Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 10-27

TUNNEL AND RESERVOIR PLAN

CALUMET TUNNEL SYSTEM

2009 ANNUAL GROUNDWATER MONITORING REPORT

June 2010

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
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June 18, 2010

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, 2009 Annual Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Calumet Tunnel System, 2009 Annual Groundwater Monitoring Report."

Very truly yours,

Louis Kollias
Director
Monitoring and Research

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TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2009 ANNUAL GROUNDWATER MONITORING REPORT

Monitoring and Research Department
Louis Kollias, Director

June 2010

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INTRODUCTION

This report contains 2009 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 groundwater 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 groundwater 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 groundwater quality monitoring wells (QC-3 through QC-19). The tunnel on the Torrence Avenue leg has nine groundwater quality monitoring wells (QC-20 through QC-28). The tunnel along the Little Calumet leg has nine groundwater quality monitoring wells (QC-29 through QC-37).

Groundwater 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). Groundwater 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 groundwater 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 2009 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 groundwater 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 2009 water quality monitoring data for groundwater quality monitoring 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. Groundwater quality monitoring well QC-1 could not be sampled on March 5, 2009, May 7, 2009, June 25, 2009, July 10, 2009, or November 1, 2009, because the pump was inoperable. A work order to repair the well has been issued. Groundwater quality monitoring well QC-3 could not be sampled after March 5, 2009, because of construction directed by the Village of South Holland. Because of this, the Metropolitan Water Reclamation District of Greater Chicago has sent a letter to the IEPA recommending abandonment of the well. Groundwater quality monitoring well QC-7 could not be sampled on August 6, 2009, because the pump was inoperable. Groundwater quality monitoring well QC-13 could not be sampled on February 10, 2009, due to snow blocking access to the well. Groundwater quality monitoring well QC-32 could not be sampled on January 15, 2009, March 12, 2009, July 1, 2009, September 3, 2009, or October 1, 2009, because there was insufficient water in the well to collect a sample. Groundwater quality monitoring well QC-33 could not be sampled during 2009 because there was insufficient water in the well to collect a sample. Groundwater quality monitoring well QC-34 could not be sampled on January 15, 2009, March 12, 2009, September 3, 2009, or October 1, 2009, because there was insufficient water in the well to collect a sample. Groundwater quality monitoring well QC-35 could not be sampled on March 18, 2009, May 7, 2009, July 1, 2009, October 1, 2009, or November 19, 2009, because there was insufficient water in the well to collect a sample. Groundwater quality monitoring well QC-36 could not be sampled in 2009 because there was insufficient water in the well to collect a sample. Groundwater quality monitoring well QC-37 could not be sampled on January 15, 2009, March 18, 2009, July 1, 2009, September 3, 2009, or October 1, 2009, 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 2009 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 2009. Table AII-1 in Appendix AII contains the entire groundwater level elevation data for 2009 for all the observation wells in the Calumet Tunnel System.

Groundwater Quality Monitoring Well Data

Tables 1 through 8 contain summary statistics of the water quality parameters for 2009 for groundwater 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 2009. The nine water quality parameters are: chloride (Cl), conductivity (Cond.), fecal coliform (FC), hardness as $CaCO_3$ (Hard.), ammonia nitrogen (NH_3-N), pH, sulfate (SO_4), 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: 2009 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS
FOR THE CALUMET TUNNEL SYSTEM OBSERVATION WELLS

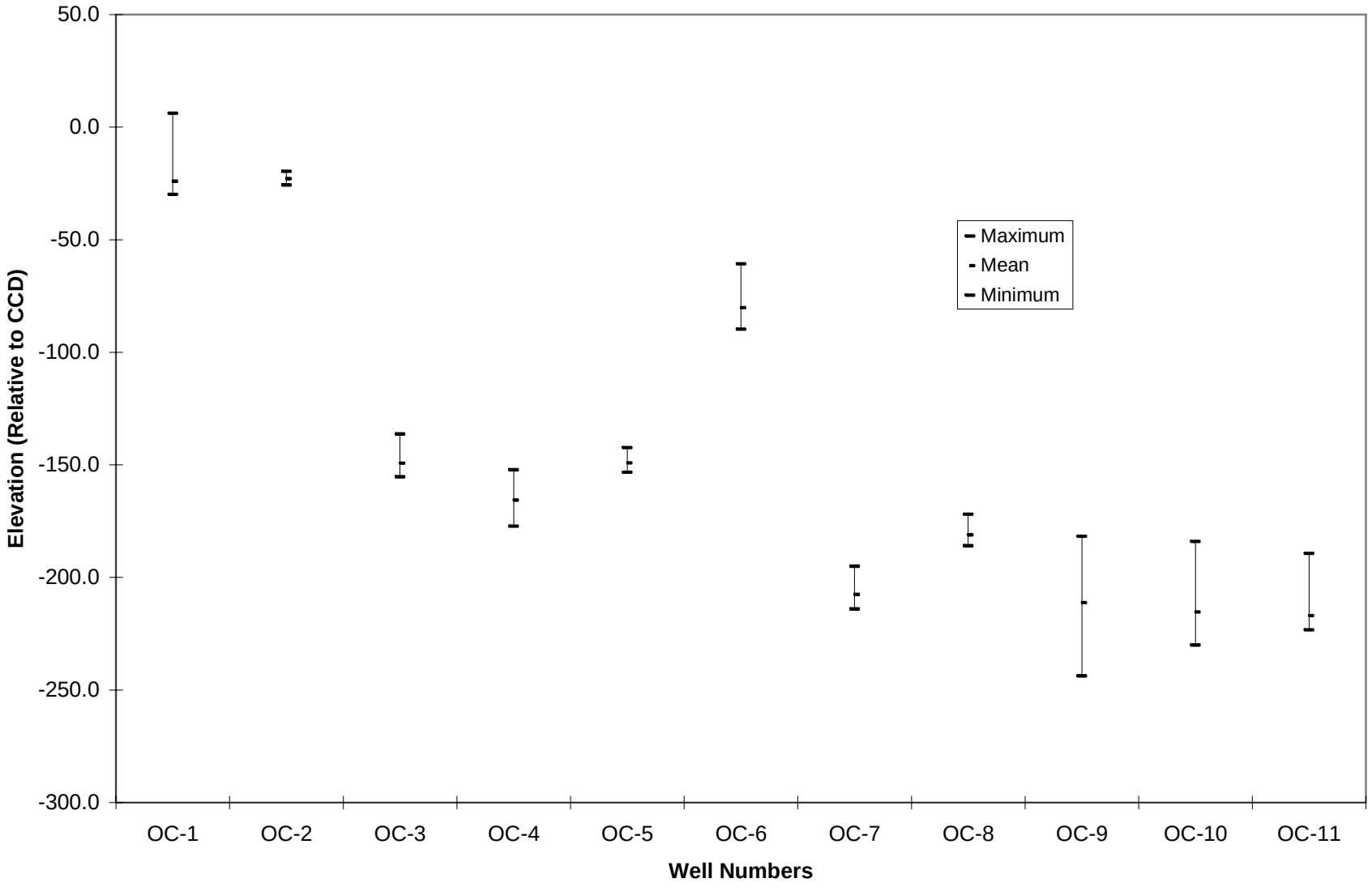


TABLE 1: SUMMARY STATISTICS OF THE 2009 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter[1]		Well Number				
		QC-1	QC-2	QC-2.1	QC-2.2	QC-3
Cl	Minimum	85.0	36.0	32.0	13.0	13.0
mg/L	Mean	85.0	43.7	33.7	13.7	13.0
	Maximum	85.0	52.0	35.0	14.0	13.0
	Std. Dev.	N/C[2]	6.7	1.5	0.6	N/C
	Median	85.0	43.0	34.0	14.0	13.0
	Coeff. Var. (%)	N/C	15.4	4.5	4.2	N/C
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	Geo. Mean	1.0	64	1.0	1.0	1.0
	Maximum	1.0	1,100	1.0	1.0	1.0
	Median	1.0	140.0	1.0	1.0	1.0
SO_4	Minimum	238.0	23.7	2.0	25.4	27.3
mg/L	Mean	238.0	27.1	2.0	30.0	27.3
	Maximum	238.0	30.5	2.0	32.6	27.3
	Std. Dev.	N/C	2.7	0.0	4.0	N/C
	Median	238.0	27.5	2.0	32.1	27.3
	Coeff. Var. (%)	N/C	9.8	0.0	13.4	N/C
NH_3-N	Minimum	0.41	0.41	0.63	0.36	0.42
mg/L	Mean	0.41	0.64	0.65	0.47	0.42
	Maximum	0.41	0.88	0.67	0.55	0.42
	Std. Dev.	N/C	0.16	0.02	0.10	N/C
	Median	0.41	0.66	0.64	0.49	0.42
	Coeff. Var. (%)	N/C	24.73	3.22	20.81	N/C
TOC	Minimum	1.80	1.40	1.10	1.20	1.00
mg/L	Mean	1.80	1.52	1.23	1.27	1.00
	Maximum	1.80	1.60	1.40	1.40	1.00
	Std. Dev.	N/C	0.10	0.15	0.12	N/C
	Median	1.80	1.55	1.20	1.20	1.00
	Coeff. Var. (%)	N/C	6.48	12.39	9.12	N/C

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2009 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	Minimum	864	356	512	346	404
mg/L	Mean	864	392	539	350	404
	Maximum	864	456	592	358	404
	Std. Dev.	N/C	39	46	7	N/C
	Median	864	378	514	346	404
	Coeff. Var. (%)	N/C	10	8	2	N/C
Hard.	Minimum	519	81	54	39	61
mg/L	Mean	519	87	55	40	61
	Maximum	519	92	57	40	61
	Std. Dev.	N/C	5	2	1	N/C
	Median	519	87	55	40	61
	Coeff. Var. (%)	N/C	5	3	1	N/C
Cond.	Minimum	1,206	401	562	379	361
µmhos/cm	Mean	1,206	501	639	439	361
	Maximum	1,206	603	751	509	361
	Std. Dev.	N/C	91	99	66	N/C
	Median	1,206	492	605	428	361
	Coeff. Var. (%)	N/C	18	15	15	N/C
pH	Minimum	7.7	7.2	7.4	7.6	8.2
unit	Mean	7.7	7.7	7.6	8.0	8.2
	Maximum	7.7	8.3	7.9	8.7	8.2
	Std. Dev.	N/C	0.4	0.3	0.6	N/C
	Median	7.7	7.6	7.6	7.7	8.2
	Coeff. Var. (%)	N/C	5.2	3.3	7.3	N/C

[1]For purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantitation (LOQ) was set equal to the value of the MDL or LOQ.
[2]N/C stands for no calculation due to single value.

TABLE 2: SUMMARY STATISTICS OF THE 2009 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	Minimum	11.0	27.0	14.0	10.0	10.0
mg/L	Mean	11.3	27.7	15.0	11.0	10.0
	Maximum	12.0	28.0	16.0	12.0	10.0
	Std. Dev.	0.6	0.6	1.0	1.4	0.0
	Median	11.0	28.0	15.0	11.0	10.0
	Coeff. Var. (%)	5.1	2.1	6.7	12.9	0.0
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	Geo. Mean	2.5	1.0	1.0	1.0	1.0
	Maximum	15.0	1.0	1.0	1.0	1.0
	Median	1.0	1.0	1.0	1.0	1.0
SO_4	Minimum	11.0	5.3	5.6	2.0	30.9
mg/L	Mean	12.3	6.9	6.0	2.0	33.1
	Maximum	15.0	7.9	6.3	2.0	36.2
	Std. Dev.	2.3	1.4	0.3	0.0	2.8
	Median	11.1	7.4	6.1	2.0	32.1
	Coeff. Var. (%)	18.5	20.3	5.6	0.0	8.5
NH_3-N	Minimum	0.13	0.12	0.31	0.26	0.65
mg/L	Mean	0.14	0.14	0.33	0.26	0.71
	Maximum	0.15	0.17	0.35	0.26	0.75
	Std. Dev.	0.01	0.03	0.02	0.00	0.06
	Median	0.15	0.14	0.34	0.26	0.74
	Coeff. Var. (%)	8.06	17.56	6.24	0.00	7.72
TOC	Minimum	1.00	1.00	1.40	1.40	1.00
mg/L	Mean	1.10	1.10	1.50	1.55	1.07
	Maximum	1.30	1.30	1.60	1.70	1.10
	Std. Dev.	0.17	0.17	0.10	0.21	0.06
	Median	1.00	1.00	1.50	1.55	1.10
	Coeff. Var. (%)	15.75	15.75	6.67	13.69	5.41

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2009 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	Minimum	412	576	460	416	312
mg/L	Mean	424	598	471	418	316
	Maximum	440	632	482	420	322
	Std. Dev.	14	30	11	3	5
	Median	420	586	470	418	314
	Coeff. Var. (%)	3	5	2	1	2
Hard.	Minimum	9	9	12	11	44
mg/L	Mean	12	9	14	14	51
	Maximum	17	10	16	17	55
	Std. Dev.	4	1	2	4	6
	Median	10	9	15	14	54
	Coeff. Var. (%)	36	6	15	30	12
Cond.	Minimum	431	565	508	466	332
µmhos/cm	Mean	448	675	590	546	397
	Maximum	466	761	670	626	483
	Std. Dev.	18	100	81	113	78
	Median	447	699	591	546	375
	Coeff. Var. (%)	4	15	14	21	20
pH	Minimum	8.6	8.7	8.8	7.5	7.7
unit	Mean	8.8	8.8	8.8	8.1	8.2
	Maximum	9.0	8.8	8.8	8.7	8.6
	Std. Dev.	0.2	0.1	0.0	0.8	0.5
	Median	8.8	8.8	8.8	8.1	8.3
	Coeff. Var. (%)	2.2	0.7	0.3	10.5	5.5

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

TABLE 3: SUMMARY STATISTICS OF THE 2009 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	Minimum	32.0	22.0	37.0	54.0	107.0
mg/L	Mean	34.0	24.0	40.7	56.0	113.0
	Maximum	35.0	26.0	44.0	58.0	124.0
	Std. Dev.	1.7	2.0	3.5	2.8	9.5
	Median	35.0	24.0	41.0	56.0	108.0
	Coeff. Var. (%)	5.1	8.3	8.6	5.1	8.4
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	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	Minimum	2.0	2.0	224.0	39.6	2.0
mg/L	Mean	2.8	2.0	264.6	41.7	2.0
	Maximum	4.5	2.0	302.7	43.8	2.0
	Std. Dev.	1.4	0	39.4	3.0	0
	Median	2.0	2.0	267.0	41.7	2.0
	Coeff. Var. (%)	50.9	0	14.9	7.1	0
NH_3-N	Minimum	0.11	0.10	0.33	0.18	0.25
mg/L	Mean	0.11	0.12	0.38	0.19	0.26
	Maximum	0.11	0.15	0.47	0.19	0.29
	Std. Dev.	0.00	0.03	0.08	0.01	0.02
	Median	0.11	0.12	0.35	0.19	0.25
	Coeff. Var. (%)	0.00	20.40	19.75	3.82	8.77
TOC	Minimum	1.00	1.00	1.00	1.00	2.50
mg/L	Mean	1.03	1.00	1.00	1.05	2.80
	Maximum	1.10	1.00	1.00	1.10	3.30
	Std. Dev.	0.06	0.00	0.00	0.07	0.44
	Median	1.00	1.00	1.00	1.05	2.60
	Coeff. Var. (%)	5.59	0.00	0.00	6.73	15.57

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2009 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	Minimum	406	304	788	456	330
mg/L	Mean	425	311	855	469	592
	Maximum	440	316	910	482	724
	Std. Dev.	17	6	62	18	227
	Median	428	314	868	469	722
	Coeff. Var. (%)	4	2	7	4	38
Hard.	Minimum	12	17	104	34	111
mg/L	Mean	15	19	140	35	119
	Maximum	17	21	164	35	132
	Std. Dev.	3	2	32	1	11
	Median	15	18	151	35	114
	Coeff. Var. (%)	17	11	23	2	10
Cond.	Minimum	449	358	530	300	662
µmhos/cm	Mean	499	387	808	369	787
	Maximum	575	423	1,112	439	903
	Std. Dev.	67	33	292	99	121
	Median	473	379	783	369	797
	Coeff. Var. (%)	13	9	36	27	15
pH	Minimum	7.6	7.4	7.7	8.1	7.3
unit	Mean	8.4	8.3	8.0	8.2	7.5
	Maximum	8.9	8.8	8.3	8.3	7.7
	Std. Dev.	0.7	0.8	0.3	0.2	0.2
	Median	8.8	8.6	8.0	8.2	7.4
	Coeff. Var. (%)	8.6	9.3	3.7	2.1	2.4

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

TABLE 4: SUMMARY STATISTICS OF THE 2009 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	Minimum	13.0	23.0	10.0	10.0	10.0
mg/L	Mean	14.0	30.3	10.0	10.7	10.0
	Maximum	15.0	41.0	10.0	12.0	10.0
	Std. Dev.	1.0	9.5	N/C[2]	1.2	N/C
	Median	14.0	27.0	10.0	10.0	10.0
	Coeff. Var. (%)	7.1	31.2	N/C	10.8	N/C
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	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	Minimum	2.0	62.2	154.6	30.5	151.6
mg/L	Mean	2.0	63.0	172.1	31.7	161.6
	Maximum	2.0	63.5	185.9	32.3	172.4
	Std. Dev.	0	0.7	16.0	1.0	10.4
	Median	2.0	63.4	175.9	32.2	160.8
	Coeff. Var. (%)	0	1.1	9.3	3.2	6.5
NH_3-N	Minimum	0.19	0.10	0.21	0.10	0.22
mg/L	Mean	0.21	0.11	0.24	0.10	0.25
	Maximum	0.22	0.12	0.29	0.11	0.27
	Std. Dev.	0.02	0.01	0.04	0.01	0.03
	Median	0.22	0.10	0.22	0.10	0.26
	Coeff. Var. (%)	8.25	10.83	18.16	5.59	10.58
TOC	Minimum	1.00	1.00	1.00	1.00	1.00
mg/L	Mean	1.23	1.00	1.00	1.00	1.00
	Maximum	1.50	1.00	1.00	1.00	1.00
	Std. Dev.	0.25	0.00	0.00	0.00	0.00
	Median	1.20	1.00	1.00	1.00	1.00
	Coeff. Var. (%)	20.40	0.00	0.00	0.00	0.00

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2009 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	Minimum	314	524	510	384	484
mg/L	Mean	332	732	679	507	673
	Maximum	350	1,148	980	744	1,040
	Std. Dev.	18	360	261	205	318
	Median	332	524	548	394	494
	Coeff. Var. (%)	5	49	38	40	47
Hard.	Minimum	13	73	111	6	101
mg/L	Mean	15	94	139	7	122
	Maximum	16	126	155	7	143
	Std. Dev.	2	28	25	1	21
	Median	15	83	152	7	121
	Coeff. Var. (%)	10	30	18	9	17
Cond.	Minimum	310	529	537	459	501
µmhos/cm	Mean	422	695	626	506	586
	Maximum	562	810	701	553	669
	Std. Dev.	128	147	83	47	84
	Median	394	745	639	506	589
	Coeff. Var. (%)	30	21	13	9	14
pH	Minimum	7.6	7.4	7.3	7.7	7.5
Unit	Mean	8.0	7.6	7.6	8.2	7.9
	Maximum	8.6	7.8	8.1	9.1	8.5
	Std. Dev.	0.5	0.2	0.5	0.8	0.6
	Median	7.8	7.6	7.3	7.7	7.6
	Coeff. Var. (%)	6.5	2.6	6.2	9.6	7.0

[1]For purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantitation (LOQ) was set equal to the value of the MDL or LOQ.
[2]N/C stands for no calculation due to single value.

TABLE 5: SUMMARY STATISTICS OF THE 2009 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	Minimum	19.0	19.0	15.0	20.0	29.0
mg/L	Mean	21.3	21.3	16.0	20.7	29.3
	Maximum	25.0	23.0	18.0	22.0	30.0
	Std. Dev.	4.2	2.1	1.7	1.2	0.6
	Median	20.0	22.0	15.0	20.0	29.0
	Coeff. Var. (%)	19.9	9.8	10.8	5.6	2.0
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	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	Minimum	2.9	20.4	2.0	2.0	2.0
mg/L	Mean	8.6	32.3	3.4	2.3	2.0
	Maximum	16.1	51.3	6.2	2.8	2.0
	Std. Dev.	6.8	16.7	2.4	0.5	0
	Median	6.8	25.1	2.0	2.0	2.0
	Coeff. Var. (%)	79.0	51.6	71.7	20.8	0
NH_3-N	Minimum	0.12	0.10	0.15	0.10	0.11
mg/L	Mean	0.13	0.10	0.25	0.15	0.13
	Maximum	0.16	0.10	0.34	0.24	0.14
	Std. Dev.	0.02	0.00	0.10	0.08	0.02
	Median	0.12	0.10	0.25	0.10	0.13
	Coeff. Var. (%)	17.32	0.00	38.53	55.11	12.06
TOC	Minimum	1.00	3.40	1.90	1.00	1.00
mg/L	Mean	1.20	5.73	1.97	1.00	1.00
	Maximum	1.60	9.20	2.10	1.00	1.00
	Std. Dev.	0.35	3.06	0.12	0.00	0.00
	Median	1.00	4.60	1.90	1.00	1.00
	Coeff. Var. (%)	28.87	53.40	5.87	0.00	0.00

TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2009 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	Minimum	264	380	280	336	250
mg/L	Mean	285	403	286	359	263
	Maximum	304	440	294	372	278
	Std. Dev.	20	33	7	20	14
	Median	286	388	284	370	260
	Coeff. Var. (%)	7	8	3	6	5
Hard.	Minimum	19	34	30	5	12
mg/L	Mean	24	43	32	6	12
	Maximum	29	55	34	6	13
	Std. Dev.	5	11	2	1	1
	Median	24	41	31	6	12
	Coeff. Var. (%)	21	25	7	10	5
Cond.	Minimum	283	358	297	299	286
µmhos/cm	Mean	354	409	299	354	301
	Maximum	420	454	300	391	316
	Std. Dev.	69	48	2	49	15
	Median	360	415	300	373	300
	Coeff. Var. (%)	19	12	1	14	5
pH	Minimum	7.9	7.5	7.9	8.7	8.5
unit	Mean	8.4	7.8	8.0	9.0	8.6
	Maximum	8.6	8.0	8.0	9.3	8.7
	Std. Dev.	0.4	0.3	0.1	0.3	0.1
	Median	8.6	7.8	8.0	9.1	8.6
	Coeff. Var. (%)	4.9	3.2	0.8	3.2	1.3

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

TABLE 6: SUMMARY STATISTICS OF THE 2009 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	Minimum	14.0	12.0	30.0	14.0	156.0
mg/L	Mean	14.7	12.7	31.3	14.7	172.5
	Maximum	16.0	14.0	33.0	15.0	190.0
	Std. Dev.	1.2	1.2	1.5	0.6	11.4
	Median	14.0	12.0	31.0	15.0	172.5
	Coeff. Var. (%)	7.9	9.1	4.9	3.9	6.6
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	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	Minimum	5.4	2.0	2.0	2.0	137.1
mg/L	Mean	7.9	2.0	2.0	2.0	153.0
	Maximum	9.6	2.0	2.0	2.0	203.3
	Std. Dev.	2.2	0.0	0.0	0.0	24.9
	Median	8.7	2.0	2.0	2.0	144.3
	Coeff. Var. (%)	28.3	0.0	0.0	0.0	16.3
NH_3-N	Minimum	0.12	0.10	0.15	0.10	0.66
mg/L	Mean	0.13	0.10	0.15	0.10	0.68
	Maximum	0.15	0.10	0.16	0.10	0.70
	Std. Dev.	0.02	0.00	0.01	0.00	0.02
	Median	0.13	0.10	0.15	0.10	0.68
	Coeff. Var. (%)	11.46	0.00	3.77	0.00	2.75
TOC	Minimum	1.00	1.00	1.00	1.00	1.20
mg/L	Mean	1.00	1.00	1.00	1.20	1.33
	Maximum	1.00	1.00	1.00	1.50	1.40
	Std. Dev.	0.00	0.00	0.00	0.26	0.08
	Median	1.00	1.00	1.00	1.10	1.35
	Coeff. Var. (%)	0.00	0.00	0.00	22.05	6.12

TABLE 6 (Continued): SUMMARY STATISTICS OF THE 2009 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	Minimum	232	278	252	262	824
mg/L	Mean	235	293	270	271	840
	Maximum	240	316	294	286	876
	Std. Dev.	4	20	22	13	20
	Median	234	286	264	266	834
	Coeff. Var. (%)	2	7	8	5	2
Hard.	Minimum	18	6	22	15	292
mg/L	Mean	22	6	23	15	308
	Maximum	25	7	23	15	332
	Std. Dev.	4	1	1	0	16
	Median	22	6	23	15	307
	Coeff. Var. (%)	16	9	3	0	5
Cond.	Minimum	277	298	301	532	391
µmhos/cm	Mean	298	326	350	667	529
	Maximum	319	358	400	802	802
	Std. Dev.	21	30	50	135	164
	Median	299	320	348	666	441
	Coeff. Var. (%)	7	9	14	20	31
pH	Minimum	8.1	8.4	8.0	7.2	7.2
unit	Mean	8.2	8.9	8.3	7.3	7.8
	Maximum	8.6	9.2	8.6	7.4	8.3
	Std. Dev.	0.3	0.4	0.3	0.1	0.5
	Median	8.1	9.1	8.4	7.2	8.0
	Coeff. Var. (%)	3.3	4.8	3.9	1.6	6.3

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

TABLE 7: SUMMARY STATISTICS OF THE 2009 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-30, QC-31, QC-32, QC-34, AND QC-35

Parameter[1]		Well Number QC-30	QC-31	QC-32	QC-34	QC-35
Cl	Minimum	10.0	14.0	26.0	17.0	33.0
mg/L	Mean	15.0	16.8	26.0	19.0	33.0
	Maximum	25.0	21.0	26.0	21.0	33.0
	Std. Dev.	6.7	2.4	N/C[2]	2.8	N/C
	Median	11.0	17.0	26.0	19.0	33.0
	Coeff. Var. (%)	45.0	14.3	N/C	14.9	N/C
FC	Minimum	1.0	1.0	1.0	1.0	1.0
cfu/100 mL	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	Minimum	50.8	40.3	69.0	44.3	196.1
mg/L	Mean	66.2	155.7	69.0	54.5	196.1
	Maximum	81.3	190.7	69.0	64.7	196.1
	Std. Dev.	10.9	57.4	N/C	14.4	N/C
	Median	65.0	176.1	69.0	54.5	196.1
	Coeff. Var. (%)	16.5	36.9	N/C	26.5	N/C
NH_3-N	Minimum	0.12	1.02	0.15	0.10	0.10
mg/L	Mean	0.26	1.03	0.15	0.10	0.10
	Maximum	0.39	1.05	0.15	0.10	0.10
	Std. Dev.	0.12	0.01	N/C	0.00	N/C
	Median	0.26	1.02	0.15	0.10	0.10
	Coeff. Var. (%)	44.94	1.29	N/C	0.00	N/C
TOC	Minimum	1.00	1.10	2.00	1.10	1.10
mg/L	Mean	1.42	1.13	2.00	1.10	1.10
	Maximum	1.90	1.20	2.00	1.10	1.10
	Std. Dev.	0.37	0.05	N/C	0.00	N/C
	Median	1.30	1.10	2.00	1.10	1.10
	Coeff. Var. (%)	26.07	4.56	N/C	0.00	N/C

TABLE 7 (Continued): SUMMARY STATISTICS OF THE 2009 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-30, QC-31, QC-32, QC-34, AND QC-35

Parameter[1]		Well Number QC-30	QC-31	QC-32	QC-34	QC-35
TDS	Minimum	368	542	602	504	1,076
mg/L	Mean	386	568	602	533	1,076
	Maximum	404	592	602	562	1,076
	Std. Dev.	17	17	N/C	41	N/C
	Median	390	570	602	533	1,076
	Coeff. Var. (%)	4	3	N/C	8	N/C
Hard.	Minimum	42	201	41	15	25
mg/L	Mean	50	220	41	18	25
	Maximum	57	231	41	20	25
	Std. Dev.	5	11	N/C	4	N/C
	Median	51	223	41	18	25
	Coeff. Var. (%)	11	5	N/C	20	N/C
Cond.	Minimum	418	470	635	615	1,245
µmhos/cm	Mean	443	506	635	630	1,245
	Maximum	475	580	635	645	1,245
	Std. Dev.	21	39	N/C	21	N/C
	Median	440	496	635	630	1,245
	Coeff. Var. (%)	5	8	N/C	3	N/C
pH	Minimum	8.2	7.4	8.4	9.0	8.5
unit	Mean	8.4	7.7	8.4	9.0	8.5
	Maximum	8.7	8.1	8.4	9.0	8.5
	Std. Dev.	0.2	0.3	N/C	N/C	N/C
	Median	8.3	7.6	8.4	9.0	8.5
	Coeff. Var. (%)	2.1	3.6	N/C	N/C	N/C

[1]For purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantitation (LOQ) was set equal to the value of the MDL or LOQ.
[2]N/C stands for no calculation due to single value.

TABLE 8: SUMMARY STATISTICS OF THE 2009 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELL QC-37

Parameter[1]		Well Number QC-37
Cl	Minimum	35.0
mg/L	Mean	35.0
	Maximum	35.0
	Std. Dev.	N/C[2]
	Median	35.0
	Coeff. Var. (%)	N/C
FC	Minimum	1.0
cfu/100 mL	Geo. Mean	1.0
	Maximum	1.0
	Median	1.0
SO_4	Minimum	87.3
mg/L	Mean	87.3
	Maximum	87.3
	Std. Dev.	N/C
	Median	87.3
	Coeff. Var. (%)	N/C
NH_3-N	Minimum	0.41
mg/L	Mean	0.41
	Maximum	0.41
	Std. Dev.	N/C
	Median	0.41
	Coeff. Var. (%)	N/C
TOC	Minimum	2.40
mg/L	Mean	2.40
	Maximum	2.40
	Std. Dev.	N/C
	Median	2.40
	Coeff. Var. (%)	N/C

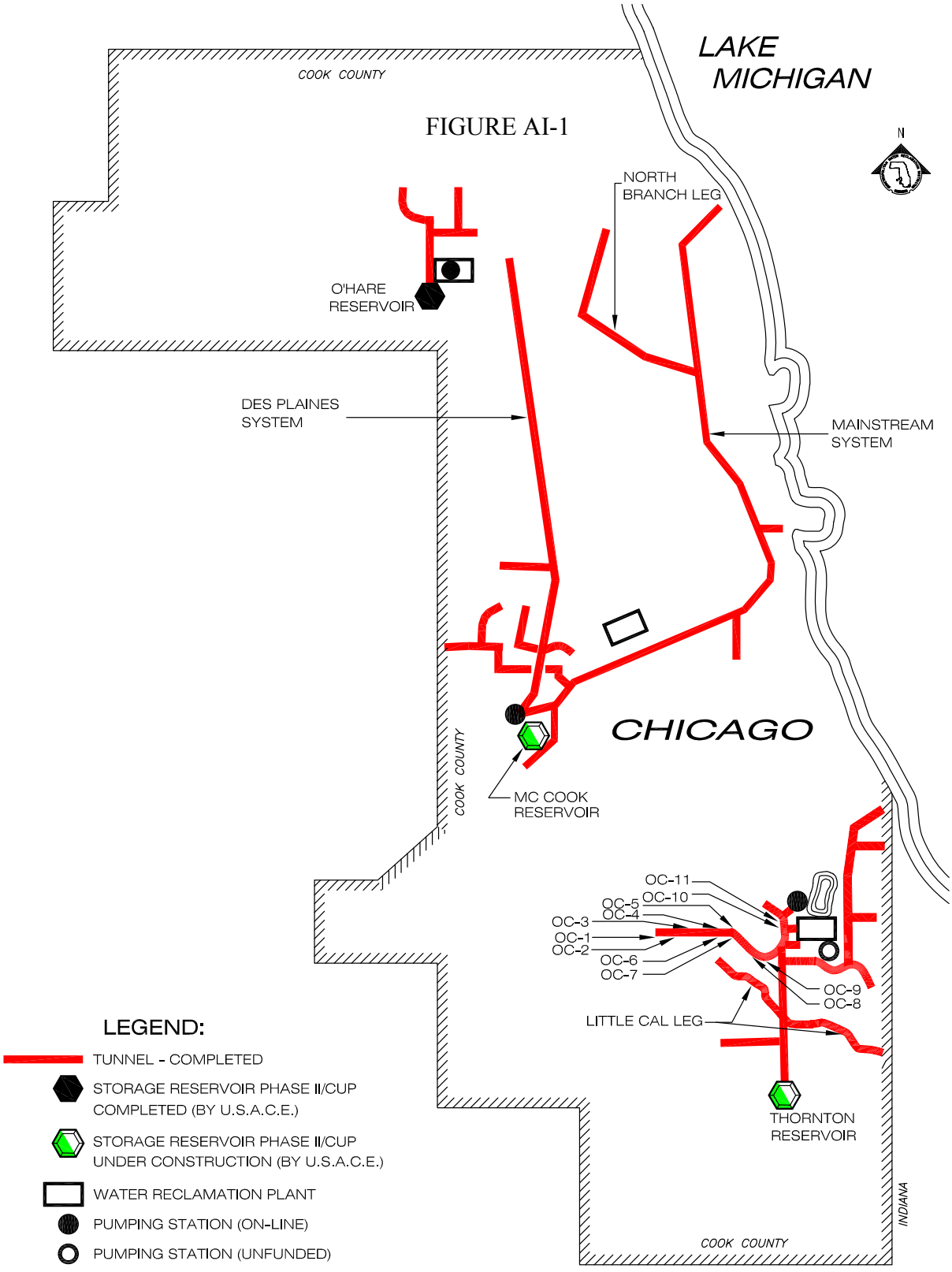
TABLE 8 (Continued): SUMMARY STATISTICS OF THE 2009 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELL QC-37

Parameter[1]		Well Number QC-37
TDS	Minimum	1,126
mg/L	Mean	1,126
	Maximum	1,126
	Std. Dev.	N/C
	Median	1,126
	Coeff. Var. (%)	N/C
Hard.	Minimum	25
mg/L	Mean	25
	Maximum	25
	Std. Dev.	N/C
	Median	25
	Coeff. Var. (%)	N/C
Cond.	Minimum	1,177
µmhos/cm	Mean	1,177
	Maximum	1,177
	Std. Dev.	N/C
	Median	1,177
	Coeff. Var. (%)	N/C
pH	Minimum	8.6
unit	Mean	8.6
	Maximum	8.6
	Std. Dev.	N/C
	Median	8.6
	Coeff. Var. (%)	N/C

[1]For purpose of statistical evaluation, any value less than the appropriate method detection limit (MDL) or limit of quantitation (LOQ) was set equal to the value of the MDL or LOQ.
[2]N/C stands for no calculation due to single value.

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

2009 GROUNDWATER LEVEL ELEVATION DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

TABLE AII-1: 2009 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Wells					
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6
1/16/09	**	-22.6	-151.3	**	**	-88.7
1/30/09	**	-25.6	**	**	**	-81.7
2/20/09	-26.8	-23.6	-153.3	-167.2	-153.3	-89.7
2/27/09	5.2	**	-147.3	-167.2	-152.3	-89.7
3/13/09	6.2	-22.6	-136.3	-165.2	-149.3	-60.7
3/20/09	-26.8	-23.6	-153.3	-167.2	-153.3	-80.7
3/27/09	-26.8	-20.6	-149.3	-165.2	-145.3	-72.7
4/10/09	-24.8	-24.6	-151.3	-177.2	-143.3	-81.7
4/24/09	-23.8	-22.6	-151.3	-166.2	-150.3	-80.7
5/8/09	-20.8	-20.6	-145.3	-152.2	-142.3	-77.7
5/15/09	-25.8	-21.6	-145.3	-163.2	-144.3	-78.7
6/5/09	-27.8	-22.6	***	-165.2	-148.3	-80.7
6/19/09	-25.8	-19.6	***	-165.2	-149.3	-77.7
7/2/09	-26.8	-22.6	-147.3	-159.2	-145.3	-79.7
7/17/09	-25.8	-22.6	-142.3	-161.2	-145.3	-81.7
7/31/09	-29.8	-24.6	-155.3	-169.2	-151.3	-81.7
8/14/09	-29.8	-23.6	-145.3	-166.2	-153.3	-81.7
8/28/09	-25.8	-21.6	-149.3	-168.2	-147.3	-77.7
9/11/09	-24.8	-23.6	-152.3	-168.2	-152.3	-81.7
9/18/09	-27.8	-23.6	-155.3	-167.2	-152.3	-81.7
10/9/09	-29.8	-24.6	-154.3	-169.2	-151.3	-82.7
10/16/09	-28.8	-24.6	-153.3	-169.2	-152.3	-81.7
10/23/09	-29.8	-22.6	-146.3	-163.2	-149.3	-78.7
11/13/09	-27.8	-22.6	-150.3	-165.2	-149.3	-76.7
12/4/09	-27.8	-21.6	-148.3	-162.2	-149.3	-76.7
Minimum	-29.8	-25.6	-155.3	-177.2	-153.3	-89.7
Mean	-24.0	-22.9	-149.3	-165.6	-149.1	-80.1
Maximum	6.2	-19.6	-136.3	-152.2	-142.3	-60.7

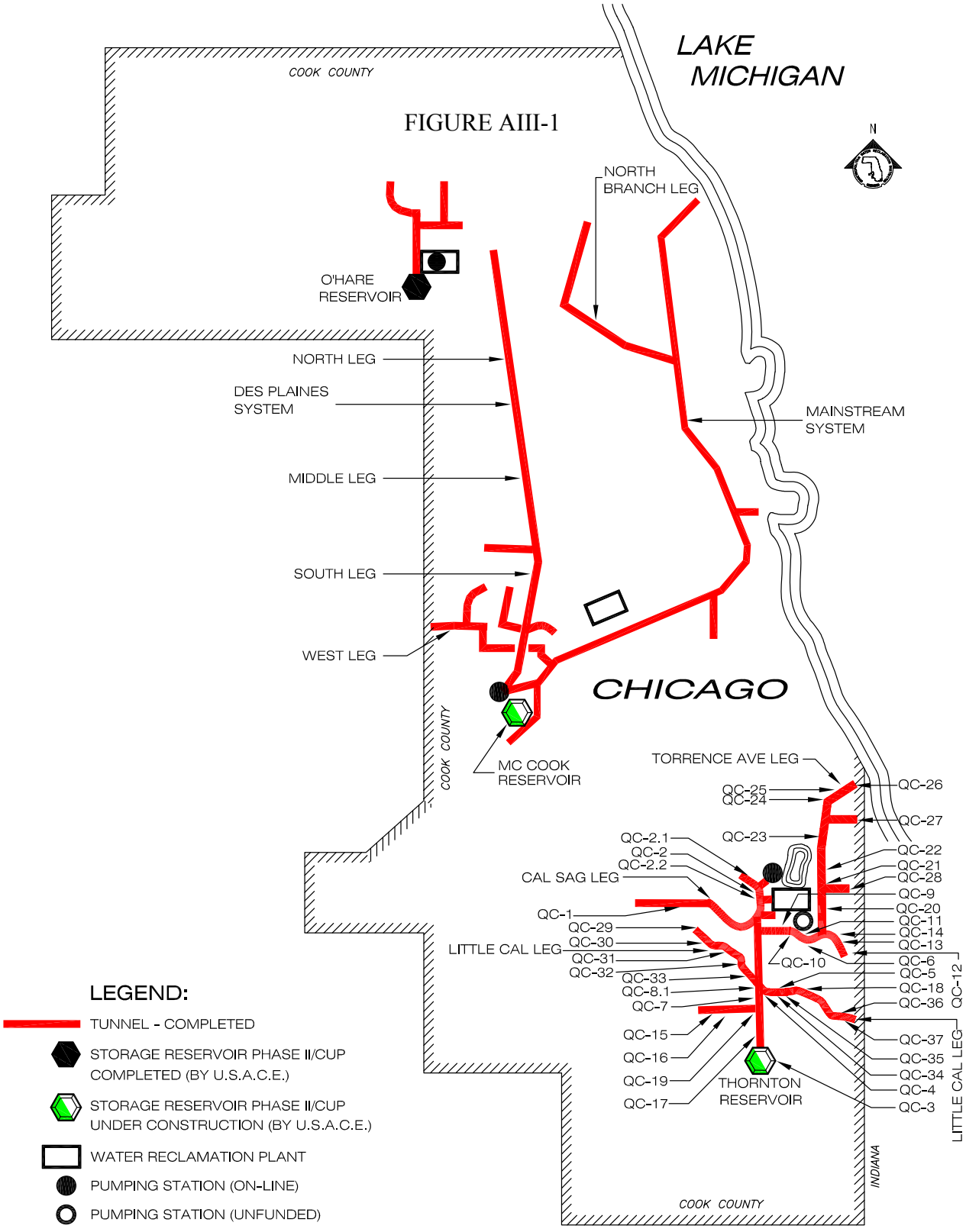
TABLE AII-1 (Continued): 2009 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Wells				
	OC-7	OC-8	OC-9	OC-10	OC-11
1/16/09	**	**	-215.7	-225.0	**
1/30/09	**	**	-212.7	-217.0	-215.3
2/20/09	-214.0	-185.9	-215.7	-217.0	-222.3
2/27/09	-211.0	**	**	-223.0	-222.3
3/13/09	-214.0	-184.9	-215.7	-184.0	-220.3
3/20/09	-214.0	-185.9	-215.7	-217.0	-222.3
3/27/09	-200.0	-180.9	-181.7	-212.0	-217.3
4/10/09	-214.0	-178.9	-216.7	-230.0	-216.3
4/24/09	-213.0	-182.9	-214.7	-212.0	-209.3
5/8/09	-206.0	-174.9	-184.7	-195.0	-210.3
5/15/09	-208.0	-175.9	-192.7	-214.0	-189.3
6/5/09	-195.0	-184.9	***	-213.0	****
6/19/09	-200.0	-179.9	-208.7	-217.0	-215.3
7/2/09	-201.0	-179.9	-208.7	-214.0	-219.3
7/17/09	-199.0	-176.9	-208.7	-208.0	-212.3
7/31/09	-209.0	-185.9	-214.7	-223.0	-221.3
8/14/09	-210.0	-184.9	-212.7	-223.0	-222.3
8/28/09	-207.0	-179.9	-213.7	-223.0	-216.3
9/11/09	-211.0	-180.9	-212.7	-216.0	-222.3
9/18/09	-211.0	-179.9	-212.7	-210.0	-216.3
10/9/09	-212.0	-185.9	-243.7	-225.0	-222.3
10/16/09	-213.0	-184.9	-215.7	-225.0	-223.3
10/23/09	-211.0	-178.9	-214.7	-215.0	-216.3
11/13/09	-202.0	-178.9	-213.7	-214.0	-219.3
12/4/09	-200.0	-171.9	-211.7	-212.0	-218.3
Minimum	-214.0	-185.9	-243.7	-230.0	-223.3
Mean	-207.6	-181.1	-211.2	-215.4	-217.0
Maximum	-195.0	-171.9	-181.7	-184.0	-189.3

*Relative to the Chicago City Datum.
**Unable to sample wells because snow was blocking access.
***Access to well denied.
****Debris blocking access to wells.

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

2009 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: 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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

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	1/8/09	85	<1	238.0	0.41	1.8	864
QC-1	3/5/09	Well could not be sampled					
QC-1	5/7/09	Well could not be sampled					
QC-1	6/25/09	Well could not be sampled					
QC-1	7/10/09	Well could not be sampled					
QC-1	11/1/09	Well could not be sampled					
QC-2	1/8/09	43	310	28.7	0.41	1.4	380
QC-2	3/5/09	51	1,100	30.5	0.54	1.6	456
QC-2	5/7/09	52	200	26.3	0.88	1.6	376
QC-2	6/25/09	43	13	28.8	0.71	1.6	362
QC-2	8/6/09	36	<1	23.7	0.66	1.5	424
QC-2	10/1/09	37	80	24.7	0.65	1.4	356
QC-2.1	3/5/09	34	<1	<2.0	0.64	1.2	512
QC-2.1	8/6/09	35	<1	<2.0	0.67	1.4	592
QC-2.1	10/1/09	32	<1	<2.0	0.63	1.1	514
QC-2.2	3/5/09	14	<1	32.1	0.36	1.4	346
QC-2.2	8/6/09	14	<1	25.4	0.55	1.2	358
QC-2.2	10/1/09	13	<1	32.6	0.49	1.2	346
QC-3[3]	3/5/09	13	<1	27.3	0.42	<1.0	404
QC-3		Well could not be sampled					
QC-3		Well could not be sampled					
QC-4	3/5/09	11	15	15.0	0.13	<1.0	412
QC-4	6/25/09	11	<1	11.0	0.15	1.3	420
QC-4	8/6/09	12	<1	11.1	0.15	<1.0	440
QC-5	3/5/09	27	<1	7.9	0.12	1.0	632
QC-5	6/25/09	28	<1	7.4	0.14	1.3	586
QC-5	8/6/09	28	<1	5.3	0.17	<1.0	576

TABLE AIV-1 (Continued): 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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

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	3/5/09	14	<1	6.3	0.31	1.5	460
QC-6	6/25/09	15	<1	6.1	0.34	1.6	470
QC-6	8/6/09	16	<1	5.6	0.35	1.4	482
QC-7	3/5/09	10	<1	<2.0	0.26	1.4	420
QC-7	6/25/09	12	<1	<2.0	0.26	1.7	416
QC-7	8/6/09	Well could not be sampled					
QC-9	3/5/09	10	<1	30.9	0.75	1.1	314
QC-9	6/25/09	10	<1	32.1	0.65	1.1	312
QC-9	10/1/09	10	<1	36.2	0.74	1.0	322
QC-10	2/10/09	35	<1	<2.0	0.11	1.1	428
QC-10	5/6/09	35	<1	<2.0	0.11	<1.0	406
QC-10	8/5/09	32	<1	4.5	0.11	<1.0	440
QC-11	2/10/09	24	<1	<2.0	0.10	<1.0	316
QC-11	5/6/09	26	<1	<2.0	0.12	<1.0	314
QC-11	8/5/09	22	<1	<2.0	0.15	<1.0	304
QC-12	2/10/09	37	<1	302.7	0.47	<1.0	910
QC-12	5/6/09	44	<1	224.0	0.35	<1.0	788
QC-12	8/5/09	41	<1	267.0	0.33	<1.0	868
QC-13	2/10/09	Well could not be sampled					
QC-13	5/6/09	58	<1	43.8	0.19	1.1	456
QC-13	8/5/09	54	<1	39.6	0.18	<1.0	482
QC-14	3/5/09	108	<1	<2.0	0.25	2.5	722
QC-14	6/25/09	107	<1	<2.0	0.25	2.6	330
QC-14	9/2/09	124	<1	<2.0	0.29	3.3	724
QC-15	3/5/09	14	<1	<2.0	0.22	<1.0	350
QC-15	6/25/09	13	<1	<2.0	0.22	1.5	314
QC-15	9/2/09	15	<1	<2.0	0.19	1.2	332

TABLE AIV-1 (Continued): 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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

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	4/16/09	27	<1	62.2	<0.10	<1.0	524
QC-16	7/22/09	41	<1	63.4	<0.10	<1.0	1,148
QC-16	9/2/09	23	<1	63.5	0.12	<1.0	524
QC-17	4/16/09	10	<1	175.9	0.21	1.0	548
QC-17	7/22/09	<10	<1	154.6	0.29	<1.0	980
QC-17	9/2/09	10	<1	185.9	0.22	<1.0	510
QC-18	5/7/09	12	<1	32.3	<0.10	<1.0	394
QC-18	7/22/09	<10	<1	30.5	0.11	<1.0	744
QC-18	9/2/09	<10	<1	32.2	0.10	<1.0	384
QC-19	4/16/09	<10	<1	151.6	0.22	<1.0	494
QC-19	7/22/09	10	<1	172.4	0.26	<1.0	1,040
QC-19	9/2/09	<10	1	160.8	0.27	<1.0	484
QC-20	1/8/09	20	<1	16.1	0.12	1.6	304
QC-20	5/14/09	25	<1	6.8	0.16	<1.0	264
QC-20	9/2/09	19	<1	2.9	0.12	<1.0	286
QC-21	4/1/09	22	<1	51.3	<0.10	4.6	440
QC-21	6/25/09	23	<1	25.1	<0.10	9.2	380
QC-21	7/23/09	19	<1	20.4	<0.10	3.4	388
QC-22	1/8/09	15	<1	6.2	0.15	1.9	284
QC-22	4/1/09	18	<1	<2.0	0.25	1.9	294
QC-22	7/23/09	15	<1	<2.0	0.34	2.1	280
QC-23	1/8/09	20	<1	2.8	<0.10	<1.0	372
QC-23	4/1/09	22	<1	<2.0	<0.10	<1.0	336
QC-23	7/23/09	20	<1	<2.0	0.24	<1.0	370
QC-24	1/8/09	29	<1	<2.0	0.11	<1.0	260
QC-24	4/1/09	30	<1	<2.0	0.13	<1.0	250
QC-24	7/23/09	29	<1	<2.0	0.14	<1.0	278

TABLE AIV-1 (Continued): 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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

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	1/8/09	14	<1	9.6	0.12	<1.0	232
QC-25	4/1/09	16	<1	8.7	0.15	<1.0	240
QC-25	7/23/09	14	<1	5.4	0.13	<1.0	234
QC-26	1/8/09	12	<1	<2.0	<0.10	<1.0	316
QC-26	4/1/09	14	<1	<2.0	0.10	<1.0	286
QC-26	7/23/09	12	<1	<2.0	<0.10	<1.0	278
QC-27	1/8/09	31	<1	<2.0	0.15	<1.0	264
QC-27	4/1/09	33	<1	<2.0	0.16	<1.0	252
QC-27	7/23/09	30	<1	<2.0	0.15	<1.0	294
QC-28	1/8/09	14	<1	<2.0	<0.10	1.0	266
QC-28	4/1/09	15	<1	<2.0	<0.10	1.1	262
QC-28	7/23/09	15	<1	<2.0	<0.10	1.5	286
QC-29	1/15/09	190	<1	148.5	0.69	1.3	848
QC-29	3/12/09	156	<1	137.1	0.66	1.3	824
QC-29	5/7/09	173	<1	140.7	0.66	1.4	876
QC-29	7/1/09	166	<1	203.3	0.69	1.4	828
QC-29	9/3/09	178	<1	144.4	0.66	1.2	824
QC-29	12/3/09	172	<1	144.2	0.70	1.4	840
QC-30	1/15/09	<10	<1	64.5	0.36	1.7	390
QC-30	3/12/09	<10	1	69.4	0.41	<1.0	440
QC-30	5/7/09	25	<1	65.0	0.12	1.9	368
QC-30	7/1/09	19	<1	81.3	0.39	1.2	404
QC-30	9/3/09	11	<1	69.3	0.17	1.0	400
QC-30	12/3/09	<10	<1	50.8	0.26	1.3	368
QC-31	1/15/09	14	<1	188.5	1.02	1.2	574
QC-31	3/12/09	17	<1	173.4	1.02	1.1	566
QC-31	5/7/09	21	<1	178.7	1.02	1.1	574
QC-31	7/1/09	17	<1	40.3	1.04	1.1	542
QC-31	10/22/09	15	<1	190.7	1.05	1.2	592
QC-31	12/10/09	17	<1	162.5	1.02	1.1	562

TABLE AIV-1 (Continued): 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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

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-32	1/15/09		Well could not be sampled				
QC-32	3/12/09		Well could not be sampled				
QC-32	5/7/09	26	<1	69.0	0.15	2.0	602
QC-32	7/1/09		Well could not be sampled				
QC-32	9/3/07		Well could not be sampled				
QC-32	10/1/09		Well could not be sampled				
QC-33	1/15/09		Well could not be sampled				
QC-33	3/12/09		Well could not be sampled				
QC-33	5/7/09		Well could not be sampled				
QC-33	7/1/09		Well could not be sampled				
QC-33	9/3/09		Well could not be sampled				
QC-33	10/1/09		Well could not be sampled				
QC-34	1/15/09		Well could not be sampled				
QC-34	3/12/09		Well could not be sampled				
QC-34	5/7/09	21	<1	64.7	<0.10	1.1	504
QC-34	7/1/09	17	<1	44.3	<0.10	1.1	562
QC-34	9/3/09		Well could not be sampled				
QC-34	10/1/09		Well could not be sampled				
QC-35	3/18/09		Well could not be sampled				
QC-35	5/7/09		Well could not be sampled				
QC-35	7/1/09		Well could not be sampled				
QC-35	9/3/09	33	<1	196.1	<0.10	1.1	1,076
QC-35	10/1/09		Well could not be sampled				
QC-35	11/19/09		Well could not be sampled				
QC-36	1/15/09		Well could not be sampled				
QC-36	3/18/09		Well could not be sampled				
QC-36	5/7/09		Well could not be sampled				
QC-36	7/1/09		Well could not be sampled				
QC-36	9/3/09		Well could not be sampled				
QC-36	10/1/09		Well could not be sampled				

TABLE AIV-1 (Continued): 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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

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-37	1/15/09			Well could not be sampled			
QC-37	3/18/09			Well could not be sampled			
QC-37	7/1/09			Well could not be sampled			
QC-37	9/3/09			Well could not be sampled			
QC-37	10/1/09			Well could not be sampled			
QC-37	12/30/09	35	<1	87.3	0.41	2.4	1,126

[1]The method detection limit (MDL) or limit or quantification (LOQ) is 10 mg/L for Cl (LOQ), 2.0 mg/L for SO_4 (LOQ), 0.10 mg/L for NH_3-N (LOQ), 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 with actual sampling volume analyzed.

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

[3]Water quality monitoring well QC-3 could not be sampled after March 5, 2009, because of construction impeding access.

TABLE AIV-2: 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER 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

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QC-1	1/8/09	519	1,206	7.7	7.2	-165	<48
QC-1	3/5/09	Well could not be sampled					
QC-1	5/7/09	Well could not be sampled					
QC-1	6/25/09	Well could not be sampled					
QC-1	7/10/09	Well could not be sampled					
QC-1	11/1/09	Well could not be sampled					
QC-2	1/8/09	92	601	7.5	6.8	-276	<48
QC-2	3/5/09	92	421	7.2	13.4	-275	<48
QC-2	5/7/09	87	603	7.6	10.1	-262	<48
QC-2	6/25/09	87	401	8.1	15.6	-278	<48
QC-2	8/6/09	83	536	7.6	13.6	-278	<48
QC-2	10/1/09	81	447	8.3	13.1	-280	<48
QC-2.1	3/5/09	54	562	7.6	12.8	-285	<48
QC-2.1	8/6/09	55	751	7.4	13.8	-283	<48
QC-2.1	10/1/09	57	605	7.9	12.4	-291	<48
QC-2.2	3/5/09	40	379	7.7	13.7	-277	<48
QC-2.2	8/6/09	39	509	7.6	13.7	-275	<48
QC-2.2	10/1/09	40	428	8.7	13.2	-275	<48
QC-3[4]	3/5/09	61	361	8.2	12.6	-206	<48
QC-3		Well could not be sampled					
QC-3		Well could not be sampled					
QC-4	3/5/09	17	431	9.0	11.5	-215	<48
QC-4	6/25/09	10	447	8.6	13.6	-248	<48
QC-4	8/6/09	9	466	8.8	14.0	-261	<48
QC-5	3/5/09	9	565	8.8	12.0	-185	<48
QC-5	6/25/09	10	761	8.8	14.0	-204	<48
QC-5	8/6/09	9	699	8.7	13.2	-229	<48

TABLE AIV-2 (Continued): 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER 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

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QC-6	3/5/09	12	508	8.8	12.5	-189	<48
QC-6	6/25/09	16	670	8.8	14.2	-191	<48
QC-6	8/6/09	15	591	8.8	13.1	-220	<48
QC-7	3/5/09	11	466	8.7	12.0	-163	<48
QC-7	6/25/09	17	626	7.5	12.7	-177	<48
QC-7	8/6/09	Well could not be sampled					
QC-9	3/5/09	54	332	8.6	12.8	-175	<48
QC-9	6/25/09	44	483	7.7	13.5	-252	<48
QC-9	10/1/09	55	375	8.3	13.2	-179	<48
QC-10	2/10/09	12	575	7.6	12.2	-220	<4
QC-10	5/6/09	15	449	8.8	13.4	-169	<4
QC-10	8/5/09	17	473	8.9	13.0	-190	<4
QC-11	2/10/09	21	423	7.4	12.8	-229	<4
QC-11	5/6/09	18	358	8.8	13.6	-191	<4
QC-11	8/5/09	17	379	8.6	13.7	-208	<4
QC-12	2/10/09	164	1,112	7.7	12.6	-251	<4
QC-12	5/6/09	104	530	8.3	13.4	-209	<4
QC-12	8/5/09	151	783	8.0	13.5	-220	<4
QC-13	2/10/09	Well could not be sampled					
QC-13	5/6/09	34	300	8.3	13.9	-215	<48
QC-13	8/5/09	35	439	8.1	13.8	-232	<48
QC-14	3/5/09	114	662	7.3	12.7	-206	<48
QC-14	6/25/09	111	903	7.4	12.3	-219	<48
QC-14	9/2/09	132	797	7.7	13.6	-219	<48
QC-15	3/5/09	16	310	7.6	12.1	-233	<48
QC-15	6/25/09	13	562	7.8	12.9	-230	<48
QC-15	9/2/09	15	394	8.6	13.4	-224	<48

TABLE AIV-2 (Continued): 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER 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

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QC-16	4/16/09	83	745	7.6	12.1	-256	<48
QC-16	7/22/09	126	810	7.4	13.0	-258	<48
QC-16	9/2/09	73	529	7.8	13.5	-216	<48
QC-17	4/16/09	155	639	7.3	12.2	-163	<48
QC-17	7/22/09	111	701	7.3	12.8	-166	<48
QC-17	9/2/09	152	537	8.1	13.0	-170	<48
QC-18	5/7/09	7	553	7.7	11.3	-212	<48
QC-18	7/22/09	6	506	7.7	13.1	-222	<48
QC-18	9/2/09	7	459	9.1	12.9	-213	<48
QC-19	4/16/09	101	589	7.5	12.0	-144	<48
QC-19	7/22/09	143	669	7.6	12.9	-153	<48
QC-19	9/2/09	121	501	8.5	13.0	-127	<48
QC-20	1/8/09	29	283	7.9	11.2	NA	<48
QC-20	5/14/09	24	420	8.6	12.7	-268	<48
QC-20	9/2/09	19	360	8.6	12.8	-269	<48
QC-21	4/1/09	55	415	7.5	12.0	-266	<48
QC-21	6/25/09	41	454	8.0	14.0	-263	<48
QC-21	7/23/09	34	358	7.8	13.6	-266	<48
QC-22	1/8/09	34	300	8.0	10.7	-259	<48
QC-22	4/1/09	30	300	8.0	11.2	-260	<48
QC-22	7/23/09	31	297	7.9	13.2	-260	<48
QC-23	1/8/09	6	299	8.7	11.5	-239	<48
QC-23	4/1/09	6	373	9.1	11.6	-241	<48
QC-23	7/23/09	5	391	9.3	13.0	-242	<48
QC-24	1/8/09	12	286	8.6	10.9	-235	<48
QC-24	4/1/09	13	300	8.5	12.2	-236	<48
QC-24	7/23/09	12	316	8.7	13.3	-236	<48

TABLE AIV-2 (Continued): 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER 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

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QC-25	1/8/09	25	276	7.8	11.6	-234	<48
QC-25	4/1/09	22	299	8.6	13.5	-236	<48
QC-25	7/23/09	18	277	8.55	13.5	-236	<48
QC-26	1/8/09	6	313	8.8	11.2	-246	<48
QC-26	4/1/09	7	330	8.8	12.0	-230	<48
QC-26	7/23/09	6	358	8.4	11.8	-207	<48
QC-27	1/8/09	23	298	8.4	11.8	-207	<48
QC-27	4/1/09	23	301	8.4	11.5	-244	<48
QC-27	7/23/09	22	400	8.6	12.1	-246	<48
QC-28	1/8/09	15	301	8.4	11.5	-244	<48
QC-28	4/1/09	15	400	8.6	12.1	-246	<48
QC-28	7/23/09	15	296	8.8	13.5	-246	<48
QC-29	1/15/09	332	532	7.4	10.7	-70	<48
QC-29	3/12/09	300	802	7.2	11.3	-25	<48
QC-29	5/7/09	293	666	7.2	12.5	-62	<48
QC-29	7/1/09	292	715	7.3	12.6	-68	<48
QC-29	9/3/09	314	980	7.1	12.7	-66	<48
QC-29	12/3/09	319	660	7.4	11.5	-68	<48
QC-30	1/15/09	51	443	8.2	8.6	-144	<48
QC-30	3/12/09	53	391	7.7	10.6	-30	<48
QC-30	5/7/09	52	437	8.3	12.8	-139	<48
QC-30	7/1/09	50	440	8.3	12.2	-138	<48
QC-30	9/3/09	57	475	8.3	13.2	-144	<48
QC-30	12/3/09	42	418	8.7	10.7	-143	<48
QC-31	1/15/09	231	502	7.9	11.5	-90	<48
QC-31	3/12/09	219	470	7.5	11.8	-64	<48
QC-31	5/7/09	213	490	7.7	13.6	-76	<48
QC-31	7/1/09	201	514	8.1	12.8	-83	<48

TABLE AIV-2 (Continued): 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER 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

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QC-31	10/22/09	228	580	7.5	17.1	-122	<48
QC-31	12/10/09	226	483	7.4	11.1	-75	<48
QC-32	1/15/09	Well could not be sampled					
QC-32	3/12/09	Well could not be sampled					
QC-32	5/7/09	41	635	8.4	14.5	-169	<48
QC-32	7/1/09	Well could not be sampled					
QC-32	9/3/07	Well could not be sampled					
QC-32	10/1/09	Well could not be sampled					
QC-33	1/15/09	Well could not be sampled					
QC-33	3/12/09	Well could not be sampled					
QC-33	5/7/09	Well could not be sampled					
QC-33	7/1/09	Well could not be sampled					
QC-33	9/3/09	Well could not be sampled					
QC-33	10/1/09	Well could not be sampled					
QC-34	1/15/09	Well could not be sampled					
QC-34	3/12/09	Well could not be sampled					
QC-34	5/7/09	15	645	9.0	15.3	-160	<48
QC-34	7/1/09	20	615	9.0	13.3	-160	<48
QC-34	9/3/09	Well could not be sampled					
QC-34	10/1/09	Well could not be sampled					
QC-35	3/18/09	Well could not be sampled					
QC-35	5/7/09	Well could not be sampled					
QC-35	7/1/09	Well could not be sampled					
QC-35	9/3/09	25	1,245	8.5	15.0	-151	<48
QC-35	10/1/09	Well could not be sampled					
QC-35	11/19/09	Well could not be sampled					
QC-36	1/15/09	Well could not be sampled					
QC-36	3/18/09	Well could not be sampled					
QC-36	5/7/09	Well could not be sampled					
QC-36	7/1/09	Well could not be sampled					

TABLE AIV-2 (Continued): 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER 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

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QC-36	9/3/09			Well could not be sampled			
QC-36	10/1/09			Well could not be sampled			
QC-37	1/15/09			Well could not be sampled			
QC-37	3/18/09			Well could not be sampled			
QC-37	7/1/09			Well could not be sampled			
QC-37	9/3/09			Well could not be sampled			
QC-37	10/1/09			Well could not be sampled			
QC-37	12/30/09	25	1,177	8.6	9.6	-133	<48

NA= Not available.

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

[2]Water level elevations are relative to Chicago City Datum.

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

[4]Water quality monitoring well QC-3 could not be sampled after March 5, 2009, because of construction impeding access.