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PRESERVATION OF PHYSICAL PARAMETERS AND MAJOR IONS IN WATERS

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ABSTRACT

The centralization of the Water Quality Branch (WQB) laboratories involves longer time periods between sample collection and sample analysis. It was therefore essential that the sample preservation techniques currently in use be thoroughly evaluated and modified where required, if the data generated by the consolidated laboratory are to be reliable.

This report describes the results of the first phase of the preservation studies. It deals with a total of 16 physical and inorganic parameters. Sixteen regional, spiked and synthetic waters were investigated over a four-month period. It was found that most parameters investigated are stable when stored in plastic containers in the dark at 4°C.

RÉSUMÉ

En raison de la centralisation des laboratoires de la Direction de la qualité des eaux (DQE), on a dû espacer le prélèvement et l'analyse des échantillons. Il a donc fallu évaluer de façon exhaustive les techniques de conservation des échantillons en vigueur et les modifier au besoin pour que les données produites par le laboratoire centralisé soient fiables.

Le présent rapport décrit les résultats de la première étape des études portant sur les techniques de conservation des échantillons. Au total, il y a 16 paramètres physiques et inorganiques en cause. On a analysé 16 échantillons d'eau prélevés en régions, additionnés de certains produits chimiques sur une période de 4 mois. On a constaté que la plupart des paramètres analysés demeuraient stables lorsque les échantillons étaient emmagasinés à l'obscurité dans des contenants de plastique, à 4° C.

EXECUTIVE SUMMARY

Due to the centralization of the Water Quality Laboratory, the time between sample collection and sample analysis will be longer. It is therefore essential that the sample preservation techniques currently in use be thoroughly evaluated and modified where required, if the data generated by the consolidated laboratory are to be reliable.

This report describes the results of the first phase of the preservation studies. In this study, the preservation of 16 major ions and physical parameters in 16 synthetic and regional waters were investigated over a four-month period. It was found that most of the parameters are stable when stored in the dark at 4°C in plastic containers.

This study provides, for the first time, concrete data to demonstrate the validity of this preservation procedure in different regional waters. The results will enhance the confidence of the data generated by the WQNL for a variety of samples using the described preservation conditions.

SOMMAIRE EXÉCUTIF

En raison de la centralisation des laboratoires de la Direction de la qualité des eaux, il faut espacer le prélèvement et l'analyse des échantillons. Il faut donc évaluer de façon exhaustive les techniques de conservation des échantillons en vigueur et les modifier au besoin pour que les données produites par le laboratoire centralisé soient fiables.

Le présent rapport décrit les résultats de la première étape des études portant sur les techniques de conservation des échantillons. Dans le cadre de l'étude, on a analysé la conservation de 16 principaux ions et paramètres physiques dans 16 échantillons d'eau artificielle prélevés en régions sur une période de 4 mois. On a constaté que la plupart des paramètres demeuraient stables lorsque les échantillons étaient emmagasinés à l'obscurité à 4° C, dans des contenants de plastique.

Grâce à l'étude, on possède pour la première fois des données concrètes qui permettent de prouver la validité des méthodes de conservation dans des échantillons d'eau de diverses régions. Les résultats indiqueront si l'on peut se fier aux données produites par le LNQE en analysant divers échantillons d'eau au moyen des techniques de conservation décrites.

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INTRODUCTION

Due to laboratory consolidation, test samples will have to be sent from the various regions across Canada to the Water Quality National Laboratory (WQNL) Burlington, for analysis. In order for the analyses to be meaningful, the sample integrity must be maintained. For this, Water Quality Branch/Headquarters has requested NWRI to carry out a thorough evaluation of preservation procedures to ensure stability of all parameters.

The objective of the task was to evaluate and improve, where necessary, the existing preservation practices for all parameters for which the National Laboratory conducts analyses. These parameters include trace metals, major ions, nutrients, physical parameters and organic constituents.

This report describes the first phase of the preservation studies; namely, the evaluation of preservation procedures for 16 major ions and physical parameters: pH, colour, specific conductance, turbidity, Na, K, Ca, Mg, Hardness, SO_4, Cl, alkalinity, Silica, NO_3 and NO_2, B and F.

The most common procedure to preserve these parameters in water samples is by storage of the samples in the dark at 4°C. However, there are insufficient data to substantiate this procedure for periods of time longer than two weeks and for waters from all regions in Canada.

After reviewing numerous data including interlaboratory data from previous quality control studies and a brief literature survey[1-26], we have grouped the major ions, nutrients and physical parameters into three groups as follows:

Group I - those parameters which have a considerable amount of supporting data to suggest that they are stable at 4°C,

Group II - those parameters which have some data indicating they might be stable at 4°C,

Group III - those parameters which have little or no data or known to be unstable at 4°C.

Table 1 lists the three groups of parameters. This study is the first phase of the studies on preservation and deals with major ions and physical parameters (Group I). The next phase deals with nutrients and residue in Group II, and the miscellaneous parameters (Group III) will be reported later.

STUDY DESIGN

To achieve the objective in this phase, we investigated 16 different waters - two different waters from each region plus some spiked and synthetic waters. Each of the waters was analysed for 16 different parameters for many different monitoring periods over a 15-week span. Furthermore, six replicate analyses of each parameter were carried out per water and monitoring period.

The total storage time was chosen to be 15 weeks which we believed would amply cover the time taken from sampling to data generation. The initial starting time, time "0" was defined as the time when all the waters were subsampled into test bottles.

As the regional waters did not arrive at the same time, and some arrived very late, the true time "0" could not be established. To establish the true time "0", the moment the samples are collected in the field, would require analysis in the field and the frequent monitoring of the samples until received in the laboratory. Resource limitations prevent us from doing this. Furthermore, just the subsampling alone took several days before the analysis could begin. Specifically, we subsampled 16 waters into 2000 test bottles which we then divided into five different sets - one set for physical parameters, one for major ions, one for contract analyses and two spare sets; the subsampling took five days to complete.

Although there is a concern that there could be some degradation for some parameters during the first few days after sampling, there is no concrete data or literature precedence to support this. Personal communication with WQB, Western Region, indicated there was no degradation for alkalinity and Ca on the first several days after sample collection. Furthermore, in the second stage of our study, to study the possibility of degradation during the first few days using Hamilton Bay water as a model, the preliminary data of several key major ions indicate that there is no degradation from the actual sample collection time to the end of the test period of two weeks.

EXPERIMENTAL

Containers

Polyethylene containers of size 250 mL, 500 mL, 50 L, 100 L, and larger ones were chromerge cleaned, rinsed and soaked with deionized distilled water for at least several days before use[27].

Waters and Preparation of Test Samples

Table 2 lists the 16 water types used in this study. There were a minimum of two different waters from each of the five regions in addition to some spiked and synthetic ones.

Each water was well homogenized by closed circuit mixing[28] then directly transferred into test bottles. There were over 2000 test samples prepared. The test samples were separated into five different sets of bottles as mentioned earlier, and each set in turn was grouped into batches which were labelled as week "0", "3", "6", "9", "15" and spares. All the batches were stored at 4°C until required for analysis.

Analytical Schedule and Data Handling

The monitoring was set to start at week 0, then at week 3, 6, 9, 12 and 15. This schedule applied simultaneously to in-house,

contract and WQNL analyses. For comparison purposes, we carried out two contract studies on major ions, one at week 0 and one at week 15. More studies might have been desirable, but there were insufficient funds.

The raw analytical data were compiled onto a predesigned table form (Table 3), water by water and for the various storage intervals. The mean and standard deviation for each parameter were then calculated and recorded onto another predesigned tabular form (Table 4), where n indicates the number of observations. In a few cases, n was less than six (the designed number of replicates) because some suspect observations were determined to be outliers (by Grubbs procedures[29] or by past experience) and therefore were not included in the calculations. In the case of apparent colour measurement, triplicate analyses were found to be sufficient.

RESULTS AND DISCUSSION

Criteria for Stability

The following is the working criteria.

For a particular parameter in all the waters studied, if 95% of the data are randomly within 10% of the week "0" mean values, the parameter is considered stable.

Some remarks on the criteria are necessary.

(a) For exceptionally good data, 95% or more are within 5% of week "0" means.

(b) For very low levels, the 10% limit is in general too restrictive; a limit of 20% would be more realistic.

(c) If there is a general trend of decrease or increase -- i.e. not a random fluctuation -- the 10% limit could be a significant indication of instability.

Physical Parameters

Table 5 summarizes the data of all physical parameters studied. The results are presented as the average plus or minus the standard deviation for each storage period and each parameter. The table allows the examination of the stability behaviour of each water for all parameters simultaneously, from week 0 to week 15.

Tables 6-9 present the summarized results of pH (Table 6), colour (Table 7), specific conductance (Table 8) and turbidity (Table 9) in 16 different waters for a period of 15 weeks. Note that the Sumas River water arrived last (after the study had already started). In order to synchronize this with the rest of the waters, its subsamples were included in the already prepared batch 3, up to batch 15.

The behaviour of pH for each water can be easily traced from week 0 to week 15, and can be readily compared to that of other waters (Table 6). The overall results indicate no significant change in pH with time. In fact, the data more than satisfy the stability criteria as 100% of the data are well within 10% limit of week "0" values.

Table 7 summarizes colour measurements. By nature of the method, visual apparent colour determinations are more susceptible to variations when measuring colour greater than 100 H.U. The measurement for Sand Pond water (no. 3), is a good illustration. However, indications are that there is no obvious change in water colours with time.

The specific conductance measurements are shown in Table 8. Comparing week 0 and week 3, the results decrease for all waters. However, an examination of the conductance-contributing major ions data of week 0 and week 3 (Tables 11-17) does not support an overall decrease of specific conductance with time. Further examination of Table 8 and Figure 1 reveals that the results for weeks 3, 6, 9 and 12 are unchanged in general, yet the week 15 results increase in general. Again, a close look at Tables 11-17 does not indicate any definite increases for week 15. Furthermore, most of the percent differences between week 0 and week 3, and between week 15 and week 12 are only 5% or less. Finally, the calculations indicate that 98% of the points (Fig. 1) are within only 7.5% (not 10%) of week "0" means

and thereby fulfill well the stability criteria. Therefore, we conclude that there is no significant change in specific conductance.

Table 9 summarizes the turbidity measurements. There is generally good within-run precision. However, the between-run variation is rather large, as seen in Figure 2. (Note the necessity to divide the ordinate into three scales — 0 to 0.9, 2 to 12, and 12 to 29 JTU in order to include every water in one figure. Similar divisions of ordinates are done in other figures.) The fluctuation in the turbidity measurement can be attributed to the rather crude homogenization step used in the analysis.

The general tendency seems to indicate a decrease in turbidity with time. For example, of the 16 waters used, 13 produce positive difference between week 0 and week 15 means, suggesting a decrease, whereas only three waters (nos. 4, 2 and 11) have negative difference (Fig. 2).

The observed large fluctuations and the decrease with time raise a serious question as to the validity of turbidity data routinely generated. The scientists of the Monitoring and Agreements Division, WQB, Ontario Region (personal communications) confirm that they use turbidity data as rough indicators for more important parameters such as phosphorus. They also perform on-site analyses whenever possible, or in-lab analyses as soon as possible after sample collection to avoid long-term storage.

Major Ions and Miscellaneous Parameters

Table 10 presents all of the major ion data. As in the case of physical parameters, the results are presented as the average plus or minus standard deviation for each ion and each monitoring period. The parameter by parameter summaries are shown in Tables 11 to 21.

The sodium measurements are summarized in Table 11 and shown graphically in Figure 3. From the figure, it can be clearly seen that the overall behaviour indicates stability throughout. These data are exceptionally good as 96% of them are within 5% of week "0" means, and 100% are within 10% limit. (As indicated earlier, water no. 9, Sumas River, arrived late and hence could not be monitored up to 15 weeks; for this water, the change looks large, but the week 9 average is only 5.4% less than the original average).

Table 12 summarizes potassium data. The means of observations for each period and each water are plotted in Figure 4. Except for a few large between-run fluctuations, such as in water no. 7 (Qu'Appelle River at week 9) or in water no. 1 (Pebbleloggitch at week 12), most variations between the monitoring periods are small, well within a standard deviation, which indicates stability throughout. In fact, 95% of the data are randomly within 5% of week "0" means, an indication of exceptional stability and good data.

The calcium measurements are summarized in Table 13 and illustrated in Figure 5. The concentration levels range from <1 to 110 ppm, and the ordinate of the figure had to be made discontinuous

to accommodate all waters. The general behaviour of Figure 5 lends itself to discussion in terms of three concentration levels of Ca -- high (>50), medium (>1 and <50), and low level (<1 ppm). For high level, the fluctuations seem large at weeks 6 and 9. A closer look reveals that only water no. 7 at week 6 differs by nearly 10% from week 0 value, while for the rest of the waters the difference is <5%. Overall, the data suggest that Calcium is stable at high levels.

At medium levels, all fluctuations are small (Fig. 5), less than 5% from the week 0 averages for ten different waters, which indicates exceptional stability.

At low levels $\leq$ 1 ppm, Figure 5 indicates significant decrease between week 0 and week 3, but no significant change between any of the following monitoring periods from week 3 to week 15 for all three waters. The question is why this decrease, particularly when there is no change at medium and high levels and even at low levels between week 3 and week 15. We note that these low level waters are highly coloured. It might be that they behave differently from other waters. But even so, all the points are within 20% of week "0" means, which, by virtue of remark (b) on stability criteria, would be an indication of stability for very low levels. Nevertheless, a follow-up study on these waters seems desirable.

The magnesium measurements are summarized in Table 14 and illustrated in Figure 6. For concentrations between 1 and 17 ppm, all the curves show that no significant changes took place, and this is

supported by the fact that 100% of the points are within 5% of week "0" means. The 36 ppm level (water no. 7) has some fluctuations but they are less than 5% from the original average. At 300 ppm level (water no. 9), it is obvious that the week 0 analysis was out of control giving only 125 ppm Mg instead of a value near 330 ppm; the difference between week 3 and week 9 is only 4.5%. Therefore, we conclude that Mg above 1 ppm level remains stable during the whole study period.

For very low Mg levels, <0.6 ppm, there seems to be a slight decrease between week 0 and week 6. These low level waters are the same highly coloured waters that contain low level Ca as discussed above. We therefore sugget a follow-up study common to both Ca and Mg even though all the points are within 20% of week "0" means.

Table 15 presents the summary of total hardness, calculated from the Ca and Mg data and expressed as ppm $CaCO_3$ using the following equation[6]:

$$\text{Total hardness} = 2.497\ Ca + 4.116\ Mg$$

Figure 7 illustrates the behaviour of hardness, which resembles that of Figure 6 for Mg and Figure 5 for Ca, so the discussions would not be necessary here, except to emphasize the observed stability at medium and high levels, and the recommendation to follow-up the low level study for all three parameters, using highly coloured waters.

The SO_4 analyses were made using the colorimetric MTB method[6]. In spite of some erroneous results such as the 16.5 ppm in water no. 3 at week 12 (Fig. 8) or the 4 less than 0.2 ppm results for water nos. 4, 8, 9 and 10 (Table 16), the overall picture indicates SO_4 stability during the 15 week study period. The erroneous results may well be due to the MTB method which is known to have interference problems with organics and coloured materials. A case study of some of these waters is suggested, using ion chromatography as the method of analysis to eliminate these uncertainties.

Table 17 summarizes Cl data. The overall behaviour suggests Cl stability throughout the investigation period (Fig. 9). The fluctuations of results arise mainly from two low level waters (waters #3 and 11), which resulted in 6% of data being out of the 10% limit. Even then, only 7% of all data are outside this limit, leaving 93% inside, which in this case is close enough to 95% required by the stability criteria.

The alkalinity data are presented in Table 18. For most waters, the alkalinity is > 5 ppm and the overal data indicate stability throughout (Figure 10). This is well supported by the fact that 99% of data are within the 10% limit. For waters with alkalinity < 5 ppm, the data are very imprecise and difficult to interpret.

Reactive silica data are summarized in Table 19. In spite of some erratic points such as in water no. 3 at weeks 12 and 15 (Fig. 11), the calculation indicates 97% of all data are within the

10% limit, indicating stability. These erratic points can be explained by the very imprecise data as indicated by high standard deviations (Tables 19, A11 and A12).

Table 20 gives the summary of the NO_3 & NO_2 measurements. There is no visible sign of instability. However, there seems to be a slight increase with time. This is particularly true for concentrations greater than 0.1 ppm in water nos. 4, 5 and 10 (Fig. 12). This is attributed to analytical variation because the preliminary results of repeat experiments indicate no such trend. Furthermore, Morse et al.[30], in comparing the storage at 2°C with freezing and preservation with various chemical additives, found the 2°C storage in the dark in plastic containers superior to the other methods and they recommended its use to preserve NO_3 and NO_2. Their recommendation is essentially the same as our use of 4°C in the dark in plastic containers. We therefore conclude that there was stability of NO_3 and NO_2 at level > 0.1 ppm. (At low levels, < 0.06 ppm, the results are very imprecise, making it difficult to draw a definite conclusion at this time.)

Table 21 summarizes all the F and B data obtained from two contract studies. Due to insufficient funding for contract analysis, only week 0 and week 15 were investigated. The data seem to indicate F stability. As there are only very few data, a follow-up study is suggested.

The contract data for B do not make sense at all (Table 21). Fortunately, this parameter is not routinely analysed by Water Quality laboratories. (At the time when this study took place, in-house instruments were not available to analyse F and B). The contract analyses of other major ions at week "0" and week 15 are comparable to in-house data.

CONCLUSIONS AND RECOMMENDATIONS

This study has demonstrated the effectiveness of storage in plastic containers in the dark at 4°C for the following parameters: pH, colour, specific conductance, Na, K, Ca, Mg, hardness, SO_4, Cl, alkalinity, silica, NO_3 & NO_2, and F.

Turbidity is the only parameter that needs further examination on methodology before another study for sample stability is initiated.

The following are some uncertainties mainly due to analytical imprecision at low levels: Ca, Mg and hardness particularly in coloured waters; SO_4, due to analytical difficulties encountered by WQNL; alkalinity and NO_3 & NO_2.

Table 22 summarizes the results of data evaluation at various concentration levels of the 16 parameters studied in 16 different types of waters.

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REFERENCES

1. 1978 Annual Book of ASTM Standards, Part 31 "Water". 01-031078-16, ASTM, Philadelphia (1978).
2. Outlines of Analytical Methods - A guide to the occurrence, significance, sampling and analysis of chemical and microbiological parameters in water, sediment, soil, vegetation and air. June 1981, Ministry of the Environment, Laboratory Services Branch.
3. Handbook for Sampling and Sample Preservation of Water and Wastewater. Environmental Monitoring and Support Laboratory Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. EPA-600/4-82-029.

4. Standard Methods for the Examination of Water and Wastewater. 13th Edition, APHA, AWWA, WPCF. American Public Health Association, Washington, D.C. (1971).

5. Methods for Determination of Inorganic Substances in Water and Fluvial Sediments. Techniques of Water Resources Investigations of the United States Geological Survey, Book 5, Chapter A1, United States Government Printing Office, Washington, 1979, Stock No. 024-001-03177-9.

6. Analytical Methods Manual. Inland Waters Directorate, Water Quality Branch, Ottawa, August 1979.

7. NIWR Interlaboratory Comparison Study No. 79/A: Analysis of a surface water and a sewage effluent. Evaluation of Results by R. Smith, National Institute for Water Research, Council for Scientific and Industrial Research, CSIR Research Report No. 367, UDC 628312543.3, 1979.

8. The Sources, Chemistry, Fate and Effects of Ammonia in Aquatic Environments. American Petroleum Institute, Washington, D.C. 20037, Ecological Analysts, Inc., Maryland 21152, Library of Congress Catalog Card No: 81-66839, ISBN: 0-89364-040-9, 1981.

9. Craig D. Stevenson, Michael Kingsford and Wayne H.L. Edgerley. Collaborative Tests of Water Analysis (the CHEMAQUA programme). II Reactive dissolved phosphorus, total dissolved phosphorus and nitrate nitrogen. Chemistry Division, Department of Scientific and Industrial Research, Lower Hutt, New Zealand, Report No. C.D. 2206, Oct. 1975.

10. NIWR Interlaboratory Comparison Study No. 80/B: Determination of Trace Metals. Evaluation of Results by R. Smith, National Institute for Water Research, Council for Scientific and Industrial Research, CSIR Research Report No. 394, UDC 628312:543.31/546.3, 1981.

11. NIWR Interlaboratory Comparison Study No. 79/B: Evaluation of the comparative reliability of the COD determination by R. Smith. National Institute for Water Research, CSIR Research Report No. 368, UDC628312.4, Pretoria, South Africa, 1979.

12. Quality Control Report 1980. Water Quality Section Laboratory Services Branch, Ministry of the Environment.

13. Quality Assurance Program Guidelines and Specifications Criteria and Procedures. U.S. Environmental Protection Agency, Region V, Reference No: EPA-905/4-80-001.

14. Chakrabarti, C.L., K.S. Subramanian, J.E. Sueiras, and D.J. Young. "Preservation of Some Anionic Species in Natural Waters". Journal AWWA, Water Technology/Quality, Oct. 1978.

15. Charpiot, Rene. "Preservation Technique for Sea Water Samples for Phosphate, Nitrite, Nitrate, Silica and Boron Determination". Cahiers Oceanographiques, 1969, 21(8), 773-93 (Fr.); Chem. Abstrats, 71:128500 (1969).

16. Chernovskaya, E.N. "Changes in the Chemical Composition of Water Samples during Storage". Voprosv Gidrokhim. 32:87-97 (1946); Chemical Abstrate, 44:9092d (1950).

17. Hellwig, D.H.R. "Preservation of Water Samples". Int. J. Air and Water Pollution, Vol. 8, Nos. 3/4, March/April 1964.

18. Lyman, H. Howe, III and C. Wayne Holley. "Comparisons of Mercury (II) Chloride and Sulfuric Acid as Preservatives for Nitrogen Forms in Water Samples". Environmental Science and Technology, Vol. 3, No. 5, pp 478-481, May 1969.

19. Brezonik, Patrick L. and G. Fred Lee. "Preservation of Water Samples for Inorganic Nitrogen Analyses with Mercuric Chloride". Air and Water Pollution International Journal. Pergamon Press, 1966, Vol. 10, No. 8, pp. 549-553, Aug. 1966.

20. Degobbis, Danilo. "On the Storage of Seawater Samples for Ammonia Determination". Limnology and Oceanography, Vol. 18, pp. 146-150, 1973.

21. Fitzgerald, G.P. and S.L. Faust. "Effect of Water Sample Preservation Methods on the Release of Phosphorus from Algae". Limnology and Oceanography, Vol. 12, pp. 332-334, 1967.

22. Gilmartin, Malvern. "Changes in Inorganic Phosphate Concentration Occurring during Seawater Sample Storage". Limnology and Oceanography, Vol. 12, pp. 325-328, 1967.

23. Ostrowski, S. et al. "Preservation of Seawater Samples for Nitrate Determination". Golansk, TOW. Nauk., Resp. Wydz.3 1968, 5, 5-14; Chemical Abstrats 71:11642 h (1969).

24. Klingaman, E.D. and D.W. Nelson. "Evaluation of Methods for Preserving the Level of Soluble Inorganic Phosphorus and Nitrogen in Unfiltered Water Samples". J. of Environmental Quality, Vol. 5, No. 1, pp. 42-46, 1976.

25. Nelson, D.W. and M.J.M. Römkens. "Suitability of Freezing as a Method of Preserving Runoff Samples for Analysis of Soluble Phosphate". J. of Environmental Quality, Vol. 1, No. 3, pp. 323-324, 1972.

26. Mackay, Shirley J. "Evaluation of the Procedure for Determining Low Levels of Phosphorus in Fresh Water". Int. J. Environment Anal. Chem., Vol. 4, pp. 33-46, 1975.

27. Cheam, V. and A.S.Y. Chau. Manual for the Bimonthly Inter-regional Quality Control Studies. Manuscript No. 48 - AMD-6-82-VC.

28. Cheam, V. and A.S.Y. Chau. Water Reference Materials - Preparation, homogeneity, long-term preservation and reference values for some major ions. In preparation.

29. Grubbs, F.E. Technometrics, Vol. 11, No. 1, 1969.

30. Morse, J. W., M. Hunt, J. Zullig, A. Mucci and T. Mendez. Ocean Science and Engineering, Vol. 7, No. 1, pp. 75-106, 1982.

Table 1. Parameters Grouping

Parameter Number	Group I	Group II	Group III
1	Ca	NH_3	BOD
2	Mg	Organic N	DO
3	Na	TKN	COD
4	K	Total N	CN
5	Hardness	Particulate Org. N	I
6	SO_4	Particulate Org. C	Acidity
7	Cl	Total P	Phosphorus Dissolved
8	$NO_3 + NO_2$	D. Organic Carbon	Phosphorus Inorganic
9	SiO_2	Residue	Phosphorus Ortho
10	F (Barringer)		Chlorophyll
11	Alkalinity (DIC)		Br
12	B (Barringer)		
13	pH		
14	Spec. Conductance		
15	Turbidity		
16	Colour		

Table 2. The 16 waters used in the preservation study on physical parameters and major ions

No.	Origin and Name	Region and Type
1 2 3	Pebbleloggitch Mercy River Sand Pond	Atlantic, natural
4 5	Carillon (on Ottawa River) St. Lambert (St. Lawrence near Montreal)	Quebec, natural
6 7	Red Deer Qu'Appelle River	Western, natural
8 9	Fraser River (at Musqueam Marsh) Sumas River (at Border)	Pacific, natural
10 11	Hamilton Harbour Waters mixture	Ontario, natural
12 13 14 15	RM-ANI-2 (ANI-12*DL) RM-ANI-3 (ANI-LOW-MED) RM-CAT-2 (CAT-12*DL) RM-CAT-3 (CAT-LOW-MED)	spiked
16	CRM-2 (SAMPLE C)	Synthetic

Table 3. Blank form for recording raw data for each parameter

Monitoring week = _____ (0,3,6,9,12,15)

Sample Number	Water	Parameter	Parameter	Parameter	Parameter	Parameter	Parameter	Parameter

Table 4. Blank form for summary of measurements for each parameter

Sample No.	Sample Name	0	3	6	9	12	15	Remarks
		n=	n=	n=	n=	n=	n=	
		n=	n=	n=	n=	n=	n=	
		n=	n=	n=	n=	n=	n=	
		n=	n=	n=	n=	n=	n=	
		n=	n=	n=	n=	n=	n=	
		n=	n=	n=	n=	n=	n=	

n is the number of replicates

Table 5. Summary of physical parameters monitoring, water by water

Water	Storage Time Week	Parameters			
		pH	Colour H.U.	Specific Conductance µS/cm	Turbidity JTU
Pebbleloggitch	0	4.52±0.02	100	35.68±0.46	0.72±0.02
	3	4.50±0.01	100	34.90±0.28	0.60±0.00
	6	4.58±0.01	100	34.23±0.26	0.65±0.00
	9	4.58±0.01	100	32.87±0.23	0.55±0.09
	12	4.53±0.02	100	34.62±0.23	0.62±0.05
	15	4.60±0.02	100	33.62±0.26	0.46±0.04
Mercy River	0	4.02±0.01	80	66.72±2.30	0.78±0.04
	3	4.06±0.00	80	61.75±0.11	0.73±0.03
	6	4.09±0.00	80	62.58±0.37	0.76±0.01
	9	4.09±0.01	80	61.27±0.48	0.68±0.09
	12	4.08±0.01	80	61.88±0.17	0.81±0.06
	15	4.11±0.01	60	64.30±0.37	0.93±0.15
Sand Pond	0	4.40±0.01	200	39.80±0.26	7.25±0.40
	3	4.53±0.03	300	37.60±0.18	7.78±0.25
	6	4.70±0.02	320	38.83±0.23	8.67±0.26
	9	4.56±0.01	400	37.23±0.16	9.04±0.33
	12	4.57±0.03	400	37.60±0.06	6.70±1.13
	15	4.60±0.02	300	40.68±0.12	5.12±0.20
Carillon	0	7.24±0.02	40	69.50±0.72	4.84±0.20
	3	6.98±0.01	40	66.73±0.12	4.83±0.26
	6	7.10±0.03	50	66.70±0.06	6.75±0.52
	9	7.16±0.04	40	65.08±0.08	4.08±1.63
	12	6.80±0.04	40	66.52±0.69	8.95±0.66
	15	7.04±0.02	60	66.48±0.10	9.37±0.55
St. Lambert	0	8.07±0.03	<5	317.67±2.34	0.83±0.04
	3	7.98±0.01	<5	298.00±0.63	0.55±0.03
	6	7.79±0.04	<5	305.00±0.00	0.79±0.13
	9	7.66±0.02	<5	298.00±0.00	0.69±0.17
	12	7.61±0.06	<5	300.33±0.52	0.89±0.26
	15	7.70±0.06	<5	315.00±0.00	0.47±0.04
Red Deer	0	8.29±0.01	40	447.67±5.39	29.00±1.10
	3	8.23±0.01	40	417.83±0.98	14.00±0.00
	6	8.20±0.02	40	427.83±0.41	15.00±1.10
	9	8.23±0.02	40	417.00±0.00	11.83±3.71
	12	8.14±0.02	40	422.33±0.52	12.00±0.00
	15	8.32±0.02	40	439.00±0.00	10.00±0.00

Table 5. Summary of physical parameters monitoring, water by water (cont'd.)

Water	Storage Time Week	Parameters			
		pH	Colour H.U.	Specific Conductance µS/cm	Turbidity JTU
Qu'Appelle River	0	7.79±0.01	40	1125.67±3.20	11.00±0.00
	3	7.70±0.01	40	1065.33±1.03	8.33±0.10
	6	7.70±0.02	40	1081.50±1.38	5.18±0.43
	9	7.75±0.02	40	1057.67±0.82	4.10±0.94
	12	7.69±0.02	40	1071.00±1.41	3.42±0.28
	15	7.74±0.02	40	1078.67±1.21	3.83±1.02
Fraser River	0	7.87±0.01	80	263.33±0.52	3.57±0.10
	3	7.21±0.03	80	254.00±0.63	4.62±0.20
	6	7.34±0.03	60	257.83±0.75	4.20±0.62
	9	7.75±0.01	60	251.67±0.82	2.45±0.78
	12	7.86±0.07	80	253.17±0.75	4.33±1.63
	15	7.88±0.09	80	257.50±0.84	3.83±0.52
Sumas River	0	-	-	-	-
	3	7.58±0.06	5	13.82±0.04	2.20±0.00
	6	7.18±0.02	5	14.67±0.05	2.77±0.31
	9	7.23±0.02	10	14.18±0.42	0.42±0.12
	12	7.15±0.03	10	14.27±0.19	2.15±0.55
	15	7.29±0.03	10	14.72±0.26	1.50±0.00
Hamilton Harbour	0	8.52±0.004	20	579.00±2.19	4.10±0.11
	3	8.06±0.01	10	549.50±0.84	3.05±0.08
	6	7.68±0.02	20	555.17±0.98	2.73±0.36
	9	7.65±0.02	20	544.00±0.63	1.67±0.68
	12	7.77±0.02	20	553.00±0.63	2.75±0.69
	15	8.07±0.02	20	570.67±0.52	1.92±0.20
Water Mixture	0	3.01±0.01	<5	503.33±1.63	0.15±0.00
	3	3.05±0.004	<5	482.50±0.55	0.07±0.08
	6	2.85±0.01	<5	-	0.18±0.00
	9	3.08±0.01	<5	478.33±0.82	0.11±0.00
	12	3.09±0.02	<5	473.50±0.84	0.10±0.00
	15	3.07±0.02	<5	488.83±0.75	0.16±0.09
RM-ANI-2 (ANI-12*D.L.)	0	7.89±0.03	<5	229±0.63	0.45±0.01
	3	7.86±0.02	<5	217±0.00	0.35±0.00
	6	7.90±0.03	<5	220.67±0.52	0.35±0.00
	9	8.22±0.02	<5	215±0.00	0.40±0.11
	12	7.70±0.04	<5	215±0.52	0.32±0.10
	15	8.19±0.02	<5	220.67±0.82	0.31±0.04

Table 5. Summary of physical parameters monitoring, water by water (cont'd.)

Water	Storage Time Week	Parameters			
		pH	Colour H.U.	Specific Conductance µS/cm	Turbidity JTU
RM-ANI-3	0	7.12±0.01	<5	306.17±1.21	0.70±0.02
(ANI-LOW-MED)	3	7.17±0.01	<5	290±0.00	0.39±0.03
	6	7.26±0.01	<5	295±0.00	0.44±0.02
	9	7.89±0.01	<5	288.67±0.52	0.56±0.09
	12	7.52±0.02	<5	287.17±0.75	0.38±0.03
	15	7.35±0.01	<5	296.50±0.55	0.33±0.03
RM-CAT-2	0	7.92±0.01	<5	235.33±0.82	0.22±0.03
(CAT-12*D.L.)	3	7.63±0.02	<5	221.16±0.75	0.13±0.02
	6	8.07±0.01	<5	223.50±0.55	0.19±0.02
	9	7.99±0.02	<5	219.50±0.55	0.53±0.72
	12	7.94±0.03	<5	221.50±0.55	0.19±0.08
	15	8.04±0.04	<5	224.83±0.41	0.12±0.02
RM-CAT-3	0	7.77±0.02	5	425.50±1.05	0.19±0.01
(CAT-LOW-MED)	3	7.59±0.01	5	400.67±0.52	0.10±0.01
	6	7.43±0.01	5	406.17±0.41	0.18±0.02
	9	7.50±0.04	5	399.00±0.00	0.16±0.02
	12	7.88±0.02	5	403.33±0.82	0.14±0.02
	15	7.67±0.04	5	416.67±0.82	0.11±0.02
CRM-2	0	5.24±0.05	<5	455.17±5.08	0.15±0.00
(Sample C)	3	4.86±0.04	<5	430.67±0.52	0.08±0.00
	6	5.50±0.02	<5	435.17±0.41	0.15±0.00
	9	4.84±0.02	<5	438±0.00	0.12±0.00
	12	4.83±0.00	<5	423.17±0.41	0.13±0.02
	15	4.77±0.05	<5	455.00±0.00	0.10±0.00

Table 6. **Summary of pH monitoring**
(average of 6 observations ± standard deviation)

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebbleloggitch	4.52±0.02	4.50±0.01	4.58±0.01	4.58±0.01	4.53±0.02	4.60±0.02
2	Mercy River	4.02±0.01	4.06±0.00	4.09±0.00	4.09±0.01	4.08±0.01	4.11±0.01
3	Sand Pond	4.40±0.01	4.53±0.03	4.70±0.02	4.56±0.01	4.57±0.03	4.60±0.02
4	Carillon	7.24±0.02	6.98±0.01	7.10±0.03	7.16±0.04	6.80±0.04	7.04±0.02
5	St. Lambert	8.07±0.03	7.98±0.01	7.79±0.04	7.66±0.02	7.61±0.06	7.70±0.06
6	Red Deer	8.29±0.01	8.23±0.01	8.20±0.02	8.23±0.02	8.14±0.02	8.32±0.02
7	Qu'Appelle River	7.79±0.01	7.70±0.01	7.70±0.02	7.75±0.02	7.69±0.02	7.74±0.02
8	Fraser River	7.87±0.01	7.21±0.03	7.34±0.03	7.75±0.01	7.86±0.07	7.88±0.09
9	Sumas River	-	7.58±0.06	7.18±0.02	7.23±0.02	7.15±0.03	7.29±0.03
10	Hamilton Harbour	8.52±0.004	8.06±0.01	7.68±0.02	7.65±0.02	7.77±0.02	8.07±0.02
11	Waters Mixture	3.01±0.01	3.05±0.004	2.85±0.01	3.08±0.01	3.09±0.02	3.07±0.02
12	RM-ANI-2 (ANI-12*D.L.)	7.89±0.03	7.86±0.02	7.90±0.03	8.22±0.02	7.70±0.04	8.19±0.02
13	RM-ANI-3 (ANI-LOW-MED)	7.12±0.01	7.17±0.01	7.26±0.01	7.89±0.01	7.52±0.02	7.35±0.01
14	RM-CAT-2 (CAT-12*D.L.)	7.92±0.01	7.63±0.02	8.07±0.01	7.99±0.02	7.94±0.03	8.04±0.04
15	RM-CAT-3 (CAT-LOW-MED)	7.77±0.02	7.59±0.01	7.43±0.01	7.50±0.04	7.88±0.02	7.67±0.04
16	CRM-2 (Sample C)	5.24±0.05	4.86±0.04	5.50±0.02	4.84±0.02	4.83±0.00	4.77±0.05

Table 7. Summary of colour (H.U.) monitoring
(average of 3 observations ± standard deviation)

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	100	100	100	100	100	100
2	Mercy River	80	80	80	80	80	60
3	Sand Pond	300	300	320	400	400	300
4	Carillon	40	40	50	50	50	60
5	St. Lambert	<5	<5	<5	<5	<5	<5
6	Red Deer	40	40	40	40	40	40
7	Qu'Appelle River	40	40	40	40	40	40
8	Fraser River	80	80	60	60	80	80
9	Sumas River	-	5	5	10	10	10
10	Hamilton Harbour	20	10	20	20	20	20
11	Waters Mixture	<5	<5	<5	<5	<5	<5
12	RM-ANI-2 (ANI-12*D.L.)	<5	<5	<5	<5	<5	<5
13	RM-ANI-3 (ANI-LOW-MED)	<5	<5	<5	<5	<5	<5
14	RM-CAT-2 (CAT-12*D.L.)	<5	<5	<5	<5	<5	<5
15	RM-CAT-3 (CAT-LOW-MED)	5	5	5	5	5	5
16	CRM-2 (Sample C)	<5	<5	<5	<5	<5	<5

Table 8. **Summary of specific conductance (μ S/cm) monitoring**
(average of 6 observations ± standard deviation)

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	35.68±0.46	34.90±0.28	34.23±0.26	32.87±0.23	34.62±0.23	33.62±0.26
2	Mercy River	66.72±2.30	61.75±0.11	62.58±0.37	61.27±0.48	61.88±0.17	64.30±0.37
3	Sand Pond	39.80±0.26	37.6±0.18	38.83±0.23	37.23±0.16	37.60±0.06	40.68±0.12
4	Carillon	69.50±0.72	66.73±0.12	66.70±0.06	65.08±0.08	66.52±0.69	66.48±0.10
5	St. Lambert	317.67±2.34	298.00±0.63	305.00±0.00	298.00±0.00	300.33±0.52	315.00±0.00
6	Red Deer	447.67±5.39	417.83±0.98	427.83±0.41	417.00±0.00	422.33±0.52	439.00±0.00
7	Qu'Appelle River	1125.67±3.20	1065.33±1.03	1081.50±1.38	1057.67±0.82	1071.00±1.41	1078.67±1.21
8	Fraser River	263.33±0.52	254.00±0.63	257.83±0.75	251.67±0.82	253.17±0.75	257.50±0.84
9	Sumas River	-	13.82±0.04	14.67±0.05	14.18±0.42	14.27±0.19	14.72±0.26
10	Hamilton Harbour	579.00±2.19	549.50±0.84	555.17±0.98	544.00±0.63	553.00±0.63	570.67±0.52
11	Waters Mixture	503.33±1.63	482.50±0.55	-	478.33±0.82	473.50±0.84	488.83±0.75
12	RM-ANI-2 (ANI-12*D.L.)	229.00±0.63	217.00±0.00	220.67±0.52	215.00±0.00	215.00±0.00	220.67±0.82
13	RM-ANI-3 (ANI-LOW-MED)	306.17±1.21	290.00±0.00	295.00±0.00	288.67±0.52	287.17±0.75	296.50±0.55
14	RM-CAT-2 (CAT-12*D.L.)	235.33±0.82	221.16±0.75	223.50±0.55	219.50±0.55	221.50±0.55	224.83±0.41
15	RM-CAT-3 (CAT-LOW-MED)	425.50±1.05	400.67±0.52	406.17±0.41	399.00±0.00	403.33±0.82	416.670±0.82
16	CRM-2 (Sample C)	455.17±5.08	430.67±0.52	435.17±0.41	438.00±0.00	423.17±0.41	455.00±0.00

Table 9. Summary of turbidity (JTU) monitoring
(average of 6 observations ± standard deviation)

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebbleloggitch	0.72±0.02	0.60±0.00	0.65±0.00	0.55±0.09	0.62±0.05	0.46±0.04
2	Mercy River	0.78±0.04	0.73±0.03	0.76±0.01	0.68±0.09	0.81±0.06	0.93±0.15
3	Sand Pond	7.25±0.40	7.78±0.25	8.67±0.26	9.04±0.33	6.70±1.13	5.12±0.20
4	Carillon	4.84±0.20	4.83±0.26	6.75±0.52	4.08±1.63	8.95±0.66	9.37±0.55
5	St. Lambert	0.83±0.04	0.55±0.03	0.79±0.13	0.69±0.17	0.89±0.26	0.47±0.04
6	Red Deer	29.00±1.10	14.00±0.00	15.00±1.10	11.83±3.71	12.00±0.00	10.00±0.00
7	Qu'Appelle River	11.00±0.00	8.33±0.10	5.18±0.43	4.10±0.94	3.42±0.28	3.83±1.02
8	Fraser River	3.57±0.10	4.62±0.20	4.20±0.62	2.45±0.78	4.33±1.63	3.83±0.52
9	Sumas River	-	2.20±0.00	2.77±0.31	0.42±0.12	2.15±0.55	1.50±0.00
10	Hamilton Harbour	4.10±0.11	3.05±0.08	2.73±0.36	1.67±0.68	2.75±0.69	1.92±0.20
11	Waters Mixture	0.15±0.00	0.07±0.08	0.18±0.00	0.11±0.00	0.10±0.00	0.16±0.09
12	RM-ANI-2 (ANI-12*D.L.)	0.45±0.01	0.35±0.00	0.35±0.00	0.40±0.11	0.32±0.10	0.31±0.04
13	RM-ANI-3 (ANI-LOW-MED)	0.70±0.02	0.39±0.03	0.44±0.02	0.56±0.09	0.38±0.03	0.33±0.03
14	RM-CAT-2 (CAT-12*D.L.)	0.22±0.03	0.13±0.02	0.19±0.02	0.53±0.72	0.19±0.08	0.12±0.02
15	RM-CAT-3 (CAT-LOW-MED)	0.19±0.01	0.10±0.01	0.18±0.02	0.16±0.02	0.14±0.02	0.11±0.02
16	CRM-2 (Sample C)	0.15±0.00	0.08±0.00	0.15±0.00	0.12±0.00	0.13±0.02	0.10±0.00

Table 10. Summary of major ions monitoring, water by water

Water	Storage Time Week	Parameters, ppm										
		SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	F
Pebbleloggitch	0	1.88±0.02	6.87±0.46	4.35±0.27	0.24±0.01	0.82±0.10	0.017±0.004	< 1	3.89±0.46	2.83±0.05	0.45±0.06	0.067±0.004
	3	1.95±0.02	6.30±0.16	4.33±0.16	0.20±0.00	0.38±0.04	<0.01	< 1	2.59±0.10	2.80±0.00	0.40±0.01	
	6	1.84±0.08	6.37±0.73	4.38±0.21	0.24±0.02	0.35±0.02	<0.01	< 1	2.54±0.41	2.90±0.07	0.37±0.01	
	9	1.89±0.01	6.38±0.34	4.15±0.06	0.23±0.00	0.37±0.01	not done	1.95±0.61	2.44±0.02	2.78±0.01	0.37±0.01	
	12	1.86±0.04	5.45±0.23	4.20±0.23	0.28±0.04	0.41±0.03	0.012±0.004	2.64±1.87	2.55±0.08	2.94±0.17	0.37±0.01	
	15	1.88±0.01	6.15±0.30	4.28±0.05	0.22±0.01	0.43±0.03	0.014±0.004	< 1	2.61±0.11	2.83±0.03	0.37±0.01	0.071±0.020
Mercy River	0	1.67±0.01	9.27±0.22	4.66±0.20	0.27±0.01	1.00±0.00	<0.01	< 1	4.48±0.17	2.93±0.05	0.48±0.04	0.069±0.013
	3	1.75±0.01	9.67±0.14	4.72±0.12	0.28±0.04	0.87±0.05	<0.01	< 1	3.95±0.22	2.98±0.04	0.43±0.05	
	6	1.62±0.07	9.28±0.28	4.55±0.16	0.28±0.01	0.80±0.01	<0.01	< 1	3.73±0.03	3.04±0.05	0.42±0.00	
	9	1.67±0.01	9.97±0.22	4.80±0.63	0.28±0.04	0.88±0.01	not done	1.88±0.54	3.94±0.04	2.96±0.16	0.43±0.01	
	12	1.65±0.01	7.90±0.74	4.55±0.16	0.27±0.02	0.90±0.02	<0.01	1.13±0.15	4.03±0.04	2.93±0.06	0.43±0.01	
	15	1.65±0.02	9.57±0.12	4.43±0.05	0.26±0.01	0.87±0.01	<0.01	< 1	3.91±0.03	2.94±0.02	0.42±0.00	0.071±0.011
Sand Pond	0	1.62±0.05	10.26±0.25	5.30±0.93	0.19±0.01	0.82±0.12	0.02±0.01	2.22±0.56	4.17±0.38	3.72±0.08	0.52±0.04	-
	3	1.74±0.02	10.62±0.17	5.95±0.08	0.23±0.05	0.56±0.05	0.02±0.01	< 1	3.80±0.69	3.83±0.05	0.55±0.08	
	6	1.63±0.06	10.42±0.61	6.17±0.35	0.24±0.00	0.46±0.02	0.01±0.01	< 1	2.93±0.06	4.13±0.04	0.43±0.04	
	9	1.68±0.004	10.70±0.30	5.73±0.08	0.18±0.01	0.48±0.05	not done	4.82±1.83	3.05±0.21	3.73±0.02	0.45±0.02	
	12	2.09±0.73	16.47±3.67	10.30±2.01	0.18±0.01	0.54±0.05	0.02±0.004	2.37±0.55	3.22±0.19	3.69±0.02	0.46±0.02	
	15	1.03±0.43	7.97±0.26	5.7±0.0	0.17±0.01	0.53±0.05	0.02±0.00	2.56±1.33	3.12±0.19	3.80±0.02	0.44±0.02	-
Carillon	0	3.49±0.05	9.57±0.37	2.02±0.15	0.80±0.02	7.30±0.28	0.13±0.01	16.80±1.45	25.64±1.09	2.23±0.08	1.80±0.11	0.098±0.01
	3	3.77±0.01	10.65±0.52	2.25±0.14	0.80±0.00	7.68±0.29	0.13±0.01	16.65±0.58	26.59±0.91	2.20±0.00	1.80±0.06	
	6	3.54±0.08	9.87±0.45	2.10±0.17	0.81±0.12	7.58±0.23	0.20±0.07	17.75±0.72	25.92±0.86	2.28±0.03	1.82±0.48	
	9	3.59±0.05	10.10±0.32	2.07±0.08	0.79±0.01	7.79±0.09	not done	15.53±1.47	26.97±0.27	2.18±0.01	1.83±0.01	
	12	3.66±0.12	9.58±0.04	2.12±0.04	0.78±0.01	7.85±0.11	0.27±0.04	17.64±2.00	26.99±0.35	2.15±0.01	1.80±0.03	
	15	3.48±0.23	<0.2	<0.1	0.79±0.01	7.57±0.05	0.30±0.09	19.32±1.49	26.13±0.17	2.21±0.03	1.75±0.01	0.103±0.02
St. Lambert	0	0.37±0.005	26.70±0.35	24.38±0.25	1.34±0.02	36.28±1.24	0.16±0.01	90.18±1.98	122.98±3.14	12.40±0.11	7.82±0.13	0.200±0.006
	3	0.39±0.03	26.57±0.21	25.05±0.24	1.35±0.06	36.17±1.02	0.14±0.004	88.60±1.30	122.06±2.63	12.48±0.21	7.72±0.15	
	6	0.40±0.01	27.03±0.39	25.07±0.16	1.36±0.01	35.60±0.37	0.13±0.08	93.17±1.68	121.21±1.68	12.43±0.10	7.85±0.22	
	9	0.37±0.01	26.88±0.45	24.35±0.27	1.36±0.03	37.38±0.19	not done	92.82±5.35	125.94±0.62	11.93±0.16	7.92±0.08	
	12	0.37±0.01	27.33±0.18	24.55±0.06	1.31±0.01	37.02±0.24	0.25±0.03	90.72±2.33	125.37±0.63	12.20±0.06	8.00±0.06	
	15	0.38±0.02	27.08±0.45	24.68±0.08	1.32±0.02	36.40±0.21	0.25±0.01	96.83±1.46	122.94±0.06	12.70±0.06	7.78±0.04	0.198±0.011

Table 10. Summary of major ions monitoring, water by water (cont'd.)

Water	Storage Time Week	Parameters, ppm										
		SiO_2	SO_4	Cl	K	Ca	NO_2&NO_3	Alkalinity	Hardness	Na	Mg	F
Red Deer	0	2.97±0.03	80.58±4.39	3.93±0.19	3.09±0.09	40.62±1.24	0.03±0.02	150.67±2.73	165.22±3.51	28.97±2.49	15.50±0.17	.293±.007
	3	3.04±0.01	77.93±0.89	4.00±0.13	3.07±0.05	40.80±0.84	0.02±0.00	146.27±3.07	163.07±2.08	29.20±0.21	14.87±0.23	
	6	3.02±0.08	70.65±4.69	3.75±0.23	3.05±0.02	40.18±0.59	<0.005	151.27±5.95	161.74±2.76	27.77±0.40	14.92±0.33	
	9	2.99±0.01	76.72±0.61	3.67±0.05	3.05±0.01	41.47±0.29	not done	151.07±3.08	166.59±1.12	28.27±0.01	15.32±0.15	
	12	2.67±0.03	77.42±0.94	3.95±0.11	3.03±0.02	41.18±0.39	0.06±0.01	154.98±4.44	164.51±1.20	29.67±0.08	14.98±0.10	
	15	3.05±0.03	72.07±1.03	3.57±0.14	3.10±0.03	40.42±0.15	0.03±0.02	155.32±11.10	161.85±1.51	29.83±0.19	14.85±0.19	.278±.17
Qu'Appelle River	0	7.66±0.06	243.62±2.08	89.42±1.50	11.67±0.26	64.15±1.68	2.86±0.06	183.83±6.52	307.47±0.04	112.00±1.10	35.78±0.17	.599±.007
	3	7.89±0.06	244.65±3.72	91.43±0.43	11.52±0.16	64.25±0.90	3.44±0.12	179.4 ±5.38	307.85±2.75	112.33±0.52	35.82±0.17	
	6	7.77±0.11	243.45±7.46	82.83±4.57	11.20±0.06	58.87±1.09	2.87±0.42	187.18±1.75	296.95±2.98	111.33±1.51	36.43±0.49	
	9	7.59±0.06	244.17±0.72	90.52±0.86	10.23±0.20	65.22±0.82	not done	183.88±2.93	315.96±3.97	99.33±0.87	37.20±0.95	
	12	7.72±0.02	236.63±4.08	91.60±0.27	10.98±0.17	64.52±0.95	3.32±0.04	188.75±4.85	313.25±4.69	109.50±1.52	36.97±0.62	
	15	7.66±0.12	237.30±4.13	89.87±1.80	11.07±0.15	63.78±0.12	3.21±0.12	195.23±3.83	306.45±0.93	114.33±1.21	35.75±0.22	.624±.045
Fraser River	0	18.17±0.11	13.50±1.23	12.78±0.87	7.30±0.10	16.28±0.37	2.16±0.05	95.77±1.42	108.15±0.80	6.93±0.05	16.52±0.11	
	3	19.16±0.10	14.80±0.84	12.75±0.19	7.20±0.06	16.38±0.47	2.57±0.02	91.12±0.69	107.66±1.59	7.12±0.12	16.22±0.17	
	6	18.27±0.21	14.17±1.23	12.43±0.10	7.27±0.05	16.53±0.20	2.18±0.20	94.57±1.39	107.69±0.70	7.14±0.06	16.13±0.21	
	9	18.23±0.07	13.48±0.86	12.28±0.10	7.10±0.00	16.78±0.16	not done	94.30±4.54	109.21±1.17	7.11±0.03	16.35±0.23	
	12	18.28±0.06	13.00±3.11	12.57±0.05	7.30±0.00	17.05±0.14	2.53±0.04	94.22±1.61	110.63±0.65	7.02±0.08	16.53±0.10	
	15	18.09±0.09	<0.02	<0.01	7.20±0.00	16.38±0.15	2.52±0.03	98.35±4.10	108.84±0.55	7.30±0.06	16.50±0.11	
Sumas River	0	3.32±0.12	656.28±20.55	4904.77±272.33	101.67±0.52	110.00±0.63	0.014±0.005	54.48±0.40	786.53±8.54	2687.50±44.24	125.17±1.17	
	3	3.21±0.07	698.87±1.63	4299.28±29.13	97.58±3.22	107.00±1.79	not done	53.55±3.03	1652.21±19.94	2582.00±27.60	336.50±3.94	
	6	3.33±0.01	709.88±5.34	4565.48±84.99	102.67±1.37	106.15±3.59	0.012±0.004	55.68±2.36	1614.42±11.67	2592.50±10.41	327.83±2.86	
	9	3.26±0.01	<0.02	4794.1±134.3	98.93±0.46	113.17±1.47	0.01 ±0.00	57.88±2.27	1605.51±12.88	2541.0±21.7	321.33±3.0	
Hamilton Harbour	0	0.23±0.01	65.88±3.64	62.03±0.98	4.92±0.12	55.10±0.55	2.80±0.08	111.17±1.84	192.12±1.88	33.32±0.11	13.25±0.24	.646±.007
	3	0.29±0.01	59.13±1.22	64.48±0.71	4.90±0.09	54.08±1.03	2.75±0.08	104.85±1.20	189.34±2.30	32.37±0.23	13.20±0.25	
	6	0.25±0.04	63.90±1.09	57.45±2.49	4.90±0.00	52.13±2.05	3.00±0.28	108.87±1.49	184.51±4.92	30.87±0.46	13.20±0.17	
	9	0.27±0.01	67.17±2.53	64.93±0.75	4.85±0.04	57.68±0.28	not done	109.37±2.80	198.97±0.63	34.05±0.24	13.35±0.14	
	12	0.20±0.05	65.05±1.08	61.98±0.23	4.97±0.02	56.85±0.46	3.56±0.06	108.13±1.45	196.83±1.29	32.73±0.21	13.33±0.10	
	15	0.20±0.08	<0.02	<0.01	4.97±0.02	56.08±0.41	3.45±0.01	113.98±0.96	194.38±1.07	33.83±0.23	13.30±0.06	.619±.03

Table 10. Summary of major ions monitoring, water by water (cont'd.)

Water	Storage Time Week	Parameters, ppm										
		SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	F
Waters Mixture	0	2.26±0.01	96.15±3.80	1.27±0.28	0.51±0.01	12.53±0.46	0.60±0.01	4.95±1.77	42.68±1.08	1.28±0.04	2.77±0.05	.126±.031
	3	2.33±0.01	94.78±2.06	1.20±0.06	0.50±0.00	13.02±0.30	0.57±0.01	<1	43.68±0.95	1.25±0.06	2.72±0.08	
	6	2.25±0.03	83.60±2.06	1.10±0.00	0.51±0.01	12.78±0.20	0.62±0.01	<1	43.16±0.63	1.25±0.02	2.73±0.05	
	9	2.25±0.01	87.78±0.37	0.98±0.04	0.50±0.01	13.40±0.06	not done	3.80±2.26	44.50±0.23	1.21±0.01	2.68±0.04	
	12	2.30±0.02	92.68±1.67	1.00±0.00	0.49±0.01	13.43±0.10	0.60±0.03	2.67±1.85	44.88±0.44	1.42±0.16	2.75±0.06	
	15	2.28±0.01	86.77±1.33	1.07±0.04	0.51±0.01	13.10±0.16	0.59±0.02	<1	43.78±0.44	1.23±0.02	2.7 ±0.0	0.69±.37
RM-ANI-2 (ANI-12*D.L.)	0	1.15±0.004	21.65±1.63	6.88±0.19	2.39±0.02	26.87±0.79	0.42±0.02	82.58±1.65	99.53±2.15	4.08±0.12	7.88±0.12	.258±.024
	3	1.18±0.01	21.50±1.01	6.85±0.08	2.45±0.06	26.37±0.20	0.38±0.01	80.22±0.68	97.67±1.04	4.13±0.05	7.73±0.18	
	6	1.14±0.02	20.40±0.86	6.78±0.08	2.41±0.02	25.63±0.36	0.43±0.01	83.47±1.00	95.36±0.96	4.02±0.08	7.62±0.08	
	9	1.14±0.01	20.57±0.24	6.48±0.15	2.49±0.01	26.82±0.16	not done	83.65±4.05	99.16±0.52	3.94±0.02	7.78±0.04	
	12	1.00±0.07	19.58±0.19	6.50±0.06	2.36±0.06	26.87±0.22	0.42±0.02	83.87±2.12	99.35±0.65	3.92±0.02	7.85±0.06	
	15	1.16±0.01	20.18±0.30	6.72±0.08	2.45±0.02	26.50±0.36	0.41±0.36	89.93±1.06	98.22±0.90	4.18±0.05	7.78±0.04	.246±.075
RM-ANI-3 (ANI-LOW-MED)	0	2.29±0.01	63.50±4.88	24.47±0.30	7.02±0.04	12.67±0.31	0.93±0.16	47.43±2.66	95.29±1.37	16.28±0.81	15.47±0.16	.648±.005
	3	2.36±0.01	60.08±2.65	24.65±0.04	6.92±0.10	12.93±0.24	0.93±0.04	45.88±0.98	94.18±1.02	16.47±0.31	15.05±0.23	
	6	2.28±0.05	51.75±3.54	24.80±0.21	6.92±0.08	12.70±0.09	0.98±0.08	47.65±0.67	92.64±0.83	16.42±0.26	14.82±0.13	
	9	2.28±0.01	56.85±2.10	23.98±0.23	6.75±0.06	13.13±0.22	not done	45.87±3.47	95.29±1.19	15.08±0.04	15.18±0.21	
	12	2.25±0.01	53.22±0.47	23.97±0.14	6.98±0.04	13.25±0.19	1.01±0.03	46.85±1.54	95.50±1.05	16.35±0.08	15.08±0.15	
	15	2.29±0.06	53.60±0.77	24.33±0.89	6.83±0.08	13.23±0.19	0.96±0.03	50.80±2.78	94.80±3.64	16.92±0.12	15.00±0.80	.609±.039
RM-CAT-2 (CAT-12*D.L.)	0	1.26±0.03	18.10±0.66	12.08±0.21	3.21±0.06	28.15±0.69	0.31±0.01	79.00±2.23	99.93±1.76	4.57±0.18	7.20±0.09	.173±.010
	3	1.28±0.02	18.20±0.43	12.27±0.19	3.25±0.06	27.93±1.36	0.29±0.01	76.27±3.76	99.25±1.48	4.55±0.06	7.17±0.16	
	6	1.20±0.07	19.52±3.64	12.57±0.48	3.25±0.02	27.45±0.19	0.34±0.01	79.28±1.61	98.59±0.70	4.48±0.10	7.30±0.06	
	9	1.23±0.01	17.50±0.28	11.90±0.09	3.21±0.03	28.33±0.51	not done	80.80±3.86	100.73±1.25	4.39±0.05	7.28±0.08	
	12	1.23±0.01	17.12±0.47	11.88±0.08	3.16±0.02	28.22±0.21	0.32±0.01	78.67±1.54	100.17±0.70	4.34±0.01	7.22±0.08	
	15	1.23±0.01	17.47±0.37	12.07±0.05	3.23±0.04	27.72±0.33	0.31±0.01	82.16±2.82	98.23±0.96	4.60±0.03	7.05±0.06	.668±.471
RM-CAT-3 (CAT-LOW-MED)	0	7.33±0.05	25.32±1.32	75.90±1.86	7.60±0.09	33.72±4.13	0.36±0.01	48.87±2.53	120.67±3.38	24.78±0.16	7.80±0.35	.200±.031
	3	7.50±0.03	26.08±1.24	77.78±1.08	7.53±0.08	34.93±0.79	0.35±0.01	46.90±2.34	119.47±2.33	24.43±0.27	8.00±0.50	
	6	7.31±0.11	25.22±0.84	70.67±2.89	7.57±0.05	34.63±0.43	0.40±0.01	48.90±1.49	119.75±1.15	24.63±0.45	8.08±0.15	
	9	7.17±0.03	25.82±0.34	78.57±0.64	7.37±0.05	36.28±0.26	not done	46.95±2.18	123.67±0.61	23.52±0.08	8.03±0.05	
	12	6.94±0.04	24.67±0.30	73.54±0.17	7.65±0.06	35.37±0.19	0.38±0.02	47.60±4.36	120.72±0.69	24.63±0.23	7.90±0.06	
	15	7.23±0.06	25.08±0.31	75.92±1.00	7.55±0.05	35.28±0.33	0.38±0.01	53.25±0.33	120.35±0.95	24.90±0.13	7.83±0.05	.17 ±.04

Table 10. Summary of major ions monitoring, water by water (cont'd.)

Water	Storage Time Week	Parameters, ppm										
		SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	F
CRM-2 (Sample)	0	<0.02	38.33±0.18	104.12±1.24	0.87±0.00	41.52±1.55	0.04±0.01	1.59±0.31	142.29±4.07	18.38±0.44	9.38±0.08	.149±.03
	3	<0.02	37.27±1.60	107.45±0.79	0.90±0.00	41.92±0.37	0.033±0.003	<1	142.67±1.25	18.87±0.23	9.23±0.10	
	6	<0.02	37.67±1.65	99.20±6.14	0.90±0.01	40.68±0.28	0.03±0.01	<1	139.18±0.95	18.67±0.18	9.13±0.16	
	9	<0.02	36.43±1.56	105.97±1.26	0.88±0.01	43.02±0.40	not done	1.98±0.62	146.31±0.95	16.85±0.14	9.45±0.08	
	12	<0.02	36.67±0.33	104.47±0.46	0.87±0.01	42.22±0.52	0.03±0.01	1.54±0.26	143.69±1.82	18.80±0.13	9.30±0.14	
	15	<0.02	38.02±0.51	103.77±0.96	0.87±0.01	42.07±0.39	0.03±0.00	-	143.20±0.93	19.23±0.10	9.25±0.05	.225±.075

Table 11. Summary of Na (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	2.83±0.05	2.80±0.00	2.90±0.07	2.78±0.01	2.94±0.17	2.83±0.03
2	Mercy River	2.93±0.05	2.98±0.04	3.04±0.05	2.96±0.16	2.93±0.06	2.94±0.02
3	Sand Pond	3.72±0.08	3.83±0.05	4.13±0.04	3.73±0.02	3.69±0.02	3.80±0.02
4	Carillon	2.23±0.08	2.20±0.00	2.28±0.03	2.18±0.01	2.15±0.01	2.21±0.03
5	St. Lambert	12.40±0.11	12.48±0.21	12.43±0.10	11.93±0.16	12.20±0.06	12.70±0.06
6	Red Deer	28.97±2.49	29.20±0.21	27.77±0.40	28.27±0.10	29.67±0.08	29.83±0.19
7	Qu'Appelle River	112.00±1.10	112.33±0.52	111.33±1.51	99.33±0.87	109.50±1.52	114.33±1.21
8	Fraser River	6.93±0.05	7.12±0.12	7.14±0.06	7.11±0.03	7.02±0.08	7.30±0.06
9	Sumas River	-	-	2687.50±44.24	2582.00±27.60	2592.50±10.41	2541.0±21.67
10	Hamilton Harbour	33.32±0.11	32.37±0.23	30.87±0.46	34.05±0.24	32.73±0.21	33.83±0.23
11	Waters Mixture	1.28±0.04	1.25±0.06	1.25+0.02	1.21+0.01	1.42±0.16	1.23±0.02
12	RM-ANI-2 (ANI-12*D.L.)	4.08±0.12	4.13±0.05	4.02±0.08	3.94±0.02	3.92±0.02	4.18±0.05
13	RM-ANI-3 (ANI-LOW-MED)	16.28±0.81	16.47±0.31	16.42±0.26	15.08±0.04	16.35±0.08	16.92±0.12
14	RM-CAT-2 (CAT-12*D.L.)	4.57±0.18	4.55±0.06	4.48±0.10	4.39±0.05	4.34±0.01	4.60±0.03
15	RM-CAT-3 (CAT-LOW-MED)	24.78±0.16	24.43±0.27	24.63±0.45	23.52±0.08	24.63±0.23	24.90±0.13
16	CRM-2 (Sample C)	18.38±0.44	18.87±0.23	18.67±0.18	16.85±0.14	18.80±0.13	19.23±0.10

Table 12. Summary of K (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	0.24±0.01	0.20±0.00	0.24±0.02	0.23±0.00	0.28±0.04	0.22±0.01
2	Mercy River	0.27±0.01	0.28±0.04	0.28±0.01	0.28±0.04	0.27±0.02	0.26±0.01
3	Sand Pond	0.19±0.01	0.23±0.05	0.24±0.00	0.18±0.01	0.18±0.01	0.17±0.01
4	Carillon	0.80±0.02	0.80±0.00	0.81±0.12	0.79±0.01	0.78±0.01	0.79±0.01
5	St. Lambert	1.34±0.02	1.35±0.06	1.36±0.01	1.36±0.03	1.31±0.01	1.32±0.02
6	Red Deer	3.09±0.09	3.07±0.05	3.05±0.02	3.05±0.01	3.03±0.02	3.10±0.03
7	Qu'Appelle River	11.67±0.26	11.52±0.16	11.20±0.06	10.23±0.20	10.98±0.17	11.06±1.15
8	Fraser River	7.30±0.10	7.20±0.06	7.27±0.05	7.10±0.00	7.30±0.00	7.20±0.00
9	Sumas River	-	-	101.67±0.52	97.58±3.22	102.67±1.37	98.93±0.46
10	Hamilton Harbour	4.92±0.12	4.90±0.09	4.90±0.00	4.85±0.04	4.97±0.02	4.97±0.02
11	Waters Mixture	0.51±0.01	0.50±0.00	0.51±0.01	0.50±0.01	0.49±0.01	0.51±0.01
12	RM-ANI-2 (ANI-12*D.L.)	2.39±0.02	2.45±0.06	2.41±0.02	2.49±0.01	2.36±0.01	2.45±0.02
13	RM-ANI-3 (ANI-LOW-MED)	7.02±0.04	6.92±0.10	6.92±0.08	6.75±0.06	6.98±0.04	6.83±0.08
14	RM-CAT-2 (CAT-12*D.L.)	3.21±0.06	3.25±0.06	3.25±0.02	3.21±0.03	3.16±0.02	3.23±0.04
15	RM-CAT-3 (CAT-LOW-MED)	7.60±0.09	7.53±0.08	7.57±0.05	7.37±0.05	7.65±0.06	7.55±0.05
16	CRM-2 (Sample C)	0.87±0.00	0.90±0.00	0.90±0.01	0.88±0.01	0.87±0.01	0.87±0.01

Table 13. Summary of Ca (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	0.82±0.10	0.38±0.04	0.35±0.02	0.37±0.01	0.41±0.03	0.43±0.03
2	Mercy River	1.00±0.00	0.87±0.05	0.80±0.01	0.88±0.01	0.90±0.02	0.87±0.01
3	Sand Pond	0.82±0.12	0.56±0.05	0.46±0.02	0.48±0.05	0.54±0.05	0.53±0.05
4	Carillon	7.30±0.28	7.68±0.29	7.58±0.23	7.79±0.09	7.85±0.11	7.57±0.05
5	St. Lambert	36.28±1.24	36.17±1.02	35.60±0.37	37.38±0.19	37.02±0.24	36.40±0.21
6	Red Deer	40.62±1.24	40.80±0.84	40.18±0.59	41.47±0.29	41.18±0.39	40.42±0.15
7	Qu'Appelle River	64.15±1.68	64.25±0.90	58.87±1.09	65.22±0.82	64.52±0.95	63.78±1.12
8	Fraser River	16.28±0.37	16.38±0.47	16.53±0.20	16.78±0.16	17.05±0.14	16.38±0.15
9	Sumas River	-	-	110.00±0.63	107.00±1.79	106.15±3.59	113.17±1.47
10	Hamilton Harbour	55.10±0.55	54.08±1.03	52.13±2.05	57.68±0.28	56.85±0.46	56.08±0.41
11	Waters Mixture	12.53±0.46	13.02±0.30	12.78±0.20	13.40±0.06	13.43±0.10	13.10±0.16
12	RM-ANI-2 (ANI-12*D.L.)	26.87±0.79	26.37±0.20	25.63±0.36	26.82±0.16	26.87±0.22	26.50±0.36
13	RM-ANI-3 (ANI-LOW-MED)	12.67±0.31	12.93±0.24	12.70±0.09	13.13±0.22	13.25±0.19	13.23±0.19
14	RM-CAT-2 (CAT-12*D.L.)	28.15±0.69	27.93±0.36	27.45±0.19	28.33±0.51	28.22±0.21	27.72±0.33
15	RM-CAT-3 (CAT-LOW-MED)	33.72±4.13	34.93±0.79	34.63±0.43	36.28±0.26	35.37±0.19	35.28±0.33
16	CRM-2 (Sample C)	41.52±1.55	41.92±0.37	40.68±0.28	43.02±0.40	42.22±0.52	42.07±0.39

Table 14. Summary of Mg (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	0.45±0.06	0.40±0.01	0.37±0.01	0.37±0.00	0.37±0.01	0.37±0.01
2	Mercy River	0.48±0.04	0.43±0.05	0.42±0.004	0.43±0.01	0.43±0.01	0.42±0.00
3	Sand Pond	0.52±0.04	0.55±0.08	0.43±0.004	0.45±0.02	0.46±0.02	0.44±0.02
4	Carillon	1.80±0.11	1.80±0.06	1.82±0.48	1.83±0.01	1.80±0.03	1.75±0.01
5	St. Lambert	7.82±0.13	7.72±0.15	7.85±0.22	7.92±0.08	8.00±0.06	7.78±0.04
6	Red Deer	15.50±0.17	14.87±0.23	14.92±0.33	15.32±0.15	14.98±0.10	14.9±0.19
7	Qu'Appelle River	35.78±0.17	35.82±0.17	36.43±0.49	37.20±0.95	36.97±0.62	35.8±0.22
8	Fraser River	16.52±0.11	16.22±0.17	16.13±0.21	16.35±0.23	16.53±0.10	16.50±0.11
9	Sumas River	-	-	125.17±1.17	336.50±3.94	327.83±2.86	321.33±3.01
10	Hamilton Harbour	13.25±0.24	13.20±0.25	13.20±0.17	13.35±0.14	13.33±0.10	13.30±0.06
11	Waters Mixture	2.77±0.05	2.72±0.08	2.73±0.05	2.68±0.04	2.75±0.06	2.70±0.00
12	RM-ANI-2 (ANI-12*D.L.)	7.88±0.12	7.73±0.18	7.62±0.08	7.78±0.04	7.85±0.06	7.78±0.04
13	RM-ANI-3 (ANI-LOW-MED)	15.47±0.16	15.05±0.23	14.82±0.13	15.18±0.21	15.08±0.15	15. 00±0.80
14	RM-CAT-2 (CAT-12*D.L.)	7.20±0.09	7.17±0.16	7.30±0.06	7.28±0.08	7.22±0.08	7.05±0.06
15	RM-CAT-3 (CAT-LOW-MED)	7.80±0.35	8.00±0.50	8.08±0.15	8.03±0.05	7.90±0.06	7.83±0.05
16	CRM-2 (Sample C)	9.38±0.08	9.23±0.10	9.13±0.16	9.45±0.08	9.30±0.14	9.25±0.06

Table 15. Summary of hardness (ppm - $CaCO_3$) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	3.89±0.46	2.59±0.10	2.54±0.41	2.44±0.02	2.55±0.08	2.61±0.11
2	Mercy River	4.48±0.17	3.95±0.22	3.73±0.03	3.94±0.04	4.03±0.04	3.91±0.03
3	Sand Pond	4.17±0.38	3.80±0.69	2.93±0.06	3.05±0.21	3.22±0.19	3.12±0.19
4	Carillon	25.64±1.09	26.59±0.91	25.92±0.86	26.97±0.27	26.99±0.35	26.13±0.17
5	St. Lambert	122.98±3.14	122.06±2.63	121.21±1.68	125.94±0.62	125.37±0.63	122.94±0.59
6	Red Deer	165.22±3.51	163.07±2.08	161.74±2.76	166.59±1.12	164.51±1.20	161.85±1.51
7	Qu'Appelle River	307.47±4.04	307.85±2.75	296.95±2.98	315.96±3.97	313.25±4.69	306.45±0.93
8	Fraser River	108.15±0.80	107.66±1.59	107.69±0.70	109.21±1.17	110.63±0.65	108.84±0.55
9	Sumas River	-	-	786.53±8.54	1652.21±19.94	1614.42±11.67	1605.50±12.88
10	Hamilton Harbour	192.12±1.88	189.34±2.30	184.51±4.92	198.97±0.63	196.83±1.29	194.38±1.07
11	Waters Mixture	42.68±1.08	43.68±0.95	43.16±0.63	44.50±0.23	44.88±0.44	43.78±0.44
12	RM-ANI-2 (ANI-12*D.L.)	99.53±2.15	97.67±1.04	95.36±0.96	99.16±0.52	99.35±0.65	98.22±0.90
13	RM-ANI-3 (ANI-LOW-MED)	95.29±1.37	94.18±1.02	92.64±0.83	95.29±1.19	95.50±1.05	94.80±3.64
14	RM-CAT-2 (CAT-12*D.L.)	99.93±1.76	99.25±1.48	98.59±0.70	100.73±1.25	100.17±0.70	98.23±0.96
15	RM-CAT-3 (CAT-LOW-MED)	120.07±3.38	119.47±2.33	119.75±1.15	123.67±0.61	120.72±0.69	120.35±0.95
16	CRM-2 (Sample C)	142.29±4.07	142.67±1.25	139.18±0.95	146.31±0.95	143.69±1.82	143.20±0.93

Table 16. Summary of SO_4 (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	6.87±0.46	6.30±0.16	6.37±0.73	6.38±0.34	5.45±0.23	6.15±0.30
2	Mercy River	9.27±0.22	9.67±0.14	9.28±0.28	9.97±0.22	7.90±0.74	9.57±0.12
3	Sand Pond	10.26±0.25	10.62±0.17	10.42±0.61	10.70±0.30	16.47±3.67	7.97±0.26
4	Carillon	9.57±0.37	10.65±0.52	9.87±0.45	10.10±0.32	9.58±0.04	<0.2
5	St. Lambert	26.70±0.35	26.57±0.21	27.03±1.39	26.88±0.45	27.33±0.18	27.08±0.45
6	Red Deer	80.58±4.39	77.93±0.89	70.65±4.69	76.72±0.61	77.42±0.94	72.07±1.03
7	Qu'Appelle River	243.62±2.08	244.65±3.72	243.45±7.46	244.17±0.72	236.63±4.08	237.30±4.13
8	Fraser River	13.50±1.23	14.80±0.84	14.17±1.23	13.48±0.86	13.00±0.11	<0.2
9	Sumas River	-	-	656.28±20.55	698.87±1.63	709.88±5.34	<0.2
10	Hamilton Harbour	65.88±3.64	59.13±1.22	63.90±1.09	67.17±2.53	65.05±1089	<0.2
11	Waters Mixture	96.15±3.80	94.78±2.06	83.60±2.06	87.78±0.37	92.68±1.67	87.77±1.33
12	RM-ANI-2 (ANI-12*D.L.)	21.65±1.63	21.50±1.01	20.40±0.86	20.57±0.24	19.58±0.19	20.18±0.30
13	RM-ANI-3 (ANI-LOW-MED)	63.50±4.88	60.08±2.65	51.75±3.54	56.85±2.10	53.22±0.47	53.60±0.71
14	RM-CAT-2 (CAT-12*D.L.)	18.10±0.66	18.20±0.43	19.52±3.64	17.50±0.28	17.12±0.47	17.47±0.37
15	RM-CAT-3 (CAT-LOW-MED)	25.32±1.32	26.08±1.24	25.22±0.84	25.82±0.34	24.67±0.30	25.08±0.31
16	CRM-2 (Sample C)	38.33±0.18	37.27±1.60	37.67±1.65	36.43±1.56	36.67±0.33	38.02±0.51

Table 17. Summary of Cl (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	4.35±0.27	4.33±0.16	4.38±0.21	4.15±0.06	4.20±0.23	4.28±0.10
2	Mercy River	4.66±0.20	4.72±0.12	4.55±0.16	4.80±0.63	4.55±0.16	4.43±0.05
3	Sand Pond	5.30±0.93	5.95±0.08	6.17±0.35	5.73±0.08	10.30±2.01	5.70±0.00
4	Carillon	2.02±0.15	2.25±0.14	2.10±0.17	2.07±0.08	2.12±0.04	--
5	St. Lambert	24.38±0.25	25.05±0.24	25.07±0.16	24.35±0.27	24.55±0.06	24.68±0.08
6	Red Deer	3.93±0.19	4.00±0.13	3.75±0.23	3.67±0.05	3.95±0.11	3.57±0.14
7	Qu'Appelle River	89.42±1.50	91.43±0.43	82.83±4.57	90.52±0.86	91.60±0.27	89.87±1.80
8	Fraser River	12.78±0.87	12.75±0.19	12.43±0.10	12.28±0.10	12.57±0.05	--
9	Sumas River	-	-	4904.77±272.33	4299.28±29.13	4565.48±84.99	4794.08±134.26
10	Hamilton Harbour	62.03±0.98	64.48±0.71	57.45±2.49	64.93±0.75	61.98±0.23	--
11	Waters Mixture	1.27±0.28	1.20±0.06	1.10±0.00	0.98±0.04	1.00±0.00	1.07±0.14
12	RM-ANI-2 (ANI-12*D.L.)	6.88±0.19	6.85±0.08	6.78±0.08	6.48±0.15	6.50±0.06	6.72±0.08
13	RM-ANI-3 (ANI-LOW-MED)	24.47±0.30	24.65±0.04	24.80±0.21	23.98±0.23	23.97±0.14	24.33±0.89
14	RM-CAT-2 (CAT-12*D.L.)	12.08±0.21	12.27±0.19	12.57±0.48	11.90±0.09	11.88±0.08	12.07±0.05
15	RM-CAT-3 (CAT-LOW-MED)	75.90±1.86	77.78±1.08	70.67±2.89	78.57±0.64	73.54±0.17	75.92±0.99
16	CRM-2 (Sample C)	104.12±1.24	107.45±0.79	99.20±6.14	105.97±1.26	104.47±0.46	103.77±0.96

Table 18. Summary of alkalinity (ppm-$CaCO_3$) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	<1	<1	<1	1.95±0.61	2.64±1.87	<1
2	Mercy River	<1	<1	<1	1.88±0.54	1.13±0.15	<1
3	Sand Pond	2.22±0.56	<1	<1	4.82±1.83	2.37±0.55	2.56±1.33
4	Carillon	16.80±1.45	16.65±0.58	17.75±0.72	15.53±1.47	17.64±2.00	19.32±1.49
5	St. Lambert	90.18±1.98	88.60±1.30	93.17±1.68	92.82±5.35	90.72±2.33	96.83±1.46
6	Red Deer	150.67±2.73	146.27±3.07	151.27±5.95	151.07±3.08	154.98±4.44	155.32±11.10
7	Qu'Appelle River	183.83±6.52	179.4±5.38	187.18±1.75	183.88±2.93	188.75±4.85	178.57±43.85
8	Fraser River	95.77±1.42	91.12±0.69	94.57±1.39	94.30±4.54	94.22±1.61	98.35±4.10
9	Sumas River	-	-	54.48±0.40	53.55±3.03	55.68±2.36	57.88±2.27
10	Hamilton Harbour	111.17±1.84	104.85±1.20	108.87±1.49	109.37±2.80	108.13±1.45	113.98±0.96
11	Waters Mixture	4.95±1.77	<1	<1	3.80±2.26	2.67±1.85	<1
12	RM-ANI-2 (ANI-12*D.L.)	82.58±1.65	80.22±0.68	83.47±1.00	83.65±4.05	83.87±2.12	89.93±1.06
13	RM-ANI-3 (ANI-LOW-MED)	47.43±2.66	45.88±0.98	47.65±0.67	45.87±3.47	46.85±1.54	50.80±2.78
14	RM-CAT-2 (CAT-12*D.L.)	79.00±2.23	76.27±3.76	79.28±1.61	80.80±3.86	78.67±1.54	82.16±2.82
15	RM-CAT-3 (CAT-LOW-MED)	48.87±2.53	46.90±2.34	48.90±1.49	46.92±2.18	47.60±4.36	53.25±0.33
16	CRM-2 (Sample C)	1.59±0.31	<1	<1	1.98±0.62	1.54±0.26	-

Table 19. Summary of SiO_2 (ppm) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	1.88±0.02	1.95±0.02	1.84±0.08	1.89±0.01	1.86±0.04	1.88±0.01
2	Mercy River	1.67±0.01	1.75±0.01	1.62±0.07	1.67±0.01	1.65±0.01	1.65±0.02
3	Sand Pond	1.62±0.05	1.74±0.02	1.63±0.06	1.68±0.004	2.09±0.73	1.03±0.43
4	Carillon	3.49±0.05	3.77±0.01	3.54±0.08	3.59±0.05	3.66±0.12	3.48±0.23
5	St. Lambert	0.37±0.01	0.39±0.03	0.40±0.01	0.37±0.01	0.37±0.01	0.38±0.02
6	Red Deer	2.97±0.03	3.04±0.01	3.02±0.08	2.99±0.01	2.67±0.03	3.05±0.03
7	Qu'Appelle River	7.66±0.06	7.89±0.06	7.77±0.11	7.59±0.06	7.72±0.02	7.66±0.12
8	Fraser River	18.17±0.11	19.16±0.10	18.27±0.21	18.23±0.07	18.28±0.06	18.09±0.09
9	Sumas River	-	-	3.32±0.12	3.21±0.07	3.33±0.01	3.26±0.01
10	Hamilton Harbour	0.23±0.01	0.29±0.01	0.25±0.04	0.27±0.01	0.20±0.05	0.20±0.08
11	Waters Mixture	2.26±0.01	2.33±0.01	2.25±0.03	2.25±0.01	2.30±0.02	2.28±0.01
12	RM-ANI-2 (ANI-12*D.L.)	1.15±0.004	1.18±0.01	1.14±0.02	1.14±0.01	1.00±0.07	1.16±0.01
13	RM-ANI-3 (ANI-LOW-MED)	2.29±0.01	2.36±0.01	2.28±0.05	2.28±0.1	2.25±0.01	2.23±0.06
14	RM-CAT-2 (CAT-12*D.L.)	1.26±0.03	1.28±0.02	1.20±0.07	1.23±0.01	1.23±0.01	1.23±0.01
15	RM-CAT-3 (CAT-LOW-MED)	7.33±0.05	7.50±0.03	7.31±0.11	7.17±0.03	6.94±0.04	7.23±0.06
16	CRM-2 (Sample C)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Table 20. Summary of NO_3 and NO_2 (ppm-N) monitoring

No.	Waters	Storage Time, Week					
		0	3	6	9	12	15
1	Pebble-loggitch	0.017±0.014	<0.01	<0.01	-	0.012±0.002	0.014±0.002
2	Mercy River	<0.01	<0.01	<0.01	-	<0.01	<0.01
3	Sand Pond	0.02±0.01	0.02±0.01	0.01±0.01	-	0.02±0.004	0.023±0.003
4	Carillon	0.13±0.01	0.13±0.01	0.20±0.07	-	0.27±0.04	0.300±0.085
5	St. Lambert	0.16±0.01	0.14±0.004	0.13±0.08	-	0.25±0.03	0.248±0.013
6	Red Deer	0.03±0.02	0.02±0.001	<.005	-	0.06±0.01	0.033±0.016
7	Qu'Appelle River	2.86±0.06	3.44±0.12	2.87±0.42	-	3.32±0.04	3.212±0.121
8	Fraser River	2.16±0.05	2.57±0.02	2.18±0.20	-	2.53±0.04	2.523±0.03
9	Sumas River	-	-	0.014±0.005	-	0.012±0.004	<0.01
10	Hamilton Harbour	2.80±0.08	2.75±0.08	3.00±0.28	-	3.56±0.06	3.452±0.118
11	Waters Mixture	0.60±0.01	0.57±0.01	0.62±0.01	-	0.60±0.03	0.591±0.017
12	RM-ANI-2 (ANI-12*D.L.)	0.42±0.02	0.38±0.01	0.43±0.01	-	0.42±0.02	0.408±0.013
13	RM-ANI-3 (ANI-LOW-MED)	0.93±0.16	0.93±0.04	0.98±0.08	-	1.01±0.03	0.957±19.510
14	RM-CAT-2 (CAT-12*D.L.)	0.31±0.01	0.29±0.01	0.34±0.01	-	0.32±0.01	0.308±0.013
15	RM-CAT-3 (CAT-LOW-MED)	0.36±0.01	0.35±0.01	0.40±0.01	-	0.38±0.02	0.378±0.013
16	CRM-2 (Sample C)	0.04±0.01	0.033±0.003	0.03±0.01	-	0.03±0.01	0.033±0.002

Table 21. Summary of F(ppm) and B (ppm) monitoring

No.	Waters	Storage Time, Week			
		0(F)	15(F)	0(B)	15 (B)
1	Pebbleloggitch	0.067±0.004	0.071±0.02	<0.004	<0.004
2	Mercy River	0.069±0.013	0.071±0.011	<0.004	<0.004
3	Sand Pond	-	-	-	-
4	Carillon	0.098±0.01	0.103±0.02	<0.004	0.005±0.001
5	St. Lambert	0.20±0.006	0.198±0.011	<0.004	0.026±0.001
6	Red Deer	0.293±0.007	0.278±0.17	<0.004	0.028±0.001
7	Qu'Appelle River	0.599±0.007	0.624±0.045	0.054±0.014	0.176±0.002
8	Fraser River	-	-	-	-
9	Sumas River	-	-	-	-
10	Hamilton Harbour	0.646±0.007	0.619±0.03	<0.004	0.097±0.001
11	Waters Mixture	0.126±0.031	0.690±0.37	<0.004	0.006±0.001
12	RM-ANI-2 (ANI-12*D.L.)	0.258±0.24	0.246±0.75	<0.004	0.013±0.002
13	RM-ANI-3 (ANI-LOW-MED)	0.648±0.005	0.609±0.039	<0.004	<0.004
14	RM-CAT-2 (CAT-12*D.L.)	0.173±0.010	0.668±0.471	<0.004	0.012±0.00
15	RM-CAT-3 (CAT-LOW-MED)	0.200±0.031	0.17±0.04	<0.004	0.007±0.001
16	CRM-2 (Sample C)	0.149±0.030	0.225±0.075	<0.004	<0.004

Table 22. Summary of evaluated results

Parameter	High Level		Medium Level		Low Level	
pH, ph units	> 7	OK	> 4 & < 7	OK	< 4	OK
Colour, H.U.	> 40	OK	> 5 & < 40	OK	< 5	OK
Specific conductance, µs/cm	>480	OK	> 40 & <480	OK	< 40	OK
Turbidity, JTU	> 6	?	>0.3 & < 6	?	<0.3	?
Na, ppm	> 80	OK	> 8 & < 35	OK	< 8	OK
K, ppm	> 10	OK	>0.7 & < 8	OK	<0.7	OK
Ca, ppm	> 50	OK	> 1 & < 50	OK	≤ 1	?
Mg, ppm	> 35	OK	> 1 & < 17	OK	< 1	?
Hardness, ppm $CaCo_3$	>300	OK	> 25 & <300	OK	< 5	?
SO_4, ppm	> 30	Some uncertainty due to MTB analysis.	> 11 & < 30	OK	<11	Some uncertainty due to MTB analysis.
Cl, ppm	> 70	OK	> 3 & < 70	OK	< 3	OK
Alkalinity, ppm $CaCO_3$	>100	OK	> 5 & <100	OK	< 5	?
SiO_2, ppm	> 7	OK	> 1 & < 7	OK	< 1	OK
NO_3 & NO_2-N, ppm	>0.9	OK	>0.1 & <0.9	OK	<0.1	?
F, ppm	>0.5	Seems OK More data needed.	>0.1 & <0.5	Seems OK More data needed.	<0.1	Seems OK More data needed.
B, ppm	Not enough data		Not enough data		Not enough data	

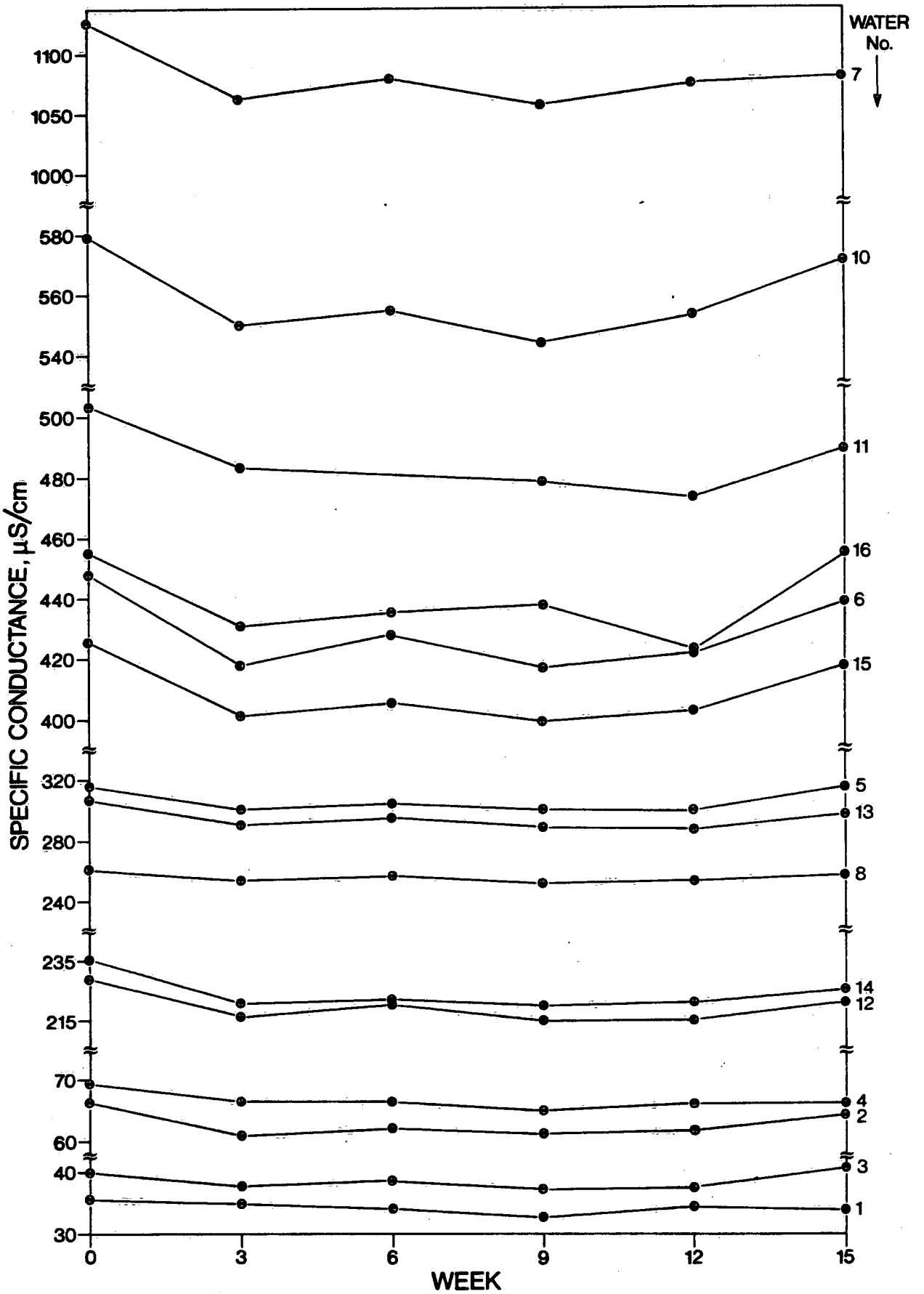

FIGURE 1. SPECIFIC CONDUCTANCE MONITORING (each point represents the average of 6 observations)

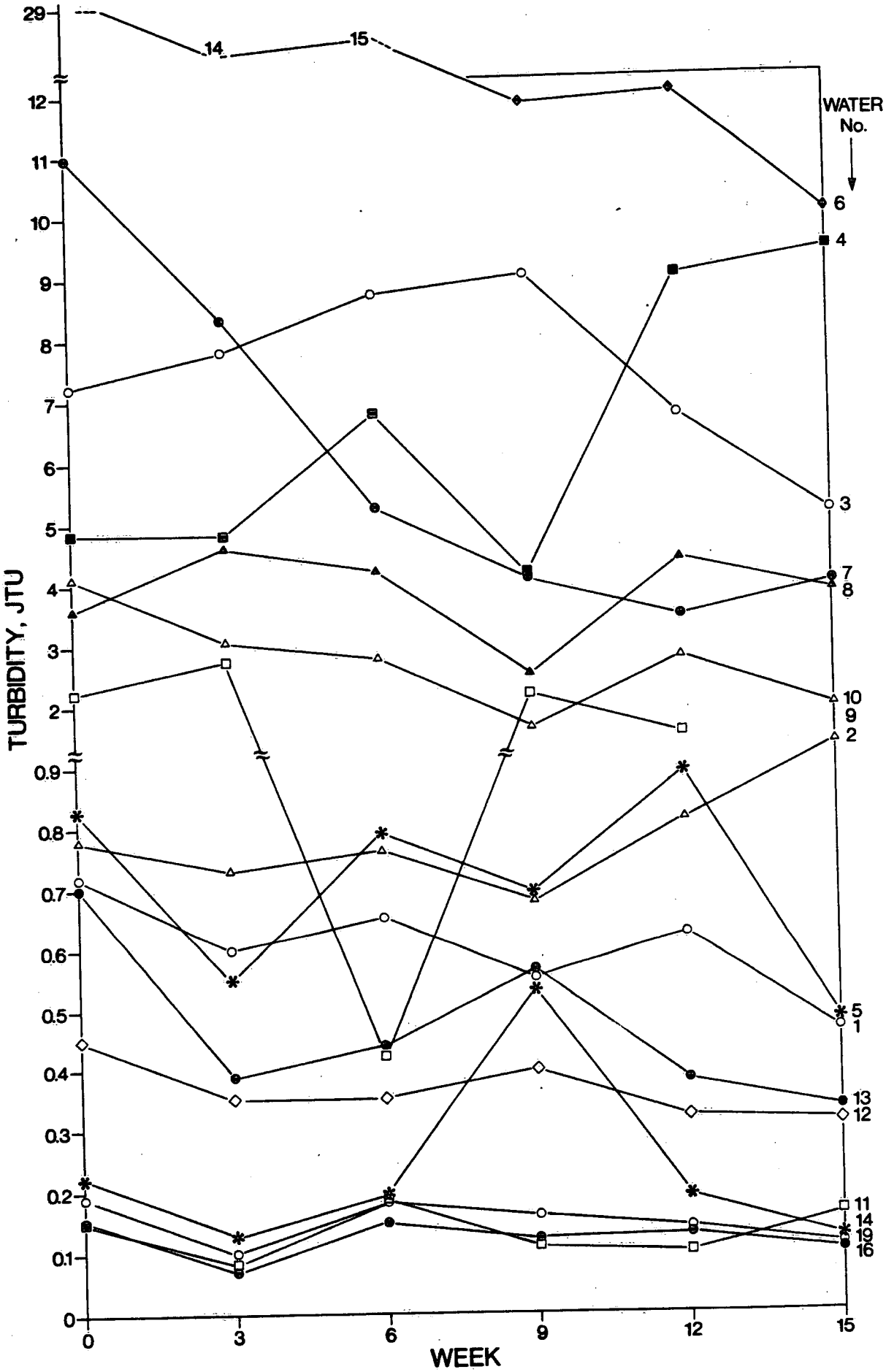

FIGURE 2. TURBIDITY MONITORING (each point represents the average of 6 observations)

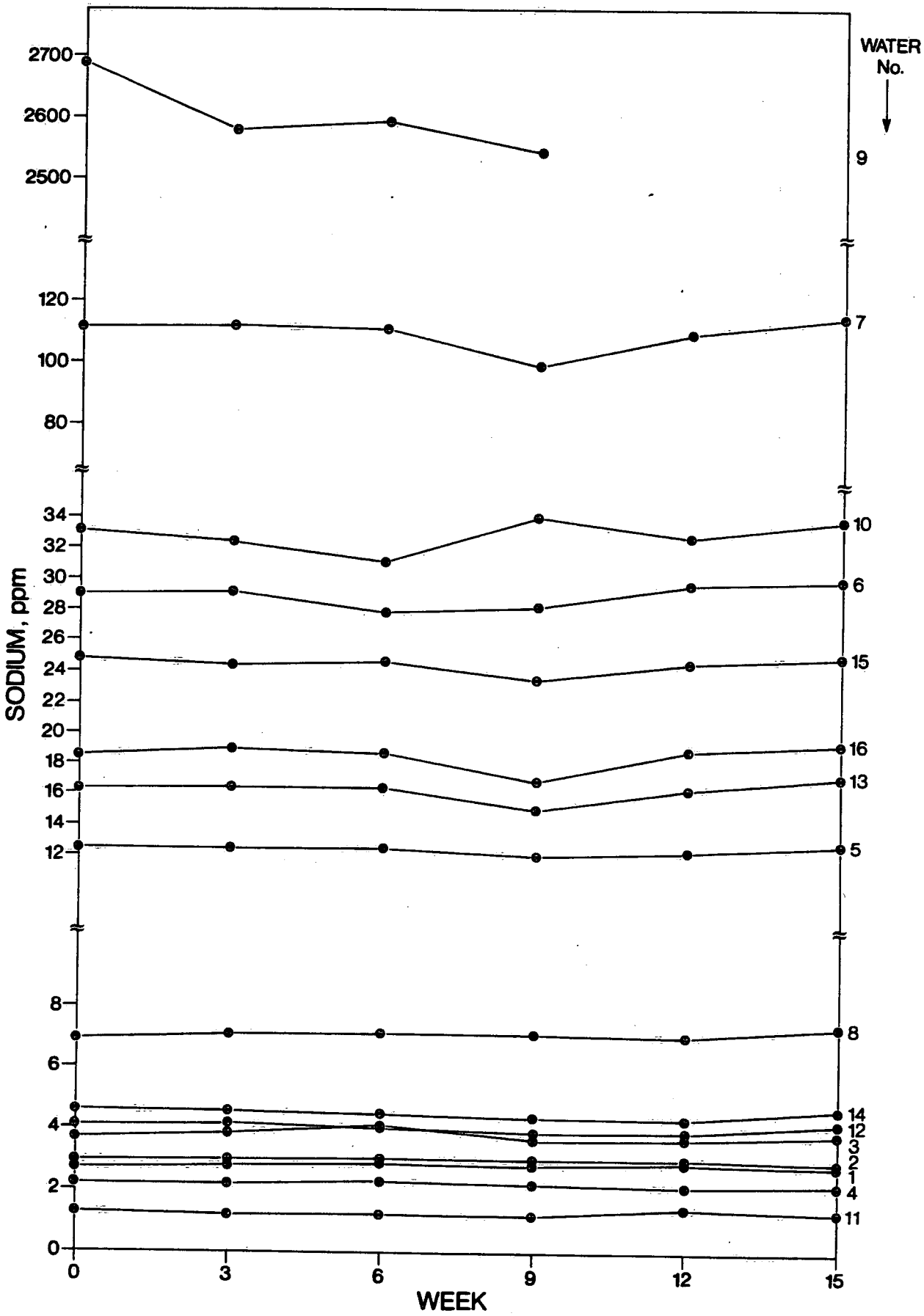

FIGURE 3. Na MONITORING (each point represents the average of 6 observations)

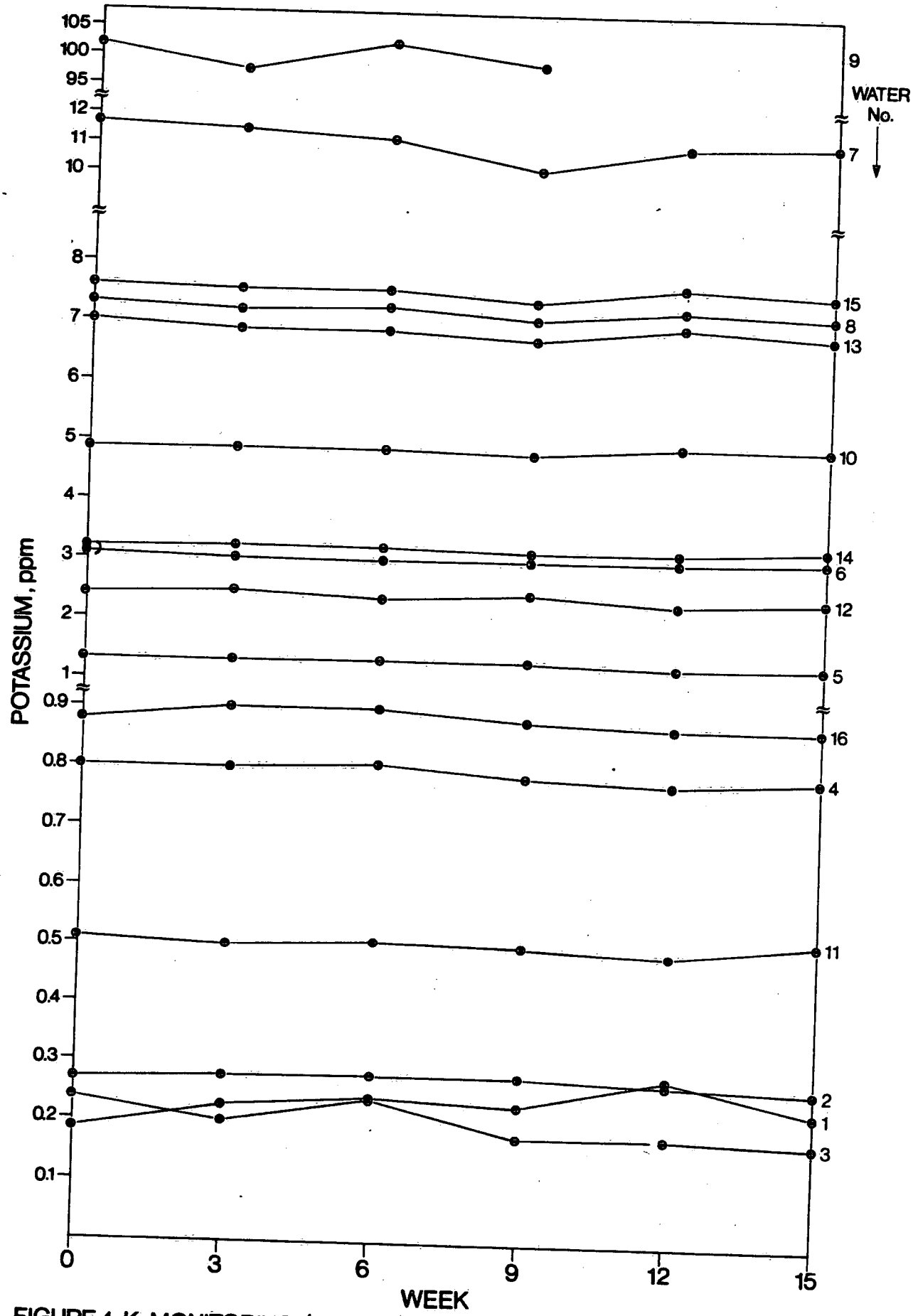

FIGURE 4. K MONITORING (each point represents the average of 6 observations)

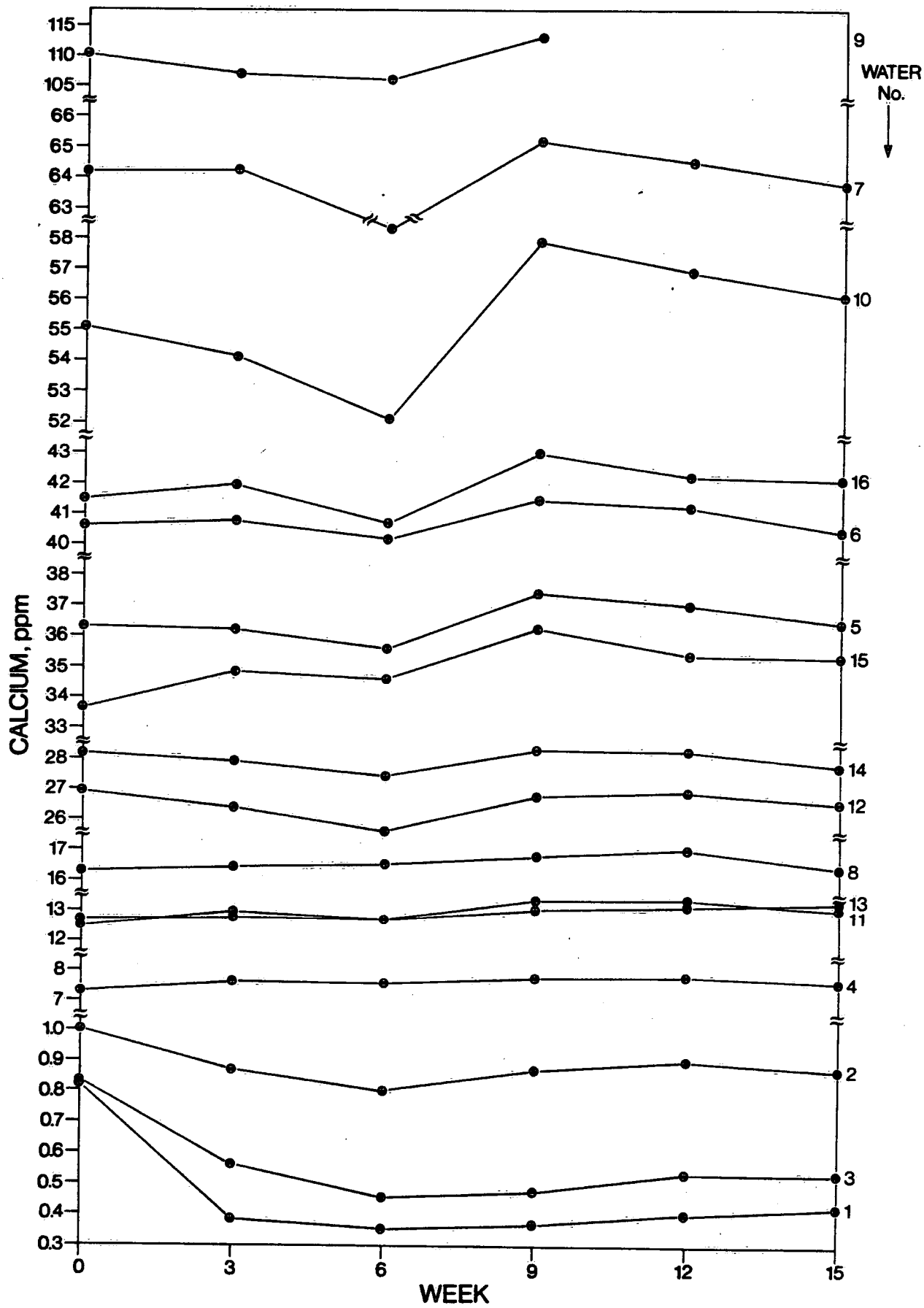

FIGURE 5. Ca MONITORING (each point represents the average of 6 observations)

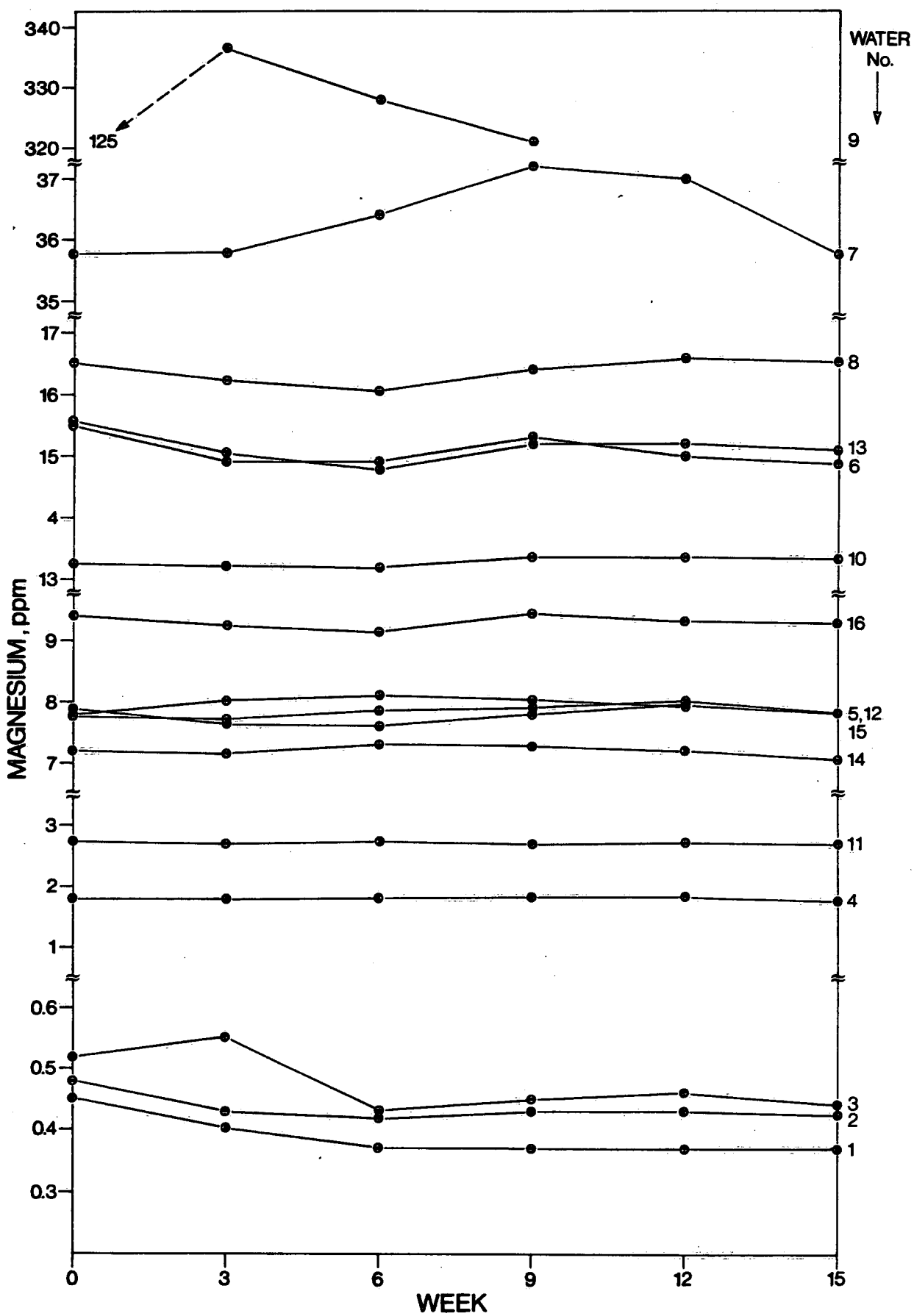

FIGURE 6. Mg MONITORING (each point represents the average of 6 observations)

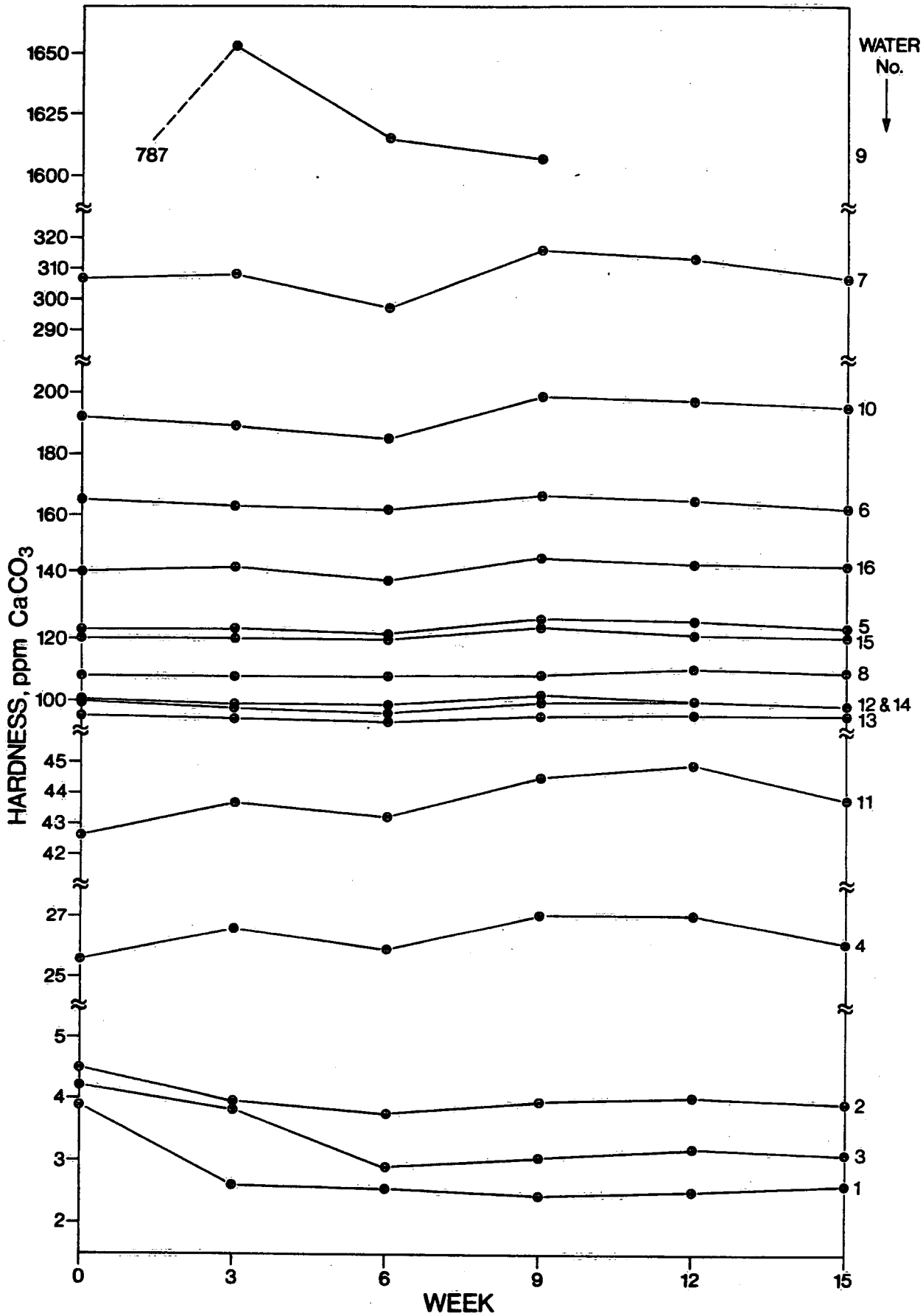

FIGURE 7. HARDNESS MONITORING (each point represents the average of 6 observations)

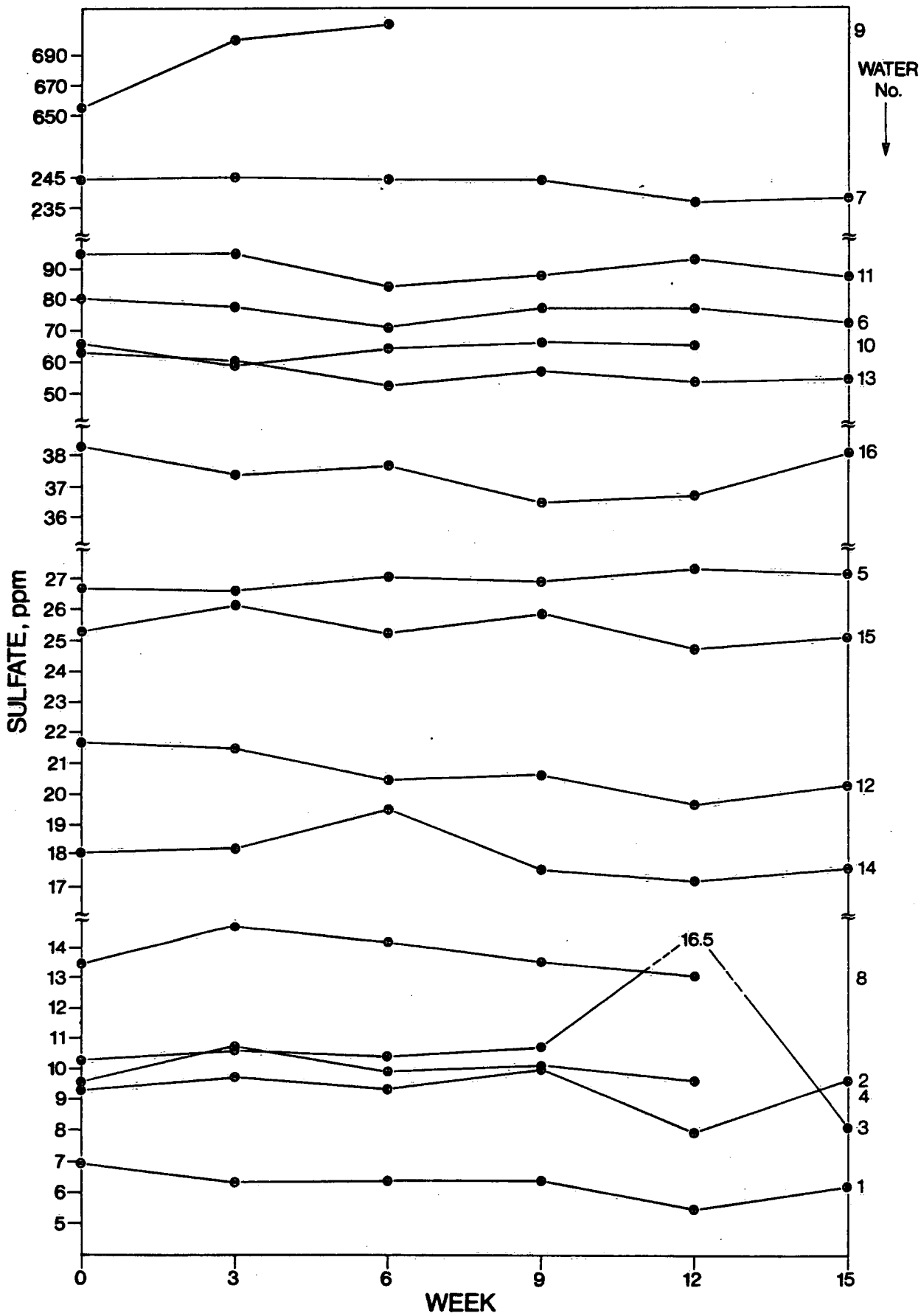

FIGURE 8. SO_4 MONITORING (each point represents the average of 6 observations)

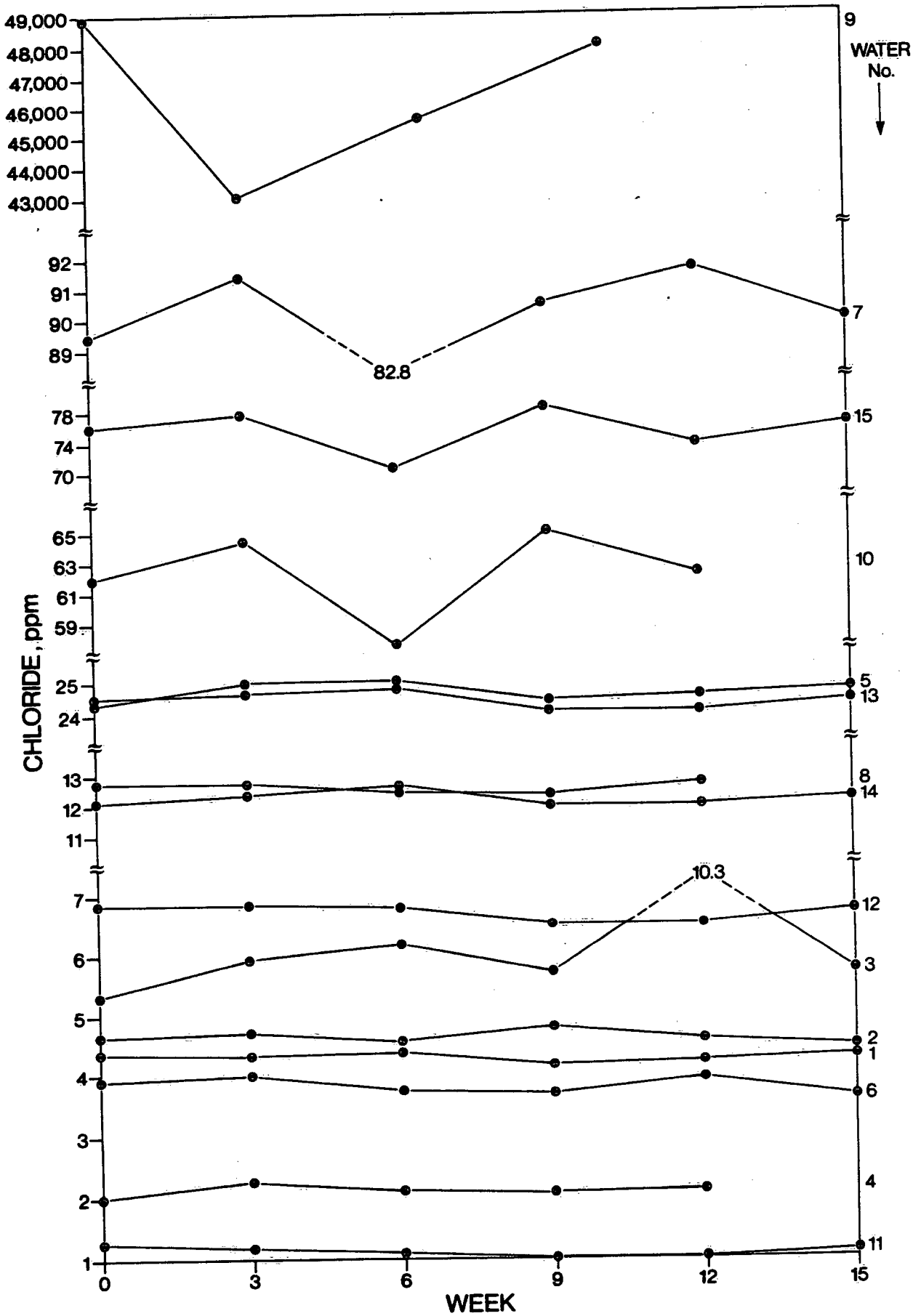

FIGURE 9. Cl MONITORING (each point represents the average of 6 observations)

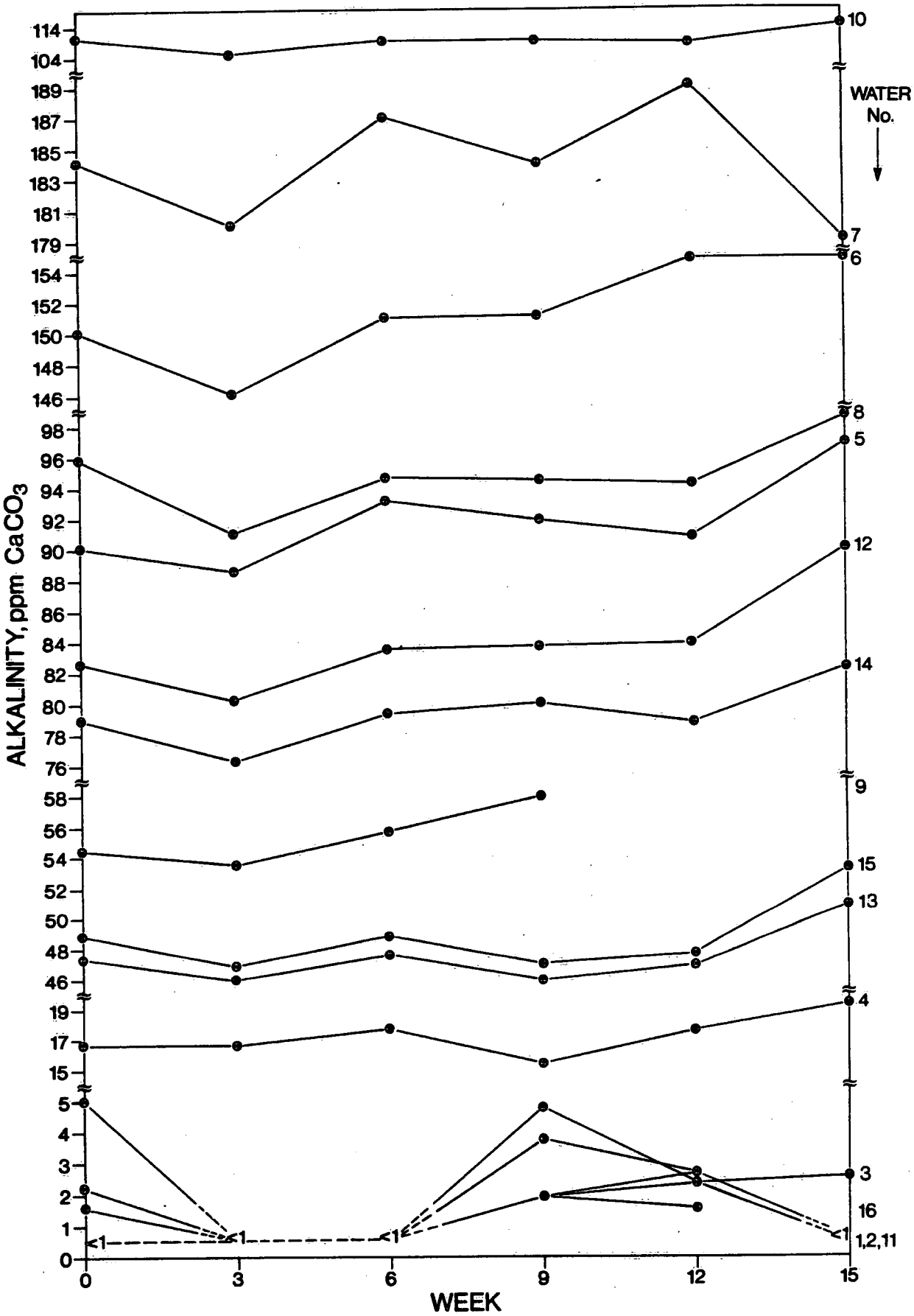

FIGURE 10. ALKALINITY MONITORING (each point represents the average of 6 observations)

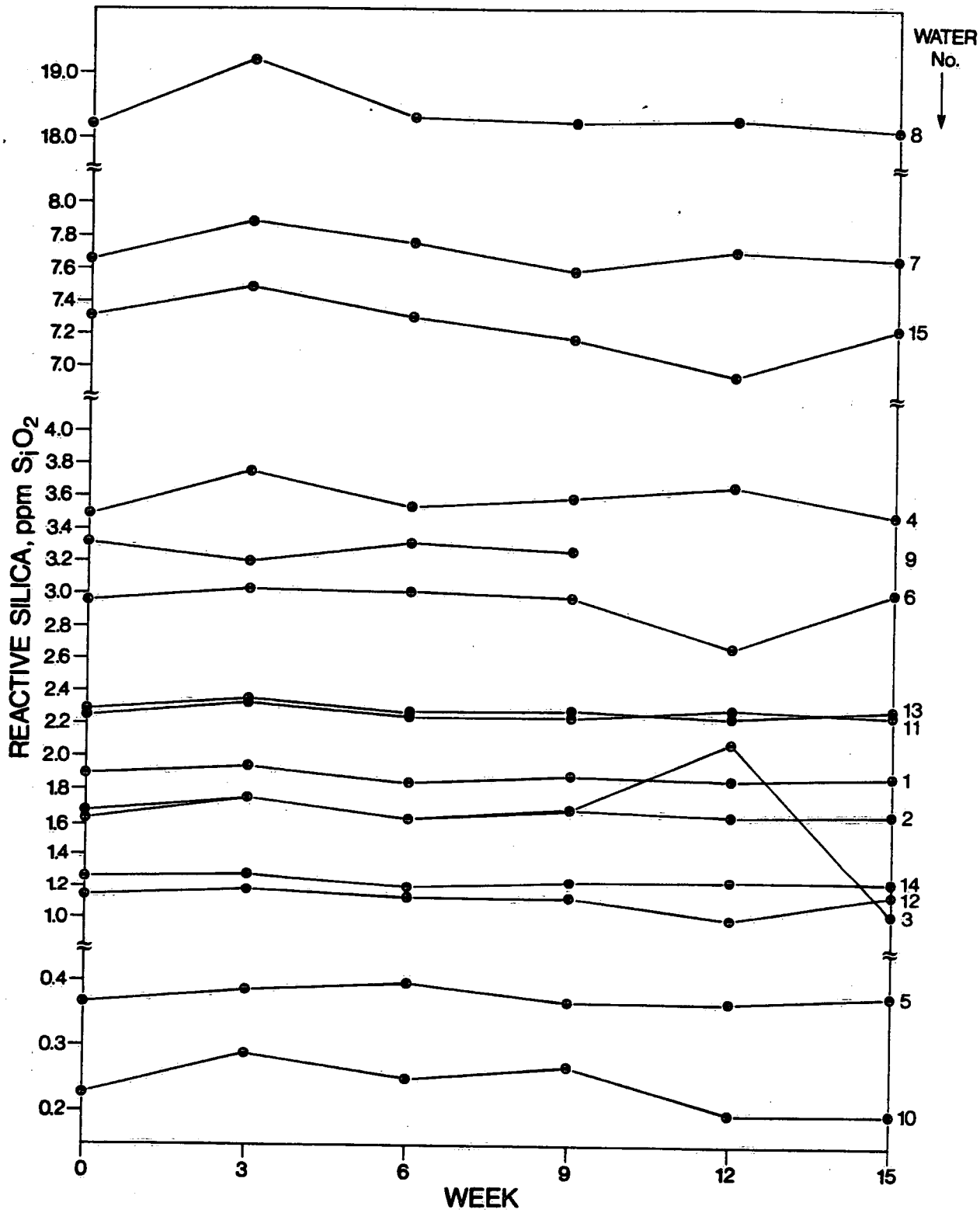

FIGURE 11. S_iO_2 MONITORING (each point represents the average of 6 observations)

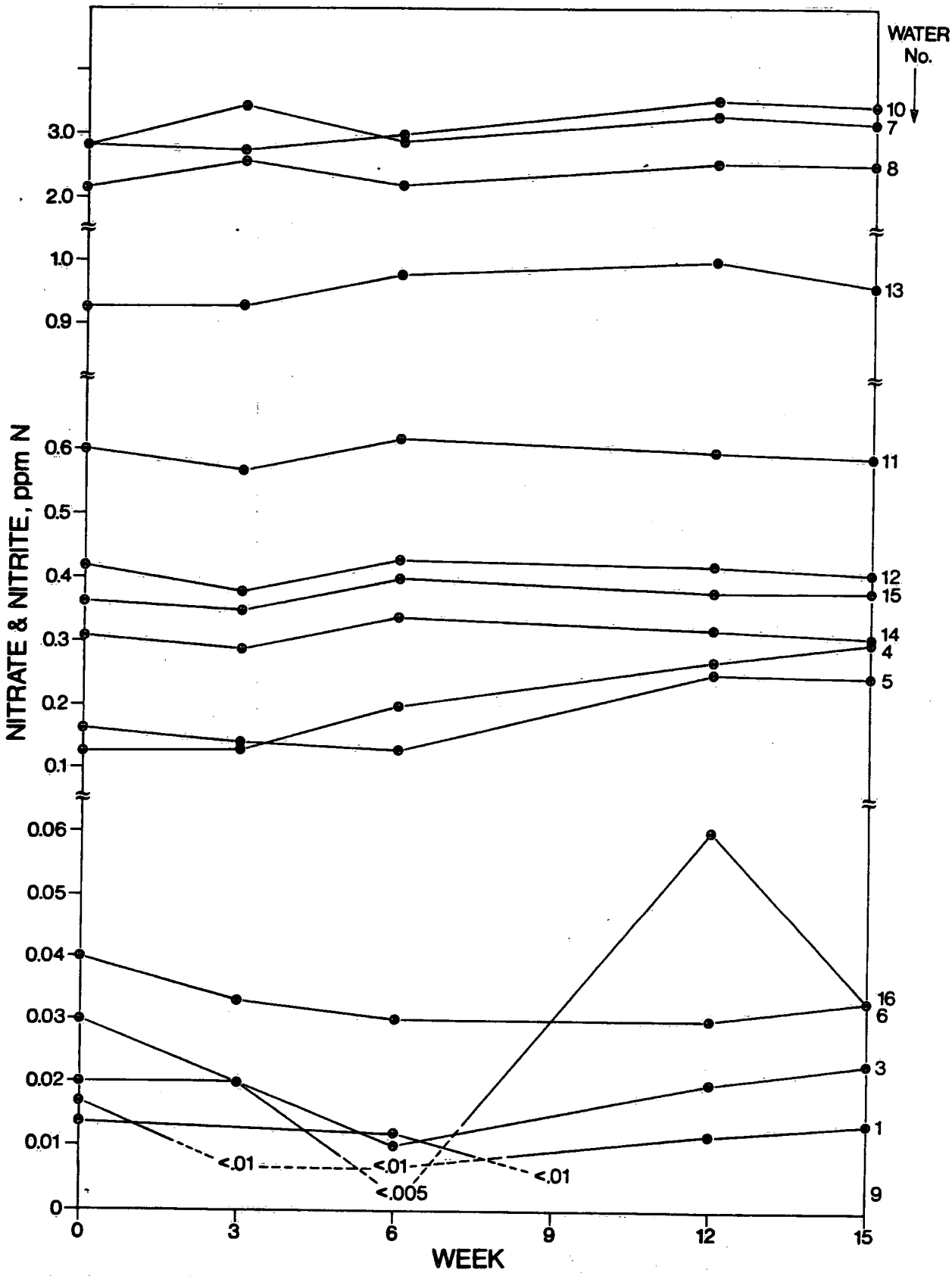

FIGURE 12. NO_3 & NO_2 MONITORING (each point represents the average of 6 observations)

APPENDIX - List of Tables on Raw Data

Table A1. Raw data of physical parameters monitoring = week 0

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Pebbleloggitch	4.55	100	35.0	0.75
	4.53	100	35.4	0.70
	4.51	100	35.5	0.70
	4.51		35.9	0.73
	4.51		36.1	0.70
	4.52		36.2	0.73
Mercy River	4.03	80	68.5	0.77
	4.02	80	68.9	0.75
	4.01	80	69.0	0.75
	4.02		64.3	0.77
	4.02		64.5	0.80
	4.01		65.1	0.85
Sand Pond	4.42	300	39.3	7.2
	4.40	300	39.8	6.6
	4.40	300	39.8	7.2
	4.40		39.9	7.2
	4.40		40.0	7.5
	4.40		40.0	7.8
Carillon	7.20	40	69.8	5.00
	7.22	40	70.2	4.50
	7.25	40	70.3	4.75
	7.25		68.6	5.00
	7.26		68.8	4.80
	7.26		69.3	5.00
St. Lambert	8.02	<5	319	0.85
	8.07	<5	319	0.80
	8.07	<5	321	0.82
	8.08		315	0.80
	8.08		316	0.82
	8.09		316	0.90
Red Deer	8.26	40	444	28
	8.29	40	454	28
	8.29	40	455	28
	8.29		443	30
	8.29		444	30
	8.30		446	30

Table A1. Raw data of physical parameters monitoring = week 0

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Qu'Appelle River	7.77	40	1122	11
	7.79	40	1123	11
	7.79	40	1125	11
	7.79		1126	11
	7.80		1127	11
	7.81		1131	11
Fraser River	7.86	80	264	3.5
	7.87	80	264	3.5
	7.88	80	263	3.7
	7.89		263	3.2
	7.86		263	3.5
	7.87		263	3.5
Sumas River	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
Hamilton Harbour	8.51	20	576	4.2
	8.52	20	579	4.2
	8.52	20	578	4.0
	8.52		578	4.0
	8.52		581	4.0
	8.52		582	4.2
Waters Mixture	3.02	<5	504	0.15
	3.01	<5	505	0.15
	3.01	<5	505	0.15
	3.00		502	0.15
	3.00		503	0.15
	3.00		501	0.15
RM-ANI-2 (ANI-12 D.L.)	7.84	<5	230	0.45
	7.89	<5	228	0.47
	7.90	<5	229	0.45
	7.90		229	0.45
	7.91		229	0.45
	7.90		229	0.45

Table A1. Raw data of physical parameters monitoring = week 0

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
RM-ANI-3	7.14	<5	307	0.72
(ANI-LOW-MED)	7.12	<5	307	0.65
	7.12	<5	308	0.70
	7.12		305	0.70
	7.12		305	0.70
	7.12		305	0.70
RM-CAT-2	7.90	<5	234	0.26
(CAT-12*D.L.)	7.92	<5	236	0.26
	7.92	<5	236	0.21
	7.93		235	0.20
	7.93		235	0.20
	7.93		236	0.20
RM-CAT-3	7.74	5	424	0.20
(CAT-LOW-MED)	7.78	5	425	0.18
	7.77	5	426	0.18
	7.78		425	0.20
	7.78		426	0.18
	7.77		427	0.20
CRM-2	5.13	<5	459	0.15
(Sample C)	5.27	<5	461	0.15
	5.26	<5	459	0.15
	5.26		449	0.15
	5.25		451	0.15
	5.26		452	0.15

Table A2. Raw data of physical parameters monitoring = week 3

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Pebbleloggitch	4.52	100	34.6	0.60
	4.49	100	35.3	0.60
	4.49	100	34.7	0.60
	4.49		34.8	0.60
	4.49		35.2	0.60
	4.49		34.8	0.60
Mercy River	4.06	80	61.6	0.75
	4.06	80	61.9	0.70
	4.06	80	61.7	0.75
	4.06		61.8	0.75
	4.06		61.7	0.75
	4.06		61.8	0.70
Sand Pond	4.58	300	37.3	8.0
	4.53	300	37.5	8.0
	4.52	300	37.6	7.5
	4.52		37.7	7.7
	4.51		37.7	7.5
	4.51		37.8	8.0
Carillon	6.97	40	66.5	4.50
	6.97	40	66.8	5.00
	6.97	40	66.8	5.00
	6.97		66.8	5.00
	6.98		66.7	5.80
	6.99		66.8	4.50
St. Lambert	7.97	<5	297	0.60
	7.97	<5	298	0.55
	7.98	<5	298	0.50
	7.99		298	0.55
	7.99		298	0.55
	8.00		299	0.55
Red Deer	8.21	40	416	14
	8.23	40	418	14
	8.23	40	418	14
	8.24		418	14
	8.24		418	14
	8.24		419	14

Table A2. Raw data of physical parameters monitoring = week 3 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Qu'Appelle River	7.68	40	1064	8.4
	7.69	40	1065	8.2
	7.70	40	1065	8.2
	7.70		1065	8.4
	7.71		1067	8.4
	7.71		1066	8.4
Fraser River	7.16	80	253	4.5
	7.19	80	254	4.5
	7.21	80	255	4.5
	7.22		254	4.5
	7.22		254	4.7
	7.23		254	5.0
Sumas River	7.65	5	13.90	2.2
	7.57	5	13.80	2.2
	7.59	5	13.80	2.2
	7.61		13.80	2.2
	7.62		13.80	2.2
	7.61		13.80	2.2
Hamilton Harbour	8.03	10	548	3.2
	8.06	10	549	3.0
	8.06	10	549	3.0
	8.06		549	3.0
	8.06		550	3.1
	8.07		551	3.0
Waters Mixture	3.06	<5	482	0.06
	3.05	<5	483	0.07
	3.05	<5	482	0.07
	3.05		482	0.08
	3.05		483	0.08
	3.05		483	0.07
RM-ANI-2 (ANI-12*D.L.)	7.81	<5	217	0.35
	7.85	<5	217	0.35
	7.86	<5	217	0.35
	7.86		217	0.35
	7.87		217	0.35
	7.88		217	0.35

Table A2. Raw data of physical parameters monitoring = week 3 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
RM-ANI-3	7.16	<5	290	0.40
(ANI-LOW-MED)	7.16	<5	290	0.42
	7.17	<5	290	0.37
	7.17		290	0.40
	7.17		290	0.35
	7.18		290	0.37
RM-CAT-2	7.60	<5	220	0.16
(CAT-12*D.L.)	7.62	<5	222	0.15
	7.62	<5	221	0.12
	7.64		221	0.12
	7.64		221	0.11
	7.65		222	0.12
RM-CAT-3	7.56	5	400	0.12
(CAT-LOW-MED)	7.58	5	400	0.10
	7.59	5	401	0.10
	7.59		401	0.10
	7.59		401	0.10
	7.60		401	0.10
CRM-2	4.88	<5	430	0.08
(Sample C)	4.87	<5	430	0.08
	4.87	<5	431	0.08
	4.87		431	0.08
	4.87		431	0.08
	4.87		431	0.08

Table A3. Raw data of physical parameters monitoring = week 6

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Pebbleloggitch	4.60	100	34.3	0.65
	4.58	100	34.7	0.65
	4.58	100	34.2	0.65
	4.58		34.2	0.65
	4.58		34.0	0.65
	4.58		34.0	0.65
Mercy River	4.09	80	62.5	0.77
	4.09	80	62.6	0.77
	4.09	80	62.4	0.77
	4.09		62.4	0.77
	4.09		62.3	0.75
	4.09		62.3	0.75
Sand Pond	4.74	320	38.5	8.5
	4.71	320	39.2	8.5
	4.70	320	38.7	8.5
	4.69		38.8	9.0
	4.69		38.9	8.5
	4.69		38.9	9.0
Carillon	7.04	50	66.6	6.50
	7.09	50	66.7	6.00
	7.11	50	66.7	6.50
	7.11		66.7	7.00
	7.12		66.7	7.00
	7.14		66.8	7.50
St. Lambert	7.72	<5	305	0.65
	7.79	<5	305	0.70
	7.79	<5	305	0.70
	7.80		305	0.85
	7.81		305	0.85
	7.82		305	1.00
Red Deer	8.17	40	428	14
	8.19	40	427	14
	8.21	40	428	15
	8.21		428	15
	8.21		428	15
	8.22		428	17

Table A3. Raw data of physical parameters monitoring = week 6 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Qu'Appelle River	7.67	40	1083	4.5
	7.72	40	1083	5.0
	7.69	40	1082	5.0
	7.70		1081	5.5
	7.71		1080	5.5
	7.72		1080	5.6
Fraser River	7.29	60	259	3.2
	7.33	60	258	4.0
	7.34	60	258	4.0
	7.36		258	4.5
	7.37		257	4.5
	7.36		257	5.0
Sumas River	7.14	5	14.70	2.2
	7.17	5	14.70	2.7
	7.18	5	14.70	3.0
	7.20		14.60	2.7
	7.20		14.70	3.0
	7.20		14.60	3.0
Hamilton Harbour	7.65	20	556	2.2
	7.67	20	556	2.5
	7.68	20	556	2.6
	7.69		555	3.0
	7.68		554	3.0
	7.71		554	3.1
Waters Mixture	2.86	<5	4.42	0.18
	2.85	<5	4.51	0.18
	2.85	<5	4.50	0.18
	2.84		4.45	0.18
	2.84		4.50	0.18
	2.84		4.51	0.18
RM-ANI-2	7.84	<5	220	0.35
(ANI-12*D.L.)	7.89	<5	221	0.35
	7.91	<5	221	0.35
	7.91		221	0.35
	7.91		220	0.35
	7.91		221	0.35

Table A3. Raw data of physical parameters monitoring = week 6 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
RM-ANI-3	7.28	<5	295	0.42
(ANI-LOW-MED)	7.26	<5	295	0.45
	7.26	<5	295	0.47
	7.26		295	0.42
	7.26		295	0.42
	7.26		295	0.45
RM-CAT-2	8.06	<5	223	0.22
(CAT-12*D.L.)	8.07	<5	223	0.20
	8.08	<5	223	0.20
	8.07		224	0.17
	8.08		224	0.17
	8.08		224	0.20
RM-CAT-3	7.42	5	406	0.20
(CAT-LOW-MED)	7.42	5	406	0.17
	7.43	5	407	0.20
	7.43		406	0.17
	7.43		406	0.20
	7.43		406	0.16
CRM-2	5.47	<5	435	0.15
(Sample C)	5.50	<5	436	0.15
	5.51	<5	435	0.15
	5.50		435	0.15
	5.51		435	0.15
	5.51		435	0.15

Table A4. Raw data of physical parameters monitoring = week 9

Water	Parameters			
	pH	Colour H.U.	Specific Conductance s/cm	Turbidity JTU
Pebbleloggitch	4.60	100	32.6	0.55
	4.57	100	33.2	0.60
	4.57	100	32.6	0.45
	4.57		33.0	0.50
	4.57		32.9	0.50
	4.57		32.9	0.70
Mercy River	4.11	80	60.3	0.55
	4.08	80	61.6	0.75
	4.08	80	61.4	0.80
	4.08		61.5	0.70
	4.08		61.4	0.65
	4.08		61.4	0.60
Sand Pond	4.58	400	36.9	9.0
	4.56	400	37.3	9.0
	4.56	400	37.3	9.5
	4.56		37.3	8.5
	4.56		37.2	9.0
	4.56		37.3	9.5
Carillon	7.08	40	65.0	6.0
	7.15	40	65.0	1.5
	7.17	40	65.1	4.0
	7.17		65.1	3.0
	7.18		65.2	5.0
	7.18		65.1	5.0
St. Lambert	7.60	<5	298	1.00
	7.66	<5	298	0.50
	7.66	<5	298	0.65
	7.67		298	0.75
	7.67		298	0.65
	7.69		298	0.60
Red Deer	8.19	40	417	7.0
	8.23	40	417	11.0
	8.24	40	418	8.0
	8.24		417	15.0
	8.25		417	15.0
	8.24		417	15.0

Table A4. Raw data of physical parameters monitoring = week 9 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Qu'Appelle River	7.72	40	1058	2.6
	7.74	40	1059	4.0
	7.75	40	1058	5.5
	7.76		1057	4.0
	7.78		1057	4.0
	7.77		1057	4.5
Fraser River	7.73	60	253	2.2
	7.75	60	252	4.0
	7.73	60	252	2.5
	7.74		251	2.0
	7.72		251	2.0
	7.75		251	2.0
Sumas River	7.19	10	14.4	0.45
	7.24	10	14.4	0.25
	7.24	10	13.4	0.30
	7.24		14.1	0.55
	7.24		14.2	0.50
	7.25		14.6	0.45
Hamilton Harbour	7.62	20	544	1.5
	7.64	20	545	1.5
	7.65	20	544	0.5
	7.65		544	2.0
	7.65		544	2.0
	7.67		543	2.5
Waters Mixture	3.09	<5	477	0.11
	3.08	<5	478	0.11
	3.07	<5	478	0.11
	3.07		479	0.11
	3.07		479	0.11
	3.07		479	0.11
RM-ANI-2 (ANI-12*D.L.)	8.18	<5	215	0.45
	8.21	<5	215	0.55
	8.22	<5	215	0.30
	8.22		215	0.27
	8.23		215	0.45
	8.23		215	0.35

Table A4. Raw data of physical parameters monitoring = week 9 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
RM-ANI-3	7.87	<5	288	0.60
(ANI-LOW-MED)	7.89	<5	289	0.65
	7.90	<5	289	0.40
	7.90		289	0.60
	7.90		289	0.60
	7.90		288	0.50
RM-CAT-2	7.96	<5	219	0.20
(CAT-12*D.L.)	7.99	<5	219	0.25
	7.99	<5	219	0.30
	8.00		220	0.20
	8.00		220	0.20
	8.00		220	0.20
RM-CAT-3	7.43	5	399	0.15
(CAT-LOW-MED)	7.49	5	399	0.20
	7.50	5	399	0.15
	7.52		399	0.15
	7.52		399	0.15
	7.53		399	0.15
CRM-2	4.88	<5	438	0.12
(Sample C)	4.83	<5	438	0.12
	4.83	<5	438	0.12
	4.83		438	0.12
	4.83		438	0.12
	4.83		438	0.12

Table A5. Raw data of physical parameters monitoring = week 12

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Pebbleloggitch	4.58	100	34.7	0.65
	4.52	100	35.0	0.65
	4.52	100	34.6	0.65
	4.52		34.6	0.65
	4.52		34.5	0.55
	4.52		34.3	0.55
Mercy River	4.09	80	62.0	0.80
	4.08	80	62.0	0.85
	4.07	80	62.1	0.85
	4.07		61.8	0.85
	4.07		61.7	0.80
	4.07		61.7	0.70
Sand Pond	4.62	400	37.6	7.7
	4.57	400	37.5	9.0
	4.57	400	37.7	9.0
	4.56		37.6	9.5
	4.55		37.6	9.0
	4.56		37.6	9.5
Carillon	6.72	40	67.7	6.5
	6.79	40	66.7	8.0
	6.83	40	66.7	8.2
	6.82		66.2	6.0
	6.81		66.1	6.0
	6.83		65.7	5.5
St. Lambert	7.51	<5	301	1.0
	7.59	<5	300	1.0
	7.61	<5	300	1.0
	7.64		301	1.2
	7.65		300	0.5
	7.67		300	0.65
Red Deer	8.10	40	422	12.00
	8.14	40	422	12.00
	8.15	40	423	12.00
	8.15		423	12.00
	8.16		422	12.00
	8.16		422	12.00

Table A5. Raw data of physical parameters monitoring = week 12 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Qu'Appelle River	7.66	40	1073	3.8
	7.71	40	1071	3.5
	7.69	40	1071	3.5
	7.69		1072	3.5
	7.69		1070	3.0
	7.70		1069	3.2
Fraser River	7.72	80	253	4.5
	7.89	80	254	5.0
	7.89	80	254	6.5
	7.88		253	1.5
	7.85		253	4.5
	7.91		252	4.0
Sumas River	7.12	10	14.5	2.5
	7.20	10	14.5	2.5
	7.20	10	14.2	2.5
	7.20		14.1	2.5
	7.20		14.1	1.2
	7.21		14.2	1.7
Hamilton Harbour	7.73	20	553	3.5
	7.78	20	554	3.0
	7.79	20	553	3.5
	7.76		553	2.0
	7.78		553	2.0
	7.79		552	2.5
Waters Mixture	3.12	<5	474	0.10
	3.10	<5	475	0.10
	3.08	<5	473	0.10
	3.08		473	0.10
	3.08		473	0.10
	3.08		473	0.10
RM-ANI-2 (ANI-12*D.L.)	7.62	<5	215	0.52
	7.69	<5	215	0.30
	7.71	<5	215	0.30
	7.72		215	0.25
	7.72		215	0.25
	7.72		215	0.30

Table A5. Raw data of physical parameters monitoring = week 12 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
RM-ANI-3	7.50	<5	286	0.40
(ANI-LOW-MED)	7.50	<5	288	0.35
	7.54	<5	287	0.35
	7.53		288	0.40
	7.53		287	0.35
	7.54		287	0.40
RM-CAT-2	7.88	<5	222	0.25
(CAT-12*D.L.)	7.93	<5	222	0.30
	7.94	<5	222	0.20
	7.95		221	0.15
	7.95		221	0.12
	7.96		221	0.11
RM-CAT-3	7.85	5	404	0.15
(CAT-LOW-MED)	7.86	5	404	0.12
	7.88	5	404	0.12
	7.89		403	0.15
	7.89		402	0.12
	7.88		403	0.15
CRM-2	4.83	<5	423	0.15
(Sample C)	4.83	<5	423	0.12
	4.83	<5	424	0.12
	4.83		423	0.15
	4.83		423	0.10
	4.83		423	0.12

Table A6. Raw data of physical parameters monitoring = week 15

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Pebbleloggitch	4.65	100	33.5	0.45
	4.61	100	33.9	0.45
	4.59	100	34.0	0.45
	4.59		33.4	0.50
	4.59		33.5	0.50
	4.59		33.4	0.45
Mercy River	4.12	60	64.20	1.20
	4.11	60	64.40	1.00
	4.10	60	64.10	0.95
	4.10		64.10	0.85
	4.10		64.00	0.85
	4.10		65.00	0.75
Sand Pond	4.63	300	40.90	9.0
	4.60	300	40.70	10.0
	4.59	300	40.70	10.0
	4.58		40.60	9.5
	4.58		40.60	8.7
	4.58		40.60	9.0
Carillon	7.01	60	66.6	5.0
	7.05	60	66.5	5.0
	7.06	60	66.5	5.0
	7.05		66.5	5.5
	7.04		66.5	5.2
	7.04		66.3	5.5
St. Lambert	7.59	<5	315	0.45
	7.69	<5	315	0.40
	7.75	<5	315	0.50
	7.71		315	0.45
	7.73		315	0.50
	7.73		315	0.50
Red Deer	8.29	40	439	10.0
	8.30	40	438	10.0
	8.32	40	439	10.0
	8.33		439	10.0
	8.33		439	10.0
	8.34		439	10.0

Table A6. Raw data of physical parameters monitoring = week 15 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
Qu'Appelle River	7.71	40	1078	2.3
	7.75	40	1080	3.0
	7.73	40	1079	4.0
	7.75		1080	4.0
	7.74		1078	4.7
	7.75		1077	5.0
Fraser River	7.70	80	258	4.0
	7.88	80	259	4.0
	7.92	80	257	4.5
	7.92		257	3.5
	7.92		257	3.0
	7.92		257	4.0
Sumas River	7.24	10	14.50	1.50
	7.27	10	14.50	1.50
	7.30	10	14.60	1.50
	7.30		14.60	1.50
	7.30		15.10	1.50
	7.31		15.00	1.50
Hamilton Harbour	8.04	20	570	2.0
	8.07	20	571	2.0
	8.06	20	570	2.0
	8.08		571	2.0
	8.08		571	2.0
	8.08		571	2.5
Waters Mixture	3.10	<5	488	0.35
	3.07	<5	488	0.10
	3.06	<5	490	0.15
	3.06		489	0.15
	3.07		489	0.13
	3.06		489	0.10
RM-ANI-2 (ANI-12*D.L.)	8.15	<5	221	0.35
	8.19	<5	222	0.35
	8.19	<5	221	0.25
	8.20		220	0.30
	8.20		220	0.30
	8.20		220	0.30

Table A6. Raw data of physical parameters monitoring = week 15 cont'd

Water	Parameters			
	pH	Colour H.U.	Specific Conductance µs/cm	Turbidity JTU
RM-ANI-3	7.33	<5	297	0.30
(ANI-LOW-MED)	7.35	<5	297	0.30
	7.35	<5	297	0.30
	7.35		296	0.35
	7.35		296	0.35
	7.36		296	0.35
RM-CAT-2	7.96	<5	225	0.15
(CAT-12*D.L.)	8.03	<5	225	0.10
	8.05	<5	225	0.15
	8.06		225	0.12
	8.07		225	0.12
	8.06		224	0.10
RM-CAT-3	7.60	5	417	0.15
(CAT-LOW-MED)	7.66	5	417	0.10
	7.67	5	418	0.10
	7.68		416	0.10
	7.70		416	0.10
	7.71		416	0.10
CRM-2	4.87	<5	455	0.10
(Sample C)	4.77	<5	455	0.10
	4.76	<5	455	0.10
	4.76		455	0.10
	4.74		455	0.10
	4.74		455	0.10

Table A7. Raw data of major ions monitoring - week 0

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3+NO_2	Alkalinity	Hardness	Na	Mg	B	F
Pebbleloggitch	1.86	6.10	4.00	0.24	0.80	<0.01	<1.00	3.6440	2.80	0.40	<.004	0.062
	1.91	7.10	4.60	0.24	0.90	0.012	1.82	4.3053	2.90	0.50	<.004	0.069
	1.88	7.10	4.70	0.24	0.90	0.014	<1.00	4.3053	2.90	0.50	<.004	0.069
	1.89	6.50	4.10	0.23	0.70	<0.01	<1.00	3.3943	2.80	0.40	<.004	0.069
	1.87	7.10	4.30	0.23	0.70	0.019	1.51	3.3943	2.80	0.40		
	1.87	7.30	4.40	0.24	0.90	0.021	1.51	4.3053	2.80	0.50		
Mercy River	1.67	9.30	4.50	0.26	1.00	<0.01	<1.00	4.5550	2.90	0.50	<.004	0.076
	1.67	9.00	4.70	0.27	1.00	<0.01	<1.00	4.5550	3.00	0.50	<.004	0.062
	1.68	9.00	4.70	0.26	1.00	<0.01	<1.00	4.5550	2.90	0.50	<.004	0.054
	1.70	9.40	4.97	0.27	1.00	<0.01	<1.00	4.1434	2.90	0.40	<.004	0.083
	1.67	9.40	4.40	0.29	1.00	0.012	1.25	4.5550	2.90	0.50		
	1.66	9.50	4.70	0.28	1.00	0.016	2.29	4.5550	3.00	0.50		
Sand Pond	1.60	9.90	5.60	0.18	0.70	<0.01	1.28	3.8059	3.60	0.50		
	1.65	10.30	5.60	0.19	0.80	0.011	2.36	4.0556	3.80	0.50		
	1.63	10.20	5.70	0.20	1.00	0.018	2.80	4.5550	3.70	0.50	-	-
	1.54	9.70	6.09	0.20	0.90	0.016	2.49	4.7169	3.70	0.60		
	1.62	10.30	5.70	0.21	0.80	0.028	2.55	4.0556	3.70	0.50		
	1.68	10.60	5.80	0.18	0.70	0.033	1.86	3.8059	3.80	0.50		
Carillon	3.51	10.30	2.20	0.83	7.80	0.153	16.30	27.7086	2.40	2.00	<.004	0.105
	3.49	9.50	2.10	0.79	7.30	0.117	17.50	25.2253	2.20	1.70	<.004	0.105
	3.48	9.30	2.10	0.79	7.40	0.128	17.70	25.8866	2.20	1.80	<.004	0.083
	3.58	9.30	1.80	0.79	7.00	0.126	18.80	24.8878	2.20	1.80	<.004	0.098
	3.44	9.50	1.90	0.79	7.10	0.134	15.00	24.7259	2.20	1.70		
	3.44	9.50	2.00	0.80	7.20	0.132	15.50	25.3872	2.20	1.80		
St. Lambert	0.37	26.40	24.50	1.32	37.50	0.137	89.30	125.3307	12.30	7.70	<.004	0.200
	0.38	27.30	24.40	1.38	36.10	0.164	88.40	122.6581	12.60	7.90	<.004	0.207
	0.37	26.40	24.80	1.33	38.10	0.168	92.80	128.0637	12.40	8.00	<.004	0.193
	0.37	26.90	24.30	1.33	35.40	0.161	92.60	120.0870	12.40	7.70	<.004	0.200
	0.37	26.70	24.20	1.33	35.00	0.161	89.20	120.3367	12.30	7.70		
	0.51	26.50	24.10	1.34	35.60	0.165	88.80	121.4096	12.40	7.90		

Table A7. Raw data of major ions monitoring - week 0 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Red Deer	2.96	75.80	4.10	3.02	41.70	0.014	153.00	167.5113	23.90	15.40	<.004	0.295
	2.98	74.40	3.80	3.03	42.50	0.013	152.00	170.7437	29.90	15.70	<.004	0.287
	3.00	82.60	4.10	3.25	40.10	0.047	147.00	163.5161	30.10	15.40	<.004	0.287
	2.93	85.20	3.70	3.03	39.10	0.020	154.00	160.6075	29.70	15.30	<.004	0.302
	2.97	83.20	3.80	3.05	40.10	0.033	149.00	163.9277	29.90	15.50		
	2.99	82.30	4.10	3.13	40.20	0.046	149.00	165.0006	30.30	15.70		
Qu'Appelle River	7.74	245.60	90.80	11.50	62.70	2.89	189.00	303.0915	113.00	35.60	.065	0.593
	7.60	240.90	87.10	11.50	63.20	2.94	191.00	305.1632	113.00	35.80	.053	0.601
	7.70	242.80	89.30	12.00	66.30	2.88	189.00	312.4923	110.00	35.70	.064	0.593
	7.69	245.3	91.30	12.00	66.30	2.82	179.00	312.4923	112.00	35.70	.034	0.608
	7.62	245.40	89.20	11.50	63.20	2.87	179.00	306.3980	112.00	36.10		
	7.62	241.70	88.80	11.50	63.20	2.77	176.00	305.1632	112.00	35.80		
Fraser River	18.092	12.9	12.1	7.40	15.9	2.09	96.6	107.62	6.9	16.5		
	18.092	13.1	12.7	7.40	16.30	2.20	98.0	109.44	7.0	16.7		
	18.370	13.2	12.6	7.28	16.20	2.20	95.9	108.37	7.0	16.5	-	-
	18.191	12.8	12.4	7.21	16.00	2.09	95.0	107.87	6.9	16.5		
	18.072	16.0	14.5	7.27	16.00	2.16	93.9	107.45	6.9	16.4		
	18.171	13.0	12.4	-	-	2.20	95.2	-	6.9	-		
Sumas River	NO DATA											
Hamilton Harbour	0.24	63.70	61.90	4.86	54.10	2.87	112.00	189.8305	33.60	13.30	<.004	0.652
	0.25	62.70	61.80	4.89	55.50	2.90	112.00	194.5611	33.20	13.60	<.004	0.644
	0.23	61.50	61.50	4.93	55.50	2.82	114.00	193.7379	33.40	13.40	<.004	0.652
	0.23	69.60	61.40	4.83	55.00	2.74	110.00	190.8430	33.10	13.00	<.004	0.637
	0.21	68.60	61.60	4.84	55.00	2.71	109.00	190.8430	33.30	13.00		
	0.23	69.20	64.00	5.14	55.50	2.75	110.00	192.9147	33.30	13.20		

Table A7. Raw data of major ions monitoring - week 0 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Waters Mixture	2.27	96.10	1.20	0.51	12.70	0.575	2.61	42.8251	1.20	2.70	<.004	0.091
	2.26	94.00	1.00	0.50	12.80	0.587	6.57	43.0751	1.30	2.70	<.004	0.134
	2.25	93.50	1.60	0.50	13.00	0.615	6.17	43.9858	1.30	2.80	<.004	0.164
	2.26	91.90	1.40	0.50	11.70	0.599	2.80	40.7397	1.30	2.80	<.004	0.113
	2.26	101.40	0.90	0.50	12.40	0.599	5.89	42.4876	1.30	2.80		
	2.26	100.00	1.50	0.53	12.60	0.605	5.64	42.9870	1.30	2.80		
RM-ANI-2 (ANI-12*D.L.)	1.15	19.40	7.20	2.35	26.90	0.389	81.90	98.8625	4.00	7.70	<.004	0.258
	1.16	22.60	6.90	2.39	27.50	0.414	82.40	101.5955	3.90	8.00	<.004	0.287
	1.15	22.60	7.00	2.40	28.00	0.430	81.90	102.4324	4.20	7.90	<.004	0.258
	1.15	19.70	6.80	2.40	25.80	0.425	85.90	96.5274	4.10	7.80	<.004	0.229
	1.15	22.90	6.70	2.40	26.50	0.415	81.90	99.0985	4.10	8.00		
	1.15	22.70	6.70	2.41	26.50	0.429	81.50	98.6869	4.20	7.90		
RM-ANI-3 (ANI-LOW-MED)	2.31	59.50	24.60	7.00	12.80	0.980	46.80	95.7596	15.70	15.50	<.004	0.644
	2.29	62.90	24.50	7.00	12.80	1.000	48.70	96.5828	15.90	15.70	<.004	0.644
	2.29	60.60	24.50	7.00	13.10	1.040	50.40	96.9203	16.30	15.60	<.004	0.652
	2.28	58.90	24.30	7.00	12.20	0.967	49.90	93.4382	15.60	15.30	<.004	0.652
	2.29	69.80	24.90	7.00	12.60	0.967	44.40	94.8486	16.40	15.40		
	2.28	69.30	24.00	7.10	12.50	0.605	44.40	94.1873	17.80	15.30		
RM-CAT-2 (CAT-12*D.L.)	1.25	18.30	12.20	3.17	28.20	0.300	79.30	99.6390	4.50	7.10	<.004	0.164
	1.25	18.20	12.10	3.20	29.20	0.314	78.60	102.9592	4.50	7.30	<.004	0.171
	1.23	16.80	12.10	3.15	28.70	0.303	83.20	100.8875	4.40	7.10	<.004	0.156
	1.25	18.20	12.40	3.31	27.70	0.293	78.30	98.8021	4.90	7.20	<.004	0.200
	1.25	18.70	11.80	3.18	27.40	0.320	76.70	98.0530	4.50	7.20		
	1.31	18.40	11.90	3.23	27.7	0.301	77.90	99.2137	4.60	7.30		
RM-CAT-3 (CAT-LOW-MED)	7.34	27.90	75.60	7.50	35.60	0.364	49.50	121.4096	32.1	7.10	<.004	0.244
	7.40	25.10	74.50	7.50	36.40	0.376	48.90	123.8188	24.70	8.00	<.004	0.178
	7.29	25.00	74.80	7.60	36.90	0.365	51.60	125.0673	25.00	8.00	<.004	0.178
	7.28	24.70	75.40	7.70	33.90	0.358	51.40	117.1647	24.70	7.90	<.004	0.200
	7.35	25.10	79.60	7.70	34.90	0.348	45.90	119.6617	24.60	7.90		
	7.31	24.10	75.50	7.60	34.60	0.336	45.90	116.9126	24.90	7.90		

Table A7. Raw data of major ions monitoring - week 0 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
CRM-2 (Sample C)	<0.02	38.30	106.50	0.87	42.50	0.034	<1.00	144.8129	17.90	9.40	<.004	0.171
	<0.02	38.50	103.90	0.87	42.80	0.037	<1.00	145.9736	18.80	9.50	<.004	0.127
	<0.02	38.00	103.20	0.88	43.20	0.041	1.24	146.5608	18.70	9.40		
	<0.02	38.40	103.80	0.87	39.40	0.035	<1.00	136.6606	17.80	9.30		
	<0.02	38.40	104.20	0.87	40.20	0.041	1.77	139.0698	18.70	9.40		
	<0.02	38.40	103.10	0.87	41.00	0.049	1.77	140.6558	18.40	9.30		

Table A8. Raw data of major ions monitoring - week 3

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Pebbleloggitch	1.95	6.4	4.3	0.2	0.3	<0.01	<1	2.396	2.8	0.4		
	1.94	6.1	4.3	<0.2	0.4	<0.01	<1	2.645	2.8	0.4		
	1.96	6.4	4.4	0.2	0.4	<0.01	<1	2.645	2.8	0.4		
	1.96	6.1	4.6	0.2	0.42	<0.013	<1	2.645	2.8	0.39	-	-
	1.92	6.4	4.1	0.2	0.37	<0.012	1.1	2.529	2.8	0.39		
	1.95	6.4	4.3	0.2	0.4	0.011	<1	2.645	2.8	0.4		
Mercy River	1.75	9.7	4.8	0.3	0.8	<0.01	<1	4.056	3.0	0.5		
	1.74	9.5	4.8	0.2	0.8	<0.01	<1	3.644	3.0	0.4		
	1.76	9.8	4.8	0.3	0.9	<0.01	<1	3.894	3.0	0.4		
	1.73	9.5	4.7	0.3	0.9	<0.01	1.1	3.894	3.0	0.4	-	-
	1.73	9.7	4.5	0.3	0.9	<0.01	<1	3.894	2.9	0.4		
	1.74	9.8	4.7	0.3	0.9	<0.014	<1	4.305	3.0	0.5		
Sand Pond	1.76	10.6	6.0	0.3	0.6	0.022	1.2	3.968	3.8	0.6		
	1.75	10.6	6.0	0.3	0.5	0.022	<1	3.307	3.9	0.5		
	1.76	10.7	6.0	0.2	0.5	0.019	<1	3.307	3.9	0.5		
	1.72	10.4	5.9	<0.2	0.6	0.013	<1	3.556	3.8	0.5	-	-
	1.71	10.5	5.8	<0.2	0.6	0.012	<1	3.556	3.8	0.5		
	1.76	10.9	6.0	0.2	0.9	0.027	1.5	5.129	3.8	0.7		
Carillon	3.76	10.4	2.3	0.8	7.9	0.137	17.8	27.547	2.2	1.9		
	3.78	10.5	2.2	0.8	7.9	0.137	16.3	27.135	2.2	1.8		
	3.78	11.0	2.2	0.8	8.0	0.129	16.6	27.385	2.2	1.8		
	3.75	11.2	2.5	0.8	7.5	0.134	16.2	26.136	2.2	1.8	-	-
	3.77	11.0	2.2	0.8	7.5	0.140	16.5	26.136	2.2	1.8		
	3.77	9.8	2.10	0.8	7.3	0.131	16.5	25.225	2.2	1.7		
St. Lambert	0.38	26.5	25.1	1.3	35.9	0.147	88.6	122.159	12.4	7.9		
	0.38	26.4	25.2	1.4	36.6	0.140	89.3	122.672	12.7	7.6		
	0.39	26.3	25.3	1.4	37.5	0.139	90.5	125.742	12.6	7.8		
	0.39	26.7	25.0	1.4	34.4	0.149	87.0	117.570	12.7	7.7	-	-
	0.36	26.8	24.6	1.3	36.3	0.144	87.3	121.511	12.2	7.5		
	0.38	26.7	25.2	1.3	36.3	0.140	88.9	122.699	12.3	7.8		

Table A8. Raw data of major ions monitoring - week 3 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Red Deer	3.04	79.4	4.1	3.1	40.9	0.014	148.9	162.633	29.4	14.7		
	3.04	77.5	4.1	3.1	42.0	0.015	148.2	165.379	29.4	14.7		
	3.04	77.0	4.0	3.1	41.2	0.017	149.9	165.028	29.2	15.1		
	3.03	77.6	3.9	3.1	41.0	0.017	143.7	163.294	29.3	14.8	-	-
	3.02	78.6	3.8	3.0	39.7	0.017	142.8	159.636	28.9	14.7		
	3.05	77.5	4.1	3.0	40.0	0.016	144.1	162.443	29.0	15.2		
Qu'Appelle River	7.96	247.9	91.3	11.8	64.4	3.51	184.3	307.748	113.0	35.7		
	7.83	242.5	91.1	11.6	63.4	3.60	178.3	305.251	113.0	35.7		
	7.89	244.3	90.9	11.5	65.3	3.46	185.7	310.819	112.0	35.9		
	7.83	243.1	91.7	11.4	63.8	3.38	123.3	307.485	112.0	36.0	-	-
	7.89	240.0	91.5	11.4	63.3	3.40	194.4	304.590	112.0	35.6		
	7.96	250.1	92.1	11.4	65.3	3.20	174.3	311.230	112.0	36.0		
Fraser River	19.08	15.0	13.0	7.2	17.0	2.59	90.1	109.540	7.1	16.3		
	19.02	15.0	12.7	7.2	16.2	2.58	92.0	107.131	7.2	16.2		
	19.28	15.3	12.9	7.3	16.8	2.59	91.8	108.217	7.3	16.1		
	19.15	13.8	12.6	7.1	16.2	2.53	91.0	107.131	7.0	16.2	-	-
	19.22	13.8	12.5	7.2	15.7	2.59	90.8	105.059	7.0	16.0		
	19.22	15.9	12.8	7.2	16.4	2.56	91.0	108.865	7.1	16.5		
Sumas River	NO DATA											
Hamilton Harbour	0.29	57.6	64.1	4.8	54.9	2.86	104.1	191.828	32.2	13.3		
	0.28	59.1	65.6	5.0	53.5	2.78	105.2	186.686	32.8	12.9		
	0.29	60.1	65.1	5.0	54.9	2.78	105.9	190.593	32.4	13.0		
	0.29	57.7	64.2	4.8	54.7	2.73	103.9	191.329	32.2	13.3	-	-
	0.29	60.1	63.7	4.9	54.2	2.71	103.5	189.257	32.4	13.1		
	0.28	60.2	64.2	4.9	52.3	2.63	106.5	186.571	32.2	13.6		

Table A8. Raw data of major ions monitoring - week 3 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Waters Mixture	2.33	96.1	1.1	0.5	13.0	0.574	<1	43.574	1.3	2.7		
	2.32	93.7	1.3	0.5	13.3	0.551	<1	44.323	1.2	2.7		
	2.33	97.9	1.2	0.5	13.4	0.556	<1	44.985	1.2	2.8		
	2.34	93.9	1.2	0.5	12.8	0.584	<1	42.663	1.2	2.6	-	-
	2.34	92.0	1.2	0.5	13.0	0.568	<1	43.986	1.3	2.8		
	2.32	95.1	1.2	0.5	12.6	0.554	<1	42.575	1.3	2.7		
RM-ANI-2 (ANI-12*D.L.)	1.18	21.2	6.9	2.4	26.5	0.385	81.0	97.452	4.1	7.6		
	1.17	21.2	6.9	2.5	26.3	0.377	79.5	96.541	4.1	7.5		
	1.19	21.3	6.9	2.5	26.3	0.372	81.0	97.776	4.2	7.8		
	1.18	20.3	6.7	2.5	26.2	0.362	79.8	97.115	4.1	7.7	-	-
	1.18	23.5	6.9	2.4	26.7	0.399	80.4	99.598	4.2	8.0		
	1.17	21.5	6.8	2.4	26.2	0.363	79.6	97.526	4.1	7.8		
RM-ANI-3 (ANI-LOW-MED)	2.37	58.6	24.8	6.9	13.0	0.939	47.0	93.378	16.4	14.8		
	2.36	61.0	24.9	7.0	13.3	0.918	45.4	95.362	16.7	15.1		
	2.38	59.1	24.8	7.0	12.8	0.895	47.2	94.525	16.8	15.2		
	2.37	59.9	24.7	7.0	13.1	0.981	45.0	94.039	16.7	14.9	-	-
	2.35	64.8	24.3	6.8	12.7	0.942	45.0	92.697	16.1	14.9		
	2.35	57.1	24.4	6.8	12.7	0.875	45.7	95.098	16.1	15.4		
RM-CAT-2 (CAT-12*D.L.)	1.29	18.0	12.4	3.2	28.1	0.294	77.9	99.389	4.5	7.1		
	1.29	18.1	12.5	3.3	27.7	0.285	68.7	99.979	4.6	7.0		
	1.30	17.6	12.3	3.3	28.2	0.290	78.9	100.874	4.6	7.4		
	1.27	18.7	12.1	3.3	28.2	0.306	77.5	100.051	4.5	7.2	-	-
	1.26	18.7	12.0	3.2	28.1	0.299	77.3	100.213	4.5	7.3		
	1.28	18.1	12.3	3.2	27.3	0.278	77.3	96.980	4.5	7.0		
RM-CAT-3 (CAT-LOW-MED)	7.56	26.8	79.4	7.6	35.3	0.347	42.3	120.661	24.5	7.9		
	7.49	27.2	77.2	7.5	35.6	0.340	47.7	120.998	24.7	7.8		
	7.49	25.1	77.7	7.6	34.5	0.335	46.8	119.075	24.6	8.0		
	7.49	24.5	78.7	7.6	35.7	0.362	47.8	121.659	24.6	7.9	-	-
	7.49	25.4	77.2	7.5	34.9	0.355	47.8	119.250	24.1	7.8		
	7.49	27.5	76.5	7.4	33.6	0.328	48.0	115.181	24.1	7.6		

NWRI CONTRIBUTION NUMBER 85-112

PRESERVATION OF PHYSICAL PARAMETERS AND MAJOR IONS IN WATERS

V. CHEAM, A.S.Y. CHAU, K.K. KWAN

Table A8. Raw data of major ions monitoring - week 3 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
CRM-2 (Sample C)	<0.02	36.3	107.4	0.9	42.3	0.032	<1	144.31	18.9	9.4		
	<0.02	36.4	107.6	0.9	42.3	0.034	<1	143.90	19.0	9.3		
	<0.02	36.1	108.4	0.9	41.5	0.029	<1	141.49	19.1	9.2		
	<0.02	38.9	107.8	0.9	41.5	0.037	<1	141.49	19.0	9.2	-	-
	<0.02	39.7	106.0	0.9	42.1	0.036	1	142.99	18.5	9.2		
	<0.02	36.2	107.5	0.9	41.8	0.029	1.1	141.83	18.7	9.1		

Table A9. Raw data of major ions monitoring - week 6

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Pebbleloggitch	1.849	7.00	4.60	0.27	0.37	0.007	<1.0	2.45	3.04	0.37		
	2.00	6.30	4.10	0.25	0.35	0.007	<1.0	2.36	2.91	0.36		
	1.748	6.40	4.30	0.23	0.35	<0.005	<1.0	2.40	2.86	0.37		
	1.829	6.50	4.20	0.23	0.34	<0.011	<1.0	2.33	2.85	0.36	-	-
	1.819	7.00	4.50	0.24	0.34	<0.005	<1.0	3.37	2.88	0.37		
	1.815	5.00	4.60	0.24	0.34	<0.005	<1.0	2.33	2.88	0.36		
Mercy River	1.650	9.20	4.40	0.27	0.80	<0.005	<1.0	3.73	3.01	0.42		
	1.686	9.30	4.50	0.27	0.79	<0.005	<1.0	3.70	3.00	0.42		
	1.490	9.80	4.70	0.28	0.80	<0.005	<1.0	3.69	3.00	0.41		
	1.650	9.10	4.40	0.28	0.80	<0.005	<1.0	3.73	3.09	0.42	-	-
	1.650	9.30	4.50	0.27	0.81	<0.005	<1.0	3.75	3.07	0.42		
	1.564	9.00	4.80	0.28	0.81	<0.005	1.8	3.75	3.09	0.42		
Sand Pond	1.730	10.60	5.90	0.24	0.50	0.009	<1.00	3.06	4.09	0.44		
	1.598	10.60	6.50	0.24	0.45	0.009	<1.00	2.89	4.14	0.43		
	1.644	10.90	5.70	0.24	0.45	0.018	<1.00	2.89	4.07	0.43		
	1.650	10.50	6.10	0.24	0.46	0.018	<1.00	2.92	4.09	0.43	-	-
	1.630	10.70	6.20	0.25	0.46	0.008	<1.00	2.92	4.15	0.43		
	1.536	9.20	6.60	0.24	0.46	0.007	1.00	2.92	4.14	0.43		
Carillon	3.539	9.70	2.00	0.80	7.37	0.066	18.30	25.73	2.28	1.78		
	3.598	9.50	2.10	0.80	7.43	0.221	18.30	25.92	2.22	1.79		
	3.384	10.70	2.30	0.81	7.90	0.168	17.90	27.14	2.28	1.80		
	3.598	9.50	1.90	0.82	7.84	0.255	18.30	24.48	2.28	1.91	-	-
	3.559	9.80	2.00	0.81	7.48	0.250	16.70	26.17	2.28	1.82		
	3.536	10.00	2.30	0.83	7.47	0.238	17.00	26.06	2.32	1.80		
St. Lambert	0.390	26.60	24.90	1.37	35.70	0.029	93.10	121.66	12.40	7.90		
	0.404	26.70	25.00	1.36	35.50	0.081	91.90	119.93	12.30	7.60		
	0.406	29.30	25.30	1.36	36.20	0.091	92.70	123.73	12.40	8.10		
	0.401	27.30	24.90	1.36	35.00	0.175	92.90	119.09	12.50	7.70	-	-
	0.408	27.30	25.10	1.37	35.60	0.258	92.30	122.23	12.60	8.10		
	0.392	25.00	25.20	1.36	35.60	0.161	96.10	120.59	12.40	7.70		

Table A9. Raw data of major ions monitoring - week 6 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Red Deer	2.982	69.20	3.60	3.06	41.30	<0.005	140.00	166.92	27.70	15.50		
	2.960	66.30	3.80	3.04	40.10	<0.005	150.00	160.64	28.00	14.70		
	3.186	76.00	4.10	3.30	39.80	0.029	154.50	159.89	28.30	14.70		
	3.042	66.60	3.50	3.03	39.70	<0.005	151.90	160.05	27.10	14.80	-	-
	3.002	68.80	3.60	3.08	39.90	<0.005	155.30	160.14	27.70	14.70		
	2.974	77.00	3.90	3.07	40.30	<0.005	155.90	162.78	27.80	15.10		
Qu'Appelle River	7.793	238.60	90.10	11.30	60.0	3.28	185.30	300.88	114.00	36.70		
	7.562	234.30	79.00	11.10	59.10	3.14	186.90	294.51	112.00	35.70		
	7.750	239.40	83.00	11.20	60.20	3.11	189.40	299.73	110.00	36.30		
	7.833	246.50	79.50	11.20	58.10	2.89	186.10	293.66	111.00	36.10	-	-
	7.893	246.90	79.10	11.20	57.50	2.65	186.10	295.05	111.00	36.80		
	7.790	255.00	86.30	11.20	58.30	2.14	189.30	297.87	110.00	37.00		
Fraser River	18.270	14.60	12.40	7.20	16.60	2.44	93.40	107.72	7.06	16.10		
	18.202	15.00	12.60	7.30	16.80	2.22	93.20	107.39	7.09	15.90		
	17.916	12.00	12.40	7.20	16.40	2.23	94.10	108.87	7.21	16.50		
	18.350	14.90	12.40	7.30	16.40	1.94	95.10	106.81	7.21	16.00	-	-
	18.290	15.10	12.50	7.30	16.30	1.93	94.60	107.38	7.13	16.20		
	18.565	13.40	12.80	7.30	16.70	2.29	97.00	107.97	7.16	16.10		
Sumas River	3.523	658.90	4552.00	101.00	109.00	0.015	54.90	778.44	2751.00	123.00		
	3.275	654.00	5054.20	102.00	110.00	0.021	54.10	793.29	2702.00	126.00		
	3.169	652.20	5052.90	101.00	111.00	<0.005	54.00	791.67	2714.00	125.00		
	3.360	680.00	5051.70	102.00	110.00	0.015	54.30	773.31	2653.00	126.00	-	-
	3.340	672.00	5155.80	102.00	110.00	0.014	54.80	793.29	2677.00	126.00		
	3.271	620.60	4562.00	102.00	110.00	0.014	54.80	789.17	2628.00	125.00		
Hamilton Harbour	0.224	63.80	56.50	4.90	52.90	3.09	108.80	186.83	30.60	13.30		
	0.262	62.80	57.10	4.90	50.20	2.91	106.50	180.09	31.40	13.30		
	0.285	62.90	58.90	4.90	53.10	3.07	108.00	187.75	31.40	13.40		
	0.272	64.80	56.10	4.90	49.00	3.20	109.20	176.68	30.60	13.20	-	-
	0.262	63.70	54.50	4.90	54.20	3.23	110.00	188.85	30.90	13.00		
	0.186	65.40	61.60	4.90	53.40	2.48	110.70	186.85	30.30	13.00		

Table A9. Raw data of major ions monitoring - week 6 cont'd.

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Waters Mixture	2.247	83.40	1.10	0.51	12.90	0.623	<1.0	43.23	1.28	2.70		
	2.266	84.40	1.10	0.50	13.10	0.619	<1.0	44.24	1.24	2.80		
	2.284	1293.50	0.50	0.52	12.50	0.109	<1.0	42.33	1.25	2.70		
	2.258	80.90	1.10	0.51	12.70	0.639	<1.0	43.24	1.24	2.80	-	-
	2.227	85.70	1.10	0.50	12.80	0.605	<1.0	43.00	1.24	2.70		
	2.207	1225.40	<0.5	0.51	12.70	0.105	3.9	42.83	1.26	2.70		
RM-ANI-2 (ANI-12*D.L.)	1.153	19.70	6.80	2.39	25.70	0.427	83.60	95.45	4.0	7.60		
	1.124	19.90	6.70	2.41	25.10	0.430	83.20	93.96	4.0	7.60		
	1.126	22.10	6.80	2.40	25.80	0.438	82.80	96.12	3.9	7.70		
	1.163	20.40	6.80	2.43	25.90	0.445	84.20	96.37	4.0	7.70	-	-
	1.153	19.90	6.90	2.45	25.30	0.431	82.10	94.46	4.1	7.60		
	1.133	20.40	6.70	2.39	26.0	0.434	84.90	95.79	4.1	7.50		
RM-ANI-3 (ANI-LOW-MED)	2.207	55.20	24.60	6.90	12.80	0.928	48.20	92.88	16.50	14.80		
	2.346	49.30	24.50	6.80	12.80	0.923	47.70	93.70	16.00	15.00		
	2.263	56.30	25.00	6.90	12.60	1.10	48.20	92.38	16.50	14.80		
	2.278	47.00	24.80	6.90	12.60	0.883	48.10	91.22	16.20	14.60	-	-
	2.286	50.60	25.00	7.00	12.70	1.030	47.10	93.04	16.60	14.90		
	2.286	52.10	24.90	7.00	12.70	1.030	46.60	92.63	16.70	14.80		
RM-CAT-2 (CAT-12*D.L.)	1.312	17.70	13.11	3.23	27.10	0.332	79.90	97.30	4.40	7.20		
	1.121	16.10	12.20	3.26	27.60	0.332	78.50	98.96	4.50	7.30		
	1.158	17.30	12.40	3.22	27.40	0.332	79.90	98.47	4.40	7.30		
	1.213	24.00	19.20	3.24	27.50	0.335	76.70	98.71	4.40	7.30	-	-
	1.233	24.30	19.40	3.26	27.50	0.340	80.50	98.71	4.60	7.30		
	1.157	17.70	21.00	3.28	27.60	0.345	81.20	99.38	4.60	7.40		
RM-CAT-3 (CAT-LOW-MED)	7.376	25.10	72.60	7.50	34.70	0.391	50.50	119.16	24.00	7.90		
	7.318	25.80	70.60	7.50	34.80	0.391	49.50	121.06	24.40	8.30		
	7.157	24.60	69.30	7.60	35.20	0.387	49.40	121.23	25.20	8.10		
	7.217	26.00	66.20	7.60	34.50	0.401	46.80	119.08	25.10	8.00	-	-
	7.416	25.90	70.60	7.60	33.90	0.402	47.30	118.40	24.50	8.20		
	7.396	23.90	74.70	7.60	34.70	0.408	49.90	119.57	24.60	8.00		

Table A9 Raw data of major ions monitoring - week 6 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
CRM-2 (Sample C)	<0.01	38.70	96.30	0.90	41.20	0.037	<1.0	140.33	18.80	9.10		
	0.01	39.10	97.30	0.88	40.50	0.029	<1.0	139.00	18.90	9.20		
	0.014	36.40	97.40	0.90	40.40	0.034	1.0	137.92	18.80	9.00		
	<0.01	37.30	98.90	0.90	40.60	0.036	<1.0	139.66	18.70	9.30	-	-
	<0.01	39.30	94.00	0.90	40.70	0.018	<1.0	139.91	19.20	9.30		
	<0.01	35.20	111.30	0.90	40.70	0.041	<1.0	138.26	18.80	8.90		

Table A10. Raw data of major ions monitoring - week 9

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Pebbleloggitch	1.90	6.60	4.10	0.23	0.38	N	2.50	2.47	2.76	0.37		
	1.90	6.30	4.10	0.23	0.37	O	2.60	2.44	2.78	0.37		
	1.87	6.00	4.20	0.23	0.36		2.30	2.42	2.78	0.37		
	1.87	6.00	4.10	0.23	0.37	D	1.50	2.44	2.77	0.37	-	-
	1.89	6.60	4.20	0.23	0.37	A	1.70	2.44	2.78	0.37		
	1.88	6.80	4.20	0.23	0.36	T	1.10	2.42	2.78	0.37		
						A						
Mercy River	1.68	9.80	5.00	0.36	0.89		1.50	3.99	3.28	0.43		
	1.69	9.70	4.40	0.26	0.87		2.00	3.94	2.89	0.43		
	1.67	9.90	4.40	0.26	0.88		2.20	3.97	2.91	0.43		
	1.66	10.00	4.40	0.27	0.88		2.10	3.93	2.90	0.42	-	-
	1.67	10.10	6.00	0.26	0.88		2.50	3.93	2.89	0.42		
	1.67	10.30	4.60	0.26	0.86		1.00	3.88	2.91	0.42		
Sand Pond	1.68	10.30	5.70	0.19	0.47		5.10	2.97	3.71	0.43		
	1.68	10.50	5.70	0.19	0.44		6.60	2.83	3.74	0.42		
	1.68	10.60	5.60	0.18	0.48		5.90	3.05	3.75	0.45		
	1.68	10.70	5.80	0.18	0.47		5.70	3.02	3.74	0.45	-	-
	1.67	11.10	5.86	0.18	0.57		4.10	3.44	3.69	0.49		
	1.68	11.00	5.80	0.18	0.45		1.50	2.97	3.74	0.45		
Carillon	3.52	9.60	2.20	0.80	7.86		17.9	27.24	2.19	1.85		
	3.64	10.00	2.00	0.80	7.93		15.40	27.33	2.18	1.83		
	3.65	10.00	2.10	0.80	7.77		16.10	26.93	2.18	1.83		
	3.57	10.10	2.00	0.79	7.74		14.50	26.82	2.19	1.82	-	-
	3.57	10.40	2.00	0.78	7.68		13.60	26.63	2.17	1.81		
	3.59	10.50	2.10	0.79	7.74		15.70	26.86	2.17	1.83		
St. Lambert	0.37	27.00	24.20	1.42	37.70		96.40	127.07	12.20	8.00		
	0.39	26.30	24.10	1.35	37.20		101.00	125.41	11.90	7.90		
	0.37	26.80	24.40	1.36	37.40		92.80	125.91	12.00	7.90		
	0.36	26.50	24.10	1.34	37.20		92.30	125.41	11.90	7.90	-	-
	0.37	27.20	24.50	1.35	37.30		87.10	126.07	11.90	8.00		
	0.37	27.50	24.80	1.33	37.50		87.30	125.74	11.70	7.80		

Table A10. Raw data of major ions monitoring - week 9 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Red Deer	3.01	77.30	3.60	3.06	41.10	N	154.80	165.19	28.10	15.20		
	2.98	77.60	3.70	3.06	42.00	O	154.10	168.26	28.30	15.40		
	2.99	76.20	3.70	3.04	41.40		152.20	167.18	28.30	15.50		
	2.98	76.50	3.70	3.06	41.50	D	148.70	166.60	28.30	15.30	-	-
	2.97	76.10	3.60	3.04	41.40	A	147.30	165.53	28.40	15.10		
	2.99	76.60	3.70	3.04	41.40	T	149.30	166.77	28.20	15.40		
						A						
Qu'Appelle River	7.64	243.70	90.20	10.60	63.90		185.50	315.14	101.00	37.80		
	7.67	244.30	92.20	10.20	64.70		185.70	316.32	99.10	37.60		
	7.55	244.80	90.20	10.20	66.20		186.90	322.94	99.10	38.30		
	7.56	243.00	90.60	10.00	65.20		183.50	314.27	98.40	36.80	-	-
	7.53	244.30	89.90	10.20	65.80		183.00	310.83	99.30	35.60		
	7.57	244.90	90.00	10.20	65.50		178.70	316.25	99.10	37.10		
Fraser River	18.21	11.80	12.30	7.10	16.60		96.50	108.95	7.14	16.40		
	18.14	14.20	12.20	7.10	16.80		101.00	109.45	7.10	16.40		
	18.17	13.90	12.20	7.10	17.00		95.00	111.19	7.11	16.70		
	18.34	13.90	12.20	7.10	16.60		92.50	107.72	7.15	16.10	-	-
	18.24	13.60	12.40	7.10	16.80		87.30	109.45	7.07	16.40		
	18.27	13.50	12.40	7.10	16.90		93.50	108.47	7.08	16.10		
Sumas River	3.28	697.20	4260.10	91.20	104.00		57.20	1617.97	2554.00	330.00		
	3.25	696.80	4277.90	99.70	108.00		54.50	1669.12	2618.00	340.00		
	3.26	698.40	4327.80	99.80	109.00		54.60	1667.49	2586.00	339.00		
	3.24	700.00	4313.50	97.50	108.00		51.30	1648.54	2546.00	335.00	-	-
	3.13	700.60	4331.40	99.50	106.00		48.70	1643.54	2586.00	335.00		
	3.11	700.20	4285.00	98.80	107.00		55.00	1666.62	2602.00	340.00		
Hamilton Harbour	0.26	62.10	65.20	4.87	57.70		113.70	198.41	34.40	13.20		
	0.28	68.30	66.00	4.84	57.20		108.80	197.98	34.20	13.40		
	0.28	67.60	65.30	4.90	57.90		111.00	199.32	34.10	13.30		
	0.27	68.00	64.90	4.81	57.70		105.60	199.57	33.70	13.50	-	-
	0.26	69.00	64.30	4.87	57.60		107.60	199.40	33.90	13.50		
	0.27	68.00	63.90	4.81	58.00		109.50	199.16	34.00	13.20		

Table A10. Raw data of major ions monitoring - week 9 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Waters Mixture	2.26	88.10	1.00	0.50	13.40	N	6.20	44.57	1.21	2.70		
	2.25	87.80	1.00	0.50	13.40	O	5.10	44.57	1.21	2.70		
	2.26	88.30	1.00	0.49	13.50		1.10	44.82	1.20	2.70		
	2.24	87.70	1.00	0.50	13.40	D	1.70	44.16	1.22	2.60	-	-
	2.26	87.50	1.00	0.49	13.30	A	4.90	44.32	1.20	2.70		
	2.25	87.30	0.90	0.49	13.40	T	<1.00	44.57	1.20	2.70		
						A						
RM-ANI-2 (ANI-12*D.L.)	1.15	20.40	6.40	2.39	27.00		87.60	99.52	3.96	7.80		
	1.14	20.60	6.50	2.40	26.80		87.90	99.02	3.97	7.80		
	1.15	20.60	6.30	2.39	27.00		84.80	99.52	3.96	7.80		
	1.14	20.90	6.40	2.40	26.70		78.90	98.77	3.93	7.80	-	-
	1.13	20.20	6.70	2.38	26.60		78.70	98.52	3.92	7.80		
	1.13	20.70	6.60	2.37	26.80		84.00	98.61	3.92	7.70		
RM-ANI-3 (ANI-LOW-MED)	2.30	60.60	23.80	6.70	12.90		47.60	94.36	15.10	15.10		
	2.29	55.20	24.10	6.80	13.50		48.20	96.27	15.10	15.20		
	2.29	54.70	23.90	6.80	13.00		50.10	94.61	15.00	15.10		
	2.28	56.30	23.90	6.80	13.20		42.40	95.11	15.10	15.10	-	-
	2.26	56.90	23.80	6.70	13.00		41.20	94.20	15.10	15.00		
	2.28	57.40	24.40	6.70	13.20		45.70	97.17	15.10	15.60		
RM-CAT-2 (CAT-12*D.L.)	1.22	17.40	11.90	3.17	28.70		85.00	101.30	4.42	7.20		
	1.22	17.30	11.80	3.22	28.80		85.10	101.96	4.40	7.30		
	1.22	17.80	11.90	3.25	28.50		81.30	101.62	4.47	7.40		
	1.22	17.90	11.80	3.20	28.20		75.50	100.47	4.37	7.30	-	-
	1.22	17.30	12.00	3.20	28.40		77.70	100.55	4.35	7.20		
	1.25	17.30	12.00	3.20	27.40		80.20	98.47	4.35	7.30		
RM-CAT-3 (CAT-LOW-MED)	7.18	25.60	77.90	7.30	36.10		49.80	123.48	23.60	8.10		
	7.16	25.70	79.40	7.40	36.20		46.60	123.73	23.50	8.10		
	7.23	25.70	79.30	7.40	36.40		47.10	123.82	23.50	8.00		
	7.16	25.80	78.10	7.30	35.90		47.50	122.57	23.40	8.00	-	-
	7.15	25.60	78.50	7.40	36.50		43.10	124.07	23.60	8.00		
	7.14	26.50	78.20	7.40	36.60		47.60	124.32	23.50	8.00		

Table A10. Raw data of major ions monitoring - week 9 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
CRM-2 (Sample C)	<0.02	35.80	107.40	0.88	43.10	N	2.80	146.72	16.90	9.50		
	<0.02	36.00	106.90	0.90	42.40	O	2.60	144.56	17.00	9.40		
	<0.02	35.70	106.90	0.87	43.00		1.90	146.47	16.80	9.50		
	<0.02	35.80	104.30	0.87	43.20	D	1.80	146.97	16.70	9.50	-	-
	<0.02	35.70	105.00	0.87	43.60	A	1.70	147.15	16.70	9.30		
	<0.02	39.60	105.30	0.87	42.80	T	1.10	145.97	17.00	9.50		
						A						

Table A11. Raw data of major ions monitoring - week 12

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Pebbleloggitch	1.84	5.70	4.00	0.34	0.46	<0.01	1.10	2.71	3.17	0.38		
	1.84	5.60	4.60	<0.29	0.40	0.014	<1.00	2.56	2.97	0.38		
	1.92	5.60	4.30	0.25	0.41	0.011	4.20	2.54	2.82	0.37		
	1.82	5.10	4.20	0.23	0.38	0.011	1.50	2.47	2.72	0.37	-	-
	1.83	5.30	4.00	0.25	0.40	0.011	5.10	2.52	2.89	0.37		
	1.88	5.40	4.10	0.30	0.40	0.013	1.30	2.52	3.07	0.37		
Mercy River	1.66	7.00	4.40	0.26	0.92	<0.01	1.30	4.07	2.90	0.43		
	1.65	7.40	4.50	0.26	0.91	<0.01	1.00	4.08	2.90	0.44		
	1.65	8.60	4.80	0.31	0.91	<0.01	<1.00	4.04	3.04	0.43		
	1.66	7.30	4.40	0.28	0.91	<0.01	<1.00	4.04	2.94	0.43	-	-
	1.65	8.50	4.50	0.27	0.90	<0.01	<1.00	3.98	2.92	0.42		
	1.64	8.60	4.70	0.26	0.87	<0.01	1.10	3.99	2.85	0.43		
Sand Pond	3.11	17.80	11.10	0.18	0.58	0.021	3.00	3.38	3.67	0.47		
	1.29	17.80	10.90	0.17	0.49	<0.01	2.00	3.03	3.69	0.44		
	2.54	18.30	11.10	0.17	0.54	<0.01	<1.00	3.20	3.67	0.45		
	2.00	18.20	11.30	0.17	0.52	0.020	<1.00	3.15	3.70	0.45	-	-
	2.36	17.70	11.20	0.19	0.50	0.023	2.10	3.06	3.73	0.44		
	1.27	9.00	6.20	0.18	0.61	0.013	<1.00	3.50	3.68	0.48		
Carillon	3.52	9.60	2.10	0.77	7.82	0.313	16.50	26.98	2.14	1.81		
	3.76	9.60	2.10	0.78	7.84	0.324	15.50	27.07	2.16	1.82		
	3.50	9.60	2.20	0.78	7.89	0.232	23.80	26.99	2.15	1.77		
	3.73	9.60	2.10	0.78	7.75	0.241	19.30	26.68	2.14	1.78	-	-
	3.73	9.60	2.10	0.77	8.04	0.284	20.20	27.61	2.16	1.83		
	3.73	9.50	2.10	0.77	7.73	0.227	16.70	26.63	2.13	1.78		
St. Lambert	0.38	27.00	24.50	1.29	37.40	0.287	89.70	126.36	12.20	8.00		
	0.38	27.40	24.60	1.31	37.00	0.268	89.70	124.91	12.20	7.90		
	0.37	27.40	24.60	1.32	36.80	0.219	94.90	124.82	12.10	8.00		
	0.37	27.50	24.50	1.31	36.90	0.238	89.00	125.48	12.20	8.10	-	-
	0.37	27.30	24.50	1.31	37.20	0.244	92.00	125.82	12.30	8.00		
	0.37	27.40	24.60	1.32	36.80	0.215	89.00	124.82	12.20	8.00		

Table A11. Raw data of major ions monitoring - week 12 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Red Deer	2.61	76.20	4.00	3.01	40.80	0.053	156.30	162.80	29.60	14.80		
	2.68	77.80	3.90	3.03	40.80	0.066	150.40	163.62	29.60	15.00		
	2.68	78.00	4.10	3.05	41.20	<0.01	161.90	165.03	29.70	15.10		
	2.68	76.80	3.80	3.04	41.00	0.054	149.90	164.12	29.70	15.00	-	-
	2.68	78.80	4.00	3.02	41.60	0.049	156.50	165.62	29.60	15.00		
	2.68	77.00	3.90	3.05	41.70	<0.01	154.90	165.86	29.80	15.00		
Qu'Appelle River	7.72	228.40	91.60	11.30	65.10	3.37	189.40	314.84	111.00	37.00		
	7.72	237.40	91.90	11.00	64.40	3.33	182.90	312.28	109.00	36.80		
	7.73	239.30	91.70	10.90	65.60	3.35	195.80	319.38	110.00	37.80		
	7.73	238.40	91.70	11.00	64.60	3.31	184.60	315.66	111.00	37.50	-	-
	7.74	238.00	91.10	10.90	64.60	3.32	192.50	311.96	109.00	36.60		
	7.69	238.30	91.60	10.80	62.80	3.26	187.30	305.40	107.00	36.10		
Fraser River	18.39	12.90	12.60	7.30	17.10	2.47	94.80	110.61	7.03	16.50		
	18.28	13.10	12.60	7.30	17.00	2.55	93.60	110.78	6.94	16.60		
	18.28	13.10	12.60	7.30	17.10	2.60	93.50	111.44	7.01	16.70		
	18.28	13.10	12.50	7.30	16.80	2.52	96.90	109.45	7.04	16.40	-	-
	18.25	12.90	12.60	7.30	17.20	2.51	94.40	110.86	6.95	16.50		
	18.22	12.90	12.50	7.30	17.10	2.52	92.10	110.61	7.16	16.50		
Sumas River	3.32	706.60	4673.46	104.00	108.00	<0.01	55.40	1627.96	2604.00	330.00		
	3.33	714.20	4530.48	104.00	107.00	<0.01	55.40	1609.00	2606.00	326.00		
	3.33	703.70	4577.13	103.00	108.00	<0.01	57.70	1619.73	2587.00	328.00		
	3.34	717.50	4431.85	103.00	107.00	0.017	57.90	1625.46	2587.00	330.00	-	-
	3.32	711.30	4545.04	101.00	108.00	0.01	56.30	1599.15	2595.00	323.00		
	<0.02	706.00	4634.89	101.00	98.90	0.01	51.40	1605.23	2578.00	330.00		
Hamilton Harbour	0.18	63.10	62.30	4.96	56.30	3.58	107.50	194.91	33.00	13.20		
	0.13	65.60	62.20	4.97	57.00	3.48	109.50	197.07	32.90	13.30		
	0.23	66.20	61.70	5.00	56.70	3.61	108.60	197.15	32.70	13.50		
	0.18	65.00	61.80	4.96	57.60	3.53	105.50	198.57	32.40	13.30	-	-
	0.24	64.80	62.00	4.96	57.60	3.63	108.80	197.48	32.70	13.40		
	0.25	65.60	61.90	4.99	56.50	3.52	108.90	195.82	32.70	13.30		

Table A11. Raw data of major ions monitoring - week 12 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Waters Mixture	2.30	89.50	1.00	0.49	13.40	0.641	<1.0	44.98	1.26	2.80		
	2.30	92.90	1.00	0.49	13.40	0.628	<1.0	44.57	1.36	2.70		
	2.31	94.40	1.00	0.50	13.60	0.584	<1.0	45.61	1.51	2.80		
	2.31	92.80	1.00	0.49	13.50	0.586	1.50	44.82	1.24	2.70	-	-
	2.31	93.50	1.00	0.50	13.30	0.594	4.80	44.32	1.61	2.70		
	2.25	93.00	1.00	0.49	13.40	0.583	1.70	44.98	1.56	2.80		
RM-ANI-2 (ANI-12*D.L.)	0.97	19.40	6.50	2.35	27.00	0.455	85.50	99.67	3.94	7.90		
	0.98	19.80	6.50	2.36	26.80	0.444	82.10	99.44	3.92	7.90		
	0.98	19.70	6.50	2.36	27.00	0.413	85.40	99.52	3.90	7.80		
	0.97	19.70	6.40	2.36	27.10	0.395	81.20	100.19	3.91	7.90	-	-
	0.97	19.60	6.50	2.38	26.50	0.418	86.30	98.27	3.93	7.80		
	1.14	19.30	6.60	2.37	26.80	0.411	82.70	99.02	3.91	7.80		
RM-ANI-3 (ANI-LOW-MED)	2.25	52.30	24.00	6.90	13.00	1.05	48.80	94.61	16.30	15.10		
	2.25	53.30	23.90	7.00	13.40	1.04	45.30	96.02	16.40	15.20		
	2.26	53.60	24.00	7.00	13.50	1.01	50.70	96.68	16.40	15.30		
	2.24	53.50	23.90	7.00	13.30	0.978	46.00	94.54	16.40	14.90	-	-
	2.23	53.40	23.80	7.00	13.10	0.986	40.80	94.45	16.20	15.00		
	2.26	53.20	24.20	7.00	13.20	0.978	47.30	94.70	16.40	15.00		
RM-CAT-2 (CAT-12*D.L.)	1.23	17.10	11.80	3.12	28.10	0.325	68.60	99.39	4.33	7.10		
	<0.02	17.50	11.90	3.15	28.60	0.328	57.00	101.46	4.35	7.30		
	1.23	17.40	12.00	3.18	28.00	0.318	81.80	99.97	4.35	7.30		
	1.22	17.30	11.80	3.16	28.30	0.309	76.90	100.31	4.35	7.20	-	-
	1.23	17.20	11.90	3.16	28.10	0.307	79.40	99.81	4.32	7.20		
	1.23	16.20	11.90	3.16	28.20	0.307	79.70	100.06	4.33	7.20		
RM-CAT-3 (CAT-LOW-MED)	6.96	24.70	73.28	7.60	35.10	0.401	50.80	120.16	24.80	7.90		
	6.98	24.90	73.55	7.70	35.50	0.394	41.90	121.57	24.60	8.00		
	6.98	24.80	73.82	7.70	35.40	0.367	53.30	119.86	25.00	7.80		
	6.91	24.90	73.55	7.70	35.20	0.369	47.20	120.41	24.60	7.90	-	-
	6.89	24.60	73.55	7.60	35.40	0.366	49.00	120.91	24.40	7.90		
	6.93	24.10	73.50	7.60	35.60	0.359	43.40	121.41	24.40	7.90		

Table A11. Raw data of major ions monitoring - week 12 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
CRM-2 (Sample C)	<0.02	36.10	104.70	0.85	41.60	0.021	1.40	141.75	18.80	9.20		
	<0.02	37.00	103.60	0.86	42.60	0.031	<1.00	145.06	18.70	9.40		
	<0.02	37.00	104.90	0.87	42.60	0.028	1.60	144.65	18.90	9.30		
	<0.02	36.60	104.40	0.87	42.80	0.036	1.20	145.97	18.70	9.50	-	-
	<0.02	36.70	104.70	0.89	42.00	0.031	1.90	143.15	18.70	9.30		
	<0.02	36.60	104.50	0.86	41.70	0.033	1.60	141.58	19.00	9.10		

Table A12. Raw data of major ions monitoring - week 15

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Pebbleloggitch	1.90	6.5	4.2	0.23	0.49	0.010	<1.0	2.829	2.87	0.39	<.004	.087
	1.87	6.5	4.4	0.22	0.42	0.013	<1.0	2.572	2.80	0.37	.006	.066
	1.88	6.2	4.3	0.22	0.41	0.016	<1.0	2.547	2.80	0.37	<.004	.044
	1.88	5.9	4.2	0.23	0.42	0.016	<1.0	2.572	2.85	0.37	<.004	.087
	1.87	5.9	4.4	0.22	0.42	0.015	76.9	2.572	2.82	0.37		
	1.88	5.9	4.2	0.22	0.42	0.015	<1.0	2.572	2.86	0.37		
Mercy River	1.64	9.6	4.4	0.26	0.87	<0.01	115.70	3.902	2.91	0.42	<.004	.066
	1.66	9.5	4.4	0.27	0.88	<0.01	<1.0	3.927	2.93	0.42	.005	.087
	1.67	9.4	4.4	0.25	0.88	<0.01	1.1	3.968	2.93	0.43	<.004	.066
	1.68	9.5	4.5	0.26	0.86	0.01	<1.0	3.887	2.95	0.42	<.004	.066
	1.63	9.7	4.5	0.27	0.87	<0.01	<1.0	3.902	2.95	0.42		
	1.63	9.7	4.4	0.27	0.86	<0.01	<1.0	3.887	2.97	0.42		
Sand Pond	1.32	8.0	5.7	0.16	0.59	0.019	3.9	3.367	3.79	0.46		
	1.57	7.8	5.7	0.18	0.58	0.020	<1.0	3.342	3.83	0.46		
	1.32	8.1	5.7	0.16	0.50	0.024	1.4	3.019	3.81	0.43		
	0.64	7.7	5.7	0.16	0.51	0.024	3.9	3.085	3.78	0.44	-	-
	0.83	7.8	5.7	0.17	0.48	0.024	1.1	2.887	3.78	0.41		
	0.52	8.4	5.7	0.18	0.51	0.026	2.5	3.044	3.83	0.43		
Carillon	3.69	<0.2	<0.1	0.78	7.58	0.269	18.1	26.173	2.20	1.76	.004	.108
	3.63	<0.2	<0.1	0.78	7.48	0.238	21.2	25.800	2.16	1.73	.005	.087
	3.67	<0.2	<0.1	0.80	7.62	0.423	17.8	26.273	2.20	1.76	.004	.087
	3.40	<0.2	<0.1	0.80	7.60	0.391	19.0	26.223	2.22	1.76	.005	.129
	3.11	<0.2	<0.1	0.80	8.56	0.219	<1.0	26.123	2.24	1.76		
	3.37	<0.2	<0.1	0.78	7.60	0.258	20.5	26.182	2.22	1.75		
St. Lambert	0.39	27.5	24.7	1.28	36.2	0.246	<1.0	122.504	12.7	7.8	.026	.193
	0.37	26.4	24.6	1.32	36.2	0.223	98.0	122.504	12.7	7.8	.027	.214
	0.35	27.1	24.6	1.30	36.3	0.249	98.0	122.342	12.6	7.7	.026	.193
	0.38	27.4	24.7	1.34	36.6	0.261	96.3	123.503	12.7	7.8	.026	.193
	0.38	27.4	24.8	1.33	36.4	0.249	<1.0	123.003	12.8	7.8		
	0.42	26.7	24.7	1.34	36.7	0.258	95.0	123.753	12.7	7.8		

Table A12. Raw data of major ions monitoring - week 15 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Red Deer	2.99	70.0	3.6	3.05	40.6	0.026	136.5	162.722	29.8	14.9	.027	.257
	3.05	72.2	3.4	3.10	40.4	0.015	156.9	162.222	29.7	14.9	.027	.278
	3.05	72.5	3.5	3.12	40.2	0.047	165.9	158.841	29.6	14.5	.027	.299
	3.08	72.7	3.8	3.10	40.5	0.047	159.6	162.884	29.8	15.0	.029	.278
	3.08	72.3	3.5	3.11	40.5	0.014	58.4	162.060	30.0	14.8		
	3.07	72.7	3.6	3.13	40.3	0.046	157.7	162.384	30.1	15.0		
Qu'Appelle River	7.77	232.1	86.5	10.8	63.7	3.26	189.2	305.624	113.0	35.6	.175	.597
	7.53	234.1	89.9	11.1	63.9	3.24	199.7	306.947	115.0	35.8	.179	.660
	7.49	234.7	89.6	11.1	63.8	3.13	196.6	305.847	114.0	35.6	.174	.575
	7.77	241.5	91.6	11.2	63.9	3.01	192.6	307.770	115.0	36.0	.176	.663
	7.70	241.1	90.8	11.0	63.6	3.29	198.1	307.021	113.0	36.0		
	7.67	240.3	90.8	11.2	63.8	3.34	195.2	305.462	116.0	35.5		
Fraser River	18.05	<0.2	<0.1	7.2	16.4	2.52	91.4	109.293	7.28	16.6		
	18.14	<0.2	<0.1	7.2	16.2	2.51	99.3	108.794	7.30	16.6		
	18.10	<0.2	<0.1	7.2	16.3	2.49	104.2	108.220	7.25	16.4		
	18.00	<0.2	<0.1	7.2	16.3	2.56	97.8	108.220	7.23	16.4	-	-
	18.03	<0.2	<0.1	7.2	16.5	2.50	98.9	109.543	7.35	16.6		
	18.24	<0.2	<0.1	7.2	16.6	2.56	98.5	108.969	7.40	16.4		
Sumas River	3.24	<0.2	4843.7	98.6	112.0	<0.01	60.5	1592.987	2527.0	319.0		
	3.27	<0.2	4819.3	99.7	114.0	<0.01	59.4	1589.747	2559.0	317.0		
	3.27	<0.2	4817.8	98.8	113.0	<0.01	57.8	1607.835	2534.0	322.0		
	3.27	<0.2	4885.4	98.6	115.0	0.01	58.0	1625.180	2567.0	325.0	-	-
	3.27	<0.2	4872.5	99.3	111.0	<0.01	53.8	1611.075	2550.0	324.0		
	3.26	0.2	4525.8	98.6	114.0	<0.01	57.8	1606.215	2509.0	321.0		
Hamilton Harbour	0.26	<0.2	<0.1	4.95	55.6	3.48	113.5	193.589	34.2	13.3	.097	.618
	0.22	<0.2	<0.1	4.94	55.6	3.55	114.0	193.178	33.8	13.2	.099	.597
	0.26	<0.2	<0.1	5.00	56.1	3.37	115.5	194.838	33.6	13.3	.097	.597
	0.27	<0.2	<0.1	4.98	56.6	3.62	114.7	193.589	34.0	13.3	.096	.663
	0.11	<0.2	<0.1	4.96	56.3	3.37	113.1	195.337	33.6	13.3		
	0.08	<0.2	<0.1	4.97	56.3	3.32	113.1	195.749	33.8	13.4		

Table A12. Raw data of major ions monitoring = week 15 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
Waters Mixture	2.27	84.3	0.9	0.52	13.1	0.594	<1.0	43.827	1.21	2.7	.005	.958
	2.26	86.3	1.1	0.52	13.0	0.563	<1.0	43.577	1.23	2.7	.007	.609
	2.28	87.0	1.0	0.50	13.1	0.605	<1.0	43.827	1.22	2.7	.005	.193
	2.28	87.6	1.3	0.51	13.4	0.587	<1.0	44.576	1.22	2.7	.005	.979
	2.28	87.7	1.1	0.51	13.0	0.611	<1.0	43.577	1.24	2.7		
	2.29	87.7	1.0	0.49	13.0	0.584	2.2	43.577	1.25	2.7		
RM-ANI-2 (ANI-12*D.L.)	1.16	20.2	6.7	2.42	26.8	0.406	<1.0	99.032	4.14	7.8	.013	.198
	1.16	19.6	6.6	2.42	26.5	0.387	91.3	98.283	4.13	7.8	.011	.358
	1.16	20.2	6.7	2.45	26.3	0.415	89.2	97.784	4.18	7.8	.012	.214
	1.17	20.4	6.8	2.48	26.9	0.407	90.2	99.282	4.28	7.8	.015	.214
	1.16	20.4	6.8	2.45	26.6	0.425	89.0	98.121	4.18	7.7		
	1.15	20.3	6.7	2.46	25.9	0.409	101.6	96.785	4.18	7.8		
RM-ANI-3 (ANI-LOW-MED)	2.17	52.1	22.6	6.7	13.0	0.935	98.2	87.629	16.8	13.4	<.004	.558
	2.33	53.6	24.4	6.8	13.2	0.912	49.2	95.951	16.9	15.3	<.004	.598
	2.32	53.8	24.8	6.8	13.5	0.984	50.9	97.935	17.0	15.6	.006	.639
	2.30	53.8	25.1	6.9	13.2	0.951	47.8	95.539	16.9	15.2	.005	.639
	2.30	54.0	24.7	6.9	13.1	0.996	55.2	95.289	16.8	15.2		
	2.29	54.3	24.4	6.9	13.4	0.963	50.9	96.450	17.1	15.3		
RM-CAT-2 (CAT-12*D.L.)	1.23	17.1	12.1	3.18	27.4	0.314	84.1	97.237	4.56	7.0	.012	1.080
	1.23	16.9	12.0	3.25	27.4	0.285	83.2	97.237	4.61	7.0	.012	0.358
	1.22	17.7	12.0	3.26	28.2	0.322	85.1	99.646	4.64	7.1	.012	0.172
	1.23	17.7	12.1	3.26	27.9	0.306	78.6	98.897	4.61	7.1	.012	1.060
	1.24	17.7	12.1	3.19	27.9	0.319	19.6	98.485	4.57	7.0		
	1.23	17.7	12.1	3.26	27.5	0.304	79.8	97.898	4.63	7.1		
RM-CAT-3 (CAT-LOW-MED)	7.16	25.4	74.0	7.5	35.7	0.384	53.3	121.256	24.9	7.8	.006	0.118
	7.21	24.5	75.9	7.5	34.9	0.356	53.3	119.258	24.8	7.8	.008	0.175
	7.32	25.2	76.7	7.5	35.1	0.385	53.6	119.757	24.8	7.8	.006	0.193
	7.27	25.2	76.7	7.6	35.0	0.368	28.0	119.508	25.0	7.8	.008	0.193
	7.20	25.1	76.1	7.6	35.4	0.389	1.8	120.918	24.8	7.9		
	7.21	25.1	76.1	7.6	35.6	0.383	52.8	121.418	25.1	7.9		

Table A12. Raw data of major ions monitoring - week 15 (cont'd.)

Water	Parameters, ppm											
	SiO_2	SO_4	Cl	K	Ca	NO_3&NO_2	Alkalinity	Hardness	Na	Mg	B	F
CRM-2 (Sample C)	<0.02	37.2	102.1	0.88	42.5	0.033	194.3	144.411	19.2	9.3	<.004	.278
	<0.02	38.1	103.5	0.88	41.7	0.033	<1	142.413	19.4	9.3	.006	.172
	<0.02	38.1	103.5	0.87	41.9	0.034	<1	142.501	19.1	9.2		
	<0.02	38.2	104.6	0.87	42.5	0.032	1.4	143.999	19.2	9.2		
	<0.02	38.3	104.6	0.87	42.2	0.037	158.2	143.662	19.2	9.3		
	<0.02	38.4	104.3	0.86	41.6	0.031	2.5	142.239	19.3	9.2		