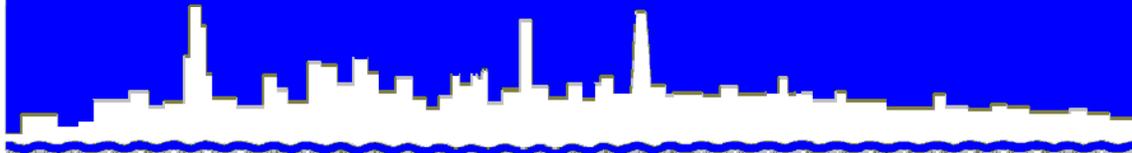


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 11-26

TUNNEL AND RESERVOIR PLAN

CALUMET TUNNEL SYSTEM

2010 ANNUAL GROUNDWATER MONITORING REPORT

May 2011

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Patricia Horton
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Debra Shore
Mariyana T. Spyropoulos

Metropolitan Water Reclamation District of Greater Chicago

100 East Erie Street Chicago, Illinois 60611-3154 f: 312.751.5194 312.751.5190

Thomas C. Granato, Ph.D.
Acting Director of Monitoring and Research
thomas.granato@mwr.org

May 26, 2011

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, 2010 Annual
Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Calumet Tunnel System, 2010
Annual Groundwater Monitoring Report."

Very truly yours,

Thomas C. Granato, Ph.D.
Acting Director
Monitoring and Research

TCG:DGM:lf

Enclosures

cc w/enc: Ms. Sally K. Swanson (USEPA Region V - WC15J) - (2)

Mr. Kits

Dr. O'Connor

Dr. Zhang

Mr. MacDonald

Library

cc w/o enc: Ms. Sharma

Mr. Cohen

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 (312) 751-5600

TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2010 ANNUAL GROUNDWATER MONITORING REPORT

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iii
INTRODUCTION	1
MONITORING DATA	2
SUMMARY OF DATA	3
Observation Well Water Level Elevation Data	3
Groundwater Quality Monitoring Well Data	3
APPENDICES	
Location Map of Groundwater Observation Wells OC-1 through OC-11 in the Calumet Tunnel System	AI
2010 Groundwater Level Elevation Data for Observation Wells OC-1 through OC-11 in the Calumet Tunnel System	AII
Location Map of Groundwater Quality Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 in the Calumet Tunnel System	AIII
2010 Groundwater Quality Data for Monitoring Wells QC-1, QC-2, QC- 2.1, QC-2.2, QC-4 through QC-7, and QC-9 through QC-37 in the Calumet Tunnel System	AIV

LIST OF TABLES

Table No		Page
1	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-2, QC-2.1, QC-2.2, QC-4, and QC-5	5
2	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-6 and QC-9 through QC-12	7
3	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-13 through QC-17	9
4	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-18 through QC-22	11
5	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-23 through QC-27	13
6	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-28 through QC-31	15
7	Summary Statistics of the 2010 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-34, QC-35, and QC-37	17
AII-1	2010 Groundwater Level Elevation Data for Observation Wells OC-1 through OC-11 in the Calumet Tunnel System	AII-1
AIV-1	2010 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-4 through QC-7, and QC-9 through QC-37 in the Calumet Tunnel System	AIV-1
AIV-2	2010 Hardness, Conductivity, pH, Temperature, Elevation, and Recharge Data for Water Quality Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, QC-4 through QC-7, and QC-9 through QC-37 in the Calumet Tunnel System	AIV-7

LIST OF FIGURES

<u>Figure No.</u>		<u>Page</u>
1	2010 Minimum, Mean, and Maximum Water Level Elevations for the Calumet Tunnel System Observation Wells	4
AI-1	Calumet Tunnel System Location Map of Groundwater Observation Wells	AI-1
AIII-3	Calumet Tunnel System Location Map of Groundwater Quality Monitoring Wells	AIII-1

INTRODUCTION

This report contains 2010 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 well QC-3, located along the tunnel between 140th Street and Indiana Avenue, is no longer being sampled because of construction being directed by the Village of South Holland. The District has been given permission by the Illinois Environmental Protection Agency (IEPA) to abandon the well (IEPA memorandum April 22, 2008).

Groundwater quality monitoring wells QC-1, QC-2, and QC-29 through QC-37 are sampled six times per year (IEPA memorandum July 9, 2004). Groundwater quality monitoring wells QC-2.1, QC-2.2, QC-4 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 2010 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 2010 water quality monitoring data for groundwater quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, QC-4 through QC-7, and QC-9 through QC-37 along the Calumet Tunnel System shown in Appendix AIII. Well QC-3 has been abandoned due to construction, and well QC-8.1 is a dry well.

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 well QC-1 could not be sampled in 2010 because the pump was inoperable. A work order has been issued to repair the pump. Groundwater quality well QC-2.1 could not be sampled on September 9, 2010, because a locked gate blocked access to the well. Groundwater quality monitoring well QC-7 could not be sampled in 2010 because the pump was inoperable. A work order is pending to repair the pump. Groundwater quality well QC-18 could not be sampled on March 4, 2010, because muddy conditions blocked access to the well. Groundwater quality well QC-21 could not be sampled on September 16, 2010, because of an electrical failure with the pump. Groundwater quality well QC-30 could not be sampled on January 28, 2010, because there was insufficient water in the well to collect a sample. Groundwater quality monitoring wells QC-32 and QC-33 could not be sampled in 2010 because there was insufficient water in these wells to collect a sample. Groundwater quality monitoring wells QC-34 and QC-35 could not be sampled on February 24, 2010, April 29, 2010, June 17, 2010, October 14, 2010, and December 2, 2010, because there was insufficient water in these wells to collect a sample. Groundwater quality well QC-36 could not be sampled in 2010 because there was insufficient water in the well to collect a sample. Groundwater quality monitoring well QC-37 could not be sampled on April 29, 2010, June 17, 2010, August 26, 2010, October 14, 2010, and December 2, 2010, 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 2010 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 2010. Table AII-1 in Appendix AII contains the entire groundwater level elevation data for 2010 for all the observation wells in the Calumet Tunnel System.

Groundwater Quality Monitoring Well Data

Tables 1 through 7 contain summary statistics of the water quality parameters for 2010 for groundwater quality monitoring wells QC-2, QC-2.1, QC-2.2, QC-4 through QC-6, QC-9 through QC-31, QC-34, QC-35, and QC-37 in the Calumet Tunnel System. The summary statistics include minimum, mean, maximum, standard deviation (Stdv.), median and coefficient of variation (COV) for eight of the nine water quality parameters analyzed during 2010. 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. The statistical analysis of the data was conducted using Microsoft[®] Excel functions.

FIGURE 1: 2010 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE CALUMET TUNNEL SYSTEM OBSERVATION WELLS

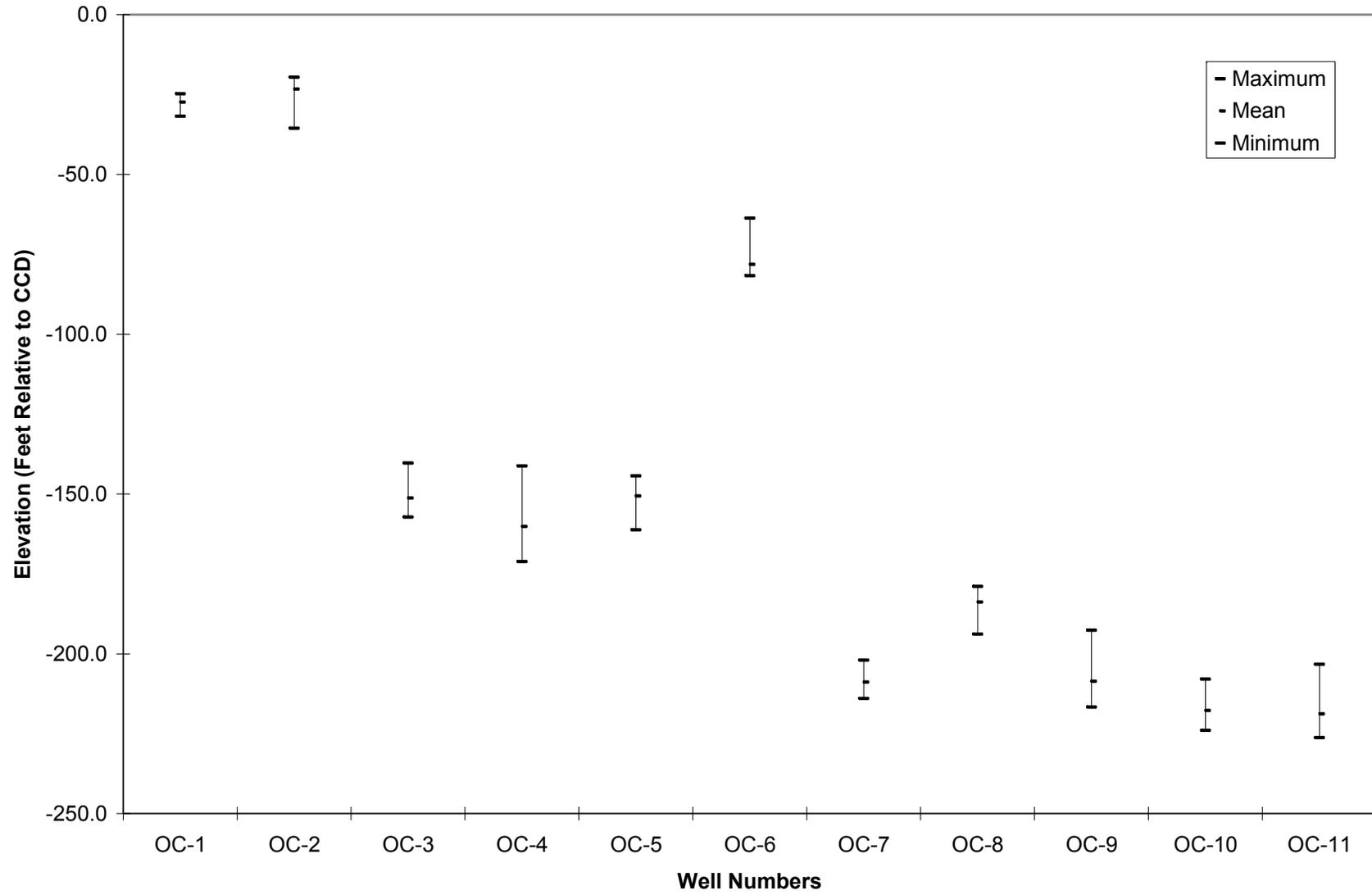


TABLE 1: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-2, QC-2.1, QC-2.2, QC-4, AND QC-5

Parameter ¹		Well Number				
		QC-2	QC-2.1	QC-2.2	QC-4	QC-5
Cl mg/L	Minimum	15	33	13	15	15
	Mean	30	33	14	15	23
	Maximum	39	33	15	15	28
	Stdv.	12	0	1	0	7
	Median	37	33	15	15	27
	COV	39	0	8	0	31
FC cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	25	1	2	1	1
	Maximum	2,400	1	4	1	1
	Median	26	1	1	1	1
SO ₄ mg/L	Minimum	22.9	2.0	27.7	8.8	3.4
	Mean	28.3	2.0	29.4	9.7	4.6
	Maximum	33.0	2.0	30.5	10.8	6.4
	Stdv.	4.7	0.0	1.5	1.0	1.6
	Median	28.9	2.0	29.9	9.6	4.1
	COV	16.5	0.0	5.1	10.2	33.7
NH ₃ -N mg/L	Minimum	0.40	0.67	0.20	0.13	0.14
	Mean	0.51	0.72	0.26	0.15	0.15
	Maximum	0.64	0.77	0.34	0.17	0.15
	Stdv.	0.10	0.07	0.07	0.02	0.01
	Median	0.48	0.72	0.25	0.15	0.15
	COV	19.08	9.82	26.94	13.33	3.94
TOC mg/L	Minimum	1.50	1.20	1.30	1.00	1.00
	Mean	1.62	1.30	1.40	1.00	1.17
	Maximum	1.70	1.40	1.50	1.00	1.30
	Stdv.	0.08	0.14	0.10	0.00	0.15
	Median	1.60	1.30	1.40	1.00	1.20
	COV	4.66	10.88	7.14	0.00	13.09

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-2, QC-2.1, QC-2.2, QC-4, AND QC-5

Parameter ¹		Well Number				
		QC-2	QC-2.1	QC-2.2	QC-4	QC-5
TDS mg/L	Minimum	346	458	172	436	562
	Mean	366	488	287	439	569
	Maximum	396	518	346	446	578
	Stdv.	18	42	100	6	8
	Median	364	488	344	436	566
	COV	5	9	35	1	1
Hard. mg/L	Minimum	83	59	45	10	9
	Mean	99	62	47	12	11
	Maximum	143	64	49	13	13
	Stdv.	22	4	2	2	2
	Median	92	62	47	12	10
	COV	22	6	4	13	20
Cond. µmhos/cm	Minimum	363	488	375	498	526
	Mean	424	564	391	581	640
	Maximum	537	641	418	655	765
	Stdv.	59	108	23	79	120
	Median	409	564	380	591	628
	COV	14	19	6	14	19
pH Unit	Minimum	7.1	7.4	7.6	8.7	7.7
	Mean	7.6	7.5	7.8	8.8	8.4
	Maximum	8.1	7.6	8.1	8.9	8.7
	Stdv.	0.4	0.2	0.3	0.1	0.6
	Median	7.8	7.5	7.8	8.9	8.7
	COV	5.4	2.6	3.2	1.2	7.5

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

TABLE 2: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-6 AND QC-9 THROUGH QC-12

Parameter ¹		Well Number				
		QC-6	QC-9	QC-10	QC-11	QC-12
Cl mg/L	Minimum	15	15	29	21	37
	Mean	15	15	30	23	39
	Maximum	15	15	30	27	42
	Stdv.	0	0	1	3	3
	Median	15	15	30	22	38
	COV	0	0	2	14	7
FC cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	3	1	1	1
	Maximum	1	20	1	1	1
	Median	1	1	1	1	1
SO ₄ mg/L	Minimum	4.3	28.1	2.0	2.0	302.9
	Mean	6.9	32.6	2.8	2.0	317.7
	Maximum	11.7	37.1	4.5	2.0	344.8
	Stdv.	4.1	4.5	1.4	0.0	23.6
	Median	4.7	32.5	2.0	2.0	305.3
	COV	60.0	13.9	50.2	0.0	7.4
NH ₃ -N mg/L	Minimum	0.33	0.35	0.10	0.12	0.24
	Mean	0.34	0.45	0.10	0.13	0.30
	Maximum	0.34	0.54	0.11	0.14	0.34
	Stdv.	0.01	0.10	0.01	0.01	0.05
	Median	0.34	0.46	0.10	0.14	0.32
	COV	1.71	21.20	5.59	8.66	17.64
TOC mg/L	Minimum	1.40	1.10	1.00	1.00	1.00
	Mean	1.53	1.23	1.00	1.00	1.00
	Maximum	1.80	1.50	1.00	1.00	1.00
	Stdv.	0.23	0.23	0.00	0.00	0.00
	Median	1.40	1.10	1.00	1.00	1.00
	COV	15.06	18.72	0.00	0.00	0.00

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-6 AND QC-9 THROUGH QC-12

Parameter ¹		Well Number				
		QC-6	QC-9	QC-10	QC-11	QC-12
TDS mg/L	Minimum	458	284	362	284	930
	Mean	460	301	379	308	946
	Maximum	464	314	390	344	978
	Stdv.	3	16	15	32	28
	Median	458	306	384	296	930
	COV	1	5	4	10	3
Hard. mg/L	Minimum	17	59	11	21	185
	Mean	17	61	12	21	196
	Maximum	18	63	12	22	218
	Stdv.	1	2	1	1	19
	Median	17	61	12	21	185
	COV	3	3	5	3	10
Cond. µmhos/cm	Minimum	466	317	420	315	720
	Mean	514	353	463	380	842
	Maximum	600	407	502	469	989
	Stdv.	75	47	41	80	136
	Median	476	336	468	356	818
	COV	15	13	9	21	16
pH Unit	Minimum	7.6	7.8	8.0	7.3	7.7
	Mean	8.3	8.0	8.4	8.0	7.7
	Maximum	8.8	8.3	8.6	8.4	7.8
	Stdv.	0.6	0.3	0.4	0.6	0.1
	Median	8.7	8.1	8.6	8.2	7.7
	COV	7.5	3.4	4.3	7.6	0.7

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

TABLE 3: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-13 THROUGH QC-17

Parameter ¹		Well Number				
		QC-13	QC-14	QC-15	QC-16	QC-17
Cl mg/L	Minimum	51	113	15	22	15
	Mean	53	120	15	23	16
	Maximum	54	125	16	24	17
	Stdv.	2	6	1	1	1
	Median	53	121	15	23	15
	COV	3	5	4	4	7
FC cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	3
	Maximum	1	1	1	1	20
	Median	1	1	1	1	1
SO ₄ mg/L	Minimum	39.9	2.0	2.0	59.3	179.2
	Mean	40.6	2.0	2.0	61.6	181.1
	Maximum	41.5	2.0	2.0	64.5	183.2
	Stdv.	0.9	0.0	0.0	2.7	2.0
	Median	40.3	2.0	2.0	61.0	180.9
	COV	2.1	0.0	0.0	4.3	1.1
NH ₃ -N mg/L	Minimum	0.16	0.27	0.21	0.02	0.24
	Mean	0.17	0.27	0.23	0.05	0.27
	Maximum	0.19	0.27	0.24	0.08	0.31
	Stdv.	0.02	0.00	0.02	0.03	0.04
	Median	0.17	0.27	0.23	0.06	0.27
	COV	8.81	0.00	6.74	57.28	12.85
TOC mg/L	Minimum	1.00	2.60	1.00	1.00	1.00
	Mean	1.00	3.07	1.10	1.00	1.00
	Maximum	1.00	3.70	1.30	1.00	1.00
	Stdv.	0.00	0.57	0.17	0.00	0.00
	Median	1.00	2.90	1.00	1.00	1.00
	COV	0.00	18.54	15.75	0.00	0.00

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-13 THROUGH QC-17

Parameter ¹		Well Number				
		QC-13	QC-14	QC-15	QC-16	QC-17
TDS mg/L	Minimum	430	672	306	500	546
	Mean	448	697	323	504	611
	Maximum	476	734	356	510	734
	Stdv.	25	33	28	5	107
	Median	438	684	308	502	552
	COV	5	5	9	1	17
Hard. mg/L	Minimum	36	131	15	83	147
	Mean	38	137	18	85	171
	Maximum	40	147	23	87	186
	Stdv.	2	9	4	2	21
	Median	37	132	16	85	180
	COV	6	7	24	2	12
Cond. µmhos/cm	Minimum	388	510	249	474	486
	Mean	455	657	347	568	520
	Maximum	521	880	413	701	560
	Stdv.	67	196	87	118	37
	Median	456	580	380	530	515
	COV	15	30	25	21	7
pH Unit	Minimum	7.2	7.0	7.0	7.5	7.6
	Mean	7.6	7.3	8.0	7.9	7.9
	Maximum	8.2	7.5	8.5	8.1	8.1
	Stdv.	0.5	0.2	0.8	0.4	0.3
	Median	7.6	7.4	8.5	8.1	7.9
	COV	6.6	3.4	10.6	4.5	3.4

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

TABLE 4: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-18 THROUGH QC-22

Parameter ¹		Well Number				
		QC-18	QC-19	QC-20	QC-21	QC-22
Cl mg/L	Minimum	15	15	18	18	14
	Mean	15	15	20	18	15
	Maximum	15	15	21	18	15
	Stdv.	0	0	2	0	1
	Median	15	15	20	18	15
	COV	0	0	11	0	4
FC cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Median	1	1	1	1	1
SO ₄ mg/L	Minimum	30.7	151.5	2.8	4.1	2.0
	Mean	36.8	155.4	12.6	4.2	2.0
	Maximum	43.0	161.8	22.4	4.3	2.1
	Stdv.	8.7	5.6	13.8	0.1	0.0
	Median	36.8	153.0	12.6	4.2	2.0
	COV	23.6	3.6	109.6	2.9	1.7
NH ₃ -N mg/L	Minimum	0.12	0.27	0.15	0.05	0.22
	Mean	0.12	0.30	0.16	0.07	0.25
	Maximum	0.12	0.32	0.16	0.09	0.29
	Stdv.	0.00	0.03	0.16	0.03	0.04
	Median	0.12	0.30	0.16	0.07	0.23
	COV	0.00	8.48	100.00	40.41	15.35
TOC mg/L	Minimum	1.00	1.00	1.00	2.60	1.40
	Mean	1.00	1.03	1.00	2.85	1.60
	Maximum	1.00	1.10	1.00	3.10	1.80
	Stdv.	0.00	0.06	0.00	0.35	0.20
	Median	1.00	1.00	1.00	2.85	1.60
	COV	0.00	5.59	0.00	12.41	12.50

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-18 THROUGH QC-22

Parameter ¹		Well Number				
		QC-18	QC-19	QC-20	QC-21	QC-22
TDS mg/L	Minimum	394	438	278	330	236
	Mean	403	461	295	333	257
	Maximum	412	474	312	336	294
	Stdv.	13	20	18	4	32
	Median	403	472	295	333	240
	COV	3	4	6	1	13
Hard. mg/L	Minimum	8	107	23	36	19
	Mean	26	111	29	37	29
	Maximum	43	115	34	37	34
	Stdv.	25	4	6	1	8
	Median	26	112	29	37	33
	COV	97	4	19	2	29
Cond. µmhos/cm	Minimum	425	405	283	404	315
	Mean	428	432	301	414	337
	Maximum	431	457	319	423	376
	Stdv.	4	26	20	13	34
	Median	428	433	301	414	320
	COV	1	6	7	3	10
pH Unit	Minimum	8.9	7.8	7.6	7.7	7.7
	Mean	9.0	8.2	8.0	7.8	7.8
	Maximum	9.1	8.5	8.5	8.0	7.9
	Stdv.	0.1	0.3	0.5	0.2	0.1
	Median	9.0	8.2	8.0	7.8	7.7
	COV	1.0	4.2	5.8	3.2	1.4

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

TABLE 5: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-23 THROUGH QC-27

Parameter ¹		Well Number				
		QC-23	QC-24	QC-25	QC-26	QC-27
Cl mg/L	Minimum	20	26	13	12	15
	Mean	20	26	14	14	24
	Maximum	21	27	15	15	29
	Stdv.	1	1	1	2	8
	Median	20	26	15	15	28
	COV	3	2	8	12	33
FC cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Median	1	1	1	1	1
SO ₄ mg/L	Minimum	2.0	2.0	3.0	2.0	2.0
	Mean	2.0	2.2	4.0	2.0	2.0
	Maximum	2.1	2.5	6.2	2.0	2.0
	Stdv.	0.0	0.3	1.9	0.0	0.0
	Median	2.0	2.0	3.0	2.0	2.0
	COV	1.7	14.3	46.1	0.0	0.0
NH ₃ -N mg/L	Minimum	0.07	0.13	0.13	0.07	0.15
	Mean	0.09	0.14	0.13	0.08	0.16
	Maximum	0.10	0.16	0.14	0.09	0.16
	Stdv.	0.02	0.02	0.01	0.01	0.01
	Median	0.09	0.14	0.13	0.08	0.16
	COV	17.63	10.66	4.33	12.50	3.69
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
	Stdv.	0.00	0.00	0.00	0.00	0.00
	Median	1.00	1.00	1.00	1.00	1.00
	COV	0.00	0.00	0.00	0.00	0.00

TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-23 THROUGH QC-27

Parameter ¹		Well Number				
		QC-23	QC-24	QC-25	QC-26	QC-27
TDS mg/L	Minimum	318	230	192	248	216
	Mean	330	241	203	271	227
	Maximum	354	258	214	300	236
	Stdv.	21	15	11	27	10
	Median	318	234	204	264	228
	COV	6	6	5	10	4
Hard. mg/L	Minimum	6	14	19	6	25
	Mean	7	14	22	7	26
	Maximum	8	14	25	8	26
	Stdv.	1	0	3	1	1
	Median	7	14	23	6	26
	COV	14	0	14	17	2
Cond. µmhos/cm	Minimum	370	270	239	285	290
	Mean	382	296	267	317	304
	Maximum	399	315	282	347	318
	Stdv.	15	23	24	31	14
	Median	379	302	279	318	304
	COV	4	8	9	10	5
pH Unit	Minimum	7.6	8.6	8.3	8.3	8.5
	Mean	8.6	8.7	8.5	8.6	8.5
	Maximum	9.2	8.7	8.7	9.1	8.6
	Stdv.	0.9	0.1	0.2	0.4	0.1
	Median	9.0	8.7	8.6	8.6	8.5
	COV	10.3	0.8	2.0	4.5	0.7

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

TABLE 6: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-28 THROUGH QC-31

Parameter ¹		QC-28	QC-29	QC-30	QC-31
Cl mg/L	Minimum	10	162	15	10
	Mean	13	178	15	15
	Maximum	15	190	15	16
	Stdv.	3	10	0	2
	Median	15	176	15	15
	COV	22	6	0	16
	FC cfu/100 mL	Minimum	1	1	1
Geo. Mean		1	1	1	1
Maximum		1	1	1	1
Median		1	1	1	1
SO ₄ mg/L	Minimum	2.2	146.1	67.4	177.6
	Mean	2.7	155.8	73.0	182.1
	Maximum	3.4	164.5	77.8	186.1
	Stdv.	0.7	7.1	4.1	3.7
	Median	2.4	155.5	73.4	182.4
	COV	25.0	4.6	5.7	2.0
NH ₃ -N mg/L	Minimum	0.05	0.65	0.28	1.03
	Mean	0.06	0.70	0.33	1.05
	Maximum	0.07	0.75	0.44	1.07
	Stdv.	0.01	0.03	0.08	0.02
	Median	0.06	0.71	0.28	1.06
	COV	16.67	4.78	22.76	1.59
TOC mg/L	Minimum	1.00	1.00	1.00	1.00
	Mean	1.87	1.28	1.02	1.08
	Maximum	3.40	1.40	1.10	1.20
	Stdv.	1.33	0.16	0.04	0.08
	Median	1.20	1.35	1.00	1.10
	COV	71.34	12.48	4.38	6.95

TABLE 6 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-28 THROUGH QC-31

Parameter ¹		QC-28	QC-29	QC-30	QC-31
TDS mg/L	Minimum	228	804	372	552
	Mean	255	872	407	570
	Maximum	270	968	482	590
	Stdv.	24	54	44	16
	Median	268	859	386	572
	COV	9	6	11	3
	Hard. mg/L	Minimum	17	323	54
Mean		18	353	58	234
Maximum		19	383	64	248
Stdv.		1	20	4	8
Median		19	353	55	231
COV		6	6	8	3
Cond. µmhos/cm		Minimum	280	400	366
	Mean	316	726	381	478
	Maximum	336	870	415	532
	Stdv.	31	172	20	32
	Median	333	782	376	474
	COV	10	24	5	7
	pH Unit	Minimum	7.9	7.2	7.5
Mean		8.4	7.4	8.1	7.5
Maximum		8.9	7.6	8.4	7.8
Stdv.		0.1	0.2	0.4	0.4
Median		8.5	7.3	8.3	7.6
COV		0.7	2.3	4.3	5.0

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

TABLE 7: SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-34, QC-35, AND QC-37

Parameter ¹		Well Number		
		QC-34	QC-35	QC-37
Cl mg/L	Minimum	17	31	26
	Mean	17	31	26
	Maximum	17	31	26
	Stdv.	N/C ²	N/C	N/C
	Median	17	31	26
	COV	N/C	N/C	N/C
FC cfu/100 mL	Minimum	1	1	1
	Geo. Mean	1	1	1
	Maximum	1	1	1
	Median	1	1	1
SO ₄ mg/L	Minimum	111.0	137.9	93.8
	Mean	111.0	137.9	93.8
	Maximum	111.0	137.9	93.8
	Stdv.	N/C	N/C	N/C
	Median	111.0	137.9	93.8
	COV	N/C	N/C	N/C
NH ₃ -N mg/L	Minimum	0.02	0.02	0.09
	Mean	0.02	0.02	0.09
	Maximum	0.02	0.02	0.09
	Stdv.	N/C	N/C	N/C
	Median	0.02	0.02	0.09
	COV	N/C	N/C	N/C
TOC mg/L	Minimum	1.50	1.20	1.70
	Mean	1.50	1.20	1.70
	Maximum	1.50	1.20	1.70
	Stdv.	N/C	N/C	N/C
	Median	1.50	1.20	1.70
	COV	N/C	N/C	N/C

TABLE 7 (Continued): SUMMARY STATISTICS OF THE 2010 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-34, QC-35, AND QC-37

Parameter ¹		Well Number		
		QC-34	QC-35	QC-37
TDS mg/L	Minimum	804	1,090	1,010
	Mean	804	1,090	1,010
	Maximum	804	1,090	1,010
	Stdv.	N/C	N/C	N/C
	Median	804	1,090	1,010
	COV	N/C	N/C	N/C
Hard. mg/L	Minimum	19	22	--- ³
	Mean	19	22	---
	Maximum	19	22	---
	Stdv.	N/C	N/C	---
	Median	19	22	---
	COV	N/C	N/C	---
Cond. µmhos/cm	Minimum	678	1,097	952
	Mean	678	1,097	952
	Maximum	678	1,097	952
	Stdv.	N/C	N/C	N/C
	Median	678	1,097	952
	COV	N/C	N/C	N/C
pH Unit	Minimum	8.5	8.0	8.3
	Mean	8.5	8.0	8.3
	Maximum	8.5	8.0	8.3
	Stdv.	N/C	N/C	N/C
	Median	8.5	8.0	8.3
	COV	N/C	N/C	N/C

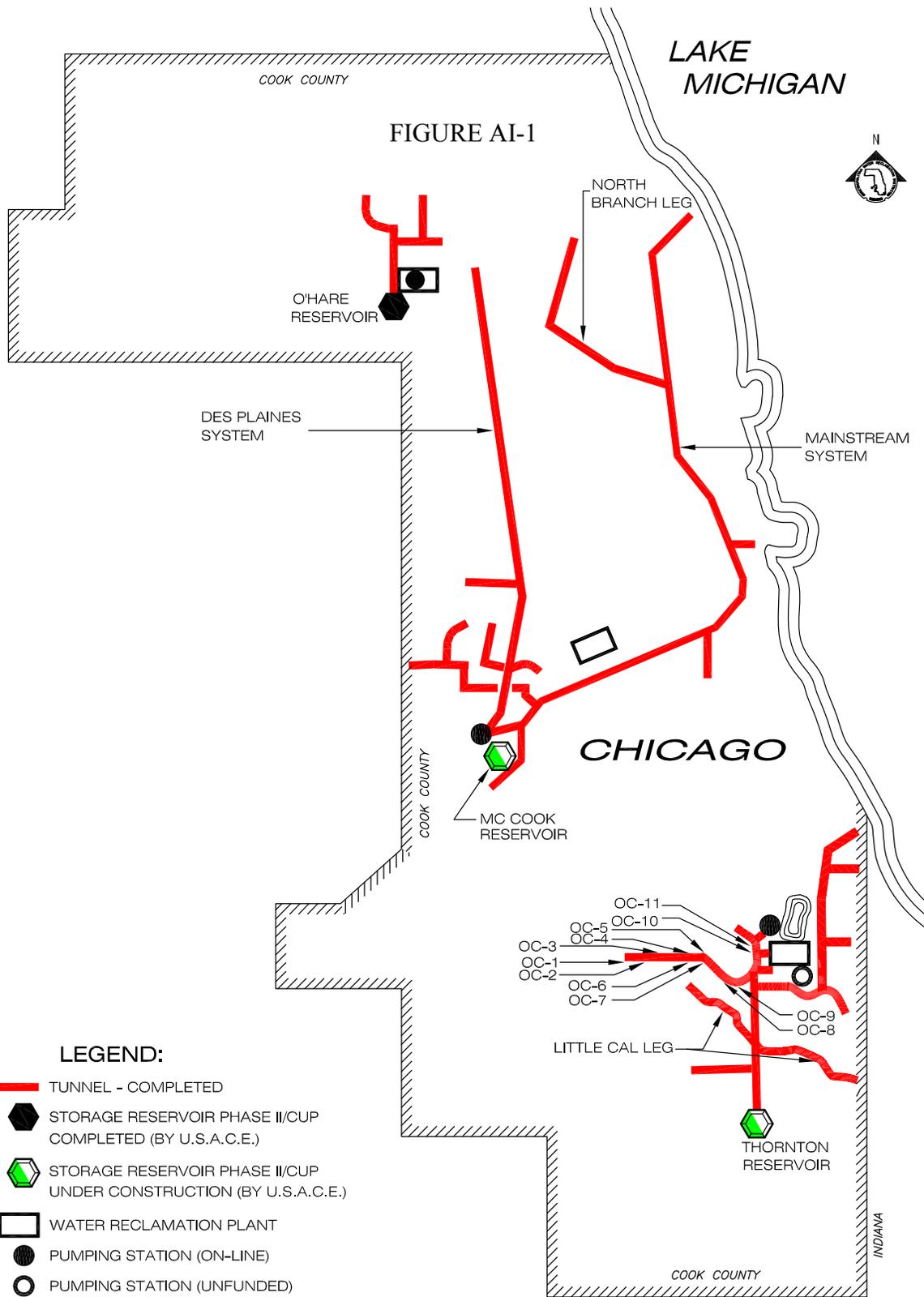
¹For purpose of statistical evaluation, any value less than the appropriate limit of quantification (LOQ) was set equal to the value of the LOQ.

²N/C stands for no calculation due to single value.

³There was not enough sample to perform the analysis.

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

2010 GROUNDWATER LEVEL ELEVATION DATA
FOR OBSERVATION WELLS OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM

TABLE AII-1: 2010 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

	Observation Wells					
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6
1/8/10	**	-22.6	-145.3	-165.2	**	-81.7
1/22/10	-26.8	-23.6	-153.3	-167.2	-150.3	-80.7
1/29/10	-26.8	-22.6	-143.3	-154.2	-151.3	-79.7
2/5/10	-27.8	-23.6	-155.3	-166.2	-151.3	-80.7
2/19/10	-27.8	-23.6	-151.3	-152.2	-153.3	-81.7
2/26/10	-26.8	-23.6	-151.3	-154.2	-153.3	-79.7
3/5/10	-26.8	-21.6	-151.3	-151.2	-152.3	-79.7
3/19/10	-26.8	**	-156.3	-167.2	**	-76.7
3/26/10	-27.8	-23.6	-156.3	-168.2	-151.3	-81.7
4/16/10	-26.8	-21.6	-155.3	-166.2	-152.3	-78.7
4/23/10	-27.8	-25.6	-156.3	-167.2	-152.3	-81.7
4/30/10	-25.8	-21.6	-155.3	-166.2	-151.3	-79.7
5/7/10	-27.8	-23.6	-149.3	-156.2	-161.3	-79.7
5/21/10	-26.8	-23.6	-156.3	-168.2	-152.3	-80.7
5/28/10	-29.8	-19.6	-156.3	-166.2	-152.3	-63.7
6/18/10	-27.8	-23.6	-149.3	-156.2	-151.3	-79.7
6/25/10	-29.8	-22.6	-148.3	-171.2	-149.3	-78.7
7/2/10	-26.8	-23.6	-156.3	-168.2	-149.3	-69.7
7/23/10	-27.8	-23.6	-144.3	-149.2	-145.3	-73.7
8/13/10	-26.8	-23.6	-157.3	-170.2	-151.3	-72.7
8/20/10	-25.8	-21.6	-143.3	-151.2	-147.3	-77.7
9/3/10	-25.8	-24.6	-156.3	-169.2	-150.3	-81.7
9/10/10	-30.8	-35.6	-154.3	***	-149.3	-79.7
9/24/10	-25.8	-23.6	-146.3	-148.2	-150.3	-79.7
10/1/10	-25.8	-21.6	-145.3	-149.2	-150.3	-79.7
10/15/10	-31.8	-22.6	-156.3	-165.2	-150.3	-67.7
10/29/10	-24.8	-21.6	-153.3	-160.2	-149.3	-77.7
11/5/10	-26.8	-22.6	-150.3	-157.2	-147.3	-78.7
11/12/10	-31.8	-22.6	-154.3	-166.2	-150.3	-80.7
12/3/10	-26.8	-21.6	-143.3	-146.2	-147.3	-77.7
12/17/10	-25.8	-22.6	-140.3	-141.2	-144.3	-81.7
Minimum	-31.8	-35.6	-157.3	-171.2	-161.3	-81.7
Mean	-27.4	-23.3	-151.3	-160.2	-150.6	-78.2
Maximum	-24.8	-19.6	-140.3	-141.2	-144.3	-63.7

TABLE AII-1 (Continued): 2010 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

	Observation Wells				
	OC-7	OC-8	OC-9	OC-10	OC-11
1/8/10	**	**	-208.7	-208.0	-213.3
1/22/10	**	**	-214.7	-219.0	-221.3
1/29/10	-208.0	-187.9	-208.7	-218.0	-226.3
2/5/10	**	**	-215.7	-220.0	-221.3
2/19/10	**	**	-199.7	-218.0	-225.3
2/26/10	**	**	-199.7	-217.0	-221.3
3/5/10	**	**	-197.7	-222.0	-215.3
3/19/10	-212.0	-180.9	-216.7	-218.0	-222.3
3/26/10	-214.0	-184.9	-214.7	-220.0	-224.3
4/16/10	-210.0	-182.9	-212.7	-221.0	-222.3
4/23/10	-211.0	-183.9	-216.7	-223.0	-224.3
4/30/10	-211.0	-182.9	-214.7	-221.0	-223.3
5/7/10	-213.0	-187.9	-199.7	-219.0	-225.3
5/21/10	-213.0	-184.9	-215.7	-224.0	-223.3
5/28/10	-213.0	-183.9	-215.7	-224.0	-221.3
6/18/10	-212.0	-181.9	-199.7	-219.0	-220.3
6/25/10	-214.0	-186.9	-212.7	-220.0	-225.3
7/2/10	-204.0	****	-210.7	-210.0	-218.3
7/23/10	-207.0	-178.9	-192.7	-212.0	-216.3
8/13/10	-207.0	-184.9	-211.7	-212.0	-219.3
8/20/10	-208.0	-179.9	-201.7	-216.0	-215.3
9/3/10	-214.0	-183.9	-216.7	-224.0	-222.3
9/10/10	-202.0	-182.9	-212.7	-215.0	-216.3
9/24/10	-202.0	-179.9	-207.7	-213.0	-208.3
10/1/10	-211.0	-185.9	-198.7	-213.0	-208.3
10/15/10	-206.0	-181.9	-213.7	-218.0	-219.3
10/29/10	-206.0	-179.9	-210.7	-217.0	-220.3
11/5/10	-204.0	-181.9	-206.7	-220.0	-216.3
11/12/10	-206.0	-181.9	-213.7	-219.0	-220.3
12/3/10	-209.0	-187.9	-200.7	-215.0	-205.3
12/17/10	-205.0	-193.9	-204.7	-217.0	-203.3
Minimum	-214.0	-193.9	-216.7	-224.0	-226.3
Mean	-208.9	-183.9	-208.6	-217.8	-218.9
Maximum	-202.0	-178.9	-192.7	-208.0	-203.3

*Relative to Chicago City Datum.

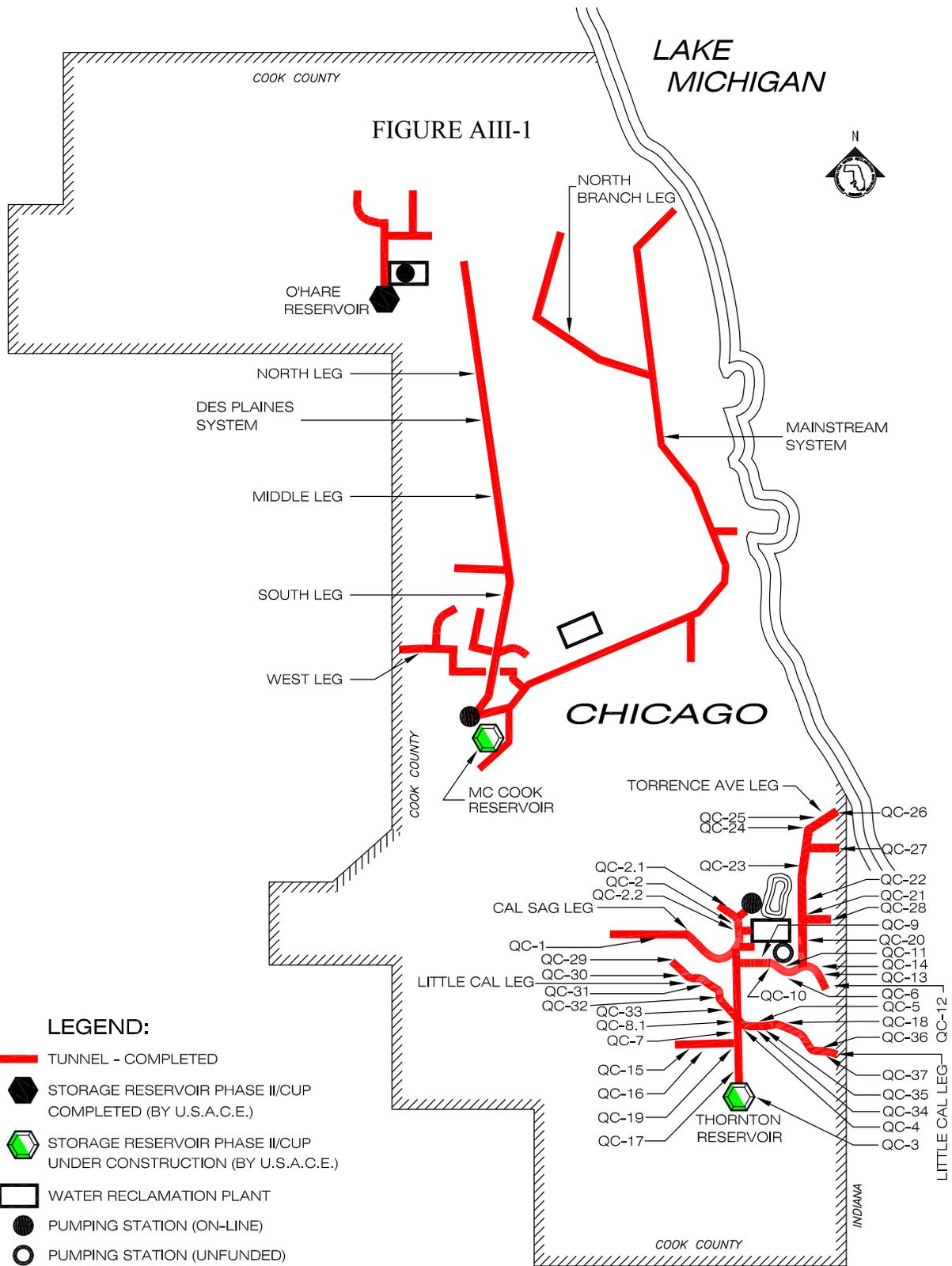
**Unable to sample wells because snow was blocking access.

***Debris blocking access to well.

****No access, area flooded.

APPENDIX AIII

LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3 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

2010 GROUNDWATER QUALITY DATA FOR MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-4 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

TABLE AIV-1: 2010 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-4 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	1/7/10						
QC-1	3/17/10						
QC-1	6/3/10						
QC-1	8/1/10						
QC-1	9/1/10						
QC-1	12/1/10						
QC-2	1/7/10	37	48	31.1	0.44	1.6	346
QC-2	3/17/10	<15	570	22.9	0.49	1.7	374
QC-2	6/3/10	39	2,400	23.1	0.64	1.6	396
QC-2	9/9/10	38	4	33.0	0.61	1.5	366
QC-2	10/20/10	37	<1	32.9	0.40	1.6	362
QC-2	12/16/10	34	<1	26.8	0.46	1.7	350
QC-2.1	9/9/10						
QC-2.1	10/20/10	33	<1	<2.0	0.77	1.4	518
QC-2.1	12/16/10	33	<1	<2.0	0.67	1.2	518
QC-2.2	1/7/10	13	<1	29.9	0.34	1.3	344
QC-2.2	3/17/10	<15	4	27.7	0.25	1.4	346
QC-2.2	9/9/10	<15	1	30.5	0.20	1.5	172
QC-4	2/4/10	<15	<1	10.8	0.13	<1.0	436
QC-4	5/6/10	<15	<1	9.6	0.15	<1.0	436
QC-4	10/20/10	<15	<1	8.8	0.17	<1.0	446
QC-5	2/4/10	<15	<1	3.4	0.15	<1.0	562
QC-5	5/6/10	27	<1	4.1	0.15	1.3	578
QC-5	12/16/10	28	<1	6.4	0.14	1.2	566
QC-6	2/4/10	<15	<1	4.7	0.33	1.4	464
QC-6	5/6/10	<15	<1	4.3	0.34	1.8	458
QC-6	12/16/10	<15	<1	11.7	0.34	1.4	458

TABLE AIV-1 (Continued): 2010 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-4 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-7	2/4/10						
QC-7	5/6/10						
QC-7	12/16/10						
							Well could not be sampled
							Well could not be sampled
							Well could not be sampled
QC-9	2/4/10	<15	<1	28.1	0.54	1.1	306
QC-9	5/6/10	<15	20	32.5	0.35	1.5	314
QC-9	12/16/10	<15	<1	37.1	0.46	1.1	284
QC-10	1/6/10	30	<1	4.5	0.11	<1.0	390
QC-10	3/16/10	30	<1	<2.0	0.10	<1.0	384
QC-10	9/29/10	29	<1	<2.0	0.10	<1.0	362
QC-11	1/6/10	21	<1	<2.0	0.14	<1.0	284
QC-11	3/16/10	27	<1	<2.0	0.12	<1.0	344
QC-11	9/29/10	22	<1	<2.0	0.14	<1.0	296
QC-12	1/21/10	42	<1	302.9	0.24	<1.0	930
QC-12	3/9/10	38	<1	344.8	0.34	<1.0	978
QC-12	7/7/10	37	<1	305.3	0.32	<1.0	874
QC-13	3/9/10	51	<1	39.9	0.19	1.0	438
QC-13	7/7/10	54	<1	41.5	0.17	<1.0	476
QC-13	9/29/10	53	<1	40.3	0.16	<1.0	430
QC-14	2/4/10	113	<1	<2.0	0.27	2.6	672
QC-14	5/6/10	125	<1	<2.0	0.27	3.7	734
QC-14	12/2/10	121	<1	2.0	0.27	2.9	684
QC-15	2/4/10	<15	<1	<2.0	0.21	<1.0	308
QC-15	5/6/10	<15	<1	<2.0	0.23	1.3	306
QC-15	12/2/10	16	<1	<2.0	0.24	<1.0	356
QC-16	2/4/10	24	<1	61.0	<0.02	1.0	500
QC-16	6/3/10	23	<1	59.3	0.06	<1.0	510
QC-16	12/2/10	22	<1	64.5	0.08	<1.0	502

TABLE AIV-1 (Continued): 2010 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-4 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-17	2/4/10	<15	<1	180.9	0.27	<1.0	546
QC-17	6/3/10	17	20	179.2	0.31	<1.0	552
QC-17	12/2/10	<15	<1	183.2	0.24	<1.0	514
QC-18	3/4/10			Well could not be sampled			
QC-18	6/3/10	<15	<1	43.0	0.12	<1.0	412
QC-18	9/16/10	<15	<1	30.7	0.12	<1.0	394
QC-19	3/4/10	<15	<1	151.5	0.30	<1.0	438
QC-19	6/3/10	<15	<1	153.0	0.32	<1.0	474
QC-19	9/16/10	<15	<1	161.8	0.27	1.1	472
QC-20	6/3/10	18	1	2.2	0.14	<1.0	304
QC-20	9/16/10	18	<1	22.4	0.16	<1.0	312
QC-20	11/18/10	21	<1	2.8	0.15	<1.0	278
QC-21	1/7/10	18	<1	4.1	0.09	2.6	330
QC-21	3/4/10	18	<1	4.3	0.05	3.1	336
QC-21	9/16/10			Well could not be sampled			
QC-22	1/7/10	14	<1	2.1	0.23	1.6	236
QC-22	3/4/10	<15	<1	2.0	0.22	1.4	240
QC-22	9/16/10	15	<1	<2.0	0.29	1.8	294
QC-23	1/7/10	20	<1	<2.0	0.10	<1.0	318
QC-23	3/4/10	21	<1	<2.0	0.07	<1.0	318
QC-23	9/16/10	20	<1	2.1	0.09	<1.0	354
QC-24	1/14/10	26	<1	2.5	0.14	<1.0	234
QC-24	3/4/10	26	<1	<2.0	0.16	<1.0	230
QC-24	9/16/10	27	<1	<2.0	0.13	<1.0	258
QC-25	1/14/10	13	<1	3.0	0.13	<1.0	214
QC-25	3/4/10	<15	<1	3.0	0.14	<1.0	204
QC-25	9/23/10	<15	<1	6.2	0.13	<1.0	192

TABLE AIV-1 (Continued): 2010 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-4 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-26	1/14/10	12	<1	<2.0	0.09	<1.0	264
QC-26	3/4/10	<15	<1	<2.0	0.07	<1.0	300
QC-26	9/23/10	<15	<1	<2.0	0.08	<1.0	248
QC-27	1/14/10	28	<1	<2.0	0.16	<1.0	228
QC-27	3/4/10	29	<1	<2.0	0.16	<1.0	236
QC-27	9/23/10	<15	<1	<2.0	0.15	<1.0	216
QC-28	1/28/10	<10	<1	2.2	0.07	3.4	268
QC-28	3/10/10	<15	<1	2.4	0.06	1.2	270
QC-28	9/23/10	<15	<1	3.4	0.05	<1.0	228
QC-29	1/28/10	190	<1	162.3	0.71	1.4	884
QC-29	3/10/10	178	<1	151.1	0.65	1.4	860
QC-29	4/22/10	173	<1	152.5	0.70	1.3	858
QC-29	6/17/10	174	<1	158.6	0.71	1.2	968
QC-29	9/23/10	162	<1	146.1	0.68	1.0	804
QC-29	11/18/10	188	<1	164.5	0.75	1.4	856
QC-30	1/28/10			Well could not be sampled			
QC-30	3/10/10	<15	<1	67.4	0.28	1.1	372
QC-30	4/22/10	<15	<1	70.6	0.28	<1.0	410
QC-30	6/17/10	<15	<1	73.4	0.28	<1.0	482
QC-30	9/23/10	<15	<1	75.9	0.39	<1.0	386
QC-30	11/18/10	<15	<1	77.8	0.44	<1.0	386
QC-31	1/28/10	<10	<1	185.9	1.03	1.2	562
QC-31	3/10/10	15	<1	177.6	1.06	1.1	590
QC-31	4/22/10	16	<1	181.8	1.05	1.1	582
QC-31	6/17/10	16	<1	186.1	1.06	<1.0	582
QC-31	9/23/10	15	<1	178.0	1.03	<1.0	554
QC-31	11/18/10	<15	<1	183.1	1.07	1.1	552
QC-32	2/24/10			Well could not be sampled			
QC-32	4/22/10			Well could not be sampled			
QC-32	6/17/10			Well could not be sampled			

TABLE AIV-1 (Continued): 2010 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-4 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	8/26/10						
QC-32	10/14/10						
QC-32	12/2/10						
QC-32							
QC-33	2/24/10						
QC-33	4/22/10						
QC-33	6/17/10						
QC-33	8/26/10						
QC-33	10/14/10						
QC-33	12/2/10						
QC-33							
QC-34	2/24/10						
QC-34	4/29/11						
QC-34	6/17/10						
QC-34	8/26/10	17	<1	111.0	<0.02	1.5	804
QC-34	10/14/10						
QC-34	12/2/10						
QC-34							
QC-35	2/24/10						
QC-35	4/29/11						
QC-35	6/17/10						
QC-35	8/26/10	31	<1	137.9	<0.02	1.2	1,090
QC-35	10/14/10						
QC-35	12/2/10						
QC-35							
QC-36	2/24/10						
QC-36	4/29/10						
QC-36	6/17/10						
QC-36	8/26/10						
QC-36	10/14/10						
QC-36	12/2/10						
QC-36							
QC-37	2/24/10	26	<1	93.8	0.09	1.7	1,010
QC-37	4/29/10						
QC-37	6/17/10						
QC-37	8/26/10						

TABLE AIV-1 (Continued): 2010 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-4 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	10/14/10						Well could not be sampled
QC-37	12/2/10						Well could not be sampled

¹The limit of quantification for Cl was 10 mg/L for January 2010, and 15 mg/L for the rest of the year; 2.0 mg/L for SO₄; 0.02 mg/L for NH₃-N; 1.0 mg/L for TOC; and 40 mg/L for TDS. The detection limit for the FC analysis using the membrane filter method varies based on the actual sample analyzed.

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

TABLE AIV-2: 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-4 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	1/7/10						
QC-1	3/17/10						
QC-1	6/3/10						
QC-1	8/1/10						
QC-1	9/1/10						
QC-1	12/1/10						
QC-2	1/7/10	90	406	7.9	11.1	-290	<48
QC-2	3/17/10	92	413	7.1	13.4	-269	<48
QC-2	6/3/10	143	422	8.1	13.8	-269	<48
QC-2	9/9/10	94	401	7.7	13.6	-290	<48
QC-2	10/20/10	91	537	7.9	13.3	-276	<48
QC-2	12/16/10	83	363	7.1	11.6	-279	<48
QC-2.1	9/9/10						
QC-2.1	10/20/10	59	641	7.6	13.4	-284	<48
QC-2.1	12/16/10	64	488	7.4	10.5	-293	<48
QC-2.2	1/7/10	47	418	7.8	10.7	-286	<48
QC-2.2	3/17/10	49	375	8.1	12.5	-288	<48
QC-2.2	9/9/10	45	380	7.6	13.2	-288	<48
QC-4	2/4/10	13	591	8.7	10.5	-253	<48
QC-4	5/6/10	12	498	8.9	12.3	-254	<48
QC-4	10/20/10	10	655	8.9	12.6	-232	<48
QC-5	2/4/10	13	765	8.7	11.5	-234	<48
QC-5	5/6/10	10	628	8.7	12.8	-234	<48
QC-5	12/16/10	9	526	7.7	11.0	-210	<48
QC-6	2/4/10	18	600	8.7	11.6	-219	<48
QC-6	5/6/10	17	476	8.8	12.7	-218	<48
QC-6	12/16/10	17	466	7.6	11.2	-218	<48

TABLE AIV-2 (Continued): 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-4 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-7	2/4/10						
QC-7	5/6/10						
QC-7	12/16/10						
				Well could not be sampled			
				Well could not be sampled			
				Well could not be sampled			
QC-9	2/4/10	61	407	8.3	11.6	-204	<48
QC-9	5/6/10	63	336	8.1	13.0	-206	<48
QC-9	12/16/10	59	317	7.8	11.3	-197	<48
QC-10	1/6/10	12	468	8.6	11.0	-185	<4
QC-10	3/16/10	12	420	8.0	12.3	-232	<4
QC-10	9/29/10	11	502	8.6	13.2	-222	<4
QC-11	1/6/10	22	356	8.2	11.2	-204	<4
QC-11	3/16/10	21	315	7.3	13.5	-234	<4
QC-11	9/29/10	21	469	8.4	13.5	-229	<4
QC-12	1/21/10	185	989	7.7	5.4	-242	<4
QC-12	3/9/10	218	720	7.8	12.2	-224	<4
QC-12	7/7/10	161	818	7.7	14.2	-219	<4
QC-13	3/9/10	40	388	7.6	12.2	-237	<48
QC-13	7/7/10	37	456	7.2	14.7	-222	<48
QC-13	9/29/10	36	521	8.2	13.3	-253	<48
QC-14	2/4/10	132	880	7.5	12.6	-211	<48
QC-14	5/6/10	147	510	7.4	13.9	-221	<48
QC-14	12/2/10	131	580	7.0	11.1	-227	<48
QC-15	2/4/10	16	413	8.5	12.0	-217	<48
QC-15	5/6/10	15	249	8.5	12.8	-226	<48
QC-15	12/2/10	23	380	7.0	10.9	-223	<48
QC-16	2/4/10	83	530	8.1	10.7	-254	<48
QC-16	6/3/10	85	474	8.1	13.6	-225	<48
QC-16	12/2/10	87	701	7.5	11.5	-262	<48

TABLE AIV-2 (Continued): 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-4 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-17	2/4/10	186	560	7.9	11.6	-169	<48
QC-17	6/3/10	180	486	8.1	12.3	-172	<48
QC-17	12/2/10	169	515	7.6	11.3	-168	<48
QC-18	3/4/10			Well could not be sampled			
QC-18	6/3/10	43	431	9.1	12.4	-219	<48
QC-18	9/16/10	8	425	8.9	13.9	-222	<48
QC-19	3/4/10	112	433	7.8	11.8	-136	<48
QC-19	6/3/10	115	457	8.5	12.6	-127	<48
QC-19	9/16/10	107	405	8.2	15.0	-119	<48
QC-20	6/3/10	28	318	8.5	13.2	-272	<48
QC-20	9/16/10	34	319	7.6	14.1	-274	<48
QC-20	11/18/10	23	283	8.5	11.7	-274	<48
QC-21	1/7/10	37	404	7.7	11.2	-272	<48
QC-21	3/4/10	36	423	8.0	12.0	-277	<48
QC-21	9/16/10			Well could not be sampled			
QC-22	1/7/10	33	376	7.7	10.5	-267	<48
QC-22	3/4/10	34	315	7.9	12.0	-275	<48
QC-22	9/16/10	19	320	7.7	13.1	-264	<48
QC-23	1/7/10	8	399	7.6	11.1	-246	<48
QC-23	3/4/10	7	370	9.0	11.0	-243	<48
QC-23	9/16/10	6	379	9.2	13.5	-242	<48
QC-24	1/14/10	14	315	8.7	11.8	-237	<48
QC-24	3/4/10	14	270	8.6	12.0	-236	<48
QC-24	9/16/10	14	302	8.7	13.3	-237	<48
QC-25	1/14/10	19	282	8.7	11.4	-234	<48
QC-25	3/4/10	23	239	8.3	11.4	-235	<48
QC-25	9/23/10	25	279	8.3	22.4	-234	<48

TABLE AIV-2 (Continued): 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-4 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-26	1/14/10	6	347	8.3	11.7	-229	<48	
QC-26	3/4/10	6	285	9.1	12.0	-231	<48	
QC-26	9/23/10	8	320	8.9	22.2	-228	<48	
QC-27	1/14/10	26	318	8.6	11.6	-208	<48	
QC-27	3/4/10	26	290	8.5	12.0	-205	<48	
QC-27	9/23/10	25	304	8.5	25.0	-206	<48	
QC-28	1/28/10	17	333	7.9	10.7	-241	<48	
QC-28	3/10/10	19	280	8.5	11.3	-248	<48	
QC-28	9/23/10	19	336	8.9	15.5	-244	<48	
QC-29	1/28/10	383	400	7.2	11.1	-65	<48	
QC-29	3/10/10	365	870	7.6	11.1	-68	<48	
QC-29	4/22/10	344	741	7.4	12.3	-65	<48	
QC-29	6/17/10	349	827	7.5	14.6	-65	<48	
QC-29	9/23/10	323	822	7.2	13.6	-63	<48	
QC-29	11/18/10	356	699	7.3	11.3	-69	<48	
QC-30	1/28/10			Well could not be sampled				
QC-30	3/10/10	55	376	7.5	11.1	-144	<48	
QC-30	4/22/10	55	367	8.0	12.0	-140	<48	
QC-30	6/17/10	54	366	8.3	14.3	-142	<48	
QC-30	9/23/10	64	415	8.3	13.2	-142	<48	
QC-30	11/18/10	61	380	8.4	10.7	-145	<48	
QC-31	1/28/10	240	486	7.8	10.0	-76	<48	
QC-31	3/10/10	248	490	7.6	12.3	-76	<48	
QC-31	4/22/10	231	446	6.8	12.5	-73	<48	
QC-31	6/17/10	228	461	7.6	16.2	-75	<48	
QC-31	9/23/10	230	532	7.6	14.4	-66	<48	
QC-31	11/18/10	228	453	7.7	12.0	-85	<48	
QC-32	2/24/10			Well could not be sampled				
QC-32	4/22/10			Well could not be sampled				
QC-32	6/17/10			Well could not be sampled				
QC-32	8/26/10			Well could not be sampled				

TABLE AIV-2 (Continued): 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-4 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-32	10/14/10						
QC-32	12/2/10						
QC-33	2/24/10						
QC-33	4/22/10						
QC-33	6/17/10						
QC-33	8/26/10						
QC-33	10/14/10						
QC-33	12/2/10						
QC-34	2/24/10						
QC-34	4/29/11						
QC-34	6/17/10						
QC-34	8/26/10	19	678	8.5	15.1	-159	<48
QC-34	10/14/10						
QC-34	12/2/10						
QC-35	2/24/10						
QC-35	4/29/11						
QC-35	6/17/10						
QC-35	8/26/10	22	1,097	8.0	15.3	-152	<48
QC-35	10/14/10						
QC-35	12/2/10						
QC-36	2/24/10						
QC-36	4/29/10						
QC-36	6/17/10						
QC-36	8/26/10						
QC-36	10/14/10						
QC-36	12/2/10						
QC-37	2/24/10	*	952	8.3	8.8	-134	<48
QC-37	4/29/10						
QC-37	6/17/10						
QC-37	8/26/10						

TABLE AIV-2 (Continued): 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-4 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-37	10/14/10						Well could not be sampled
QC-37	12/2/10						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.

*There was not enough sample to perform the analysis.