

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 16-19

TUNNEL AND RESERVOIR PLAN

GLORIA ALITTO MAJEWSKI

CHICAGOLAND UNDERFLOW PLAN RESERVOIR

WATER QUALITY MONITORING WELLS

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2015

July 2016

Metropolitan Water Reclamation District of Greater Chicago
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LIST OF ABBREVIATIONS

°C	degrees Celsius
CFU	colony forming units
Cl ⁻	chloride
EC	electrical conductivity
FC	fecal coliform
ft	feet
hr	hour
IEPA	Illinois Environmental Protection Agency
L	liter
m	meter
mg	milligram
mL	milliliter
mS	millisiemens
NH ₃ -N	ammonia nitrogen
SO ₄ ²⁻	sulfate
TDS	total dissolved solids
TOC	total organic carbon

ANNUAL DATA FOR MONITORING WELLS

Introduction

Four monitoring wells, QK-1 through QK-4, are located on the perimeter of the Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir. Well QK-1 is positioned at the northwest corner of the reservoir, with QK-2, -3, and -4 at the northeast, southeast, and southwest corners, respectively (Figure 1). In addition, there are nine privately owned water supply wells, W1X through W9X, which are located within 1,000 ft of the reservoir. The four monitoring wells are sampled quarterly and for at least six consecutive weeks following each reservoir fill event in which the reservoir is used to store combined sewer overflow from the Tunnel and Reservoir Plan system (Illinois Environmental Protection Agency [IEPA] memorandum dated October 14, 1997). Fill-event samples may substitute for quarterly samples, depending on the occurrence of fill events. Groundwater elevations are also measured during each sampling event. There are no observation wells associated with this site.

There were two major fill events at this site during the weeks of 4/1 and 6/16/2015. Based on IEPA requirements, the wells should be sampled for at least six consecutive weeks following a fill event. As a result, Wells QK-1 and -4 were sampled for seven consecutive weeks. However, Well QK-2 was sampled for the required six weeks following the first event, but only two samples were retrieved following the second event. Two additional quarterly samples were collected from each well in September and December.

Summary of Data

Monitoring Wells. The analytical data for groundwater sampled during 2015 from monitoring wells QK-1, -2, and -4 are presented in Table 1. Physical characteristics, such as elevation, groundwater temperature, and estimated time of recharge for each well between initial pumpdown and sampling are also included. Table 2 lists the overall descriptive statistics for the groundwater data for these wells during 2015.

Following major repairs and flushing of these wells in 2014, Well QK-1 again exhibited signs of fecal coliform (FC) contamination during 2015. Elevated FC populations did correlate with the two rain events during the year. Following decontamination with a 15 percent hypochlorite solution, the FC counts eventually returned to the background level of <1 CFU/100 mL.

FIGURE 1: LOCATION OF FOUR WATER QUALITY MONITORING WELLS AND NINE PRIVATE WELLS SURROUNDING THE MAJEWSKI CHICAGO UNDERFLOW PLAN RESERVOIR

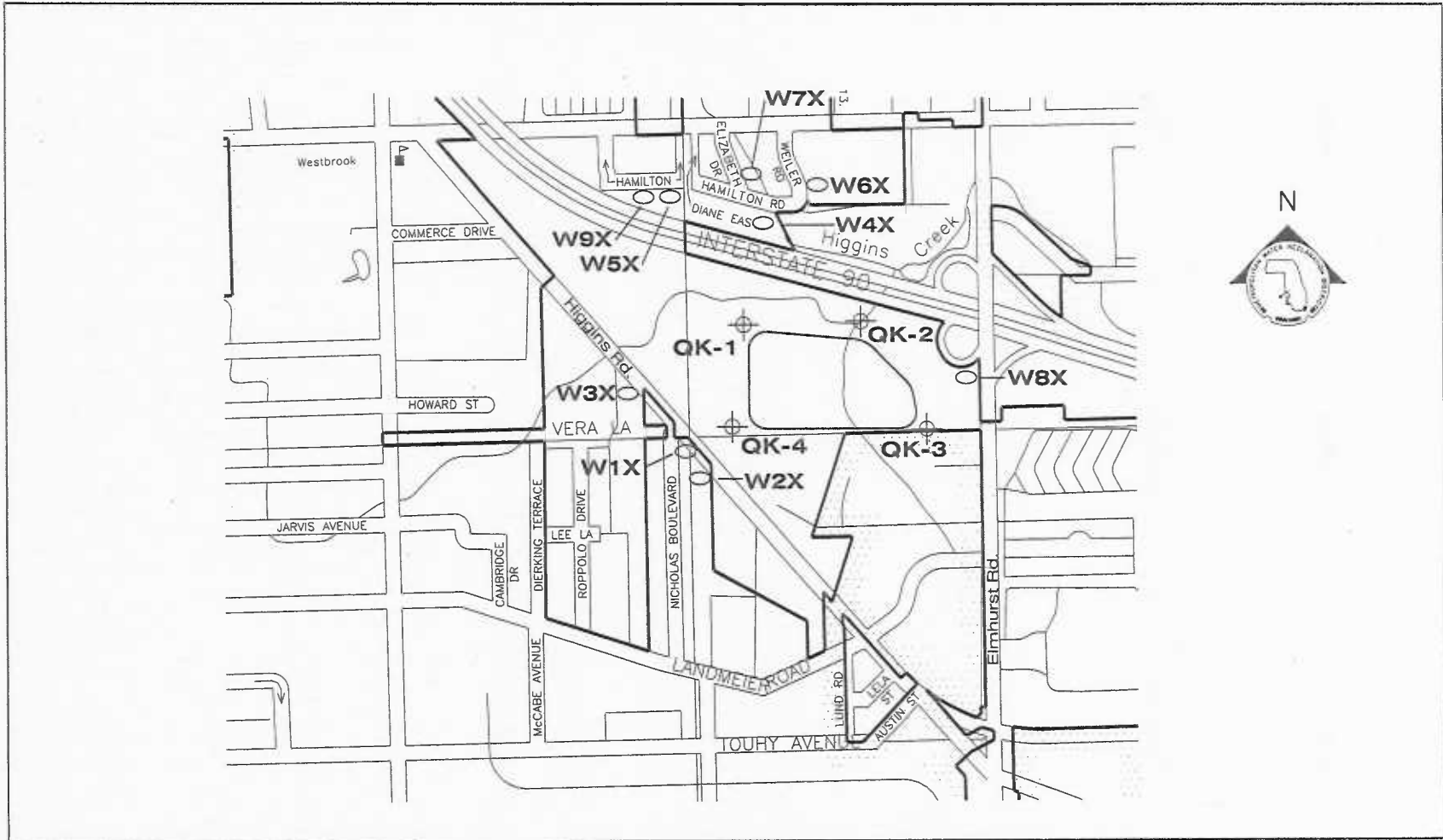


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	mg/L						CFU/100 mL	°C	ft	hr
Fill Event 1													
QK-1	04/01/15	7.0	130	1,318	10	21	683	<0.10	759	<1	12.5	5.3	<4
QK-1	04/10/15	7.0	83	800	2	75	352	0.64	490	34,000	11.9	11	<4
QK-1	04/15/15	6.7	49	1,084	<1	49	552	0.17	685	5,200	13.5	3.3	<4
QK-1	04/22/15	6.6	108	1,204	<1	35	640	<0.10	748	800	10.6	3.3	<4
QK-1	04/30/15	7.1	111	968	1	75	403	0.42	542	500	12.4	0.3	<4
QK-1	05/06/15	7.4	102	816	1	95	284	0.60	494	40	15.5	2.3	<4
QK-1	05/13/15	7.2	106	904	1	82	389	0.64	548	<1	12.2	5.3	<4
Fill Event 2													
QK-1	06/16/15	7.9	101	512	3	84	112	1.1	529	170,000	13.7	6.3	<4
QK-1	06/24/15	7.3	68	1,028	<1	58	498	0.29	643	16,000	13.9	5.3	<4
QK-1	06/30/15	7.5	147	1,010	<1	71	429	0.41	588	10,000	13.2	4.3	<4
QK-1	07/08/15	8.1	140	998	1	65	467	0.33	550	2,500	13.2	1.3	<4
QK-1	07/15/15	7.8	146	1,004	<1	64	466	0.34	595	460	13.0	4.3	<4
QK-1	07/20/15	7.8	133	1,146	1	47	534	0.17	651	400	13.8	2.3	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m			mg/L				CFU/100 mL	°C	ft	hr
Third Quarter													
QK-1	09/02/15	7.5	119	1,146	1	41	560	0.17	687	4	17.1	5.3	<4
Fourth Quarter													
QK-1	12/21/15	7.0	133	1,234	<1	25	724	<0.10	749	<1	11.5	5.3	<4
Fill Event 1													
QK-2	04/01/15	7.7	97	916	8	<10	539	<0.10	508	<1	14.7	-1.0	<4
QK-2	04/10/15	7.8	83	886	<1	<10	587	<0.10	524	3	12.1	-1.0	<4
QK-2	04/15/15	6.4	78	986	1	<10	605	<0.10	550	<1	13.9	-3.0	<4
QK-2	04/22/15	6.9	85	988	<1	<10	598	<0.10	557	<1	10.3	1.0	<4
QK-2	04/30/15	7.9	90	968	1	<10	552	<0.10	526	<1	12.5	-6.0	<4
QK-2	05/06/15	7.3	100	886	1	<10	516	<0.10	502	<1	15.1	-6.0	<4
Fill Event 2													
QK-2	06/16/15	7.3	95	872	<1	<10	532	<0.10	331	5	14.1	-5.0	<4
QK-2	07/20/15	7.5	110	990	5	<10	559	3.5	527	<1	13.1	-2.0	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	mg/L					CFU/100 mL	°C	ft	hr	
Third Quarter													
QK-2	09/02/15	7.1	123	864	2	<10	483	1.2	507	<1	14.8	5.0	<4
Fourth Quarter													
QK-2	12/21/15	7.4	117	924	<1	<10	599	0.51	518	<1	11.6	-1.0	<4
Fill Event 1													
QK-4	04/01/15	7.3	99	812	2	103	274	0.62	469	<1	12.2	14	<4
QK-4	04/10/15	7.1	89	796	1	101	272	0.69	512	<1	11.8	19	<4
QK-4	04/15/15	6.9	96	816	<1	91	316	0.57	524	<1	13.0	7.9	<4
QK-4	04/22/15	6.6	88	812	1	101	277	0.60	504	<1	11.3	10	<4
QK-4	04/30/15	7.4	90	864	1	94	290	0.60	509	<1	12.1	10	<4
QK-4	05/06/15	7.1	92	828	1	107	249	0.63	485	<1	12.9	19	<4
QK-4	05/13/15	7.1	70	830	<1	106	285	0.70	503	19	12.2	6.9	<4
Fill Event 2													
QK-4	06/16/15	7.3	95	532	<1	101	245	0.65	499	2	13.2	19	<4
QK-4	06/24/15	7.4	114	820	<1	106	262	0.62	491	<1	13.2	11	<4
QK-4	06/30/15	7.7	115	834	<1	108	265	0.65	486	<1	14.0	19	<4
QK-4	07/08/15	8.0	113	818	1	108	267	0.64	489	<1	13.0	11	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	mg/L						CFU/100 mL	°C	ft	hr
QK-4	07/15/15	7.8	121	814	<1	103	275	0.62	485	<1	13.6	13	<4
QK-4	07/20/15	7.7	121	860	2	107	253	0.65	501	<1	13.9	8.9	<4
Third Quarter													
QK-4	09/02/15	7.3	130	872	2	105	239	0.63	521	<1	14.5	21	<4
Fourth Quarter													
QK-4	12/21/15	7.0	117	776	<1	105	277	0.60	486	<1	12.3	20	<4

¹No samples from Well QK-3 during 2015; access blocked by highway construction equipment and traffic.

²EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

³Relative to Chicago city datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Statistic	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ³
			mS/m	-----mg/L-----						CFU/100 mL
Fill Event 1										
QK-1	Minimum	6.6	49	800	1	21	284	0.17	490	<1
	Mean	7.0	99	1,013	3	62	472	0.49	609	161
	Maximum	7.4	130	1,318	10	95	683	0.64	759	34,000
	Std. Dev.	0.3	26	197	4	27	153	0.20	118	NA ⁴
	Median	7.0	106	968	1	75	403	0.60	548	500
	Coeff. of Var. (%)	4.0	26	19	137	44	32	41	19	NA
Fill Event 2										
QK-1	Minimum	7.3	68	512	1	47	112	0.17	529	<1
	Mean	7.7	123	950	2	65	418	0.44	593	4,818
	Maximum	8.1	147	1,146	3	84	534	1.1	651	170,000
	Std. Dev.	0.3	32	221	1	12	154	0.34	49	NA ⁴
	Median	7.8	137	1,007	1	65	466	0.34	592	6,250
	Coeff. of Var. (%)	3.6	26	23	55	19	37	77	8	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Statistic	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ³
			mS/m	-----mg/L-----						CFU/100 mL
Fill Event 1										
QK-2	Minimum	6.4	78	886	1	<10	516	<0.10	502	<1
	Mean	7.3	89	938	2	<10	566	<0.10	528	1
	Maximum	7.9	100	988	8	<10	605	<0.10	557	3
	Std. Dev.	0.6	8	48	3	0.0	36	0.0	22	NA
	Median	7.5	88	942	1	<10	569	<0.10	525	<1
	Coeff. of Var. (%)	8.0	9	5	124	0.0	6	0.0	4	NA
Fill Event 2										
QK-2	Minimum	7.3	95	872	<1	<10	532	0.10	331	<1
	Mean	7.4	103	931	3	<10	546	1.8	429	2
	Maximum	7.5	110	990	5	<10	559	3.5	527	5
	Std. Dev.	0.2	11	83	3	0.0	19	2.4	139	NA
	Median	7.4	103	931	3	<10	546	1.8	429	1
	Coeff. of Var. (%)	2.4	10	9	104	0.0	3	134	32	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QK-1, -2, AND -4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well ¹	Statistic	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ³
			mS/m	-----mg/L-----						CFU/100 mL
Fill Event 1										
QK-4	Minimum	6.6	70	796	1	91	249	0.57	469	<1
	Mean	7.1	89	823	1	100	280	0.63	501	2
	Maximum	7.4	99	864	2	107	316	0.70	524	19
	Std. Dev.	0.3	9	22	0.5	6	21	0.05	18	NA
	Median	7.1	90	816	1	101	277	0.62	504	<1
	Coeff. of Var. (%)	3.6	10	3	39	6	7	7.7	4	NA
Fill Event 2										
QK-4	Minimum	7.3	95	532	1	101	245	0.62	485	<1
	Mean	7.7	113	780	2	106	261	0.64	492	<1
	Maximum	8.0	121	860	2	108	275	0.65	501	2
	Std. Dev.	0.2	9	122	0.6	3	11	0.01	7	NA
	Median	7.7	114	819	2	107	263	0.65	490	<1
	Coeff. of Var. (%)	3.2	8	16	41	3	4	2.3	1	NA

¹No samples from Well QK-3 during 2015; access blocked by highway construction equipment and traffic.

²EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

³Geometric mean calculated for fecal coliform.

⁴Not applicable.