

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***RESEARCH AND DEVELOPMENT
DEPARTMENT***

REPORT NO. 01-12-A

1999 ANNUAL SUMMARY REPORT

***WATER QUALITY WITHIN THE WATERWAYS SYSTEM OF
THE METROPOLITAN WATER RECLAMATION DISTRICT
OF GREATER CHICAGO***

ADDENDUM

***APPENDIX III
SIGNIFICANCE TESTS ON 1999 UPSTREAM AND DOWNSTREAM
SAMPLE MEANS - SIGNIFICANCE PROBABILITIES
ASSOCIATED WITH APPROPRIATE TEST***

October 2001

ADDENDUM

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SIGNIFICANCE TESTS ON 1999 UPSTREAM AND DOWNSTREAM SAMPLE
MEANS - SIGNIFICANCE PROBABILITIES ASSOCIATED WITH
APPROPRIATE TEST

1999 ANNUAL SUMMARY REPORT
WATER QUALITY WITHIN THE WATERWAYS SYSTEM OF
THE METROPOLITAN WATER RECLAMATION DISTRICT
OF GREATER CHICAGO

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APPENDIX III

SIGNIFICANCE TESTS ON 1999 UPSTREAM AND DOWNSTREAM SAMPLE
MEANS - SIGNIFICANCE PROBABILITIES ASSOCIATED WITH
APPROPRIATE TEST

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-1

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR NORTH SIDE WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
DO (mg/L)	7.51	7.43	0.028	-	-	0.766	0.766
Temp (°C)	15.9	16.9	0.392	0.113	0.755	1.000	0.755
pH	8.12	7.56	0.222	0.499	0.017	0.010	0.017
Cl (mg/L)	43	154	0.000	-	-	0.004	0.004
Turb (JTU)	9.10	7.50	0.004	-	-	0.183	0.183
Alk (mg/L)	129	142	0.004	-	-	0.137	0.137
TKN (mg/L)	1.27	2.48	0.006	-	-	0.044	0.044
NH ₄ -N (mg/L)	0.348	0.921	0.000	-	-	0.032	0.032
NH ₃ -N (mg/L)	0.008	0.021	0.000	-	-	0.361	0.361
ORG-N (mg/L)	0.92	1.56	0.000	-	-	0.106	0.106
NO ₂ +NO ₃ (mg/L)	0.32	5.67	0.002	-	-	0.000	0.000
TS (mg/L)	299	573	0.000	-	-	0.002	0.002
TVS (mg/L)	-	-	-	-	-	-	-
TSS (mg/L)	9.9	10.3	0.027	-	-	0.974	0.974
TDS (mg/L)	289	563	0.000	-	-	0.002	0.002
Phenol (µg/L)	12.4	20.4	0.275	0.307	0.003	0.003	0.003
SO ₄ (mg/L)	34.3	51.3	0.186	0.239	0.002	0.007	0.002
FOG (mg/L)	-	-	-	-	-	-	-
T.P (mg/L)	0.215	1.351	0.013	-	-	0.000	0.000
Sol. P (mg/L)	0.098	1.066	0.004	-	-	0.000	0.000
CN (mg/L)	0.002	0.005	0.289	0.105	0.000	0.000	0.000
WAD-CN (mg/L)	0.000	0.001	0.002	-	-	0.004	0.004
F (mg/L)	0.184	0.781	0.011	-	-	0.000	0.000
TOC (mg/L)	6.30	9.92	0.188	0.334	0.008	0.006	0.008

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-1 (Continued)

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR NORTH SIDE WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
FC (#/100ml)	130	7866	0.003	-	-	0.000	0.000
Ca (mg/L)	43.4	56.5	0.047	-	-	0.006	0.006
Mg (mg/L)	15.4	19.9	0.033	-	-	0.011	0.011
Hard (mg/L)	172	223	0.036	-	-	0.009	0.009
G. Alpha (pCi/L)	3.40	3.49	0.001	-	-	0.410	0.410
G. Beta (pCi/L)	5.97	8.46	0.028	-	-	0.003	0.003
Ag (mg/L)	0.000	0.000	-	-	-	1.000	1.000
As (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ba (mg/L)	0.023	0.020	0.266	0.075	0.101	0.112	0.101
B (mg/L)	0.015	0.207	0.001	-	-	0.000	0.000
Cd (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Cu (mg/L)	0.001	0.003	0.000	-	-	0.178	0.178
Cr (mg/L)	0.001	0.000	0.000	-	-	0.895	0.895
Fe (mg/L)	0.183	0.136	0.003	-	-	0.091	0.091
Pb (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ni (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Mn (mg/L)	0.024	0.018	0.479	0.065	0.265	0.468	0.265
Hg (µg/L)	0.012	0.006	0.000	-	-	0.473	0.473
Zn (mg/L)	0.007	0.037	0.015	-	-	0.000	0.000
Se (mg/L)	0.000	0.000	-	-	-	1.000	1.000

¹Significance Probability ≤ 0.05 indicates that up and down populations are not normal.

²Significance Probability ≤ 0.05 indicates that variances are unequal.

³Significance Probability ≤ 0.05 indicates that means are unequal if t-test is used.

⁴Significance Probability ≤ 0.05 indicates that means are unequal if Wilcoxon test is used.

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METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-2

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR STICKNEY WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
DO (mg/L)	5.99	7.16	0.727	0.164	0.048	0.034	0.048
Temp (°C)	15.6	17.9	0.059	0.241	0.386	0.429	0.386
pH	7.85	7.67	0.994	0.341	0.489	0.575	0.489
Cl (mg/L)	106	155	0.000	-	-	0.340	0.340
Turb (JTU)	13.83	9.73	0.009	-	-	0.033	0.033
Alk (mg/L)	140	129	0.004	-	-	0.186	0.186
TKN (mg/L)	1.64	1.43	0.000	-	-	0.758	0.758
NH ₄ -N (mg/L)	0.793	0.357	0.000	-	-	0.002	0.002
NH ₃ -N (mg/L)	0.031	0.006	0.000	-	-	0.121	0.121
ORG-N (mg/L)	0.85	1.07	0.000	-	-	0.060	0.060
NO ₂ +NO ₃ (mg/L)	3.58	7.01	0.114	0.273	0.000	0.000	0.000
TS (mg/L)	478	613	0.000	-	-	0.091	0.091
TVS (mg/L)	-	-	-	-	-	-	-
TSS (mg/L)	18.5	13.2	0.015	-	-	0.083	0.083
TDS (mg/L)	459	600	0.000	-	-	0.091	0.091
Phenol (µg/L)	16.0	15.3	0.089	0.292	0.735	0.599	0.735
SO ₄ (mg/L)	50.0	75.6	0.028	-	-	0.001	0.001
FOG (mg/L)	-	-	-	-	-	-	-
T.P (mg/L)	0.690	1.044	0.010	-	-	0.268	0.268
Sol. P (mg/L)	0.459	0.754	0.012	-	-	0.148	0.148
CN (mg/L)	0.005	0.006	0.273	0.318	0.102	0.097	0.102
WAD-CN (mg/L)	0.001	0.001	0.396	0.445	0.863	0.686	0.863
F (mg/L)	0.512	0.743	0.548	0.364	0.000	0.001	0.000
TOC (mg/L)	7.25	8.45	0.009	-	-	0.050	0.050

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-2 (Continued)

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR STICKNEY WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
FC (#/100ml)	327	4970	0.411	0.333	0.000	0.000	0.000
Ca (mg/L)	54.4	56.8	0.000	-	-	0.268	0.268
Mg (mg/L)	20.3	21.0	0.001	-	-	0.372	0.372
Hard (mg/L)	219	228	0.000	-	-	0.372	0.372
G. Alpha (pCi/L)	3.96	3.64	0.000	-	-	0.717	0.717
G. Beta (pCi/L)	7.36	9.18	0.095	0.458	0.033	0.045	0.033
Ag (mg/L)	0.000	0.000	-	-	-	1.000	1.000
As (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ba (mg/L)	0.023	0.019	0.848	0.151	0.059	0.064	0.059
B (mg/L)	0.132	0.175	0.918	0.422	0.003	0.005	0.003
Cd (mg/L)	0.000	0.000	0.000	-	-	1.000	1.000
Cu (mg/L)	0.002	0.001	0.000	-	-	0.963	0.963
Cr (mg/L)	0.001	0.001	0.000	-	-	0.521	0.521
Fe (mg/L)	0.313	0.210	0.023	-	-	0.023	0.023
Pb (mg/L)	0.004	0.000	0.000	-	-	0.384	0.384
Ni (mg/L)	0.001	0.000	0.000	-	-	0.384	0.384
Mn (mg/L)	0.027	0.022	0.010	-	-	0.069	0.069
Hg (µg/L)	0.022	0.018	0.000	-	-	0.791	0.791
Zn (mg/L)	0.032	0.036	0.001	-	-	0.301	0.301
Se (mg/L)	0.000	0.000	-	-	-	1.000	1.000

¹Significance Probability ≤ 0.05 indicates that up and down populations are not normal.

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METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-3

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR CALUMET WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
DO (mg/L)	8.48	6.69	0.000	-	-	0.006	0.006
Temp (°C)	15.7	16.5	0.048	-	-	0.884	0.884
pH	8.10	7.82	0.225	0.219	0.100	0.042	0.100
Cl (mg/L)	95	139	0.237	0.388	0.107	0.100	0.107
Turb (JTU)	14.73	8.82	0.155	0.020	0.001	0.001	0.001
Alk (mg/L)	129	158	0.472	0.003	0.033	0.017	0.033
TKN (mg/L)	1.10	1.38	0.255	0.058	0.175	0.077	0.175
NH ₄ -N (mg/L)	0.276	0.332	0.001	-	-	0.144	0.144
NH ₃ -N (mg/L)	0.012	0.009	0.000	-	-	0.558	0.558
ORG-N (mg/L)	0.82	1.05	0.009	-	-	0.032	0.032
NO ₂ +NO ₃ (mg/L)	1.79	4.27	0.000	-	-	0.000	0.000
TS (mg/L)	461	664	0.311	0.496	0.026	0.026	0.026
TVS (mg/L)	-	-	-	-	-	-	-
TSS (mg/L)	26.4	12.7	0.000	-	-	0.000	0.000
TDS (mg/L)	440	651	0.347	0.459	0.020	0.022	0.020
Phenol (µg/L)	15.3	46.6	0.000	-	-	0.001	0.001
SO ₄ (mg/L)	72.4	125.0	0.464	0.385	0.000	0.001	0.000
FOG (mg/L)	-	-	-	-	-	-	-
T.P (mg/L)	0.324	2.595	0.000	-	-	0.000	0.000
Sol. P (mg/L)	0.110	2.684	0.000	-	-	0.000	0.000
CN (mg/L)	0.003	0.010	0.110	0.388	0.000	0.000	0.000
WAD-CN (mg/L)	0.000	0.003	0.000	-	-	0.000	0.000
F (mg/L)	0.317	0.759	0.154	0.487	0.000	0.000	0.000
TOC (mg/L)	6.68	9.26	0.000	-	-	0.010	0.010

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-3 (Continued)

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR CALUMET WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
FC (#/100ml)	55	3792	0.129	0.260	0.000	0.000	0.000
Ca (mg/L)	50.4	62.1	0.078	0.128	0.072	0.101	0.072
Mg (mg/L)	21.6	22.4	0.760	0.466	0.773	0.743	0.773
Hard (mg/L)	215	247	0.249	0.245	0.222	0.264	0.222
G. Alpha (pCi/L)	3.51	3.70	0.014	-	-	0.250	0.250
G. Beta (pCi/L)	7.07	9.25	0.163	0.431	0.014	0.011	0.014
Ag (mg/L)	0.000	0.000	-	-	-	1.000	1.000
As (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ba (mg/L)	0.032	0.020	0.974	0.459	0.000	0.000	0.000
B (mg/L)	0.123	0.244	0.453	0.352	0.002	0.004	0.002
Cd (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Cu (mg/L)	0.003	0.000	0.000	-	-	0.242	0.242
Cr (mg/L)	0.001	0.001	0.000	-	-	1.000	1.000
Fe (mg/L)	0.395	0.251	0.001	-	-	0.025	0.025
Pb (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ni (mg/L)	0.002	0.003	0.000	-	-	1.000	1.000
Mn (mg/L)	0.057	0.056	0.029	-	-	0.450	0.450
Hg (µg/L)	0.029	0.038	0.000	-	-	1.000	1.000
Zn (mg/L)	0.032	0.027	0.036	-	-	0.973	0.973
Se (mg/L)	0.000	0.000	-	-	-	1.000	1.000

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³Significance Probability <=0.05 indicates that means are unequal if t-test is used.

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METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-4

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR JOHN E. EGAN WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
DO (mg/L)	9.07	7.97	0.277	0.186	0.314	0.290	0.314
Temp (°C)	14.4	15.2	0.672	0.331	0.824	0.775	0.824
pH	8.24	7.87	0.168	0.028	0.225	0.360	0.225
Cl (mg/L)	218	177	0.000	-	-	0.084	0.084
Turb (JTU)	23.70	11.18	0.012	-	-	0.004	0.004
Alk (mg/L)	158	166	0.000	-	-	0.360	0.360
TKN (mg/L)	1.17	1.46	0.001	-	-	0.438	0.438
NH ₄ -N (mg/L)	0.067	0.090	0.002	-	-	0.586	0.586
NH ₃ -N (mg/L)	0.007	0.003	0.000	-	-	0.922	0.922
ORG-N (mg/L)	1.11	1.37	0.001	-	-	0.398	0.398
NO ₂ +NO ₃ (mg/L)	0.26	7.07	0.000	-	-	0.000	0.000
TS (mg/L)	734	670	0.000	-	-	0.275	0.275
TVS (mg/L)	-	-	-	-	-	-	-
TSS (mg/L)	33.7	14.4	0.091	0.100	0.005	0.006	0.005
TDS (mg/L)	700	655	0.000	-	-	0.504	0.504
Phenol (µg/L)	16.6	20.3	0.026	-	-	0.089	0.089
SO ₄ (mg/L)	74.9	83.6	0.000	-	-	0.481	0.481
FOG (mg/L)	-	-	-	-	-	-	-
T.P (mg/L)	0.128	2.224	0.000	-	-	0.000	0.000
Sol. P (mg/L)	0.074	1.843	0.000	-	-	0.000	0.000
CN (mg/L)	0.004	0.010	0.018	-	-	0.013	0.013
WAD-CN (mg/L)	0.002	0.002	0.000	-	-	0.020	0.020
F (mg/L)	0.282	0.595	0.001	-	-	0.048	0.048
TOC (mg/L)	10.50	9.82	0.148	0.105	0.367	0.444	0.367

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-4 (Continued)

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR JOHN E. EGAN WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
FC (#/100ml)	45	265	0.190	0.254	0.008	0.031	0.008
Ca (mg/L)	60.0	58.4	0.001	-	-	0.549	0.549
Mg (mg/L)	27.8	23.5	0.000	-	-	0.073	0.073
Hard (mg/L)	264	242	0.000	-	-	0.916	0.916
G. Alpha (pCi/L)	3.64	3.53	0.000	-	-	0.378	0.378
G. Beta (pCi/L)	6.06	11.95	0.000	-	-	0.003	0.003
Ag (mg/L)	0.000	0.000	-	-	-	1.000	1.000
As (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ba (mg/L)	0.041	0.023	0.031	-	-	0.002	0.002
B (mg/L)	0.071	0.225	0.009	-	-	0.006	0.006
Cd (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Cu (mg/L)	0.000	0.003	0.000	-	-	0.093	0.093
Cr (mg/L)	0.000	0.001	0.000	-	-	0.391	0.391
Fe (mg/L)	0.760	0.375	0.032	-	-	0.007	0.007
Pb (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ni (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Mn (mg/L)	0.091	0.050	0.218	0.398	0.001	0.003	0.001
Hg (µg/L)	0.058	0.057	0.000	-	-	0.794	0.794
Zn (mg/L)	0.020	0.027	0.005	-	-	0.055	0.055
Se (mg/L)	0.000	0.000	-	-	-	1.000	1.000

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²Significance Probability ≤ 0.05 indicates that variances are unequal.

³Significance Probability ≤ 0.05 indicates that means are unequal if t-test is used.

⁴Significance Probability ≤ 0.05 indicates that means are unequal if Wilcoxon test is used.

⁵Significance Probability ≤ 0.05 indicates that means are unequal using applicable test.

- = No Statistics.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-5

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
 AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
 FOR JAMES C. KIRIE WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
DO (mg/L)	9.39	8.61	0.002	-	-	0.921	0.921
Temp (°C)	14.0	16.1	0.739	0.137	0.504	0.450	0.504
pH	8.02	7.77	0.650	0.479	0.335	0.375	0.335
Cl (mg/L)	294	168	0.000	-	-	0.028	0.028
Turb (JTU)	22.09	5.36	0.003	-	-	0.000	0.000
Alk (mg/L)	172	190	0.671	0.092	0.290	0.293	0.290
TKN (mg/L)	1.29	1.74	0.001	-	-	0.066	0.066
NH ₄ -N (mg/L)	0.116	0.245	0.013	-	-	0.041	0.041
NH ₃ -N (mg/L)	0.016	0.022	0.000	-	-	0.340	0.340
ORG-N (mg/L)	1.17	1.50	0.000	-	-	0.057	0.057
NO ₂ +NO ₃ (mg/L)	0.34	4.99	0.001	-	-	0.000	0.000
TS (mg/L)	858	700	0.002	-	-	0.646	0.646
TVS (mg/L)	-	-	-	-	-	-	-
TSS (mg/L)	43.9	5.0	0.000	-	-	0.000	0.000
TDS (mg/L)	814	695	0.002	-	-	0.768	0.768
Phenol (µg/L)	21.6	25.0	0.098	0.219	0.277	0.339	0.277
SO ₄ (mg/L)	55.4	99.3	0.057	0.232	0.000	0.000	0.000
FOG (mg/L)	-	-	-	-	-	-	-
T.P (mg/L)	0.221	0.671	0.002	-	-	0.004	0.004
Sol. P (mg/L)	0.071	0.506	0.000	-	-	0.000	0.000
CN (mg/L)	0.003	0.011	0.000	-	-	0.001	0.001
WAD-CN (mg/L)	0.000	0.005	0.000	-	-	0.204	0.204
F (mg/L)	0.207	0.745	0.004	-	-	0.000	0.000
TOC (mg/L)	10.82	10.18	0.093	0.074	0.572	0.920	0.572

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-5 (Continued)

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR JAMES C. KIRIE WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
FC (#/100ml)	369	223	0.073	0.471	0.596	0.621	0.596
Ca (mg/L)	67.5	72.3	0.816	0.028	0.554	0.555	0.554
Mg (mg/L)	28.5	28.2	0.332	0.045	0.938	0.844	0.938
Hard (mg/L)	286	297	0.779	0.036	0.773	0.646	0.773
G. Alpha (pCi/L)	3.77	3.69	0.002	-	-	0.921	0.921
G. Beta (pCi/L)	7.18	16.83	0.003	-	-	0.001	0.001
Ag (mg/L)	0.000	0.000	-	-	-	1.000	1.000
As (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ba (mg/L)	0.054	0.022	0.138	0.108	0.000	0.000	0.000
B (mg/L)	0.124	0.376	0.046	-	-	0.001	0.001
Cd (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Cu (mg/L)	0.003	0.000	0.000	-	-	0.078	0.078
Cr (mg/L)	0.000	0.000	0.000	-	-	1.000	1.000
Fe (mg/L)	0.812	0.103	0.002	-	-	0.000	0.000
Pb (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ni (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Mn (mg/L)	0.112	0.022	0.024	-	-	0.000	0.000
Hg (µg/L)	0.045	0.050	0.000	-	-	0.971	0.971
Zn (mg/L)	0.025	0.045	0.050	0.448	0.009	0.017	0.009
Se (mg/L)	0.000	0.000	-	-	-	1.000	1.000

¹Significance Probability <=0.05 indicates that up and down populations are not normal.

²Significance Probability <=0.05 indicates that variances are unequal.

³Significance Probability <=0.05 indicates that means are unequal if t-test is used.

⁴Significance Probability <=0.05 indicates that means are unequal if Wilcoxon test is used.

⁵Significance Probability <=0.05 indicates that means are unequal using applicable test.

- = No Statistics.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-6

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR HANOVER PARK WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
DO (mg/L)	10.04	8.20	0.022	-	-	0.224	0.224
Temp (°C)	13.9	16.0	0.475	0.243	0.553	0.438	0.553
pH	7.90	7.89	0.842	0.331	0.942	0.700	0.942
Cl (mg/L)	257	127	0.000	-	-	0.095	0.095
Turb (JTU)	17.67	12.36	0.000	-	-	0.040	0.040
Alk (mg/L)	192	163	0.048	-	-	0.270	0.270
TKN (mg/L)	1.81	2.64	0.004	-	-	0.080	0.080
NH ₄ -N (mg/L)	0.131	0.367	0.000	-	-	0.620	0.620
NH ₃ -N (mg/L)	0.003	0.018	0.000	-	-	0.663	0.663
ORG-N (mg/L)	1.68	2.27	0.051	0.428	0.196	0.149	0.196
NO ₂ +NO ₃ (mg/L)	2.88	8.01	0.026	-	-	0.005	0.005
TS (mg/L)	869	622	0.000	-	-	0.197	0.197
TVS (mg/L)	-	-	-	-	-	-	-
TSS (mg/L)	21.1	19.6	0.000	-	-	0.221	0.221
TDS (mg/L)	848	603	0.000	-	-	0.197	0.197
Phenol (µg/L)	18.8	20.1	0.344	0.237	0.528	0.492	0.528
SO ₄ (mg/L)	87.1	68.7	0.000	-	-	0.183	0.183
FOG (mg/L)	-	-	-	-	-	-	-
T.P (mg/L)	0.952	2.742	0.026	-	-	0.008	0.008
Sol. P (mg/L)	0.729	2.243	0.006	-	-	0.008	0.008
CN (mg/L)	0.007	0.012	0.088	0.276	0.048	0.047	0.048
WAD-CN (mg/L)	0.001	0.002	0.011	-	-	0.247	0.247
F (mg/L)	0.419	0.719	0.036	-	-	0.033	0.033
TOC (mg/L)	12.67	11.45	0.005	-	-	0.056	0.056

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE AIII-6 (Continued)

SIGNIFICANCE PROBABILITIES OF WATER QUALITY PARAMETERS
AT UPSTREAM (U) AND DOWNSTREAM (D) LOCATIONS
FOR HANOVER PARK WATER RECLAMATION PLANT IN 1999

Parameter (Unit)	Mean (U)	Mean (D)	Normal Sig Prob ¹	Equal Variance Sig Prob ²	t-test Sig Prob ³	Wilcoxon Sig Prob ⁴	Equal Means Sig Prob ⁵
FC (#/100ml)	386	590	0.906	0.264	0.502	0.621	0.502
Ca (mg/L)	76.9	61.9	0.005	-	-	0.494	0.494
Mg (mg/L)	51.0	24.7	0.000	-	-	0.254	0.254
Hard (mg/L)	402	256	0.000	-	-	0.362	0.362
G. Alpha (pCi/L)	4.14	3.59	0.000	-	-	0.305	0.305
G. Beta (pCi/L)	8.49	10.64	0.467	0.365	0.101	0.111	0.101
Ag (mg/L)	0.000	0.000	-	-	-	1.000	1.000
As (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ba (mg/L)	0.045	0.025	0.037	-	-	0.025	0.025
B (mg/L)	0.128	0.311	0.020	-	-	0.008	0.008
Cd (mg/L)	0.001	0.000	0.000	-	-	0.315	0.315
Cu (mg/L)	0.002	0.006	0.000	-	-	0.156	0.156
Cr (mg/L)	0.002	0.000	0.000	-	-	0.126	0.126
Fe (mg/L)	0.672	0.285	0.007	-	-	0.002	0.002
Pb (mg/L)	0.000	0.000	-	-	-	1.000	1.000
Ni (mg/L)	0.002	0.000	0.000	-	-	0.315	0.315
Mn (mg/L)	0.073	0.038	0.000	-	-	0.094	0.094
Hg (µg/L)	0.012	0.053	0.000	-	-	0.196	0.196
Zn (mg/L)	0.036	0.042	0.008	-	-	0.969	0.969
Se (mg/L)	0.000	0.000	-	-	-	1.000	1.000

¹Significance Probability <=0.05 indicates that up and down populations are not normal.

²Significance Probability <=0.05 indicates that variances are unequal.

³Significance Probability <=0.05 indicates that means are unequal if t-test is used.

⁴Significance Probability <=0.05 indicates that means are unequal if Wilcoxon test is used.

⁵Significance Probability <=0.05 indicates that means are unequal using applicable test.

- = No Statistics.