

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

*REPORT NO. 21-09*

*THORNTON COMPOSITE RESERVOIR*

*GROUNDWATER MONITORING REPORT*

*FOURTH QUARTER 2020*

*March 2021*

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March 3, 2021

Mr. Michael Summers  
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Illinois Environmental Protection Agency  
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Dear Mr. Summers:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter 2020"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter 2020" 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@mwrdr.org.

Very truly yours,



Albert E. Cox, Ph.D.  
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AC:BM:cm

Attachment

cc: Mr. M. Brown, IEPA  
Mr. E. Podczewinski

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**Thornton Composite Reservoir Groundwater Monitoring Report**  
**Fourth Quarter 2020**

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## LIST OF ACRONYMS

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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

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## **ACKNOWLEDGMENT**

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 20-100-11. 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. Coleen Maurovich 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 overflow (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, bi-weekly 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, 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 ft 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 (IPCB, IEPA, 2013) to evaluate any exceedances in groundwater standards.

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

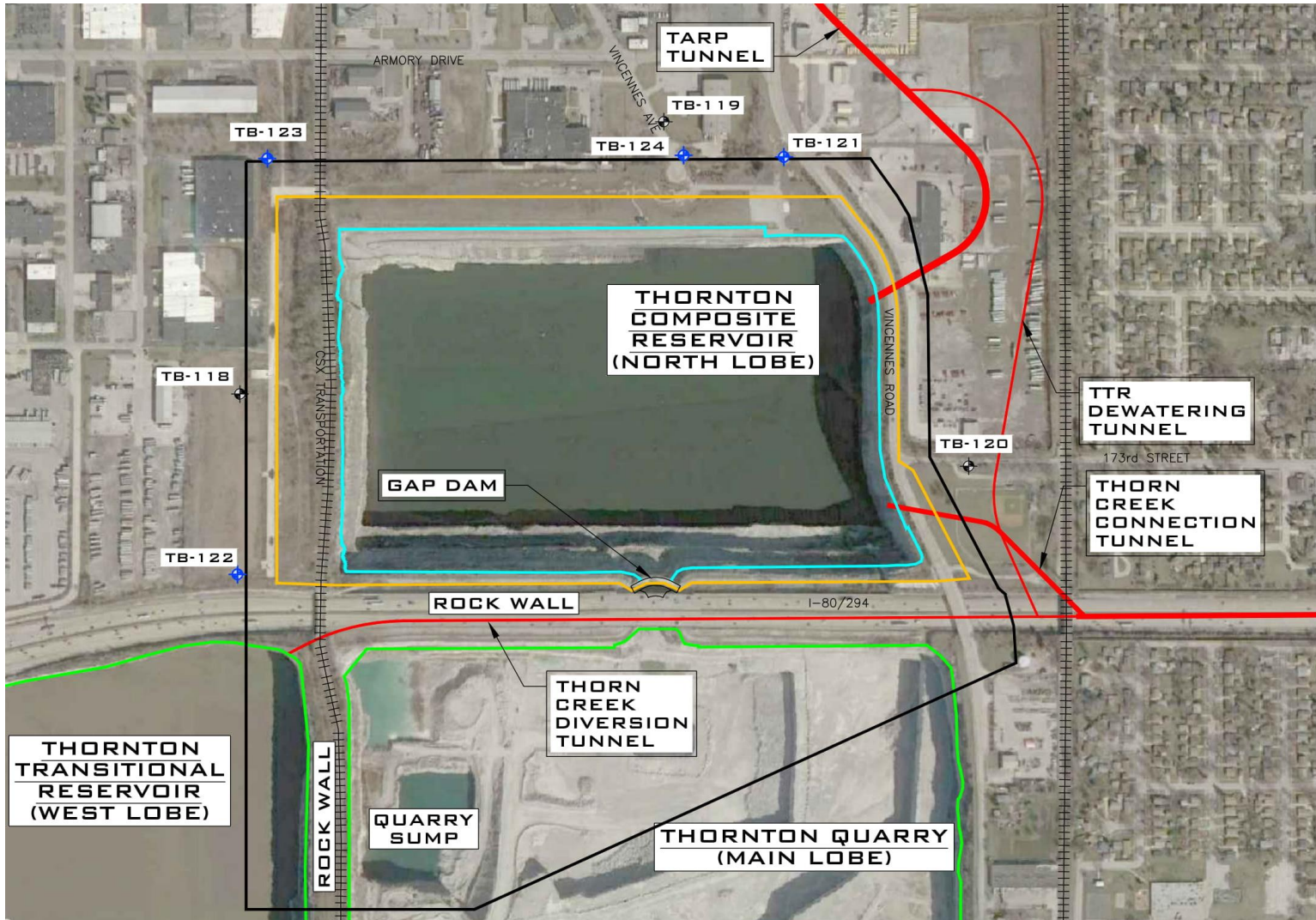


TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124  
AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates <sup>1</sup>		Ground Surface El (ft, CCD <sup>2</sup> )	Top of Riser El (ft, CCD <sup>2</sup> )	Depth of Well (ft)	Sampling Port Interval (ft, CCD)			
	Northing (ft)	Easting (ft)				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	1,792,200.77	695,591.56	29.6	29.2	728	-663 to -698			

<sup>1</sup>Illinois State Plane Coordinate System (NAD 1927).

<sup>2</sup>Chicago City Datum (CCD).

There were two fill events during the fourth quarter of 2020. The first event (the fourth event of 2020) began on October 24 and lasted one day. The annual monitoring event was conducted in place of this fill event sampling. One complete set of samples was collected during October 26 – November 4, 2020, at the Reservoir, the Main Quarry Sump, and all monitoring wells. The second fill event during the quarter (the fifth event of 2019) began on December 14 and lasted two days. One complete set of samples was collected during December 15 – 18, 2020, at 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 during the annual monitoring event from October 26 – November 4, 2020, and at the Main Quarry Sump and at all monitoring wells during fill event sampling conducted from December 15 – 18, 2020.

## 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 interval 3 of all multi-level wells from October 26 – November 4, 2020. One complete set of fill event samples was collected at the Main Quarry Sump, the deep well, and at sampling port interval 3 of all multi-level wells from December 15 – 18, 2020. Sample collection dates are shown in Table 2.

Using a WTW Multi 3400i 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 the annual monitoring event in October and during fill event sampling in December 2020.

All samples were packed in ice and shipped to the 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 shipped in ice to the District's Analytical Microbiology Laboratory for fecal coliform analysis. For the annual monitoring event, an additional set of aliquots was prepared in the field and shipped 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 OCTOBER AND FILL EVENT SAMPLING IN DECEMBER 2020

Date of	Event	Device/Structure Sampled
10/26/2020	Annual Sampling	TB-121
10/28/2020	Annual Sampling	TB-118, TB-122
10/29/2020	Annual Sampling	TB-123, Reservoir
10/30/2020	Annual Sampling	Main Quarry Sump, Sump duplicate
11/03/2020	Annual Sampling	TB-119, TB-120
11/04/2020	Annual Sampling	TB-124
12/15/2020	Fill Event #5	Main Quarry Sump
12/16/2020	Fill Event #5	TB-119, TB-119 duplicate, TB-121
12/17/2020	Fill Event #5	TB-118, TB-122, TB-123
12/18/2020	Fill Event #5	TB-120, TB-124

TABLE 3: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE ANNUAL MONITORING EVENT IN OCTOBER AND FILL EVENT MONITORING IN DECEMBER 2020

Fill	Sample Date	Well ID	Sampling Port	Groundwater Elevation
				----- (ft CCD <sup>1</sup> ) -----
Annual	10/28/2020	TB-118	-289	-88
Annual	11/03/2020	TB-119	-289	-164
Annual	11/03/2020	TB-120	-290	ND <sup>2</sup>
Annual	10/26/2020	TB-121	-288	-170
Annual	10/28/2020	TB-122	-288	-159
Annual	10/29/2020	TB-123	-288	-51
Annual	11/04/2020	TB-124 <sup>3</sup>	NA <sup>4</sup>	-335
5	12/17/2020	TB-118	-289	-89
5	12/16/2020	TB-119	-289	-165
5	12/18/2020	TB-120	-290	ND
5	12/16/2020	TB-121	-288	-171
5	12/17/2020	TB-122	-288	-162
5	12/17/2020	TB-123	-288	-52
5	12/18/2020	TB-124	NA	-338

<sup>1</sup>Chicago City Datum.

<sup>2</sup>No data available. Pressure readings could not be made at ports in this well.

<sup>3</sup>TB-124 is a conventional well screened from -663 to -698 ft CCD. Samples were taken at approximately 650 ft below ground surface once during the annual monitoring event sampling in October 2020 and during the fill event in October and December 2020.

<sup>4</sup>NA = 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 October 26 – November 4 are presented in Table 5. There were a few exceedances of the Part 620 groundwater standards, including pH, total dissolved solids (TDS), chloride, sulfate, and boron, as indicated in bold font in Table 5. Among these parameters, only pH showed a value higher than the background maximum.

Almost all organic parameters were undetectable in the annual monitoring samples from wells and the Main Quarry Sump (Table 5). Only Benzo[a]anthracene and Benzo[b]pyrene were detected above their Class I Groundwater Standards in any well or in the Main Quarry Sump. For Mecoprop, 1,4-Dioxane, Benzo[a]anthracene, Benzo[k]fluoranthene, and Bis (2-ethylhexyl) phthalate, the lab reporting limit was higher than the Class I Groundwater Standard for at least one analysis of groundwater from a well or the Main Quarry Sump. The maximum lab 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).

The analytical data for all well samples and the Main Quarry Sump sample collected during fill event monitoring from December 15 – 18 are presented in Table 6. There were a few exceedances of the Part 620 groundwater standards, including pH, TDS, chloride, sulfate, boron, and zinc, as indicated in bold font in Table 6. Among these parameters, only pH showed a value higher than the background maximum.

There was no detection of fecal coliform bacteria in any well or in the Main Quarry Sump during either the annual monitoring event or fill event sampling (Tables 5 and 6).



TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Parameters	Analytical Method
<u>Inorganic</u>	
Chloride, Fluoride, Sulfate	USEPA 300.0
Total Dissolved Solids	SM 2540C
TAL metals	USEPA 200.8
Mercury	SM 3112B
Ammonia (as N)	USEPA 350.1
Hardness (as Calcium and Magnesium)	SM 3120B,
TOC	SM 5310B
Cyanide	USEPA 335.3
<u>Organic</u>	
Herbicides including 2,4-D; 2,4,5-TP (Silvex); Dalapon; Dicamba; Dinoseb; Mecoprop; Picloram	USEPA 8151A
Endothall	USEPA 548.1
Polychlorinated biphenyls (PCBs)	USEPA 8082A
Pesticides including Alachlor; alpha-BHC; Chlordane; Endrin; gamma-BHC; Heptachlor; Heptachlor Epoxide; Methoxychlor; Toxaphene;	USEPA 8081B
All Explosives	USEPA 8330B
1,2-Dibromo-3-Chloropropane; Ethylene Dibromide	USEPA 504.1
Aldicarb; Carbofuran	USEPA 531.1
All other VOCs	USEPA 8260B
Phenolics, total recoverable	USEPA 9066
All other SVOCs and Atrazine	USEPA 8270D
<u>Radiological</u>	
Radium-226 (pCi/L)	USEPA 903.0
Radium-228 (pCi/L)	USEPA 904.0
<u>Others</u>	
Phenols (at District labs for fill event samples)	USEPA 420.4
Fecal Coliform	SM 9222D

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 OCTOBER 2020

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well									Sump-Dup <sup>2</sup>	Reservoir
				TB-118	TB-119	TB-120	TB-121	TB-122	TB-123	TB-124	Sump			
pH	6.5-9.0	8.4	NL <sup>3</sup>	8.3	8.6	7.9	8.0	8.4	7.6	<b>11.8<sup>4</sup></b>	8.3	8.3	NDR <sup>5</sup>	
EC (mS/m)	NL	415	NL	65	54	99	135	148	95	212	120	120	NDR <sup>5</sup>	
Fecal coliform (CFU/100 mL)	NL	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	120000	
----- Concentration (mg/L) -----														
TDS	1,200	2,960	10	<b>1,260</b>	540	324	1,076	820	580	<b>1,576</b>	<b>1,220</b>	<b>1,202</b>	418	
TOC	NL	1	5	<5	<5	<5	<5	<5	<5	16	<5	<5	24	
Cyanide, Total	0.2	BRL <sup>6</sup>	0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	<0.010	
Fluoride	4.0	3.2	0.20	0.50	0.68	0.90	0.44	0.95	0.58	0.90	0.35	0.33	0.36	
Chloride	200	1,230	20	<b>425</b>	89	52	<b>292</b>	<b>250</b>	64	182	<b>211</b>	<b>214</b>	84	
Sulfate	400	890	20	212	141	43	194	98	132	334	<b>477</b>	<b>483</b>	65	
Ammonia	NL	ND <sup>7</sup>	0.30	0.52	0.47	0.47	0.62	0.61	0.64	1.6	<0.30	<0.30	15	
METALS														
Ag	0.05	0.003	0.002	<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	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.008	<0.002	<0.002	0.010	
B	2.0	3.78	0.005	0.726	0.865	0.158	0.942	<b>2.29</b>	1.63	1.00	0.420	0.436	0.140	
Ba	2.0	0.217	0.001	0.037	0.033	0.031	0.092	0.017	0.050	0.019	0.023	0.023	0.141	
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	<0.002	
Cd	0.005	0.002	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Co	1.0	0.035	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.008	0.008	0.006	
Cr	0.10	86.4	0.002	0.010	<0.004	0.008	<0.004	0.011	0.005	<0.004	<0.004	<0.004	0.023	
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	0.151	
Fe	5.0	3.23	0.010	0.212	0.119	0.719	0.030	0.090	0.059	0.782	0.055	0.045	12.2	
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	0.0007	
Mn	0.15	0.183	0.001	0.006	0.005	0.050	0.003	0.004	0.003	0.004	0.003	0.003	0.214	
Ni	0.10	0.093	0.001	0.010	<0.002	0.013	0.003	0.007	0.004	0.009	0.027	0.028	0.023	
Pb	0.0075	0.006	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.059	

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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 OCTOBER 2020

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well								Sump	Reservoir	
				TB-118	TB-119	TB-120	TB-120D <sup>2</sup>	TB-121	TB-122	TB-123	TB-124			
----- Concentration (mg/L) -----														
METALS														
Sb	0.006	0.012	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.004
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	<0.004	<0.004
Tl	0.002	0.013	0.001	<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	<0.01	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.015
Zn	5.0	9.95	0.005	0.141	0.074	3.859	<0.010	0.180	0.131	0.907	<0.010	<0.010	<0.010	0.561
Ca	NL	276	0.50	169	87.2	56.7	141	77.1	82.0	98.1	131	130	130	79.1
Mg	NL	153	0.50	81.7	44.1	17.6	73.3	39.9	43.1	58.2	117	117	117	31.5
HERBICIDES														
2,4-D	0.07	BRL	0.0003	<0.00027	<0.00026	<0.0003	<0.00025	<0.00027	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	0.002
2,4,5-TP (Silvex)	0.05	BRL	0.00015	<0.00013	<0.00013	<0.00015	<0.00012	<0.00014	<0.00012	<0.00013	<0.00012	<0.00013	<0.00013	<0.00014
Atrazine	0.003	BRL	0.021	<0.002	<0.0021	<0.0023	<0.0021	<0.0022	<0.0021	<0.0021	<0.0019	<0.002	<0.002	<0.021
Dalapon	0.20	BRL	0.003	<0.0027	<0.0026	<0.003	<0.0025	<0.0027	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0029
Dicamba	0.21	BRL	0.0003	<0.00027	<0.00026	<0.0003	<0.00025	<0.00027	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00029
Dinoseb	0.007	BRL	0.0006	<0.00053	<0.00052	<0.0006	<0.0005	<0.00055	<0.0005	<0.0005	<0.00049	<0.0005	<0.0005	<0.00058
Endothall	0.100	BRL	0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Mecoprop	0.007	BRL	0.072	<0.064	<0.062	<0.072	<0.06	<0.066	<0.06	<0.061	<0.059	<0.06	<0.06	<0.069
Picloram	0.50	BRL	0.0003	<0.00027	<0.00026	<0.0003	<0.00025	<0.00027	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00029
Simazine	0.004	BRL	0.0089	<0.0016	<0.0016	<0.0018	<0.0016	<0.0017	<0.0017	<0.0017	<0.0016	<0.0015	<0.0015	<0.0089
PCBs														
PCB-1016	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00038	<0.00045
PCB-1221	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00038	<0.00045
PCB-1232	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00038	<0.00045

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 OCTOBER 2020

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well								Sump	Reservoir
				TB-118	TB-119	TB-120	TB-120D <sup>2</sup>	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
PCB-1242	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00045
PCB-1248	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00045
PCB-1254	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00045
PCB-1260	0.0005	BRL	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00045
PCBs, Total	0.0005	ND	0.00046	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.00045
PESTICIDES													
Alachlor	0.002	BRL	0.0022	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.0022
Aldicarb	0.003	0.0048	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
alpha-BHC	0.00011	BRL	0.00022	0.000047	<0.00004	<0.000046	<0.000041	<0.000043	<0.000043	<0.000042	<0.00004	<0.00003	<0.00022
Carbofuran	0.04	BRL	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chlordane	0.002	BRL	0.00045	<0.00008	<0.00008	<0.000092	<0.000082	<0.000085	<0.000086	<0.000083	<0.00008	<0.00007	<0.00045
Endrin	0.002	BRL	0.00022	<0.00004	<0.00004	<0.000046	<0.000041	<0.000043	<0.000043	<0.000042	<0.00004	<0.00003	<0.00022
gamma-BHC	0.0002	BRL	0.00022	<0.00004	<0.00004	<0.000046	<0.000041	<0.000043	<0.000043	<0.000042	<0.00004	<0.00003	<0.00022
Heptachlor	0.0004	BRL	0.00022	<0.00004	<0.00004	<0.000046	<0.000041	<0.000043	<0.000043	<0.000042	<0.00004	<0.00003	<0.00022
Heptachlor epoxide	0.0002	BRL	0.00022	<0.00004	<0.00004	<0.000046	<0.000041	<0.000043	<0.000043	<0.000042	<0.00004	<0.00003	<0.00022
Methoxychlor	0.040	BRL	0.00045	<0.00008	<0.00008	<0.000092	<0.000082	<0.000085	<0.000086	<0.000083	<0.00008	<0.00007	<0.00045
Toxaphene	0.003	BRL	0.0022	<0.00041	<0.00041	<0.00046	<0.00041	<0.00043	<0.00043	<0.00042	<0.0004	<0.00038	<0.0022



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 OCTOBER 2020

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well									
				TB-118	TB-119	TB-120	TB-120D <sup>2</sup>	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Acetone	6.3	BRL	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.026
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	0.700	0.008	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0057	<0.002	<0.002	<0.002
Carbon tetrachloride	0.005	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlorobenzene (benzene Cl)	0.100	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	0.070	BRL	0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
cis-1,2-Dichloroethene	0.070	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dichlorodifluoromethane	1.4	BRL	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ethylbenzene	0.700	BRL	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Isopropylbenzene (Cumene)	0.70	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Methylene Chloride (dichloromethane)	0.005	BRL	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Methyl tert-butyl ether	0.070	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Styrene	0.1	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tetrachloroethene	0.005	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	1.0	0.008	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0016	<0.0005	<0.0005	0.022
trans-1,2- Dichloroethene	0.100	BRL	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
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	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

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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 OCTOBER 2020

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well								Sump	Reservoir
				TB-118	TB-119	TB-120	TB-120D <sup>2</sup>	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
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	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SVOCs													
1,2,4-	0.070	0.050	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichlorobenzene	0.600	0.049	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	0.075	0.048	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Methylnaphthalene	0.028	0.034	0.017	<0.0016	<0.0017	<0.0018	<0.0017	<0.0018	<0.0017	<0.0017	<0.0015	<0.0016	<0.017
2-Methylphenol	0.350	BRL	0.017	<0.0016	<0.0017	<0.0018	<0.0017	<0.0018	<0.0017	<0.0017	<0.0015	<0.0016	<0.017
Acenaphthene	0.42	0.077	0.0085	<0.0008	<0.0008	<0.0009	<0.00083	<0.0008	<0.00083	<0.00085	<0.00076	<0.0008	<0.0085
Anthracene	2.10	BRL	0.0085	<0.0008	<0.0008	<0.0009	<0.00083	<0.0008	<0.00083	<0.00085	<0.00076	<0.0008	<0.0085
Benzo[a]anthracene	0.00013	BRL	0.0014	<0.0001	<0.0001	<0.00015	<0.00014	0.00021	<0.00014	<0.00014	<0.00012	<0.0001	0.0018
Benzo[a]pyrene	0.0002	BRL	0.0017	<0.0001	<0.0001	<0.00018	<0.00017	0.00023	<0.00017	<0.00017	<0.00015	<0.0001	0.0033
Benzo[b]fluoranthene	0.00018	BRL	0.0017	<0.0001	<0.0001	<0.00018	<0.00017	<0.0001	<0.00017	<0.00017	<0.00015	<0.0001	0.0025
Benzo[k]fluoranthene	0.00017	BRL	0.0017	<0.0001	<0.0001	<0.00018	<0.00017	<0.0001	<0.00017	<0.00017	<0.00015	<0.0001	0.0018
Benzoic acid	28	BRL	0.17	<0.016	<0.017	<0.018	<0.017	<0.018	<0.017	0.2	<0.015	<0.016	<0.17
Bis(2-ethylhexyl)													
phthalate	0.0060	0.0052	0.085	<0.008	<0.0085	<0.009	<0.0083	<0.0088	<0.0083	<0.0085	<0.0076	<0.008	<0.085
Chrysene	0.012	BRL	0.0017	<0.0001	<0.0001	<0.00018	<0.00017	<0.0001	<0.00017	<0.00017	<0.00015	<0.0001	0.0024
Dibenz(a,h)anthracene	0.0003	BRL	0.0026	<0.0002	<0.0002	<0.00027	<0.00025	<0.0002	<0.00025	<0.00025	<0.00023	<0.0002	<0.0026
Diethyl phthalate	5.60	BRL	0.043	<0.004	<0.0042	<0.0045	<0.0042	<0.0044	<0.0042	<0.0042	<0.0038	<0.004	<0.043
Di-n-butyl phthalate	0.700	BRL	0.043	<0.004	<0.0042	<0.0045	<0.0042	<0.0044	<0.0042	<0.0042	<0.0038	<0.004	<0.043
Fluoranthene	0.280	0.113	0.0085	<0.0008	<0.0008	<0.0009	<0.00083	<0.0008	<0.00083	<0.00085	<0.00076	<0.0008	<0.0085

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 OCTOBER 2020

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well									
				TB-118	TB-119	TB-120	TB-120D <sup>2</sup>	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Fluorene	0.280	BRL	0.0085	<0.0008	<0.000	<0.0009	<0.00083	<0.00088	<0.00083	<0.00085	<0.000	<0.0008	<0.0085
Hexachloro-	0.050	BRL	0.17	<0.016	<0.017	<0.018	<0.017	<0.018	<0.017	<0.017	<0.015	<0.016	<0.17
Indeno[1,2,3-cd]pyrene	0.00043	BRL	0.0017	<0.00016	<0.000	<0.00018	<0.00017	<0.00018	<0.00017	<0.00017	<0.000	<0.00016	0.0017
Naphthalene	0.140	BRL	0.0085	<0.0008	<0.000	<0.0009	<0.00083	<0.00088	<0.00083	<0.00085	<0.000	<0.0008	<0.0085
Pentachlorophenol	0.001	0.1690	0.00015	<0.00013	<0.000	<0.00015	<0.00012	<0.00014	<0.00012	<0.00013	<0.000	<0.00013	<0.0001
Phenolics, Total	0.100	0.062	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.02	<0.005	<0.005	0.026
Pyrene	0.210	0.126	0.0085	<0.0008	<0.000	<0.0009	<0.00083	<0.00088	<0.00083	<0.00085	<0.000	<0.0008	<0.0085
----- pCi/L -----													
16 RADIOACTIVITY													
Radium-226	20	4.31	0.897	1.89	1.16	0.546	1.98	1.5	1.41	0.33	0.61	<0.314	<0.897
Radium-228	20	2.58	2.08	1.58	0.831	<0.301	1.33	0.439	1.38	<0.295	0.947	0.69	<2.08

<sup>1</sup>Lab reporting limit. Where analyses for the same parameter had different RL, the maximum RL is shown.

<sup>2</sup>Duplicate sample.

<sup>3</sup>No existing limit.

<sup>4</sup>For well and sump samples only, concentrations in bold font indicate their exceedance of Part 620 Class 1 Groundwater Standards.

<sup>5</sup>No data reportable. Reservoir sample contained too much particulate matter for accurate measurement with field pH/EC meter.

<sup>6</sup>Below reporting limit in background monitoring samples.

<sup>7</sup>Not determined.



TABLE 6: 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 MONITORING IN DECEMBER 2020

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well								Sump
					TB-118	TB-119	TB-119D <sup>2</sup>	TB-120	TB-121	TB-122	TB-123	TB-124	
pH		6.5 - 9.0	8.4	NL <sup>3</sup>	7.3	8.6	8.6	7.7	8.1	9.3	7.9	<b>12.8</b> <sup>4</sup>	8.3
EC	mS/m	NL	415	NL	217	133	133	136	177	150	96	222	116
TDS	mg/L	1,200	2,960	25	<b>1,336</b>	534	328	348	1,008	878	590	1,110	<b>1,258</b>
TOC	"	NL	1	1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NDR	13.5	<5.0
Chloride	"	200	1,230	1	<b>394</b>	62	44	47	<b>221</b>	174	57	178	<b>201</b>
Sulfate	"	400	890	1	196	101	41	39	130	66	118	336	<b>479</b>
Ammonia as N	"	NL	ND <sup>5</sup>	0.30	0.61	0.72	0.91	0.55	0.78	0.59	1.02	1.8	<0.300
Total Phenol	"	0.1	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.019	<0.005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
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	0.733	0.931	0.841	0.162	0.945	<b>2.85</b>	1.73	1.09	0.417
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	<0.002	0.010
Cr	"	0.1	86.4	0.002	<0.004	0.005	<0.004	<0.004	0.008	0.006	<0.004	0.011	<0.004
Cu	"	0.65	0.004	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.006	<0.002
Mn	"	0.15	0.183	0.001	0.005	0.006	0.005	0.053	0.005	0.004	0.003	0.005	<0.002
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	<0.010	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	0.040	0.140	0.077	<b>5.11</b>	0.226	0.155	0.029	2.55	<0.010
Ca	"	NL	276	0.5	167	87.9	85.7	57.6	135	72.1	81.8	67.0	129
Mg	"	NL	153	0.5	80.0	43.7	42.7	17.3	69.2	36.9	42.3	0.60	114

<sup>1</sup>Lab reporting limit.

<sup>2</sup>Duplicate sample.

<sup>3</sup>No existing limit.

<sup>4</sup>Concentrations in bold font indicate exceedance of Part 620 Class 1 Groundwater Standards.

<sup>5</sup>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 EPA, 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.