Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 17-27

TUNNEL AND RESERVOIR PLAN

THORNTON TRANSITIONAL FLOOD CONTROL

RESERVOIR AND WELLS

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2016

August 2017

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 (312) 751-5600

TUNNEL AND RESERVOIR PLAN
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ANNUAL GROUNDWATER MONITORING REPORT
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Monitoring and Research Department
Edward W. Podczerwinski, Acting Director

August 2017

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
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July 26, 2017

Chief
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Sir or Madam:

Subject: Tunnel and Reservoir Plan, Thornton Transitional Flood Control Reservoir and Wells, Annual Groundwater Monitoring Report for 2016

Attached are three copies of "Tunnel and Reservoir Plan, Thornton Transitional Flood Control Reservoir and Wells, Annual Groundwater Monitoring Report for 2016."

Very truly yours,

Albert E. Cox
Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:PL:cm
Attachment
cc/w att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)
Mr. Podczerwinski
Dr. Zhang
Dr. Cox
Dr. Tian
Dr. Lindo
cc w/o att: Mr. St. Pierre
Mr. Murray

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

°C	degrees Celsius
Ag	silver
As	arsenic
B	boron
Ba	barium
BG	billion gallons
BOD_5	five-day biochemical oxygen demand
Cd	cadmium
CFU	colony forming unit
Cl^-	chloride
CN^-	cyanide
Cr	chromium
CSO	combined sewer flow
Cu	copper
EC	electrical conductivity
F^-	fluoride
FC	fecal coliform
Fe	iron
ft	feet
Hg	mercury
IEPA	Illinois Environmental Protection Agency
L	liter
m	meter
mg	milligram
MG	million gallons
mL	milliliter
Mn	manganese
mS	millisiemen
NH_3-N	ammonia nitrogen
Ni	nickel
Pb	lead
SO_4^{2-}	sulfate
SOW	Scope of Work
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
TTR	Thornton Transitional Reservoir

ANNUAL DATA FOR MONITORING WELLS AND TRANSITIONAL RESERVOIR

Introduction

This report is submitted annually to fulfill the reporting requirements of the Illinois Environmental Protection Agency (IEPA) regarding the utilization of the Thornton Transitional Reservoir (TTR) for flood control. The reporting requirements, stated in Section 7 of the Scope of Work (SOW) approved by the IEPA on August 6, 2001, and modified May 9, 2005, for Groundwater Quality Monitoring of the Reservoir and adjacent wells, include:

1. Analytical data for the monitoring wells and transitional reservoir for the previous year.

2. Review and comparison of analytical data for the monitoring wells with calculated statistical limits for previously analyzed background samples in order to evaluate exceedances in the concentrations of analytes.

Project Description

The Reservoir is located in the West Lobe of the Thornton Quarry, southeast of the intersection of the Tri-State Tollway and Halsted Street in Thornton, Illinois (Figure 1). The Reservoir was the final structure to be implemented for the Little Calumet River Watershed under the Natural Resources Conservation Service Little Calumet Watershed Plan of November 1998. The Reservoir provides 3.7 billion gallons (BG) of floodwater storage, increased from the original volume of 3.1 BG due to additional rock mining. This provides sufficient volume to capture a 100-year storm event from Thorn Creek at a point just south of the Tri-State Tollway. This project provides flood control benefits for 21 businesses and 4,400 residences. Within the Little Calumet watershed are the Illinois communities of Blue Island, Calumet City, Dixmoor, Dolton, Glenwood, Harvey, Lansing, Phoenix, Riverdale, and South Holland, which all benefit from the implemented flood control measures.

The Reservoir consists of a diversion structure at Thorn Creek, a 24-foot diameter dropshaft, and 22-foot diameter conveyance tunnel to the Lower West Lobe of Thornton Quarry. The project also includes an 8-foot diameter tunnel connected to the Calumet Tunnel and Reservoir Plan System that is utilized for Reservoir dewatering purposes only.

The analytes measured in these samples include:

1. pH, electrical conductivity (EC), total dissolved solids (TDS), BOD_5, CN^-, F^-, Cl^-, SO_4^{2-}, NH_3-N, and phenol. Trace metals: Ag, As, B, Ba, Cd, Cr, Cu, Fe, Hg, Mn, Ni, and Pb.

2. Other parameters: fecal coliform (FC), groundwater temperature, and water elevation.

There was one significant rain event (2.75 inches rain) and a subsequent diversion/fill event during July 22 through 24, 2016 (Table 1) which resulted in an accumulation of 155 MG in the

FIGURE 1: THORNTON TRANSITIONAL RESERVOIR
MONITORING WELL LOCATIONS

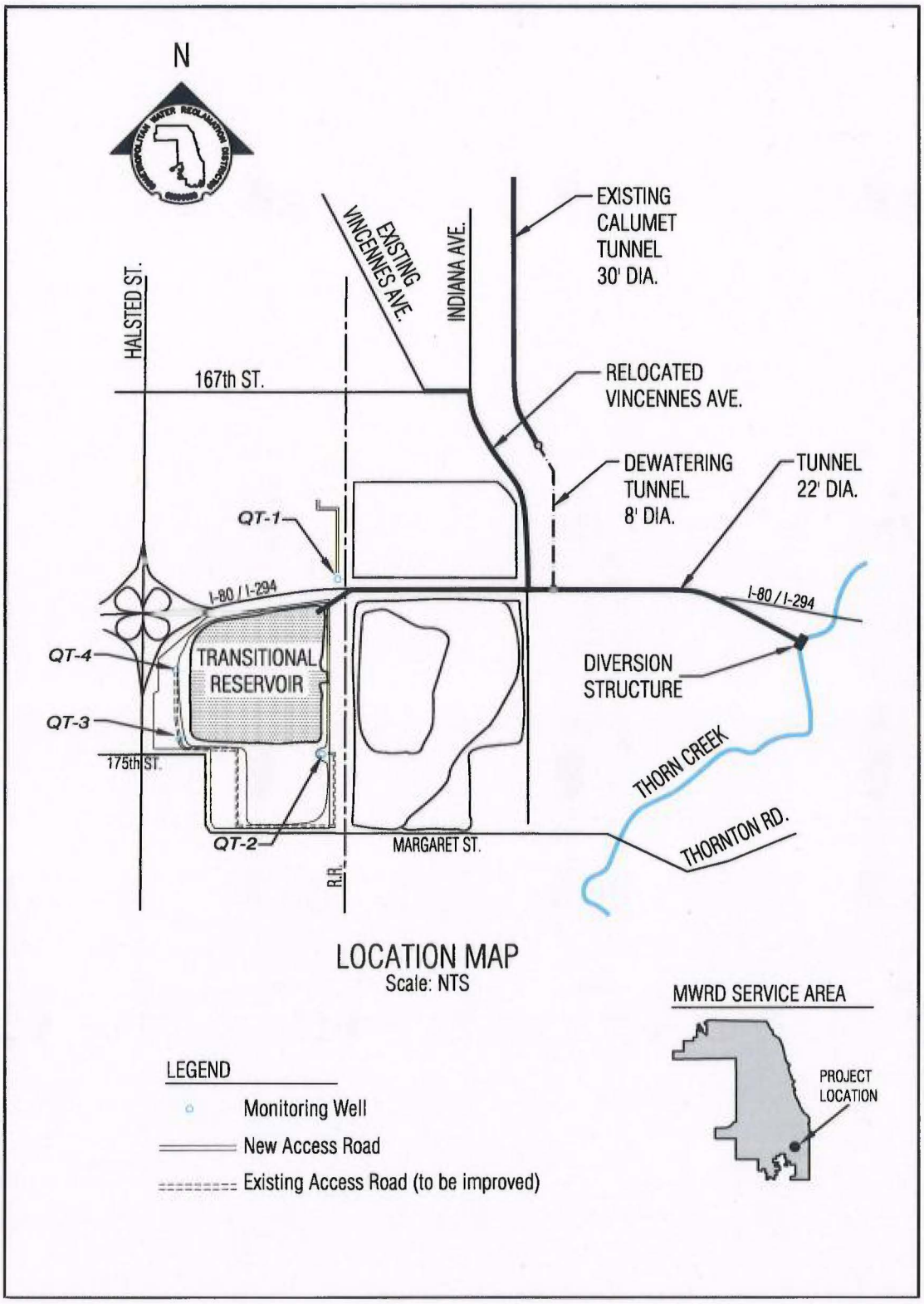

TABLE 1: DIVERSION TO THE THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR DURING 2016

Date of Diversion	Volume Collected in Thornton Transitional Reservoir	Rainfall (measured at Calumet WRP)	Date Reservoir Completely Drained	Number of Weeks Sampled
	million gallons	inches		
7/22/16	NA	0.03	NA[1]	24
7/23/16	NA	1.68		
7/24/16	NA	1.04		
Total	155	2.75		

[1]Not available; reservoir contained water January through July 2016.

Thornton Transitional Reservoir (TTR). Since the Thornton Composite Reservoir (TCR) was placed in service in October 2015, water accumulated in the TTR is generally used for flushing the TCR for odor-control procedures. As a result, water was impounded in the TTR between January and July 2016. This triggered 24 sampling events for all TTR wells (groundwater) and the reservoir (water from Thorn Creek and combined sewer flow [CSF]) from January through July 2016. Analytical data for all sampling events are reported in Tables 2 through 6.

Summary of Data for Monitoring Wells and Reservoir

Water was present in the TTR during January through July 2016. This accumulation of water required a total 24 weekly sampling events. Analytical data generated during this period are presented (Tables 2 through 6) for wells QT-1, -2, -3, -4, and the TTR, respectively. Well QT-4 was sampled only 16 times due to problems accessing this well during the period.

The parameters in the wells that exceeded the upper 95 percent confidence limits established for the background samples of respective wells are presented in Table 7. Some of these exceedances occurred only once. Manganese exceeded the established limit in all wells, while Cl^- and Fe exceeded the limit in two wells. In nearly all cases where exceedances were observed in 2016 for any parameter in a well, the corresponding concentration of that parameter in the reservoir was much lower than that in the well, indicating that the reservoir is most likely not the source of contamination causing the observed exceedances.

TABLE 2: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled[1]	pH	EC[2]	TDS[2]	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
		mS/m	mg/L											
Upper 95% Confidence Limit	7.6	N[3]	2,408	N	0.002	0.59	589	508	N	N	0.0000	0.001	N	0.095
01/07/16	7.1	415	2,386	<2	<0.005	0.35	960	315	0.32	0.006	<0.0010	<0.050	0.25	0.076
01/13/16	7.2	379	2,286	<2	<0.005	0.27	931	304	0.41	<0.005	<0.0010	<0.050	0.24	0.052
01/21/16	7.1	399	2,330	<2	<0.005	0.35	927	315	0.32	<0.005	<0.0010	<0.050	0.22	0.075
01/27/16	6.9	373	2,320	<2	<0.005	0.29	917	305	0.34	<0.005	<0.0010	<0.050	0.20	0.061
02/04/16	7.0	392	2,386	<2	<0.005	0.38	923	321	0.36	<0.005	<0.0010	<0.050	0.20	0.077
02/10/16	7.3	381	2,388	<2	<0.005	0.36	936	NRR[4]	0.36	<0.005	<0.0010	<0.050	0.21	0.075
02/18/16	7.1	417	2,366	<2	<0.005	0.37	935	332	0.37	<0.005	<0.0010	<0.050	0.19	0.076
02/24/16	7.2	412	2,360	<2	<0.005	0.36	587	315	0.30	<0.005	<0.0010	<0.050	0.19	0.072
03/10/16	7.3	397	2,462	<2	<0.005	0.37	936	297	0.28	<0.005	<0.0010	<0.050	0.17	0.081
03/17/16	7.3	368	2,298	<2	<0.005	0.36	882	320	0.32	<0.005	<0.0010	<0.050	0.18	0.083
03/23/16	7.2	404	2,450	<2	0.006	0.35	937	305	0.28	<0.005	<0.0010	<0.050	0.18	0.082
04/13/16	8.6	400	2,294	<2	<0.005	0.28	957	265	0.29	<0.005	<0.0010	<0.050	0.25	0.070
04/21/16	7.0	403	2,404	<2	<0.005	0.35	958	308	0.33	<0.005	<0.0010	<0.050	0.24	0.084
04/28/16	7.1	377	2,400	<2	<0.005	0.36	959	265	0.20	0.006	<0.0010	<0.050	0.21	0.084
05/04/16	7.1	384	918	<2	<0.005	0.30	NRR	357	0.19	<0.005	<0.0010	<0.050	0.15	0.030
05/12/16	7.3	413	2,264	<2	<0.005	0.24	949	262	0.24	<0.005	<0.0010	<0.050	0.21	0.051
05/18/16	7.4	421	2,384	<2	<0.005	0.35	951	308	0.28	<0.005	<0.0010	<0.050	0.22	0.092
05/25/16	6.9	400	2,548	<2	<0.005	0.37	917	283	0.29	<0.005	<0.0010	<0.050	0.21	0.096
06/02/16	7.3	405	2,452	<2	<0.005	0.37	961	295	0.22	<0.005	<0.0010	<0.050	0.24	0.092
06/09/16	7.1	414	2,480	<2	<0.005	0.36	964	266	0.26	<0.005	<0.0010	<0.050	0.16	0.081
07/28/16	6.9	392	2,612	<2	<0.005	0.35	979	289	0.27	0.006	<0.0010	<0.050	0.20	0.070

TABLE 2 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled[1]	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Water Elevation[5]	Recharge Time
	mg/L								CFU/100 mL	°C	ft	hr
Upper 95% Confidence Limit	0.002	0.005	0.022	49	0.00005	0.094	0.005	0.019	N	N	N	N
01/07/16	0.002	<0.005	<0.005	12	<0.0002	0.102	<0.005	<0.020	<1	12.4	-148	<48
01/13/16	0.001	<0.005	<0.005	15	<0.0002	0.931	<0.005	<0.020	<1	12.0	-148	<48
01/21/16	0.001	<0.005	<0.005	13	<0.0002	0.191	<0.005	<0.020	<1	12.3	-151	<48
01/27/16	0.001	<0.005	<0.005	16	<0.0002	0.506	<0.005	<0.020	<1	12.4	-146	<48
02/04/16	0.002	<0.005	<0.005	14	<0.0002	0.084	<0.005	<0.020	<1	12.1	-146	<48
02/10/16	<0.001	<0.005	0.005	10	<0.0002	0.098	<0.005	<0.020	<1	11.6	-155	<48
02/18/16	0.001	<0.005	<0.005	14	<0.0002	0.180	<0.005	<0.020	<1	12.4	-155	<48
02/24/16	0.001	<0.005	<0.005	14	<0.0002	0.169	<0.005	<0.020	<1	11.9	-158	<48
03/10/16	0.002	<0.005	0.007	16	<0.0002	0.105	<0.005	<0.020	<1	13.3	-148	<48
03/17/16	0.002	<0.005	<0.005	14	<0.0002	0.078	<0.005	<0.020	<1	13.7	-148	<48
03/23/16	0.002	<0.005	0.018	13	<0.0002	0.120	<0.005	<0.020	<1	12.6	-150	<48
04/13/16	<0.001	<0.005	<0.005	11	<0.0002	0.216	<0.005	<0.020	<1	13.1	-69	<48
04/21/16	<0.001	0.069	0.009	13	<0.0002	0.083	0.781	<0.020	<1	13.4	-150	<48
04/28/16	<0.001	<0.005	0.007	13	<0.0002	0.133	<0.005	<0.020	<1	12.3	-146	<48
05/04/16	<0.001	<0.005	<0.005	4	<0.0002	0.026	0.008	<0.020	<1	13.1	-150	<48
05/12/16	<0.001	<0.005	0.009	16	<0.0002	0.539	<0.005	<0.020	<1	13.3	-147	<48
05/18/16	<0.001	<0.005	<0.005	13	<0.0002	0.118	<0.005	<0.020	<1	14.1	-146	<48
05/25/16	<0.001	<0.005	0.008	14	<0.0002	0.148	<0.005	<0.020	<1	13.8	-149	<48
06/02/16	<0.001	<0.005	<0.005	13	<0.0002	0.160	<0.005	<0.020	1	12.8	-155	<48
06/09/16	0.007	<0.005	<0.005	14	<0.0002	0.123	<0.005	<0.020	<1	13.0	-150	<48
07/28/16	<0.001	<0.005	<0.005	14	<0.0002	0.113	<0.005	<0.010	<1	13.8	-160	<48

[1]Samples retrieved from QT-1 following rain events as well as prolonged storage of water in reservoir (for operational procedures).
[2]EC = electrical conductivity; TDS = total dissolved solids.
[3]No limit.
[4]No reportable result.
[5]Relative to Chicago City Datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

TABLE 3: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled[1]	pH	EC[2]	TDS[2]	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
		mS/m	mg/L											
Upper 95% Confidence Limit	7.5	N[3]	2,651	N	0.002	0.38	478	757	N	N	0.0001	0.006	N	0.069
01/07/16	7.2	156	1,090	<2	<0.005	0.22	106	503	0.24	<0.005	<0.0010	<0.050	0.21	0.031
01/13/16	7.1	142	1,072	<2	<0.005	0.27	104	491	0.33	<0.005	<0.0010	<0.050	0.19	0.031
01/21/16	7.1	147	1,016	<2	<0.005	0.27	100	485	0.24	<0.005	<0.0010	<0.050	0.16	0.031
01/27/16	7.2	155	1,254	<2	<0.005	0.26	93	645	0.24	<0.005	<0.0010	<0.050	0.12	0.033
02/04/16	7.1	184	1,336	<2	<0.005	0.24	97	688	0.25	<0.005	<0.0010	<0.050	0.14	0.035
02/10/16	6.7	159	1,288	<2	<0.005	0.26	106	624	0.21	<0.005	<0.0010	<0.050	0.15	0.034
02/18/16	7.2	105	1,076	<2	<0.005	0.29	113	551	0.29	<0.005	<0.0010	<0.050	0.14	0.031
02/24/16	7.1	158	1,008	<2	<0.005	0.28	116	500	0.19	<0.005	<0.0010	<0.050	0.14	0.031
03/03/16	7.2	153	976	<2	<0.005	0.30	103	460	0.20	<0.005	<0.0010	<0.050	0.19	0.032
03/10/16	7.4	154	1,010	<2	<0.005	0.29	101	465	0.17	<0.005	<0.0010	<0.050	0.15	0.032
03/17/16	7.4	143	968	<2	<0.005	0.30	106	479	0.19	<0.005	<0.0010	<0.050	0.16	0.031
03/23/16	7.4	149	944	<2	0.006	0.30	99	445	0.16	<0.005	<0.0010	<0.050	0.14	0.029
03/31/16	7.8	137	916	<2	<0.005	0.27	109	413	0.16	<0.005	<0.0010	<0.050	0.17	0.031
04/07/16	8.0	152	868	<2	<0.005	0.30	101	395	0.21	<0.005	<0.0010	<0.050	0.18	0.031
04/13/16	7.8	137	908	<2	<0.005	0.29	118	407	0.19	<0.005	<0.0010	<0.050	0.18	0.031
04/21/16	7.3	148	918	<2	<0.005	0.30	101	407	0.22	<0.005	<0.0010	<0.050	0.16	0.029
04/28/16	7.2	132	876	<2	<0.005	0.26	101	389	0.10	<0.005	<0.0010	<0.050	0.15	0.029
05/04/16	7.3	133	1,382	<2	<0.005	0.21	367	207	0.18	<0.005	<0.0010	<0.050	0.11	0.090
05/12/16	7.2	147	890	<2	<0.005	0.31	102	365	0.13	<0.005	<0.0010	<0.050	0.15	0.029
05/18/16	7.2	150	1,134	<2	<0.005	0.27	107	533	0.10	<0.005	<0.0010	0.058	0.15	0.037
05/25/16	7.2	160	1,146	<2	<0.005	0.28	103	480	0.24	<0.005	<0.0010	<0.050	0.15	0.036
06/02/16	7.2	131	982	<2	<0.005	0.28	107	436	0.10	<0.005	<0.0010	<0.050	0.17	0.033
06/09/16	7.0	138	1,032	<2	<0.005	0.28	102	440	<0.10	<0.005	<0.0010	<0.050	0.11	0.031
07/28/16	7.5	130	998	<2	<0.005	0.30	141	264	<0.10	<0.005	<0.0010	0.033	0.18	0.028

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled[1]	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Water Elevation[4]	Recharge Time
	mg/L								CFU/100 mL	°C	ft	hr
Upper 95% Confidence Limit	0.002	0.007	0.033	5	0.0003	0.063	N	0.019	N	N	N	N
01/07/16	0.001	<0.005	<0.005	6.6	<0.0002	0.052	0.011	<0.020	<1	13.2	-179	<48
01/13/16	0.001	<0.005	<0.005	7.7	<0.0002	0.066	0.025	<0.020	<1	12.4	-179	<48
01/21/16	<0.001	<0.005	<0.005	7.2	<0.0002	0.072	0.009	<0.020	<1	12.9	-179	<48
01/27/16	0.002	<0.005	<0.005	11	<0.0002	0.089	0.013	<0.020	<1	12.5	-180	<48
02/04/16	0.001	<0.005	<0.005	9.5	<0.0002	0.083	0.039	<0.020	<1	11.7	-184	<48
02/10/16	<0.001	0.005	<0.005	6.6	<0.0002	0.050	0.014	<0.020	<1	12.7	-182	<48
02/18/16	0.001	<0.005	<0.005	8.3	<0.0002	0.080	0.008	<0.020	<1	13.1	-182	<48
02/24/16	<0.001	<0.005	<0.005	6.8	<0.0002	0.061	0.013	<0.020	<1	12.0	-186	<48
03/03/16	0.001	<0.005	<0.005	5.4	<0.0002	0.041	0.008	<0.020	<1	12.9	-189	<48
03/10/16	<0.001	<0.005	<0.005	4.7	<0.0002	0.033	0.008	<0.020	<1	13.2	-183	<48
03/17/16	<0.001	<0.005	<0.005	4.9	<0.0002	0.043	0.007	<0.020	<1	13.3	-184	<48
03/23/16	0.001	<0.005	<0.005	4.7	<0.0002	0.038	0.010	<0.020	<1	12.9	-185	<48
03/31/16	0.002	<0.005	<0.005	4.7	<0.0002	0.042	0.009	<0.020	<1	14.1	-184	<48
04/07/16	<0.001	<0.005	<0.005	4.9	<0.0002	0.040	0.007	<0.020	<1	13.5	-183	<48
04/13/16	<0.001	<0.005	<0.005	4.6	<0.0002	0.037	0.017	<0.020	<1	13.6	-183	<48
04/21/16	<0.001	<0.005	<0.005	4.7	<0.0002	0.042	0.019	<0.020	<1	13.6	-183	<48
04/28/16	<0.001	<0.005	<0.005	4.2	<0.0002	0.034	0.008	<0.020	<1	13.8	-181	<48
05/04/16	<0.001	<0.005	<0.005	24	<0.0002	0.292	<0.005	<0.020	<1	13.9	-188	<48
05/12/16	<0.001	<0.005	<0.005	4.1	<0.0002	0.025	0.010	<0.020	<1	14.2	-188	<48
05/18/16	<0.001	<0.005	<0.005	5.6	<0.0002	0.045	0.008	<0.020	<1	14.4	-187	<48
05/25/16	<0.001	<0.005	<0.005	6.6	<0.0002	0.052	0.009	<0.020	<1	14.1	-188	<48
06/02/16	<0.001	<0.005	<0.005	5.4	<0.0002	0.046	0.008	<0.020	<1	13.8	-182	<48
06/09/16	<0.001	<0.005	<0.005	5.0	<0.0002	0.048	0.008	<0.020	<1	14.0	-186	<48

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Water Elevatin[4]	Recharge Time
	mg/L								CFU/100 mL	°C	ft	hr
07/28/16	<0.001	<0.005	<0.005	1.5	<0.0002	0.013	0.005	<0.010	1	14.4	-193	<48

[1]Samples retrieved from QT-2 following rain events as well as prolonged storage of water in reservoir (for operational procedures).
[2]EC = electrical conductivity; TDS = total dissolved solids.
[3]No limit.
[4]Relative to Chicago City Datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

TABLE 4: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled[1]	pH	EC[2]	TDS[2]	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
		mS/m	mg/L											
Upper 95% Confidence Limit	7.8	N[3]	1,353	N	0.002	0.36	190	238	N	N	0.0292	0.000	N	0.082
01/07/16	7.0	231	1,330	<2	<0.005	0.22	356	220	0.23	0.006	<0.0010	<0.050	0.17	0.081
01/13/16	7.0	217	1,380	3	<0.005	0.21	281	214	0.31	<0.005	<0.0010	<0.050	0.14	0.082
01/21/16	7.0	229	1,298	<2	<0.005	0.21	375	206	0.28	<0.005	<0.0010	<0.050	0.11	0.082
01/27/16	7.1	210	1,312	<2	<0.005	0.20	358	209	0.26	0.005	<0.0010	<0.050	0.10	0.082
02/04/16	7.0	226	1,268	<2	<0.005	0.22	368	203	0.27	<0.005	<0.0010	<0.050	0.13	0.079
02/10/16	7.1	206	1,288	<2	<0.005	0.21	358	211	0.25	<0.005	<0.0010	<0.050	0.18	0.076
02/18/16	7.0	221	1,244	<2	<0.005	0.23	406	208	0.27	<0.005	<0.0010	<0.050	0.11	0.078
02/24/16	7.1	222	1,252	<2	<0.005	0.22	348	197	0.18	0.005	<0.0010	<0.050	0.11	0.079
03/03/16	7.3	220	1,258	<2	<0.005	0.21	362	202	0.18	<0.005	<0.0010	<0.050	0.11	0.083
03/10/16	7.2	228	1,358	<2	<0.005	0.22	364	199	0.18	<0.005	<0.0010	<0.050	0.13	0.086
03/17/16	7.3	216	1,038	<2	<0.005	0.22	370	205	0.22	<0.005	<0.0010	<0.050	0.14	0.087
03/23/16	7.2	221	1,366	<2	<0.005	0.21	387	205	0.18	<0.005	<0.0010	<0.050	0.11	0.086
03/31/16	7.8	214	1,366	<2	<0.005	0.21	388	220	0.19	0.006	<0.0010	<0.050	0.16	0.094
04/07/16	7.9	219	1,280	<2	<0.005	0.24	373	184	0.22	<0.005	<0.0010	<0.050	0.16	0.091
04/13/16	8.2	226	1,300	<2	<0.005	0.21	373	200	0.21	<0.005	<0.0010	<0.050	0.13	0.092
04/21/16	7.0	226	1,382	<2	<0.005	0.21	374	197	0.22	0.007	<0.0010	<0.050	0.12	0.090
04/28/16	7.0	101	1,316	<2	<0.005	0.20	369	196	0.12	0.008	<0.0010	<0.050	0.11	0.093
05/04/16	7.5	226	2,460	<2	<0.005	0.37	905	279	0.26	<0.005	<0.0010	<0.050	0.20	0.085
05/12/16	7.1	222	1,308	<2	<0.005	0.21	373	214	0.14	<0.005	<0.0010	<0.050	0.10	0.092
05/18/16	7.1	212	1,324	<2	<0.005	0.20	368	202	0.18	0.005	<0.0010	<0.050	0.14	0.098
05/25/16	7.0	222	1,498	<2	<0.005	0.22	368	196	0.18	0.005	<0.0010	<0.050	0.12	0.099
06/02/16	7.3	228	1,336	<2	<0.005	0.23	385	191	0.12	<0.005	<0.0010	<0.050	0.12	0.096
06/09/16	7.1	224	1,392	<2	<0.005	0.22	374	185	0.12	<0.005	<0.0010	<0.050	0.07	0.086
07/28/16	7.1	207	1,508	10	<0.005	0.22	368	183	<0.10	0.009	<0.0010	<0.020	0.25	0.070

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Water Elevation[4]	Recharge Time
	mg/L								CFU/100 mL	°C	ft	hr
Upper 95% Confidence Limit	0.001	0.006	0.022	21	0.00005	0.158	N	0.014	N	N	N	N
01/07/16	0.002	<0.005	<0.005	15	<0.0002	0.209	<0.005	<0.020	<1	12.1	-177	<48
01/13/16	0.003	<0.005	<0.005	24	<0.0002	0.345	<0.005	<0.020	<1	11.0	-174	<48
01/21/16	0.003	<0.005	<0.005	25	<0.0002	0.416	<0.005	<0.020	<1	11.6	-180	<48
01/27/16	0.003	<0.005	<0.005	27	<0.0002	0.356	<0.005	<0.020	<1	11.3	-174	<48
02/04/16	0.003	<0.005	<0.005	21	<0.0002	0.362	0.009	<0.020	<1	11.2	-180	<48
02/10/16	<0.001	<0.005	<0.005	3.8	<0.0002	0.080	<0.005	<0.020	<1	10.2	-191	<48
02/18/16	0.004	<0.005	<0.005	26	<0.0002	0.297	<0.005	<0.020	<1	11.4	-191	<48
02/24/16	0.003	<0.005	<0.005	25	<0.0002	0.337	0.021	<0.020	<1	11.4	-193	<48
03/03/16	0.003	<0.005	<0.005	25	<0.0002	0.344	0.005	<0.020	<1	12.8	-193	<48
03/10/16	0.002	<0.005	<0.005	16	<0.0002	0.162	<0.005	<0.020	<1	11.9	-176	<48
03/17/16	0.001	<0.005	<0.005	13	<0.0002	0.136	<0.005	<0.020	<1	12.0	-178	<48
03/23/16	0.003	<0.005	0.006	20	<0.0002	0.269	<0.005	<0.020	<1	11.8	-180	<48
03/31/16	0.014	<0.005	0.005	12	<0.0002	0.148	<0.005	<0.020	<1	12.6	-180	<48
04/07/16	<0.001	<0.005	<0.005	19	<0.0002	0.281	<0.005	<0.020	<1	12.0	-177	<48
04/13/16	<0.001	<0.005	<0.005	24	<0.0002	0.304	<0.005	<0.020	<1	12.6	-178	<48
04/21/16	<0.001	<0.005	<0.005	25	<0.0002	0.336	0.008	<0.020	<1	13.0	-183	<48
04/28/16	<0.001	<0.005	<0.005	25	<0.0002	0.326	<0.005	<0.020	<1	12.0	-181	<48
05/04/16	<0.001	<0.005	<0.005	14	<0.0002	0.125	<0.005	<0.020	<1	12.3	-185	<48
05/12/16	<0.001	<0.005	<0.005	26	<0.0002	0.357	<0.005	<0.020	<1	12.6	-184	<48
05/18/16	<0.001	<0.005	<0.005	16	<0.0002	0.182	<0.005	<0.020	<1	13.7	-186	<48
05/25/16	<0.001	<0.005	<0.005	25	<0.0002	0.313	<0.005	<0.020	<1	12.9	-186	<48
06/02/16	<0.001	<0.005	<0.005	26	<0.0002	0.368	<0.005	<0.020	<1	12.7	-192	<48

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Water Elevation	Recharge Time
	mg/L								CFU/100 mL	°C	(ft)	hr
06/09/16	0.003	<0.005	<0.005	24	<0.0002	0.304	<0.005	<0.020	<1	12.9	-194	<48
07/28/16	<0.001	<0.005	<0.005	12	<0.0002	0.138	<0.005	<0.020	<1	13.1	-185	<48

[1]Samples retrieved from QT-3 following rain events as well as prolonged storage of water in reservoir (for operational procedures).
[2]EC = electrical conductivity; TDS = total dissolved solids.
[3]No limit.
[4]Relative to Chicago City Datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled[1]	pH	EC[2]	TDS[2]	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
		mS/M	mg/L											
Upper 95% Confidence Limit	7.7	N[3]	2,034	N	0.002	0.39	590	314	N	N	0.0033	N	N	0.181
01/07/16	7.1	205	1,224	<2	<0.005	0.25	288	255	0.32	0.005	<0.0010	<0.050	0.44	0.074
01/13/16	7.2	198	1,266	<2	<0.005	0.25	298	249	0.38	<0.005	<0.0010	<0.050	0.43	0.074
01/21/16	7.0	200	1,178	<2	<0.005	0.26	282	243	0.38	<0.005	<0.0010	<0.050	0.39	0.073
01/27/16	7.2	190	1,194	<2	<0.005	0.24	267	242	0.32	<0.005	<0.0010	<0.050	0.34	0.075
02/04/16	7.2	198	1,176	<2	<0.005	0.26	268	239	0.38	<0.005	<0.0010	<0.050	0.35	0.069
02/10/16	6.9	185	1,218	<2	<0.005	0.26	259	242	0.36	<0.005	<0.0010	<0.050	0.35	0.069
02/18/16	7.1	205	1,200	<2	<0.005	0.27	312	241	0.36	0.005	<0.0010	<0.050	0.35	0.071
02/24/16	7.2	203	1,160	5	<0.005	0.24	305	237	0.26	<0.005	<0.0010	<0.050	0.35	0.069
03/10/16	7.3	196	1,276	<2	<0.005	0.26	267	231	0.28	<0.005	<0.0010	<0.050	0.34	0.074
03/17/16	7.4	202	1,154	<2	<0.005	0.26	274	250	0.32	<0.005	<0.0010	<0.050	0.35	0.077
03/23/16	7.3	202	1,248	<2	0.006	0.26	283	234	0.27	<0.005	<0.0010	<0.050	0.32	0.077
04/13/16	8.3	201	1,184	<2	<0.005	0.25	273	233	0.29	<0.005	<0.0010	<0.050	0.43	0.076
05/18/16	7.7	223	1,146	<2	<0.005	0.25	243	248	0.25	<0.005	<0.0010	<0.050	0.41	0.077
05/25/16	7.1	193	1,242	<2	<0.005	0.26	261	226	0.27	<0.005	<0.0010	<0.050	0.39	0.080
06/09/16	7.5	192	1,244	<2	<0.005	0.21	275	210	0.19	<0.005	<0.0010	<0.050	0.33	0.065
07/28/16	7.2	210	1,456	<2	<0.005	0.22	299	219	0.14	0.008	<0.0010	<0.050	0.41	0.065

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Date Sampled	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Water Elevation[4]	Recharge Time
	mg/L								CFU/100 mL	°C	ft	hr
Upper 95% Confidence Limit	0.001	0.022	0.035	24	0.00004	0.203	N	0.018	N	N	N	N
01/07/16	<0.001	<0.005	<0.005	12	<0.0002	0.105	<0.005	<0.020	<1	12.3	-91	<48
01/13/16	0.001	<0.005	<0.005	12	<0.0002	0.144	<0.005	<0.020	<1	13.7	-89	<48
01/21/16	0.001	<0.005	<0.005	14	<0.0002	0.195	<0.005	<0.020	<1	13.8	-93	<48
01/27/16	0.001	<0.005	<0.005	15	<0.0002	0.243	<0.005	<0.020	<1	11.7	-90	<48
02/04/16	<0.001	<0.005	<0.005	11	<0.0002	0.205	<0.005	<0.020	<1	13.5	-89	<48
02/10/16	<0.001	<0.005	<0.005	10	<0.0002	0.071	<0.005	<0.020	<1	13.0	-105	<48
02/18/16	0.001	<0.005	<0.005	14	<0.0002	0.215	<0.005	<0.020	<1	12.5	-105	<48
02/24/16	0.002	<0.005	<0.005	14	<0.0002	0.200	<0.005	<0.020	<1	13.7	-110	<48
03/10/16	0.002	<0.005	<0.005	11	<0.0002	0.099	<0.005	<0.020	<1	13.1	-89	<48
03/17/16	0.002	<0.005	<0.005	11	<0.0002	0.088	<0.005	<0.020	<1	13.5	-90	<48
03/23/16	0.002	<0.005	<0.005	15	<0.0002	0.199	<0.005	<0.020	<1	13.0	-89	<48
04/13/16	<0.001	<0.005	<0.005	12	<0.0002	0.246	<0.005	<0.020	<1	13.5	-89	<48
05/18/16	<0.001	<0.005	<0.005	13	<0.0002	0.101	<0.005	<0.020	<1	13.9	-88	<48
05/25/16	<0.001	<0.005	<0.005	16	<0.0002	0.193	<0.005	<0.020	<1	13.0	-90	<48
06/09/16	0.001	<0.005	<0.005	10	<0.0002	0.215	<0.005	<0.020	<1	13.6	-123	<48
07/28/16	<0.001	<0.005	<0.005	8	<0.0002	0.096	<0.005	<0.010	<1	13.6	-90	<48

[1]Samples retrieved from QT-4 following rain events as well as prolonged storage of water in reservoir (for operational procedures).
[2]EC = electrical conductivity; TDS = total dissolved solids.
[3]No limit.
[4]Relative to Chicago City Datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

TABLE 6: ANALYSIS OF FILL-EVENT WATER STORED IN THE THORNTON TRANSITIONAL RESERVOIR LOCATED AT THE THORNTON SITE AND SAMPLED DURING 2016

Date Sampled[1]	pH	TDS[2]	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
		mg/L											
02/03/16	6.8	372	<2	<0.005	0.22	83	68	0.11	<0.005	<0.0010	<0.050	0.07	0.022
02/10/16	7.6	424	<2	<0.005	0.19	85	67	<0.10	<0.005	<0.0010	<0.050	0.07	0.022
02/18/16	6.2	398	3	<0.005	0.22	103	74	0.11	<0.005	<0.0010	<0.050	0.07	0.023
02/24/16	7.6	420	<2	<0.005	0.19	97	81	<0.10	<0.005	<0.0010	<0.050	0.08	0.022
03/10/16	6.4	422	3	<0.005	0.22	98	78	<0.10	<0.005	<0.0010	<0.050	0.09	0.023
03/17/16	8.7	422	5	<0.005	0.21	98	89	<0.10	<0.005	<0.0010	<0.050	0.09	0.023
03/24/16	8.8	428	4	<0.005	0.19	90	81	0.14	<0.005	<0.0010	<0.050	0.08	0.021
03/31/16	6.4	452	4	<0.005	0.18	99	93	<0.10	<0.005	<0.0010	<0.050	0.09	0.024
04/07/16	6.7	432	3	<0.005	0.22	98	101	<0.10	<0.005	<0.0010	<0.050	0.10	0.024
04/13/16	8.7	452	<2	<0.005	0.22	123	104	<0.10	<0.005	<0.0010	<0.050	0.12	0.024
04/21/16	6.7	500	3	<0.005	0.21	100	114	<0.10	<0.005	<0.0010	<0.050	0.09	0.023
04/28/16	7.0	484	3	<0.005	0.20	108	111	<0.10	<0.005	<0.0010	<0.050	0.09	0.023
05/04/16	7.2	480	<2	<0.005	0.22	108	117	<0.10	<0.005	<0.0010	<0.050	0.09	0.022
05/12/16	8.9	476	3	<0.005	0.21	104	123	<0.10	<0.005	<0.0010	<0.050	0.10	0.021
05/18/16	7.3	512	<2	<0.005	0.22	105	140	<0.10	<0.005	<0.0010	<0.050	0.11	0.021
05/25/16	7.2	590	5	<0.005	0.22	110	134	<0.10	<0.005	<0.0010	<0.050	0.12	0.022
06/02/16	7.4	556	<2	<0.005	0.22	119	149	<0.10	<0.005	<0.0010	<0.050	0.13	0.021
06/09/16	6.9	646	<2	<0.005	0.22	125	162	<0.10	<0.005	<0.0010	<0.050	0.11	0.023
07/25/16	7.1	332	15	<0.005	0.22	57	84	0.15	<0.005	<0.0010	<0.020	0.11	0.038

TABLE 6 (Continued): ANALYSIS OF FILL-EVENT WATER STORED IN THE THORNTON TRANSITIONAL RESERVOIR LOCATED AT THE THORNTON SITE AND SAMPLED DURING 2016

Date Sampled[1]	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp	Depth of Water
	mg/L								CFU/100 mL	°C	ft
02/03/16	<0.001	<0.005	<0.005	0.40	<0.0002	0.010	<0.005	<0.020	20	3.0	18
02/10/16	0.001	<0.005	<0.005	0.27	<0.0002	0.006	<0.005	<0.020	<10	2.0	18
02/18/16	<0.001	<0.005	<0.005	0.55	<0.0002	0.020	<0.005	<0.020	<10	NA[3]	18
02/24/16	<0.001	<0.005	<0.005	0.32	<0.0002	0.013	0.006	<0.020	<10	3.0	18
03/10/16	<0.001	<0.005	<0.005	0.12	<0.0002	0.005	<0.005	<0.020	<10	NA	18
03/17/16	<0.001	<0.005	<0.005	0.15	<0.0002	0.006	<0.005	<0.020	<10	23.1	18
03/24/16	<0.001	<0.005	<0.005	0.11	<0.0002	0.004	<0.005	<0.020	<10	9.0	18
03/31/16	0.001	<0.005	<0.005	0.11	<0.0002	0.004	<0.005	<0.020	<10	7.0	18
04/07/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.004	<0.005	<0.020	<10	5.0	20
04/13/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.007	<0.005	<0.020	<10	9.5	18
04/21/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.004	<0.005	<0.020	40	16.0	18
04/28/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.006	<0.005	<0.020	200	6.0	18
05/04/16	<0.001	<0.005	<0.005	0.12	<0.0002	0.007	0.007	<0.020	90	10.0	19
05/12/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.004	0.007	<0.020	3,700	18.1	18
05/18/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.004	0.006	<0.020	<10	14.0	16
05/25/16	<0.001	<0.005	<0.005	0.21	<0.0002	0.010	0.007	<0.020	310	23.0	15
06/02/16	<0.001	<0.005	<0.005	<0.10	<0.0002	0.005	0.005	<0.020	260	26.0	17
06/09/16	<0.001	<0.005	<0.005	0.16	<0.0002	0.009	0.007	<0.020	390	16.0	13
07/25/16	<0.001	0.005	0.009	3.7	<0.0002	0.116	0.007	<0.020	1,200	26.0	5

[1]Samples retrieved from the Transitional Reservoir following rain events during 2016, and also due to prolonged storage of water in reservoir at the frequency similar to monitoring wells.
[2]TDS = total dissolved solids.
[3]No available reading.

TABLE 7: EXCEEDANCES[1] DETECTED IN WELLS AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2016

Well	Parameter exceeding limit[1]
1	TDS, Cl^-, Mn
2	Fe, Mn
3	TDS, Cl^-, Ba, Cd, Fe, Mn
4	Mn

[1]Concentrations of analytes exceed upper limits of 95% confidence intervals for background samples.