MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 21-21

TUNNEL AND RESERVOIR PLAN

MCCOOK RESERVOIR

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2020

May 2021

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
6001 WEST PERSHING ROAD CICERO, ILLINOIS 60804-4112

Edward W. Podczerwinski, P.E.
Director of Monitoring and Research

May 11, 2021

Mr. Michael Summers, P.G.
Groundwater Section Manager
Bureau of Water/Public Water Supplies
Illinois Environmental Protection Agency
Michael.Summers@Illinois.gov

Dear Mr. Summers:

Subject: Transmittal of the Report, "Tunnel and Reservoir Plan McCook Reservoir Annual Groundwater Monitoring Report for 2020"

Please find attached the report entitled "Tunnel and Reservoir Plan McCook Reservoir Annual Groundwater Monitoring Report for 2020." The report was prepared for transmittal to the Illinois Environmental Protection Agency in accordance with the Chicagoland Underflow Plan McCook Reservoir Groundwater Monitoring and Analysis Plan.

If you have any questions or would like additional information, please contact Mr. Benjamin Morgan at (708) 588-3743 or MorganB@mwrd.org.

Very truly yours,

Albert Cox

Albert E. Cox, Ph.D.
Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:BM:cm
Attachment
cc: Mr. B. O'Neil, USACE
Mr. E. Podczerwinski
Dr. C. O'Connor
Dr. H. Zhang

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

TUNNEL AND RESERVOIR PLAN
MCCOOK RESERVOIR
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2020

By

Benjamin Morgan
Environmental Soil Scientist

Guanglong Tian
Principal Environmental Scientist

Albert Cox
Environmental Monitoring and Research Manager

Heng Zhang
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division

Monitoring and Research Department
Edward W. Podczerwinski, Director

May 2021

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LIST OF ABBREVIATLONS

CCD	Chicago City Datum
CFU	colony forming units
Class I	Illinois Class I Potable Resource Groundwater Standards
COD	chemical oxygen demand
CSF	combined sewer flow
District	Metropolitan Water Reclamation District of Greater Chicago
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
MAP	Monitoring and analysis plan
Reservoir	Chicagoland Underflow Plan McCook Reservoir
PCBs	polychlorinated biphenyls
TARP	Tunnel and Reservoir Plan
TL	tolerance limit
TOC	total organic carbon
USACE	United States Army Corps of Engineers

ACKNOWLEDGMENT

The McCook Reservoir groundwater monitoring is conducted by the Monitoring and Research Department of the Metropolitan Water Reclamation District of Greater Chicago (District) under the Groundwater Monitoring and Analysis Plan prepared by the United States Army Corps of Engineers (USACE). Organic analyses were performed by TestAmerica Laboratories, Inc., inorganic analyses by the District's Analytical Laboratories Division, and fecal coliform analyses by the District's Analytical Microbiology Section. Special thanks to James Rivera and Barbara Covic for collecting samples and to Ms. Coleen Maurovich for typing and formatting this report.

DISCLAIMER

Mention of proprietary equipment, chemicals, and software in this report does not constitute endorsement by the District.

McCook Reservoir Site Description

The Chicagoland Underflow Plan McCook Reservoir (Reservoir), located within Lyons Township in western Cook County, is part of the Tunnel and Reservoir Plan (TARP). The Reservoir was designed to reduce flooding in the Chicago area by providing storage of combined sewer flow (CSF) during storms. The Reservoir construction has been divided into two phases. Phase I of the Reservoir is complete and has been in operation since January 2018. Phase II of the Reservoir is still under construction and is anticipated to begin operation in 2029. When the capacity of the sewer systems is exceeded, the CSF is conveyed to the Reservoir by the TARP tunnels for storage until it can be treated at the Stickney Water Reclamation Plant.

The groundwater protection system surrounding the Reservoir is designed to prevent exfiltration of CSF from the Reservoir to the surrounding groundwater during high-stage conditions and control seepage of groundwater into the Reservoir during low-stage conditions. The groundwater protection system consists of a double-row grout curtain that completely surrounds Phases I and II of the Reservoir to a depth of -320 ft Chicago City Datum (CCD). The grouted area has achieved permeabilities of less than 1 lugeon.

Groundwater Monitoring Program

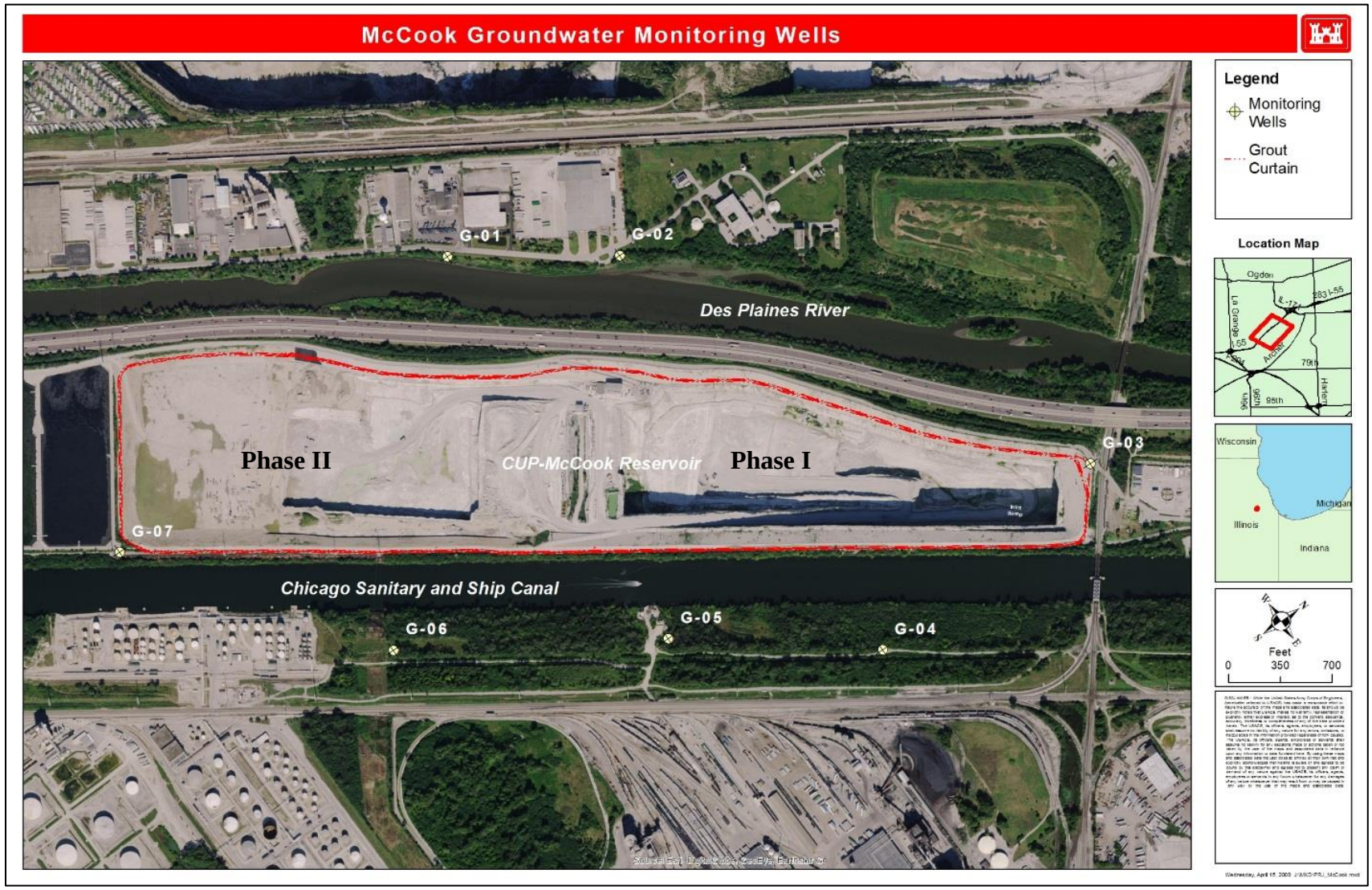
A Groundwater Monitoring and Analysis Plan (MAP) (USACE, 2014), including seven groundwater monitoring wells around the perimeter of the Reservoir (Figure 1), was developed by the USACE in coordination with the District and approved by the Illinois Environmental Protection Agency (IEPA) to monitor groundwater conditions and the performance of the groundwater protection system.

The objectives of the monitoring program as specified in the MAP are:

- To characterize local background groundwater quality by measuring Field, Routine, Organic, and Inorganic parameters prior to Reservoir operation.
- To assess potential exfiltration of CSF effluent into groundwater by measuring Field and Routine parameters while the Reservoir is in high-stage operation.
- To determine potential migration of groundwater contaminants into the Reservoir system from the surrounding area by measuring Field, Routine, Organic, and Inorganic parameters while the Reservoir is in low-stage operation.
- To evaluate long-term changes in groundwater quality associated with Reservoir operations.

To evaluate changes in groundwater quality, monitoring wells are installed 100 feet outside the grout curtain. However, due to physical constraints near the Reservoir where it would be impossible to install or access wells, some are located greater than 100 feet from the grout curtain. In the summer of 2016, a USACE investigation discovered that wells G-04 and G-05 exhibited signs of a compromised annular seal. These wells were re-drilled during fall 2017 and became operational for monitoring in November 2017.

FIGURE 1: MCCOOK RESERVOIR SITE AND MONITORING WELL LOCATIONS



Background Monitoring. Background monitoring began in the first quarter of 2016. Groundwater samples collected during the background monitoring program were analyzed for concentrations of organic and inorganic parameters and groundwater quality indicators based on Illinois Class I Potable Resource Groundwater standards constituents in 35 IAC 620.410 (Class I) and Illinois General Use Water Quality standards constituents in 35 IAC 302 B. Background monitoring results were used to determine upper tolerance limits (TL) in each well for all measured groundwater quality parameters to enable future assessment of groundwater protection system efficacy. The TL for all parameters were established in 2019 using all background data and the statistical approaches recommended in the MAP. The details are documented in the Appendix of the 2018 McCook annual report.

High-Stage/Fill-Event Monitoring. High-stage monitoring is initiated when water elevation in the Reservoir exceeds -265 ft CCD. The initial high-stage/fill-event threshold of -280 ft CCD was increased to -265 ft CCD in January 2018 to reflect the Reservoir operating conditions. During high-stage monitoring, samples are collected every 14 days until the Reservoir water elevation falls below -265 ft CCD. The intent of the high-stage program is to monitor time-series data when the Reservoir is under large positive (outward) gradients that have the potential to exfiltrate CSF water. For the current Phase I of the Reservoir operation during high-stage monitoring events, only wells G-01, G-02, G-03, G-04, and G-05 must be monitored. The measurements and analyses include four Field and nine Routine Parameters as specified in Table 2 of the MAP.

Low-Stage Semiannual Monitoring. Low-stage monitoring is implemented on a semiannual basis to collect water quality data when the Reservoir is acting as a regional groundwater sink. Low-stage sampling requires that water elevation in the Reservoir is at or below the "wet bottom" elevation (-265 ft CCD). Low-stage samples can only be collected after low-stage operation has been maintained for at least four days to ensure that monitoring results are characteristic of the regional groundwater and do not reflect re-infiltration of groundwater constituents that exfiltrated during the high-stage operation. The first low-stage semiannual sampling occurs during the second quarter of each year (April-June), analyzing all eighty-one (81) Field, Routine, Organic, and Inorganic Parameters as specified in Tables 2, 3 and 4 of the MAP. The second low-stage semiannual sampling occurs during the fourth quarter of each year (October-December), analyzing only the Field and Routine Parameters. The two low-stage semiannual samplings require collecting samples from all seven wells.

This is the 2020 report under the groundwater monitoring program for the Reservoir. It presents field activities and analytical results for groundwater monitoring of Reservoir operations from January 1, 2020 – December 31, 2020. Monitoring conducted on January 2, 2020, is excluded from this report, as it was associated with a fill event that began on December 29, 2019, and was included in the 2019 annual report.

Monitoring Activities for 2020

During the 2020 operation, there were 27 high-stage Reservoir events. One event lasted for over five weeks and would have required three samplings, but monitoring was suspended during this time due to the coronavirus pandemic based on approval from the IEPA. All 26 other

high-stage events lasted for less than two weeks, requiring one sampling each. Two of these events also occurred during the time when monitoring was suspended and were not sampled. Another four high-stage events were of too short duration to allow for sampling before the next new high-stage event began. Thus, a total of 20 high-stage samplings were conducted throughout 2020. One re-sampling was conducted in October because incubation for the test of fecal coliform on the initial samples exceeded the 24-hour limit. The Reservoir operated at high stage for a total of 188 days in 2020. Water samples were collected and immediately analyzed in the field for pH and electrical conductivity, and water temperature and depth were recorded. Samples were packed in ice and transported to District laboratories for analysis of the nine Routine parameters.

The first low-stage semiannual monitoring sample collections were conducted during the second quarter of 2020 on June 18 and 19, 2020, after the Reservoir had been at low-stage for over four days. All seven wells were sampled. Water sample pH, electrical conductivity, temperature, and elevation were recorded in the field. Water samples were packed in ice and shipped to TestAmerica Laboratories, Inc. for analysis of Organic constituents in accordance with requirements specified in the MAP. Aliquots of each sample were also packed in ice and taken to the District's laboratories for analysis of Routine and Inorganic parameters.

The second semiannual sampling was conducted on November 9 and 10, 2020, following low-stage operation at the Reservoir for over four days. All seven wells were sampled. Field parameters for each water sample were measured. Water samples were packed in ice and brought to the District's laboratories for analysis of Routine parameters.

Analytical Results for 2020

High-Stage/Fill Event Monitoring. All analytical results for all high-stage samples collected from wells G-01, G-02, G-03, G-04, and G-05 and the duplicate samples and re-samples are reported in Tables 1 – 5, respectively. Analytical results that exceed Class I standards are shown in bold text in each table. Analytical results were compared to upper TL based on the background monitoring data.

Groundwater pH was below the Class I standard in one sample from well G-04 and two samples from well G-05; however, it was below the lower TL in only one sample from well G-05. The total dissolved solids (TDS) exceeded the Class I standard in all samples from well G-01, eight samples from well G-03, one sample from well G-04, and twelve samples from well G-05. However, TDS only exceeded the upper TL in those samples from wells G-04 and G-05. Chloride concentrations exceeded Class I standards in all samples from wells G-01 and G-03; however, it did not exceed the upper TL for these wells. Sulfate exceeded the Class I standard in three samples from well G-01, one sample from well G-04, and all except two samples from well G-05, but it never exceeded the upper TL for these wells.

There were a few exceedances of upper TL for parameters that do not have established limits under Class I standards. The total organic carbon (TOC) exceeded the upper TL in eight samples from well G-01 and two samples from well G-02. The TOC was undetected in seven samples from well G-01 and eleven samples from well G-02, but the laboratory reporting limit for

TABLE 1: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-01 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.3-8.1	586	3,845	2.7	40	1,280	730	0.13	2.8	1,607	<1	15.7	-106
1	01/14/2020	6.5	232	**1,970**	1.1	22	**599**	NDR[4]	<0.15	0.80	1,003	<1	13.2	-114
2	01/29/2020	6.6	180	**1,656**	5.5	40	**506**	348	0.24	3.0	869	<1	13.3	-113
3	02/27/2020	6.6	112	**1,616**	2.0	30	**483**	342	0.17	2.8	915	<1	13.1	-114
4	03/12/2020	6.6	114	**1,776**	NA[5]	36	**486**	342	0.21	2.8	893	<1	13.5	-114
8	06/16/2020	6.7	247	**2,040**	3.1	33	**608**	**482**	<0.15	0.81	1,129	<1	13.6	-111
8D[6]	06/16/2020	6.7	247	**2,094**	3.2	36	**609**	**499**	0.36	0.82	1,119	<1	13.6	-111
9	06/29/2020	6.7	229	**2,072**	1.8	20	**570**	**475**	<0.15	0.90	1,100	<1	14.2	-111
10	07/10/2020	6.9	201	**1,664**	2.4	21	**484**	354	0.34	3.1	931	2	13.7	-111
11/12	07/20/2020	6.8	191	**1,644**	2.9	26	**454**	323	0.17	3.7	832	<1	13.7	-114
13	08/05/2020	6.8	197	**1,898**	<5.0[7]	25	**578**	NDR[8]	<0.15	1.3	1,032	<1	13.9	-112
14	08/14/2020	6.7	194	**1,998**	<5.0	30	**525**	**429**	<0.15	2.3	1,010	<1	14.0	-112
14D	08/14/2020	6.7	194	**1,982**	<5.0	33	**522**	**425**	<0.15	2.2	991	<1	14.0	-112
15	08/19/2020	6.8	174	**1,580**	<5.0	30	**446**	311	0.24	3.9	837	<1	13.8	-114
16	09/03/2020	6.9	191	**1,540**	<5.0	21	**456**	320	0.24	3.8	900	<1	13.6	-113
17	09/09/2020	6.7	191	**1,628**	<5.0	<15	**458**	315	0.27	4.0	843	<1	11.9	-114
18	09/22/2020	6.9	176	**1,568**	<5.0	24	**484**	330	0.18	3.6	870	<1	13.6	-115
19/20/21	10/06/2020	6.8	216	**1,558**	5.6	28	**457**	314	0.19	3.7	874	NDR[9]	13.6	-114
19/20/21D	10/06/2020	6.8	216	**1,550**	6.5	29	**471**	322	0.19	3.6	891	NDR[9]	13.6	-114

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-01 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	NS	**NS**	**NS**	**NS**
	Upper TL[3]	5.3-8.1	586	3,845	2.7	40	1,280	730	0.13	2.8	1,607	<1	15.7	-106
19/20/21R[10]	10/12/2020	6.8	243	**1,620**	6.9	28	**481**	338	0.35	3.1	913	<1	14.0	-114
19/20/21R,D	10/12/2020	6.8	243	**1,760**	6.3	33	**461**	322	0.19	3.2	916	<1	14.0	-114
22	10/19/2020	6.9	214	**1,612**	5.7	38	**464**	321	0.18	3.5	895	<1	13.6	-115
23	11/05/2020	6.9	259	**1,652**	<5.0	53	**461**	324	0.17	3.2	863	<1	13.6	-115
24	11/19/2020	6.8	199	**1,518**	8.1	43	**450**	314	0.20	3.9	850	<1	13.5	-117
25/26	12/03/2020	6.9	185	**1,540**	6.8	42	**435**	305	0.31	3.8	857	<1	13.4	-118
27	12/09/2020	6.8	168	**1,516**	6.7	48	**440**	302	0.21	3.4	891	<1	13.4	-117
27D	12/09/2020	6.8	168	**1,562**	6.9	50	**419**	288	0.28	3.5	868	<1	13.4	-117

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]No data reportable. Test canceled by analytical lab due to precision failure after duplicate and retested samples did not confirm results.
[5]Not analyzed due to limited staffing caused by the coronavirus pandemic.
[6]Duplicate sample.
[7]Reporting limit increased due to change in analytical method.
[8]No data reportable. Sample not thermally preserved due to cold room failure.
[9]No data reportable. Incubation exceeded 24-hour limit.
[10]Resampled due to canceled fecal coliform results.

TABLE 2: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-02 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.1	182	1,214	4.3	31	383	207	0.68	2.2	791	<1	17.3	-69
1	01/14/2020	6.6	108	894	2.2	<15	191	146	<0.15	1.9	583	<1	12.9	-79
1D[4]	01/14/2020	6.6	108	964	2.2	<15	192	146	<0.15	1.9	555	<1	12.9	-79
2	01/29/2020	6.6	102	892	2.4	18	186	152	<0.15	1.8	605	<1	12.8	-80
3	02/27/2020	6.7	78	886	2.3	15	178	152	0.28	1.8	640	<1	13.6	-80
4	03/12/2020	6.7	74	966	NA[5]	<15	188	167	0.23	1.8	606	<1	13.3	-79
8	06/16/2020	6.9	121	922	2.6	20	187	161	0.31	1.9	646	<1	13.9	-77
9	06/29/2020	7.0	114	954	2.1	<15	185	158	<0.15	1.8	616	<1	14.1	-77
10	07/10/2020	7.0	113	922	2.2	28	188	166	<0.15	1.7	642	<1	14.1	-77
10D	07/10/2020	7.0	113	934	2.3	<15	189	167	<0.15	1.7	634	<1	14.1	-77
11/12	07/20/2020	6.9	115	980	2.4	17	185	161	0.18	1.7	598	<1	13.8	-78
13	08/05/2020	6.9	95	902	<5.0[6]	17	184	NDR[7]	0.39	1.8	604	<1	13.9	-77
14	08/14/2020	6.9	99	972	<5.0	20	186	162	<0.15	1.8	620	<1	14.1	-76
15	08/19/2020	6.6	102	936	<5.0	21	181	173	0.17	1.7	681	<1	14.4	-78
15D	08/19/2020	6.6	102	956	<5.0	16	181	173	0.15	1.7	651	<1	14.4	-78
16	09/03/2020	6.9	112	916	<5.0	16	180	169	<0.15	1.7	645	<1	13.7	-78
17	09/10/2020	6.9	98	978	<5.0	25	181	164	0.23	1.8	700	<1	13.6	-80
18	09/22/2020	7.0	102	872	<5.0	<15	190	171	<0.15	1.8	607	<1	13.4	-80
19/20/21	10/06/2020	6.9	125	888	<5.0	<15	186	168	<0.15	1.8	636	NDR[8]	13.8	-79
19/20/21R[9]	10/12/2020	6.9	145	926	<5.0	<15	186	164	<0.15	1.8	655	<1	13.6	-79

TABLE 2 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-02 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.1	182	1,214	4.3	31	383	207	0.68	2.2	791	<1	17.3	-69
22	10/19/2020	6.9	126	928	<5.0	20	185	159	<0.15	1.8	613	<1	13.3	-79
22	10/19/2020	6.9	126	920	<5.0	23	185	159	<0.15	1.7	635	<1	13.3	-79
23	11/05/2020	6.9	151	914	5.8	28	182	152	0.21	1.7	663	<1	13.2	-79
24	11/20/2020	6.9	117	898	5.9	33	178	178	<0.15	1.7	652	<1	13.9	-80
25/26	12/03/2020	6.9	112	882	<5.0	17	182	158	0.16	1.7	646	<1	13.3	-80
27	12/09/2020	6.9	101	892	<5.0	24	179	162	0.23	1.6	685	<1	14.0	-80

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]Not analyzed due to limited staffing caused by the coronavirus pandemic.
[6]Reporting limit increased due to change in analytical method.
[7]No data reportable. Sample not thermally preserved due to cold room failure.
[8]No data reportable. Incubation exceeded 24-hour limit.
[9]Resampled due to canceled fecal coliform results.

TABLE 3: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-03 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.4	312	1,826	19.3	93	618	167	0.24	32	570	<1	18.3	-95
1	01/14/2020	6.7	158	**1,210**	8.4	44	**386**	142	<0.15	22	447	<1	13.7	-109
2	01/29/2020	6.6	143	1,184	8.9	52	**416**	137	<0.15	22	472	<1	13.7	-111
2D[4]	01/29/2020	6.6	143	**1,208**	8.9	46	**413**	136	<0.15	22	489	<1	13.7	-111
3	02/27/2020	6.9	88	1,106	8.1	47	**357**	130	<0.15	19	456	<1	13.8	-110
4	03/12/2020	6.9	94	**1,210**	NA[5]	57	**390**	143	0.18	23	477	<1	13.9	-109
8	06/16/2020	7.0	160	1,088	8.4	45	**342**	150	<0.15	18	474	<1	14.6	-107
9	06/29/2020	7.0	156	1,136	7.8	46	**345**	140	<0.15	18	473	<1	15.6	-108
10	07/10/2020	7.1	157	1,118	8.5	45	**357**	145	<0.15	18	498	<1	14.3	-109
11/12	07/21/2020	7.1	162	1,146	8.2	42	**341**	136	<0.15	19	451	<1	14.1	-112
11/12D	07/21/2020	7.1	162	1,146	8.2	48	**339**	136	0.33	18	444	<1	14.1	-112
13	08/05/2020	7.0	130	1,054	10.8	49	**340**	NDR[6]	<0.15	19	460	<1	14.2	-110
14	08/14/2020	7.0	136	1,156	10.5	47	**343**	133	<0.15	19	460	<1	14.4	-110
15	08/19/2020	7.0	136	1,114	11.7	51	**346**	132	<0.15	18	458	<1	14.2	-111
16	09/03/2020	7.0	162	1,098	12.7	50	**374**	139	<0.15	19	489	<1	14.1	-109
16D	09/03/2020	7.0	162	1,136	12.8	48	**367**	135	0.17	19	506	<1	14.1	-109
17	09/09/2020	6.8	175	**1,268**	15.1	48	**403**	144	<0.15	23	519	<1	12.3	-110
18	09/22/2020	7.0	158	**1,256**	15.1	56	**438**	154	<0.15	24	525	<1	14.1	-109
19/20/21	10/08/2020	7.0	210	1,174	13.4	47	**382**	134	<0.15	19	488	<1	14.5	-109

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-03 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.4	312	1,826	19.3	93	618	167	0.24	32	570	<1	18.3	-95
22	10/21/2020	7.1	157	1,168	11.9	60	**365**	134	<0.15	19	476	<1	14.2	-111
23	11/05/2020	7.0	208	**1,220**	NDR[7]	38	**375**	132	<0.15	20	504	<1	13.8	-111
23D	11/05/2020	7.0	208	**1,204**	14.7	56	**392**	138	<0.15	21	498	<1	13.8	-111
24	11/19/2020	6.9	150	**1,250**	15.3	70	**414**	137	<0.15	24	517	<1	14.0	-110
25/26	12/03/2020	7.0	152	1,132	13.5	51	**363**	127	<0.15	20	461	<1	14.0	-113
27	12/09/2020	6.9	157	**1,236**	15.2	71	**406**	135	<0.15	23	522	<1	14.0	-111

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]Not analyzed due to limited staffing caused by the coronavirus pandemic.
[6]No data reportable. Sample not thermally preserved due to cold room failure.
[7]No data reportable. Sample not chemically preserved.

TABLE 4: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-04 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.2	179	1,100	8.1	30	213	584	0.11	19	746	<1	17.0	-34
1	01/16/2020	**6.4**	119	1,146	4.7	26	155	336	<0.15	11	673	<1	13.8	-33
2	01/28/2020	6.6	112	1,106	4.5	<15	159	342	<0.15	11	710	<1	13.7	-34
3	02/25/2020	6.8	132	1,112	4.2	22	148	304	<0.15	10	690	<1	14.3	-36
3D[4]	02/25/2020	6.8	132	1,088	4.2	25	149	305	<0.15	9.9	784	<1	14.3	-36
4	03/10/2020	6.8	67	1,126	NA[5]	19	151	317	<0.15	10	677	<1	14.6	-34
8	06/17/2020	6.6	138	1,166	4.1	28	155	319	<0.15	10	721	<1	14.7	-35
9	06/30/2020	6.9	135	1,186	4.0	15	159	326	<0.15	10	726	<1	14.6	-33
10	07/10/2020	6.9	131	1,066	3.9	25	153	319	<0.15	9.5	746	<1	15.4	-33
11/12	07/20/2020	6.9	118	**1,206**	4.2	19	152	325	<0.15	10	697	1	14.6	-32
13	08/04/2020	6.8	144	1,146	<5.0[6]	22	166	NDR[7]	<0.15	11	736	<1	15.1	-32
13D	08/04/2020	6.8	144	1,140	<5.0	21	168	NDR[7]	<0.15	11	722	<1	15.1	-32
14	08/14/2020	6.9	117	1,160	<5.0	21	157	332	<0.15	11	723	<1	14.9	-35
15	08/19/2020	6.6	123	1,184	<5.0	27	164	344	<0.15	10	746	<1	15.0	-33
16	09/03/2020	6.8	129	1,116	<5.0	21	161	343	<0.15	10	751	<1	15.3	-35
17	09/11/2020	6.7	145	1,162	5.1	<15	157	335	<0.15	10	745	<1	14.8	-33
17D	09/11/2020	6.7	145	1,150	6.0	17	158	336	<0.15	11	724	<1	14.8	-33
18	09/23/2020	6.8	129	1,112	<5.0	89	166	363	0.21	10	722	<1	15.0	-33
19/20/21	10/06/2020	6.7	169	1,178	<5.0	<15	148	**444**	0.19	6.1	839	NDR[8]	14.5	-35
19/20/21R[9]	10/12/2020	6.8	118	1,186	5.5	17	159	346	<0.15	10	744	<1	15.6	-34

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-04 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.2	179	1,100	8.1	30	213	584	0.11	19	746	<1	17.0	-34
22	10/21/2020	6.9	143	1,162	NDR[10]	25	153	337	0.15	10	705	<1	14.8	-34
23	11/04/2020	6.8	175	1,146	5.2	17	155	336	<0.15	10	733	<1	15.1	-32
24	11/19/2020	6.6	152	1,138	5.1	26	162	344	<0.15	11	730	<1	15.1	-33
24D	11/19/2020	6.6	152	1,146	<5.0	20	161	345	<0.15	11	751	<1	15.1	-33
25/26	12/03/2020	6.9	142	1,182	5.5	22	153	318	<0.15	10	713	<1	14.1	-34
27	12/10/2020	6.7	119	1,104	5.0	16	140	315	<0.15	9.8	705	<1	15.0	-34

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]Not analyzed due to limited staffing caused by the coronavirus pandemic.
[6]Reporting limit increased due to change in analytical method.
[7]No data reportable. Sample not thermally preserved due to cold room failure.
[8]No data reportable. Incubation exceeded 24-hour limit.
[9]Resampled due to canceled fecal coliform results.
[10]No data reportable. Sample not chemically preserved.

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-05 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.4	219	1,200	29.8	102	159	499	0.32	6.6	738	<1	15.3	-38
1	01/16/2020	6.5	121	1,186	2.3	18	136	**431**	<0.15	6.5	723	<1	13.8	-35
2	01/28/2020	6.6	107	1,146	2.8	<15	140	**437**	0.17	6.4	762	<1	13.6	-35
3	02/25/2020	6.8	132	1,160	2.4	24	137	**408**	0.17	6.3	686	<1	14.2	-35
4	03/10/2020	6.7	65	**1,210**	NA[4]	15	144	**409**	0.17	6.5	765	<1	14.0	-35
4D[5]	03/10/2020	6.7	65	1,190	NA[4]	<15	145	**413**	0.26	6.5	760	<1	14.0	-35
8	06/17/2020	**6.4**	139	**1,228**	2.5	<15	147	399	<0.15	5.9	711	<1	14.3	-35
9	06/30/2020	6.8	136	**1,266**	2.1	<15	145	**417**	<0.15	6.0	786	<1	14.4	-35
9D	06/30/2020	6.8	136	**1,238**	2.2	<15	147	**423**	<0.15	6.1	788	<1	14.4	-35
10	07/10/2020	6.7	135	**1,202**	2.1	<15	149	**429**	<0.15	6.3	840	<1	14.5	-37
11/12	07/20/2020	6.9	124	**1,268**	2.4	16	144	**418**	<0.15	6.1	746	<1	14.6	-36
13	08/04/2020	6.9	134	1,138	<5.0[6]	15	142	NDR[7]	<0.15	6.1	774	<1	14.7	-34
14	08/14/2020	6.9	112	**1,266**	<5.0	18	142	**410**	<0.15	6.4	792	<1	14.4	-36
15	08/19/2020	6.8	114	**1,232**	<5.0	25	143	**427**	<0.15	5.8	765	<1	14.2	-35
16	09/03/2020	6.8	135	1,178	<5.0	<15	146	**425**	<0.15	6.1	812	<1	14.7	-36
17	09/11/2020	6.7	137	**1,220**	<5.0	<15	142	**425**	<0.15	6.3	787	<1	14.4	-36
18	09/23/2020	6.9	133	1,192	<5.0	<15	155	**446**	0.17	5.9	820	<1	16.1	-35
18D	09/23/2020	6.9	133	1,196	<5.0	71	149	**432**	<0.15	5.9	787	<1	16.1	-35
19/20/21	10/06/2020	6.7	157	1,090	<5.0	<15	156	352	<0.15	9.9	731	NDR[8]	15.2	-33
19/20/21R[9]	10/12/2020	7.0	112	**1,208**	<5.0	<15	142	**411**	0.15	6.0	832	<1	14.3	-38

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-05 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2020

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.4	219	1,200	29.8	102	159	499	0.32	6.6	738	<1	15.3	-38
22	10/21/2020	6.9	141	**1,236**	<5.0	15	145	**417**	<0.15	6.2	804	<1	14.3	-37
23	11/04/2020	6.8	166	**1,268**	<5.0	15	147	**438**	<0.15	5.8	803	<1	14.4	-35
24	11/19/2020	**5.9**	138	1,186	<5.0	17	147	**422**	<0.15	6.1	816	<1	14.2	-36
25/26	12/03/2020	6.9	134	1,180	<5.0	16	142	**407**	0.23	5.8	778	<1	13.7	-35
25/26D	12/03/2020	6.9	134	1,174	<5.0	15	142	**408**	0.19	5.7	790	<1	13.7	-35
27	12/10/2020	6.6	121	**1,214**	<5.0	<15	134	**404**	<0.15	6.6	784	<1	15.3	-37

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**

[2]No Standard established by 35 IAC Part 620.410.

[3]For pH, upper and lower tolerance limits are shown.

[4]Not analyzed due to limited staffing caused by the coronavirus pandemic.

[5]Duplicate sample.

[6]Reporting limit increased due to change in analytical method.

[7]No data reportable. Sample not thermally preserved due to cold room failure.

[8]No data reportable. Incubation exceeded 24-hour limit.

[9]Resampled due to canceled fecal coliform results.

these samples was higher than the upper TL at these wells. The chemical oxygen demand (COD) exceeded the upper TL in four samples from well G-01 and one sample each from wells G-02 and G-04. Total phosphorus (P) exceeded the upper TL in all except five samples from well G-01, one sample from well G-03, and three samples from well G-04. Total P was undetected in all remaining samples from wells G-01 and G-04, but the laboratory reporting limit was greater than the upper TL at these wells. Ammonia exceeded the upper TL in thirteen samples from well G-01 and one sample from well G-05. Hardness exceeded the upper TL in four samples from well G-04 and all except four samples from well G-05. Groundwater elevation exceeded the upper TL at ten events in well G-04 and all except one event in well G-05. Fecal coliform bacteria were detected only in one sample each from wells G-01 and G-04 at 2 and 1 CFU/100 mL, respectively.

Low-Stage Semiannual Monitoring. All results for Field and Routine parameters for low-stage semiannual sampling and TL for these parameters are reported in Table 6. The results for Inorganic and Radioactive parameters are reported in Table 7, and all associated upper TL for parameters in Table 7 are listed in Table 8. The results for Organic parameters are reported in Table 9, and all associated upper TL for parameters in Table 9 are listed in Table 10. Analytical results that exceed the Class I standards are shown in bold text in Tables 6, 7 and 9. Analytical results were compared to upper TL based on the background monitoring data.

There were a few exceedances of Class I standards and upper TL by Routine and Field parameters (Table 6). The TDS exceeded the Class I standard in all samples at wells G-01 and G-05, in the first semiannual sample at well G-07, and in the second semiannual sample at well G-03 but never exceeded the upper TL for these wells. Chloride concentrations exceeded the Class I standard in all samples at wells G-01, G-03, and G-07 but never exceeded the upper TL for these wells. Sulfate concentrations exceeded the Class I standard in all samples at well G-05 but never exceeded the upper TL for this well. There were a few exceedances of upper TLs among parameters without established Class I standards. The COD exceeded the upper TL in the second semiannual sample at well G-06. Total phosphorus exceeded the upper TL in one sample each at wells G-01, G-04, and G-06. Total phosphorus was below the reporting limit in all remaining samples from these wells, but the reporting limit was higher than the upper TL for these wells. Ammonia exceeded the upper TL only at well G-01 in both samples. Hardness exceeded the upper TL in two samples each from wells G-04 and G-05. Groundwater elevation exceeded the upper TL for one measurement at well G-04 and both measurements at well G-05. The TOC was below the reporting limit in one sample each at wells G-02, G-05, and G-06, but the reporting limit was higher than the upper TL for these wells. Fecal coliform bacteria were not detected in any sample.

Among the Inorganic parameters that are measured once per year during the first low-stage semiannual sampling event, only boron at wells G-04, G-05, and G-06 exceeded the Class I standard (Table 7); however, it did not exceed the upper TL for these wells. Nitrate-nitrogen was below the reporting limit in wells G-02 to G-07, but the reporting limit was higher than the upper TL for these wells. Radioactive parameters did not exceed Class I standards or upper TL at any well.

There were a few detections of Organic parameters in groundwater collected during the first low-stage semiannual sampling (Table 9). Vinyl chloride exceeded the Class I standard in well G-06, but it did not exceed the upper TL for that well. Cis-1,2-Dichloroethene was detected

TABLE 6: ANALYSIS OF ROUTINE PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMIANNUAL SAMPLING IN 2020

Well	Sampling Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
				mS/m	---------- mg/L ----------								CFU/100 mL	°C	ft CCD
		Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
G-01		Upper TL[3]	5.3-8.1	586	3,845	2.7	40	1,280	730	0.13	2.8	1,607	<1	15.7	-106
	1	06/19/20	6.9	190	**1,624**	2.2	22	**475**	342	<0.15	3.3	915	<1	13.5	-112
	2	11/09/20	6.8	202	**1,590**	5.1	35	**445**	315	0.21	3.3	922	<1	13.9	-115
G-02		Upper TL	5.7-8.1	182	1,214	4.3	31	383	207	0.68	2.2	791	<1	17.3	-69
	1	06/19/20	6.9	108	928	2.4	<1	184	164	<0.15	1.8	614	<1	13.1	-77
	2	11/09/20	6.9	116	918	<5.0[4]	18	177	147	<0.15	1.7	609	<1	13.4	-79
G-03		Upper TL	5.7-8.4	312	1,826	19.3	93	618	167	0.24	32	570	<1	18.3	-95
	1	06/19/20	7.0	159	1,112	8.0	41	**348**	144	<0.15	18	470	<1	15.0	-108
	2	11/09/20	7.0	165	**1,236**	14.3	56	**381**	133	<0.15	22	508	<1	14.4	-108
G-04		Upper TL	6.3-9.2	179	1,100	8.1	30	213	584	0.11	19	746	<1	17.0	-34
	1	06/18/20	6.8	138	1,152	4.0	23	158	335	0.54	10	706	<1	15.0	-34
	1 DUP[5]	06/18/20	6.8	138	1,134	4.1	26	159	336	<0.15	10	788	<1	15.0	-34
	2	11/10/20	6.9	140	1,168	5.3	28	157	338	<0.15	10	763	<1	14.5	-33
G-05		Upper TL	6.3-9.4	219	1,200	29.8	10	159	499	0.32	6.6	738	<1	15.3	-38
	1	06/19/20	6.8	124	**1,228**	2.1	<1	144	**437**	<0.15	6.2	792	<1	14.1	-37
	2	11/10/20	6.9	137	**1,208**	<5.0	25	146	**420**	<0.15	5.6	827	<1	14.4	-35

TABLE 6 (Continued): ANALYSIS OF ROUTINE PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMIANNUAL SAMPLING IN 2020

Well	Sampling Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
				mS/m	mg/L								CFU/100 mL	°C	ft CCD
		Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
G-06		Upper TL	6.0-7.9	176	1,324	3.8	17	147	392	0.081	3.7	804	<1	16.2	-13
	1	06/18/20	7.0	109	964	2.3	<15	125	294	0.27	2.7	688	<1	13.3	-17
	2	11/10/20	7.0	115	1,004	<5.0	15	123	308	<0.15	2.7	748	<1	13.0	-18
	2 DUP	11/10/20	7.0	115	980	<5.0	19	124	309	<0.15	2.8	726	<1	13.0	-18
G-07		Upper TL	5.8-7.8	536	2,856	12.2	62	558	610	4.3	192[6]	1,430	<1	20.3	-3
	1	06/19/20	6.9	212	**1,292**	6.4	36	**258**	391	1.2	141	697	<1	13.5	-5
	2	11/09/20	6.9	198	1,100	NDR[7]	45	**237**	327	1.2	120	618	<1	13.7	-4

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Reporting limit increased due to change in analytical method.
[5]Duplicate sample.
[6]McCook Reservoir site was previously unpaved biosolids lagoons. Elevated NH_3-N may reflect infiltration or drilling through old biosolids lagoon sediments.
[7]No data reportable. Sample not chemically preserved.

TABLE 7: ANALYSIS OF INORGANIC AND RADIOACTIVE PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING THE FIRST LOW-STAGE SEMIANNUAL SAMPLING IN JUNE 2020

Parameter	Units	Class I Std[1]	G-01	G-02	G-03	G-04	G-04 DUP[2]	G-05	G-06	G-07
Ag	mg/L	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
As	"	0.01	<0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.003
B	"	2.00	0.45	0.33	0.61	**2.4**	NDR[3]	**2.2**	**4.6**	0.26
Ba	"	2.00	0.038	0.056	0.061	0.043	0.045	0.056	0.023	0.038
Be	"	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cd	"	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	"	1.00	<0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.003
Cr	"	0.1	<0.002	0.028	0.011	<0.002	<0.002	<0.002	<0.002	<0.002
Cu	"	0.65	<0.001	0.001	0.004	0.001	0.002	<0.001	0.002	<0.001
CN	"	0.2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
F	"	4.00	0.36	0.29	0.46	0.44	0.45	0.37	0.38	0.23
Fe	"	5.00	0.14	1.24	0.62	0.60	0.68	0.56	0.31	1.1
Hg	"	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Mn	"	0.15	0.023	0.025	0.017	0.012	0.013	0.028	0.005	0.006
Ni	"	0.1	<0.001	0.038	0.020	0.001	0.001	<0.001	<0.001	0.005
NO_3-N	"	10.0	0.27	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Pb	"	0.0075	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sb	"	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se	"	0.05	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Tl	"	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5.00	<0.005	0.007	<0.005	0.006	0.006	<0.005	0.011	0.17
Ra-226	pCi/L	20.0	1.38	0.824	1.16	1.40	1.21	1.38	1.17	1.01
Ra-228	"	20.0	1.01	0.675	1.44	1.19	0.901	1.19	0.624	1.51

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]Duplicate sample.
[3]No data reportable. Result was over calibration range and sample was disposed before reanalysis could take place.

TABLE 8: UPPER TOLERANCE LIMITS FOR INORGANIC AND RADIOACTIVE PARAMETERS AT THE MCCOOK RESERVOIR SITE ESTABLISHED BY BACKGROUND MONITORING PRIOR TO OPERATION IN JANUARY 2018

Parameter	Units	G-01	G-02	G-03	G-04	G-05	G-06	G-07
Ag	mg/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025
As	"	0.0018	0.025	0.0028	0.0035	0.0027	0.025	0.0086
B	"	0.598	0.51	1.09	2.5	2.5	7.1	0.59
Ba	"	0.048	0.092	0.15	0.095	0.053	0.058	0.09
Be	"	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Cd	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Co	"	0.035	0.0081	0.0032	0.035	0.035	0.035	0.0048
Cr	"	0.025	0.633	0.13	0.035	0.035	0.035	0.035
Cu	"	0.0044	0.015	0.0095	0.0031	0.0025	0.0062	0.0074
CN	"	0.1	0.1	0.1	0.1	0.1	0.1	0.1
F	"	0.05	0.05	0.33	0.4	0.35	0.37	0.05
Fe	"	4.92	10.5	4.48	1.37	0.95	1.43	2.44
Hg	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mn	"	0.099	0.103	0.21	0.036	0.026	0.021	0.012
Ni	"	0.011	0.25	0.065	0.0092	0.0062	0.05	0.01
NO_3-N	"	1.08	0.075	0.075	0.075	0.075	0.075	0.075
Pb	"	0.00375	0.00375	0.0056	0.0077	0.00375	0.00375	0.00375
Sb	"	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Se	"	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Tl	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zn	"	0.01	0.01	0.01	0.057	0.1	0.069	0.01
Ra-226	pCi/L	2.78	2.33	2.58	1.89	1.60	2.24	3.75
Ra-228	"	3.19	1.51	4.12	3.08	1.65	1.89	4.64

TABLE 9: ANALYSIS OF ORGANIC PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING THE FIRST LOW-STAGE SEMIANNUAL SAMPLING IN JUNE 2020

Parameter	Unit	Class I Std[1]	Max RL[2]	G-01	G-02	G-02 DUP[3]	G-03	G-04	G-05	G-06	G-07
HERBICIDES											
2,4-D	mg/L	0.07	0.00025	<0.00025	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024
Silvex (2,4,5-TP)	"	0.05	0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
Atrazine[4]	"	0.003	0.0027	<0.0027	<0.0020	<0.0019	<0.0021	<0.0019	<0.0019	<0.0019	<0.0019
Dalapon	"	0.2	0.0025	<0.0025	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024
Simazine	"	0.004	0.0017	<0.0016	<0.0016	<0.0015	<0.0016	<0.0016	<0.0016	<0.0015	<0.0017
PCBs, Total	"	0.00005	0.00041	<0.00040	<0.00039	<0.00038	<0.00039	<0.00040	<0.00040	<0.00037	<0.00041
PESTICIDES											
Alachlor	"	0.002	0.00041	<0.00040	<0.00039	<0.00038	<0.00039	<0.00040	<0.00040	<0.00037	<0.00041
Aldicarb	"	0.003	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Carbofuran	"	0.04	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chlordane (technical)	"	0.002	0.000083	<0.000080	<0.000078	<0.000077	<0.000078	<0.000080	<0.000079	<0.000075	<0.000083
Endrin	"	0.002	0.000041	<0.000040	<0.000039	<0.000038	<0.000039	<0.000040	<0.000040	<0.000037	<0.000041
gamma-BHC (Lindane)	"	0.0002	0.000041	<0.000040	<0.000039	<0.000038	<0.000039	<0.000040	<0.000040	<0.000037	<0.000041
Heptachlor	"	0.0004	0.000041	<0.000040	<0.000039	<0.000038	<0.000039	<0.000040	<0.000040	<0.000037	<0.000041
Heptachlor epoxide	"	0.0002	0.000041	<0.000040	<0.000039	<0.000038	<0.000039	<0.000040	<0.000040	<0.000037	<0.000041
Methoxychlor	"	0.04	0.000083	<0.000080	<0.000078	<0.000077	<0.000078	<0.000080	<0.000079	<0.000075	<0.000083
Toxaphene	"	0.003	0.00041	<0.00040	<0.00039	<0.00038	<0.00039	<0.00040	<0.00040	<0.00037	<0.00041
VOCs											
1,1,1-Trichloroethane	"	0.2	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
1,1,2-Trichloroethane	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	"	0.007	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-Chloropropane	"	0.0002	0.000018	<0.000018	<0.000018	<0.000018	<0.000017	<0.000018	<0.000018	<0.000018	<0.000018
Ethylene Dibromide	"	0.00005	0.000018	<0.000018	<0.000018	<0.000018	<0.000017	<0.000018	<0.000018	<0.000018	<0.000018
Benzene	"	0.005	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00065	<0.00050
Carbon tetrachloride	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

TABLE 9 (Continued): ANALYSIS OF ORGANIC PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING THE FIRST LOW-STAGE SEMIANNUAL SAMPLING IN JUNE 2020

Parameter	Unit	Class I Std[1]	Max RL[2]	G-01	G-02	G-02 DUP[3]	G-03	G-04	G-05	G-06	G-07
VOCs continued											
Chlorobenzene	mg/L	0.1	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,2-Dichloroethene	"	0.07	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0025	0.0060
Ethylbenzene	"	0.7	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Methylene Chloride	"	0.005	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methyl tert-butyl ether	"	0.07	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Styrene	"	0.1	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	"	1	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
trans-1,2-Dichloroethene	"	0.1	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	"	0.005	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Vinyl chloride	"	0.002	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.060**	<0.0010
Xylenes, Total	"	10	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
SVOCs											
1,2,4-Trichlorobenzene	"	0.07	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene	"	0.6	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	"	0.075	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Benzo[a]pyrene[4]	"	0.0002	0.00022	<0.00022	<0.00016	<0.00015	<0.00016	<0.00015	<0.00015	<0.00015	<0.00015
Bis(2-ethylhexyl) phthalate[4]	"	0.006	0.011	<0.011	<0.0081	<0.0076	<0.0082	<0.0077	<0.0077	<0.0077	<0.0077
Hexachlorocyclopentadiene[4]	"	0.05	0.022	<0.022	<0.016	<0.015	<0.016	<0.015	<0.015	<0.015	<0.015
Pentachlorophenol	"	0.001	0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
Phenolics, Total	"	0.1	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]Maximum Lab Reporting Limit for analyses of an analyte at all monitoring wells.
[3]Duplicate sample.
[4]Analysis was conducted beyond the specified holding time.

TABLE 10: UPPER TOLERANCE LIMITS FOR ORGANIC PARAMETERS AT THE MCCOOK RESERVOIR SITE ESTABLISHED BY BACKGROUND MONITORING PRIOR TO OPERATION IN JANUARY 2018

Parameter	Units	G-01	G-02	G-03	G-04	G-05	G-06	G-07
HERBICIDES								
2,4-D	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Silvex (2,4,5-TP)	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Atrazine	"	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Dalapon	"	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Simazine	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PCBs, Total	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
PESTICIDES								
Alachlor	"	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Aldicarb	"	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Carbofuran	"	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Chlordane (technical)	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Endrin	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
gamma-BHC (Lindane)	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Heptachlor	"	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Heptachlor epoxide	"	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Methoxychlor	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Toxaphene	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
VOCs								
1,1,1-Trichloroethane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,1,2-Trichloroethane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,1-Dichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,2-Dichloroethane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,2-Dichloropropane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,2-Dibromo-3-Chloropropane	"	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
1,2-Dibromoethane	"	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Benzene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.00057	0.0025
Carbon tetrachloride	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025

TABLE 10 (Continued): UPPER TOLERANCE LIMITS FOR ORGANIC AT THE MCCOOK RESERVOIR SITE ESTABLISHED BY BACKGROUND MONITORING PRIOR TO OPERATION IN JANUARY 2018

Parameter	Units	G-01	G-02	G-03	G-04	G-05	G-06	G-07
VOCs continued								
Chlorobenzene	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001
cis-1,2-Dichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0130	0.0029
Ethylbenzene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Methylene Chloride	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Methyl tert-butyl ether	"	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Styrene	"	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Tetrachloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Toluene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
trans-1,2-Dichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Trichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0011
Vinyl chloride	"	0.001	0.001	0.001	0.001	0.0052	0.203	0.001
Xylenes, Total	"	0.0025	0.0025	0.0025	0.0025	0.0022	0.0025	0.0025
SVOCs								
1,2,4-Trichlorobenzene	"	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
1,2-Dichlorobenzene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,4-Dichlorobenzene	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Benzo[a]pyrene	"	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bis(2-ethylhexyl) phthalate	"	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Hexachlorocyclopentadiene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Pentachlorophenol	"	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phenolics, Total	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025

in wells G-06 and G-07 but did not exceed the Class I standard. Benzene was detected in well G-06 but did not exceed the Class I standard. 1,1,1-Trichloroethene was detected in well G-07 but did not exceed the Class I standard. Bis(2-ethylhexyl) phthalate was below the reporting limit in all wells, but the reporting limit was higher than the Class I standard and the upper TL for all wells. Benzo[a]pyrene was below the reporting limit in all wells, but the reporting limit was higher than the Class I standard and upper TL in well G-01.

REFERENCES

Illinois Administrative Code title 35, § 620.410 Groundwater Quality Standards for Class I: Potable Resource Groundwater (Amended at 36 Ill. Reg. 15206, effective October 5, 2012).

United States Army Corps of Engineers (USACE). 2014. Chicago Underflow Plan McCook Reservoir Lyons Township, Illinois. Groundwater Monitoring and Analysis Plan. Amended July 2014. Approved by IEPA April 2015.