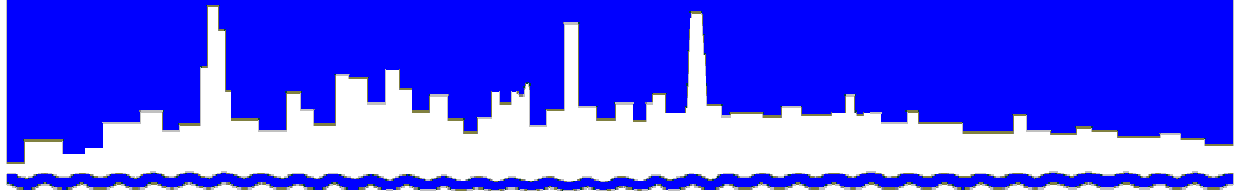


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 17-26

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FIRST QUARTER 2017

August 2017

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June 29, 2017

Richard P. Cobb, P.G.
Deputy Division Manager
Division of Public Water Supplies
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794

Dear Mr. Cobb:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2017"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2017" 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 are the Excel spreadsheets of the Thornton Composite Reservoir raw data from TestAmerica Laboratory as required by the IEPA.

If you have any questions or would like to have additional information, please contact Dr. Pauline Lindo at (708) 588-4109 or pauline.lindo@mwr.org.

Very truly yours,

Albert E. Cox, Ph.D.
Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:PL:cm
Attachments
cc: Mr. E. Podczerwinski
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Thornton Composite Reservoir Groundwater Monitoring Report
First Quarter 2017

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LIST OF ACRONYMS

Acronym	Definition
Ca	Calcium
CCD	Chicago City Datum
CSO	Combined Sewer Overflow
FC	Fecal Coliform
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
M&R	Monitoring and Research
TCR	Thornton Composite Reservoir
TDS	Total Dissolved Solids

ACKNOWLEDGMENT

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research (M&R) Department according to the Thornton Composite Reservoir contract 16-104-11. All samples were collected by Andrews Engineering, Inc. (contractor). All analyses were performed by TestAmerica Analytical Laboratories, Inc. The final report was produced according to the new format guidelines of the Metropolitan Water Reclamation District of Greater Chicago's (District) M&R Department. 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 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 CSFs 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 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 as long as the water in the reservoir is 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, 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 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

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		Ground Surface El (ft, CCD ²)	Top of Riser El (ft, CCD ²)	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			

¹Illinois State Plane Coordinate System (NAD 1927).

²Chicago City Datum (CCD).

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.

There were two fill events during the first quarter of 2017. This report presents field activities, observations, and analytic (inorganic) data for surface and groundwater monitoring samples taken at the Main Quarry Sump and at all monitoring wells during the first quarter/fill-event samplings of January 24 – 26 and March 2 – 4, 2017.

FIELD ACTIVITIES

For this report period, two sets of fill-event monitoring samples were collected at the sump, the deep well, and from sampling port Interval 3 at all multi-level wells. These fill-event samples also fulfilled the monitoring requirement for the first quarter of 2017. Samples were collected according to the schedule listed in Table 2.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING
DURING THE FILL EVENTS OF JANUARY AND MARCH 2017

Date of Sampling	Device/Structure Sampled
January Event	
1/24/2017	TB-119 TB-121, TB-121 Dup, TB-124
1/25/2017	TB-118, TB-120, TB-122
1/26/2017	TB-123, Quarry Sump
March Event	
3/02/2017	TB-120, TB-120 Dup, TB-121, Quarry Sump
3/03/2017	TB-122 and TB-124
3/04/2017	TB-118, TB-119, TB-123

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 of the multi-level wells, hydrostatic pressure was measured to calculate the groundwater elevation at the port sampled. Table 3 lists the elevations at Port 3 of each well and the corresponding groundwater elevations during this sampling event.

All samples were packed in ice and shipped to IL State ELAP/NELAC-certified TestAmerica Laboratories, Inc. for the analysis of selected inorganic constituents (IAC Title 35 Part 620 Class I Groundwater Standards) only, in accordance with the revised GMP for the fill-event samples.

TABLE 3: SUMMARY OF ELEVATIONS AT PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE JANUARY AND MARCH 2017 MONITORING

Well and Interval ID	Sampling Port 003 Elevation (ft CCD ¹)	Interval 3 Groundwater Elevation (ft CCD)	Interval 3 Groundwater Elevation (ft CCD)
		(January 24 - 26)	(March 2 - 4)
TB-118-003	-289	-129	-127
B-119-003	-289	-194	-195
TB-120-003	-290	-233	-230
TB-121-003	-288	-199	-201
TB-122-003	-288	-212	-214
TB-123-003	-288	-78	-79
TB-124 ²	-663	-439	-445

¹Chicago City Datum.

²TB-124 is a conventional well screened from -663 to -698 CCD; samples taken at elevations of approximately -439 and -445 CCD, respectively. Interval 3 elevation not applicable to this well.

ANALYTICAL RESULTS

Table 4 lists the analytical methods for parameters used by the laboratory. The analytical data for all well samples and the Main Quarry Sump sample collected during January and March 2017 are presented in Tables 5 and 6, respectively. Analytical results were reviewed to identify any analytes that exceeded the Illinois Class I Groundwater Standards (35 IAC Part 620).

During the January 2017 fill-event sampling, among the inorganic analytes, there were a few exceedances of the Part 620 groundwater standards, including total dissolved solids (TDS), chloride, sulfate, and boron, as indicated in bold font in Table 5. These exceedances occurred in four wells and in the sump. However, none of these constituents showed concentrations exceeding the maximum background levels.

During the March 2017 fill event, the concentrations of TDS, chloride, and sulfate also exceeded the Part 620 limits in three wells and the sump, as indicated in bold font in Table 6. However, none of these parameters had concentrations exceeding the maximum background concentrations.

For both events, all other analytes measured, including all metals, were within the limits of the Tier I groundwater standards.

The fecal coliform (FC) populations of samples collected during both sampling events at all monitoring wells and at the Main Quarry sump were all undetectable (Tables 5 and 6), except for the sump during the month of March (Table 6). This sample contained 40 CFU/100 mL.

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Inorganic Chemical Parameters	Analytical Method ¹
Chloride	325.2
Alkalinity, Bicarbonate	2320B
Total Dissolved Solids	2540C
Sulfate	4500-SO4-2 C or D
TAL metals	6010B & 7470A
Ammonia (as N)	350.1R2.0
Hardness	2340B
TOC	5310C
Others:	
Phenols	SVOC/8270C
Fecal Coliform	SM 9221E

¹All standard EPA methods used by NELAC-certified and other laboratories.

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 DURING THE JANUARY 2017 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump
					TB-118	TB-119	TB-120	TB-121	TB-121-D ²	TB-122	TB-123	TB-124	
pH		6.5 - 9.0	8.4	NL ³	7.1	6.9	7.3	7.0	7.0	7.3	7.1	8.4	7.5
Electrical Conductivity	mS/m	NL	415	0.5	177	75	114	135	135	137	85	208	142
Total Dissolved Solids	mg/L	1,200	2,960	10	1,200	540	750	1,000	1,000	900	580	1,600	1,100
Total Organic Carbon	"	NL ³	1.0	1.0	4.1	2.2	2.4	2.2	2.1	2.7	1.8	1.0	1.8
Chloride	"	200	1,230	2	340	56	170	200	240	210	54	310	160
Sulfate	"	400	890	2	210	95	100	150	190	83	120	620	490
Ammonia as N	"	NL	NA ⁴	0.20	0.45	0.50	0.36	0.53	0.69	0.52	0.64	0.97	0.20
Phenol ⁵	"	0.10	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fecal Coliform ⁶	CFU 100 mL	NL	<1	10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ag	mg/L	0.05	0.003	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
B	"	2	3.8	0.050	0.74	0.90	1.0	1.2	1.2	2.6	1.9	1.3	0.32
Be	"	0.004	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	"	1	0.035	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.018
Cr	"	0.1	86.4	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.005
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
Mn	"	0.15	0.183	0.0025	0.0046	0.0075	0.0037	0.0026	0.0029	<0.0025	<0.0025	0.0080	0.0034
Se	"	0.05	0.008	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
V	"	0.049	NA	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE DURING THE JANUARY 2017 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump
					TB-118	TB-119	TB-120	TB-121	TB-121D ²	TB-122	TB-123	TB-124	
Zn	"	5	10	0.020	0.057	0.095	<0.020	<0.020	<0.020	0.020	<0.020	1.0	<0.020
Ca	"	NL	276	0.20	150	78	96	130	130	68	76	69	120
Mg	"	NL	153	0.20	76	43	50	69	68	37	43	65	90

¹Lab reporting limit.

²Duplicate sample.

³No existing limit.

⁴No analysis performed.

⁵Total recoverable phenolics.

⁶<10 CFU/100 mL is reported as no detection, since a 10-mL aliquot was used in the FC analysis of samples.

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 DURING THE MARCH 2017 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump
					TB-118	TB-119	TB-120	TB-120 D ²	TB-121	TB-122	TB-123	TB-124	
pH		6.5 - 9.0	8.4	NL ³	7.1	7.5	6.9	6.9	7.1	7.3	7.1	8.7	7.5
Electrical Conductivity	mS/m	NL ³	415	0.5	181	81	115	115	143	144	89	215	136
Total Dissolved Solids	mg/L	1,200	2,960	10	1,200	440	770	760	1,100	930	550	1,600	1,100
Total Organic Carbon	"	NL	1.0	0.1	3.3	1.7	3.4	2.4	2.0	2.6	1.8	<1.0	1.9
Chloride	"	200	1,230	5	280	46	150	150	240	170	47	260	150
Sulfate	"	400	890	15	210	87	100	110	190	73	<2	610	450
Ammonia as N	"	NL	NA ⁴	0.10	0.47	0.44	0.38	0.38	0.56	0.58	0.63	0.96	<0.20
Phenol ⁵	"	0.10	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fecal Coliform ⁶	CFU/ 100 mL	NL	<1	1	<1	<1	<10	<10	<10	<10	<2	<10	40
Ag	mg/L	0.05	0.003	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
B	"	2	3.8	0.05	0.96	1.1	1.2	1.2	1.1	2.0	2.0	1.2	0.29
Be	"	0.004	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	"	1	0.035	0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	0.0010	<0.0005	0.016
Cr	"	0.1	86.4	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.005
Cu	"	0.65	0.004	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.002
Mn	"	0.15	0.183	0.0002	0.0058	0.0068	0.0041	0.0042	0.0026	<0.0002	0.0038	<0.0002	0.0049
Se	"	0.05	0.008	0.0005	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0005	<0.0025	<0.0005	<0.0025
V	"	0.049	NA	0.0025	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0025	<0.0050	<0.0025	<0.0050

TABLE 6 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118-003 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE DURING THE MARCH 2017 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump
					TB-118	TB-119	TB-120	TB-120-D ²	TB-121-	TB-122	TB-123	TB-124	
Zn	"	5	10	0.020	<0.020	<0.020	0.031	<0.020	0.020	<0.020	<0.020	<0.020	<0.020
Ca	"	NL ²	276	0.20	180	85	92	97	130	63	84	59	130
Mg	"	NL	153	0.20	89	46	48	51	68	31	46	69	92

¹Lab reporting limit; for several metals, the laboratory reported multiple RLs.

²Duplicate sample.

³No existing limit.

⁴No analysis performed.

⁵Total recoverable phenolics.

⁶<10 CFU/100 ml is reported as no detection for some wells, as a 10 ml aliquot was used for FC analyses of samples.

REFERENCES

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

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