (%)	115.7	34.5	0.0	22.0	6.4
NH ₃ -N mg/L	Minimum	0.07	0.02	0.14	0.02	0.57
	Mean	0.10	0.04	0.17	0.03	0.64
	Maximum	0.13	0.06	0.22	0.04	0.71
	Std. Dev.	0.04	0.03	0.05	0.01	0.05
	Median	0.10	0.04	0.14	0.03	0.64
	Coeff. Var. (%)	42.43	70.71	27.71	47.14	7.57
TOC mg/L	Minimum	1.00	1.00	1.00	1.00	1.00
	Mean	1.00	1.00	1.00	1.55	1.00
	Maximum	1.00	1.00	1.00	2.10	1.00
	Std. Dev.	0.00	0.00	0.00	0.78	0.00
	Median	1.00	1.00	1.00	1.55	1.00
	Coeff. Var. (%)	0.00	0.00	0.00	50.18	0.00

TABLE 6 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-25 THROUGH QC-29

Parameter ¹	Well Number					
	QC-25	QC-26	QC-27	QC-28	QC-29	
TDS mg/L	Minimum	236	266	204	284	688
	Mean	253	277	245	289	794
	Maximum	270	288	268	294	848
	Std. Dev.	24	16	36	7	57
	Median	253	277	264	289	811
	Coeff. Var. (%)	10	6	15	2	7
Hard. mg/L	Minimum	20	6	24	13	255
	Mean	29	8	25	16	308
	Maximum	38	9	27	19	338
	Std. Dev.	13	2	2	4	30
	Median	29	8	24	16	311
	Coeff. Var. (%)	44	28	7	27	10
Cond. µmhos/cm	Minimum	230	263	254	293	501
	Mean	269	332	375	452	883
	Maximum	308	401	502	610	1,480
	Std. Dev.	55	98	124	224	373
	Median	269	332	370	452	869
	Coeff. Var. (%)	21	29	33	50	42
pH unit	Minimum	7.5	7.8	7.6	7.9	7.2
	Mean	7.7	8.0	7.7	8.0	7.5
	Maximum	7.8	8.2	7.7	8.0	7.8
	Std. Dev.	0.2	0.3	0.1	0.1	0.3
	Median	7.7	8.0	7.7	8.0	7.4
	Coeff. Var. (%)	2.8	3.5	0.8	0.9	3.5

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 7: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-30 THROUGH QC-34

Parameter ¹		Well Number				
		QC-30	QC-31	QC-32	QC-33	QC-34
Cl mg/L	Minimum	10.0	11.0	20.0	23.0	10.0
	Mean	14.2	14.4	20.5	23.0	10.0
	Maximum	29.8	17.0	21.0	23.0	10.0
	Std. Dev.	8.8	2.2	0.7	NC	0.0
	Median	10.0	14.8	20.5	23.0	10.0
	Coeff. Var. (%)	61.8	14.9	3.4	NC	0.0
FC cfu/100 mL	Minimum	1.0	1.0	1.0	1.0	1.0
	Geo. Mean	1.3	1.4	1.0	1.0	5.7
	Maximum	4.0	9.0	1.0	1.0	32.0
	Median	1.0	1.0	1.0	1.0	16.5
SO ₄ mg/L	Minimum	2.0	176.4	72.7	88.7	17.7
	Mean	48.6	186.0	74.8	88.7	31.1
	Maximum	66.0	202.0	76.8	88.7	44.5
	Std. Dev.	26.5	8.7	2.9	NC	19.0
	Median	60.9	184.0	74.8	88.7	31.1
	Coeff. Var. (%)	54.5	4.7	3.9	NC	61.1
NH ₃ -N mg/L	Minimum	0.24	0.88	0.03	0.07	0.02
	Mean	0.29	0.96	0.14	0.07	0.07
	Maximum	0.35	1.01	0.24	0.07	0.11
	Std. Dev.	0.05	0.05	0.15	NC	0.06
	Median	0.27	0.99	0.14	0.07	0.07
	Coeff. Var. (%)	17.75	5.07	109.99	NC	97.91
TOC mg/L	Minimum	1.10	1.00	1.60	1.20	1.00
	Mean	3.42	1.00	1.75	1.20	2.25
	Maximum	6.90	1.00	1.90	1.20	3.50
	Std. Dev.	2.30	0.00	0.21	NC	1.77
	Median	3.50	1.00	1.75	1.20	2.25
	Coeff. Var. (%)	67.23	0.00	12.12	NC	78.57

TABLE 7 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-30 THROUGH QC-34

Parameter ¹		Well Number				
		QC-30	QC-31	QC-32	QC-33	QC-34
TDS mg/L	Minimum	358	516	584	590	142
	Mean	397	556	622	590	213
	Maximum	468	584	660	590	284
	Std. Dev.	45	24	54	NC	100
	Median	382	565	622	590	213
	Coeff. Var. (%)	11	4	9	NC	47
Hard. mg/L	Minimum	49	229	41	15	9
	Mean	56	235	41	15	17
	Maximum	61	238	41	15	24
	Std. Dev.	5	3	0	NC	11
	Median	57	236	41	15	17
	Coeff. Var. (%)	10	1	0	NC	64
Cond. µmhos/cm	Minimum	352	416	535	542	230
	Mean	462	580	694	542	297
	Maximum	622	941	852	542	363
	Std. Dev.	111	196	224	NC	94
	Median	444	511	694	542	297
	Coeff. Var. (%)	24	34	32	NC	32
pH unit	Minimum	7.8	7.7	8.1	8.3	8.4
	Mean	8.0	8.0	8.2	8.3	8.7
	Maximum	8.2	8.8	8.2	8.3	8.9
	Std. Dev.	0.2	0.4	0.1	NC	0.4
	Median	8.2	7.8	8.2	8.3	8.7
	Coeff. Var. (%)	2.7	5.3	0.9	NC	4.1

NC = No calculation was performed because there was only one data point.

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

TABLE 8: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-35 THROUGH QC-37

Parameter ¹		Well Number		
		QC-35	QC-36	QC-37
Cl mg/L	Minimum	29.0	29.1	24.0
	Mean	29.0	30.1	25.9
	Maximum	29.0	31.0	27.7
	Std. Dev.	NC	1.3	2.6
	Median	29.0	30.1	25.9
	Coeff. Var. (%)	NC	4.5	10.1
FC cfu/100 mL	Minimum	1.0	1.0	1.0
	Geo. Mean	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0
	Median	1.0	1.0	1.0
SO ₄ mg/L	Minimum	245.0	16.4	63.7
	Mean	245.0	18.4	66.5
	Maximum	245.0	20.4	69.4
	Std. Dev.	NC	2.8	4.0
	Median	245.0	18.4	66.5
	Coeff. Var. (%)	NC	15.3	6.0
NH ₃ -N mg/L	Minimum	0.03	0.02	0.19
	Mean	0.03	0.05	0.20
	Maximum	0.03	0.08	0.20
	Std. Dev.	NC	0.04	0.01
	Median	0.03	0.05	0.20
	Coeff. Var. (%)	NC	84.85	3.63
TOC mg/L	Minimum	1.00	1.00	2.10
	Mean	1.00	1.00	2.20
	Maximum	1.00	1.00	2.30
	Std. Dev.	NC	0.00	0.14
	Median	1.00	1.00	2.20
	Coeff. Var. (%)	NC	0.00	6.43

TABLE 8 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-35 THROUGH QC-37

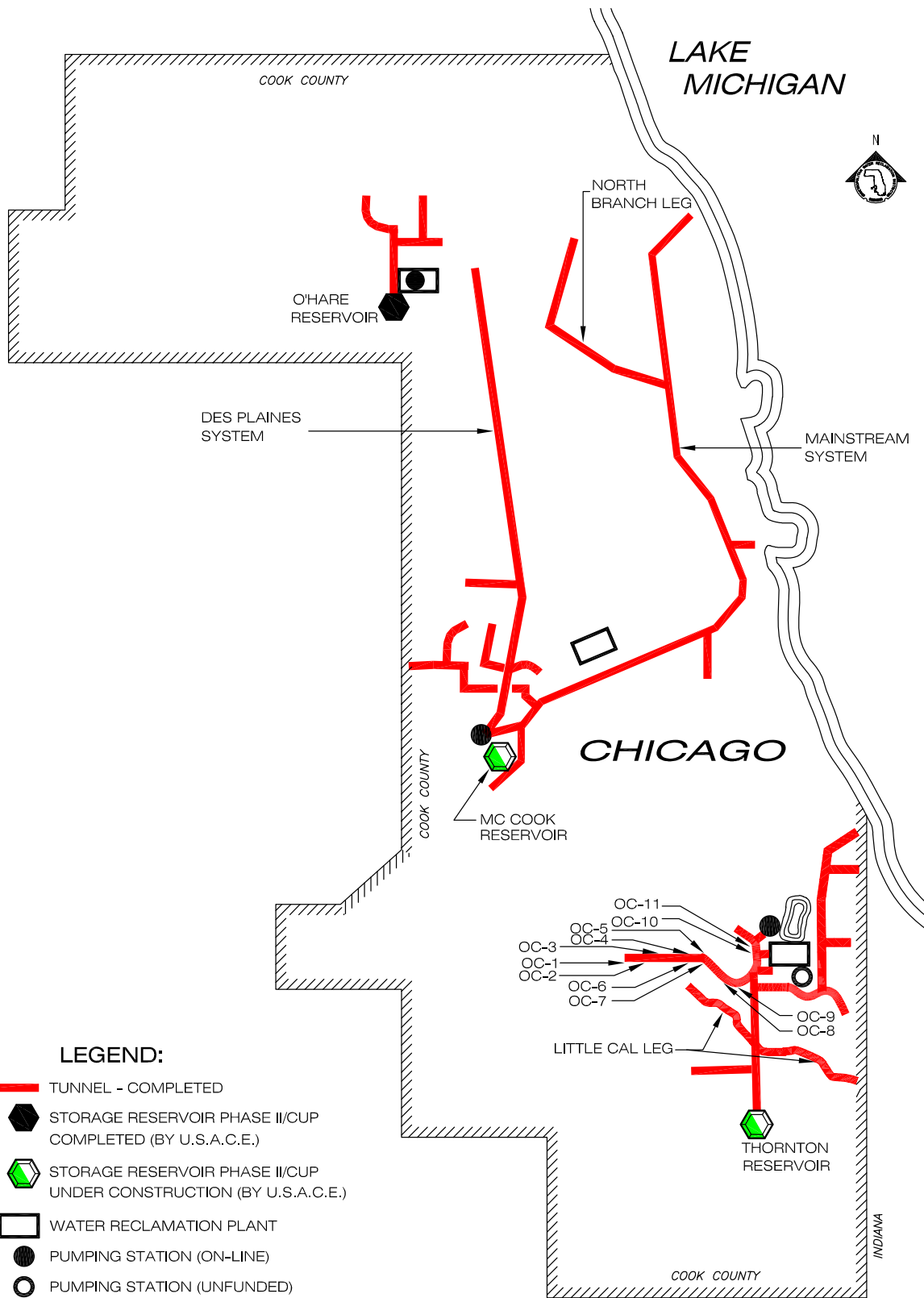
Parameter ¹		Well Number		
		QC-35	QC-36	QC-37
TDS mg/L	Minimum	1,168	770	956
	Mean	1,168	775	970
	Maximum	1,168	780	984
	Std. Dev.	NC	7	20
	Median	1,168	775	970
	Coeff. Var. (%)	NC	1	2
Hard. mg/L	Minimum	38	12	16
	Mean	38	13	17
	Maximum	38	13	17
	Std. Dev.	NC	1	1
	Median	38	13	17
	Coeff. Var. (%)	NC	6	4
Cond. µmhos/cm	Minimum	1,450	654	852
	Mean	1,450	1,028	1,126
	Maximum	1,450	1,401	1,399
	Std. Dev.	NC	528	387
	Median	1,450	1,028	1,126
	Coeff. Var. (%)	NC	51	34
pH unit	Minimum	7.5	8.2	8.2
	Mean	7.5	8.4	8.6
	Maximum	7.5	8.5	8.9
	Std. Dev.	NC	0.2	0.5
	Median	7.5	8.4	8.6
	Coeff. Var. (%)	NC	2.5	5.8

NC = No calculation was performed because there was only one data point.

¹For the purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantification (LOQ) was set equal to the value of the MDL or LOQ.

APPENDIX AI

LOCATION MAP OF GROUNDWATER OBSERVATION WELLS
OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM



**CALUMET TUNNEL SYSTEM
LOCATION MAP OF
GROUNDWATER OBSERVATION WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AII

2008 GROUNDWATER LEVEL ELEVATION DATA
FOR OBSERVATION WELLS OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM

TABLE AII-1: 2008 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Well					
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6
	feet					
1/4/08	-27.8	-23.6	-155.3	-169.2	**	-83.7
1/11/08	6.2	-8.6	-138.3	-165.2	-151.3	-63.7
1/18/08	-25.8	-20.6	-151.3	-167.2	-151.3	-75.7
2/15/08	-23.8	-21.6	-158.3	-160.2	-153.3	-87.7
2/29/08	-26.8	-22.6	-154.3	-167.2	-151.3	-80.7
3/14/08	-26.8	***	-154.3	-166.2	-151.3	-82.7
3/28/08	-25.8	-23.6	-155.3	-181.2	-147.3	-85.7
4/11/08	-63.8	-22.6	-153.3	-167.2	-150.3	-81.7
4/25/08	-26.8	-22.6	-153.3	-178.2	-149.3	-88.7
5/9/08	-26.8	-22.6	-149.3	-183.2	-151.3	-88.7
5/23/08	-26.8	-22.6	-149.3	-169.2	-152.3	-80.7
6/6/08	-27.8	-22.6	-153.3	-165.2	-151.3	-79.7
6/20/08	-25.8	-23.6	-155.3	-159.2	-149.3	-143.7
7/1/08	-27.8	-22.6	-153.3	-169.2	-152.3	-80.7
7/18/08	-27.8	-22.6	-155.3	-167.2	-153.3	-82.7
8/1/08	-27.8	-24.6	-155.3	-168.2	-152.3	-81.7
8/15/08	-27.8	-24.6	-155.3	-169.2	-152.3	-81.7
8/29/08	-27.8	-24.6	-155.3	-169.2	-153.3	-81.7
9/12/08	-29.8	-24.6	-157.3	-180.2	-150.3	-88.7
9/26/08	-26.8	-21.6	-150.3	-166.2	-150.3	-75.7
10/10/08	-25.8	-22.6	-152.3	-167.2	-150.3	-78.7
10/28/08	-26.8	-22.6	-152.3	-176.2	-143.3	-81.7
11/7/08	-25.8	-22.6	-152.3	-163.2	-151.3	-78.7
11/21/08	-26.8	-23.6	14.7	-165.2	-151.3	-143.7
12/5/08	-26.8	-23.6	-153.3	-160.2	-142.3	-79.7
Minimum	-63.8	-24.6	-158.3	-183.2	-153.3	-143.7
Mean	-27.0	-22.4	-146.3	-168.8	-150.5	-86.3
Maximum	6.2	-8.6	14.7	-159.2	-142.3	-63.7

TABLE AII-1 (Continued): 2008 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Well				
	OC-7	OC-8	OC-9	OC-10	OC-11
	feet				
1/4/08	-214.0	-185.9	-214.7	-220.0	-224.3
1/11/08	-210.0	****	-214.7	-185.0	-224.3
1/18/08	-212.0	***	-214.7	-211.0	-225.3
2/15/08	-230.0	-187.9	-187.7	-203.0	-214.3
2/29/08	-212.0	-185.9	-214.7	-215.0	-223.3
3/14/08	-212.0	-186.9	-214.7	-217.0	-223.3
3/28/08	-216.0	-183.9	-212.7	-227.0	-219.3
4/11/08	-211.0	-185.9	-213.7	-218.0	-223.3
4/25/08	-212.0	-178.9	-207.7	-223.0	-222.3
5/9/08	-218.0	-179.9	-214.7	-230.0	-216.3
5/23/08	-212.0	-184.9	-213.7	-214.0	-225.3
6/6/08	-215.0	-181.9	-215.7	-224.0	-227.3
6/20/08	-208.0	-178.9	-208.7	-230.0	-219.3
7/1/08	-218.0	-185.9	-215.7	-224.0	-262.3
7/18/08	-215.0	-184.9	-207.7	-225.0	-265.3
8/1/08	-214.0	-185.9	-215.7	-226.0	-225.3
8/15/08	-214.0	-184.9	-216.7	-226.0	-225.3
8/29/08	-215.0	-184.9	-216.7	-226.0	-225.3
9/12/08	-220.0	-187.9	-206.7	-232.0	-223.3
9/26/08	-207.0	-176.9	-215.7	-216.0	-221.3
10/10/08	-213.0	-182.9	-212.7	-220.0	-225.3
10/28/08	-212.0	-187.9	-207.7	-223.0	-215.3
11/7/08	-209.0	-177.9	-200.7	-213.0	-204.3
11/21/08	-210.0	-179.9	-216.7	-228.0	-225.3
12/5/08	-212.0	-182.9	-216.7	-217.0	-208.3
Minimum	-230.0	-187.9	-216.7	-232.0	-265.3
Mean	-213.6	-183.6	-211.9	-219.7	-224.6
Maximum	-207.0	-176.9	-187.7	-185.0	-204.3

*Relative to Chicago City Datum.

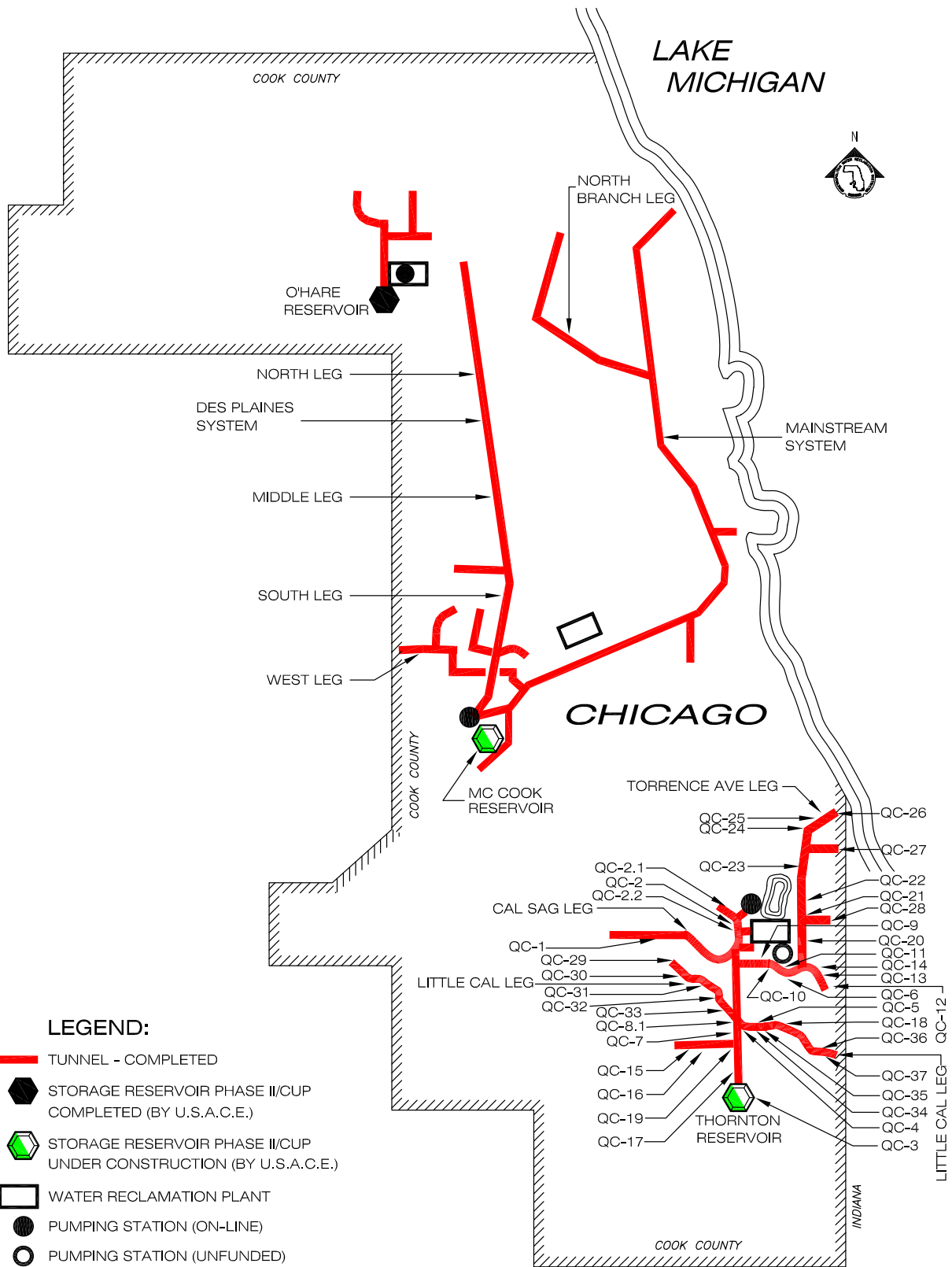
**No reading, truck blocked access.

***No access, area flooded and frozen.

****No access, area flooded.

APPENDIX AIII

LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM



**CALUMET TUNNEL SYSTEM
LOCATION MAP OF GROUNDWATER
QUALITY MONITORING WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AIV

2008 GROUNDWATER QUALITY DATA FOR MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

TABLE AIV-1: 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Cl ¹ mg/L	FC ^{1,2} cfu/100 mL	SO ₄ ¹ mg/L	NH ₃ -N ¹ mg/L	TOC ¹ mg/L	TDS ¹ mg/L
QC-1	1/10/08	75	<1	236.6	0.39	1.6	916
QC-1	3/6/08	79	<1	245.9	0.37	1.5	850
QC-1	4/3/08	77	<1	250.0	0.36	1.3	870
QC-1	6/12/08	70	<1	234.9	0.41	1.2	894
QC-1	8/21/08	72	<1	229.8	0.35	1.0	936
QC-1	11/6/08	77	<1	229.2	0.34	1.4	874
QC-2	1/10/08	22	580	35.5	0.31	1.3	436
QC-2	3/6/08	47	22	30.4	0.63	1.2	380
QC-2	4/3/08	37	6	31.6	0.77	1.3	352
QC-2	6/12/08	34	3,000	26.2	0.75	1.1	386
QC-2	8/21/08	30	1	27.4	0.70	<1.0	402
QC-2	11/6/08	33	14	27.5	0.64	1.0	366
QC-2.1	1/8/08			Well could not be sampled			
QC-2.1	6/12/08	34	1	<2.0	0.74	<1.0	570
QC-2.1	8/21/08	12	NA ³	32.7	0.26	1.0	406
QC-2.2	1/10/08	32	<1	26.4	0.36	1.5	394
QC-2.2	6/12/08	13	10	32.9	0.29	<1.0	350
QC-2.2	8/21/08			Well could not be sampled			
QC-3	1/10/08	13	<1	26.1	0.42	<1.0	528
QC-3	6/12/08	12	<1	26.7	0.45	<1.0	420
QC-3	11/6/08	12	<1	22.8	0.38	<1.0	438
QC-4	4/3/08	10	<1	17.1	0.13	<1.0	436
QC-4	8/21/08	10	<1	16.0	0.13	<1.0	482
QC-4	11/6/08	<10	<1	11.5	0.09	<1.0	422
QC-5	4/3/08	28	<1	14.6	0.12	<1.0	606
QC-5	8/21/08	24	<1	4,120.0	0.11	<1.0	602
QC-5	10/9/08	24	<1	7.1	0.06	<1.0	644

TABLE AIV-1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Cl ¹ mg/L	FC ^{1,2} cfu/100 mL	SO ₄ ¹ mg/L	NH ₃ -N ¹ mg/L	TOC ¹ mg/L	TDS ¹ mg/L
QC-6	4/3/08	13	<1	13.8	0.32	1.1	472
QC-6	6/12/08	14	<1	10.1	0.33	<1.0	514
QC-6	10/9/08	13	<1	6.8	0.27	1.0	464
QC-7	4/3/08	11	<1	<2.0	0.25	1.3	414
QC-7	6/12/08	10	<1	<2.0	0.27	<1.0	436
QC-7	10/9/08	<10	<1	<2.0	0.22	1.0	558
QC-9	3/27/08	10	<1	32.4	0.15	<1.0	288
QC-9	6/12/08	10	<1	32.6	0.12	<1.0	330
QC-9	10/9/08	<10	<1	29.9	0.60	<1.0	342
QC-10	1/23/08	33	<1	<2.0	0.07	<1.0	410
QC-10	4/29/08	31	<1	<2.0	0.09	<1.0	400
QC-10	6/4/08	30	<1	<2.0	0.10	<1.0	378
QC-11	1/23/08	25	<1	<2.0	0.11	<1.0	286
QC-11	4/29/08	22	<1	<2.0	0.13	<1.0	306
QC-11	6/4/08	21	<1	<2.0	0.12	<1.0	290
QC-12	1/23/08	41	<1	328.7	0.32	<1.0	948
QC-12	4/29/08	38	<1	338.1	0.31	<1.0	972
QC-12	6/4/08	37	<1	371.0	0.32	<1.0	990
QC-13	1/23/08			Well could not be sampled			
QC-13	4/29/08	56	<1	49.0	0.18	<1.0	432
QC-13	6/4/08	48	<1	44.1	0.16	<1.0	436
QC-14	1/31/08	128	<1	<2.0	0.29	2.4	710
QC-14	6/12/08	115	<1	<2.0	0.26	1.9	728
QC-14	8/21/08	110	<1	<2.0	0.20	2.0	706
QC-15	1/31/08	17	<1	<2.0	0.20	<1.0	332
QC-15	6/5/08	13	<1	<2.0	0.15	<1.0	312
QC-15	8/21/08	12	<1	2.6	0.17	<1.0	356

TABLE AIV-1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Cl ¹ mg/L	FC ^{1,2} cfu/100 mL	SO ₄ ¹ mg/L	NH ₃ -N ¹ mg/L	TOC ¹ mg/L	TDS ¹ mg/L
QC-16	3/13/08	26	<1	66.3	0.12	<1.0	606
QC-16	6/5/08	22	<1	61.0	0.08	<1.0	510
QC-16	8/21/08	21	<1	68.2	<0.02	<1.0	552
QC-17	3/27/08	13	<1	191.0	0.27	<1.0	534
QC-17	6/5/08	10	<1	192.0	0.29	<1.0	530
QC-17	8/21/08	<10	<1	186.0	0.26	<1.0	538
QC-18	3/13/08	124	<1	35.1	0.11	<1.0	440
QC-18	6/5/08	<10	<1	37.4	0.12	<1.0	508
QC-18	12/4/08	<10	<1	33.9	0.07	<1.0	466
QC-19	3/27/08	<10	<1	152.7	0.26	<1.0	460
QC-19	6/5/08	<10	<1	149.0	0.26	<1.0	466
QC-19	12/4/08	<10	<1	159.1	0.22	<1.0	460
QC-20	1/31/08			Well could not be sampled			
QC-20	10/9/08			Well could not be sampled			
QC-20	12/4/08	17	<1	64.7	0.08	1.0	392
QC-21	1/31/08	23	<1	<2.0	0.11	<1.0	334
QC-21	7/10/08	15	<1	<2.0	0.04	<1.0	328
QC-21	12/4/08	19	<1	126.1	<0.02	11.7	556
QC-22	1/31/08	19	<1	<2.0	0.19	1.1	250
QC-22	7/10/08	13	<1	<2.0	0.18	1.1	260
QC-22	12/4/08	16	<1	11.8	0.08	1.0	306
QC-23	1/31/08	22	<1	<2.0	0.16	<1.0	322
QC-23	7/10/08	18	<1	<2.0	0.08	<1.0	326
QC-23	12/4/08	19	<1	<2.0	0.02	<1.0	342
QC-24	1/31/08	35	<1	<2.0	0.17	<1.0	262
QC-24	7/10/08	25	<1	<2.0	0.12	<1.0	282
QC-24	12/4/08	26	<1	<2.0	0.09	<1.0	238

TABLE AIV-1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Cl ¹ mg/L	FC ^{1,2} cfu/100 mL	SO ₄ ¹ mg/L	NH ₃ -N ¹ mg/L	TOC ¹ mg/L	TDS ¹ mg/L
QC-25	1/31/08			Well could not be sampled			
QC-25	5/15/08	14	<1	2.5	0.13	<1.0	236
QC-25	12/4/08	13	<1	25.2	0.07	<1.0	270
QC-26	1/31/08			Well could not be sampled			
QC-26	5/15/08	13	<1	<2.0	0.06	<1.0	288
QC-26	12/4/08	11	<1	3.3	0.02	<1.0	266
QC-27	1/31/08	37	<1	<2.0	0.22	<1.0	204
QC-27	5/15/08	32	<1	<2.0	0.14	<1.0	264
QC-27	8/21/08	27	<1	<2.0	0.14	<1.0	268
QC-28	1/31/08			Well could not be sampled			
QC-28	5/15/08	14	<1	2.1	0.04	2.1	284
QC-28	8/21/08	13	<1	2.9	<0.02	<1.0	294
QC-29	1/17/08	167	<1	128.3	0.61	<1.0	828
QC-29	3/20/08	142	<1	119.8	0.57	<1.0	688
QC-29	5/21/08	155	<1	145.0	0.63	<1.0	778
QC-29	8/7/08	162	<1	135.0	0.71	<1.0	848
QC-29	10/1/08	144	<1	134.8	0.64	<1.0	816
QC-29	12/11/08	150	<1	137.4	0.67	01.0	806
QC-30	1/17/08	30	4	66.0	0.24	3.5	468
QC-30	3/20/08			Well could not be sampled			
QC-30	5/21/08	<10	<1	60.9	0.34	4.0	358
QC-30	8/7/08	<10	<1	<2.0	0.35	1.1	382
QC-30	10/1/08	11	<1	61.1	0.25	6.9	414
QC-30	12/11/08	10	<1	53.0	0.27	1.6	364
QC-31	1/17/08	15	9	183.6	0.88	<1.0	566
QC-31	3/20/08	17	<1	176.4	0.93	<1.0	542
QC-31	5/21/08	16	<1	202.0	0.99	<1.0	516
QC-31	8/7/08	13	<1	184.4	1.01	<1.0	584

TABLE AIV-1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Cl ¹ mg/L	FC ^{1,2} cfu/100 mL	SO ₄ ¹ mg/L	NH ₃ -N ¹ mg/L	TOC ¹ mg/L	TDS ¹ mg/L
QC-31	10/1/08	11	<1	181.9	0.98	<1.0	564
QC-31	12/11/08	15	<1	187.4	0.99	<1.0	566
QC-32	1/17/08			Well could not be sampled			
QC-32	3/20/08			Well could not be sampled			
QC-32	5/21/08	20	<1	72.7	0.24	1.9	584
QC-32	8/7/08			Well could not be sampled			
QC-32	10/1/08	21	<1	76.8	0.03	1.6	660
QC-32	12/11/08			Well could not be sampled			
QC-33	1/17/08			Well could not be sampled			
QC-33	3/20/08			Well could not be sampled			
QC-33	6/5/08			Well could not be sampled			
QC-33	8/7/08			Well could not be sampled			
QC-33	10/1/08			Well could not be sampled			
QC-33	12/11/08	23	<1	88.7	0.07	1.2	590
QC-34	1/17/08			Well could not be sampled			
QC-34	3/20/08			Well could not be sampled			
QC-34	6/5/08			Well could not be sampled			
QC-34	8/7/08			Well could not be sampled			
QC-34	10/16/08	10	32	17.7	0.11	3.5	142
QC-34	12/11/08	10	<1	44.5	<0.02	<1.0	284
QC-35	1/17/08			Well could not be sampled			
QC-35	3/20/08			Well could not be sampled			
QC-35	6/5/08			Well could not be sampled			
QC-35	8/7/08	29	1	245.0	0.03	<1.0	1,168
QC-35	10/16/08			Well could not be sampled			
QC-35	12/11/08			Well could not be sampled			
QC-36	1/17/08	29	<1	20.4	0.02	<1.0	770
QC-36	3/20/08	31	<1	16.4	0.08	<1.0	780
QC-36	6/5/08			Well could not be sampled			
QC-36	8/7/08			Well could not be sampled			

TABLE AIV-1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Cl ¹ mg/L	FC ^{1,2} cfu/100 mL	SO ₄ ¹ mg/L	NH ₃ -N ¹ mg/L	TOC ¹ mg/L	TDS ¹ mg/L
QC-36	10/16/08						
QC-36	12/11/08						
QC-37	1/17/08	28	<1	63.7	0.20	2.1	984
QC-37	3/20/08						
QC-37	6/5/08						
QC-37	8/7/08						
QC-37	10/16/08	24	<1	69.4	0.19	2.3	956
QC-37	12/11/08						

¹The method detection limit (MDL) or limit of quantification (LOQ) is 10 mg/L for Cl (LOQ), 2.0 mg/L for SO₄ (LOQ), 0.02 mg/L for NH₃-N (MDL), 1.0 mg/L for TOC (LOQ), and 40 mg/L for TDS (LOQ). The detection limit for the FC analysis using the membrane filter method varies based on the actual sample volume analyzed.

²Unfiltered samples, all others were filtered through 0.45 µm membrane.

³NA = No analytical result.

TABLE AIV-2: 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
QC-1	1/10/08	546	810	7.4	12	-153	<48
QC-1	3/6/08	558	905	7.4	12	-163	<48
QC-1	4/3/08	545	632	7.5	11	-163	<48
QC-1	6/12/08	542	742	7.8	13	-168	<48
QC-1	8/21/08	533	1,019	7.4	13	-165	<48
QC-1	11/6/08	487	535	7.4	12	-173	<48
QC-2	1/10/08	47	434	8.0	12	-240	<48
QC-2	3/6/08	97	562	7.5	13	-281	<48
QC-2	4/3/08	85	399	7.8	12	-271	<48
QC-2	6/12/08	85	403	7.7	14	-269	<48
QC-2	8/21/08	88	495	8.2	15	-286	<48
QC-2	11/6/08	78	393	7.7	13	-277	<48
QC-2.1	1/8/08						Well could not be sampled
QC-2.1	6/12/08	48	544	8.0	14	-292	<48
QC-2.1	8/21/08	47	467	8.6	14	-288	<48
QC-2.2	1/10/08	85	422	8.5	9	-285	<48
QC-2.2	6/12/08	45	382	7.9	13	-223	<48
QC-2.2	8/21/08						Well could not be sampled
QC-3	1/10/08	66	479	8.1	9	-201	<48
QC-3	6/12/08	65	426	8.0	14	-236	<48
QC-3	11/6/08	59	446	8.0	12	-257	<48
QC-4	4/3/08	11	506	8.1	12	-234	<48
QC-4	8/21/08	11	601	7.4	13	-230	<48
QC-4	11/6/08	9	462	8.1	13	-262	<48
QC-5	4/3/08	11	661	8.1	12	-233	<48
QC-5	8/21/08	13	853	7.6	13	-230	<48
QC-5	10/9/08	32	884	7.3	12	-197	<48

TABLE AIV-2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
QC-6	4/3/08	17	510	8.0	12	-204	<48
QC-6	6/12/08	18	504	7.9	13	-202	<48
QC-6	10/9/08	15	701	7.7	12	-184	<48
QC-7	4/3/08	11	446	7.8	12	-177	<48
QC-7	6/12/08	11	476	8.0	13	-176	<48
QC-7	10/9/08	15	573	7.5	12	-162	<48
QC-9	3/27/08	58	444	7.5	12	-249	<48
QC-9	6/12/08	60	340	7.8	14	-245	<48
QC-9	10/9/08	55	413	7.4	13	-228	<48
QC-10	1/23/08	12	371	8.0	12	-192	<4
QC-10	4/29/08	10	501	7.7	12	-224	<4
QC-10	6/4/08	11	642	8.9	13	-198	<4
QC-11	1/23/08	22	302	7.6	12	-211	<4
QC-11	4/29/08	21	485	7.3	12	-227	<4
QC-11	6/4/08	20	484	8.8	13	-216	<4
QC-12	1/23/08	203	594	7.7	11	-227	<4
QC-12	4/29/08	21	1,210	7.6	12	-248	<4
QC-12	6/4/08	38	1,490	7.7	13	-231	<4
QC-13	1/23/08			Well could not be sampled			
QC-13	4/29/08	39	630	7.4	12	-257	<48
QC-13	6/4/08	2,692	745	8.1	13	-235	<48
QC-14	1/31/08	139	890	7.6	12	-214	<48
QC-14	6/12/08	129	668	7.9	14	-217	<48
QC-14	8/21/08	134	773	7.6	13	-218	<48
QC-15	1/31/08	15	490	7.4	11	-222	<48
QC-15	6/5/08	15	362	7.9	13	-222	<48
QC-15	8/21/08	14	464	7.2	13	-232	<48

TABLE AIV-2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
QC-16	3/13/08	88	421	7.9	11	-242	<48
QC-16	6/5/08	76	582	8.1	13	-208	<48
QC-16	8/21/08	84	999	7.5	12	-256	<48
QC-17	3/27/08	187	590	7.7	11	-165	<48
QC-17	6/5/08	176	492	8.0	14	-168	<48
QC-17	8/21/08	174	527	7.7	13	-171	<48
QC-18	3/13/08	8	396	8.2	11	-207	<48
QC-18	6/5/08	8	402	8.2	13	-212	<48
QC-18	12/4/08	8	453	7.7	11	-214	<48
QC-19	3/27/08	104	589	7.3	11	-122	<48
QC-19	6/5/08	103	466	7.9	12	-125	<48
QC-19	12/4/08	105	489	7.6	10	-134	<48
QC-20	1/31/08			Well could not be sampled			
QC-20	10/9/08			Well could not be sampled			
QC-20	12/4/08	65	589	7.5	11	-290	<48
QC-21	1/31/08	13	440	7.7	11	-268	<48
QC-21	7/10/08	14	212	7.4	12	-266	<48
QC-21	12/4/08	114	645	7.7	11	-271	<48
QC-22	1/31/08	27	430	7.5	10	-266	<48
QC-22	7/10/08	26	261	7.6	12	-264	<48
QC-22	12/4/08	40	399	7.3	11	-270	<48
QC-23	1/31/08	6	471	7.3	11	-241	<48
QC-23	7/10/08	6	370	8.3	12	-238	<48
QC-23	12/4/08	6	468	7.8	11	-249	<48
QC-24	1/31/08	12	355	7.5	11	-240	<48
QC-24	7/10/08	15	312	7.8	12	-224	<48
QC-24	12/4/08	12	362	7.7	12	-238	<48

TABLE AIV-2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
QC-25	1/31/08			Well could not be sampled			
QC-25	5/15/08	20	230	7.8	13	-235	<48
QC-25	12/4/08	38	308	7.5	11	-242	<48
QC-26	1/31/08			Well could not be sampled			
QC-26	5/15/08	6	263	8.2	12	-231	<48
QC-26	12/4/08	9	401	7.8	11	-227	<48
QC-27	1/31/08	27	370	7.7	10	-213	<48
QC-27	5/15/08	24	254	7.6	12	-206	<48
QC-27	8/21/08	24	502	7.7	14	-213	<48
QC-28	1/31/08			Well could not be sampled			
QC-28	5/15/08	19	293	8.0	13	-246	<48
QC-28	8/21/08	13	610	7.9	14	-252	<48
QC-29	1/17/08	321	501	7.5	11	-63	<48
QC-29	3/20/08	255	972	7.2	11	-72	<48
QC-29	5/21/08	299	1,068	7.8	12	-69	<48
QC-29	8/7/08	338	1,480	7.2	13	-69	<48
QC-29	10/1/08	332	765	7.7	12	-67	<48
QC-29	12/11/08	300	512	7.3	11	-71	<48
QC-30	1/17/08	61	352	7.8	11	-142	<48
QC-30	3/20/08			Well could not be sampled			
QC-30	5/21/08	51	517	8.2	12	-147	<48
QC-30	8/7/08	60	622	8.2	13	-150	<48
QC-30	10/1/08	57	373	7.8	12	-146	<48
QC-30	12/11/08	49	444	8.2	10	-147	<48
QC-31	1/17/08	236	416	7.7	12	-82	<48
QC-31	3/20/08	235	653	7.7	12	-100	<48
QC-31	5/21/08	235	545	7.8	12	-93	<48
QC-31	8/7/08	236	941	7.8	13	-93	<48
QC-31	10/1/08	238	476	8.8	13	-84	<48
QC-31	12/11/08	229	446	8.1	11	-90	<48

TABLE AIV-2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
QC-32	1/17/08						
QC-32	3/20/08						
QC-32	5/21/08	41	852	8.1	13	-172	<48
QC-32	8/7/08						
QC-32	10/1/08	41	535	8.2	13	-172	<48
QC-32	12/11/08						
QC-33	1/17/08						
QC-33	3/20/08						
QC-33	6/5/08						
QC-33	8/7/08						
QC-33	10/1/08						
QC-33	12/11/08	15	542	8.3	11	-177	<48
QC-34	1/17/08						
QC-34	3/20/08						
QC-34	6/5/08						
QC-34	8/7/08						
QC-34	10/16/08	24	230	8.4	13	-169	<48
QC-34	12/11/08	9	363	8.9	11	-165	<48
QC-35	1/17/08						
QC-35	3/20/08						
QC-35	6/5/08						
QC-35	8/7/08	38	1,450	7.5	15	-153	<48
QC-35	10/16/08						
QC-35	12/11/08						
QC-36	1/17/08	13	654	8.2	9	-130	<48
QC-36	3/20/08	12	1,401	8.5	8	-137	<48
QC-36	6/5/08						
QC-36	8/7/08						
QC-36	10/16/08						
QC-36	12/11/08						

TABLE AIV-2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond. ¹ µmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
QC-37	1/17/08	17	852	8.2	10	-132	<48
QC-37	3/20/08			Well could not be sampled			
QC-37	6/5/08			Well could not be sampled			
QC-37	8/7/08			Well could not be sampled			
QC-37	10/16/08	16	1,399	8.9	15	-136	<48
QC-37	12/11/08			Well could not be sampled			

¹Unfiltered samples, all others were filtered through 0.45 µm membrane.

²Water level elevations are relative to Chicago City Datum.

³Refers to elapsed time after initial drawdown before the well recovered sufficiently for sampling.