Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 21-27

TUNNEL AND RESERVOIR PLAN THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR AND WELLS ANNUAL GROUNDWATER MONITORING REPORT FOR 2020

July 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

July 19, 2021

Chief
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Sir or Madam:

Subject: Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report for 2020

Attached are three copies of "Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report for 2020."

Very truly yours,

Albert Cox

Albert Cox
Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:EE:lf
Attachment
cc w/att: Mr. Ryan Bahr (USEPA Region 5 - WC15J) - (2)
Mr. E. Podczerwinski
Dr. H. Zhang
cc w/o att: Mr. J. Murray
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TUNNEL AND RESERVOIR PLAN THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR AND WELLS ANNUAL GROUNDWATER MONITORING REPORT FOR 2020

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July 2021

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°C	degrees Celsius
Ag	silver
As	arsenic
B	boron
Ba	barium
BG	billion gallons
BOD_5	five-day biological oxygen demand
Cd	cadmium
Cl^-	chloride
CN^-	cyanide
Cr	chromium
Cu	copper
EC	electrical conductivity
F^-	fluoride
FC	fecal coliform
Fe	iron
Hg	mercury
IEPA	Illinois Environmental Protection Agency
Mn	manganese
NH_3-N	ammonia nitrogen
Ni	nickel
Pb	lead
SO_4^{2-}	sulfate
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
TTR	Thornton Transitional Reservoir

ANNUAL DATA FOR THORNTON TRANSITIONAL RESERVOIR AND MONITORING WELLS

Introduction

This report is submitted annually to fulfill the reporting requirements of the Illinois Environmental Protection Agency (IEPA) regarding the utilization of the Thornton Transitional Reservoir (TTR) for flood control. The reporting requirements for groundwater quality monitoring of the Reservoir and adjacent wells were stated in Section 7 of the Scope of Work approved by the IEPA on August 6, 2001, modified on May 9, 2005, and last modified on March 14, 2019. The current monitoring program requires the four wells, QT-1, QT-2, QT-3 and QT-4, and the reservoir to be sampled one time at each fill event. In addition, the four wells, QT-1, QT-2, QT-3 and QT-4, need to be sampled once per quarter. The report includes:

1. Analytical data for the monitoring wells and TTR for 2020.

2. Review and comparison of analytical data for the monitoring wells with calculated statistical limits for previously analyzed background samples in order to evaluate exceedances in the concentrations of analytes.

Project Description

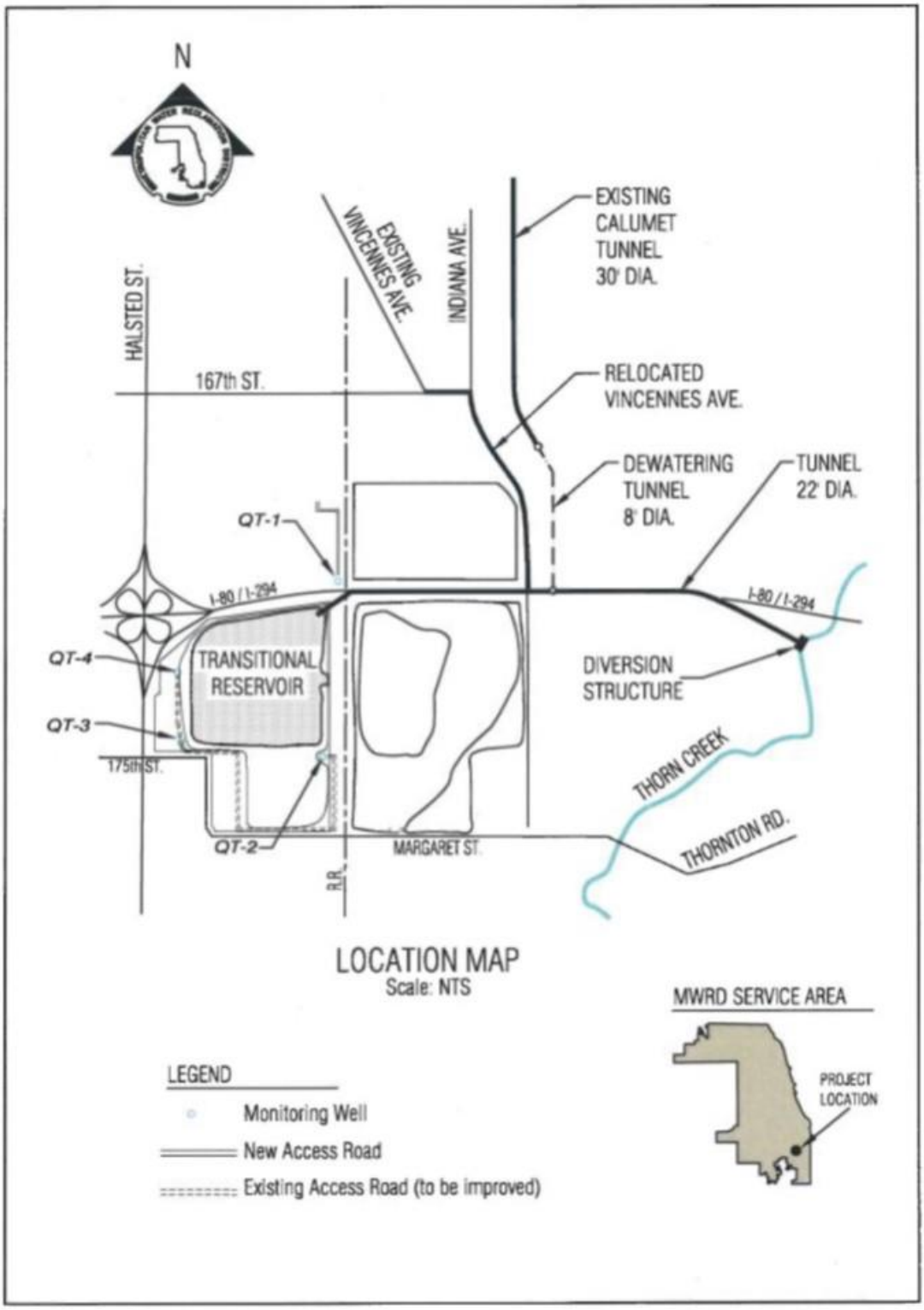
The Reservoir is located in the West Lobe of the Thornton Quarry, southeast of the intersection of the Tri-State Tollway and Halsted Street in Thornton, Illinois (Figure 1). The Reservoir was the final structure to be implemented for the Little Calumet River Watershed under the Natural Resources Conservation Service Little Calumet Watershed Plan of November 1998. The Reservoir provides 3.7 billion gallons (BG) of floodwater storage, increased from the original volume of 3.1 BG due to additional rock mining. This provides sufficient volume to capture a 100-year storm event from Thorn Creek at a point just south of the Tri-State Tollway. This project provides flood control benefits for 21 businesses and 4,400 residences. Within the Little Calumet watershed are the Illinois communities of Blue Island, Calumet City, Dixmoor, Dolton, Glenwood, Harvey, Lansing, Phoenix, Riverdale, and South Holland, which all benefit from the implemented flood control measures.

The Reservoir consists of a diversion structure at Thorn Creek, a 24-foot diameter dropshaft, and a 22-foot diameter conveyance tunnel to the Lower West Lobe of the Thornton Quarry. The project also includes an 8-foot diameter tunnel connected to the Calumet Tunnel and Reservoir Plan System that is utilized for Reservoir dewatering purposes only.

The analytes measured in these samples include:

1. pH, electrical conductivity (EC), total dissolved solids (TDS), five-day biological oxygen demand (BOD_5), cyanide (CN^-), fluoride (F^-), chloride (Cl^-), sulfate (SO_4^{2-}), ammonia nitrogen (NH_3-N), phenol, and trace metals silver (Ag), arsenic (As), boron (B), barium (Ba), cadmium (Cd), chromium (Cr),

FIGURE 1: THORNTON TRANSITIONAL RESERVOIR
MONITORING WELL LOCATIONS



copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), and lead (Pb).

2. Other parameters: fecal coliform (FC), groundwater temperature, and water elevation.

There were five significant rain events in 2020 which resulted in the diversion of Thorn Creek water to the TTR (Table 1). Since the Thornton Composite Reservoir (TCR) was placed in service in October 2015, water accumulation in the TTR is generally used for flushing the TCR for odor control. As a result, water was impounded in the TTR between January and December 2020. According to the current monitoring plan approved in March 2019, the TTR should be sampled once at each fill event, and four monitoring wells sampled once at each fill event and quarterly. This required five sampling events for the reservoir and nine sampling events for TTR wells. However, due to the COVID-19 pandemic, per IEPA approval, TTR monitoring wells were not sampled following the three fill events that occurred in April and May 2020.

Summary of Data for Monitoring Wells and Reservoir

Analytical data for all sampling events are presented in Tables 2 through 6 for wells QT-1, QT-2, QT-3, QT-4, and the TTR, respectively.

The parameters in the wells that exceeded the upper 95 percent confidence limits established from the background samples of respective wells are presented in Table 7. Total dissolved solids, chloride, and manganese exceeded the established limit in two wells, QT-1 and QT-3. Sulfate and barium exceeded the limit in well QT-3. Arsenic exceeded the limit in well QT-2. However, in nearly all cases where exceedances were observed in 2020 for any parameter in a well, the corresponding concentration of that parameter in the reservoir was much lower than that in the well, indicating that the reservoir is most likely not the source of the observed exceedances.

TABLE 1: DIVERSIONS TO THE THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR DURING 2020

Date of Diversion	Volume Collected in Thornton Transitional Reservoir Million Gallons	Rainfall (Measured at Calumet WRP) Inches	Date Reservoir Completely Drained	Number of Weeks Sampled
01/11/20	965	1.78	NA[1]	1
04/29/20	1,359	1.62	NA	1
05/15/20	2,726	4.16	NA	1
05/23/20	2,859	1.16	NA	1
07/19/20	1,227	0.82	NA	1
Total	—	9.54	—	—

[1]NA= Not available. Reservoir contained water from January through December 2020. Recent protocol for the operation of the Thornton Transitional Reservoir keeps the reservoir at approximately five percent full to allow make-up water to be fed into the Thornton Composite Reservoir.

TABLE 2: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.6	NL[1]	2,408	NL	0.002	0.59	589	508	NL	NL	<0.0008	0.001	NL	0.095
Fill Event	01/15/20	7.1	247	2,274	<2.0	<0.005	0.36	926	338	0.37	<0.005	<0.002	<0.001	0.24	0.082
1st Quarter	03/04/20	7.2	222	2,076	<2.0	NRR[3]	0.34	920	314	0.33	<0.005	<0.002	<0.001	0.25	0.076
2nd Quarter	06/12/20	7.3	267	2,258	<2.0	<0.005	0.33	915	329	0.36	<0.005	<0.002	<0.001	0.25	0.080
Fill Event	07/30/20	7.3	242	2,328	<2.0	<0.005	0.34	892	324	0.33	<0.005	<0.004	<0.002	0.25	0.078
3rd Quarter	09/25/20	7.2	232	3,238	<2.0	<0.005	0.31	877	308	0.39	<0.005	<0.004	<0.002	0.25	0.077
4th Quarter	12/02/20	N/S[2]	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S

TABLE 2 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform CFU/100 mL	Temp. °C	Water Elevation[4] feet	Recharge Time hours
		mg/L											
Upper 95% Confidence Limit		0.002	0.005	0.022	49	0.00005	0.094	0.005	0.019	NL[2]	NL	NL	NL
Fill Event	01/15/20	<0.001	<0.002	0.005	16	<0.0005	0.082	0.001	<0.001	<1	12.0	-149	<48
1st Quarter	03/04/20	<0.001	<0.002	<0.001	13	<0.0005	0.075	<0.001	<0.001	<1	12.4	-152	<48
2nd Quarter	06/12/20	<0.001	<0.002	0.003	14	<0.0005	0.102	<0.001	<0.001	<1	13.2	-131	<48
Fill Event	07/30/20	<0.002	<0.004	0.005	13	<0.0005	0.060	<0.002	<0.002	<1	13.4	-146	<48
3rd Quarter	09/25/20	<0.002	<0.004	0.008	12	<0.0005	0.068	<0.002	<0.002	<1	12.9	-153	<48
4th Quarter	12/02/20	N/S[2]	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<48

[1]NL: No limit.
[2]N/S: No samples were collected because the well pump malfunctioned.
[3]NRR: No result reported due to exceedance of sample holding time under COVID-19 pandemic minimal staffing or due to laboratory quality assurance/quality control failure.
[4]Relative to Chicago City Datum (579.48) feet above mean sea level at intersection of State and Madison Streets.

TABLE 3: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.5	NL[1]	2,651	NL	0.002	0.38	478	757	NL	NL	0.0001	0.006	NL	0.069
Fill Event	01/15/20	7.0	121	1,048	<2.0	0.001	0.24	122	505	<0.30	<0.005	<0.002	0.042	0.18	0.036
1st Quarter	03/04/20	7.5	98	960	<2.0	<0.005	0.28	121	386	<0.30	<0.005	<0.002	0.025	0.17	0.030
2nd Quarter	06/12/20	7.3	111	1,038	<2.0	<0.005	0.29	124	439	<0.30	<0.005	<0.002	0.033	0.17	0.033
Fill Event	07/30/20	7.2	100	1,112	<2.0	<0.005	0.27	109	489	<0.30	<0.005	<0.004	0.031	0.18	0.031
3rd Quarter	09/25/20	7.3	91	1,298	<2.0	<0.005	0.27	114	379	<0.30	<0.005	<0.004	0.031	0.17	0.031
4th Quarter	12/02/20	7.3	102	890	NRR[2]	<0.005	0.27	120	344	<0.30	<0.005	<0.004	0.032	0.18	0.030

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform CFU/100 mL	Temp. °C	Water Elevation[3] feet	Recharge Time hours
		mg/L											
Upper 95% Confidence Limit		0.002	0.007	0.033	5.0	0.0003	0.063	NL	0.019	NL	NL	NL	NL
Fill Event	01/15/20	<0.001	<0.002	0.001	2.9	<0.0005	0.034	0.012	<0.001	<1	13.3	-189	<48
1st Quarter	03/04/20	<0.001	<0.002	<0.001	1.2	<0.0005	0.022	0.007	<0.001	<1	13.0	-192	<48
2nd Quarter	06/12/20	<0.001	<0.002	<0.001	2.7	<0.0005	0.038	0.005	<0.001	<1	14.1	-153	<48
Fill Event	07/30/20	<0.002	<0.004	<0.002	3.6	<0.0005	0.053	0.006	<0.002	<1	14.3	-185	<48
3rd Quarter	09/25/20	<0.002	<0.004	<0.002	1.5	<0.0005	0.020	0.004	<0.002	<1	14.5	-193	<48
4th Quarter	12/02/20	<0.002	<0.004	0.002	1.8	NRR	0.019	0.005	<0.002	<1	13.0	-196	<48

[1]NL: No limit.
[2]NRR: No result reported due to exceedance of sample holding time under COVID-19 pandemic minimal staffing or due to laboratory quality assurance/quality control failure.
[3]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 4: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.8	NL[1]	1,353	NL	0.002	0.36	190	238	NL	NL	0.0292	<0.002	NL	0.082
Fill Event	01/15/20	6.9	144	1,500	<2.0	<0.005	0.15	448	250	<0.30	0.005	<0.002	<0.001	0.26	0.102
1st Quarter	03/04/20	7.1	128	1,506	<2.0	<0.005	0.20	432	249	<0.30	<0.005	<0.002	<0.001	0.29	0.100
2nd Quarter	06/12/20	7.2	140	1,618	<2.0	0.009	0.19	499	294	0.33	<0.005	<0.002	<0.001	0.23	0.116
Fill Event	07/30/20	7.1	157	1,652	<2.0	<0.005	0.19	505	295	<0.30	<0.005	<0.004	<0.002	0.23	0.112
3rd Quarter	09/25/20	7.1	143	1,952	<2.0	<0.005	0.21	431	230	0.35	<0.005	<0.004	<0.002	0.31	0.093
4th Quarter	12/02/20	7.2	145	1,420	NRR[2]	<0.005	0.21	404	212	0.34	<0.005	<0.004	<0.002	0.41	0.088

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform CFU/100 mL	Temp. °C	Water Elevation[3] feet	Recharge Time hours
		mg/L											
Upper 95% Confidence Level		0.001	0.006	0.022	21	0.00005	0.158	NL[1]	0.014	NL	NL	NL	NL
Fill Event	01/15/20	<0.001	<0.002	0.002	15	<0.0005	0.166	0.001	<0.001	<1	11.5	-181	<48
1st Quarter	03/04/20	<0.001	<0.002	0.016	5.1	<0.0005	0.117	0.008	<0.001	<1	11.6	-185	<48
2nd Quarter	06/12/20	<0.001	<0.002	0.002	13	<0.0005	0.113	0.001	<0.001	<1	13.8	-149	<48
Fill Event	07/30/20	<0.002	<0.004	0.003	13	<0.0005	0.129	<0.002	<0.002	<1	12.9	-174	<48
3rd Quarter	09/25/20	<0.002	<0.004	0.002	11	<0.0005	0.166	<0.002	<0.002	<1	12.6	-185	<48
4th Quarter	12/02/20	<0.002	<0.004	0.004	9.4	NRR	0.134	0.003	<0.002	<1	11.9	-186	<48

[1]No limit.
[2]NRR: No result reported due to exceedance of sample holding time under COVID-19 pandemic minimal staffing or due to laboratory quality assurance/quality control failure.
[3]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLES FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.7	NL[1]	2,034	NL	0.002	0.39	590	314	NL	NL	0.0033	NL	NL	0.181
Fill Event	01/15/20	6.9	135	1,088	<2.0	0.001	0.22	253	236	0.37	0.005	<0.002	<0.001	0.37	0.076
1st Quarter	03/04/20	7.3	112	1,114	<2.0	<0.005	0.24	253	225	0.33	<0.005	<0.002	<0.001	0.37	0.075
2nd Quarter	06/12/20	7.1	117	1,034	<2.0	<0.005	0.24	225	216	0.37	<0.005	<0.002	<0.001	0.35	0.067
Fill Event	07/30/20	7.2	106	1,034	<2.0	<0.005	0.24	197	214	0.32	<0.005	<0.004	<0.002	0.37	0.066
3rd Quarter	09/25/20	7.3	116	1,590	<2.0	<0.005	0.24	257	213	0.40	<0.005	<0.004	<0.002	0.37	0.074
4st Quarter	12/02/20	7.3	138	1,098	NRR[2]	<0.005	0.23	241	200	0.32	<0.005	<0.004	<0.002	0.38	0.074

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLES FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform CFU/100 mL	Temp. °C	Water Elevation[3] feet	Recharge Time Hours
		mg/L											
Upper 95% Confidence Limit		0.001	0.022	0.035	24	0.00004	0.203	NL	0.018	NL	NL	NL	NL
Fill Event	01/15/20	<0.001	<0.002	0.001	10	<0.0005	0.077	<0.001	<0.001	<1	13.1	-93	<48
1st Quarter	03/04/20	<0.001	<0.002	<0.001	8.6	<0.0005	0.065	0.001	<0.001	<1	13.4	-92	<48
2nd Quarter	06/12/20	<0.001	<0.002	<0.001	<0.2	<0.0005	0.053	<0.001	<0.001	<1	13.2	-89	<48
Fill Event	07/30/20	<0.002	<0.004	<0.002	9.0	<0.0005	0.063	<0.002	<0.002	260	13.4	-91	<48
3rd Quarter	09/25/20	<0.002	<0.004	0.002	10	<0.0005	0.066	<0.002	<0.002	<1	14.7	-92	<48
4st Quarter	12/02/20	<0.002	<0.004	0.003	8.0	NRR	0.053	<0.002	<0.002	<1	14.4	-93	<48

[1]NL: No limit.
[2]NRR: No result reported due to exceedance of sample holding time under COVID-19 pandemic minimal staffing or due to laboratory quality assurance/quality control failure.
[3]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 6: ANALYSIS OF FILL EVENT WATER STORED IN THE THORNTON TRANSITIONAL RESERVOIR AND SAMPLED DURING 2020

Event	Sample Date	pH	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
			mg/L											
1st Fill Event	01/13/20	7.0	320	4.0	<0.005	0.13	66	39	0.34	<0.005	<0.002	0.002	0.04	0.033
2nd Fill Event	05/01/20	6.2	316	NRR[1]	<0.005	0.17	50	29	NRR	<0.005	<0.002	0.002	0.06	0.037
3rd Fill Event	05/20/20	6.0	258	3.0	0.006	0.17	43	30	NRR	<0.005	<0.002	0.003	0.06	0.032
4th Fill Event	05/26/20	6.0	254	<2.0	<0.005	0.19	46	33	0.31	<0.005	<0.002	0.002	0.06	0.021
5th Fill Event	07/21/20	6.0	406	<2.0	<0.005	0.20	73	118	0.32	<0.005	<0.004	<0.002	0.10	0.017

TABLE 6 (Continued): ANALYSIS OF FILL EVENT WATER STORED IN THE THORNTON TRANSITIONAL RESERVOIR AND SAMPLED DURING 2020

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform CFU/100 mL	Temp. °C	Depth of Water feet
		mg/L										
1st Fill Event	01/13/20	<0.001	0.003	0.007	3.9	<0.0005	0.074	0.006	0.006	5,400	3	20
2nd Fill Event	05/01/20	<0.001	0.004	0.006	3.0	<0.0005	0.070	0.005	0.005	2,900	9	25
3rd Fill Event	05/20/20	<0.001	<0.002	0.004	1.7	<0.0005	0.027	0.004	0.002	390	13.5	45
4th Fill Event	05/26/20	<0.001	<0.002	0.005	0.5	<0.0005	0.007	0.002	<0.001	50	23	45
5th Fill Event	07/21/20	<0.002	<0.004	0.003	0.2	<0.0005	0.018	0.006	<0.002	16,000	27	25

[1]NRR: No result reported due to exceedance of sample holding time under COVID-19 pandemic minimal staffing or due to laboratory quality assurance/quality control failure.

TABLE 7: EXCEEDANCES[1] DETECTED IN WELLS AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2020

Well Number	Parameter Exceeding Limit
QT-1	TDS, Cl^-, Mn
QT-2	As
QT-3	TDS, Cl^-, SO_4^{2-}, Ba, Mn
QT-4	None

[1]Concentrations of analytes exceed upper limits of 95 percent confidence intervals for background samples.