Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 23-09

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FOURTH QUARTER 2022

March 2023

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.
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March 13, 2023

Mr. Michael Summers
Groundwater Section Manager
Bureau of Water/Public Water Supplies
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794
MICHAEL.SUMMERS@Illinois.gov

Dear Mr. Summers:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter 2022"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter 2022" 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
Monitoring and Research Department

AC:BM:lf
Attachments
cc: Mr. M. Brown, IEPA
Mr. E. Podczerwinski

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THORNTON COMPOSITE RESERVOIR GROUNDWATER MONITORING REPORT FOURTH QUARTER 2022

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LIST OF ABBREVIATIONS

Acronym	Definition
CCD	Chicago City Datum
CFU	colony forming unit
CSF	combined sewer flow
EC	electrical conductivity
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
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 Thornton Composite Reservoir Contract 21-100-11. Analyses were performed by the Analytical Laboratories Division and the Analytical Microbiology Laboratory of the Metropolitan Water Reclamation District of Greater Chicago (District). 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 District.

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 from the Main Quarry Sump, and one from each of the seven wells are collected annually and analyzed for the Illinois Administrative Code (IAC) Title 35 Part 620 Class I groundwater constituents. 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, sampling is required every two weeks while the water in the reservoir remains above an elevation of -280 feet 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 multilevel monitoring wells is capable of monitoring four distinct 20-foot intervals in the Silurian dolomite aquifer.

The locations of the monitoring wells, the quarry sump, the 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 feet CCD). 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 IAC Title 35 Part 620 Class I Groundwater Standards (Illinois Pollution Control Board, Illinois Environmental Protection Agency, 2013) to evaluate any exceedances in groundwater standards.

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

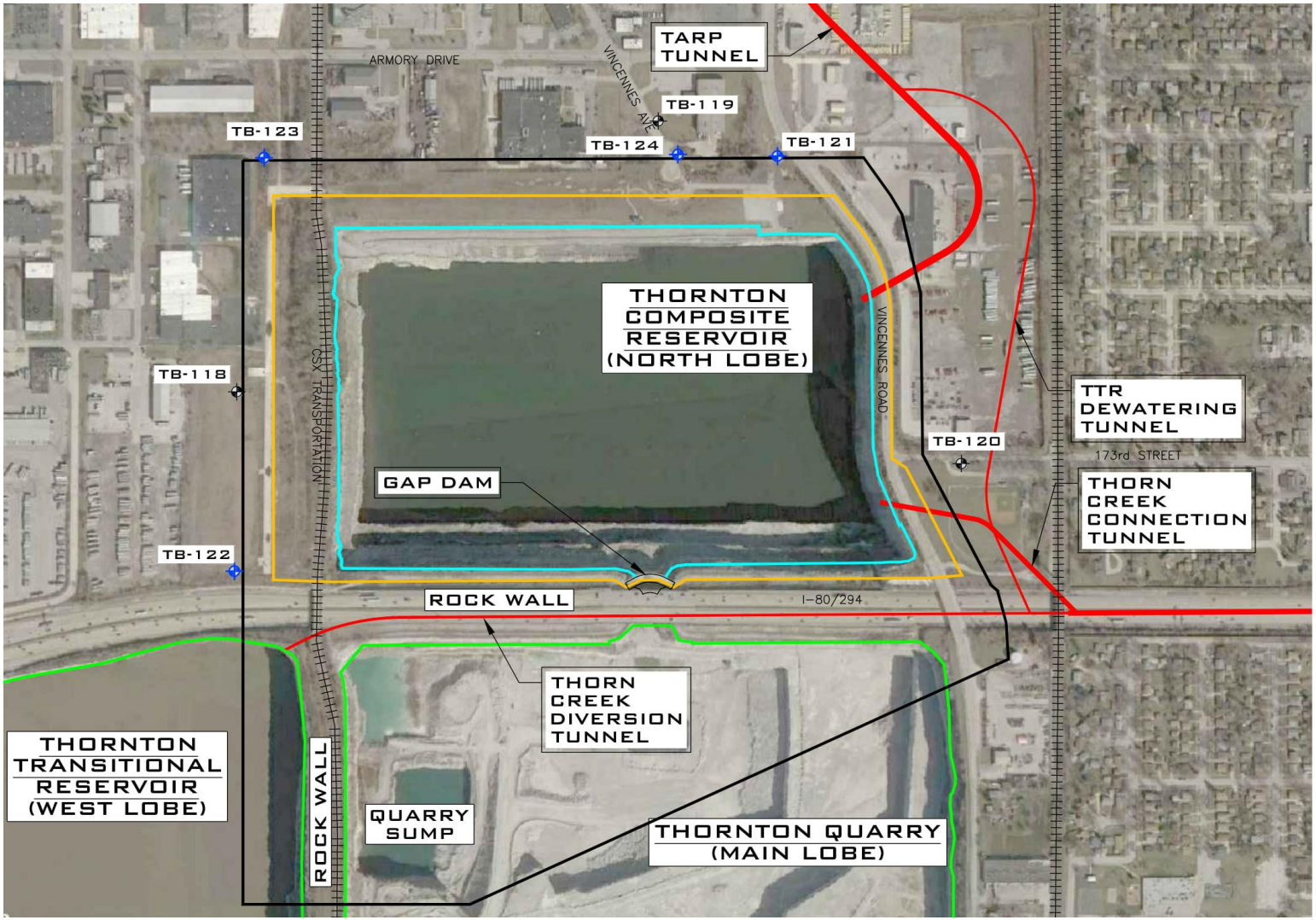

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates[1] Northing (ft)	Coordinates[1] Easting (ft)	Ground Surface Elevation (ft, CCD[2])	Top of Riser Elevation (ft, CCD)	Depth of Well (ft)	Sampling Port Interval (ft, CCD) Interval 1	Interval 2	Interval 3	Interval 4
TB-118	1,791,110.38	693,560.44	38.5	41.5	532	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-119	1,792,316.63	695,509.39	27.9	29.5	529	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-120	1,790,782.31	696,888.93	40.0	42.1	540	-86 to -106	-213 to -233	-284 to -304	-393 to -413
TB-121	1,792,193.10	696,044.98	29.4	30.4	461	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-122	1,790,288.61	693,549.38	48.8	51.7	480	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-123	1,792,185.60	693,685.69	28.9	31.8	460	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-124[3]	1,792,200.77	695,591.56	29.6	29.2	728	-663 to -698			

[1]Illinois State Plane Coordinate System (NAD 1927).
[2]Chicago City Datum (CCD).
[3]TB-124 is a conventional well screened from -663 to -698 ft CCD. Samples are taken at approximately 650 ft below ground surface.

There were no fill events during the fourth quarter of 2022. Per the Revised GMP, one complete set of annual monitoring event samples was collected during November 15 – December 8, 2022, at the Reservoir, the Main Quarry Sump, and all monitoring wells.

This report presents field activities, observations, and analytical data for surface and groundwater monitoring samples taken at the Main Quarry Sump, the TCR, and at all monitoring wells from November 15 – December 8, 2022, for the annual monitoring sampling.

FIELD ACTIVITIES

For this report period, one complete set of samples for the annual monitoring event was collected at the TCR, the Main Quarry Sump, the deep well, and at sampling port 3 of all multilevel wells from November 15 – December 8, 2022. Sample collection dates are shown in Table 2.

Using a YSI ProQuatro pH/conductivity/temperature meter, the pH, electrical conductivity (EC), and temperature of each sample were measured and recorded immediately after collection.

Prior to sampling monitoring wells, hydrostatic pressure was measured, at Port 3 in multilevel wells or at 650 feet below surface level in well TB-124, to calculate the groundwater elevation. Table 3 lists the elevations at Port 3 of each well and the corresponding groundwater elevations during the annual monitoring event sampling in November 2022.

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 (IAC Title 35 Part 620 Class I Groundwater Standards) 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 (FC) analysis. An additional set of aliquots was prepared in the field and transported in ice to a contract laboratory for analysis of selected organic constituents (IAC Title 35 Part 620 Class I Groundwater Standards) in accordance with the Revised GMP.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE ANNUAL MONITORING EVENT IN NOVEMBER AND DECEMBER 2022

Date of Sampling	Device/Structure Sampled
11/15/22	TB-122[1]
11/16/22	TB-118[2], TB-120[2], TB-121[2], TB-123[2]
11/17/22	TB-118[3], TB-119[2], TB-119 Duplicate[2], TB-124[1]
11/18/22	Main Quarry Sump[1], Reservoir[1]
11/28/22	TB-121[3]
11/30/22	TB-119[3], TB-119 Duplicate[3]
12/01/22	TB-123[3]
12/08/22	TB-120[3]

[1]Aliquots collected for all analyses: fecal coliform, inorganic, and organic parameters.
[2]Aliquots collected only for analyses of fecal coliform and inorganic parameters.
[3]Aliquots collected only for analyses of organic parameters.

TABLE 3: SUMMARY OF ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING ANNUAL MONITORING EVENT SAMPLING IN NOVEMBER 2022

Sample Date	Well ID	Sampling Port	Groundwater Elevation
		(ft CCD[1])	
		Annual	
11/16/22	TB-118	-289	-85
11/17/22	TB-119	-289	-165
11/16/22	TB-120	-290	-221
11/16/22	TB-121	-288	-169
11/15/22	TB-122	-288	-165
11/16/22	TB-123	-288	-50
11/17/22	TB-124[2]	NA[3]	-389

[1]Chicago City Datum.
[2]TB-124 is a conventional well screened from -663 to -698 ft CCD. Samples were taken at approximately 650 ft below ground surface during the annual monitoring event sampling in November 2022.
[3]Not applicable.

ANALYTICAL RESULTS

Table 4 lists the analytical methods used by the laboratory for measured parameters. Analytical results were reviewed to identify any analytes that exceeded the Illinois Class I Groundwater Standards (35 IAC Part 620).

The analytical data for all well samples, the Main Quarry Sump, and the TCR collected during the annual monitoring event from November 15 – December 8, 2022, are presented in Table 5. There were a few exceedances of the Class I Groundwater Standards, including pH, total dissolved solids (TDS), chloride, sulfate, arsenic, and boron, as indicated in bold font in Table 5. Among these parameters, only pH showed a value higher than the background maximum. Groundwater fecal coliform bacteria were detected only in well TB-121 at 1 CFU/100 mL during the annual monitoring event (Table 5).

Almost all organic parameters were undetectable in the annual monitoring event samples (Table 5). There were no exceedances of Class I Groundwater Standards for any organic parameter in the annual monitoring samples. For simazine in sample TB-121, pentachlorophenol in samples from TB-118, TB-122, TB-124, the Main Quarry Sump, and the TCR, and for all PCB arochlors except PCB-1260, total PCBs, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, ethylene dibromide, 1,4-dioxane, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, bis(2-ethylhexyl)phthalate, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene in all samples, the parameter was below the laboratory reporting limit, but the reporting limits were higher than the Class I Groundwater Standards. The maximum laboratory reporting limits for RDX (cyclonite) and bis(2-ethylhexyl)phthalate were also higher than their background maximum concentrations (0.00021 and 0.0052 mg/L, respectively). There were no exceedances of Class I Groundwater Standards for Radioactivity parameters in the annual monitoring event samples.

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Parameters	Analytical Method
Inorganic	
Chloride, fluoride, sulfate	USEPA 300.0
Total dissolved solids	SM 2540C
Boron and Target Analyte List metals except calcium, magnesium, and mercury	USEPA 200.8
Hardness (as calcium and magnesium)	USEPA 200.7
Mercury	SM 3112B
Ammonia (as N)	USEPA 350.1
Total organic carbon	SM 5310B
Cyanide	USEPA Kelada-01
Organic	
Herbicides including 2,4-D, 2,4,5-TP (Silvex), dalapon, dicamba, dinoseb, mecoprop, picloram, and aldicarb and carbofuran	USEPA 8321B
Endothall	USEPA 548.1
Polychlorinated biphenyls	USEPA 8082A
Pesticides including alachlor, alpha-BHC, chlordane, endrin, gamma-BHC, heptachlor, heptachlor epoxide, methoxychlor, toxaphene, and atrazine and simazine	USEPA 8081B
All explosives	USEPA 8330B
1,2-dibromo-3-chloropropane and ethylene dibromide	USEPA 8011
All other volatile organic compounds	USEPA 8260B/D
Phenolics, total recoverable	USEPA 9065
All other semivolatile volatile organic compounds	USEPA 8270D
Radiological	
Radium-226 (pCi/L[1])	SM 7500-Ra B
Radium-228 (pCi/L)	SM 7500-Ra D
Others	
Fecal coliform	SM 9222D

[1]pCi/L = picocuries per liter.

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT IN NOVEMBER AND DECEMBER 2022

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL[1]	Well								Sump	Reservoir
				TB-118	TB-119	TB-119D[2]	TB-120	TB-121	TB-122	TB-123	TB-124		
pH	6.5 - 9.0	8.4	NL[3]	8.8	8.0	8.0	8.6	8.0	8.8	8.4	**11.8**	8.5	NRR[4]
EC (mS/m)	NL	415	NL	73.3	80.6	80.6	103	131	147	111	248	109	NRR
Fecal coliform (CFU/100 mL)	NL	<1	1	<1	<1	<1	<10	1	<1	<1	<1	<1	250
	Concentration (mg/L)												
TDS	1,200	2,960	25	1,152	566	520	**1,236**	820	900	564	1,190	**1,294**	**1,312**
TOC	NL	1	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	16.5
Cyanide, Total	0.2	BRL[5]	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	4	3.2	0.1	0.53	0.52	0.52	1.15	0.46	0.92	0.56	1.18	0.32	0.47
Chloride	200	1,230	0.5	**355**	80	80	**289**	**305**	**272**	62	**283**	**240**	**217**
Sulfate	400	890	1.0	185	112	113	214	181	99	124	**644**	**547**	**469**
Ammonia as N	NL	ND[6]	0.3	0.66	0.50	0.53	1.20	0.80	0.59	0.73	1.15	<0.30	11.08
Metals													
Ag	0.05	0.003	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
As	0.01	0.025	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	**0.011**	<0.002	0.005
B	2	3.78	0.010	0.868	1.18	0.907	1.72	**2.47**	**2.48**	1.59	1.01	0.381	0.481
Ba	2	0.217	0.002	0.032	0.027	0.034	0.020	0.043	0.021	0.051	0.013	0.024	0.042
Be	0.004	0.0002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cd	0.005	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Co	1	0.035	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.011	<0.002
Cr	0.1	86.4	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Cu	0.65	0.004	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Fe	5	3.23	0.020	0.201	0.166	0.157	0.797	0.089	0.021	0.030	0.325	<0.020	0.746
Hg	0.002	0.0007	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Mn	0.15	0.183	0.002	0.005	0.005	0.006	0.023	0.004	0.003	0.002	<0.002	<0.002	0.131
Ni	0.1	0.093	0.002	0.006	0.002	<0.002	0.006	0.004	<0.002	0.002	0.006	0.033	0.006
Pb	0.0075	0.006	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sb	0.006	0.012	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Se	0.05	0.008	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Tl	0.002	0.013	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
V	0.049	BRL	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	5	9.95	0.010	0.100	0.029	<0.010	1.63	0.212	0.016	0.021	0.361	<0.010	<0.010
Ca	NL	276	0.5	161.290	74.3	90.9	63.1	50.0	77.5	81.2	83.3	141	181
Mg	NL	153	0.5	79.0	39.3	46.2	29.5	25.3	39.9	42.5	61.1	126	87.8
Herbicides													
2,4-D	0.07	BRL	0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
2,4,5-TP (Silvex)	0.05	BRL	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Atrazine	0.003	BRL	0.00114	<0.00104	<0.000964	<0.00107	<0.0011	<0.00102	<0.00114	<0.00104	<0.00105	<0.001	<0.00112
Dalapon	0.2	BRL	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dicamba	0.21	BRL	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dinoseb	0.007	BRL	0.0003	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT IN NOVEMBER AND DECEMBER 2022

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL	Well								Sump	Reservoir
				TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
	Concentration (mg/L)												
Endothall	0.1	BRL	0.005	<0.0050	<0.0050	<0.0050	NA[7]	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Mecoprop	0.007	BRL	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Picloram	0.5	BRL	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Simazine	0.004	BRL	0.005	<0.00104	<0.000964	<0.00107	<0.0011	<0.0050	<0.00114	<0.00104	<0.00105	<0.001	<0.00112
Polychlorinated Biphenyls													
PCB-1016	0.0005	BRL	0.00114	<0.00104	<0.000964	<0.00107	<0.0011	<0.00102	<0.00114	<0.00104	<0.00105	<0.001	<0.00112
PCB-1221	0.0005	BRL	0.000686	<0.000627	<0.000579	<0.000643	<0.000661	<0.00061	<0.000686	<0.000623	<0.000632	<0.000601	<0.000673
PCB-1232	0.0005	BRL	0.000686	<0.000627	<0.000579	<0.000643	<0.000661	<0.00061	<0.000686	<0.000623	<0.000632	<0.000601	<0.000673
PCB-1242	0.0005	BRL	0.00229	<0.00209	<0.00193	<0.00214	<0.0022	<0.00203	<0.00229	<0.00208	<0.00211	<0.002	<0.00224
PCB-1248	0.0005	BRL	0.000686	<0.000627	<0.000579	<0.000643	<0.000661	<0.00061	<0.000686	<0.000623	<0.000632	<0.000601	<0.000673
PCB-1254	0.0005	BRL	0.000686	<0.000627	<0.000579	<0.000643	<0.000661	<0.00061	<0.000686	<0.000623	<0.000632	<0.000601	<0.000673
PCB-1260	0.0005	BRL	0.000457	<0.000418	<0.000386	<0.000429	<0.00044	<0.000407	<0.000457	<0.000415	<0.000421	<0.000401	<0.000449
Total PCB	0.0005	ND	0.00229	<0.00209	<0.00193	<0.00214	<0.0022	<0.00203	<0.00229	<0.00208	<0.00211	<0.002	<0.00224
Pesticides													
Alachlor	0.002	BRL	0.00114	<0.00104	<0.000964	<0.00107	<0.0011	<0.00102	<0.00114	<0.00104	<0.00105	<0.001	<0.00112
Aldicarb	0.003	0.0048	0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
alpha-BHC	0.00011	BRL	0.0000457	<0.0000418	<0.0000386	<0.0000429	<0.000044	<0.0000407	<0.0000457	<0.0000415	<0.0000421	<0.0000401	<0.0000449
Carbofuran	0.04	BRL	0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Chlordane	0.002	BRL	0.00114	<0.00104	<0.000964	<0.00107	<0.0011	<0.00102	<0.00114	<0.00104	<0.00105	<0.001	<0.00112
Endrin	0.002	BRL	0.0000457	<0.0000418	<0.0000386	<0.0000429	<0.000044	<0.0000407	<0.0000457	<0.0000415	<0.0000421	<0.0000401	<0.0000449
gamma-BHC	0.0002	BRL	0.0000457	<0.0000418	<0.0000386	<0.0000429	<0.000044	<0.0000407	<0.0000457	<0.0000415	<0.0000421	<0.0000401	<0.0000449
Heptachlor	0.0004	BRL	0.0000457	<0.0000418	<0.0000386	<0.0000429	<0.000044	<0.0000407	<0.0000457	<0.0000415	<0.0000421	<0.0000401	<0.0000449
Heptachlor epoxide	0.0002	BRL	0.0000457	<0.0000418	<0.0000386	<0.0000429	<0.000044	<0.0000407	<0.0000457	<0.0000415	<0.0000421	<0.0000401	<0.0000449
Methoxychlor	0.04	BRL	0.0000457	<0.0000418	<0.0000386	<0.0000429	<0.000044	<0.0000407	<0.0000457	<0.0000415	<0.0000421	<0.0000401	<0.0000449
Toxaphene	0.003	BRL	0.00229	<0.00209	<0.00193	<0.00214	<0.0022	<0.00203	<0.00229	<0.00208	<0.00211	<0.002	<0.00224
Explosives													
1,3-Dinitrobenzene	0.0007	BRL	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
2,4-Dinitrotoluene	0.0001	0.0684	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
2,6-Dinitrotoluene	0.0003	0.0197	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
1,3,5-Trinitrobenzene	0.84	BRL	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
2,4,6-Trinitrotoluene	0.014	BRL	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
Nitrobenzene	0.014	BRL	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
HMX	1.4	0.044	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	0.00359	<0.00195	<0.00407
RDX	0.084	0.00021	0.00407	<0.00197	<0.00219	<0.00210	<0.00200	<0.00190	<0.00209	<0.00207	<0.00187	<0.00195	<0.00407
Volatile Organic Compounds													
1,1,1-Trichloroethane	0.2	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1,2-Trichloroethane	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1-Dichloroethane	1.4	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT IN NOVEMBER AND DECEMBER 2022

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL	Well								Sump	Reservoir
				TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
	Concentration (mg/L)												
1,1-Dichloroethene	0.007	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloroethane	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloropropane	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dibromo-3-Chloropropane	0.0002	BRL	0.000143	<0.000143	<0.000143	<0.000143	<0.000143	<0.000143	<0.000143	<0.000143	<0.000143	<0.000143	<0.000143
Ethylene Dibromide	0.00005	BRL	0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
1,4-Dioxane	0.0077	BRL	0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
2-Butanone	4.2	BRL	0.00175	<0.00175	<0.00175	<0.00175	<0.00175	<0.00175	<0.00175	<0.00175	<0.00175	<0.00175	<0.00175
Acetone	6.3	BRL	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0138	<0.002	<0.002
Benzene	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Carbon disulfide	0.7	0.008	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00324	<0.001	<0.001
Carbon tetrachloride	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorobenzene	0.1	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chloroform	0.07	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
cis-1,2-Dichloroethene	0.07	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dichlorodifluoromethane	1.4	BRL	0.001	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Ethylbenzene	0.7	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Isopropylbenzene	0.7	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methylene Chloride	0.005	BRL	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Methyl tert-butyl ether	0.07	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Styrene	0.1	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tetrachloroethene	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Toluene	1	0.008	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00293	<0.0005	<0.0005
trans-1,2-Dichloroethene	0.1	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Trichloroethene	0.005	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Trichlorofluoromethane	2.1	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Vinyl chloride	0.002	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Xylenes, Total	10	BRL	0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.00198	<0.0015	<0.0015
Semivolatile Organic Compounds													
1,2,4-Trichlorobenzene	0.07	0.05	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
1,2-Dichlorobenzene	0.6	0.049	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
1,4-Dichlorobenzene	0.075	0.048	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
2-Methylnaphthalene	0.028	0.034	0.0115	<0.00416	<0.0044	<0.00411	<0.0115	<0.0041	<0.0042	<0.00424	<0.00433	<0.00404	<0.00407
2-Methylphenol	0.35	BRL	0.00288	<0.00104	<0.0011	<0.00103	<0.00288	<0.00103	<0.00105	<0.00106	<0.00108	<0.00101	<0.00102
Acenaphthene	0.42	0.077	0.00173	<0.000625	<0.00066	<0.000616	<0.00173	<0.000615	<0.000631	<0.000635	<0.00065	<0.000605	<0.000611
Anthracene	2.1	BRL	0.00173	<0.000625	<0.00066	<0.000616	<0.00173	<0.000615	<0.000631	<0.000635	<0.00065	<0.000605	<0.000611
Benzo[a]anthracene	0.00013	BRL	0.00173	<0.000625	<0.00066	<0.000616	<0.00173	<0.000615	<0.000631	<0.000635	<0.00065	<0.000605	<0.000611
Benzo[a]pyrene	0.0002	BRL	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
Benzo[b]fluoranthene	0.00018	BRL	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
Benzo[k]fluoranthene	0.00017	BRL	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
Benzoic acid	28	BRL	0.115	<0.0416	<0.044	<0.0411	<0.115	<0.041	<0.042	<0.0424	0.116	<0.0404	<0.0407
Bis(2-ethylhexyl)phthalate	0.006	0.0052	0.0576	<0.0208	<0.022	<0.0205	<0.0576	<0.0205	<0.021	<0.0212	<0.0217	<0.0202	<0.0204

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT IN NOVEMBER AND DECEMBER 2022

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL	Well								Sump	Reservoir
				TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
	Concentration (mg/L)												
Chrysene	0.012	BRL	0.00173	<0.000625	<0.00066	<0.000616	<0.00173	<0.000615	<0.000631	<0.000635	<0.00065	<0.000605	<0.000611
Dibenz[a,h]anthracene	0.0003	BRL	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
Diethyl phthalate	5.6	BRL	0.0173	<0.00625	<0.0066	<0.00616	<0.0173	<0.00615	<0.00631	<0.00635	<0.0065	<0.00605	<0.00611
Di-n-butyl phthalate	0.7	BRL	0.0288	<0.0104	<0.011	<0.0103	<0.0288	<0.0103	<0.0105	<0.0106	<0.0108	<0.0101	<0.0102
Fluoranthene	0.28	0.113	0.00288	<0.00104	<0.0011	<0.00103	<0.00288	<0.00103	<0.00105	<0.00106	<0.00108	<0.00101	<0.00102
Fluorene	0.28	BRL	0.00173	<0.000625	<0.00066	<0.000616	<0.00173	<0.000615	<0.000631	<0.000635	<0.00065	<0.000605	<0.000611
Hexachlorocyclopentadiene	0.05	BRL	0.0432	<0.0156	<0.0165	<0.0154	<0.0432	<0.0154	<0.0158	<0.0159	<0.0163	<0.0151	<0.0153
Indeno[1,2,3-cd]pyrene	0.00043	BRL	0.00576	<0.00208	<0.0022	<0.00205	<0.00576	<0.00205	<0.0021	<0.00212	<0.00217	<0.00202	<0.00204
Naphthalene	0.14	BRL	0.0115	<0.00416	<0.0044	<0.00411	<0.0115	<0.0041	<0.0042	<0.00424	<0.00433	<0.00404	<0.00407
Pentachlorophenol	0.001	0.169	0.0325	<0.0312	<0.00020	<0.00020	<0.00020	<0.00020	<0.0315	<0.00020	<0.0325	<0.0303	<0.0305
Phenolics, Total	0.1	0.062	0.05	0.0557	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
Pyrene	0.21	0.126	0.00288	<0.00104	<0.0011	<0.00103	<0.00288	<0.00103	<0.00105	<0.00106	<0.00108	<0.00101	<0.00102
Radioactivity	pCi/L												
Radium-226	20	4.31	0.896	3.32	1.82	<0.896	1.25	2.19	1.25	1.51	<0.891	1.35	<0.635
Radium-228	20	2.58	0.694	1.65	0.8	<0.653	1.21	1.26	0.528	1.06	<0.504	0.874	0.715

[1]Laboratory reporting limit. Where analyses for the same parameter had different RLs, the maximum RL is shown.
[2]Duplicate sample.
[3]No existing limit.
[4]No reportable result because very low reservoir elevation and high concentration of debris and solids prevented testing.
[5]Below reporting limit in background monitoring samples.
[6]Not determined.
[7]Not analyzed due to insufficient aliquot volume.

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

Illinois Environmental Protection Agency, 2012, 35 Illinois Administrative Code (IAC) Part 620 Class I Groundwater Standards, 2012.

Illinois Pollution Control Board, 2013, Illinois Administrative Code Title 35: Environmental Protection, Subtitle F: Potable Water Supplies, Chapter I: Pollution Control Board, Part 620 – Groundwater Quality, October 7, 2013.