

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

*REPORT NO. 21-29*

*TUNNEL AND RESERVOIR PLAN CALUMET TUNNEL SYSTEM*

*ANNUAL GROUNDWATER MONITORING REPORT FOR 2020*

*July 2021*

Kari K. Steele  
*President*  
Barbara J. McGowan  
*Vice President*  
Marcelino Garcia  
*Chairman of Finance*  
Cameron Davis  
Kimberly Du Buclet  
Josina Morita  
Eira L. Corral Sepúlveda  
Debra Shore  
Mariyana T. Spyropoulos

**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 Calumet Tunnel System Annual Groundwater  
Monitoring Report for 2020

Attached are three copies of "Tunnel and Reservoir Plan Calumet Tunnel System Annual  
Groundwater Monitoring Report for 2020."

Very truly yours,



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  
Mr. S. Serafino

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

**TUNNEL AND RESERVOIR PLAN CALUMET TUNNEL SYSTEM  
ANNUAL GROUNDWATER MONITORING REPORT FOR 2020**

**By**

**Essam El-Naggar**  
**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**

## TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iii
LIST OF ABBREVIATIONS	iv
ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS	1
Introduction	1
Modified Groundwater Monitoring Program	1
Summary of Data	4
Observation Wells	4

## LIST OF TABLES

<u>Table No.</u>		<u>Page</u>
1	Analysis of Chemical and Physical Parameters in Groundwater from Fill Event Monitoring Wells in the Calumet Tunnel System of the Tunnel and Reservoir Plan Sampled During 2020	5
2	Analysis of Fecal Coliform in Groundwater from Fill Event Monitoring Wells in the Calumet Tunnel System of the Tunnel and Reservoir Plan Sampled During 2020	6
3	Analysis of Chemical and Physical Parameters and Fecal Coliform in Groundwater from Annual Sampling Wells in the Calumet Tunnel System of the Tunnel and Reservoir Plan Sampled During 2020	7
4	Groundwater Elevations for Monitoring/Observation Wells OC-1 Through OC-11 in the Calumet Tunnel System of the Tunnel and Reservoir Plan Measured During 2020	9

## LIST OF FIGURES

<u>Figure No.</u>		<u>Page</u>
1	Map of Monitoring Wells in the Calumet Tunnel System	2
2	Map of Observation Wells in the Calumet Tunnel System	3
3	Minimum, Mean, and Maximum Water Elevations for Observation Wells OC-1 Through OC-11 in the Calumet Tunnel System of the Tunnel and Reservoir Plan Measured During 2020	10

## LIST OF ABBREVIATIONS

°C	degrees Celsius
CCD	Chicago City Datum
CFU	colony forming units
CTS	Calumet Tunnel System
Cl <sup>-</sup>	chloride
District	Metropolitan Water Reclamation District of Greater Chicago
EC	electrical conductivity
FC	fecal coliform
IEPA	Illinois Environmental Protection Agency
L	liter
M	meter
mg	milligram
mS	millisiemens
NH <sub>3</sub> -N	ammonia nitrogen
SO <sub>4</sub> <sup>2-</sup>	sulfate
TARP	Tunnel and Reservoir Plan
TDS	total dissolved solids
Temp.	temperature
TOC	total organic carbon

## ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS

### Introduction

All monitoring and observation wells are located along the length of the Calumet Tunnel System (CTS). Four monitoring wells (QC-1, QC-2, QC-2-1, and QC-2-2) and 11 observation wells (OC-1 through OC-11) are located along the tunnel between Crawford Avenue and the Calumet Water Reclamation Plant. Seventeen monitoring wells (QC-3 through QC-19) are located between 140<sup>th</sup> Street and Indiana Avenue, nine (QC-20 through QC-28) are along Torrence Avenue, and nine (QC-29 through QC-37) along the Little Calumet River (Figures 1 and 2). Monitoring well QC-3 was abandoned with the approval of the Illinois Environmental Protection Agency (IEPA).

The monitoring wells were sampled based on the modified groundwater monitoring program for the Metropolitan Water Reclamation District of Greater Chicago (District)'s Tunnel and Reservoir Plan (TARP) as briefly described below.

### Modified Groundwater Monitoring Program

In a letter dated July 13, 2017, the IEPA accepted the modifications for the District's TARP groundwater monitoring program effective from January 2017 for a period of three years (2017–2019). Under the revised monitoring plan, three wells (QC-2, QC-4, and QC-17), which had fecal coliform (FC) detected in 10 percent or more of samples during the period 1995–2013, will be sampled for four TARP tunnel fill events, based on the water levels in the TARP following storm events. The fill event-based criterion that triggers a fill event sampling is when the level of water in the TARP Mainstream tunnel reaches -150 feet Chicago City Datum (CCD). At each event, sampling is done weekly for three weeks. The samples collected during the first week of sampling are analyzed for all parameters in the current monitoring program, including pH, temperature, electrical conductivity, total dissolved solids, hardness, ammonia nitrogen, total organic carbon, chloride, sulfate, and FC. However, the samples from the second and third weeks are analyzed for FC only. The modified program continued to operate in 2020 and beyond until a new program structure is approved by IEPA in 2021.

The other 28 wells associated with the CTS are sampled once per year. These wells had FC detected in less than 10 percent of samples during the period 1995–2013.

Groundwater elevations in the monitoring wells were measured during each sampling event, while elevations in the observation wells were measured biweekly with a minor variation. The groundwater level in monitoring well QC-8.1 no longer yields sufficient samples for analysis. However, this well was converted to an observation well several years ago, and its groundwater elevations are still measured biweekly.

Based on further evaluation of the monitoring wells, QC-1 did not function following repairs, and QC-3 and QC-8 were abandoned many years ago. Therefore, these wells were also added to the group of wells (QC-32, QC-33, QC-34, QC-36, and QC-37) discontinued for monitoring under the modified groundwater monitoring program.



FIGURE 1: MAP OF MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM

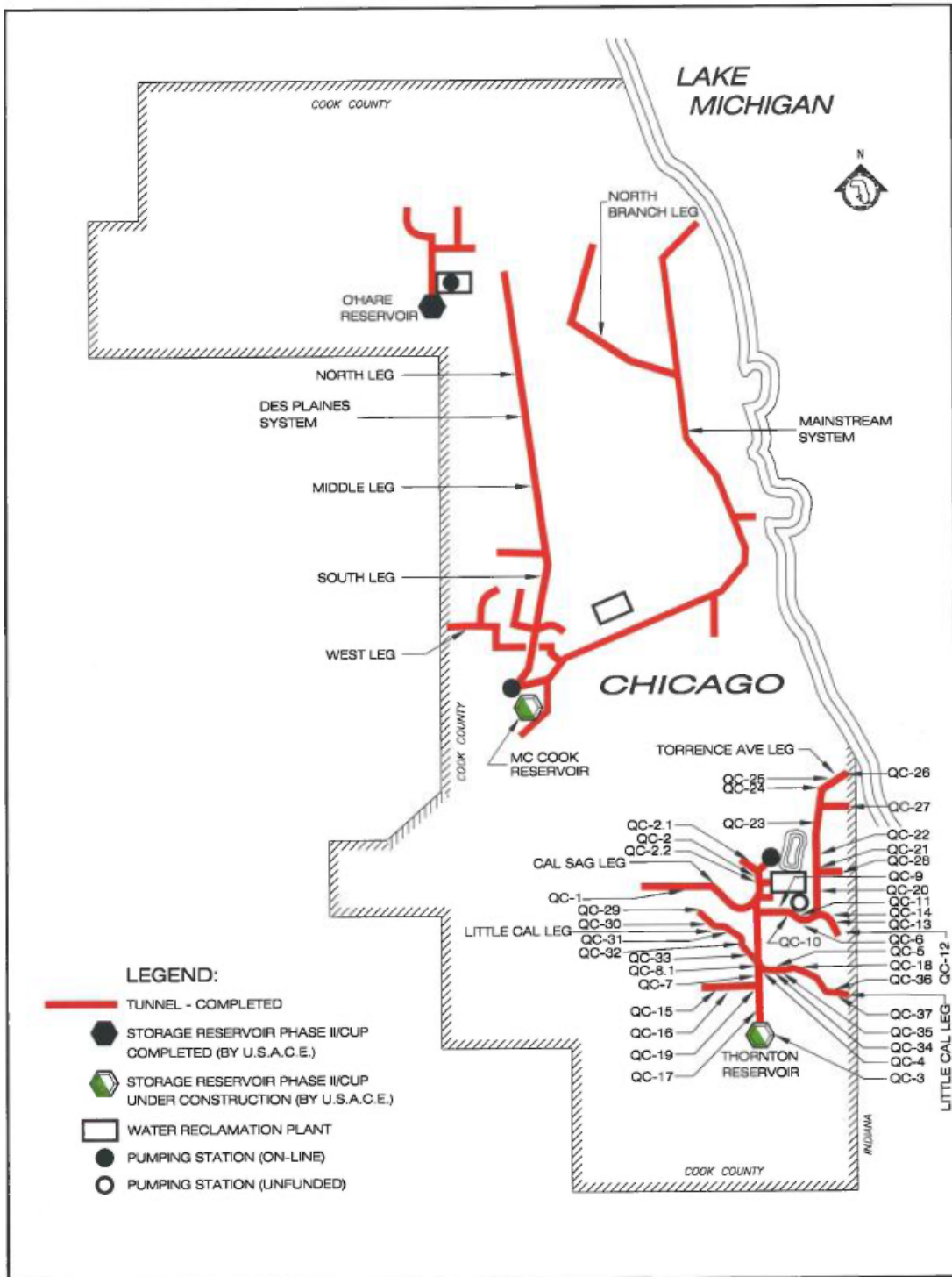
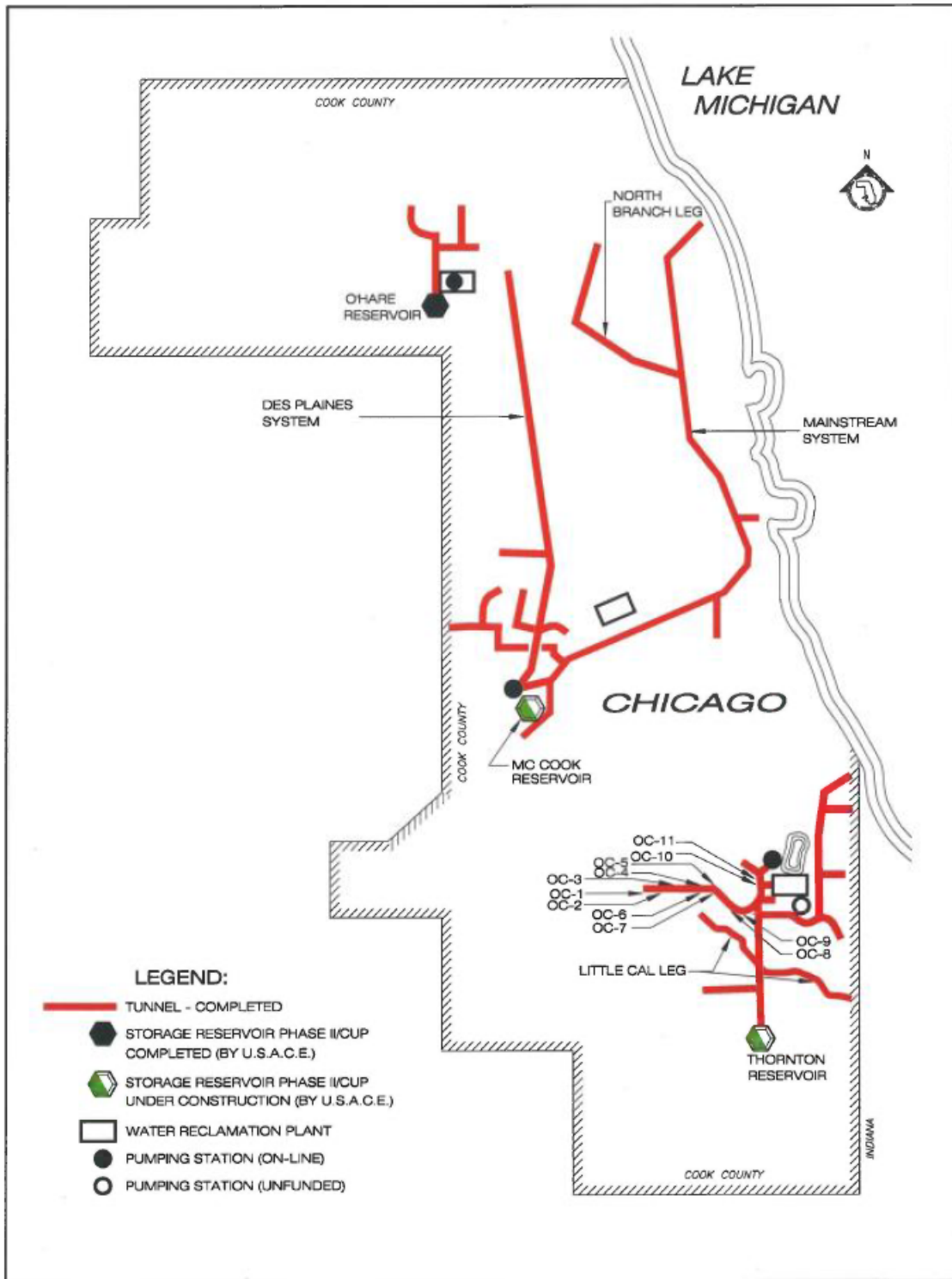


FIGURE 2: MAP OF OBSERVATION WELLS IN THE CALUMET TUNNEL SYSTEM



## Summary of Data

During 2020, there were three tunnel fill events observed on the following dates: April 30, 2020, May 15, 2020, and October 22, 2020. Sampling was not conducted at the first two fill events due to suspension of the TARP monitoring program during the COVID-19 pandemic, per the approval of IEPA. Groundwater sampling was conducted only during the fill event of October 22, 2020.

The analytical data for groundwater sampled during 2020 from fill event-based monitoring wells QC-2, QC-4 and QC-17 are presented in [Table 1](#). Physical characteristics, such as elevation, groundwater temperature, and estimated time of recharge for each well between initial drawdown and sampling, are also included. The FC data for groundwater sampled during 2020 fill event at these wells are presented in [Table 2](#). The analytical data for groundwater from the wells sampled once per year are presented in [Table 3](#). FC counts in all the annual sampling wells were undetectable (<1 CFU/100 mL) except for well QC-26 at 1 CFU/100 mL.

**Observation Wells.** Groundwater elevations were measured for observation wells OC-1 through -11. Water elevations were calculated relative to the CCD (579.48 feet above mean sea level) at the intersection of State and Madison Streets and presented in [Table 4](#). During 2020, monitoring activities were suspended from mid-March to early June 2020 due to the COVID-19 pandemic. The minimum, mean, and maximum values for each well were calculated and plotted to determine fluctuations in groundwater elevations during the year ([Figure 3](#)). Generally, these fluctuations appeared to be minimal or within expected ranges throughout the year in most wells. However, there were notable fluctuations in groundwater elevations of 15, 12, and 10 feet at wells OC-8, OC-9, and OC-6, respectively.

TABLE 1: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS IN GROUNDWATER FROM FILL EVENT MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2020

Well	Fill Event <sup>1</sup>	Date Sampled	pH	EC mS/m	TDS	TOC	Cl-	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Temp. °C	Water Elevation <sup>2</sup> feet	Recharge Time hours
					-----mg/L-----								
QC-2	F3	10/30/2020	8.2	42	324	<5.0	30	28	<0.30	74	11.6	NA <sup>3</sup>	<48
QC-4	F3	10/30/2020	8.7	50	404	<5.0	9.0	16	<0.30	9.0	12.3	-226	<48
QC-17	F3	10/30/2020	8.0	57	474	<5.0	8.0	177	<0.30	147	12.5	-195	<48

<sup>1</sup>Fill events 1 and 2 were not sampled due to the COVID-19 pandemic.

<sup>2</sup>Relative to Chicago City Datum (579.48 feet above mean sea level) at the intersection of State and Madison Streets.

<sup>3</sup>No measurement was determined because the water level indicator probe got stuck in the well.

TABLE 2: ANALYSIS OF FECAL COLIFORM IN GROUNDWATER FROM FILL EVENT MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2020

Well	Fill Event <sup>1</sup>	Week 1 Sample Date <sup>2</sup>	Fecal Coliform, CFU/100 mL		
			Week 1	Week 2	Week 3
QC-2	F3	10/30/20	2	27	NA <sup>3</sup>
QC-4	F3	10/30/20	<1	NReq <sup>4</sup>	NReq
QC-17	F3	10/30/20	<1	NReq	NReq

<sup>1</sup>Fill events 1 and 2 were not sampled due to the COVID-19 pandemic.

<sup>2</sup>Sampling date of the first week of the fill event.

<sup>3</sup>No sample was collected because the well was dry.

<sup>4</sup>NReq: Sampling was not required because the fecal coliform level was below the detection limit in the previous week.

TABLE 3: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM ANNUAL SAMPLING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2020

Well	Sampled Date	pH	EC mS/m	TDS	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Temp. °C	Water Elevation <sup>2</sup> feet	Fecal Coliform CFU/100 mL
						mg/L						
QC-2-1	07/16/20	8.2	63	462	2.0	35	4	0.46	55	16.4	-299	<1
QC-2-2	07/16/20	8.6	40	298	1.8	14	24	<0.30	31	15.5	-296	<1
QC-5	07/16/20	8.6	58	462	1.1	49	11	<0.30	8	13.2	-213	<1
QC-6	07/16/20	8.5	46	450	1.2	16	4	<0.30	16	13.2	-207	<1
QC-7	07/16/20	8.4	41	366	1.3	11	<1.0	<0.30	12	13.6	-151	<1
QC-9	07/16/20	7.9	33	296	<1.0	10	40	0.48	54	14.5	-259	<1
QC-10	01/22/20	8.7	45	392	<1.0	33	<1.0	<0.30	9	12.7	-165	<1
QC-11	01/22/20	8.7	34	284	<1.0	24	<1.0	<0.30	19	12.8	-188	<1
QC-12	01/22/20	7.9	85	798	<1.0	34	270	0.60	136	12.6	-220	<1
QC-13	01/22/20	8.4	45	378	1.2	56	10	<0.30	30	12.5	-228	<1
QC-14	07/23/20	7.2	77	678	3.0	150	1	0.35	159	13.8	-202	<1
QC-15	07/23/20	8.3	32	300	<1.0	13	<1.0	<0.30	14	13.1	-199	<1
QC-16	07/23/20	8.6	55	452	<1.0	23	75	<0.30	55	15.4	-258	<1
QC-18	01/23/20	8.5	37	344	<1.0	8	32	<0.30	6	12.1	-194	<1
QC-19	01/23/20	8.2	41	410	1.2	7	97	0.31	95	12.1	-157	<1
QC-20	01/23/20	7.7	33	314	1.8	23	24	0.36	40	11.6	-242	<1
QC-21	07/23/20	8.4	37	348	1.4	18	33	0.50	39	13.6	-236	<1
QC-22	07/23/20	8.4	27	232	1.9	15	5	0.37	32	12.5	-234	<1
QC-23	07/23/20	8.9	37	310	<1.0	21	2	<0.30	9	13.0	-216	<1
QC-24	07/31/20	8.5	26	236	<5.0	29	<1.0	<0.30	14	12.9	-222	<1
QC-25	07/31/20	8.5	30	282	<5.0	14	40	<0.30	56	13.9	-224	<1
QC-26	07/31/20	9.1	30	294	<5.0	13	<1.0	<0.30	7	13.3	-215	1
QC-27	07/31/20	8.4	28	260	<5.0	33	<1.0	<0.30	22	14.1	-191	<1
QC-28	07/31/20	9.0	29	274	<5.0	13	<1.0	<0.30	15	13.3	-226	<1
QC-29	01/23/20	6.6	81	922	1.4	174	231	0.82	423	11.7	-47	<1

TABLE 3 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM ANNUAL SAMPLING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2020

Well	Sampled Date	pH	EC mS/m	TDS	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Temp. °C	Water Elevation <sup>2</sup> feet	Fecal Coliform CFU/100 mL
						mg/L						
QC-30	01/23/20	7.3	52	548	1.5	49	139	0.68	106	11.1	-109	<1
QC-31	01/23/20	7.1	49	540	1.7	20	188	1.13	236	12.5	-37	<1
QC-35	08/27/20	8.6	112	856	<5.0	34	16	<0.30	15	16.5	-152	<1

<sup>1</sup>Reporting limits changed to <5.0 mg/L on July 31, 2020, due to a new instrument..

<sup>2</sup>Relative to Chicago City Datum (579.48 feet above mean sea level) at the intersection of State and Madison Streets.

TABLE 4: GROUNDWATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2020

Date <sup>1</sup>	Observation Well Number											
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6	OC-7	OC-8	OC-8.1	OC-9	OC-10	OC-11
	-----Elevation (feet) <sup>2</sup> -----											
01/31/2020	-38	-22	-152	-152	-146	-75	-206	-175	-215	-209	-224	-225
02/10/2020	-38	-23	-150	-152	-146	-74	-207	-175	-214	-210	-224	-224
02/28/2020	-38	-23	-151	-152	-147	-73	-207	-175	-214	-210	-226	-224
03/13/2020	-38	-23	-151	-152	-145	-72	-207	-175	-213	-210	-223	-224
06/04/2020	-37	-19	-147	-151	-145	-65	-206	-163	-213	NA	-223	-223
06/17/2020	-39	-23	-150	-152	-147	-70	-205	-163	-213	NA	-224	-224
07/02/2020	-39	-25	-152	-152	-150	-72	-205	-174	-213	-209	-220	-224
07/16/2020	-39	-24	-151	-151	-146	-73	-206	-176	-213	-209	-223	-224
08/07/2020	-39	-23	-151	-152	-146	-72	-207	-176	-213	-209	-223	-224
08/21/2020	-39	-23	-150	-151	-146	-72	-208	-175	-213	-211	-225	-225
09/04/2020	-41	-24	-150	-152	-147	-73	-207	-176	-212	-210	-225	-225
09/23/2020	-40	-25	-151	-152	-147	-72	-209	-177	-212	-211	-225	-224
10/08/2020	-40	-24	-150	-152	-147	-72	-208	-176	-212	-211	-225	-224
10/23/2020	-41	-25	-151	NA <sup>3</sup>	-147	-73	-209	-175	-212	-211	-224	-225
11/04/2020	-40	-25	-150	-152	-147	-73	-208	-176	-213	-211	-226	-225
11/20/2020	-41	-25	-152	-154	NA	-74	-208	-177	-212	-211	-226	-226
12/02/2020	-40	-24	-151	-153	-148	-73	-209	-178	-212	-221	-228	-226
12/17/2020	-40	-24	-151	-152	-148	-73	-210	-177	-213	-211	-219	-225

<sup>1</sup>Date measurements were taken. No measurements were conducted during the period from mid-March to end of May due to the COVID-19 pandemic.

<sup>2</sup>Relative to Chicago city datum (579.48 feet above mean sea level) at the intersection of State and Madison Streets.

<sup>3</sup>No measurements were obtained due to the inaccessibility of the well.



FIGURE 3: GROUNDWATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2020

