

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

*REPORT NO. 24-19*

*TUNNEL AND RESERVOIR PLAN*

*CALUMET TUNNEL SYSTEM*

*ANNUAL GROUNDWATER MONITORING REPORT*

*FOR 2023*

*July 2024*

*Protecting Our Water Environment*



**Metropolitan Water Reclamation District of Greater Chicago**

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July 11, 2024

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Ms. Joey Logan-Pugh  
Chief  
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Illinois Environmental Protection Agency  
P. O. Box 19276  
Springfield, IL 62794-9276

Dear Ms. Logan-Pugh:

Subject: Tunnel and Reservoir Plan Calumet Tunnel System Annual Groundwater  
Monitoring Report for 2023

The report entitled "Tunnel and Reservoir Plan Calumet Tunnel System Annual Groundwater  
Monitoring Report for 2023" is attached.

Very truly yours,

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

AC:EE:lf  
Attachment  
cc: Mr. Ryan Bahr (USEPA Region 5 - WC15J)  
Mr. E. Podczerwinski  
Dr. H. Zhang  
cc w/o att: Mr. J. Murray  
Mr. A. Gronski

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**TUNNEL AND RESERVOIR PLAN  
CALUMET TUNNEL SYSTEM  
ANNUAL GROUNDWATER MONITORING REPORT  
FOR 2023**

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## LIST OF ABBREVIATIONS

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| Abbreviation                  | Definition   |
|-------------------------------|--|
| °C                            | degrees Celsius  |
| CCD                           | Chicago City Datum   |
| CFU                           | colony forming units                                       |
| Cl <sup>-</sup>               | chloride   |
| CTS                           | Calumet Tunnel System                                      |
| 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  |
| mL                            | milliliter   |
| 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                                       |

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# 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) are 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.

## Groundwater Monitoring Program

In a letter dated May 14, 2021, the Illinois Environmental Protection Agency (IEPA) approved a modified TARP groundwater monitoring program for the District's Calumet, Mainstream, Des Plaines, and Upper Des Plaines tunnel systems effective January 2021. The modification of the TARP groundwater monitoring program was based on the key findings from a three-year fill event-based groundwater monitoring study conducted by the District from 2017 to 2019, which were submitted to the IEPA in a report dated July 30, 2020.

Under the modified monitoring program, three CTS fill event-based monitoring wells (QC-2, QC-4, and QC-17) are sampled for two tunnel fill events per year, usually following storm events. Fecal coliforms (FC) in these wells were detected in 10 percent or more of samples during the period 1995–2013. The criterion that triggers fill event sampling is that the water level in the Thornton Composite Reservoir, which receives water from the CTS, reaches -280 feet Chicago City Datum (CCD). Sampling is conducted during the first week of each fill event. For the first fill event, samples are analyzed for all parameters including pH, temperature (Temp.), electrical conductivity (EC), total dissolved solids (TDS), hardness, ammonia nitrogen (NH<sub>3</sub>-N), total organic carbon (TOC), chloride (Cl<sup>-</sup>), sulfate (SO<sub>4</sub><sup>2-</sup>), and FC. For the second fill event, samples are analyzed for FC only.

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

Eight of the monitoring wells (QC-1, QC-3, QC-8, QC-32, QC-33, QC-34, QC-36, and QC-37) were abandoned previously. Therefore, the monitoring requirement for this group of wells has been discontinued under the modified groundwater monitoring program.



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

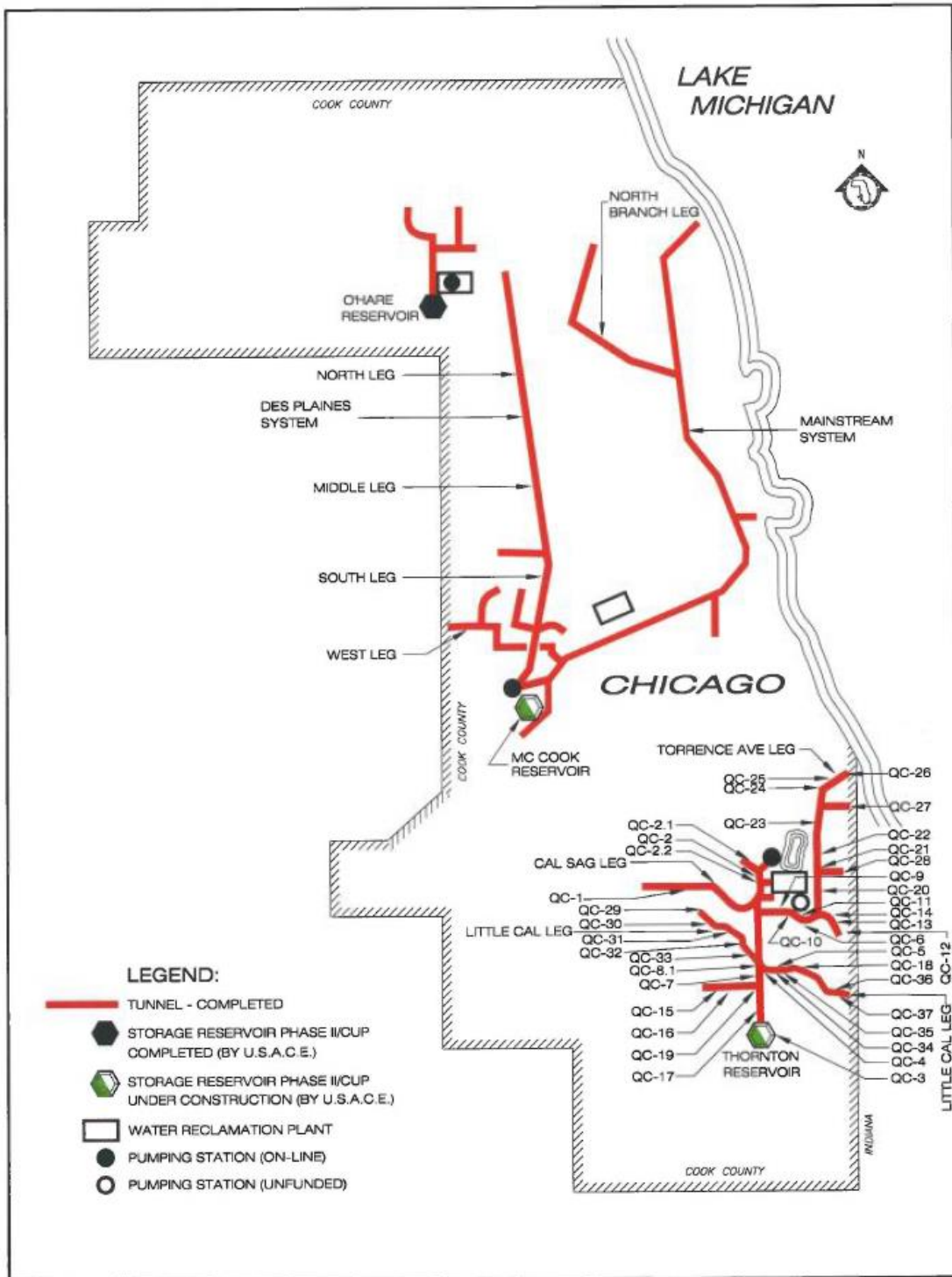
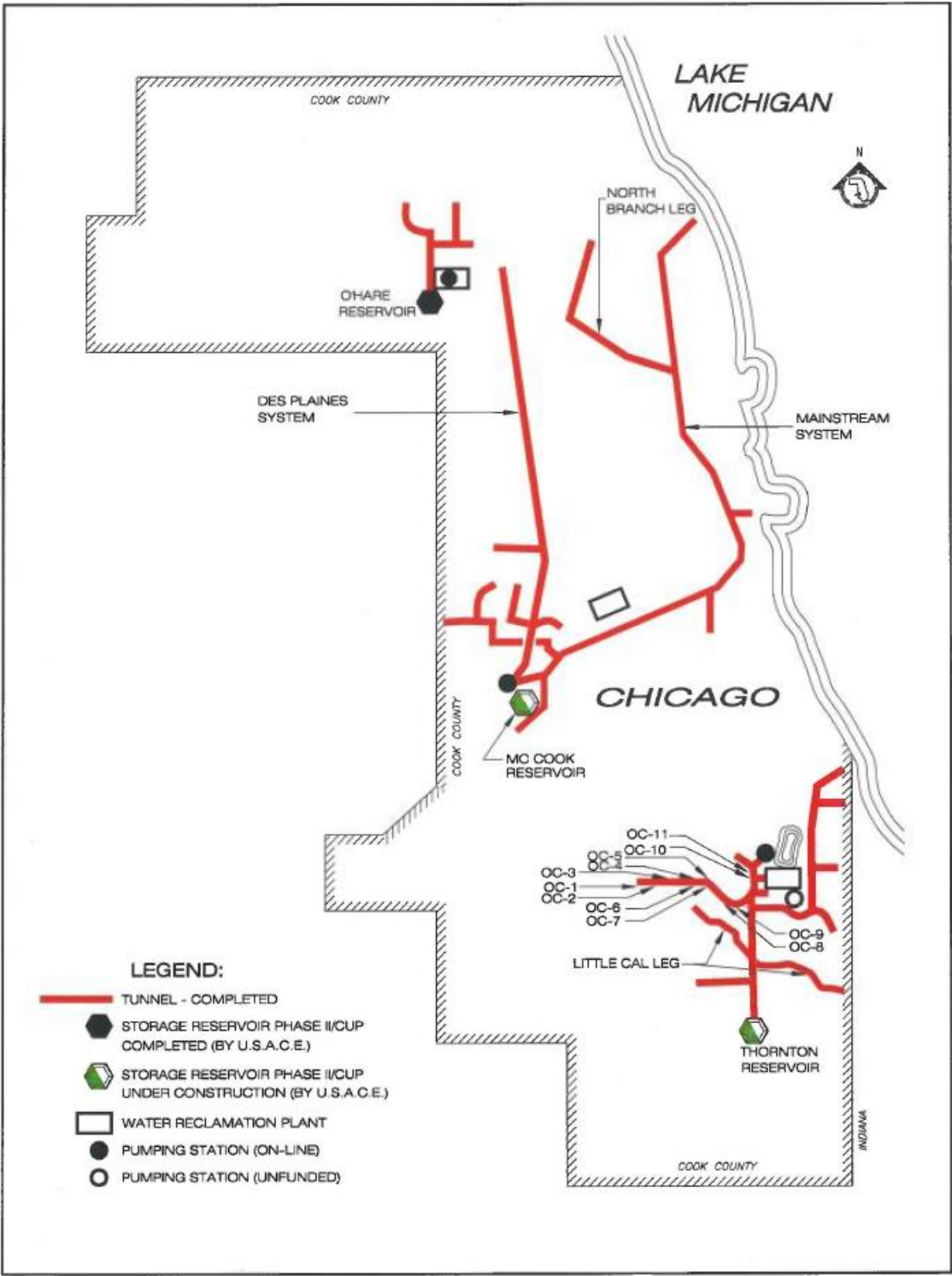


FIGURE 2: MAP OF OBSERVATION WELLS IN THE CALUMET TUNNEL SYSTEM



Groundwater elevations in the monitoring wells were measured at each sampling event. The elevations in the observation wells were measured twice per month.

## Summary of Data

**Monitoring Wells.** Monitoring wells QC 2, QC 4, and QC 17 were sampled on February 16, 2023 following the fill event from February 10 to February 12 of Thornton Composite Reservoir (TCR), and on July 7, 2023 following the fill event from July 3 to August 2, 2023.

The groundwater analytical data and physical parameters for fill event-based monitoring wells QC 2, QC 4, and QC 17 are presented in Table 1. During the two monitored fill events, FC was only detected at well QC-2 following the first fill event (Table 1).

The analytical data for groundwater from the wells sampled once per year are presented in Table 2. No annual sampling was conducted at well QC-2.1 due to well pump malfunction. Fecal coliforms were undetectable (<1 CFU/100 mL) in all sampled annual wells except well QC-31.

**Observation Wells.** Groundwater elevations were measured for observation wells OC-1 through OC-11 twice per month. Water elevations were calculated relative to CCD (579.48 feet above mean sea level at the intersection of State and Madison Streets) and are presented in Table 3. The minimum, mean, and maximum groundwater elevations for each well during the year are presented in Figure 3.

TABLE 1: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM FILL EVENT MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2023<sup>1</sup>

| Well  | Sample Date | pH  | EC<br>mS/m | TDS<br>-----mg/L----- | TOC  | Cl <sup>-</sup> | SO <sub>4</sub> <sup>2-</sup> | NH <sub>3</sub> -N | Hardness | Temp.<br>°C | Water<br>Elevation <sup>2</sup><br>feet | Fecal<br>Coliform<br>CFU/100 mL | Recharge<br>Time<br>hours |
|-------|-------------|-----|------------|-----------------------|------|-----------------|-------------------------------|--------------------|----------|-------------|---|---------------------------------|---------------------------|
| QC-2  | 02/16/23    | 8.3 | 42         | 318                   | <5.0 | 23              | 40                            | <0.3               | 81       | 11.1        | -318                                    | 570                             | <48                       |
|       | 07/07/23    | 8.1 | 44         | —                     | —    | —               | —                             | —                  | —        | 12.7        | -318                                    | <1                              | <48                       |
| QC-4  | 02/16/23    | 8.9 | 51         | 374                   | <5.0 | 8               | 16                            | <0.3               | 15       | 11.8        | -228                                    | <1                              | <48                       |
|       | 07/07/23    | 8.5 | 54         | —                     | —    | —               | —                             | —                  | —        | 12.1        | -229                                    | <1                              | <48                       |
| QC-17 | 02/16/23    | 8.1 | 59         | 442                   | <5.0 | 7               | 180                           | <0.3               | 146      | 11.3        | -185                                    | <1                              | <48                       |
|       | 07/07/23    | 7.9 | 62         | —                     | —    | —               | —                             | —                  | —        | 12.7        | -180                                    | <1                              | <48                       |

<sup>1</sup>Chemistry parameters need to be analyzed for first fill event only.

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

TABLE 2: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM ANNUAL MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2023

| Well   | Sample Date | pH              | EC mS/m | TDS            | TOC  | Cl <sup>-</sup> | SO <sub>4</sub> <sup>2-</sup> | NH <sub>3</sub> -N | Hardness | Temp. °C | Water Elevation <sup>1</sup> feet | Fecal Coliform CFU/100 mL |  |
|--------|-------------|-----------------|---------|----------------|------|-----------------|-------------------------------|--------------------|----------|----------|-----------------------------------|---------------------------|--|
|        |             |                 |         | -----mg/L----- |      |                 |                               |                    |          |          |                                   |                           |  |
| QC-2-1 | 11/04/22    | NA <sup>2</sup> | NA      | NA             | NA   | NA              | NA                            | NA                 | NA       | NA       | NA                                | NA                        |  |
| QC-2-2 | 08/30/23    | 8.6             | 45      | 314            | <5.0 | 15              | 33                            | <0.30              | 27       | 14.3     | -300                              | <1                        |  |
| QC-5   | 10/26/23    | 8.5             | 69      | 518            | <5.0 | 51              | 10                            | <0.30              | 8        | 13.0     | -214                              | <1                        |  |
| QC-6   | 08/30/23    | 8.5             | 59      | 482            | <5.0 | 16              | 2                             | 0.32               | 11       | 13.6     | -206                              | <1                        |  |
| QC-7   | 08/30/23    | 8.5             | 53      | 352            | <5.0 | 11              | <1                            | 0.31               | 6        | 13.4     | -146                              | <1                        |  |
| QC-9   | 09/14/23    | 8.2             | 39      | 292            | <5.0 | 10              | 38                            | 0.42               | 55       | 14.9     | -257                              | <1                        |  |
| QC-10  | 09/21/23    | 8.2             | 49      | 382            | <5.0 | 33              | <1                            | <0.30              | 9        | 13.4     | -194                              | <1                        |  |
| QC-11  | 09/21/23    | 8.4             | 39      | 272            | <5.0 | 24              | <1                            | <0.30              | 18       | 14.8     | -188                              | <1                        |  |
| QC-12  | 02/02/23    | 8.0             | 92      | 312            | <5.0 | 34              | 240                           | 0.30               | 117      | 12.9     | -309                              | <1                        |  |
| QC-13  | 02/02/23    | 8.4             | 44      | 726            | <5.0 | 51              | 6                             | <0.30              | 34       | 11.8     | -314                              | <1                        |  |
| QC-14  | 07/26/23    | 7.4             | 99      | 670            | <5.0 | 153             | <1                            | 0.36               | 159      | 14.4     | -204                              | <1                        |  |
| QC-15  | 05/26/23    | 8.7             | 41      | 302            | <5.0 | 13              | <1                            | <0.30              | 14       | 14.0     | -198                              | <1                        |  |
| QC-16  | 09/14/23    | 8.3             | 61      | 472            | <5.0 | 22              | 79                            | <0.30              | 72       | 14.2     | -257                              | <1                        |  |
| QC-18  | 03/15/23    | 8.9             | 43      | 320            | <5.0 | 8               | 31                            | <0.30              | 7        | 12.4     | -195                              | <1                        |  |
| QC-19  | 03/15/23    | 8.5             | 53      | 382            | <5.0 | 9               | 146                           | 0.40               | 101      | 13.0     | -145                              | <1                        |  |
| QC-20  | 03/15/23    | 8.6             | 33      | 244            | <5.0 | 21              | 4                             | <0.30              | 26       | 12.2     | -246                              | <1                        |  |
| QC-21  | 03/15/23    | 8.6             | 42      | 310            | <5.0 | 18              | 39                            | 0.52               | 35       | 13.1     | -239                              | <1                        |  |
| QC-22  | 09/14/23    | 8.4             | 30      | 236            | <5.0 | 15              | 7                             | <0.30              | 32       | 12.9     | -234                              | <1                        |  |
| QC-23  | 09/14/23    | 9.1             | 43      | 322            | <5.0 | 21              | 2                             | <0.30              | 7        | 14.2     | -220                              | <1                        |  |
| QC-24  | 03/30/23    | 8.7             | 29      | 214            | <5.0 | 28              | <1                            | <0.30              | 14       | 12.6     | -226                              | <1                        |  |
| QC-25  | 03/30/23    | 8.2             | 36      | 274            | <5.0 | 13              | 48                            | <0.30              | 68       | 13.0     | -225                              | <1                        |  |
| QC-26  | 10/12/23    | 9.2             | 33      | 246            | <5.0 | 13              | 2                             | <0.30              | 7        | 12.8     | -213                              | <1                        |  |
| QC-27  | 10/12/23    | 8.4             | 32      | 204            | <5.0 | 35              | <1                            | <0.30              | 23       | 13.2     | -184                              | <1                        |  |
| QC-28  | 10/12/23    | 8.9             | 32      | 200            | <5.0 | 13              | <1                            | <0.30              | 15       | 13.4     | -225                              | <1                        |  |

TABLE 2 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM ANNUAL MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2023

| Well  | Sample Date | pH  | EC mS/m | TDS            | TOC  | Cl <sup>-</sup> | SO <sub>4</sub> <sup>2-</sup> | NH <sub>3</sub> -N | Hardness | Temp. °C | Water Elevation <sup>1</sup> feet | Fecal Coliform CFU/100 mL |
|-------|-------------|-----|---------|----------------|------|-----------------|-------------------------------|--------------------|----------|----------|-----------------------------------|---------------------------|
|       |             |     |         | -----mg/L----- |      |                 |                               |                    |          |          |                                   |                           |
| QC-29 | 03/30/23    | 8.0 | 94      | 706            | <5.0 | 139             | 149                           | 1.14               | 269      | 12.2     | -47                               | <1                        |
| QC-30 | 07/26/23    | 8.5 | 64      | 470            | <5.0 | 33              | 104                           | 1.18               | 80       | 13.2     | -111                              | <1                        |
| QC-31 | 07/26/23    | 8.2 | 65      | 456            | <5.0 | 18              | 159                           | 0.41               | 193      | 14.5     | -37                               | 1                         |
| QC-35 | 07/26/23    | 8.7 | 115     | 818            | <5.0 | 34              | 18                            | <0.30              | 14       | 15.8     | -102                              | <1                        |

<sup>1</sup>Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

<sup>2</sup>Well was not sampled due to well pump malfunction.

TABLE 3: GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2023

| Date     | Observation Well No.                     |      |      |      |      |      |      |                 |        |      |       |       |
|----------|--|------|------|------|------|------|------|-----------------|--------|------|-------|-------|
|          | 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>1</sup> ----- |      |      |      |      |      |      |                 |        |      |       |       |
| 01/06/23 | -40                                      | -24  | -153 | -149 | -147 | -72  | -200 | -176            | -209   | -211 | -223  | -225  |
| 01/20/23 | -40                                      | -23  | -153 | -149 | -147 | -74  | -209 | -177            | -209   | -211 | -223  | -225  |
| 02/03/23 | -40                                      | -23  | -153 | -150 | -147 | -72  | -209 | -177            | -209   | -212 | -226  | -226  |
| 02/17/23 | -39                                      | -23  | -153 | -149 | -147 | -72  | -209 | -177            | -209   | -212 | -226  | -226  |
| 03/02/23 | -39                                      | -22  | -152 | -149 | -147 | -72  | -209 | -176            | -209   | -212 | -226  | -225  |
| 03/17/23 | -39                                      | -22  | -152 | -149 | -146 | -72  | -209 | -177            | -209   | -212 | -226  | -225  |
| 04/07/23 | -39                                      | -22  | -152 | -149 | -147 | -71  | -209 | NA <sup>2</sup> | -209   | -212 | -223  | -226  |
| 04/20/23 | -39                                      | -22  | -152 | -149 | -146 | -76  | -209 | -177            | -208   | -211 | -226  | -225  |
| 05/05/23 | -37                                      | -22  | -152 | -148 | -146 | -72  | -209 | -177            | -209   | -211 | -226  | -225  |
| 05/19/23 | -40                                      | -22  | -152 | -143 | -147 | -72  | -209 | -177            | -209   | -212 | -225  | -225  |
| 06/02/23 | -40                                      | -23  | -152 | -149 | -147 | -72  | -208 | -177            | -209   | -212 | -223  | -226  |
| 06/23/23 | -41                                      | -21  | -152 | -149 | -146 | -63  | -209 | -176            | -209   | -210 | -221  | -225  |
| 07/05/23 | -38                                      | -24  | -153 | -149 | -147 | -71  | -209 | -176            | -209   | -212 | -223  | -225  |
| 07/24/23 | -40                                      | -22  | -152 | -149 | -146 | -70  | -208 | -167            | -209   | -212 | -223  | -225  |
| 08/04/23 | -50                                      | -22  | -152 | -148 | -146 | -71  | -208 | -175            | -207   | -212 | -221  | -225  |
| 08/18/23 | -40                                      | -23  | -152 | -148 | -146 | -71  | -208 | -176            | -208   | -211 | -225  | -224  |
| 09/01/23 | -40                                      | -23  | -151 | -148 | -146 | -71  | -208 | NA              | -208   | -211 | -226  | -225  |
| 09/15/23 | -40                                      | -23  | -152 | -148 | -147 | -72  | -205 | -176            | -208   | -212 | -224  | -226  |
| 10/06/23 | -40                                      | -23  | -152 | -147 | -146 | -67  | -208 | -176            | -208   | -212 | -225  | -225  |
| 10/20/23 | -39                                      | -22  | -152 | -148 | -146 | -56  | -208 | -176            | -208   | -211 | -223  | -225  |
| 11/03/23 | -40                                      | -23  | -151 | -148 | -147 | -72  | -209 | -176            | -208   | -211 | -224  | -223  |
| 11/17/23 | -40                                      | -23  | -151 | -148 | -146 | -70  | -209 | -176            | -208   | -212 | -224  | -225  |
| 12/05/23 | -39                                      | -22  | -151 | -148 | -146 | -70  | -208 | -183            | -207   | -211 | -226  | -225  |
| 12/15/23 | -40                                      | -22  | -152 | -149 | -147 | -72  | -209 | -177            | -207   | -212 | -227  | -226  |

<sup>1</sup>Relative to Chicago city datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

<sup>2</sup>No measurements were obtained due to inaccessibility to the well location.

FIGURE 3: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATION FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2023

