Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 24-23

TUNNEL AND RESERVOIR PLAN

THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR AND

WELLS ANNUAL GROUNDWATER MONITORING REPORT

FOR 2023

July 2024

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
podczerwinskie@mwrd.org

July 11, 2024

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

Dear Ms. Logan-Pugh:

Subject: Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report for 2023

The report entitled "Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report for 2023" is attached.

Very truly yours,

Albert Cox

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

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

TUNNEL AND RESERVOIR PLAN
THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR AND WELLS
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2023

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

Monitoring and Research Department
Edward W. Podczerwinski, Director **July 2024**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviation	Definition
°C	degrees Celsius
Ag	silver
As	arsenic
B	boron
Ba	barium
BG	billion gallons
BOD_5	five-day biological oxygen demand
Cd	cadmium
CFU	colony forming units
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
L	liter
m	meter
mg	milligram
mL	milliliter
Mn	manganese
mS	millisiemens
NH_3-N	ammonia nitrogen
Ni	nickel
Pb	lead
SO_4^{2-}	sulfate
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
Temp.	temperature
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 Metropolitan Water Reclamation District of Greater Chicago's Thornton Transitional Reservoir (TTR) for flood control. The reporting requirements for groundwater quality monitoring of the TTR 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 TTR to be sampled one time at each fill event. In addition, the four wells must be sampled once per quarter. This report includes:

1. Analytical data for the monitoring wells and TTR for 2023.

2. Review and comparison of analytical data for the monitoring wells with calculated statistical limits for previously analyzed background samples.

Project Description

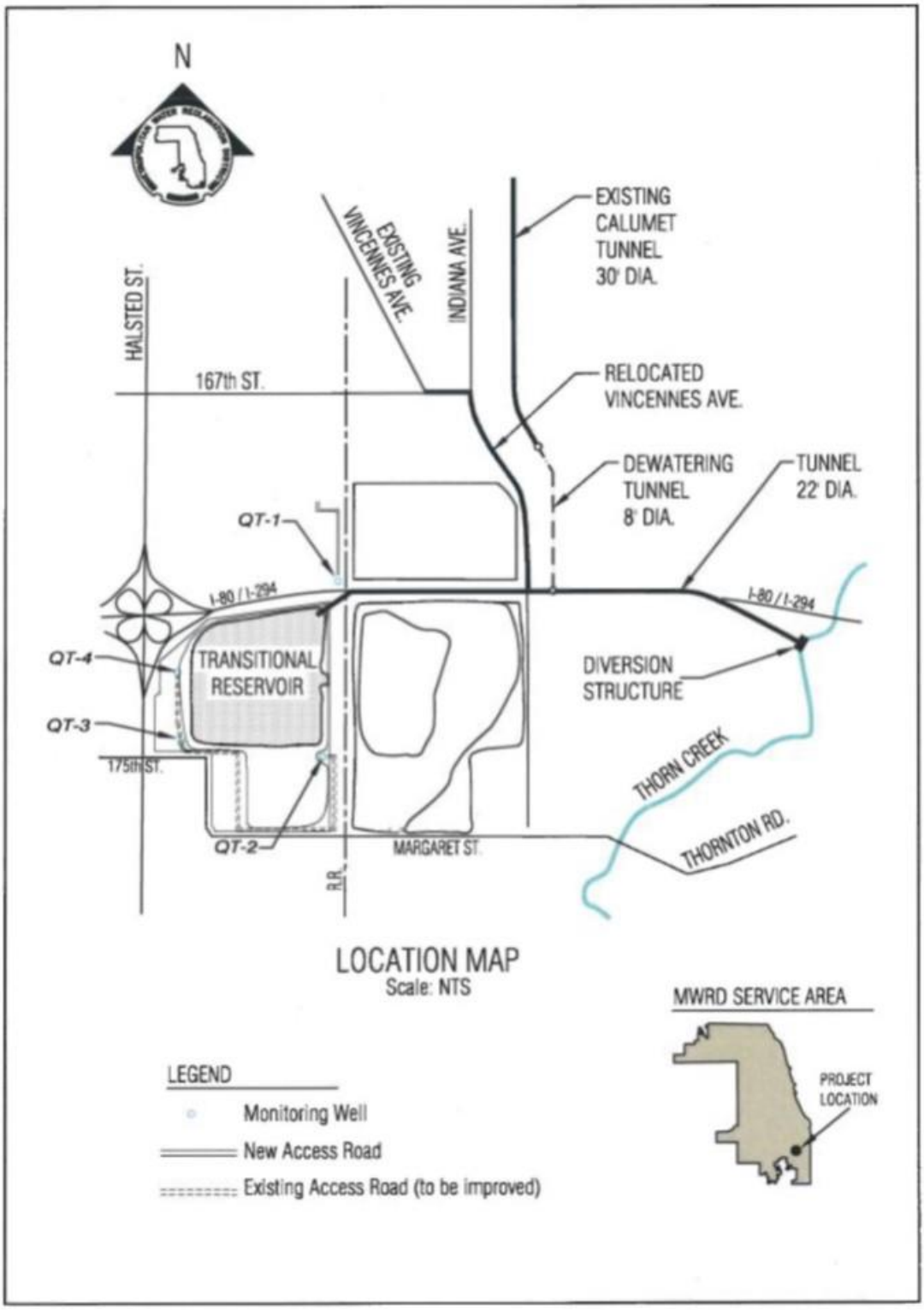
The TTR is located in the West Lobe of the Thornton Quarry, southeast of the intersection of the Tri-State Tollway and Halsted Street in Thornton, Illinois (Figure 1). The TTR was the final structure to be implemented for the Little Calumet River Watershed under the Natural Resources Conservation Service Little Calumet Watershed Plan of November 1998. The TTR 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 TTR 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 eight-foot diameter tunnel connected to the Calumet Tunnel and Reservoir Plan System that is utilized for TTR 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), copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), and lead (Pb).

FIGURE 1: THORNTON TRANSITIONAL RESERVOIR
MONITORING WELL LOCATIONS



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

Since the Thornton Composite Reservoir (TCR) was placed in service in October 2015, water accumulation in the TTR has generally been used to flush the TCR for odor control. 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 once every quarter. In September 2022, as part of the Calumet Tunnel and Reservoir System Final Reservoir Preparation project, the Thorn Creek Overflow Tunnel was connected to the TCR and the TTR was decommissioned. Thus, in 2023, the monitoring required is quarterly sampling of the four groundwater monitoring wells surrounding the reservoir.

Summary of Data for Monitoring Wells

Analytical data for 2023 quarterly sampling are presented in Tables 1 through 4 for monitoring wells QT-1, QT-2, QT-3, QT-4, respectively.

The parameters in the wells that exceeded the upper 95 percent confidence limits established from the background samples of each well are presented in Table 5. Total dissolved solids, chloride, and manganese exceeded the established limit in two wells, QT-1 and QT-3. Barium exceeded the established limit only in well QT-3. Arsenic exceeded the established limit in well QT-2 only.

As stated in a letter to IEPA on August 17, 2023, since the TTR is no longer in service as flood control reservoir as from 2023, effective January 17, 2024, monitoring of the TTR has been discontinued and this is the final monitoring report.

TABLE 1: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

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
1st Quarter	02/23/23	7.4	311	2,176	<2	<0.005	0.28	1,032	275	0.40	<0.005	<0.004	<0.002	0.28	0.068
2nd Quarter	06/15/23	7.1	330	2,458	<2	<0.005	0.41	1,001	256	0.31	<0.005	<0.004	<0.002	0.26	0.054
3rd Quarter	08/31/23	7.1	334	2,522	<2	<0.005	0.34	1,019	289	0.33	<0.005	<0.004	<0.002	0.24	0.086
4th Quarter	10/26/23	7.3	331	2,494	<2	<0.005	0.37	1,073	291	<0.30	<0.005	<0.004	<0.002	0.22	0.080

4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[2]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.002	0.005	0.022	49	0.00005	0.094	0.005	0.019	NL	NL	NL	NL
1st Quarter	02/23/23	<0.002	<0.004	<0.002	16	<0.0005	0.383	<0.002	<0.002	<1	12.2	-267	<48
2nd Quarter	06/15/23	<0.002	<0.004	<0.002	12	<0.0005	0.312	<0.002	<0.002	<1	13.4	-267	<48
3rd Quarter	08/31/23	<0.002	<0.004	<0.002	13	<0.0005	0.066	<0.002	<0.002	<1	14.2	-270	<48
4th Quarter	10/26/23	<0.002	<0.004	<0.002	11	<0.0005	0.067	<0.002	<0.002	<1	13.0	-265	<48

[1]NL = No limit.
[2]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 2: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

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
1st Quarter	02/23/23	7.2	132	1,132	<2	<0.005	0.27	182	478	0.42	<0.005	<0.004	0.046	0.22	0.046
2nd Quarter	06/15/23	7.1	151	1,336	<2	<0.005	0.24	188	480	0.34	<0.005	<0.004	0.042	0.24	0.046
3rd Quarter	08/31/23	7.1	147	1,284	<2	<0.005	0.24	182	501	0.37	<0.005	<0.004	0.046	0.21	0.048
4th Quarter	10/26/23	7.1	147	1,262	<2	<0.005	0.26	180	506	<0.30	<0.005	<0.004	0.051	0.21	0.043

TABLE 2 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[2]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.002	0.007	0.033	5.0	0.0003	0.063	NL	0.019	NL	NL	NL	NL
1st Quarter	02/23/23	<0.002	<0.004	<0.002	3	<0.0005	0.031	0.005	<0.002	<1	13.3	-193	<48
2nd Quarter	06/15/23	<0.002	<0.004	<0.002	3	<0.0005	0.025	0.004	<0.002	<1	14.8	-193	<48
3rd Quarter	08/31/23	<0.002	<0.004	<0.002	3	<0.0005	0.027	0.005	<0.002	1	14.1	-193	<48
4th Quarter	10/26/23	<0.002	<0.004	0.003	4	<0.0005	0.039	0.004	<0.002	<1	14.1	-192	<48

[1]NL = No limit.
[2]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-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

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
1st Quarter	02/23/23	7.1	173	1,286	<2	<0.005	0.25	428	220	0.43	<0.005	<0.004	<0.002	0.40	0.089
2nd Quarter	06/15/23	7.3	172	1,306	<2	<0.005	0.23	379	188	0.35	<0.005	<0.004	<0.002	0.36	0.071
3rd Quarter	08/31/23	6.9	187	1,502	<2	<0.005	0.23	459	257	0.34	<0.005	<0.004	<0.002	0.34	0.089
4th Quarter	10/26/23	6.9	184	1,308	<2	<0.005	0.25	395	197	<0.30	<0.005	<0.004	<0.002	0.33	0.067

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[2]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.001	0.006	0.022	21	0.00005	0.158	NL	0.014	NL	NL	NL	NL
1st Quarter	02/23/23	<0.002	<0.004	<0.002	9	<0.0005	0.131	0.028	<0.002	<1	12.0	-184	<48
2nd Quarter	06/15/23	<0.002	<0.004	<0.002	9	<0.0005	0.210	<0.002	<0.002	<1	15.1	-183	<48
3rd Quarter	08/31/23	<0.002	<0.004	<0.002	6	<0.0005	0.099	<0.002	<0.002	<1	13.2	-182	<48
4th Quarter	10/26/23	<0.002	<0.004	<0.002	9	<0.0005	0.201	<0.002	<0.002	<1	12.5	-181	<48

[1]NL = No limit.

[2]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-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

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
1st Quarter	02/23/23	7.3	144	1,050	<2	<0.005	0.25	285	206	0.44	<0.005	<0.004	<0.002	0.38	0.080
2nd Quarter	06/15/23	7.2	149	1,162	<2	<0.005	0.24	269	208	0.37	<0.005	<0.004	<0.002	0.34	0.076
3rd Quarter	08/31/23	7.1	149	1,124	<2	<0.005	0.24	268	222	0.30	<0.005	<0.004	<0.002	0.34	0.079
4th Quarter	10/26/23	7.1	147	1,078	<2	<0.005	0.25	268	214	<0.30	<0.005	<0.004	<0.002	0.34	0.070

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[2]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.001	0.022	0.035	24	0.00004	0.203	NL	0.018	NL	NL	NL	NL
1st Quarter	02/23/23	<0.002	<0.004	<0.002	10	<0.0005	0.098	0.002	<0.002	<1	13.0	-91	<48
2nd Quarter	06/15/23	<0.002	<0.004	<0.002	6	<0.0005	0.065	<0.002	<0.002	<1	14.5	-91	<48
3rd Quarter	08/31/23	<0.002	<0.004	<0.002	8	<0.0005	0.058	<0.002	<0.002	<1	14.8	-90	<48
4th Quarter	10/26/23	<0.002	<0.004	<0.002	5	<0.0005	0.053	<0.002	<0.002	<1	15.1	-90	<48

[1]NL = No limit.
[2]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 5: EXCEEDANCES[1] DETECTED IN WELLS AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

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

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