

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 14-35

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2013

September 2014

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

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September 26, 2014

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Bureau Chief
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P. O. Box 19276
Springfield, IL 62794-9276

Dear Ms. Willhite:

Subject: Tunnel and Reservoir Plan, Upper Des Plaines Tunnel System, Annual
Groundwater Monitoring Report for 2013

Attached are three copies of "Tunnel and Reservoir Plan, Upper Des Plaines Tunnel
System, Annual Groundwater Monitoring Report for 2013."

Very truly yours,

Thomas C. Granato, Ph.D.
Director
Monitoring and Research

TCG:PL:cm

Attachment

cc w/att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)

Dr. Zhang

Dr. Cox

Dr. Hundal

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cc w/o att: Mr. St. Pierre

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**TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
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FOR 2013**

**Monitoring and Research Department
Thomas C. Granato, Director**

September 2014

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ANNUAL DATA FOR MONITORING WELLS

Introduction

This system consists of two sub-systems, Upper Des Plaines (UDP) 20 and UDP 21. The UDP 20 contains six monitoring wells, MW-1 through MW-6, while UDP 21 contains three monitoring wells, MW-7 through MW-9 ([Figure 1](#)). These nine monitoring wells are all sampled six times per year (Illinois Environmental Protection Agency memorandum dated July 9, 2004). Groundwater elevations in the monitoring wells were measured during each sampling event. Since these also function as observation wells, elevations were measured bi-weekly.

All monitoring wells in the UDP Tunnel system were sampled at the required frequency. However, samples could not be retrieved from a few wells. Monitoring wells MW-2 and MW-5 could not be sampled during 2011 through 2013, probably due to inoperable pumps. Well MW-7 yielded samples only twice for the entire year. These defective wells are scheduled for service as soon as wells at a nearby site are completed. Unlike the previous year, Wells MW-8 and -9 were sampled this year at the required frequency, following repairs in May 2013.

Summary of Data for Monitoring Wells

The analytical data for groundwater sampled during 2013 from monitoring wells MW-1 through MW-9 are presented in [Table 1](#). Physical characteristics, such as elevation, groundwater temperature, and estimated time of recharge for each well between initial drawdown and sampling, are also included. Fecal coliform (FC) counts for all wells were non-detectable, but between August and October MW-8 contained elevated FC counts (maximum of 3,700 MPN/100mL) which decreased to 5 MPN/100 mL by December 2013. On June 19, 2013, Well MW-6 contained 24 MPN/100 mL. [Table 2](#) lists the descriptive statistics for groundwater data of monitoring wells MW-1 through MW-9 for the year 2013.

Adjusted groundwater elevations in Wells MW-1 through MW-9 were calculated relative to the Chicago city datum (579.48 ft. above mean sea level) at the intersection of Madison and State Streets ([Table 3](#)). The minimum, mean, and maximum values for each well were calculated and plotted to determine fluctuations in groundwater elevations during the year ([Figure 2](#)). Generally, these fluctuations were apparent in several wells throughout the year.

FIGURE 1: MAP OF MONITORING WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM

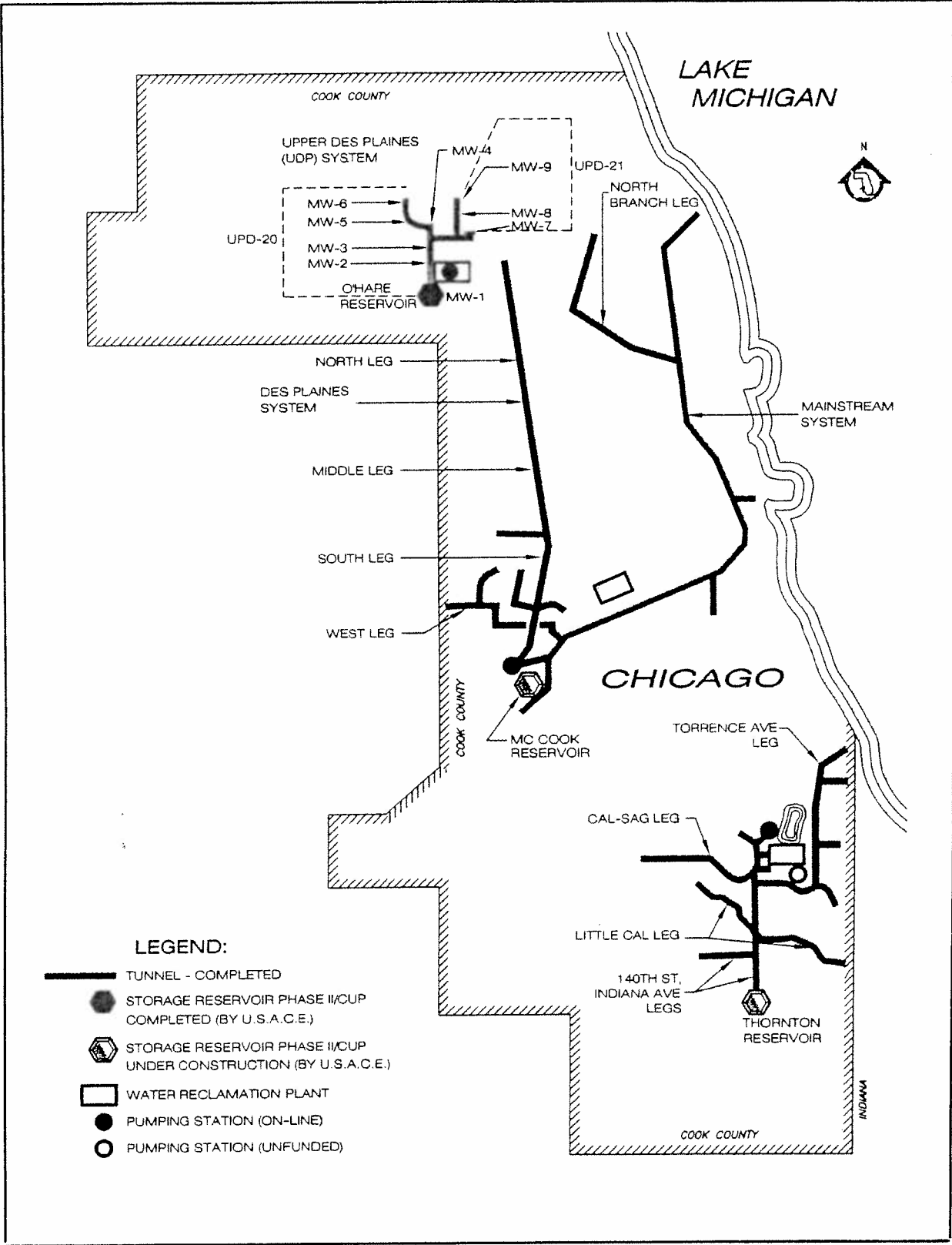


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2013

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	----- mg/L -----						MPN/100 mL	°C	ft.	hr.
MW-1	01/16/13	7.2	88	808	<1	28	355	0.29	475	<1	12.1	14	<48
MW-1	03/27/13	7.6	70	792	<1	30	357	0.34	477	2	14.2	15	<48
MW-1	05/23/13	7.2	79	818	<1	<10	363	0.42	447	<1	14.5	29	<48
MW-1	07/10/13	7.5	82	818	1	128	360	0.29	448	2	15.3	13	<48
MW-1	09/12/13	7.7	88	814	<1	30	374	0.25	452	<1	13.0	10	<48
MW-1	11/07/13	7.7	83	766	1	30	357	0.36	418	<1	13.2	13	<48
MW-3	02/21/13	7.3	75	804	<1	17	447	0.34	483	<1	13.4	34	<48
MW-3	05/23/13	7.5	97	838	<1	<10	426	0.34	471	<1	14.2	34	<48
MW-3	08/28/13	7.7	77	852	<1	13	451	0.34	460	<1	15.9	39	<48
MW-3	09/12/13	7.8	87	836	<1	12	448	0.34	443	<1	15.9	31	<48
MW-3	10/16/13	7.3	81	828	<1	15	397	0.32	452	<1	14.3	39	<48
MW-3	11/14/13	7.7	70	808	1	14	424	0.34	469	<1	13.8	38	<48
MW-4	02/21/13	7.8	74	882	1	84	356	<0.10	521	<1	13.1	-23	<48
MW-4	05/23/13	7.4	99	952	<1	<10	365	<0.10	536	<1	13.8	-20	<48
MW-4	08/28/13	7.7	103	1,024	<1	65	368	0.17	564	<1	14.4	-10	<48
MW-4	09/12/13	7.6	100	958	<1	62	382	0.11	573	<1	14.2	-25	<48
MW-4	10/16/13	7.8	101	956	<1	67	378	0.31	558	2	13.9	-7.1	<48
MW-4	11/14/13	7.7	96	952	<1	66	379	<0.10	564	<1	13.8	-9.1	<48
MW-6	01/30/13	7.1	64	696	2	36	297	0.48	375	<1	14.5	60	<4
MW-6	04/29/13	7.6	78	714	1	34	301	0.46	376	1	18.1	60	<4
MW-6	06/19/13	7.6	37	724	2	33	299	0.52	376	24	13.9	63	<4
MW-6	08/14/13	7.6	79	748	1	34	316	0.53	400	9	14.4	63	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2013

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	----- mg/L -----						MPN/100 mL	°C	ft.	hr.
MW-6	10/21/13	7.7	79	768	1	40	325	0.58	390	<1	13.6	60	<4
MW-6	11/13/13	7.4	124	702	1	36	302	0.51	383	<1	9.5	59	<4
MW-7	02/20/13	6.8	62	880	<1	35	395	0.53	558	<1	13.3	18	<4
MW-7	04/29/13	7.4	97	832	<1	38	354	0.56	482	36	15.3	20	<4
MW-8	06/20/13	8.7	45	600	2	172	72	0.37	92	<1	15.5	-34	<48
MW-8	08/28/13	8.2	86	804	1	48	327	<0.10	384	1,000	15.9	-59	<48
MW-8	09/12/13	8.4	85	730	1	43	343	<0.10	363	100	16.9	-62	<48
MW-8	10/16/13	8.4	62	522	2	49	190	<0.10	246	3,700	14.8	-56	<48
MW-8	11/07/13	8.5	70	624	1	39	269	<0.10	298	75	14.3	-62	<48
MW-8	12/19/13	8.5	82	704	1	64	387	<0.10	351	5	14.6	-54	<48
MW-9	06/20/13	7.7	50	800	1	81	209	0.26	250	<1	15.0	3.8	<48
MW-9	07/10/13	7.6	60	754	1	39	339	0.36	388	<1	18.0	3.8	<48
MW-9	08/28/13	7.9	89	848	1	30	346	0.44	399	1	15.4	2.8	<48
MW-9	09/12/13	7.9	84	760	1	31	348	0.43	392	<1	15.2	1.8	<48
MW-9	10/16/13	7.8	81	732	1	38	320	0.29	363	2	14.4	3.8	<48
MW-9	11/07/13	8.0	82	744	1	31	327	0.41	367	<1	14.3	0.8	<48

¹No samples obtained from Wells MW-2 and -5; considered intermittently or permanently dry; only two samples retrieved from MW-7.

²EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

³Relative to Chicago city datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform
			mS/m	----- mg/L -----						MPN/100 mL
MW-1	Minimum	7.2	70	766	1	28	355	0.25	418	<1
	Mean	7.5	82	803	1	49	361	0.33	453	1
	Maximum	7.7	88	818	1	128	374	0.42	477	2
	Std. Dev.	0.3	7	20	0.2	44	7	0.06	22	NA ³
	Median	7.6	83	811	1	30	359	0.32	450	1
	Coeff. of Var. (%)	3.3	8	3	18	90	2	19	5	NA
MW-3	Minimum	7.3	70	804	1	12	397	0.32	443	<1
	Mean	7.5	81	828	1	14	432	0.34	463	<1
	Maximum	7.8	97	852	1	17	451	0.34	483	<1
	Std. Dev.	0.2	10	19	0	2	21	0.01	14	NA ³
	Median	7.6	79	832	1	14	437	0.34	465	<1
	Coeff. of Var. (%)	2.7	12	2	0	14	5	2.4	3	NA
MW-4	Minimum	7.4	74	882	1	62	356	0.11	521	<1
	Mean	7.7	95	954	1	69	371	0.20	553	1
	Maximum	7.8	103	1,024	1	84	382	0.31	573	2
	Std. Dev.	0.2	11	45	0	9	10	0.10	20	NA
	Median	7.7	100	954	1	66	373	0.17	561	1
	Coeff. of Var. (%)	2.0	11	5	0	13	3	52	4	NA
MW-6	Minimum	7.1	37	696	1	33	297	0.46	375	<1
	Mean	7.5	77	725	1	36	307	0.51	383	2
	Maximum	7.7	124	768	2	40	325	0.58	400	24
	Std. Dev.	0.2	28	28	0.2	3	11	0.04	10	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform
			mS/m	----- mg/L -----						MPN/100 mL
	Median	7.6	78	719	1	35	302	0.52	380	1
	Coeff. of Var. (%)	2.7	37	4	17	7	4	8.1	3	NA
MW-7	Minimum	6.8	62	832	<1	35	354	0.53	482	<1
	Mean	7.1	80	856	<1	37	374	0.55	520	6
	Maximum	7.4	97	880	<1	38	395	0.56	558	36
	Std. Dev.	0.4	25	34	0	2	29	0.02	54	NA
	Median	7.1	80	856	<1	37	374	0.55	520	18
	Coeff. of Var. (%)	5.3	31	4	0	6	8	3.9	10	NA
MW-8	Minimum	8.2	45	522	1	39	72	<0.10	92	<1
	Mean	8.5	72	664	1	69	265	0.14	289	1,465
	Maximum	8.7	86	804	2	172	387	0.37	384	3,700
	Std. Dev.	0.2	16	101	0.5	51	116	0.11	109	NA
	Median	8.5	76	664	1	49	298	0.11	325	88
	Coeff. of Var. (%)	2.1	22	15	39	74	44	79	38	NA
MW-9	Minimum	7.6	50	732	1	30	209	0.26	250	<1
	Mean	7.8	74	773	1	42	315	0.37	360	<1
	Maximum	8.0	89	848	1	81	348	0.44	399	2

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform
			mS/m	----- mg/L -----						MPN/100 mL
MW-9	Std. Dev.	0.2	15	43	0.1	20	53	0.08	56	NA
	Median	7.8	81	757	1	35	333	0.39	378	1
	Coeff. of Var. (%)	2.0	21	6	5	47	17	21	15	NA

¹EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

²Geometric mean calculated.

³Not applicable.

TABLE 3: GROUNDWATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013

Date ¹	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
----- Elevation (ft) ² -----									
01/04/13	32.8	41.8	38.6	-0.10	-32.6	57.6	19.7	-21.2	-0.20
01/11/13	23.8	41.8	43.6	29	-34.6	59.6	17.7	-2.20	-18
02/01/13	34.8	43.8	37.6	-4.1	-36.6	58.6	16.7	-52.2	0.80
2/8/013	25.8	40.8	42.6	28	NR ³	58.6	13.7	-6.20	-15
03/01/13	34.8	40.8	36.6	0.90	NR	57.6	16.7	-24.2	2.8
03/08/13	32.8	42.8	39.6	-3.1	-42.6	57.6	16.7	-23.2	-13
04/12/13	33.8	40.8	39.6	-1.1	-34.6	57.6	18.7	-10.2	-8.2
04/26/13	34.8	42.8	41.6	1.9	-28.6	59.6	22.7	-18.2	1.8
05/10/13	35.8	42.8	37.6	-0.10	-33.6	55.6	19.7	-16.2	1.8
05/31/13	36.8	43.8	38.6	-2.1	-35.6	62.6	15.7	17.8	0.80
06/14/13	36.8	43.8	38.6	-2.1	-35.6	62.6	15.7	17.8	0.80
06/21/13	42.8	44.8	39.6	-2.1	-35.6	62.6	16.7	-50.2	-0.20
07/12/13	12.8	44.8	40.6	-3.1	-35.6	63.6	17.7	-63.2	1.8
07/26/13	35.8	41.8	39.6	0.90	-33.6	58.6	16.7	-12.2	-12
08/02/13	34.8	43.8	36.6	-5.1	-34.6	62.6	14.7	-50.2	1.8
08/16/13	34.8	42.8	35.6	-5.1	-34.6	59.6	14.7	-44.2	2.8
09/06/13	33.8	42.8	38.6	-7.1	-35.6	61.6	16.7	-61.2	2.8
09/20/13	35.8	41.8	37.6	-4.1	-35.6	62.6	14.7	-60.2	4.8

TABLE 3: GROUNDWATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013

Date ¹	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	----- Elevation (ft) ² -----								
10/04/13	42.8	42.8	38.6	-7.1	-36.6	59.6	14.7	-52.2	2.8
10/18/13	33.8	42.8	37.6	-7.1	-35.6	61.6	14.7	-61.2	2.8
11/01/13	34.8	42.8	38.6	-0.10	-36.6	57.6	15.7	-54.2	2.8
11/15/13	34.8	40.8	37.6	-3.1	-36.6	58.6	15.7	-55.2	2.8
12/03/13	34.8	41.8	38.6	0.90	-36.6	57.6	15.7	-55.2	0.80
12/10/13	34.8	42.8	39.6	-0.10	-37.6	56.6	15.7	-55.2	3.8

¹Date measurements were taken.

²Relative to Chicago city datum (579.48' above mean sea level) at intersection of State and Madison Streets.

³No reading; well covered with snow.

FIGURE 2: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATIONS FOR MONITORING/ OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013

