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

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Monitoring and Research Department
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Introduction

This report contains 2008 data for the Tunnel and Reservoir Plan Mainstream Tunnel System compiled from monitoring of groundwater level elevations in observation wells, and monitoring of groundwater quality in water quality monitoring wells. The observation wells are all sampled once every two months while the monitoring wells are sampled at varying frequency. Monitoring wells QM–53, QM–56, QM–58, QM–61, QM–66, QM–68 through QM–74, QM–76, QM–77, and QM–81 are sampled three times per year (Illinois Environmental Protection Agency [IEPA] memoranda July 9, 2004, and February 23, 2006). Monitoring wells QM–62 through QM–65, QM–67, QM–75, QM–78 through QM–80, and QM–82 are sampled six times per year (IEPA memorandum July 9, 2004). Sampling of water quality monitoring wells QM–51, QM–52, QM–54, QM–55, QM–57, and QM–60 was discontinued with the approval of the IEPA (memorandum dated May 4, 1994). Water quality monitoring well QM–59 has been dry since February 1995 and is no longer being monitored. The observation wells and water quality monitoring wells are located along the length of the Mainstream Tunnel between Morton Grove and Hodgkins.

Monitoring Data

Appendix AI contains a location map of observation wells OM–1 through OM–23 located along the Mainstream Tunnel System.

Table AII–1 in Appendix AII contains groundwater level elevation data for the year 2008 for observation wells OM–1 through OM–23 located along the Mainstream Tunnel System. Table AII–1 also contains the yearly minimum, mean, and maximum water level elevations of each observation well.

Appendix AIII contains a location map of water quality monitoring wells QM–53 through QM–82 located along the Mainstream Tunnel System.

Tables AIV–1 and AIV–2 of Appendix AIV contain water quality data for the year 2008 pertaining to water quality monitoring wells QM–53 through QM–82 located along the Mainstream Tunnel System. Ten water quality parameters were monitored: 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), total organic carbon (TOC), and temperature (Temp.). Water elevation in each water quality monitoring well as measured at the time of sampling is also included in Table AIV–2. The recharge time after initial drawdown in each monitoring well prior to sampling is also provided in Table AIV–2.

All of the wells in the Mainstream system were visited for the required number of samples. However, in some instances the samples could not be collected for various reasons. Water

quality monitoring well QM–58 could not be sampled on April 2, 2008, or September 17, 2008, because there was insufficient water in the well to collect a sample. Water quality monitoring well QM–62 could not be sampled in 2008 because the pump could not be activated because of a structural problem with the well. Patrick Engineering has investigated the problem and is scheduled to repair the well. Water quality monitoring well QM–64 could not be sampled on October 23, 2008, because access to the well was blocked. Water quality monitoring well QM–66 could not be sampled in 2008 because there was insufficient water in the well to collect a sample. Water quality monitoring well QM–70 could not be sampled on March 27, 2008, because the pump was inoperable due to an electrical problem. Water quality monitoring well QM–76 could not be sampled on February 7, 2008, because there was insufficient water in the well to collect a sample.

Summary of Data

Observation Wells Water Level Elevation Data. In Figure 1, the 2008 groundwater level elevation data for the observation wells (OM–1 through OM–23) of the Mainstream Tunnel System have been plotted. In this figure, minimum, mean, and maximum water level elevations of all the observation wells are plotted to show fluctuations in water level elevations during 2008. Table AII–1 in Appendix AII contains the groundwater level elevation data for the year 2008 for the observation wells located in the Mainstream Tunnel System.

Water Quality Monitoring Wells Data. Tables 1 through 5 contain summary statistics of the water quality parameters for the year 2008 for water quality monitoring wells QM–53 through QM–82 in the Mainstream Tunnel System. These statistics are computed from the 2008 data collected from each water quality monitoring well. The summary statistics include minimum, mean, maximum, standard deviation (Std. Dev.), median and coefficient of variation (Coeff. Var.) for eight of the nine water quality parameters analyzed during 2008. These eight water quality parameters are: chloride (Cl), conductivity (Cond.), hardness as $CaCO_3$ (Hard.), ammonia nitrogen (NH_3–N), pH, sulfate (SO_4), total dissolved solids (TDS), and total organic carbon (TOC). For fecal coliform (FC), the summary statistics include minimum, geometric mean (Geo. Mean), maximum, and median. Median values were calculated using the Microsoft® Excel function MEDIAN. In instances where an even number of samples were collected and analyzed, the reported median is the average of the two numbers in the middle of the series.

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

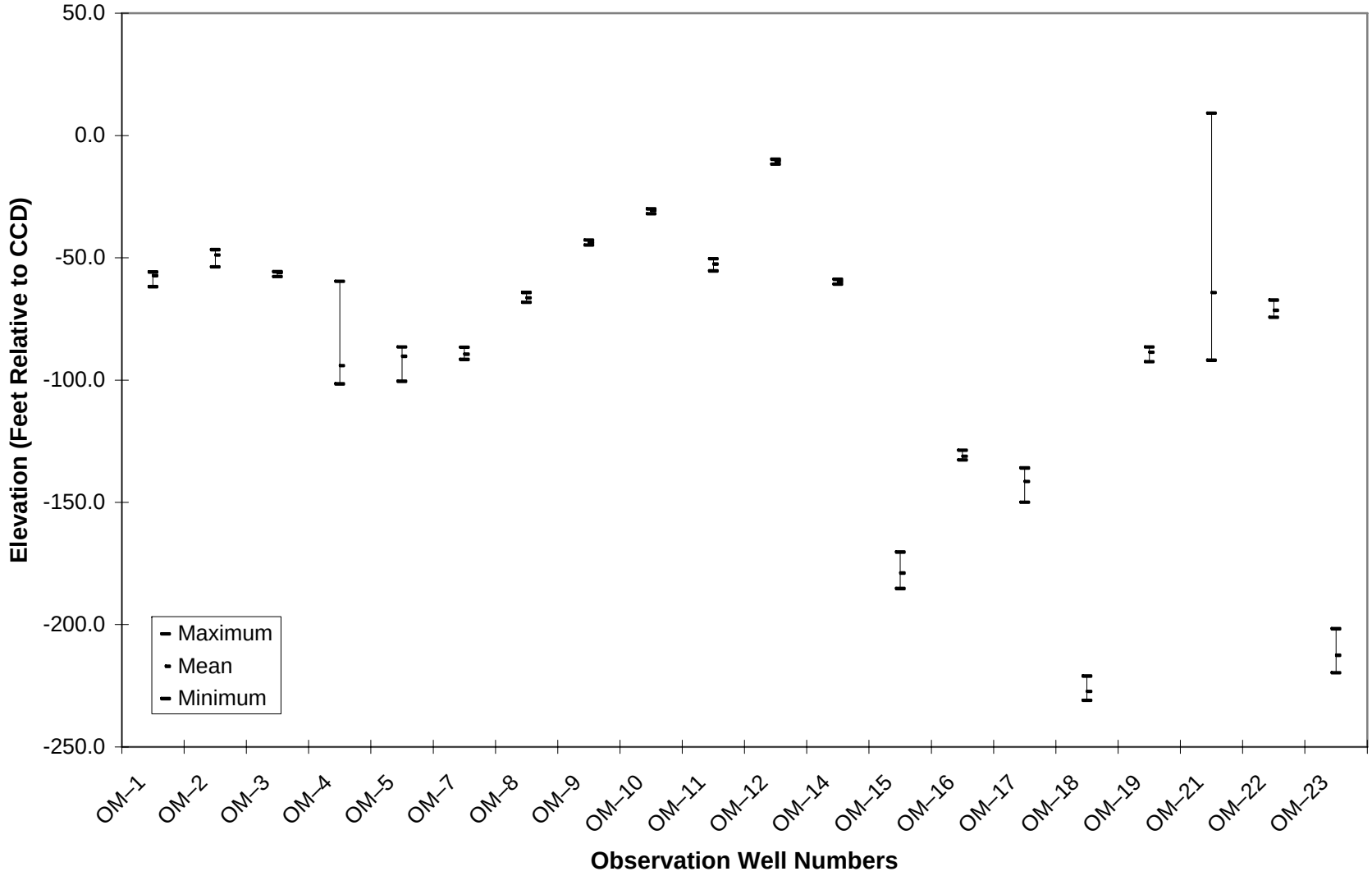


TABLE 1: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–53, QM–56, QM–58, QM–61, AND QM–63

Parameter[1]		Well Number				
		QM–53	QM–56	QM–58	QM–61	QM–63
Cl	Minimum	14	34	16	58	47
mg/L	Mean	14	35	16	84	50
	Maximum	15	37	16	132	54
	Std. Dev.	1	2	NC	41	3
	Median	14	34	16	63	49
	Coeff. Var. (%)	4	5	NC	49	6
FC	Minimum	1	1	1	2	1
cfu/100 mL	Geo. Mean	1	1	1	140	2
	Maximum	1	1	1	12,400	16
	Median	1	1	1	110	2
SO_4	Minimum	33.9	15.0	169.0	16.8	845.6
mg/L	Mean	38.5	16.4	169.0	32.2	905.3
	Maximum	43.1	18.6	169.0	51.8	965.0
	Std. Dev.	4.6	1.9	NC	17.8	42.2
	Median	38.5	15.7	169.0	28.1	898.7
	Coeff. Var. (%)	11.9	11.6	NC	55.3	4.7
NH_3–N	Minimum	0.07	0.47	1.08	0.23	1.86
mg/L	Mean	0.09	0.48	1.08	0.30	2.96
	Maximum	0.12	0.50	1.08	0.40	7.94
	Std. Dev.	0.03	0.02	NC	0.09	2.44
	Median	0.07	0.48	1.08	0.26	1.97
	Coeff. Var. (%)	33.31	3.16	NC	30.59	82.45
TOC	Minimum	1.0	1.0	1.0	1.0	1.5
mg/L	Mean	1.0	1.0	1.0	1.0	1.7
	Maximum	1.0	1.0	1.0	1.1	1.9
	Std. Dev.	0.0	0.0	NC	0.1	0.2
	Median	1.0	1.0	1.0	1.0	1.7
	Coeff. Var. (%)	0.0	0.0	NC	5.6	10.0

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–53, QM–56, QM–58, QM–61, AND QM–63

Parameter[1]		Well Number				
		QM–53	QM–56	QM–58	QM–61	QM–63
TDS	Minimum	154	264	448	356	1,664
mg/L	Mean	205	285	448	397	1,717
	Maximum	234	298	448	422	1,774
	Std. Dev.	45	18	NC	36	44
	Median	228	292	448	414	1,716
	Coeff. Var. (%)	22	6	NC	9	3
Hard.	Minimum	128	117	260	122	813
mg/L	Mean	133	125	260	149	871
	Maximum	138	130	260	184	912
	Std. Dev.	5	7	NC	32	40
	Median	134	127	260	142	883
	Coeff. Var. (%)	4	5	NC	21	5
Cond.	Minimum	185	256	545	362	510
µmhos/cm	Mean	227	318	545	700	1,263
	Maximum	296	420	545	1,086	2,083
	Std. Dev.	60	89	NC	364	663
	Median	200	278	545	651	1,080
	Coeff. Var. (%)	27	28	NC	52	53
pH	Minimum	7.4	7.4	7.7	7.8	7.3
unit	Mean	7.6	7.6	7.7	7.9	7.5
	Maximum	7.9	7.7	7.7	8.0	7.8
	Std. Dev.	0.3	0.2	NC	0.1	0.2
	Median	7.6	7.6	7.7	7.8	7.5
	Coeff. Var. (%)	3.3	2.0	NC	1.5	2.3

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

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

TABLE 2: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–64, QM–65, AND QM–67 THROUGH QM–69

Parameter[1]		Well Number				
		QM–64	QM–65	QM–67	QM–68	QM–69
Cl	Minimum	47	364	166	24	32
mg/L	Mean	75	412	244	26	34
	Maximum	151	476	324	27	36
	Std. Dev.	43	42	59	2	2
	Median	60	416	252	26	33
	Coeff. Var. (%)	57	10	24	6	6
FC	Minimum	1	1	20	1	1
cfu/100 mL	Geo. Mean	17	2	77	2	1
	Maximum	6,000	14	250	7	1
	Median	4	1	72	1	1
SO_4	Minimum	33.9	173.2	15.1	34.9	41.8
mg/L	Mean	44.0	184.8	20.6	38.0	43.9
	Maximum	51.7	196.0	25.6	42.9	47.8
	Std. Dev.	6.8	10.1	4.3	4.3	3.3
	Median	43.8	184.4	20.6	36.2	42.2
	Coeff. Var. (%)	15.5	5.5	21.0	11.4	7.6
NH_3–N	Minimum	1.78	6.68	7.46	0.52	0.91
mg/L	Mean	1.94	8.32	8.02	0.58	0.93
	Maximum	2.24	10.70	8.67	0.61	0.96
	Std. Dev.	0.19	1.53	0.45	0.05	0.03
	Median	1.87	8.37	7.96	0.60	0.93
	Coeff. Var. (%)	10.01	18.34	5.62	8.55	2.70
TOC	Minimum	1.0	4.8	2.1	1.0	1.0
mg/L	Mean	1.1	5.7	2.2	1.0	1.0
	Maximum	1.2	6.8	2.4	1.0	1.0
	Std. Dev.	0.1	0.7	0.2	0.0	0.0
	Median	1.0	5.8	2.2	1.0	1.0
	Coeff. Var. (%)	8.4	12.4	6.7	0.0	0.0

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–64, QM–65, AND QM–67 THROUGH QM–69

Parameter[1]		Well Number				
		QM–64	QM–65	QM–67	QM–68	QM–69
TDS	Minimum	396	1,248	670	222	316
mg/L	Mean	462	1,442	813	264	319
	Maximum	520	1,586	942	316	324
	Std. Dev.	49	116	109	48	4
	Median	448	1,478	831	254	318
	Coeff. Var. (%)	11	8	13	18	1
Hard.	Minimum	182	515	222	169	139
mg/L	Mean	209	546	279	177	151
	Maximum	235	560	327	183	158
	Std. Dev.	19	18	45	7	10
	Median	212	555	293	178	155
	Coeff. Var. (%)	9	3	16	4	7
Cond.	Minimum	443	1,062	748	231	312
µmhos/cm	Mean	600	1,905	1,178	299	467
	Maximum	768	2,722	1,807	359	550
	Std. Dev.	135	724	433	64	134
	Median	625	1,786	1,077	307	539
	Coeff. Var. (%)	23	38	37	22	29
pH	Minimum	7.3	7.0	7.5	7.2	7.6
unit	Mean	7.6	7.4	7.7	7.4	8.0
	Maximum	7.9	7.7	7.9	7.5	8.3
	Std. Dev.	0.3	0.3	0.2	0.2	0.4
	Median	7.7	7.5	7.7	7.4	8.2
	Coeff. Var. (%)	3.7	3.6	2.2	2.1	4.7

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

TABLE 3: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–70 THROUGH QM–74

Parameter[1]		Well Number				
		QM–70	QM–71	QM–72	QM–73	QM–74
Cl	Minimum	45	117	119	30	43
mg/L	Mean	47	123	126	33	45
	Maximum	48	133	135	35	49
	Std. Dev.	2	9	8	3	3
	Median	47	118	125	34	43
	Coeff. Var. (%)	5	7	6	8	8
FC	Minimum	1	1	1	1	1
cfu/100 mL	Geo. Mean	2	1	1	1	1
	Maximum	3	1	1	1	1
	Median	2	1	1	1	1
SO_4	Minimum	50.8	67.0	2.0	2.0	2.0
mg/L	Mean	52.1	69.5	2.2	2.4	4.1
	Maximum	53.5	72.6	2.6	3.1	8.3
	Std. Dev.	1.9	2.8	0.3	0.6	3.6
	Median	52.1	68.8	2.0	2.0	2.0
	Coeff. Var. (%)	3.7	4.1	15.5	26.8	88.8
NH_3–N	Minimum	0.37	0.43	0.32	0.24	0.19
mg/L	Mean	0.37	0.44	0.35	0.24	0.22
	Maximum	0.37	0.46	0.37	0.25	0.23
	Std. Dev.	0.00	0.02	0.03	0.01	0.02
	Median	0.37	0.44	0.35	0.24	0.23
	Coeff. Var. (%)	0.00	3.45	7.26	2.37	10.66
TOC	Minimum	1.0	1.0	1.0	1.0	1.0
mg/L	Mean	1.0	1.0	1.0	1.0	1.1
	Maximum	1.0	1.0	1.0	1.0	1.2
	Std. Dev.	0.0	0.0	0.0	0.0	0.1
	Median	1.0	1.0	1.0	1.0	1.0
	Coeff. Var. (%)	0.0	0.0	0.0	0.0	10.8

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–70 THROUGH QM–74

Parameter[1]		Well Number				
		QM–70	QM–71	QM–72	QM–73	QM–74
TDS	Minimum	326	456	428	290	226
mg/L	Mean	340	496	471	297	245
	Maximum	354	550	538	304	266
	Std. Dev.	20	49	59	7	20
	Median	340	482	448	298	242
	Coeff. Var. (%)	6	10	12	2	8
Hard.	Minimum	131	186	198	138	96
mg/L	Mean	136	201	208	147	98
	Maximum	141	209	215	152	99
	Std. Dev.	7	13	9	8	2
	Median	136	207	212	152	98
	Coeff. Var. (%)	5	6	4	5	2
Cond.	Minimum	545	357	378	254	233
µmhos/cm	Mean	546	557	590	283	258
	Maximum	547	875	704	301	275
	Std. Dev.	1	278	184	26	22
	Median	546	439	689	295	266
	Coeff. Var. (%)	0	50	31	9	9
pH	Minimum	8.1	7.5	7.4	7.6	7.7
unit	Mean	8.2	7.8	7.6	7.7	7.8
	Maximum	8.2	8.0	7.8	7.8	8.0
	Std. Dev.	0.1	0.3	0.2	0.1	0.2
	Median	8.2	8.0	7.5	7.7	7.8
	Coeff. Var. (%)	0.9	3.7	2.8	1.3	2.0

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

TABLE 4: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–75 THROUGH QM–79

Parameter[1]		Well Number				
		QM–75	QM–76	QM–77	QM–78	QM–79
Cl	Minimum	11	11	10	11	18
mg/L	Mean	14	13	11	12	19
	Maximum	23	14	11	14	22
	Std. Dev.	5	2	1	1	2
	Median	13	13	11	12	19
	Coeff. Var. (%)	33	17	5	11	8
FC	Minimum	1	1	1	1	1
cfu/100 mL	Geo. Mean	5	1	21	1	1
	Maximum	2,100	1	8,700	1	1
	Median	1	1	1	1	1
SO_4	Minimum	6.6	71.5	2.0	42.9	15.4
mg/L	Mean	11.9	75.7	2.6	47.4	19.2
	Maximum	18.9	79.8	3.1	51.1	25.9
	Std. Dev.	4.2	5.8	0.6	3.3	4.1
	Median	11.5	75.7	2.8	48.0	17.8
	Coeff. Var. (%)	35.7	7.7	21.0	7.1	21.6
NH_3–N	Minimum	0.24	0.21	0.13	0.06	0.02
mg/L	Mean	0.31	0.22	0.14	0.08	0.04
	Maximum	0.61	0.22	0.15	0.10	0.07
	Std. Dev.	0.15	0.01	0.01	0.02	0.02
	Median	0.26	0.22	0.14	0.07	0.04
	Coeff. Var. (%)	46.50	3.29	7.14	19.64	44.72
TOC	Minimum	1.0	1.0	1.0	1.0	1.0
mg/L	Mean	1.0	1.0	1.5	1.0	1.0
	Maximum	1.0	1.0	1.7	1.0	1.0
	Std. Dev.	0.0	0.0	0.4	0.0	0.0
	Median	1.0	1.0	1.7	1.0	1.0
	Coeff. Var. (%)	0.0	0.0	27.6	0.0	0.0

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–75 THROUGH QM–79

Parameter[1]		Well Number				
		QM–75	QM–76	QM–77	QM–78	QM–79
TDS	Minimum	166	362	92	206	292
mg/L	Mean	214	365	154	292	332
	Maximum	244	368	200	328	390
	Std. Dev.	28	4	56	45	34
	Median	214	365	170	303	322
	Coeff. Var. (%)	13	1	36	15	10
Hard.	Minimum	58	54	40	9	9
mg/L	Mean	61	59	41	10	10
	Maximum	66	64	41	11	11
	Std. Dev.	3	7	1	1	1
	Median	61	59	41	10	10
	Coeff. Var. (%)	4	12	1	6	6
Cond.	Minimum	241	322	198	308	363
µmhos/cm	Mean	319	342	221	444	499
	Maximum	378	362	240	608	580
	Std. Dev.	56	28	21	110	79
	Median	330	342	226	429	509
	Coeff. Var. (%)	18	8	10	25	16
pH	Minimum	7.8	7.5	7.7	7.6	7.6
unit	Mean	8.2	7.6	8.2	8.2	8.5
	Maximum	8.6	7.7	8.4	8.7	9.0
	Std. Dev.	0.3	0.1	0.4	0.4	0.7
	Median	8.2	7.6	8.4	8.2	8.9
	Coeff. Var. (%)	3.9	1.9	4.9	5.0	7.8

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

TABLE 5: SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–80 THROUGH QM–82

Parameter[1]		Well Number		
		QM–80	QM–81	QM–82
Cl	Minimum	12	18	14
mg/L	Mean	16	19	26
	Maximum	30	20	29
	Std. Dev.	7	1	6
	Median	14	19	28
	Coeff. Var. (%)	43	5	23
FC	Minimum	1	1	1
cfu/100 mL	Geo. Mean	1	1	1
	Maximum	1	1	1
	Median	1	1	1
SO_4	Minimum	2.0	11.2	5.1
mg/L	Mean	43.2	14.8	9.7
	Maximum	244.0	20.0	13.5
	Std. Dev.	98.4	4.6	3.0
	Median	3.5	13.3	10.2
	Coeff. Var. (%)	228.0	30.9	30.4
NH_3–N	Minimum	0.02	0.03	0.04
mg/L	Mean	0.03	0.05	0.05
	Maximum	0.04	0.07	0.06
	Std. Dev.	0.01	0.02	0.01
	Median	0.03	0.06	0.05
	Coeff. Var. (%)	23.77	39.03	17.89
TOC	Minimum	1.0	1.0	1.0
mg/L	Mean	1.0	1.0	1.0
	Maximum	1.0	1.0	1.0
	Std. Dev.	0.0	0.0	0.0
	Median	1.0	1.0	1.0
	Coeff. Var. (%)	0.0	0.0	0.0

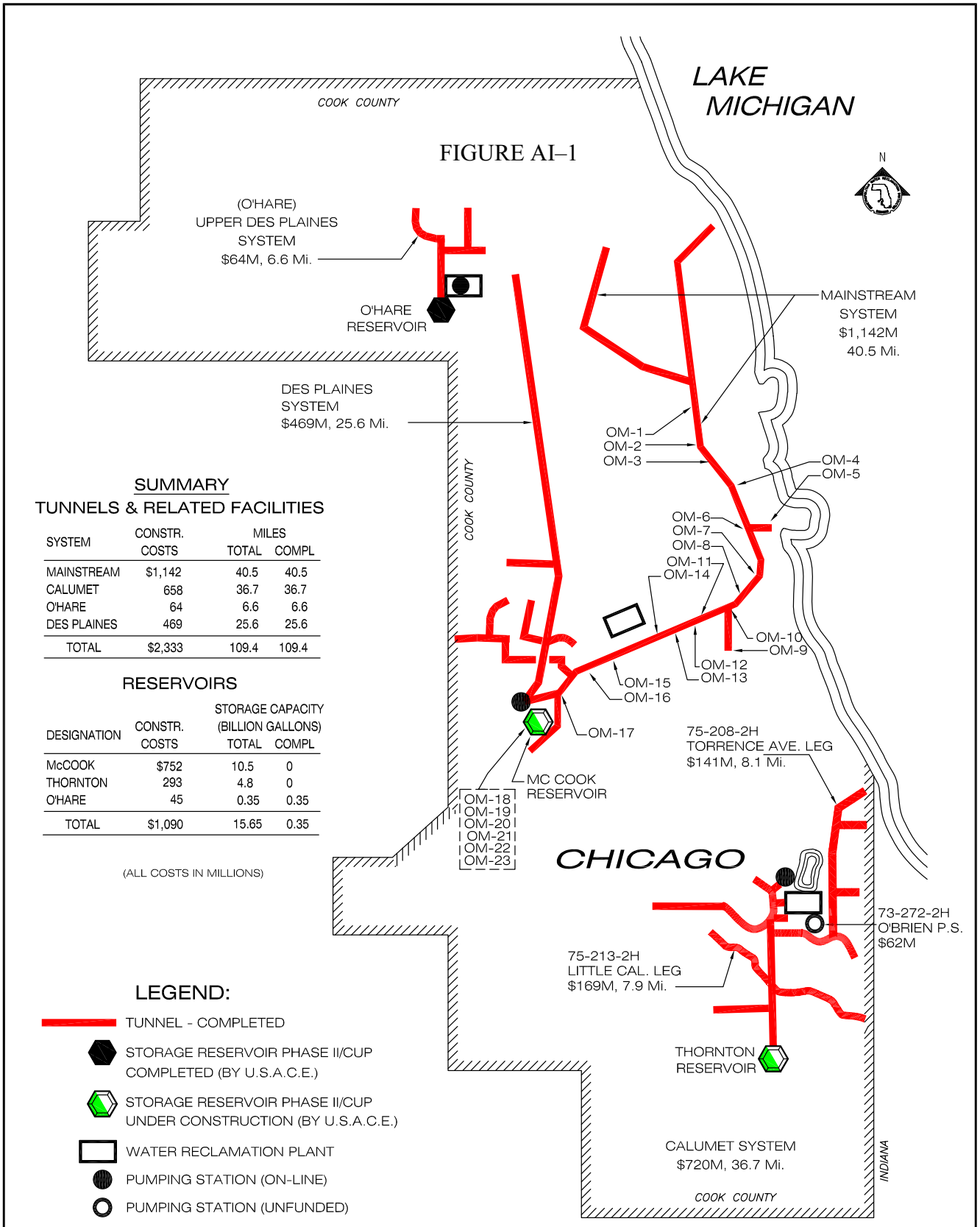
TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2008 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE MAINSTREAM TUNNEL SYSTEM: WELLS QM–80 THROUGH QM–82

Parameter[1]		Well Number QM–80	QM–81	QM–82
TDS	Minimum	176	220	262
mg/L	Mean	208	245	282
	Maximum	252	258	294
	Std. Dev.	25	21	12
	Median	207	256	285
	Coeff. Var. (%)	12	9	4
Hard.	Minimum	19	29	14
mg/L	Mean	20	29	14
	Maximum	22	30	15
	Std. Dev.	1	1	0
	Median	20	29	14
	Coeff. Var. (%)	5	2	3
Cond.	Minimum	242	263	283
µmhos/cm	Mean	302	309	416
	Maximum	340	365	498
	Std. Dev.	39	52	77
	Median	315	300	419
	Coeff. Var. (%)	13	17	19
pH	Minimum	7.4	7.5	7.5
unit	Mean	8.3	7.9	8.3
	Maximum	9.0	8.6	8.8
	Std. Dev.	0.7	0.6	0.6
	Median	8.6	7.7	8.5
	Coeff. Var. (%)	8.3	7.4	6.9

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

APPENDIX AI

LOCATION MAP OF GROUNDWATER OBSERVATION WELLS OM–1 THROUGH OM–23 IN THE MAINSTREAM TUNNEL SYSTEM



SUMMARY
TUNNELS & RELATED FACILITIES

SYSTEM	CONSTR. COSTS	MILES TOTAL	MILES COMPL
MAINSTREAM	$1,142	40.5	40.5
CALUMET	658	36.7	36.7
O'HARE	64	6.6	6.6
DES PLAINES	469	25.6	25.6
TOTAL	$2,333	109.4	109.4

RESERVOIRS

DESIGNATION	CONSTR. COSTS	STORAGE CAPACITY (BILLION GALLONS) TOTAL	STORAGE CAPACITY (BILLION GALLONS) COMPL
McCOOK	$752	10.5	0
THORNTON	293	4.8	0
O'HARE	45	0.35	0.35
TOTAL	$1,090	15.65	0.35

(ALL COSTS IN MILLIONS)

LEGEND:

- TUNNEL - COMPLETED
- STORAGE RESERVOIR PHASE II/CUP COMPLETED (BY U.S.A.C.E.)
- STORAGE RESERVOIR PHASE II/CUP UNDER CONSTRUCTION (BY U.S.A.C.E.)
- WATER RECLAMATION PLANT
- PUMPING STATION (ON-LINE)
- PUMPING STATION (UNFUNDED)

MAINSTREAM TUNNEL SYSTEM LOCATION MAP OF GROUNDWATER OBSERVATION WELLS

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

APPENDIX AII

2008 GROUNDWATER LEVEL ELEVATION DATA FOR OBSERVATION WELLS OM–1 THROUGH OM–23 IN THE MAINSTREAM TUNNEL SYSTEM

TABLE AII–1: 2008 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OM–1 THROUGH OM–23 IN THE MAINSTREAM TUNNEL SYSTEM

Date	Observation Well											
	OM–1	OM–2	OM–3	OM–4	OM–5	OM–6	OM–7	OM–8	OM–9	OM–10	OM–11	OM–12
	feet											
2/8/08	-56.8	**	-55.7	-100.6	-86.5	-41.4	-91.6	-64.2	-43.8	-30.0	**	**
4/11/08	-61.8	-53.7	-55.7	-101.6	-100.5	-41.4	-90.6	-68.2	-44.8	-32.0	-51.4	-10.7
6/6/08	-55.8	-48.7	-55.7	-100.6	-88.5	-43.4	-86.6	-66.2	-42.8	-30.0	-50.4	-11.7
9/12/08	-56.8	-47.7	-55.7	-100.6	-88.5	-40.4	-86.6	-65.2	-43.8	-31.0	-52.4	***
10/24/08	-56.8	-47.7	-57.7	-101.6	-90.5	-43.4	-89.6	-66.2	-43.8	-31.0	-53.4	-9.7
11/7/08	-55.8	-46.7	-55.7	-59.6	-87.5	-43.4	-91.6	-68.2	-43.8	-30.0	-55.4	-9.7
Minimum	-61.8	-53.7	-57.7	-101.6	-100.5	-43.4	-91.6	-68.2	-44.8	-32.0	-55.4	-11.7
Mean	-57.3	-48.9	-56.0	-94.1	-90.3	-42.2	-89.4	-66.4	-43.8	-30.7	-52.6	-10.5
Maximum	-55.8	-46.7	-55.7	-59.6	-86.5	-40.4	-86.6	-64.2	-42.8	-30.0	-50.4	-9.7

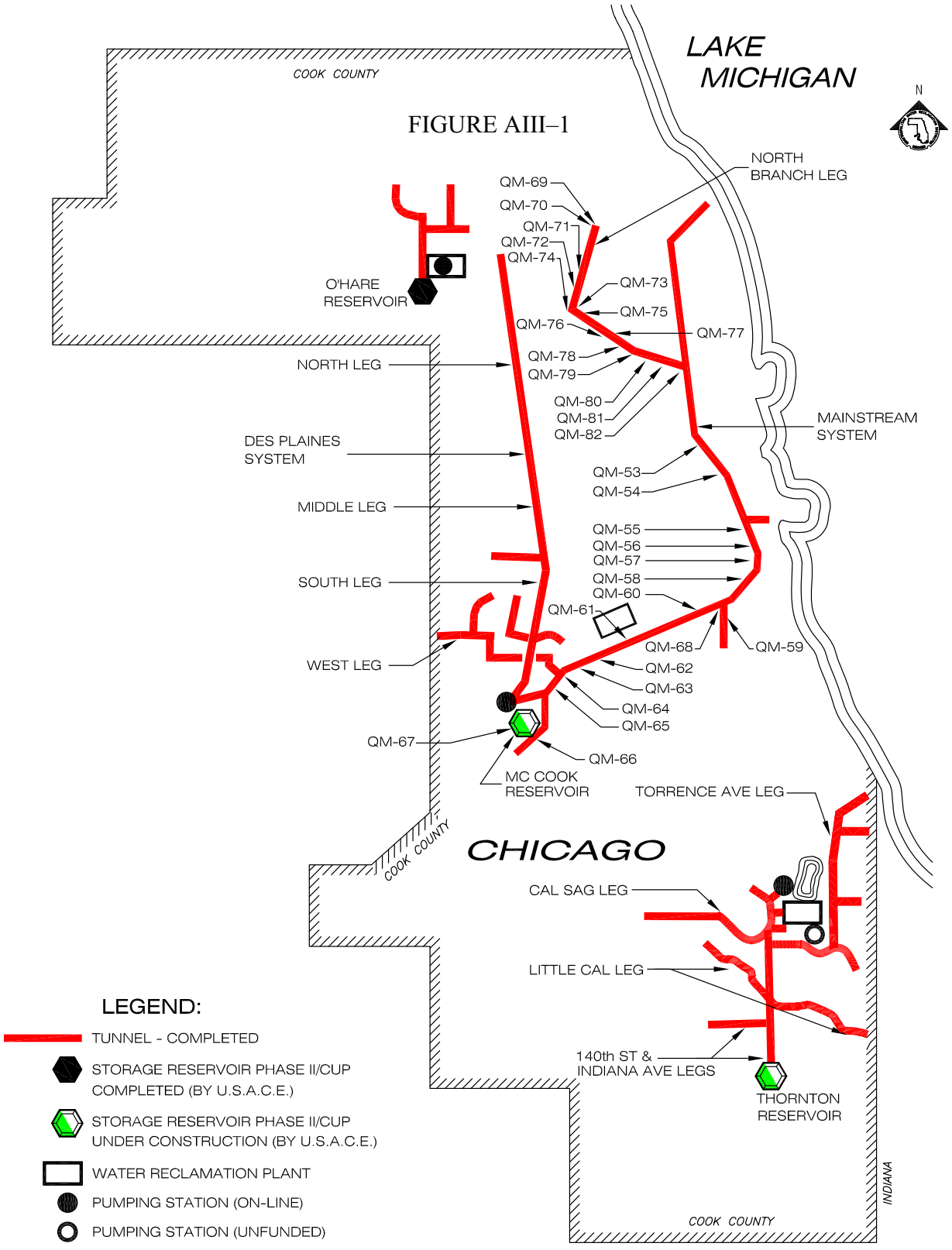
TABLE AII–1 (Continued): 2008 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OM–1 THROUGH OM–23 IN THE MAINSTREAM TUNNEL SYSTEM

Date	Observation Well										
	OM–13	OM–14	OM–15	OM–16	OM–17	OM–18	OM–19	OM–20	OM–21	OM–22	OM–23
	feet										
2/8/08	**	**	-185.3	-131.7	-143.0	-221.0	-92.5	-111.9	-72.9	-67.3	-211.7
4/11/08	42.4	-58.8	-183.3	-132.7	-142.0	-227.0	-87.5	-104.9	-85.9	-74.3	-219.7
6/6/08	41.4	-59.8	-170.3	-132.7	-137.0	-231.0	-91.5	-113.9	-71.9	-68.3	-213.7
9/12/08	41.4	-58.8	-176.3	-128.7	-136.0	-229.0	-87.5	-119.9	-71.9	-70.3	-201.7
10/24/08	41.4	-60.8	-179.3	-130.7	-150.0	-227.0	-86.5	-107.9	9.1	-74.3	-212.7
11/7/08	42.4	-60.8	-179.3	-130.7	-141.0	-229.0	-86.5	-108.9	-91.9	-74.3	-215.7
Minimum	41.4	-60.8	-185.3	-132.7	-150.0	-231.0	-92.5	-119.9	-91.9	-74.3	-219.7
Mean	41.8	-59.8	-179.0	-131.2	-141.5	-227.3	-88.7	-111.2	-64.2	-71.5	-212.5
Maximum	42.4	-58.8	-170.3	-128.7	-136.0	-221.0	-86.5	-104.9	9.1	-67.3	-201.7

*Relative to Chicago City Datum.
**Access to well blocked by snow.
***Construction blocked access to well.

APPENDIX AIII

LOCATION MAP OF GROUNDWATER QUALITY
MONITORING WELLS QM–53 THROUGH QM–82
IN THE MAINSTREAM TUNNEL SYSTEM



MAINSTREAM TUNNEL SYSTEM
LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

APPENDIX AIV

2008 GROUNDWATER QUALITY MONITORING DATA FOR WELLS QM–53 THROUGH QM–82 IN THE MAINSTREAM TUNNEL SYSTEM

TABLE AIV–1: 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QM–53 THROUGH QM–82 IN THE MAINSTREAM 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
QM–53	4/2/08	15	<1	43.1	0.07	<1.0	154
QM–53	7/24/08	14	<1	38.5	0.12	<1.0	228
QM–53	12/18/08	14	<1	33.9	0.07	<1.0	234
QM–56	4/2/08	37	<1	18.6	0.47	<1.0	264
QM–56	7/24/08	34	<1	15.7	0.48	<1.0	292
QM–56	12/18/08	34	<1	15.0	0.50	<1.0	298
QM–58	4/2/08	Well could not be sampled					
QM–58	7/24/08	16	<1	169.0	1.08	<1.0	448
QM–58	9/17/08	Well could not be sampled					
QM–61	2/5/08	132	12,400	51.8	0.40	1.1	422
QM–61	9/4/08	63	110	28.1	0.23	<1.0	414
QM–61	12/10/08	58	2	16.8	0.26	<1.0	356
QM–62	2/7/08	Well could not be sampled					
QM–62	4/30/08	Well could not be sampled					
QM–62	7/2/08	Well could not be sampled					
QM–62	9/11/08	Well could not be sampled					
QM–62	10/30/08	Well could not be sampled					
QM–62	12/4/08	Well could not be sampled					
QM–63	2/7/08	53	2	885.2	1.86	1.8	1,664
QM–63	5/1/08	54	<1	889.0	1.97	1.9	1,720
QM–63	7/2/08	49	<1	965.0	2.07	1.9	1,774
QM–63	9/11/08	47	4	938.4	1.97	1.5	1,756
QM–63	10/23/08	48	16	845.6	7.94	1.6	1,674
QM–63	12/4/08	47	<1	908.4	1.95	1.6	1,712
QM–64	2/21/08	151	6,000	48.6	1.79	1.1	502
QM–64	4/30/08	66	4	51.7	2.24	1.2	520
QM–64	6/17/08	60	<1	43.8	2.03	<1.0	448
QM–64	9/4/08	53	55	42.1	1.87	<1.0	446
QM–64	10/23/08	Well could not be sampled					
QM–64	12/10/08	47	1	33.9	1.78	1.0	396

TABLE AIV–1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QM–53 THROUGH QM–82 IN THE MAINSTREAM 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
QM–65	2/7/08	366	<1	187.7	6.76	5.1	1,376
QM–65	5/1/08	364	<1	196.0	6.68	4.8	1,248
QM–65	7/2/08	433	<1	196.0	9.03	5.7	1,478
QM–65	9/11/08	416	1	181.0	8.78	5.8	1,478
QM–65	10/23/08	415	14	174.8	7.96	6.0	1,488
QM–65	12/4/08	476	<1	173.2	10.70	6.8	1,586
QM–66	2/7/08		Well could not be sampled				
QM–66	7/2/08		Well could not be sampled				
QM–66	10/23/08		Well could not be sampled				
QM–67	2/7/08	272	210	20.0	8.34	2.4	870
QM–67	5/1/08	324	41	25.6	8.67	2.1	942
QM–67	7/2/08	279	58	21.2	8.14	2.1	898
QM–67	9/11/08	233	86	25.0	7.46	2.1	792
QM–67	10/23/08	190	250	15.1	7.70	2.4	704
QM–67	12/4/08	166	20	16.4	7.78	2.3	670
QM–68	4/2/08	27	<1	42.9	0.61	<1.0	222
QM–68	7/24/08	24	7	36.2	0.60	<1.0	316
QM–68	12/4/08	26	<1	34.9	0.52	<1.0	254
QM–69	3/27/08	36	<1	47.8	0.93	<1.0	318
QM–69	7/24/08	32	<1	41.8	0.96	<1.0	324
QM–69	10/22/08	33	<1	42.2	0.91	<1.0	316
QM–70	3/27/08		Well could not be sampled				
QM–70	10/22/08	45	<1	50.8	0.37	<1.0	326
QM–70	11/13/08	48	3	53.5	0.37	<1.0	354
QM–71	3/27/08	133	<1	72.6	0.44	<1.0	456
QM–71	7/24/08	117	<1	68.8	0.46	<1.0	550
QM–71	10/22/08	118	<1	67.0	0.43	<1.0	482

TABLE AIV–1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QM–53 THROUGH QM–82 IN THE MAINSTREAM 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
QM–72	3/27/08	135	<1	2.6	0.35	<1.0	428
QM–72	7/24/08	119	<1	<2.0	0.37	<1.0	538
QM–72	10/22/08	125	<1	<2.0	0.32	<1.0	448
QM–73	3/27/08	35	<1	3.1	0.24	1.0	290
QM–73	7/24/08	30	<1	<2.0	0.25	<1.0	298
QM–73	11/13/08	34	1	<2.0	0.24	1.0	304
QM–74	3/27/08	49	<1	<2.0	0.23	1.2	226
QM–74	7/24/08	43	<1	<2.0	0.23	<1.0	266
QM–74	9/18/08	43	<1	8.3	0.19	<1.0	242
QM–75	2/7/08	23	<1	12.5	0.61	<1.0	166
QM–75	4/23/08	13	<1	13.7	0.26	<1.0	244
QM–75	6/19/08	12	<1	9.1	0.25	<1.0	240
QM–75	7/17/08	11	<1	10.6	0.25	<1.0	208
QM–75	8/28/08	11	6	6.6	0.27	<1.0	216
QM–75	9/18/08	15	2,100	18.9	0.24	<1.0	212
QM–76	2/7/08	Well could not be sampled					
QM–76	4/23/08	14	<1	71.5	0.22	<1.0	362
QM–76	7/24/08	11	<1	79.8	0.21	<1.0	368
QM–77	2/7/08	<10	<1	<2.0	0.14	1.7	92
QM–77	4/23/08	11	<1	3.1	0.15	1.7	200
QM–77	9/18/08	11	8,700	2.8	0.13	1.0	170
QM–78	2/7/08	14	<1	49.0	0.09	<1.0	206
QM–78	4/23/08	13	<1	51.1	0.07	<1.0	328
QM–78	6/19/08	12	<1	50.4	0.07	<1.0	324
QM–78	7/17/08	11	<1	47.0	0.07	<1.0	308
QM–78	8/28/08	11	<1	44.2	0.10	<1.0	298
QM–78	9/18/08	11	<1	42.9	0.06	<1.0	290
QM–79	4/17/08	19	<1	25.9	0.03	<1.0	328
QM–79	6/19/08	19	<1	22.1	0.02	<1.0	350

TABLE AIV–1 (Continued): 2008 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS QM–53 THROUGH QM–82 IN THE MAINSTREAM 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
QM–79	7/17/08	18	<1	19.3	0.03	<1.0	292
QM–79	8/28/08	18	<1	16.1	0.05	<1.0	314
QM–79	9/18/08	18	<1	15.4	0.04	<1.0	316
QM–79	11/13/08	22	<1	16.3	0.07	<1.0	390
QM–80	4/17/08	30	<1	3.9	0.04	<1.0	194
QM–80	6/19/08	14	<1	244.0	<0.02	<1.0	252
QM–80	7/17/08	12	<1	3.4	0.03	<1.0	176
QM–80	8/28/08	13	<1	<2.0	0.03	<1.0	212
QM–80	9/18/08	13	1	3.5	0.04	<1.0	208
QM–80	11/13/08	14	<1	<2.0	0.03	<1.0	206
QM–81	4/17/08	20	<1	20.0	0.03	<1.0	258
QM–81	7/24/08	18	<1	13.3	0.06	<1.0	256
QM–81	9/18/08	19	<1	11.2	0.07	<1.0	220
QM–82	4/17/08	14	<1	13.5	0.05	<1.0	290
QM–82	6/19/08	29	<1	11.6	0.04	<1.0	284
QM–82	7/17/08	28	<1	9.6	0.05	<1.0	262
QM–82	8/28/08	28	<1	5.1	0.06	<1.0	274
QM–82	9/18/08	27	<1	7.8	0.06	<1.0	286
QM–82	11/13/08	29	<1	10.7	0.04	<1.0	294

[1]The method detection limit (MDL) or limit of quantification (LOQ) is 10 mg/L for Cl (LOQ), 2.0 mg/L for SO_4 (LOQ), 0.02 mg/L for NH_3–N (MDL), 1.0 mg/L for TOC (LOQ), and 40 mg/L for TDS (LOQ). The detection limit for the FC analysis using the membrane filter method varies based on the actual sample volume analyzed.

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

TABLE AIV–2: 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QM–51 THROUGH QM–82 IN THE MAINSTREAM TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QM–53	4/2/08	134	185	7.4	11	-40	<4
QM–53	7/24/08	138	296	7.6	12	-35	<4
QM–53	12/18/08	128	200	7.9	10	-40	<4
QM–56	4/2/08	130	278	7.7	13	-77	<4
QM–56	7/24/08	127	420	7.4	14	-75	<4
QM–56	12/18/08	117	256	7.6	13	-77	<4
QM–58	4/2/08	Well could not be sampled					
QM–58	7/24/08	260	545	7.7	13	-99	<4
QM–58	9/17/08	Well could not be sampled					
QM–61	2/5/08	184	651	7.8	12	-186	<4
QM–61	9/4/08	142	1,086	8.0	14	-79	<4
QM–61	12/10/08	122	362	7.8	13	-171	<4
QM–62	2/7/08	Well could not be sampled					
QM–62	4/30/08	Well could not be sampled					
QM–62	7/2/08	Well could not be sampled					
QM–62	9/11/08	Well could not be sampled					
QM–62	10/30/08	Well could not be sampled					
QM–62	12/4/08	Well could not be sampled					
QM–63	2/7/08	881	510	7.5	12	-189	<4
QM–63	5/1/08	905	804	7.8	13	-192	<4
QM–63	7/2/08	912	2,083	7.5	15	-193	<4
QM–63	9/11/08	885	2,020	7.4	14	-189	<4
QM–63	10/23/08	813	1,315	7.4	13	-200	<4
QM–63	12/4/08	830	845	7.3	12	-195	<4
QM–64	2/21/08	205	768	7.3	12	-160	<4
QM–64	4/30/08	235	625	7.3	12	-170	<4
QM–64	6/17/08	213	485	7.7	14	-165	<4
QM–64	9/4/08	212	680	7.8	14	-170	<4
QM–64	10/23/08	Well could not be sampled					
QM–64	12/10/08	182	443	7.9	13	-162	<4

TABLE AIV–2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QM–51 THROUGH QM–82 IN THE MAINSTREAM TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QM–65	2/7/08	559	1,062	7.5	12	-190	<48
QM–65	5/1/08	534	1,372	7.7	13	-194	<48
QM–65	7/2/08	559	2,704	7.0	15	-192	<48
QM–65	9/11/08	560	2,722	7.2	14	-190	<48
QM–65	10/23/08	515	2,170	7.6	13	-194	<48
QM–65	12/4/08	551	1,402	7.5	12	-196	<48
QM–66	2/7/08			Well could not be sampled			
QM–66	7/2/08			Well could not be sampled			
QM–66	10/23/08			Well could not be sampled			
QM–67	2/7/08	315	748	7.6	11	-167	<48
QM–67	5/1/08	327	962	7.9	13	-165	<48
QM–67	7/2/08	303	1,807	7.5	16	-165	<48
QM–67	9/11/08	282	1,574	7.6	16	-163	<48
QM–67	10/23/08	227	1,191	7.7	13	-164	<48
QM–67	12/4/08	222	788	7.9	12	-166	<48
QM–68	4/2/08	183	231	7.4	12	-138	<48
QM–68	7/24/08	178	359	7.5	14	-124	<48
QM–68	12/4/08	169	307	7.2	12	-139	<48
QM–69	3/27/08	158	312	7.6	10	-35	<48
QM–69	7/24/08	155	539	8.3	12	-34	<48
QM–69	10/22/08	139	550	8.2	11	-37	<48
QM–70	3/27/08			Well could not be sampled			
QM–70	10/22/08	141	547	8.2	12	-64	<48
QM–70	11/13/08	131	545	8.1	11	-63	<48
QM–71	3/27/08	207	439	7.5	10	-59	<48
QM–71	7/24/08	209	875	8.0	12	-57	<48
QM–71	10/22/08	186	357	8.0	11	-61	<48
QM–72	3/27/08	215	378	7.5	10	-78	<48
QM–72	7/24/08	212	704	7.4	13	-78	<48
QM–72	10/22/08	198	689	7.8	11	-78	<48

TABLE AIV–2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QM–51 THROUGH QM–82 IN THE MAINSTREAM TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QM–73	3/27/08	152	295	7.7	11	-166	<48
QM–73	7/24/08	152	301	7.6	13	-161	<48
QM–73	11/13/08	138	254	7.8	12	-161	<48
QM–74	3/27/08	99	233	7.8	11	-17	<48
QM–74	7/24/08	98	275	7.7	12	-20	<48
QM–74	9/18/08	96	266	8.0	13	-19	<48
QM–75	2/7/08	66	340	8.1	10	-67	<48
QM–75	4/23/08	60	262	7.8	12	-65	<48
QM–75	6/19/08	61	371	8.6	11	-64	<48
QM–75	7/17/08	60	378	8.3	13	-65	<48
QM–75	8/28/08	58	320	7.8	12	-58	<48
QM–75	9/18/08	61	241	8.3	12	-38	<48
QM–76	2/7/08	Well could not be sampled					
QM–76	4/23/08	54	322	7.7	12	-184	<48
QM–76	7/24/08	64	362	7.5	13	-186	<48
QM–77	2/7/08	41	240	8.4	10	-184	<48
QM–77	4/23/08	40	198	7.7	12	-182	<48
QM–77	9/18/08	41	226	8.4	13	-122	<48
QM–78	2/7/08	10	407	8.3	11	-160	<48
QM–78	4/23/08	10	308	7.8	12	-156	<48
QM–78	6/19/08	10	608	8.1	11	-156	<48
QM–78	7/17/08	10	525	8.4	12	-159	<48
QM–78	8/28/08	9	451	7.6	12	-160	<48
QM–78	9/18/08	11	362	8.7	12	-150	<48
QM–79	4/17/08	11	483	7.6	12	-144	<48
QM–79	6/19/08	10	580	9.0	11	-147	<48
QM–79	7/17/08	10	562	8.8	12	-143	<48
QM–79	8/28/08	10	472	7.7	12	-146	<48
QM–79	9/18/08	10	363	9.0	13	-126	<48
QM–79	11/13/08	9	535	8.9	11	-167	<48

TABLE AIV–2 (Continued): 2008 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QM–51 THROUGH QM–82 IN THE MAINSTREAM TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
QM–80	4/17/08	19	299	7.5	12	-142	<48
QM–80	6/19/08	22	340	9.0	12	-138	<48
QM–80	7/17/08	20	331	8.6	13	-140	<48
QM–80	8/28/08	21	272	7.4	13	-129	<48
QM–80	9/18/08	20	242	8.6	12	-132	<48
QM–80	11/13/08	20	330	8.8	12	-156	<48
QM–81	4/17/08	29	365	7.7	13	-137	<48
QM–81	7/24/08	29	263	7.5	13	-132	<48
QM–81	9/18/08	30	300	8.6	13	-129	<48
QM–82	4/17/08	14	420	7.5	12	-186	<48
QM–82	6/19/08	15	390	8.4	13	-187	<48
QM–82	7/17/08	14	498	8.6	15	-188	<48
QM–82	8/28/08	14	418	7.6	13	-189	<48
QM–82	9/18/08	14	283	8.7	13	-186	<48
QM–82	11/13/08	14	484	8.8	12	-200	<48

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