Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 21-35

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

SECOND QUARTER 2021

August 2021

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
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August 17, 2021

Mr. Michael Summers
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MICHAEL.SUMMERS@Illinois.gov

Dear Mr. Summers:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Second Quarter 2021"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Second Quarter 2021" transmitted electronically. The report is prepared for transmittal to the Illinois Environmental Protection Agency (IEPA) in accordance with the Thornton Composite Reservoir Groundwater Monitoring Plan. Also attached is the Excel spreadsheet of the Thornton Composite Reservoir raw data as required by the IEPA.

If you have any questions or would like to have additional information, please contact Mr. Benjamin Morgan at (708) 588-3743 or MorganB@mwrd.org.

Very truly yours,

Albert Cox

Albert E. Cox, Ph.D.
Environmental Monitoring and Research Manager
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AC:BM:lf
Attachments
cc: Mr. M. Brown, IEPA
Mr. E. Podczerwinski

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THORNTON COMPOSITE RESERVOIR GROUNDWATER MONITORING REPORT SECOND QUARTER 2021

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations	Definition
CCD	Chicago City Datum
CFU	Colony Forming Unit
CSF	Combined Sewer Flow
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
IPCB	Illinois Pollution Control Board
TCR	Thornton Composite Reservoir
TOC	Total Organic Carbon

ACKNOWLEDGMENTS

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research Department. All samples were collected by A3 Environmental Consultants (contractor) under the Thornton Composite Reservoir Contract 21-100-11. Analyses were performed by the Analytical Laboratories Division and the Analytical Microbiology Section of the Metropolitan Water Reclamation District of Greater Chicago. Special thanks are due to Ms. Laura Franklin for typing and formatting this report.

DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

INTRODUCTION

A Groundwater Protection System (GPS) was constructed for the Thornton Composite Reservoir (TCR) to protect against the exfiltration of combined sewer flow (CSF) into the surrounding dolomite aquifers. The CSF and minimal amounts of stormwater are stored in the reservoir during and after large storm events. To monitor the performance of the GPS, a network of monitoring wells located outside the perimeter of the GPS is being monitored as discussed in the Revised Groundwater Monitoring Plan (GMP) (Black & Veatch, 2016). As explained in the Revised GMP, one sample of reservoir water, one of the Main Quarry Sump, and one from each of the seven wells are collected annually and analyzed for constituents listed in the Illinois Pollution Control Board (IPCB) Groundwater Quality Standards for Class I: Potable Resource Groundwater, Illinois Administrative Code (IAC) Title 35 Section 620.410 (IPCB, 2012), referred to hereafter as the Part 620 groundwater standards. In addition, following a reservoir fill event or during a routine quarterly event, groundwater is sampled from the seven wells and the Main Quarry Sump and tested for a targeted list of parameters that are more likely to be detected in CSF water.

The monitoring well system consists of one deep well, TB-124, which monitors the underlying Galena aquifer, and six vertical Westbay multi-level monitoring wells: TB-118, TB-119, TB-120, TB-121, TB-122, and TB-123, which monitor the Silurian dolomite aquifers. As discussed in the Revised GMP, following a reservoir fill event, biweekly sampling is required while the water in the reservoir remains above an elevation of -280 ft Chicago City Datum (CCD). Groundwater is sampled from each well at the first sample interval port immediately below the reservoir water elevation. Each of the multi-level monitoring wells is capable of monitoring four distinct 20-ft intervals in the Silurian dolomite aquifer.

The locations of monitoring wells, quarry sump, TCR, and the GPS are presented in Figure 1. The Main Quarry Sump is located beyond the south boundary of the GPS and is not a component of the TCR but is an integral part of the Hanson Material Services mining quarry to the south of the TCR. This sump facilitates mining operations by minimizing the water level at the bottom of the quarry. It is possible that the bottom of this sump could extend beyond the lowest depth of the TCR (-297.5 CCD ft). The sump contains mainly groundwater and small quantities of surface runoff, and it is sampled quarterly and during fill events, along with the wells, to evaluate the potential migration of contaminants from the TCR to the sump.

Table 1 lists the characteristics of all wells at the TCR site (well location coordinates, elevations and depths, and the sampling port interval elevations).

Prior to the TCR becoming operational in November 2015, eight (8) sampling events were conducted on a quarterly basis for two years (May 2012 through March 2014) to provide background data on the existing groundwater quality. In order to evaluate the effectiveness of the grout curtain and the GPS, the Revised GMP (2016) presents the analysis of data for all samples collected during the background monitoring period and provides a baseline for comparison with routine monitoring data. Changes over time in groundwater calcium and magnesium concentrations would also be useful in tracking the occurrence of infiltration/exfiltration. Groundwater analytical data routinely generated for the monitoring wells, reservoir, and sump will also be compared with the Part 620 groundwater standards to evaluate any exceedances in groundwater standards.

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

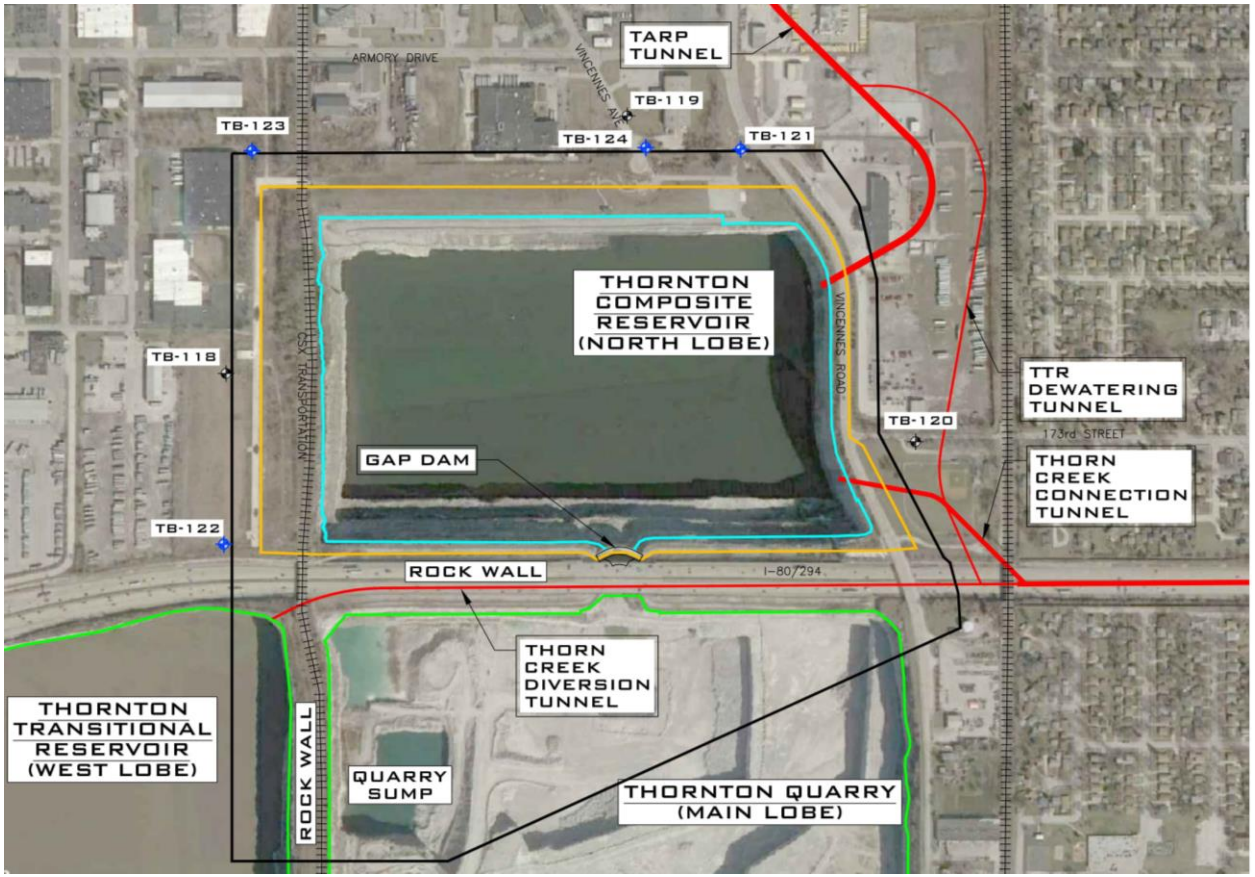

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates[1] Northing (ft)	Coordinates[1] Easting (ft)	Ground Surface Elevation (ft, CCD[2])	Top of Riser Elevation (ft, CCD[2])	Depth of Well (ft)	Sampling Port Interval (ft, CCD) Interval 1	Interval 2	Interval 3	Interval 4
TB-118	1791110.38	693560.44	38.5	41.5	532	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-119	1792316.63	695509.39	27.9	29.5	529	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-120	1790782.31	696888.93	40.0	42.1	540	-86 to -106	-213 to -233	-284 to -304	-393 to -413
TB-121	1792193.10	696044.98	29.4	30.4	461	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-122	1790288.61	693549.38	48.8	51.7	480	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-123	1792185.60	693685.69	28.9	31.8	460	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-124	1792200.77	695591.56	29.6	29.2	728	-663 to -698			

[1]Illinois State Plane Coordinate System (NAD 1927).
[2]Chicago City Datum (CCD).

There were two fill events during the second quarter of 2021. These were the second and third fill events of 2021. The first fill event of the second quarter began on May 11 and lasted until May 16, requiring a single sampling conducted from May 14–19. One complete set of samples was collected at the Main Quarry Sump and all monitoring wells. The second fill event of the second quarter began on June 26 and lasted until August 1. It was not possible to collect samples for this fill event due to equipment malfunctioning, and because the equipment is very specialized it was impractical to have it repaired or obtain a replacement before the end of the fill event.

This report presents field activities, observations, and analytical data for surface and groundwater monitoring samples taken at the Main Quarry Sump and at all monitoring wells during fill event sampling conducted from May 14–19, 2021.

FIELD ACTIVITIES

For this report period, one complete set of samples was collected at the Main Quarry Sump, the deep well, and at sampling port interval 3 of all multi-level wells during fill event sampling from May 14–19, 2021 (Table 2).

Using a Myron L Ultrameter 6P pH/conductivity/temperature meter, the pH, electrical conductivity (EC), and temperature of each sample were measured and recorded immediately after collection.

Prior to sampling the multi-level wells, hydrostatic pressure was measured to calculate the groundwater elevation at Port 3 of each well. Table 3 lists the elevations at Port 3 of each well and the corresponding groundwater elevations during fill event sampling from May 14–19, 2021.

All samples were packed in ice and transported to the Metropolitan Water Reclamation District of Greater Chicago's (District's) Analytical Laboratories Division for the analysis of selected inorganic constituents (Part 620 groundwater standards, IAC Title 35 Section 620.410) in accordance with the revised GMP. Additional aliquots were also prepared in the field and transported in ice to the District's Analytical Microbiology Laboratory for fecal coliform analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING FILL EVENT SAMPLING IN MARCH 2021

Date of Sampling	Event	Device/Structure Sampled
05/14/21	Fill event #2	Sump, Sump Duplicate
05/18/21	Fill event #2	TB-119, TB-120, TB-121, TB-122
05/19/21	Fill event #2	TB-118, TB-123, TB-124

TABLE 3: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING FILL EVENT SAMPLING IN MARCH 2021

Sample Date	Well ID	Sampling Port 003 Elevation	Groundwater Elevation
		(ft CCD[1])	
05/19/21	TB-118	-289	-86
05/18/21	TB-119	-289	-164
05/18/21	TB-120	-290	ND[2]
05/18/21	TB-121	-288	-170
05/18/21	TB-122	-288	-161
05/19/21	TB-123	-288	-50
05/19/21	TB-124	NA[3]	-338

[1]Chicago City Datum.
[2]No data available. Pressure readings could not be made at ports in this well.
[3]Not applicable. TB-124 is a conventional well screened from -663 to -698 ft CCD. During May, one sample was taken at approximately 650 ft below ground surface.

ANALYTICAL RESULTS

Table 4 lists the analytical methods used by the laboratory for various parameters. Analytical results were reviewed to identify any analytes that exceeded the Part 620 groundwater standards (IAC Title 35 Section 620.410).

The analytical data for all well samples and the Main Quarry Sump sample collected during fill event sampling from May 14–19, 2021, are presented in Table 5. There were a few exceedances of the Part 620 groundwater standards, including TDS, chloride, sulfate, and boron, as indicated in bold font in Table 5. Among these parameters, none showed a value higher than the background maximum.

Fecal coliform populations were detected in well TB-123 and the Main Quarry Sump at 2 and 3 CFU/100 mL, respectively (Table 5).

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Analytical Parameters	Analytical Method
Chloride, Sulfate	EPA 300.0 Rev 2.1
Total Dissolved Solids	SM 2540-C
Metals Except Calcium, Magnesium	EPA 200.8
Calcium, Magnesium	EPA 200.7
Ammonia (as Nitrogen)	EPA 350.1
Total Organic Carbon	SM 5310-C
Phenols	EPA 420.4
Fecal Coliform	SM 9222D

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE FOR FILL EVENT SAMPLING IN MARCH 2021

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL[1]	Well								
					TB-118	TB-119	TB-120	TB-121	TB-122	TB-123	TB-124	Sump	Sump-D[2]
pH		6.5–9.0	8.4	NL[3]	7.1	8.2	7.9	7.9	8.1	7.8	7.5	8.4	8.4
EC	mS/m	NL	415	NL	211	148	153	124	142	111	221	127	127
TDS	mg/L	1,200	2,960	25	**1,380**	670	380	**1,210**	874	606	**1,688**	**1,362**	**1,322**
TOC	"	NL	1	1	<5.0	<5.0	5.1	<5.0	<5.0	<5.0	NA[4]	<5.0	<5.0
Chloride	"	200	1,230	1	**372**	66	51	**289**	**219**	61	**282**	**210**	**211**
Sulfate	"	400	890	1	191	103	42	182	85	123	**655**	**515**	**518**
Ammonia as N	"	NL	ND[5]	0.3	0.66	0.57	0.64	0.67	0.57	0.74	1.3	<0.30	<0.30
Total Phenol	"	0.1	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	2	<1	2	3
Ag	mg/L	0.05	0.003	0.002	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
B	"	2	3.8	0.005	0.764	0.897	0.194	0.948	**2.84**	1.55	0.968	0.375	0.363
Be	"	0.004	0.002	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Co	"	1	0.035	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.012	0.013
Cr	"	0.1	86.4	0.002	0.008	<0.004	0.005	0.012	0.014	0.006	0.005	<0.004	<0.004
Cu	"	0.65	0.004	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mn	"	0.15	0.183	0.005	0.007	0.006	0.053	0.005	0.006	0.006	0.004	<0.002	0.015
Se	"	0.05	0.008	0.002	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
V	"	0.049	ND	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	"	5	10	0.005	0.072	0.027	4.27	0.145	0.103	0.017	0.828	<0.010	<0.010
Ca	"	NL	276	0.5	162	91.3	59.8	144	74.8	80.8	103	146	164
Mg	"	NL	153	0.5	80.1	46.8	18.3	74.5	38.6	43.2	58.0	121	130

[1]Laboratory reporting limit.
[2]Duplicate sample.
[3]No existing limit.
[4]Not analyzed because sample was not preserved at pH <2.
[5]Not determined.

REFERENCES

Black & Veatch, 2014, "Background Groundwater Quality Report for Thornton Composite Reservoir," prepared for the Metropolitan Water Reclamation District of Greater Chicago, July 2014.

Black & Veatch, 2016c, "Revised Groundwater Monitoring Plan, Groundwater Protection System for Thornton Composite Reservoir," prepared for the Metropolitan Water Reclamation District of Greater Chicago, May 2016.

Illinois Pollution Control Board, 2012. Illinois Administrative Code Title 35: Environmental Protection, Subtitle F: Public Water Supplies, Chapter I: Pollution Control Board, Section 620.410: Groundwater Quality Standards for Class I: Potable Resource Groundwater, amended at 36 Ill. Reg. 15206, effective October 5, 2012.