MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 11-21

TUNNEL AND RESERVOIR PLAN

GLORIA ALITTO MAJEWSKI

CHICAGOLAND UNDERFLOW PLAN RESERVOIR

WATER QUALITY MONITORING WELLS

2010 ANNUAL GROUNDWATER MONITORING REPORT

May 2011

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

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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, Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir Water Quality Monitoring Wells, 2010 Annual Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir Water Quality Monitoring Wells, 2010 Annual Groundwater Monitoring Report."

Very truly yours,

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

TCG:DGM:lf
Enclosure
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TUNNEL AND RESERVOIR PLAN
GLORIA ALITTO MAJEWSKI
CHICAGOLAND UNDERFLOW PLAN RESERVOIR
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Monitoring and Research Department
Thomas C. Granato, Acting Director

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INTRODUCTION

This report contains data for the year 2010 for the four water quality monitoring wells located on the perimeter of the Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir (Reservoir) (Figure 1). The four water quality monitoring wells are QK-1, QK-2, QK-3, and QK-4. Well QK-1 is located on the northwest side, QK-2 on the northeast side, QK-3 on the southeast side, and QK-4 on the southwest side of the reservoir. Also shown in Figure 1 are locations of the nine private water supply wells within 1,000 feet of the reservoir. Please note that originally there were ten private water supply wells, but one was abandoned as of January 25, 1996, leaving only nine private water supply wells. These wells are shown as W1X through W9X in Figure 1.

The Water Pollution Control Permit No. 1996-AB-3401 dated July 9, 1996, issued by the Illinois Environmental Protection Agency (IEPA) to construct and/or operate the Reservoir is subject to the following three special conditions:

> Special Condition 1: If this project is located within wetlands, the U. S. Army Corps of Engineers (COE) may require a permit for construction pursuant to Section 404 of the Clean Water Act.
>
> Special Condition 2: The operational portion of this permit shall not become effective until the Permittee has received IEPA approval of a groundwater monitoring program for this site.
>
> Special Condition 3: The operating reports associated with the groundwater monitoring program shall be submitted quarterly to the IEPA's Maywood Regional Office and Springfield Permit Section.

The groundwater monitoring plan for the Reservoir as summarized in the IEPA letter dated October 14, 1997, to Mr. Joseph D. Jacobazzi of the COE, Chicago District is as follows:

1. The establishment of existing background concentrations at the site by sampling the four (4) monitoring wells a minimum of six times over the period of 12 months. Parameters to be sampled will be all of the Class I Standards parameters, with the exception of radioactive compounds, and the Tunnel and Reservoir Plan (TARP) indicator parameters.

2. The establishment of existing background concentrations for the inorganic Class I Standards parameters and TARP indicator parameters for the ten private wells within 1,000 feet of the reservoir with a minimum of three sampling events.

3. After the establishment of existing background concentrations, the four monitoring wells at the site shall be sampled quarterly for the TARP indicator

parameters. The results will be submitted to the IEPA in accordance with Special Condition 3 of Permit No. 1996-AB-3401.

4. Groundwater sampling of the TARP indicator parameters for event-based monitoring shall be conducted on a weekly basis following an event in which the reservoir is used to store combined sewage overflow from the TARP system. The weekly sampling frequency will continue until all sampling results indicate concentrations below the 95 percent confidence level established for the background concentrations. Event-based monitoring requirements will continue weekly for at least six weeks after the event.

   Until existing background confidence limits are established at each monitoring well, the event-based monitoring requirements will continue on a weekly basis for at least six weeks after the event. All samples from the monitoring wells will be compared to the Class I Standards until the 95 percent confidence levels have been determined for each parameter at each well. If the sampling reveals that the water quality has been impacted, sampling should continue on a weekly basis until there is no indication of groundwater being impacted.

5. A preventive response will be required if any of the detected contaminants exceed the levels specified in the Standards, Subsection 620.310(a)(3). The COE and Metropolitan Water Reclamation District of Greater Chicago (District) have the option to demonstrate that the Reservoir is not the source of contamination.

6. In the event that a Class I Standard is exceeded due to the storage of combined sewage in the reservoir, a groundwater management zone may be required.

   Unless the concentrations which exceed Class I Standards are due to natural causes, the COE and/or District will be responsible for the remediation of groundwater contamination on site.

7. In the event that any of the Class I Standards are exceeded in any potable water supply well as a result of leakage from the Reservoir, an alternate water supply shall be supplied with either the COE or District bearing all costs as associated with providing the alternate water supply.

Out of the seven above items summarizing the groundwater monitoring plan for the Reservoir, the requirements under items 3 and 4 are to be fulfilled by the District. The remainder of the requirements set forth under items 1, 2, 5, 6, and 7 are to be fulfilled by the COE.

According to item 3 referred to above, the four water quality monitoring wells located on the perimeter of the Reservoir are to be sampled quarterly for the TARP water quality indicator parameters. The ten TARP water quality parameters to be analyzed are: chloride (Cl), fecal

coliform (FC), sulfate (SO_4), ammonia nitrogen (NH_3-N), total organic carbon (TOC), total dissolved solids (TDS), hardness (Hard.), conductivity (Cond.), pH, and temperature (Temp.).

According to item 4, the sampling of the Reservoir water quality monitoring wells for the TARP indicator parameters for fill-event based monitoring shall be conducted on a weekly basis following a fill event in which the reservoir is used to store combined sewage overflow from the TARP system. The weekly sampling will continue for at least six weeks. The same ten TARP water quality parameters are to be analyzed for each weekly sample.

This report fulfills the requirements, as set forth under items 3 and 4 referred to above. In 2010, all four water quality monitoring wells were monitored quarterly as required under item 3 except when there was insufficient water in the well to collect a sample, and weekly after each of the two fill events that occurred in 2010 as required under item 4.

MONITORING DATA

Quarterly Monitoring

Table 1 contains the 2010 data for ten TARP water quality indicator parameters obtained from samples collected on a quarterly basis from the four water quality monitoring wells (QK-1, QK-2, QK-3, and QK-4) located on the perimeter of the Reservoir. Water quality monitoring wells QK-1 and QK-2 could not be sampled on January 13, 2010, August 30, 2010, and November 29, 2010, because of insufficient water in these wells to collect a sample. Water quality monitoring wells QK-3 and QK-4 were sampled as required.

Table 2 contains summary statistics of the water quality parameters for the year 2010 quarterly samples for wells QK-1 through QK-4. The summary statistics include minimum, mean, maximum, standard deviation (Stdv), median, and coefficient of variation (COV) for the values of the TARP water quality indicator parameters analyzed during 2010, except for FC. Geometric mean was calculated for FC, along with minimum, maximum, and median. The statistical analysis of the data was conducted using Microsoft® Excel functions.

Fill Event Monitoring

The Reservoir experienced two fill events during 2010. They occurred on May 13, 2010, and July 24, 2010. Sampling of these events was conducted weekly according to item 4 requirements as described on page 2. According to this requirement, sampling of the TARP indicator parameters for fill event-based monitoring should be conducted on a weekly basis following a fill event for at least six weeks or until all sampling results indicate concentrations below the 95 percent confidence level for background concentration.

May 13, 2010, Fill Event. Table 3 contains water quality data for water quality monitoring wells QK-1 through QK-4 for the post-fill sampling for the May 13, 2010, fill event. Sampling covered the period of May 14, 2010 through June 16, 2010.

All wells were sampled as required with the following exceptions. Water quality monitoring well QK-1 could not be sampled on May 19, 2010, May 26, 2010, June 2, 2010, June 9, 2010, and June 16, 2010, because of insufficient water in the well to collect a sample. Water quality monitoring well QK-2 could not be sampled on May 19, 2010, May 26, 2010, June 2, 2010, June 9, 2010, and June 16, 2010, because of insufficient water in the well to collect a sample. Water quality monitoring well QK-3 could not be sampled on June 2, 2010, and June 16, 2010, because of insufficient water in the well to collect a sample. Water quality monitoring well QK-4 was sampled as required during the event.

July 24, 2010, Fill Event. Table 4 contains water quality data for water quality monitoring wells QK-1 through QK-4 for the post-fill sampling for the July 24, 2010, fill event. Sampling covered the period of July 26, 2010, through August 30, 2010.

All wells were sampled as required with the following exceptions. Water quality monitoring well QK-1 could not be sampled on August 3, 2010, August 11, 2010, August 16, 2010, August 25, 2010, and August 30, 2010, because of insufficient water in the well to collect a sample. Samples could not be collected from water quality monitoring well QK-2 because of insufficient water in the well to collect a sample. Water quality monitoring well QK-3 and QK-4 were sampled as required during the event.

On July 26, 2010, the District received a letter from the COE concerning the results from water quality monitoring well QK-1, and requested that the District investigate the condition of the well. The District complied with the COE's request, and on November 1, 2010, the District sent a letter to the COE with data from water quality monitoring wells QK-1 and QK-2 after a preliminary investigation. From its own investigation, the District determined that water quality monitoring well QK-1 is adequate and that it is a slow-recharging well.

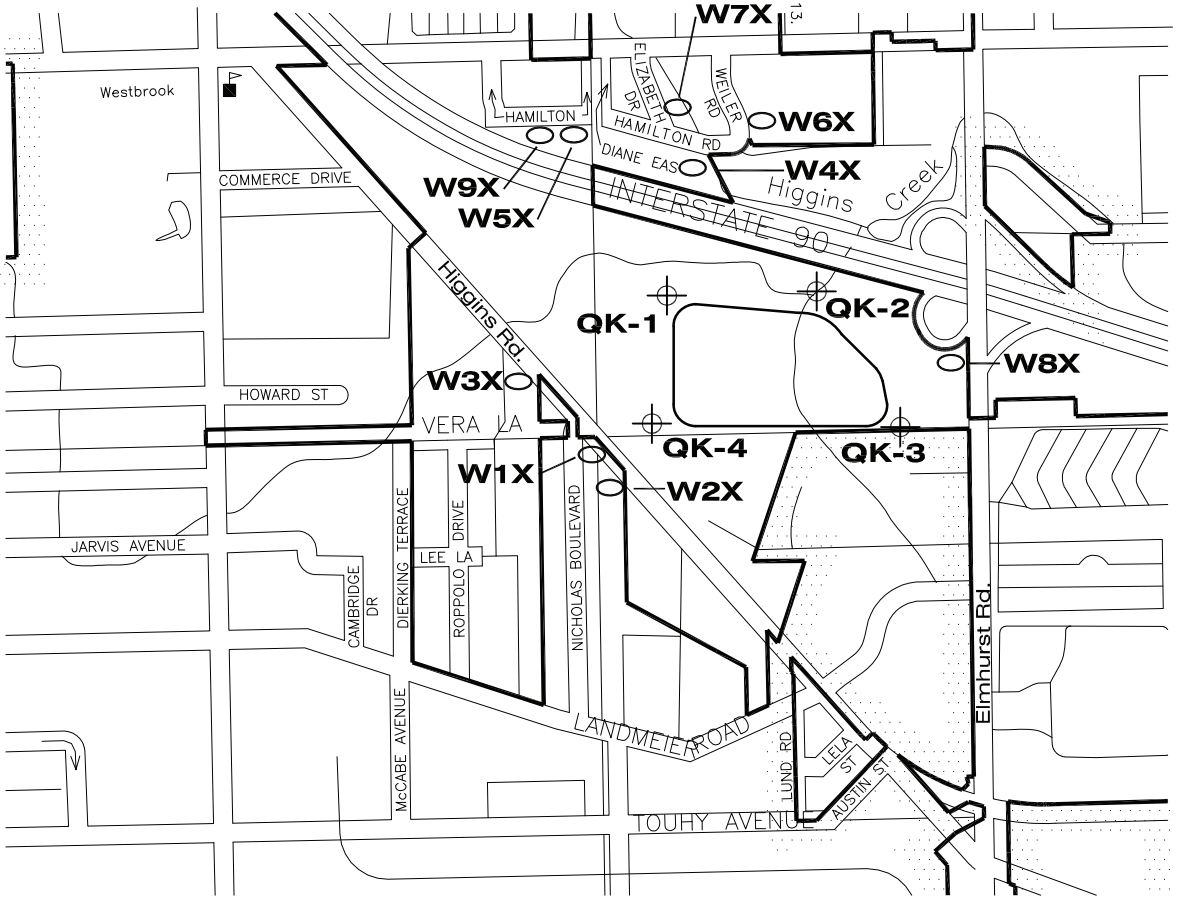

FIGURE 1

LOCATION OF FOUR WATER QUALITY MONITORING WELLS AND NINE PRIVATE WELLS

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 1: 2010 QUARTERLY GROUNDWATER QUALITY DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1 THROUGH QK-4

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	Hard. mg/L	Cond.[2] µmhos/cm	pH[2]	Temp. °C
QK-1	1/13/10	Well could not be sampled									
QK-1	5/14/10	48	14,000	148	0.63	1.9	492	277	487	7.45	12.6
QK-1	8/30/10	Well could not be sampled									
QK-1	11/29/10	Well could not be sampled									
QK-2	1/13/10	Well could not be sampled									
QK-2	5/14/10	<15	140	525	0.09	1.2	946	494	750	7.61	12.5
QK-2	8/30/10	Well could not be sampled									
QK-2	11/29/10	Well could not be sampled									
QK-3	1/13/10	29	68	603	0.04	1.4	1,344	921	703	6.64	10.0
QK-3	5/14/10	103	5,000	459	<0.02	1.8	1,198	699	882	7.32	12.7
QK-3	8/30/10	36	29	424	0.07	1.1	944	556	833	7.10	15.4
QK-3	11/29/10	40	<1	255	0.52	1.0	712	421	1,005	7.13	11.8
QK-4	1/13/10	43	<1	362	0.48	1.7	1,050	573	666	7.30	9.8
QK-4	5/14/10	84	26	254	0.56	1.3	820	483	575	6.95	13.5
QK-4	8/30/10	45	<1	421	0.49	1.2	1,008	575	877	7.20	14.5
QK-4	11/29/10	44	<1	416	0.34	1.0	962	567	1,223	7.02	12.1

[1]The limit of quantification is 15 mg/L for Cl, 2.0 mg/L for SO_4, 0.02 mg/L for NH_3-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.
[2]Unfiltered samples, all others were filtered through a 0.45 µm membrane.

TABLE 2: SUMMARY STATISTICS OF THE 2010 QUARTERLY SAMPLING DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1, QK-2, QK-3, AND QK-4

Parameter[1]		Well Number			
		QK-1	QK-2	QK-3	QK-4
Cl	Minimum	48	15	29	43
mg/L	Mean	48	15	52	54
	Maximum	48	15	103	84
	Stdv.	N/C[2]	N/C	34	20
	Median	48	15	38	45
	COV	N/C	N/C	66	37
FC	Minimum	14,000	140	1	1
cfu/100 mL	Geo. Mean	14,000	140	56	2
	Maximum	14,000	140	5,000	26
	Median	14,000	140	49	1
SO_4	Minimum	148	525	255	254
mg/L	Mean	148	525	435	363
	Maximum	148	525	603	421
	Stdv.	N/C	N/C	143	78
	Median	148	525	442	389
	COV	N/C	N/C	33	21
NH_3-N	Minimum	0.63	0.09	0.02	0.34
mg/L	Mean	0.63	0.09	0.16	0.47
	Maximum	0.63	0.09	0.52	0.56
	Stdv.	N/C	N/C	0.24	0.09
	Median	0.63	0.09	0.06	0.49
	COV	N/C	N/C	147.21	19.71
TOC	Minimum	1.9	1.2	1.0	1.0
mg/L	Mean	1.9	1.2	1.3	1.3
	Maximum	1.9	1.2	1.8	1.7
	Stdv.	N/C	N/C	0.4	0.3
	Median	1.9	1.2	1.3	1.3
	COV	N/C	N/C	27.1	22.6

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2010 QUARTERLY SAMPLING DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1, QK-2, QK-3, AND QK-4

Parameter[1]		Well Number			
		QK-1	QK-2	QK-3	QK-4
TDS	Minimum	492	946	712	820
mg/L	Mean	492	946	1,050	960
	Maximum	492	946	1,344	1,050
	Stdv.	N/C	N/C	279	100
	Median	492	946	1,071	985
	COV	N/C	N/C	27	10
Hard.	Minimum	277	494	421	483
mg/L	Mean	277	494	649	550
	Maximum	277	494	921	575
	Stdv.	N/C	N/C	214	44
	Median	277	494	628	570
	COV	N/C	N/C	33	8
Cond.	Minimum	487	750	703	575
µmhos/cm	Mean	487	750	856	835
	Maximum	487	750	1,005	1,223
	Stdv.	N/C	N/C	125	288
	Median	487	750	858	772
	COV	N/C	N/C	15	34
pH	Minimum	7.45	7.61	6.64	6.95
unit	Mean	7.45	7.61	7.05	7.12
	Maximum	7.45	7.61	7.32	7.30
	Stdv.	N/C	N/C	0.29	0.16
	Median	7.45	7.61	7.12	7.11
	COV	N/C	N/C	4.10	2.26

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

TABLE 3: 2010 GROUNDWATER QUALITY DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1 THROUGH QK-4
MAY 13, 2010 FILL EVENT

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	Hard. mg/L	Cond.[2] µmhos/cm	pH[2]	Temp. °C
QK-1	5/14/10	48	14,000	148	0.63	1.9	492	277	487	7.45	12.6
QK-1	5/19/10	Well could not be sampled									
QK-1	5/26/10	Well could not be sampled									
QK-1	6/2/10	Well could not be sampled									
QK-1	6/9/10	Well could not be sampled									
QK-1	6/16/10	Well could not be sampled									
QK-2	5/14/10	<15	140	525	0.09	1.2	946	494	750	7.61	12.5
QK-2	5/19/10	Well could not be sampled									
QK-2	5/26/10	Well could not be sampled									
QK-2	6/2/10	Well could not be sampled									
QK-2	6/9/10	Well could not be sampled									
QK-2	6/16/10	Well could not be sampled									
QK-3	5/14/10	103	5,000	459	<0.02	1.8	1,198	699	882	7.32	12.7
QK-3	5/19/10	54	240	376	0.19	1.2	940	569	662	7.15	13.0
QK-3	5/26/10	43	200	291	0.42	1.3	832	452	578	6.95	13.7
QK-3	6/2/10	Well could not be sampled									
QK-3	6/9/10	39	30	304	0.44	1.1	864	455	550	7.12	15.1
QK-3	6/16/10	Well could not be sampled									
QK-4	5/14/10	84	26	254	0.56	1.3	820	483	575	6.95	13.5
QK-4	5/19/10	51	<1	355	0.35	1.3	966	541	724	7.44	12.7
QK-4	5/26/10	45	<1	348	0.47	1.0	956	560	725	7.20	14.7

TABLE 3 (Continued): 2010 GROUNDWATER QUALITY DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1 THROUGH QK-4
MAY 13, 2010 FILL EVENT

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	Hard. mg/L	Cond.[2] µmhos/cm	pH[2]	Temp. °C
QK-4	6/2/10	43	<1	390	0.50	1.1	964	546	1,208	7.50	15.9
QK-4	6/9/10	44	<1	394	0.51	1.0	1,008	550	755	7.20	13.7
QK-4	6/16/10	43	<1	396	0.51	1.1	1,104	524	1,269	7.60	15.7

[1]The limit of quantification is 15 mg/L for Cl, 2.0 mg/L for SO_4, 0.02 mg/L for NH_3-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.
[2]Unfiltered samples, all others were filtered through a 0.45 µm membrane.

TABLE 4: 2010 GROUNDWATER QUALITY DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1 THROUGH QK-4
JULY 24, 2010 FILL EVENT

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	Hard. mg/L	$Cond.^2$ µmhos/cm	pH^2	Temp. °C
QK-1	7/26/10	37	>20,000	288	0.36	1.1	858	392	702.0	7.35	15.0
QK-1	8/3/10	Well could not be sampled									
QK-1	8/11/10	Well could not be sampled									
QK-1	8/16/10	Well could not be sampled									
QK-1	8/25/10	Well could not be sampled									
QK-1	8/30/10	Well could not be sampled									
QK-2	7/26/10	Well could not be sampled									
QK-2	8/3/10	Well could not be sampled									
QK-2	8/11/10	Well could not be sampled									
QK-2	8/16/10	Well could not be sampled									
QK-2	8/25/10	Well could not be sampled									
QK-2	8/30/10	Well could not be sampled									
QK-3	7/26/10	92	4,700	322	0.13	1.1	1,222	508	742.0	7.05	16.1
QK-3	8/3/10	41	30	264	0.54	1.0	912	421	501.0	7.30	14.4
QK-3	8/11/10	39	780	276	0.55	1.0	850	427	510.0	7.15	17.5
QK-3	8/16/10	37	150	408	0.50	1.2	766	431	510.0	6.92	15.0
QK-3	8/25/10	39	34	305	0.35	1.0	842	463	875.0	7.21	14.7
QK-3	8/30/10	36	29	424	0.07	1.1	944	560	833.0	7.10	15.4
QK-4	7/26/10	55	7	397	0.61	<1.0	1,078	497	750.0	7.32	16.0
QK-4	8/3/10	43	<1	416	0.54	1.1	1,192	569	657.0	7.35	14.1
QK-4	8/11/10	46	1	399	0.58	1.1	1,102	567	686.0	7.10	14.1

TABLE 4 (Continued): 2010 GROUNDWATER QUALITY DATA FOR GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR WATER QUALITY MONITORING WELLS QK-1 THROUGH QK-4
JULY 24, 2010 FILL EVENT

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	Hard. mg/L	Cond.[2] µmhos/cm	pH[2]	Temp. °C
QK-4	8/16/10	43	<1	422	0.47	1.2	1,012	574	686.0	7.10	14.1
QK-4	8/25/10	46	<1	413	0.51	1.3	1,020	574	785.0	7.14	15.0
QK-4	8/30/10	45	<1	421	0.49	1.2	1,008	580	877.0	7.20	14.5

[1]The limit of quantification is 15 mg/L for Cl, 2.0 mg/L for SO_4, 0.02 mg/L for NH_3-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.
[2]Unfiltered samples, all others were filtered through a 0.45 µm membrane.