Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 19-14

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FIRST QUARTER 2019

July 2019

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
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Edward W. Podczerwinski, P.E.
Director of Monitoring and Research

June 28, 2019

Mr. Richard P. Cobb, P.G.
Acting Division Manager
Division of Public Water Supplies
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794
RICK.COBB@Illinois.gov

Dear Mr. Cobb:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2019"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2019" 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 Dr. Guanglong Tian at (708) 588-4201 or guanglong.tian@mwrd.org.

Very truly yours,

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

AC:NK:cm
Attachment
cc: Mr. E. Podczerwinski

Metropolitan Water Reclamation District of Greater Chicago
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Thornton Composite Reservoir Groundwater Monitoring Report

First Quarter 2019

Nicholas Kollias
Aquatic Biologist

Pauline Lindo
Environmental Soil Scientist

Guanglong Tian
Principal Environmental Scientist

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LIST OF ACRONYMS

Acronym	Definition
CCD	Chicago City Datum
CFU	Colony Forming Unit
CSF	Combined Sewer Flow
FC	Fecal Coliform
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
M&R	Monitoring and Research
QC	Quality Control
TCR	Thornton Composite Reservoir
TDS	Total Dissolved Solids
TOC	Total Organic Carbon

ACKNOWLEDGMENT

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research (M&R) Department. All samples were collected by Tetra Tech, Inc. (contractor) under the Thornton Composite Reservoir Contract 19-105-11. All analyses were performed by the Analytical Laboratories Division of the Metropolitan Water Reclamation District of Greater Chicago. Special thanks are due to Ms. Mina Patel for compiling some data and 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, 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 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 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

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

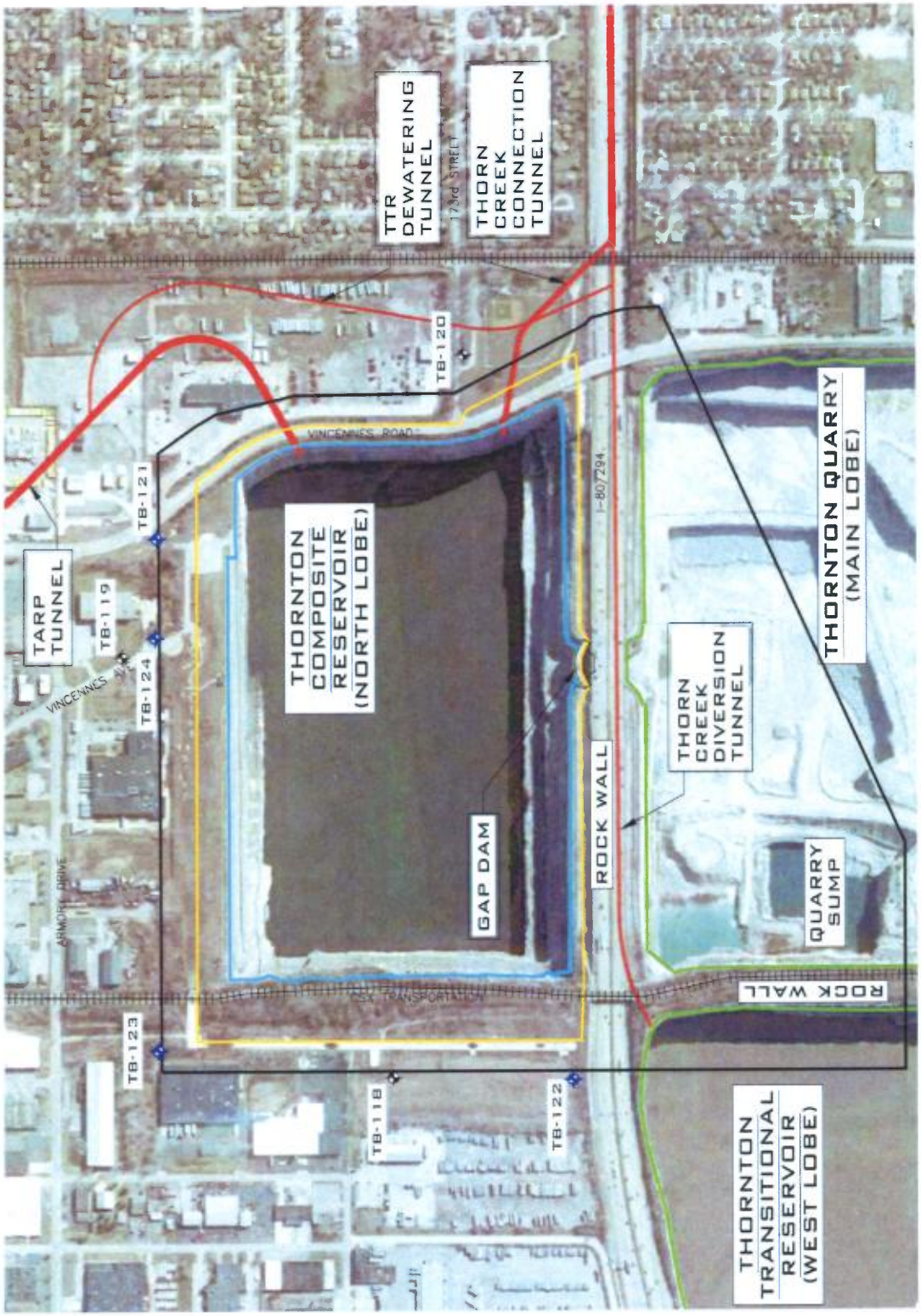

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates[1] Northing (ft)	Coordinates[1] Easting (ft)	Ground Surface El (ft, CCD[2])	Top of Riser El (ft, CCD[2])	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	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).

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 was one fill event on February 7, 2019, during the first quarter of 2019; however, sampling could not be done due to the malfunction of sampling equipment. Thus, a quarterly sampling, as designed in the revised GPS, was conducted from March 28 to April 1, 2019. 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 for this quarterly sampling.

FIELD ACTIVITIES

For this report period, one set of quarterly samples was collected at the sump, the deep well, and at sampling port interval 3 of all multi-level wells. Samples were collected according to the schedule listed 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 this sampling period.

All samples were packed in ice and shipped to the Metropolitan Water Reclamation District of Greater Chicago'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 for the fill-event/quarterly samples. Additional aliquots were also prepared in the field and shipped in ice to the District's Analytical Microbiology and Biomonitoring Laboratory for fecal coliform analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE QUARTERLY SAMPLING OF MARCH AND APRIL 2019

Date of Sampling	Device/Structure Sampled
3/28/2019	TB-119, TB-121, TB-124, Sump
3/29/2019	TB-118, TB-122, TB-123
4/1/2019	TB-120, TB-120 Dup

TABLE 3: SUMMARY OF ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE QUARTERLY MONITORING OF MARCH AND APRIL 2019

Well ID	Sampling Port 003 Elevation	Groundwater Elevation
	---------- (ft CCD[1]) ----------	
TB-118	-288.5	-90
TB-119	-288.5	-164
TB-120	-288.5	-190
TB-121	-288.5	-172
TB-122	-288.5	-162
TB-123	-288.5	-51
TB-124[2]	NA[3]	-370

[1]Chicago City Datum.
[2]TB-124 is a conventional well screened from -663 to -698 ft below ground surface. During March, one sample was taken at approximately 650 ft below ground surface.
[3]NA = Not Applicable.

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 Illinois Class I Groundwater Standards (35 IAC Part 620).

The analytical data for all well samples and the Main Quarry Sump sample collected during the first quarter monitoring of March 28 to April 1, 2019, are presented in Table 5. There were a few exceedances of Part 620 groundwater standards, including TDS, chloride, sulfate, and boron as indicated in bold font in Table 5, however, none of the parameters showed a concentration higher than the background maximum.

The fecal coliform (FC) populations of samples collected for the first quarter monitoring were undetectable at all monitoring wells and the Main Quarry Sump (Table 5).

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Chemical Parameters	Analytical Method
Chloride	SM 4500-Cl- D
Alkalinity, Bicarbonate	SM 2320 B
Total Dissolved Solids	SM 2540 C
Sulfate	USEPA 375.2R2.0, 1993
Total metals	SM3120B, 1999
Ammonia (as N)	EPA 350.1
Hardness	SM 2340B, 1997
TOC	SM 5310-C
Phenols	EPA 420.4
Fecal Coliform	SM 9221E

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 QUARTERLY MONITORING OF MARCH AND APRIL 2019

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]	7.8	6.9	7.6	7.6	7.5	7.6	7.8	9.0	8.5
EC	mS/m	NL	415	NL	490	101	125	125	486	470	148.3	550	580
TDS	mg/L	1,200	2,960	25	1132	484	668	796	110	794	564	**1,428**	**1,426**
TOC	"	NL	1	1	1.7	<1.0	1.1	1.1	1.1	1.2	<1.0	1	<1.0
Chloride	"	200	1,230	1	**357**	57	154	156	**245**	**202**	57	**267**	**202**
Sulfate	"	400	890	1	211	100	107	109	181	86	131	**568**	**516**
Ammonia as N	"	NL	ND[4]	0.30	0.48	0.44	0.34	0.35	0.66	0.50	0.62	1.36	<0.30
Total Phenol	"	0.1	0.06	0.005	<0.005	0.009	<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	<1	<1	<1	<1
Ag	mg/L	0.05	0.003	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
B	"	2	3.8	0.005	0.76	0.90	0.87	0.89	1.02	**2.43**	1.65	1.01	0.35
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	0.013
Cr	"	0.1	86.4	0.002	<0.002	0.003	<0.002	<0.002	0.003	0.014	0.009	0.003	<0.002
Cu	"	0.65	0.004	0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
Mn	"	0.15	0.183	0.001	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Se	"	0.05	0.008	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	0.003
V	"	0.049	ND	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5	10	0.005	0.085	0.031	0.038	0.038	0.025	0.027	0.099	1.163	0.013
Ca	"	NL	276	0.5	169	87	96	100	138	73	79	73	155
Mg	"	NL	153	0.5	81	42	47	49	69	37	41	46	110

[1]Lab reporting limit.
[2]Duplicate sample.
[3]No existing limit.
[4]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.