

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 12-25

TUNNEL AND RESERVOIR PLAN

DES PLAINES TUNNEL SYSTEM

2011 ANNUAL GROUNDWATER MONITORING REPORT

July 2012

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July 10, 2012

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, Des Plaines Tunnel System, 2011 Annual
Groundwater Monitoring Report

Enclosed are three copies of the "Tunnel and Reservoir Plan, Des Plaines Tunnel System,
2011 Annual Groundwater Monitoring Report."

Very truly yours,

Thomas C. Granato
Director
Monitoring and Research

TCG:DGM:lf

Enclosures

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TUNNEL AND RESERVOIR PLAN
DES PLAINES TUNNEL SYSTEM
2011 ANNUAL GROUNDWATER MONITORING REPORT

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2011 MONITORING RESULTS

Introduction

This report contains 2011 data for the Tunnel and Reservoir Plan Des Plaines Tunnel System compiled from the monitoring of the 40 monitoring wells, QD-21 through QD-60, located along the Des Plaines Tunnel alignment. The monitoring wells are located along the 13A extension, south leg, middle leg, and north leg of the Des Plaines Tunnel System. These monitoring wells were sampled either three times per year or six times per year. Monitoring wells QD-21 through QD-26, QD-28 through QD-32, QD-35, QD-36, and QD-38 through QD-60 were sampled three times per year (Illinois Environmental Protection Agency [IEPA] memoranda July 9, 2004, and February 23, 2006). Monitoring wells QD-27, QD-33, QD-34, and QD-37 were sampled six times per year (IEPA memoranda July 9, 2004, and February 23, 2006).

Monitoring Data

Appendix AI contains a schematic showing the relative locations of the 40 monitoring wells along the Des Plaines Tunnel System.

Tables AII-1 and AII-2 in Appendix AII contain groundwater quality data for 2011 pertaining to the 40 monitoring wells QD-21 through QD-60 in the Des Plaines Tunnel System.

All of the monitoring wells in the Des Plaines Tunnel System were visited for the required number of samples. However, in some instances the monitoring well could not be sampled. Monitoring well QD-40 could not be sampled during 2011, because the pump was inoperable. A work order was issued in 2010 to fix the pump. The work order has not yet been completed due to a lack of parts to repair the pump. Monitoring well QD-34 could not be sampled on January 31, 2011, February 23, 2011, May 26, 2011, and July 15, 2011, because the pump was inoperable. Monitoring well QD-49 could not be sampled on February 17, 2011, because there was insufficient water in the monitoring well to collect a sample. Monitoring well QD-58 could not be sampled on October 13, 2011, because of a generator malfunction. A work order to fix the generator has been issued.

Summary of Data

Tables 1 through 8 contain summary statistics of the groundwater quality parameters for 2011 for all 40 monitoring wells QD-21 through QD-60 in the Des Plaines Tunnel System. These statistics are computed from the groundwater quality data collected from each monitoring well in 2011. The summary statistics include minimum, mean, maximum, standard deviation (Stdv), median, and coefficient of variation (COV) for eight groundwater quality parameters analyzed during 2011. These groundwater quality parameters are: chloride (Cl), conductivity (Cond.), hardness as calcium carbonate (Hard.), ammonia nitrogen (NH₃-N), pH, sulfate (SO₄), total dissolved solids (TDS), and total organic carbon (TOC). For a ninth parameter, fecal coliform (FC), the geometric

mean (Geo. Mean) has been calculated and presented in the tables, along with minimum, maximum, and median. The statistical analyses of the data were conducted using Microsoft[®] Excel functions.

TABLE 1: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-21 THROUGH QD-25

Parameter ¹	Monitoring Well Number					
	QD-21	QD-22	QD-23	QD-24	QD-25	
Cl mg/L	Minimum	270	133	162	98	469
	Mean	299	139	179	104	493
	Maximum	330	144	188	111	527
	Stdv	30	6	14	7	30
	Median	296	141	186	102	483
	COV	10	4	8	6	6
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	303	275	326	159	174
	Mean	313	303	338	168	219
	Maximum	320	355	355	180	269
	Stdv	9	45	15	11	48
	Median	315	279	333	166	215
	COV	3	15	5	6	22
NH ₃ -N mg/L	Minimum	0.22	0.36	0.44	0.49	0.71
	Mean	0.24	0.41	0.49	0.52	0.72
	Maximum	0.26	0.44	0.53	0.54	0.74
	Stdv	0.02	0.04	0.05	0.03	0.02
	Median	0.25	0.42	0.50	0.53	0.72
	COV	8.55	10.24	9.35	5.09	2.11
TOC mg/L	Minimum	1.2	1.2	1.6	1.8	1.6
	Mean	1.6	1.3	1.7	1.9	1.7
	Maximum	2.0	1.4	1.7	2.0	1.8
	Stdv	0.4	0.1	0.1	0.1	0.1
	Median	1.5	1.3	1.7	1.9	1.7
	COV	25.8	7.7	3.5	5.3	5.9

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-21 THROUGH QD-25

Parameter ¹		Monitoring Well Number				
		QD-21	QD-22	QD-23	QD-24	QD-25
TDS mg/L	Minimum	1,394	1,084	1,134	764	1,546
	Mean	1,478	1,183	1,287	873	1,639
	Maximum	1,530	1,274	1,468	1,014	1,822
	Stdv	73	95	169	128	158
	Median	1,510	1,192	1,260	840	1,550
	COV	5	8	13	15	10
Hard. mg/L	Minimum	774	771	818	524	567
	Mean	814	780	831	533	629
	Maximum	854	790	851	545	719
	Stdv	40	10	17	11	80
	Median	815	778	825	531	600
	COV	5	1	2	2	13
Cond. µmhos/cm	Minimum	969	799	945	832	1,205
	Mean	1,244	972	1,069	877	1,608
	Maximum	1,414	1,097	1,150	958	2,155
	Stdv	241	155	109	70	491
	Median	1,350	1,020	1,111	842	1,465
	COV	19	16	10	8	31
pH unit	Minimum	6.9	6.7	6.8	6.8	6.7
	Mean	6.9	7.0	6.9	7.2	7.0
	Maximum	7.0	7.2	7.0	7.5	7.2
	Stdv	0.1	0.3	0.1	0.4	0.3
	Median	6.9	7.2	6.9	7.3	7.2
	COV	0.7	4.1	1.4	5.0	4.4

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

TABLE 2: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-26 THROUGH QD-30

Parameter ¹		Monitoring Well Number				
		QD-26	QD-27	QD-28	QD-29	QD-30
Cl mg/L	Minimum	12	333	268	132	138
	Mean	13	371	280	147	139
	Maximum	14	428	294	157	140
	Stdv	1	35	13	13	1
	Median	12	359	279	151	139
	COV	9	9	5	9	1
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	93	33	208	249	308
	Mean	96	41	225	266	324
	Maximum	99	48	242	277	352
	Stdv	3	6	17	15	24
	Median	97	41	227	271	313
	COV	3	13	7	6	7
NH ₃ -N mg/L	Minimum	0.29	27.24	0.56	0.43	0.29
	Mean	0.33	29.57	0.59	0.44	0.61
	Maximum	0.37	33.64	0.63	0.45	1.23
	Stdv	0.04	2.79	0.04	0.01	0.53
	Median	0.32	28.21	0.57	0.44	0.32
	COV	12.37	9.45	6.45	2.27	87.11
TOC mg/L	Minimum	1.0	13.5	1.1	1.9	1.2
	Mean	1.0	14.8	1.2	2.1	1.4
	Maximum	1.0	15.6	1.2	2.4	1.7
	Stdv	0.0	0.8	0.1	0.3	0.3
	Median	1.0	15.0	1.2	2.0	1.4
	COV	0.0	5.6	4.9	12.6	17.6

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-26 THROUGH QD-30

Parameter ¹		Monitoring Well Number				
		QD-26	QD-27	QD-28	QD-29	QD-30
TDS mg/L	Minimum	544	1,230	1,188	1,022	996
	Mean	593	1,320	1,316	1,151	1,275
	Maximum	680	1,460	1,506	1,246	1,482
	Stdv	76	82	168	116	251
	Median	554	1,296	1,254	1,186	1,348
	COV	13	6	13	10	20
Hard. mg/L	Minimum	404	518	609	696	601
	Mean	417	538	639	721	695
	Maximum	430	554	674	742	766
	Stdv	13	13	33	23	85
	Median	417	541	633	724	718
	COV	3	3	5	3	12
Cond. µmhos/cm	Minimum	358	362	835	875	854
	Mean	464	1,235	1,103	916	947
	Maximum	545	1,755	1,590	951	1,095
	Stdv	96	516	422	38	129
	Median	491	1,235	885	922	893
	COV	21	42	38	4	14
pH unit	Minimum	7.2	6.5	6.8	6.7	7.0
	Mean	7.5	7.1	7.0	6.9	7.3
	Maximum	7.8	7.5	7.1	7.2	7.7
	Stdv	0.3	0.3	0.2	0.3	0.4
	Median	7.5	7.1	7.0	6.8	7.1
	COV	4.4	4.8	2.5	4.3	4.9

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

TABLE 3: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-31 THROUGH QD-35

Parameter ¹	Monitoring Well Number					
	QD-31	QD-32	QD-33	QD-34	QD-35	
Cl mg/L	Minimum	120	533	347	126	106
	Mean	126	540	356	131	113
	Maximum	133	545	370	135	124
	Stdv	7	6	9	6	10
	Median	126	542	353	131	109
	COV	5	1	2	5	9
FC CFU/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	3	1	1	1	1
	Maximum	22	1	1	1	1
	Median	1	1	1	1	1
SO ₄ mg/L	Minimum	169	219	174	270	261
	Mean	180	226	193	277	275
	Maximum	188	230	215	284	301
	Stdv	10	6	14	10	23
	Median	182	229	194	277	262
	COV	5	3	7	4	8
NH ₃ -N mg/L	Minimum	0.10	0.20	0.10	0.41	0.32
	Mean	0.12	0.21	0.19	0.42	0.35
	Maximum	0.15	0.21	0.29	0.43	0.38
	Stdv	0.03	0.01	0.06	0.01	0.03
	Median	0.10	0.21	0.19	0.42	0.36
	COV	24.74	2.79	32.57	3.37	8.65
TOC mg/L	Minimum	1.0	1.0	1.0	1.6	1.7
	Mean	1.2	1.0	1.0	1.7	1.9
	Maximum	1.0	1.0	1.0	1.7	2.1
	Stdv	0.0	0.0	0.0	0.1	0.2
	Median	1.0	1.0	1.0	1.7	1.9
	COV	0.0	0.0	0.0	4.3	10.5

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-31 THROUGH QD-35

Parameter ¹	Monitoring Well Number					
	QD-31	QD-32	QD-33	QD-34	QD-35	
TDS mg/L	Minimum	906	1,994	1,474	1,178	946
	Mean	985	2,073	1,658	1,232	1,075
	Maximum	1,092	2,204	1,864	1,286	1,212
	Stdv	96	114	150	76	133
	Median	956	2,020	1,614	1,232	1,068
	COV	10	6	9	6	12
Hard. mg/L	Minimum	241	32	19	710	561
	Mean	253	38	28	720	659
	Maximum	268	43	38	729	744
	Stdv	14	6	6	13	92
	Median	250	38	28	720	671
	COV	5	15	21	2	14
Cond. µmhos/cm	Minimum	769	1,925	1,198	372	890
	Mean	920	2,359	1,842	654	1,059
	Maximum	1,043	2,960	2,480	937	1,284
	Stdv	139	537	413	400	203
	Median	948	2,191	1,838	654	1,003
	COV	15	23	22	61	19
pH unit	Minimum	7.5	8.4	8.1	7.0	7.0
	Mean	7.6	8.8	8.4	7.4	7.2
	Maximum	7.7	9.2	8.8	7.8	7.5
	Stdv	0.2	0.4	0.2	0.5	0.3
	Median	7.5	8.9	8.4	7.4	7.0
	COV	2.0	4.2	2.6	7.2	4.1

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

TABLE 4: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-36, QD-37, QD-38, QD-39, AND QD-41

Parameter ¹		Monitoring Well Number				
		QD-36	QD-37	QD-38	QD-39	QD-41
Cl mg/L	Minimum	119	248	163	21	10
	Mean	131	262	167	30	12
	Maximum	148	269	173	45	16
	Stdv	15	7	5	13	3
	Median	126	263	166	25	11
	COV	12	3	3	42	26
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	290	363	95	83	343
	Mean	322	384	100	87	346
	Maximum	341	412	102	90	350
	Stdv	28	19	4	4	3
	Median	336	385	102	89	346
	COV	9	5	4	5	1
NH ₃ -N mg/L	Minimum	0.31	0.27	0.27	0.10	0.21
	Mean	0.33	0.32	0.33	0.10	0.26
	Maximum	0.34	0.35	0.37	0.10	0.30
	Stdv	0.02	0.03	0.05	0.00	0.05
	Median	0.33	0.33	0.34	0.10	0.27
	COV	4.68	9.61	15.71	0.00	17.63
TOC mg/L	Minimum	1.4	1.0	1.0	1.0	1.3
	Mean	1.5	1.0	1.0	1.0	1.5
	Maximum	1.6	1.0	1.0	1.0	1.6
	Stdv	0.1	0.0	0.0	0.0	0.2
	Median	1.5	1.0	1.0	1.0	1.5
	COV	6.7	0.0	0.0	0.0	10.4

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-36, QD-37, QD-38, QD-39, AND QD-41

Parameter ¹		Monitoring Well Number				
		QD-36	QD-37	QD-38	QD-39	QD-41
TDS mg/L	Minimum	1,138	1,400	802	822	752
	Mean	1,219	1,560	811	970	882
	Maximum	1,376	1,748	826	1,116	1,090
	Stdv	136	130	13	147	182
	Median	1,144	1,540	806	972	804
	COV	11	8	2	15	21
Hard. mg/L	Minimum	742	539	248	18	426
	Mean	753	592	280	34	430
	Maximum	766	620	338	66	437
	Stdv	12	29	51	27	6
	Median	751	602	253	19	427
	COV	2	5	18	80	1
Cond. µmhos/cm	Minimum	697	1,107	825	890	654
	Mean	968	1,430	937	1,031	779
	Maximum	1,302	1,795	1,120	1,186	854
	Stdv	307	264	160	148	109
	Median	904	1,443	865	1,017	829
	COV	32	18	17	14	14
pH unit	Minimum	6.6	6.9	7.7	8.1	7.4
	Mean	7.0	7.4	7.8	8.2	7.5
	Maximum	7.4	8.0	7.9	8.4	7.5
	Stdv	0.4	0.4	0.1	0.2	0.0
	Median	7.0	7.3	7.7	8.2	7.5
	COV	5.5	5.6	1.3	1.8	0.4

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

TABLE 5: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-42 THROUGH QD-46

Parameter ¹		Monitoring Well Number				
		QD-42	QD-43	QD-44	QD-45	QD-46
Cl mg/L	Minimum	13	31	10	13	10
	Mean	17	35	15	16	11
	Maximum	21	40	19	17	13
	Stdv	4	5	5	2	2
	Median	16	35	16	17	10
	COV	24	13	31	15	16
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	282	201	210	196	107
	Mean	285	209	213	198	118
	Maximum	289	215	215	202	124
	Stdv	4	7	3	3	9
	Median	283	211	212	197	123
	COV	1	4	1	2	8
NH ₃ -N mg/L	Minimum	0.21	0.23	0.25	0.24	0.20
	Mean	0.27	0.28	0.31	0.28	0.22
	Maximum	0.31	0.32	0.34	0.33	0.23
	Stdv	0.05	0.05	0.05	0.05	0.02
	Median	0.28	0.30	0.33	0.26	0.22
	COV	19.24	16.68	16.09	17.08	7.05
TOC mg/L	Minimum	1.0	1.0	1.0	1.1	1.0
	Mean	1.1	1.0	1.0	1.1	1.1
	Maximum	1.2	1.0	1.0	1.2	1.3
	Stdv	0.1	0.0	0.0	0.1	0.2
	Median	1.2	1.0	1.0	1.1	1.0
	COV	10.2	0.0	0.0	5.1	15.7

TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-42 THROUGH QD-46

Parameter ¹		Monitoring Well Number				
		QD-42	QD-43	QD-44	QD-45	QD-46
TDS mg/L	Minimum	764	684	622	546	572
	Mean	884	776	717	559	581
	Maximum	1,108	910	898	578	586
	Stdv	194	119	157	17	8
	Median	780	531	630	554	584
	COV	22	15	22	3	1
Hard. mg/L	Minimum	400	432	323	93	66
	Mean	404	443	330	102	102
	Maximum	408	450	340	120	162
	Stdv	4	9	9	15	53
	Median	405	446	326	94	77
	COV	1	2	3	15	52
Cond. µmhos/cm	Minimum	653	540	505	507	531
	Mean	784	622	565	628	663
	Maximum	903	703	614	789	848
	Stdv	125	82	55	145	165
	Median	797	624	577	588	611
	COV	16	13	10	23	25
pH unit	Minimum	6.8	7.2	7.6	8.0	7.4
	Mean	7.2	7.4	7.6	8.5	7.7
	Maximum	7.4	7.5	7.7	9.2	7.9
	Stdv	0.3	0.1	0.1	0.7	0.3
	Median	7.4	8.1	7.6	8.2	7.9
	COV	4.5	1.7	0.8	7.7	3.6

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

TABLE 6: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-47 THROUGH QD-51

Parameter ¹		Monitoring Well Number				
		QD-47	QD-48	QD-49	QD-50	QD-51
Cl mg/L	Minimum	11	10	14	10	12
	Mean	14	10	18	12	15
	Maximum	16	11	22	13	22
	Stdv	3	1	6	2	31
	Median	15	10	18	12	12
	COV	19	6	31	13	205
FC CFU/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	13	1	1
	Maximum	1	1	170	1	1
	Median	1	1	86	1	1
SO ₄ mg/L	Minimum	137	270	209	268	116
	Mean	149	276	211	273	117
	Maximum	156	283	212	281	120
	Stdv	10	7	2	7	2
	Median	153	275	211	272	116
	COV	7	2	1	3	2
NH ₃ -N mg/L	Minimum	0.19	0.15	0.20	0.10	0.10
	Mean	0.22	0.24	0.28	0.11	0.10
	Maximum	0.26	0.37	0.35	0.12	0.10
	Stdv	0.04	0.11	0.11	0.01	0.00
	Median	0.22	0.21	0.28	0.11	0.10
	COV	15.72	46.74	41.35	9.09	0.00
TOC mg/L	Minimum	1.0	1.2	1.0	1.1	1.0
	Mean	1.1	1.4	1.1	1.1	1.2
	Maximum	1.3	1.6	1.1	1.2	1.4
	Stdv	0.2	0.2	0.1	0.1	0.2
	Median	1.1	1.4	1.1	1.1	1.1
	COV	13.5	14.3	6.7	5.1	17.8

TABLE 6 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-47 THROUGH QD-51

Parameter ¹		Monitoring Well Number				
		QD-47	QD-48	QD-49	QD-50	QD-51
TDS mg/L	Minimum	514	552	620	670	526
	Mean	525	643	651	688	544
	Maximum	532	764	682	712	564
	Stdv	9	109	44	22	19
	Median	528	612	651	682	542
	COV	2	17	7	3	4
Hard. mg/L	Minimum	209	261	324	11	5
	Mean	236	327	354	22	5
	Maximum	252	398	384	32	5
	Stdv	23	69	42	11	0
	Median	246	323	354	24	5
	COV	10	21	12	47	0
Cond. µmhos/cm	Minimum	441	483	687	651	536
	Mean	552	608	736	698	646
	Maximum	663	849	784	777	773
	Stdv	111	209	69	69	119
	Median	552	493	736	667	630
	COV	20	34	9	10	18
pH unit	Minimum	7.5	7.3	7.9	8.8	8.6
	Mean	7.6	7.8	8.0	9.1	8.9
	Maximum	7.7	8.3	8.1	9.2	9.4
	Stdv	0.1	0.5	0.1	0.2	0.4
	Median	7.7	7.9	8.0	9.2	8.7
	COV	1.0	6.6	1.2	2.7	4.7

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

TABLE 7: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-52 THROUGH QD-56

Parameter ¹		Monitoring Well Number				
		QD-52	QD-53	QD-54	QD-55	QD-56
Cl mg/L	Minimum	15	18	16	15	10
	Mean	15	19	17	16	12
	Maximum	16	19	17	17	14
	Stdv	1	1	1	1	2
	Median	15	19	17	16	12
	COV	4	3	3	6	17
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	137	151	130	172	15
	Mean	141	157	132	179	28
	Maximum	145	160	136	189	53
	Stdv	4	5	3	9	22
	Median	141	159	131	175	15
	COV	3	3	3	5	79
NH ₃ -N mg/L	Minimum	0.10	0.10	0.12	0.34	0.17
	Mean	0.12	0.10	0.23	0.35	0.18
	Maximum	0.13	0.10	0.35	0.37	0.20
	Stdv	0.02	0.00	0.12	0.02	0.02
	Median	0.13	0.10	0.21	0.34	0.17
	COV	14.43	0.00	51.13	4.95	9.62
TOC mg/L	Minimum	1.0	1.1	1.0	1.0	1.0
	Mean	1.1	1.2	1.0	1.7	1.0
	Maximum	1.3	1.2	1.0	2.3	1.0
	Stdv	0.2	0.1	0.0	0.7	0.0
	Median	1.0	1.2	1.0	1.9	1.0
	COV	15.7	4.9	0.0	38.4	0.0

TABLE 7 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-52 THROUGH QD-56

Parameter ¹		Monitoring Well Number				
		QD-52	QD-53	QD-54	QD-55	QD-56
TDS mg/L	Minimum	486	572	422	430	296
	Mean	491	584	435	459	324
	Maximum	494	592	456	498	374
	Stdv	5	11	19	35	43
	Median	494	588	426	448	302
	COV	1	2	4	8	13
Hard. mg/L	Minimum	19	10	36	96	19
	Mean	19	11	39	122	36
	Maximum	20	13	45	147	47
	Stdv	1	2	5	26	15
	Median	19	10	37	123	43
	COV	3	16	13	21	42
Cond. µmhos/cm	Minimum	379	588	500	456	389
	Mean	493	757	590	598	453
	Maximum	590	843	641	691	501
	Stdv	107	146	78	125	58
	Median	510	840	630	647	469
	COV	22	19	13	21	13
pH unit	Minimum	8.3	8.8	8.5	8.1	8.1
	Mean	8.6	9.0	9.0	8.5	8.3
	Maximum	9.0	9.3	9.6	9.0	8.8
	Stdv	0.3	0.2	0.5	0.5	0.4
	Median	8.7	8.9	8.9	8.4	8.1
	COV	3.9	2.7	5.9	5.4	4.7

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

TABLE 8: SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-57 THROUGH QD-60

Parameter ¹		Monitoring Well Number			
		QD-57	QD-58	QD-59	QD-60
Cl mg/L	Minimum	12	10	112	43
	Mean	12	11	115	45
	Maximum	13	11	116	49
	Stdv	1	1	2	3
	Median	12	11	116	44
	COV	5	7	2	7
FC CFU/100 mL	Minimum	1	1	1	1
	Geo. Mean	1	1	1	1
	Maximum	1	1	1	1
	Median	1	1	1	1
SO ₄ mg/L	Minimum	15	15	34	96
	Mean	40	15	39	98
	Maximum	55	15	43	100
	Stdv	22	0	5	2
	Median	50	15	41	98
	COV	54	0	12	2
NH ₃ -N mg/L	Minimum	0.15	0.21	0.24	0.19
	Mean	0.22	0.31	0.36	0.28
	Maximum	0.29	0.40	0.44	0.37
	Stdv	0.07	0.13	0.10	0.09
	Median	0.21	0.31	0.39	0.27
	COV	32.42	44.05	29.18	32.60
TOC mg/L	Minimum	1.0	1.0	1.0	1.0
	Mean	1.0	1.0	1.0	1.0
	Maximum	1.0	1.0	1.1	1.0
	Stdv	0.0	0.0	0.1	0.0
	Median	1.0	1.0	1.0	1.0
	COV	0.0	0.0	5.6	0.0

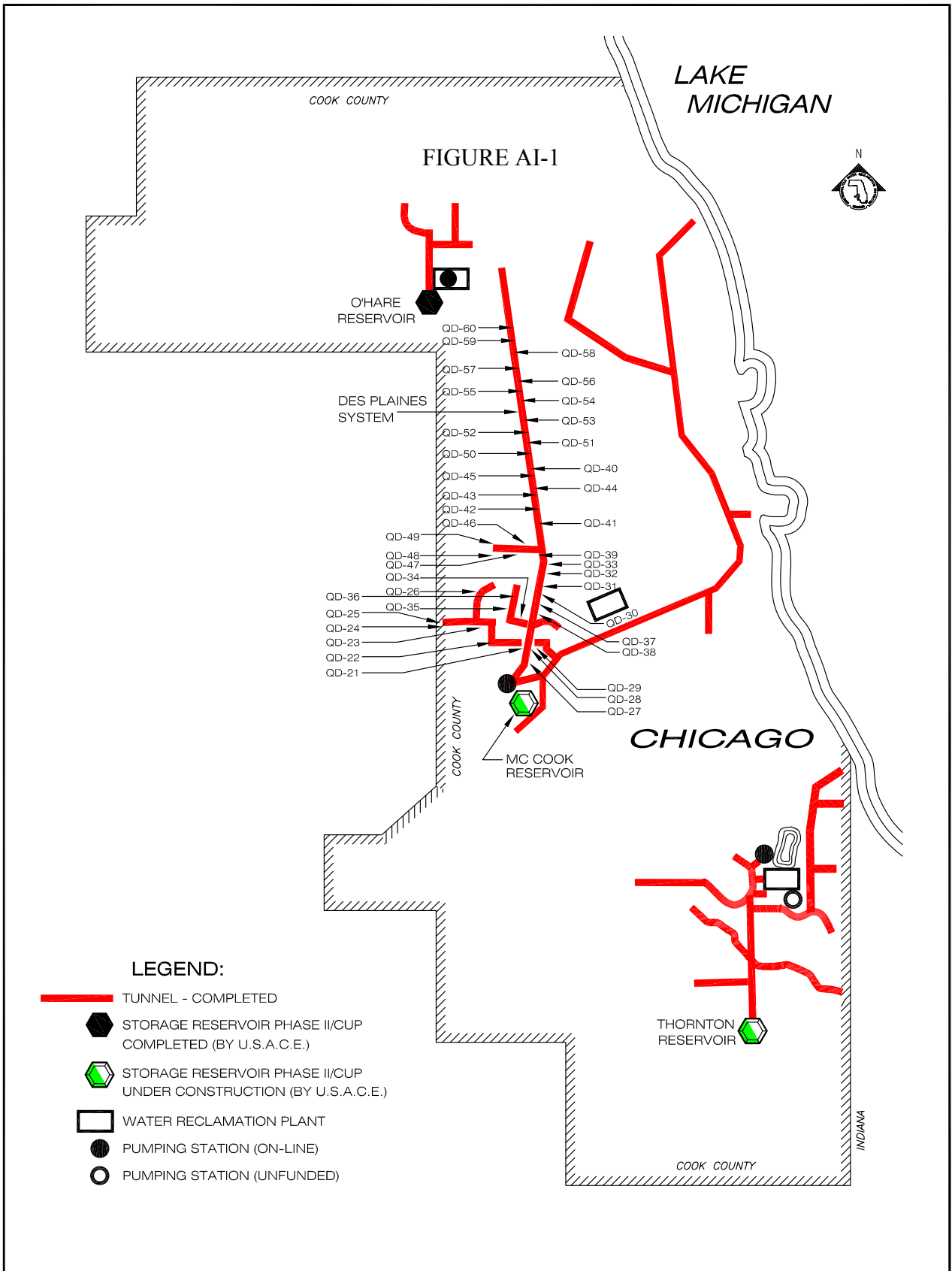
TABLE 8 (Continued): SUMMARY STATISTICS OF THE 2011 DATA FOR THE MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM: QD-57 THROUGH QD-60

Parameter ¹		Monitoring Well Number			
		QD-57	QD-58	QD-59	QD-60
TDS mg/L	Minimum	334	254	452	318
	Mean	369	255	507	385
	Maximum	388	256	538	426
	Stdv	30	1	48	58
	Median	384	255	530	410
	COV	8	1	9	15
Hard. mg/L	Minimum	18	111	258	243
	Mean	23	113	266	247
	Maximum	30	114	273	251
	Stdv	6	2	8	4
	Median	20	113	268	248
	COV	28	2	3	2
Cond. µmhos/cm	Minimum	409	392	635	410
	Mean	490	398	702	475
	Maximum	554	404	759	572
	Stdv	74	8	63	86
	Median	506	398	713	443
	COV	15	2	9	18
pH unit	Minimum	8.0	7.7	7.6	7.6
	Mean	8.4	7.7	7.7	7.8
	Maximum	8.5	7.8	7.9	8.0
	Stdv	0.3	0.1	0.2	0.2
	Median	8.5	7.7	7.6	7.7
	COV	3.2	0.8	2.2	2.7

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

APPENDIX AI

LOCATION MAP OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES
PLAINES TUNNEL SYSTEM



**DES PLAINES TUNNEL SYSTEM
LOCATION MAP OF MONITORING WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AII

2011 GROUNDWATER QUALITY DATA FOR MONITORING WELLS QD-21 THROUGH
QD-60 IN THE DES PLAINES TUNNEL SYSTEM

TABLE AII-1: 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	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 mg/L
QD-21	1/20/11	296	<1	320	0.26	2.0	1,394
QD-21	2/24/11	330	<1	315	0.25	1.5	1,510
QD-21	5/18/11	270	<1	303	0.22	1.2	1,530
QD-22	1/20/11	144	<1	275	0.44	1.4	1,084
QD-22	2/24/11	141	<1	279	0.42	1.3	1,192
QD-22	5/18/11	133	<1	355	0.36	1.2	1,274
QD-23	1/20/11	186	<1	355	0.53	1.7	1,260
QD-23	2/24/11	162	<1	333	0.50	1.6	1,134
QD-23	5/18/11	188	<1	326	0.44	1.7	1,468
QD-24	1/20/11	111	<1	180	0.54	2.0	840
QD-24	4/27/11	98	1	159	0.49	1.9	764
QD-24	7/7/11	102	1	166	0.53	1.8	1,014
QD-25	1/20/11	483	<1	269	0.74	1.8	1,546
QD-25	4/27/11	469	<1	215	0.71	1.6	1,550
QD-25	7/7/11	527	<1	174	0.72	1.7	1,822
QD-26	1/13/11	12	<1	97	0.29	BLOQ	544
QD-26	5/26/11	12	<1	93	0.32	BLOQ	680
QD-26	11/2/11	14	<1	99	0.37	BLOQ	554
QD-27	1/13/11	428	<1	48	32.58	13.5	1,364
QD-27	3/17/11	352	<1	39	27.24	15.2	1,272
QD-27	5/26/11	396	<1	40	33.64	14.8	1,460
QD-27	7/15/11	356	<1	41	28.56	15.5	1,314
QD-27	9/23/11	361	<1	33	27.86	15.6	1,278
QD-27	11/2/11	333	<1	46	27.56	14.1	1,230
QD-28	1/20/11	294	<1	242	0.63	1.2	1,188
QD-28	4/27/11	279	<1	227	0.56	1.2	1,254
QD-28	7/7/11	268	<1	208	0.57	1.1	1,506

TABLE AII-1 (Continued): 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	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 mg/L	
QD-29	1/31/11	151	<1	277	0.45	2.4	1,022	
QD-29	4/27/11	132	<1	249	0.43	1.9	1,186	
QD-29	9/1/11	157	<1	271	0.44	2.0	1,246	
QD-30	1/13/11	138	<1	313	0.29	1.2	996	
QD-30	3/17/11	139	<1	352	0.32	1.4	1,348	
QD-30	5/26/11	140	<1	308	1.23	1.7	1,482	
QD-31	1/13/11	120	<1	182	BLOQ	BLOQ	906	
QD-31	3/17/11	133	<1	188	0.15	BLOQ	956	
QD-31	5/26/11	126	22	169	0.10	BLOQ	1,092	
QD-32	1/13/11	533	<1	229	0.21	BLOQ	2,020	
QD-32	3/17/11	545	<1	230	0.20	BLOQ	1,994	
QD-32	5/26/11	542	<1	219	0.21	BLOQ	2,204	
QD-33	1/13/11	347	<1	215	0.18	BLOQ	1,474	
QD-33	3/17/11	349	<1	194	0.17	BLOQ	1,568	
QD-33	5/26/11	370	<1	182	0.22	BLOQ	1,864	
QD-33	7/15/11	353	<1	174	0.29	BLOQ	1,812	
QD-33	10/13/11	363	<1	194	0.19	BLOQ	1,614	
QD-33	12/22/11	353	<1	199	BLOQ	BLOQ	1,614	
QD-34	1/31/11		Monitoring well could not be sampled ³					
QD-34	2/23/11		Monitoring well could not be sampled ³					
QD-34	5/26/11		Monitoring well could not be sampled ³					
QD-34	7/15/11		Monitoring well could not be sampled ³					
QD-34	10/12/11	126	<1	270	0.43	1.7	1,178	
QD-34	11/2/11	135	<1	284	0.41	1.6	1,286	
QD-35	1/31/11	106	<1	301	0.38	1.7	1,068	
QD-35	2/23/11	124	<1	262	0.32	1.9	946	
QD-35	5/4/11	109	<1	261	0.36	2.1	1,212	
QD-36	1/31/11	126	<1	341	0.34	1.4	1,138	
QD-36	2/23/11	148	<1	336	0.33	1.5	1,144	
QD-36	5/4/11	119	<1	290	0.31	1.6	1,376	

TABLE AII-1 (Continued): 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	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 mg/L
QD-37	1/13/11	261	<1	412	0.34	BLOQ	1,600
QD-37	3/17/11	263	<1	392	0.30	BLOQ	1,400
QD-37	5/26/11	269	<1	363	0.34	BLOQ	1,654
QD-37	7/15/11	248	<1	364	0.31	BLOQ	1,748
QD-37	10/13/11	265	<1	390	0.27	BLOQ	1,476
QD-37	11/2/11	263	<1	379	0.35	BLOQ	1,480
QD-38	1/13/11	173	<1	102	0.37	BLOQ	806
QD-38	4/7/11	163	<1	102	0.27	BLOQ	802
QD-38	7/15/11	166	<1	95	0.34	BLOQ	826
QD-39	4/7/11	25	<1	90	BLOQ	BLOQ	822
QD-39	5/26/11	45	<1	83	BLOQ	BLOQ	1,116
QD-39	7/15/11	21	<1	89	BLOQ	BLOQ	972
QD-40	2/17/11		Monitoring well could not be sampled ³				
QD-40	4/7/11		Monitoring well could not be sampled ³				
QD-40	8/5/11		Monitoring well could not be sampled ³				
QD-41	2/17/11	16	<1	346	0.30	1.5	752
QD-41	4/7/11	11	<1	350	0.21	1.6	804
QD-41	8/5/11	BLOQ	<1	343	0.27	1.3	1,090
QD-42	2/17/11	21	<1	289	0.31	1.2	764
QD-42	4/7/11	16	<1	283	0.21	1.2	780
QD-42	8/5/11	13	<1	282	0.28	1.0	1,108
QD-43	2/17/11	40	<1	211	0.32	BLOQ	684
QD-43	4/7/11	35	<1	215	0.23	1.0	734
QD-43	8/5/11	31	<1	201	0.30	BLOQ	910
QD-44	2/17/11	19	<1	212	0.33	BLOQ	622
QD-44	4/7/11	16	<1	210	0.25	BLOQ	630
QD-44	8/5/11	BLOQ	<1	215	0.34	1.0	898

TABLE AII-1 (Continued): 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	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 mg/L	
QD-45	2/17/11	17	<1	197	0.33	1.1	554	
QD-45	4/7/11	13	<1	202	0.24	1.2	578	
QD-45	10/13/11	17	1	196	0.26	1.1	546	
QD-46	1/31/11	13	<1	124	0.23	1.3	586	
QD-46	2/23/11	BLOQ	<1	123	0.22	BLOQ	572	
QD-46	5/4/11	BLOQ	<1	107	0.20	1.0	584	
QD-47	2/17/11	16	<1	156	0.26	1.3	528	
QD-47	4/7/11	11	<1	153	0.19	1.1	532	
QD-47	8/19/11	15	<1	137	0.22	1.0	514	
QD-48	2/17/11	BLOQ	<1	270	0.21	1.4	552	
QD-48	4/21/11	11	<1	275	0.15	1.2	612	
QD-48	8/19/11	10	<1	283	0.37	1.6	764	
QD-49	2/17/11		Monitoring well could not be sampled ³					
QD-49	8/19/11	14	<1	209	0.35	1.0	682	
QD-49	10/13/11	22	170	212	0.20	1.1	620	
QD-50	2/17/11	BLOQ	<1	281	0.11	1.2	712	
QD-50	4/21/11	12	<1	272	0.12	1.1	670	
QD-50	10/13/11	13	<1	268	BLOQ	1.1	682	
QD-51	4/21/11	12	<1	116	BLOQ	1.1	542	
QD-51	11/17/11	12	<1	116	BLOQ	1.4	526	
QD-51	12/22/11	22	<1	120	BLOQ	BLOQ	564	
QD-52	2/17/11	15	<1	141	0.13	1.3	494	
QD-52	4/21/11	15	<1	137	0.13	1.0	486	
QD-52	8/25/11	16	<1	145	BLOQ	1.0	494	
QD-53	4/21/11	18	<1	159	BLOQ	1.2	572	
QD-53	6/30/11	19	<1	151	BLOQ	1.2	588	
QD-53	8/25/11	19	<1	160	BLOQ	1.1	592	

TABLE AII-1 (Continued): 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	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 mg/L	
QD-54	4/21/11	16	<1	130	0.21	BLOQ	426	
QD-54	6/30/11	17	<1	131	0.35	BLOQ	456	
QD-54	8/25/11	17	<1	136	0.12	BLOQ	422	
QD-55	4/21/11	16	<1	175	0.37	1.0	498	
QD-55	6/30/11	15	<1	172	0.34	2.3	430	
QD-55	11/17/11	17	<1	189	0.34	1.9	448	
QD-56	4/20/11	12	<1	BLOQ	0.17	BLOQ	302	
QD-56	10/13/11	14	<1	53	0.20	BLOQ	374	
QD-56	11/17/11	10	<1	BLOQ	0.17	BLOQ	296	
QD-57	6/30/11	12	<1	50	0.29	1.0	388	
QD-57	10/13/11	12	<1	BLOQ	0.15	BLOQ	334	
QD-57	12/22/11	13	<1	55	0.21	BLOQ	384	
QD-58	4/20/11	11	<1	BLOQ	0.21	BLOQ	256	
QD-58	6/30/11	10	<1	BLOQ	0.40	BLOQ	254	
QD-58	10/13/11		Monitoring well could not be sampled ³					
QD-59	4/20/11	116	<1	43	0.24	1.1	538	
QD-59	6/30/11	116	<1	41	0.44	1.0	530	
QD-59	11/17/11	112	<1	34	0.39	BLOQ	452	
QD-60	4/20/11	43	<1	98	0.27	BLOQ	426	
QD-60	11/17/11	49	<1	96	0.19	BLOQ	318	
QD-60	12/22/11	44	<1	100	0.37	BLOQ	410	

¹The limit of quantification (LOQ) is 10 mg/L for Cl, 15 mg/L for SO₄, 0.10 mg/L for NH₃-N, 1.0 mg/L for TOC, and 60 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.

³Monitoring well could not be sampled due to reasons given in text.

BLOQ = Below LOQ.

TABLE AII-2: 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ Unit	Temp. °C	Groundwater Elevation ² Feet	Recharge ³ Hours
QD-21	1/20/11	815	969	7.0	11.5	-65	<4
QD-21	2/24/11	854	1,350	6.9	12.3	-64	<4
QD-21	5/18/11	774	1,414	6.9	12.8	-61	<4
QD-22	1/20/11	771	799	7.2	12.0	-30	<4
QD-22	2/24/11	790	1,020	7.2	12.4	-27	<4
QD-22	5/18/11	778	1,097	6.7	12.6	-23	<4
QD-23	1/20/11	825	945	7.0	12.0	-35	<4
QD-23	2/24/11	851	1,150	6.8	13.0	-34	<4
QD-23	5/18/11	818	1,111	6.9	13.6	-30	<4
QD-24	1/20/11	545	832	7.3	10.8	16	<4
QD-24	4/27/11	524	842	6.8	12.0	22	<4
QD-24	7/7/11	531	958	7.5	12.3	0	<4
QD-25	1/20/11	719	1,205	7.2	9.8	-28	<4
QD-25	4/27/11	600	1,465	6.7	11.3	27	<4
QD-25	7/7/11	567	2,155	7.2	13.2	17	<4
QD-26	1/13/11	417	358	7.8	10.5	-37	<4
QD-26	5/26/11	430	545	7.5	11.8	-10	<4
QD-26	11/2/11	404	491	7.2	12.5	-30	<4
QD-27	1/13/11	545	362	7.5	10.1	-226	<48
QD-27	3/17/11	536	1,080	7.2	12.3	-185	<48
QD-27	5/26/11	547	1,742	6.5	12.5	-159	<48
QD-27	7/15/11	527	1,755	7.2	13.1	-195	<48
QD-27	9/23/11	554	1,324	7.0	12.4	-201	<48
QD-27	11/2/11	518	1,145	7.1	13.1	-217	<48
QD-28	1/20/11	674	835	7.0	11.6	-146	<4
QD-28	4/27/11	633	885	6.8	13.0	-128	<4
QD-28	7/7/11	609	1,590	7.1	14.2	-153	<4

TABLE AII-2 (Continued): 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond. ¹ µmhos/cm	pH ¹ Unit	Temp. °C	Groundwater Elevation ² Feet	Recharge ³ Hours	
QD-29	1/31/11	724	951	7.2	11.3	-181	<4	
QD-29	4/27/11	696	875	6.7	12.9	-201	<4	
QD-29	9/1/11	742	922	6.8	13.4	-154	<4	
QD-30	1/13/11	601	854	7.7	11.0	-139	<4	
QD-30	3/17/11	766	893	7.1	12.4	-115	<4	
QD-30	5/26/11	718	1,095	7.0	11.5	-109	<4	
QD-31	1/13/11	241	769	7.7	10.8	-196	<4	
QD-31	3/17/11	250	948	7.5	12.3	-194	<4	
QD-31	5/26/11	268	1,043	7.5	11.1	-195	<4	
QD-32	1/13/11	32	1,925	8.4	10.2	-210	<48	
QD-32	3/17/11	38	2,191	9.2	12.0	-212	<48	
QD-32	5/26/11	43	2,960	8.9	11.1	-213	<48	
QD-33	1/13/11	28	1,795	8.2	10.8	-158	<48	
QD-33	3/17/11	27	1,964	8.8	12.8	-183	<48	
QD-33	5/26/11	30	2,480	8.5	11.6	-177	<48	
QD-33	7/15/11	28	1,880	8.4	13.3	-186	<48	
QD-33	10/13/11	38	1,198	8.1	14.1	-191	<48	
QD-33	12/22/11	19	1,735	8.4	11.3	-179	<48	
QD-34	1/31/11		Monitoring well could not be sampled ⁴					
QD-34	2/23/11		Monitoring well could not be sampled ⁴					
QD-34	5/26/11		Monitoring well could not be sampled ⁴					
QD-34	7/15/11		Monitoring well could not be sampled ⁴					
QD-34	10/12/11	729	372	7.8	12.5	-98	<4	
QD-34	11/2/11	710	937	7.0	12.9	103	<4	
QD-35	1/31/11	744	1,003	7.5	11.6	-113	<4	
QD-35	2/23/11	561	890	7.0	10.6	-121	<4	
QD-35	5/4/11	671	1,284	7.0	12.6	-94	<4	
QD-36	1/31/11	751	697	6.6	10.6	-112	<4	
QD-36	2/23/11	766	904	7.0	10.8	-135	<4	
QD-36	5/4/11	742	1,302	7.4	11.9	-111	<4	

TABLE AII-2 (Continued): 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ Unit	Temp. °C	Groundwater Elevation ² Feet	Recharge ³ Hours
QD-37	1/13/11	579	1,107	7.2	12.3	-206	<48
QD-37	3/17/11	600	1,333	7.3	12.8	-194	<48
QD-37	5/26/11	539	1,795	6.9	12.8	-197	<48
QD-37	7/15/11	620	1,552	7.8	14.5	-202	<48
QD-37	10/13/11	604	1,601	8.0	12.8	-197	<48
QD-37	11/2/11	609	1,190	7.4	13.7	221	<48
QD-38	1/13/11	338	825	7.7	10.7	-205	<48
QD-38	4/7/11	253	1,120	7.7	12.7	-208	<48
QD-38	7/15/11	248	865	7.9	13.2	-209	<48
QD-39	4/7/11	19	1,017	8.4	11.3	-144	<48
QD-39	5/26/11	66	1,186	8.1	11.4	-158	<48
QD-39	7/15/11	18	890	8.2	12.1	-159	<48
QD-40	2/17/11	Monitoring well could not be sampled ⁴					
QD-40	4/7/11	Monitoring well could not be sampled ⁴					
QD-40	8/5/11	Monitoring well could not be sampled ⁴					
QD-41	2/17/11	437	654	7.5	12.3	-146	<48
QD-41	4/7/11	426	854	7.5	12.4	-139	<48
QD-41	8/5/11	427	829	7.4	14.0	-141	<48
QD-42	2/17/11	408	653	6.8	12.4	-124	<48
QD-42	4/7/11	405	903	7.4	11.9	-117	<48
QD-42	8/5/11	400	797	7.4	13.2	-120	<48
QD-43	2/17/11	450	624	7.5	11.8	-118	<48
QD-43	4/7/11	446	540	7.4	11.4	2	<48
QD-43	8/5/11	432	703	7.2	14.1	-130	<48
QD-44	2/17/11	340	577	7.6	10.7	-10	<4
QD-44	4/7/11	323	505	7.7	10.8	-7	<4
QD-44	8/5/11	326	614	7.6	13.2	-7	<4

TABLE AII-2 (Continued): 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ Unit	Temp. °C	Groundwater Elevation ² Feet	Recharge ³ Hours	
QD-45	2/17/11	120	588	8.0	12.2	-12	<48	
QD-45	4/7/11	94	507	9.2	11.3	-6	<48	
QD-45	10/13/11	93	789	8.2	12.4	-8	<48	
QD-46	1/31/11	77	531	7.9	10.5	-185	<4	
QD-46	2/23/11	162	611	7.9	9.9	-170	<4	
QD-46	5/4/11	66	848	7.4	12.2	-176	<4	
QD-47	2/17/11	252	552	7.5	12.9	5	<48	
QD-47	4/7/11	246	441	7.7	12.1	4	<48	
QD-47	8/19/11	209	663	7.7	13.9	1	<48	
QD-48	2/17/11	261	493	8.3	12.6	-177	<48	
QD-48	4/21/11	323	483	7.3	12.5	-179	<48	
QD-48	8/19/11	398	849	7.9	14.0	-179	<48	
QD-49	2/17/11		Monitoring well could not be sampled ⁴					
QD-49	8/19/11	384	784	7.9	14.6	-179	<48	
QD-49	10/13/11	324	687	8.1	13.9	-186	<48	
QD-50	2/17/11	24	777	9.2	11.4	-137	<48	
QD-50	4/21/11	32	667	9.2	11.2	-139	<48	
QD-50	10/13/11	11	651	8.8	12.6	-140	<48	
QD-51	4/21/11	5	630	9.4	11.9	-110	<48	
QD-51	11/17/11	5	536	8.7	13.3	-112	<48	
QD-51	12/22/11	5	773	8.6	11.1	-111	<48	
QD-52	2/17/11	19	590	8.7	12.3	-88	<48	
QD-52	4/21/11	20	510	8.3	16.1	-87	<48	
QD-52	8/25/11	19	379	9.0	13.7	-91	<48	
QD-53	4/21/11	13	840	8.9	12.3	-165	<48	
QD-53	6/30/11	10	843	8.8	15.4	-168	<48	
QD-53	8/25/11	10	588	9.3	14.0	-168	<48	

TABLE AII-2 (Continued): 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond. ¹ μmhos/cm	pH ¹ Unit	Temp. °C	Groundwater Elevation ² Feet	Recharge ³ Hours	
QD-54	4/21/11	45	641	8.5	12.1	-22	<48	
QD-54	6/30/11	37	630	8.9	14.0	-27	<48	
QD-54	8/25/11	36	500	9.6	13.1	-29	<48	
QD-55	4/21/11	147	647	8.4	11.6	-138	<48	
QD-55	6/30/11	96	691	8.1	14.2	-136	<48	
QD-55	11/17/11	123	456	9.0	10.3	-143	<48	
QD-56	4/20/11	47	469	8.1	11.3	-68	<48	
QD-56	10/13/11	19	389	8.1	12.8	-65	<48	
QD-56	11/17/11	43	501	8.8	10.7	-83	<48	
QD-57	6/30/11	20	554	8.5	13.4	-110	<48	
QD-57	10/13/11	30	409	8.5	12.1	100	<48	
QD-57	12/22/11	18	506	8.0	10.3	-107	<48	
QD-58	4/20/11	111	392	7.7	10.9	-112	<48	
QD-58	6/30/11	114	404	7.8	13.3	-104	<48	
QD-58	10/13/11		Monitoring well could not be sampled ⁴					
QD-59	4/20/11	268	713	7.6	11.0	-44	<48	
QD-59	6/30/11	273	759	7.6	13.5	-38	<48	
QD-59	11/17/11	258	635	7.9	11.3	-54	<48	
QD-60	4/20/11	248	572	7.6	11.7	-116	<48	
QD-60	11/17/11	243	410	7.7	10.3	-124	<48	
QD-60	12/22/11	251	443	8.0	11.6	-108	<48	

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

²Groundwater elevations are relative to Chicago City Datum.

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

⁴Monitoring well could not be sampled due to reasons given in text.