Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 24-24

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

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 Upper Des Plaines Tunnel System Annual Groundwater Monitoring Report for 2023

The report entitled "Tunnel and Reservoir Plan Upper Des Plaines Tunnel System 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
UPPER DES PLAINES TUNNEL SYSTEM
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
CFU	colony forming units
Cl^-	chloride
District	Metropolitan Water Reclamation District of Greater Chicago
EC	electrical conductivity
FC	fecal coliform
IEPA	Illinois Environmental Protection Agency
L	liter
m	meter
mL	milliliter
mS	millisiemens
NH_3-N	ammonia nitrogen
SO_4^{2-}	sulfate
TARP	Tunnel and Reservoir Plan
TDS	total dissolved solids
Temp.	temperature
TOC	total organic carbon
UDP	Upper Des Plaines

ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS

Introduction

This system consists of two subsystems, Upper Des Plaines (UDP) 20 and UDP 21. The UDP 20 subsystem contains six monitoring wells, MW-1 through MW-6, while the UDP 21 subsystem contains three monitoring wells, MW-7 through MW-9 (Figure 1). Groundwater elevations in the monitoring wells were measured during each sampling event. In addition, groundwater elevations were measured biweekly since these wells also function as observation wells. The monitoring wells were sampled based on the modified groundwater monitoring program for the Metropolitan Water Reclamation District of Greater Chicago's (District's) Tunnel and Reservoir Plan (TARP) as briefly described below.

Modified 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 UDP tunnel systems effective January 2021. The modification of the TARP groundwater monitoring program was based on the key findings of a three-year fill event-based groundwater monitoring study conducted by the District from 2017 to 2019 and submitted to the IEPA in a report dated July 30, 2020.

Under the modified monitoring program, four UDP wells (MW-5, MW-6, MW-7, and MW-8) 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 collected during 1995–2013. The criterion that triggers fill-event sampling is that the water from the UDP Tunnel System starts to enter the Gloria Alitto Majewski Reservoir. Sampling is conducted during the first week following 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_3-N), total organic carbon (TOC), chloride (Cl^-), sulfate (SO_4^{2-}), and FC. For the second fill event, samples are analyzed for FC only.

The other five wells associated with the UDP Tunnel System, 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.

Summary of Data for Monitoring and Observation Wells

Monitoring Wells. During 2023, the UDP fill event-based monitoring wells MW-5, MW-6, MW-7, and MW-8 were sampled following the two fill events, which occurred on February 27 and July 2, 2023. The groundwater analytical data and physical parameters for the fill event-based monitoring wells are presented in Table 1.

FIGURE 1: MAP OF MONITORING AND OBSERVATION WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM

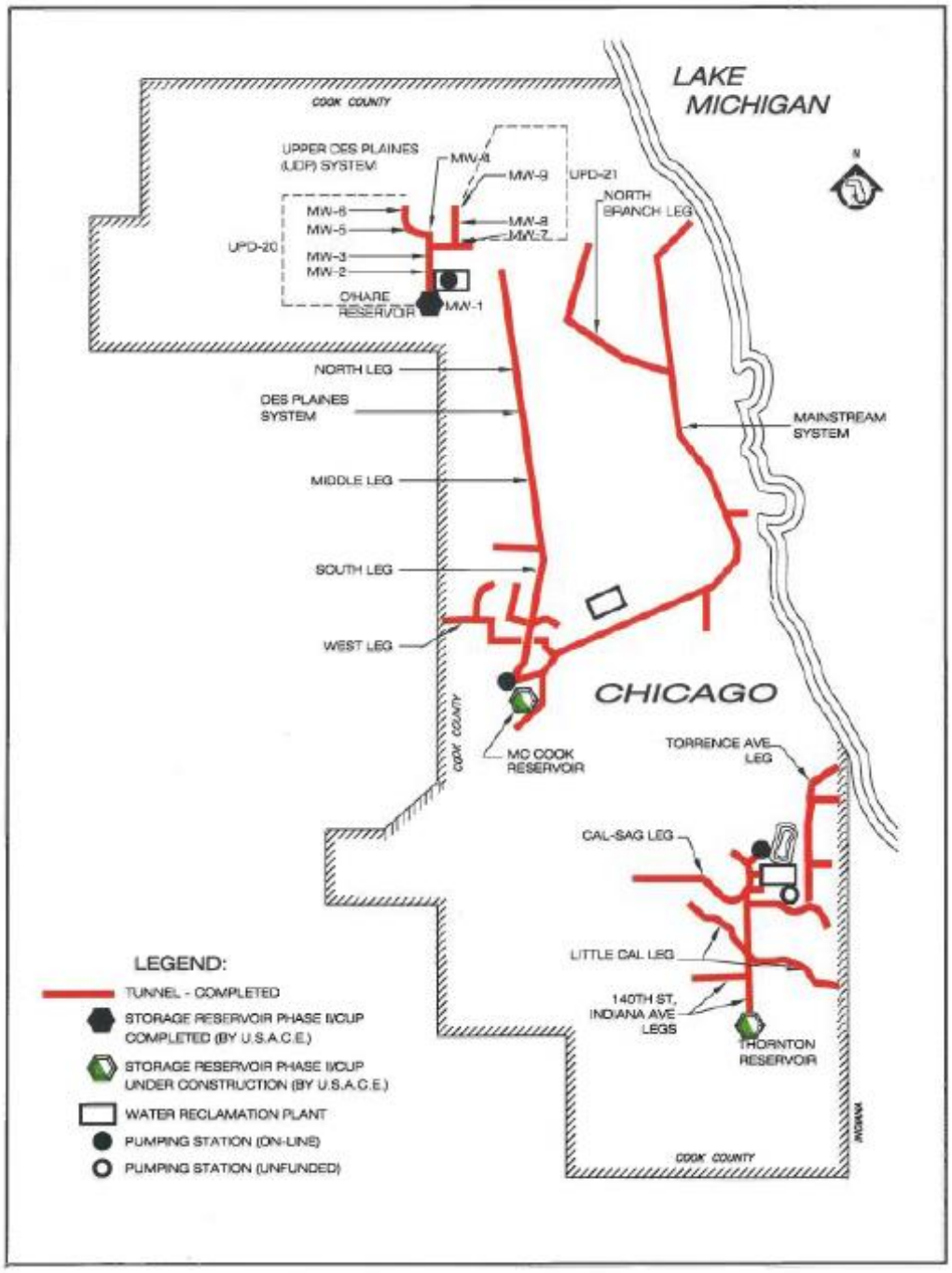

TABLE 1: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM FILL EVENT MONITORING WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2023[1]

Well	Sample Date	pH	EC mS/m	TDS	TOC	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Temp. °C	Water Elevation[2] feet	Fecal Coliform CFU/100 mL	Recharge Time hours
				mg/L									
MW-5	03/01/23	8.6	87	606	<5.0	182	194	<0.30	189	13.5	-56	<1	<48
	07/07/23	8.4	95	—	—	—	—	—	—	15.2	-59	12	<48
MW-6	03/01/23	7.8	63	520	<5.0	36	258	0.39	292	14.0	39	<1	<4
	07/06/23	7.8	107	—	—	—	—	—	—	14.5	66	<1	<4
MW-7	03/01/23	7.5	92	798	<5.0	43	389	0.51	481	15.4	25	<1	<4
	07/07/23	7.4	115	—	—	—	—	—	—	15.6	25	<1	<4
MW-8	03/01/23	8.2	90	802	<5.0	65	357	<0.30	418	15.0	-42	<1	<48
	07/07/23	7.9	111	—	—	—	—	—	—	15.0	-34	50	<48

[1]Chemistry parameters need to be analyzed for first fill event only.
[2]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

Fecal coliforms were detected in wells MW-5 and MW-8 during the second monitored fill event of July 2, 2023. Fecal coliforms were not detected at wells MW-6 and MW-7 for either of the two monitored events.

The analytical data for groundwater sampled from the five wells sampled once per year are presented in Table 2. Fecal coliforms in all annual wells were undetectable.

Observation Wells. Groundwater elevations were measured twice per month at observation wells MW-1 through MW-9. Groundwater elevations were calculated relative to the Chicago City Datum (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 2. Overall, groundwater fluctuation in the UDP observation wells remained less than 10 feet during the year, except for wells MW-5, MW-8 and MW-9 where the groundwater fluctuations ranged between 12 feet to 30 feet.

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

Well	Sample Date	pH	EC mS/m	TDS	TOC	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Temp. °C	Water Elevation[1] feet	Fecal Coliform CFU/100 mL
				mg/L								
MW-1	11/02/23	7.8	85	712	<5.0	35	366	0.37	409	13.5	4.2	<1
MW-2	12/07/23	7.8	99	858	<5.0	72	413	0.65	471	14.3	49	<1
MW-3	11/02/23	8.1	87	754	<5.0	14	442	0.31	441	14.7	44	<1
MW-4	04/07/23	7.9	98	868	<5.0	78	382	<0.30	607	13.5	0.5	<10
MW-9	04/07/23	8.1	74	660	<5.0	34	330	<0.30	322	13.3	12	<1

[1]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 3: GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2023

Date	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	Elevation (feet)[1]								
01/13/23	41	49	43	5	-48	68	25	24	11
01/27/23	40	49	43	5	-47	68	25	23	12
02/10/23	40	49	43	5	-46	68	24	25	12
02/24/23	41	48	43	4	-42	68	25	24	13
03/10/23	40	49	43	5	-55	69	24	5	11
03/29/23	39	46	41	2	-54	66	22	22	9
04/14/23	40	50	44	5	-46	69	25	24	18
04/28/23	40	50	44	4	-46	69	25	24	17
05/12/23	40	49	43	4	-46	69	25	24	16
05/31/23	41	48	44	5	-46	66	26	23	16
06/12/23	40	49	43	5	-45	65	26	16	21
06/30/23	40	49	43	5	-45	65	25	23	12
07/14/23	40	49	43	4	-56	67	26	-5	11
07/28/23	39	49	49	5	-51	65	25	23	10
08/11/23	40	52	43	5	-47	66	30	24	11
08/25/23	39	48	43	5	-47	65	25	23	10
09/08/23	39	49	43	5	-46	64	25	23	10
09/22/23	39	48	43	5	-45	65	25	23	10
10/13/23	39	49	43	5	-45	66	25	22	9
10/27/23	39	49	43	5	-44	67	25	22	10
11/13/23	43	48	45	4	-43	63	25	22	10
12/01/23	44	49	45	3	-44	68	25	23	10
12/08/23	42	49	45	6	-43	68	25	23	10
12/20/23	42	48	45	5	-43	68	25	22	11

[1]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

FIGURE 2: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2023