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# PRESERVATION OF NUTRIENTS AND RESIDUE IN WATER SAMPLES

V. Cheam, A.S.Y. Chau, J. Sherry and K.K. Kwan

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# PRESERVATION OF NUTRIENTS AND RESIDUE IN WATER SAMPLES

by

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National Water Research Institute

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NWRI Contribution #86-178

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## MANAGEMENT PERSPECTIVE

Due to the Water Quality Laboratory centralization, the time between sample collection and sample analysis is longer than before. 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.

The second phase of the preservation studies is described in this report, dealing with 11 parameters of nutrients and residues. Eighteen regional, spiked and synthetic waters were investigated over a four month period. It was found that total nitrogen, dissolved organic carbon and residue were stable at 4°C and that total P was stable when preserved in 0.3% $H_2SO_4$. The study also confirmed that for labile parameters the commonly practiced preservation procedure of sample storage at 4°C is inadequate and that samples should be analysed as soon as possible.

## RÉSUMÉ D'ORIENTATION

En raison de la centralisation du Laboratoire national de la qualité des eaux, les intervalles entre le prélèvement des échantillons et leur analyse sont maintenant plus longs qu'avant. Il est donc essentiel de faire une évaluation approfondie des techniques de conservation des échantillons utilisées à l'heure actuelle et de les modifier s'il y a lieu, pour que les données produites par le laboratoire centralisé soient fiables.

Dans ce rapport, on décrit la deuxième phase de l'étude sur la conservation qui porte sur 11 paramètres de nutriants et résidus. Au cours d'une période de quatre mois, on a analysé 18 échantillons d'eau dopés et synthétiques de la région. On a découvert que l'azote total, le carbone organique dissous et les résidus restaient stables à 4 °C et qu'il en allait de même pour le P total lorsqu'on le conservait dans une solution de $H_2SO_4$ à 0,3 p. 100. L'étude permet également de confirmer que la méthode répandue de conservation des échantillons à 4 °C est inadéquate lorsque les paramètres sont instables et que les échantillons devraient être analysés dès que possible.

## ABSTRACT

The centralization of WQB laboratories has involved longer time periods between sample collection and sample analysis. 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 National Water Quality Laboratory are to be reliable.

This report describes the preservation study of 11 nutrients and residues. Eighteen regional, spiked and synthetic waters were investigated over a four month period. It was found that total nitrogen, dissolved organic carbon and residue were stable when stored in plastic containers in the dark at 4°C and that total P was stable when preserved in 0.3% $H_2SO_4$. For TKN, ammonia, $NO_3$ & $NO_2$ and organic nitrogen, samples should be analysed as soon as possible. A definite conclusion could not be made on PON, POC and ash due to high data imprecision.

## SOMMAIRE

En raison de la centralisation des laboratoires de la DQE, les intervalles entre le prélèvement des échantillons et leur analyse sont maintenant plus longs. Par conséquent, il est essentiel de faire une évaluation approfondie des techniques de conservation des échantillons utilisées à l'heure actuelle et de les modifier s'il y a lieu, pour que les données produites par le Laboratoire national de la qualité des eaux soient fiables.

Ce rapport décrit une étude sur la conservation de 11 nutriants et résidus. Pendant une période de quatre mois, on a analysé 18 échantillons d'eau dopés et synthétiques dans la région. On a découvert que l'azote total, le carbone organique dissous et les résidus restaient stables lorsqu'ils étaient entreposés à l'obscurité dans des contenants de plastique à 4 °C, et qu'il en allait de même pour le P total lorsqu'on le conservait dans une solution de $H_2SO_4$ à 0,3 p. 100. On devrait très bientôt procéder à l'analyse de l'azote total (méthode de Kjeldahl), de l'ammoniaque, du $NO_3$ et $NO_2$ et de l'azote organique. On ne peut tirer de conclusion définitive sur l'état de l'azote organique en particules, du carbone organique en particules et des cendres car les données sont très imprécises.

# INTRODUCTION

Centralization of the Water Quality Branch's analytical laboratories has resulted in samples having to be sent from the various regions of Canada to the national laboratory in Burlington. To ensure sample integrity during transit, NWRI was requested to undertake an evaluation of preservation procedures for all parameters routinely measured. These parameters include trace metals, major ions, nutrients, physical parameters and the whole spectrum of organic constituents.

The study of sample preservation techniques involved several phases. The first phase evaluated preservation procedures for 12 major ions and 4 physical parameters in 16 different regional waters across Canada[1]. This report describes the second phase of the preservation studies; namely, the evaluation of preservation procedures for nutrients and residue - TKN, ammonia, organic nitrogen, $NO_3$ & $NO_2$, total nitrogen, particulate organic nitrogen, dissolved organic carbon, particulate organic carbon, total P, residue and ash.

The procedure normally used to preserve these parameters (except total P) is storage of samples in the dark at 4°C. The procedure for total P involves the use of 0.3% $H_2SO_4$. However, there are insufficient data to demonstrate that these preservation procedures are effective for long-term stability (more than 2-3

weeks) in a variety of water matrices, particularly waters from the various geographic regions of Canada.

After reviewing numerous data sets, including inter-laboratory data from previous Q.C. studies and a brief literature survey[2-28], we grouped the major ions, nutrients and physical parameters into three groups as follows:

Group I - those parameters for which there was enough or nearly enough supporting data to provide some evidence of sample stability at 4°C.

Group II - those parameters for which there was some data indicating sample stability at 4°C.

Group III - those parameters for which there was little or no data or which were known to be unstable at 4°C.

Table 1 lists the three groups of parameters. The miscellaneous parameters (Group III) are being examined by a research section.

## EXPERIMENTAL

### Study Design and Sample Preparation

In this study, we investigated the stability of Group II parameters in 18 different waters including natural waters from each region plus some spiked and synthetic waters (Table 2). Each water was well homogenized by closed circuit mixing[29] before being transferred into test bottles. These bottles were then grouped into

batch "0", 2, 5, 9, 12 and 15, corresponding to the scheduled monitoring periods of week "0", 2, ..., 15. All the nutrient test samples were stored at 4°C and the P samples at room temperature.

The total storage time was chosen to be 15 weeks which we believed would amply cover the time between sample collection and data generation. The initial starting time, time "0" was defined as the time when all the waters were subsampled into test bottles. The monitoring of sample stability started right after subsampling.

As the regional waters did not arrive at the same time, and some arrived late, the true time "0" could not be established. Before the analysis could begin, about 2-3 weeks had already elapsed because of the time taken for sample shipping and for synchronizing the week "0" analyses. To establish the true time "0", that is the moment the samples are collected in the field, would have required analysis in the field and frequent monitoring of the samples until received in the laboratory. Resource limitations prevented us from doing this. We were however able to carry out a "true time zero" preservation study for 28 parameters using Hamilton Harbor water as the model water[32].

Containers

Glass containers of 100 mL size and polyethylene containers of size 250 ML, 500 ML, 50 L, 100 L and larger ones were Chromerge cleaned, rinsed and soaked in deionized distilled water for at least one week before use[30].

## Analysis

The analysis was performed by the WQNL in Burlington augmented by some in-house analyses. Six replicate analyses of each parameter were carried out per water and monitoring period. The mean and standard deviations for each parameter were then calculated. Some suspect observations were determined to be outliers (by Grubbs procedures[31] or by past experience) and therefore were not included in the calculations. All raw data are presented in the Appendix (Tables A1 to A7).

## Criteria for Stability

The following was the working criteria.

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

Some remarks on the criteria are necessary:

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

(b) For data with a few pronounced and uncharacteristic fluctuations, 90% of the total data within the 10% limit was accepted as an indication of stability.

(c) For very low levels, the 10% limit was, in general, too restrictive; a limit of 20% was more realistic.

(d) If there was a general trend (decrease or increase) - i.e., not a random fluctuation -- the 10% limit was considered to be a significant indication of instability.

## RESULTS AND DISCUSSION

Before this study was initiated, many U.S. and Canadian analytical method manuals and some pertinent scientific literature were reviewed. The review confirmed the knowledge that the following parameters; namely, $NO_3$ & $NO_2$, $NH_3$, TKN and organic nitrogen are stable for a very short time only and several manuals[5,6,8,10] recommended water samples be analysed as soon as possible. Our results for these parameters (TKN, $NH_3$, organic nitrogen, and $NO_3$ & $NO_2$) confirmed these recommendations. Furthermore, a recent "time zero" preservation study[32] showed that TKN, $NH_3$ and $NO_3$& $NO_2$ are stable for two and a half weeks only.

Table 3 and Figure 1 summarize the $NO_3$ & $NO_2$ data. The calculations indicate that 11% of the $NO_3$&$NO_2$ data are outside the 10% limit. A closer examination of the tabulated results reveals that these 11% of data are all greater than the week "0" mean values and that five waters (nos. 6, 12, 11, 10 and 9) show an increasing trend (Fig. 1). This suggests, by virtue of remark d of the criteria, that $NO_3$ & $NO_2$ increases with time. This trend was also

observed after 2-1/2 weeks of 4°C storage starting from the "true time zero"[32]. Of further interest, it is noteworthy that Morse et al.[2] found the storage at 2°C in the dark more preferable than the complex techniques of freezing and chemical additives for preservation of $NO_3$, $NO_2$, ammonia, orthophosphate and total phosphorus.

Sample stability was observed for total nitrogen, dissolved organic carbon and total phosphate. Table 4 summarizes the data for total nitrogen. Except for some large variations between monitoring periods, particularly in water no. 13 (the concentration of which is too low for reliable analyses), the data indicate little change throughout (Fig. 2). Ninety-five percent of the data are within the criteria limit, hence stability is inferred.

Table 5 summarizes the dissolved organic carbon (DOC) data. As there are many waters with very low DOC concentrations, some high data imprecision is expected. For example, the data set for water no. 13 which had the lowest DOC level of 0.2 ppm for week "0" value, had a standard deviation of 0.24 ppm. Also the week "0" value for water no. 12 was uncharacteristically low (Fig. 3). In spite of this, 92% of the data were within the 10% limit, which implies stability (remark b of criteria). The stability of DOC was also reported in the "time zero" study[32].

Only five waters were tested for total P because the adequacy of the preservative 0.3% $H_2SO_4$ in glass bottles has been widely accepted. Table 6 summarizes total P data, which are also

plotted in Fig. 4. The week "2" values are all lower than the rest, causing fairly pronounced fluctuations in particular for the very low and very high levels ($P_0$ and $P_4$ waters). The three middle levels show very little change with time. Overall, the data confirms the effectiveness of preserving with 0.3% $H_2SO_4$.

Although all the water samples were analyzed for residue (nonfilterable, dried to constant weight at 105°C), the results for very low residue contents (below 0.002 g/200 ml) were expected to be imprecise and are included only for reference. It is those data containing $\geq$0.002 g/200 ml, that is at or above detection limit, that were used for interpretation of sample stability. The residue data on those samples with contents $\geq$ 0.002 g/200 ml show that 96% of the data are within the 10% limit described earlier, hence stability is inferred (Table 7, Fig. 5). However, for particulate organic nitrogen (PON), particulate organic carbon (POC) and ash ("fixed nonfilterable residue" from 550°C furnace), a definite conclusion could not be drawn due to high data imprecision (Tables A1-A6).

## CONCLUSIONS AND RECOMMENDATIONS

The refrigeration of water samples at 4°C was effective in preserving total nitrogen, dissolved organic carbon, and residue. Also the preservative 0.3% $H_2SO_4$ was effective for total phosphate. The present study confirms previous literature findings that for

TKN, ammonia, and $NO_3$ & $NO_2$, samples should be analyzed as soon as possible,preferably within two weeks and a half from collection time.

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**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 |
| | | $NO_3$ & $NO_2$ | |
| 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) | Ash | Chlorophyll |
| 11 | Alkalinity (DIC) | | Br |
| 12 | B (Barringer) | | |
| 13 | pH | | |
| 14 | Spec. Conductance | | |
| 15 | Turbidity | | |
| 16 | Colour | | |

**Table 2. The 18 waters used in the preservation study on nutrients and residue**

| No. | Water Origin and Name | Region and Type |
|---|---|---|
| 1<br>2 | Pebbleloggitch<br>Mercy River | Atlantic, natural |
| 3 | St. Lambert | Quebec, natural |
| 4<br>5 | Red Deer<br>Qu'Appelle River | Western, natural |
| 6<br>7 | Fraser River<br>Sumas River | Pacific, natural |
| 8<br>9 | Hamilton Harbour<br>Waters Mixture | Ontario, natural |
| 10<br>11<br>12 | RM-ANI-2 (ANI-12*DL)<br>RM-ANI-3 (ANI-LOW-MED)<br>RM-ANI-5 (ANI-MED-HI) | Spiked |
| 13 | CRM-92 (SAMPLE C) | Synthetic |
| 14 | Lake Huron, $P_0$ (Preserved with 0.3% $H_2SO_4$) | Spiked |
| 15<br>16<br>17<br>18 | $P_1$ (preserved with 0.3% $H_2SO_4$)<br>$P_2$ (preserved with 0.3% $H_2SO_4$)<br>$P_3$ (preserved with 0.3% $H_2SO_4$)<br>$P_4$ (preserved with 0.3% $H_2SO_4$) | Natural |

**: 3. Summary of $NO_3$& $NO_2$-N (ppm) Monitoring**

| No. | Waters | Storage Time, Week | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 5 | 9 | 12 | 15 |
| 1 | Pebbleloggitch | .019±.003 | .016±.005 | .021±.004 | .022±.004 | .021±.004 | .016±.005 |
| 2 | Mercy River | <.01 | <.01 | <.01 | .013±.004 | <.01 | <.010 |
| 3 | St. Lambert | .261±.012 | .268±.009 | .282±.005 | .297±.003 | .296±.005 | .259±.032 |
| 4 | Red Deer | .160±.007 | .168±.005 | .171±.007 | .187±.006 | .179±.004 | .066±.012 |
| 5 | Qu'Appelle River | 3.352±.033 | 3.247±.062 | 3.370±.096 | 3.368±.034 | 3.308±.133 | 3.410±.083 |
| 6 | Fraser River | 2.510±.048 | 2.558±.026 | 2.612±.079 | 2.612±.052 | 2.577±.169 | 2.742±.039 |
| 7 | Sumas River | .013±.001 | .015±.002 | .014±.001 | .020±.003 | .015±.002 | .015±.003 |
| 8 | Hamilton Harbour | 3.253±.023 | 3.188.072 | 3.383±.074 | 3.358±.033 | 3.335±.078 | 3.407±.072 |
| 9 | Waters Mixture | .273±.011 | .287±.003 | .291±.004 | .296±.003 | <.289±.008 | .313±.012 |
| | 'M-ANI-2 ANI-12*D.L.) | .386±.016 | .407±.003 | .413±.007 | .420±.005 | .413±.012 | .450±.018 |
| 11 | RM-ANI-3 (ANI-LOW-MED) | .937±.035 | .998±.010 | 1.002±.015 | 1.005±.012 | .996±.025 | 1.062±.019 |
| 12 | RM-ANI-5 (ANI-MED-HI) | 1.757±.064 | 1.807±.021 | 1.853±.010 | 1.815±.023 | 1.812±.049 | 2.083±.022 |
| 13 | CRM-2 (Sample C) | .031±.003 | .027±.004 | .033±.001 | .036±.003 | .032±.004 | .032±.003 |

e 4 **Summary of Total Nitrogen (ppm) Monitoring**

| No. | Waters | Storage Time, Week | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 5 | 9 | 12 | 15 |
| 1 | Pebbleloggitch | .390±.016 | .394±.004 | .356±.012 | .417±.042 | .393±.026 | .380±.027 |
| 2 | Mercy River | .253±.024 | .237±.014 | .267±.028 | .289±.009 | .269±.017 | .252±.014 |
| 3 | St. Lambert | .478±.019 | .486±.015 | .461±.019 | .538±.009 | .501±.028 | .466±.034 |
| 4 | Red Deer | .532±.028 | .571±.029 | .484±.016 | .603±.013 | .565±.025 | .508±.040 |
| 5 | Qu'Appelle River | 4.321±.146 | 4.253±.066 | 4.247±.156 | 4.287±.085 | 4.215±.112 | 4.335±.097 |
| 6 | Fraser River | 3.210±.074 | 3.245±.025 | 3.202±.136 | 3.363±.161 | 3.304±.075 | 3.449±.036 |
| 7 | Sumas River | .182±.011 | 0.225±.101 | .186±.018 | .176±.059 | .183±.040 | .145±.042 |
| 8 | Hamilton Harbour | 3.891±.032 | 3.808±.068 | 3.856±.088 | 3.906±.080 | 3.827±.081 | 3.954±.048 |
| 9 | Waters Mixture | .333±.032 | .316±.009 | .378±.112 | .402±.009 | .396±.012 | .398±.036 |
| | M-ANI-2 (ANI-12*D.L.) | 5.786±.238 | 5.736±.226 | 5.458±.103 | 5.850±.128 | 5.506±.552 | 5.828±.547 |
| 11 | RM-ANI-3 (ANI-LOW-MED) | 1.374±.033 | 1.440±.020 | 1.358±.019 | 1.432±.045 | 1.398±.038 | 1.490±.025 |
| 12 | RM-ANI-5 (ANI-MED-HI) | 2.630±.093 | 2.705±.039 | 2.630±.026 | 2.60±.101 | 2.671±.063 | 2.871±.104 |
| 13 | CRM-2 (Sample C) | .043±.005 | .027±.004 | .095±.046 | .098±.032 | .045±.014 | .059±.008 |

Table 5 **Summary of DOC (ppm) Monitoring**

| No. | Water | Storage Time, Week | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 5 | 9 | 12 | 15 |
| 1 | Pebble-loggitch | 10.875±.050 | 10.917±.194 | 10.883±.256 | 10.533±.121 | 10.620±.110 | 10.45±.243 |
| 2 | Mercy River | 7.925±.096 | 7.80±.179 | 7.833±.196 | 7.750±.164 | 7.867±.186 | 7.683±.117 |
| 3 | St. Lambert | 2.900±.000 | 2.683±.160 | 2.883±.147 | 3.277±.286 | 3.160±.313 | 3.183±.223 |
| 4 | Red Deer | 4.050±.173 | 3.80±.063 | 4.233±.151 | 4.367±.258 | 4.267±.216 | 4.35±.152 |
| 5 | Qu'Appelle River | 8.180±.084 | 7.967±.186 | 7.967±.103 | 8.083±.133 | 7.850±.122 | 7.90±.261 |
| 6 | Fraser River | 6.460±.055 | 6.283±.117 | 6.320±.130 | 6.317±.133 | 6.240±.114 | 6.233±.186 |
| 7 | Sumas River | .880±.045 | .550±.055 | .840±.055 | 1.05±.176 | 1.120±.084 | 1.117±.160 |
| 8 | Hamilton Harbour | 3.680±.045 | 3.500±.000 | 3.60±.089 | 3.617±.160 | 3.567±.151 | 3.683±.264 |
| 9 | ters xture | 1.375±.126 | 1.383±.041 | 1.333±.121 | 1.583±.337 | 1.667±.186 | 1.6±.452 |
| 10 | RM-ANI-2 (ANI-12*D.L.) | 3.425±.126 | 3.35±.055 | 3.383±.075 | 3.500±.158 | 3.440±.114 | 3.55±.217 |
| 11 | RM-ANI-3 (ANI-LOW-MED) | 1.875±.050 | 1.820±.045 | 1.867±.137 | 1.80±.110 | 1.780±.130 | 1.783±.293 |
| 12 | RM-ANI-5 (ANI-MED-HI) | 23.200±.000 | 26.6±0.0 | 25.617±2.335 | 25.55±1.206 | 25.567±1.971 | 25.3±.405 |
| 13 | CRM-2 (Sample C) | .200±.000 | .380±.084 | .650±.495 | .467±.151 | .340±.089 | .667±.252 |

## 6. Summary of total P (ppm) Monitoring

| No. | Waters | Storage Time, Week | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 5 | 9 | 12 | 15 |
| 14 | $P_0$ | .0078±.0003 | .0049±.0001 | .0076±.0005 | .0075±.0010 | .0061±.0007 | .0070±.0005 |
| 15 | $P_1$ | .0160±.0002 | .0155±.0001 | .0173±.0008 | .0174±.0006 | .0174±.0005 | .0170±.0008 |
| 16 | $P_2$ | .1124±.0015 | .1028±.0004 | .1174±.0030 | .1186±.0024 | .1154±.0021 | .1113±.0023 |
| 17 | $P_3$ | .2759±.0019 | .2685±.0137 | .2958±.0060 | .2926±.0030 | .3027±.0090 | .2860±.0078 |
| 18 | $P_4$ | .4837±.0032 | .4480±.0060 | .6291±.0559 | .5709±.0801 | .5680±.0690 | .5146±.0136 |

## 7. Summary of Residue (g/200 ml) Monitoring

| No. | Waters | Storage Time, Week | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 5 | 9 | 12 | 15 |
| 1 | Pebbleloggitch | 0.00018± 0.00018 | 0.00023± 0.00038 | 0.00038± 0.00013 | 0.00025± 0.00033 | 0.00013± 0.00058 | 0.00000 |
| 2 | Mercy River | 0.00052± 0.00026 | 0.00028± 0.00017 | 0.00037± 0.00082 | 0.00015± 0.00010 | 0.00010± 0.00008 | 0.00267± 0.00023 |
| 3 | St. Lambert | 0.00048± 0.00032 | 0.00063± 0.00032 | 0.00063± 0.00027 | 0.00068± 0.00020 | 0.00055± 0.00016 | 0.00062± 0.00017 |
| 4 | Red Deer | 0.01180± 0.00055 | 0.01170± 0.00040 | 0.01200± 0.00030 | 0.01160± 0.00060 | 0.01097± 0.00082 | 0.00986± 0.00122 |
| 5 | Ou'Appelle River | 0.00437± 0.00014 | 0.00458± 0.00018 | 0.00428± 0.00015 | 0.0044± 0.00376 | 0.00450± 0.00023 | 0.00392± 0.00045 |
| 6 | Fraser River | 0.00510± 0.00040 | 0.00540± 0.00020 | 0.00550± 0.00030 | 0.00540± 0.00030 | 0.00477± 0.00059 | 0.00532± 0.00033 |
| 7 | Sumas River | 0.00190± 0.00024 | 0.00205± 0.00024 | 0.00195± 0.00016 | 0.00187± 0.00028 | 0.00278± 0.00084 | 0.00185± 0.00023 |
| 8 | Hamilton Harbour | 0.00082± 0.00040 | 0.00085± 0.00030 | 0.00085± 0.00028 | 0.00070± 0.00020 | 0.00060± 0.00026 | 0.00035± 0.00027 |
| 9 | Waters Mixture | 0.00007± 0.00016 | 0.00038± 0.00013 | -0.00005± 0.00020 | 0.00015± 0.00026 | 0.00010± 0.00000 | No Data |
| 10 | RM-ANI-2 (ANI-12*D.L.) | 0.00020± 0.00009 | 0.00002± 0.00032 | 0.00025± 0.00030 | 0.00016± 0.00006 | 0.00025± 0.00013 | No Data |
| 11 | RM-ANI-3 (ANI-LOW-MED) | 0.00052± 0.00026 | 0.00050± 0.00032 | 0.00040± 0.00012 | 0.00048± 0.00026 | 0.00025± 0.00022 | 0.00017± 0.00006 |
| 12 | RM-ANI-5 (ANI-MED-HI) | 0.00013± 0.00012 | 0.00018± 0.00026 | 0.00010± 0.00016 | 0.00017± 0.00020 | 0.00045± 0.00021 | 0.00000 |
| 13 | CRM-2 (Sample C) | 0.00013± 0.00010 | 0.00020± 0.00039 | -0.00003± 0.00036 | 0.00018± 0.00026 | 0.00085± 0.00092 | 0.00060± 0.00046 |

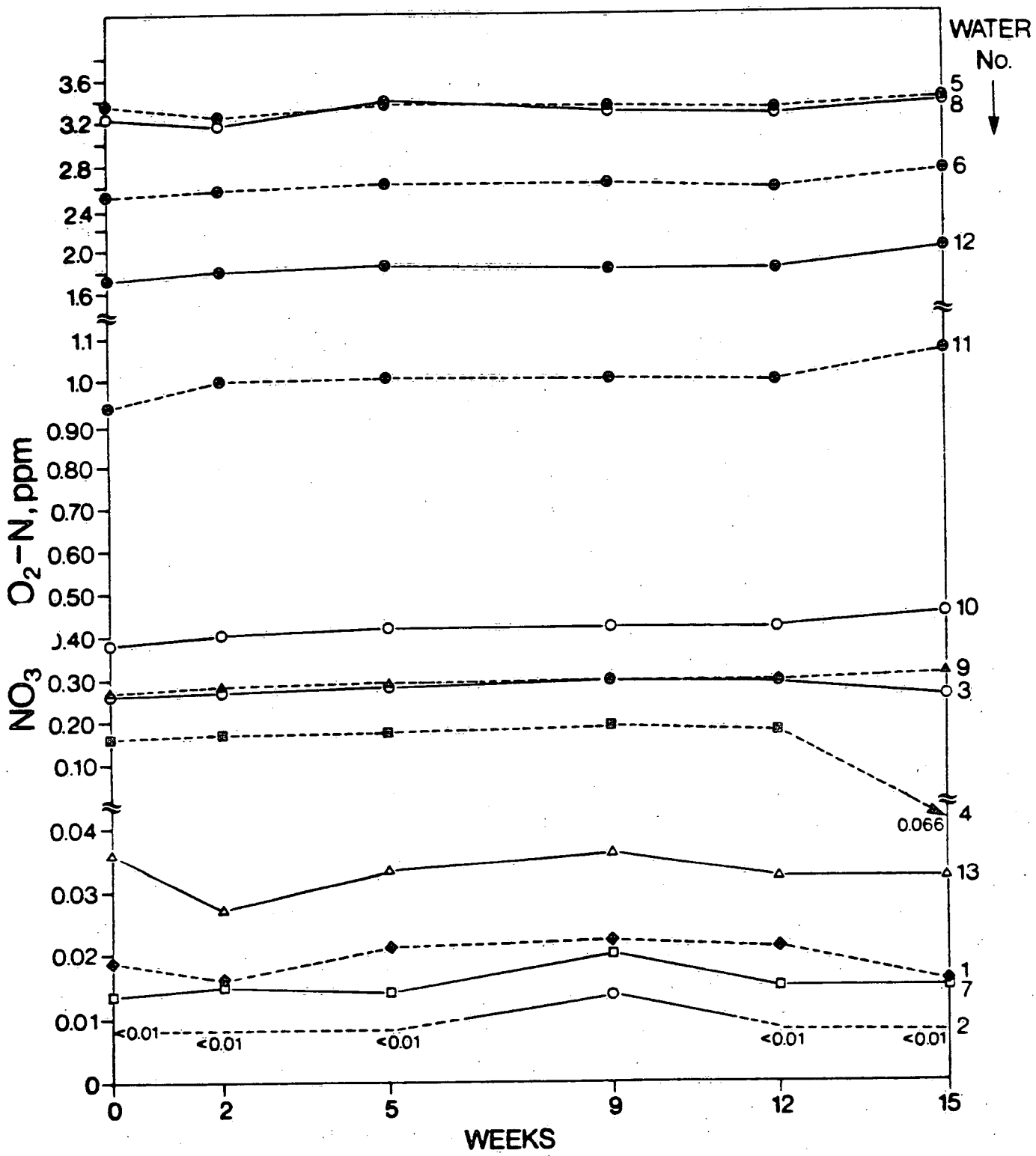


FIGURE 1. $NO_3$ AND $NO_2$ MONITORING (each point represents the average of 6 observations)

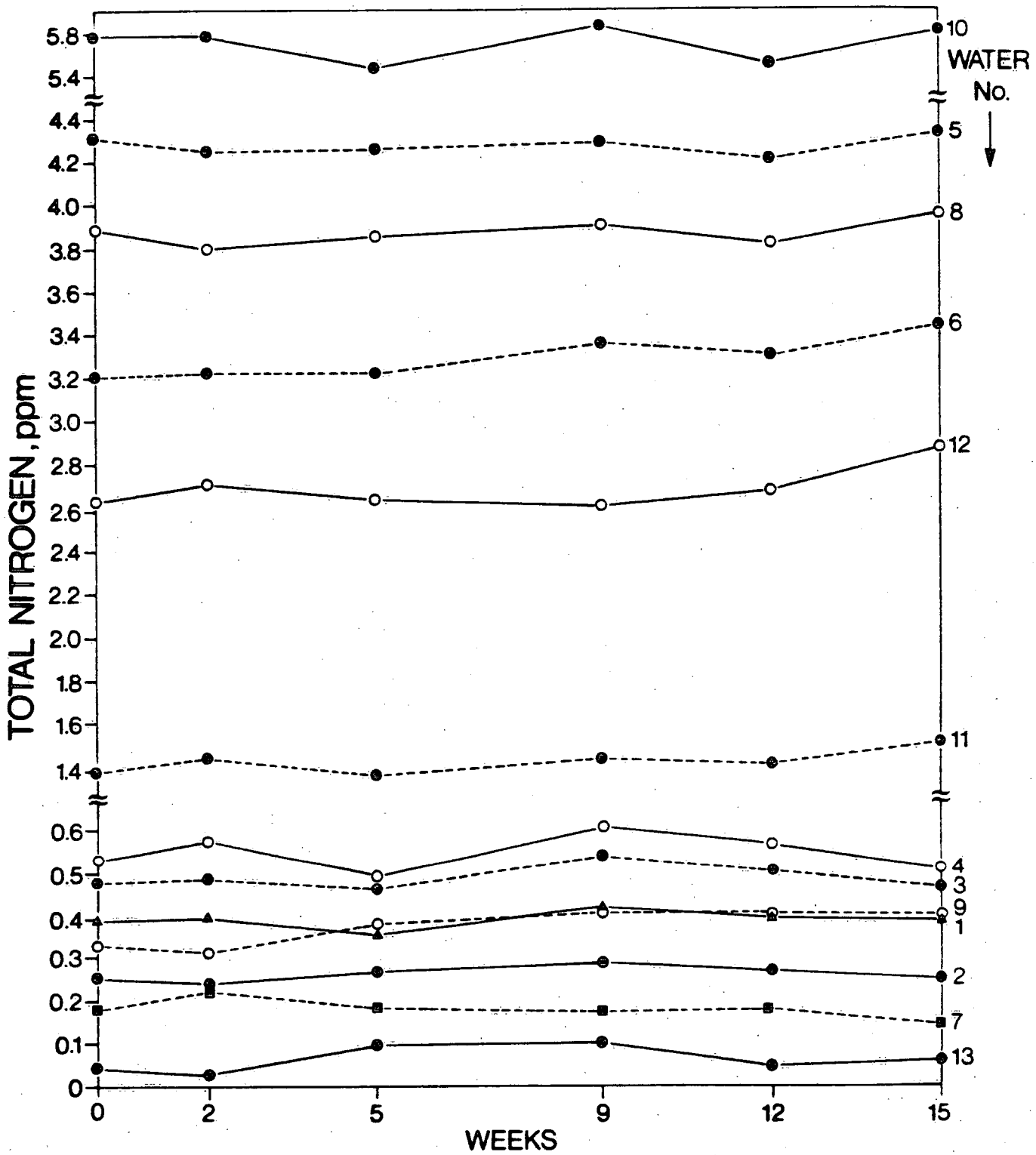


FIGURE 2. TOTAL NITROGEN MONITORING (each point represents the average of 6 observations)

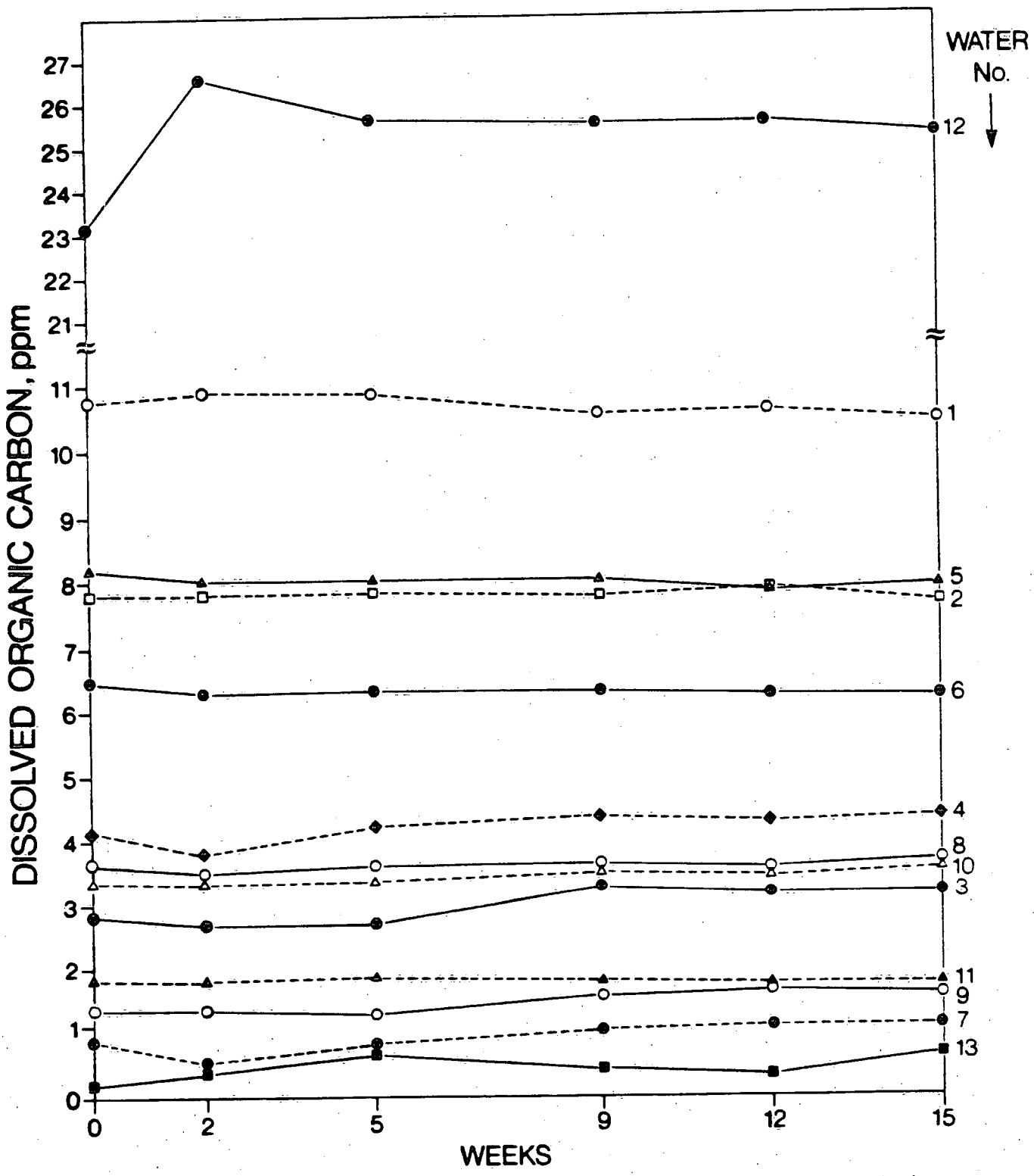


FIGURE 3. DOC MONITORING (each point represents the average of 6 observations)

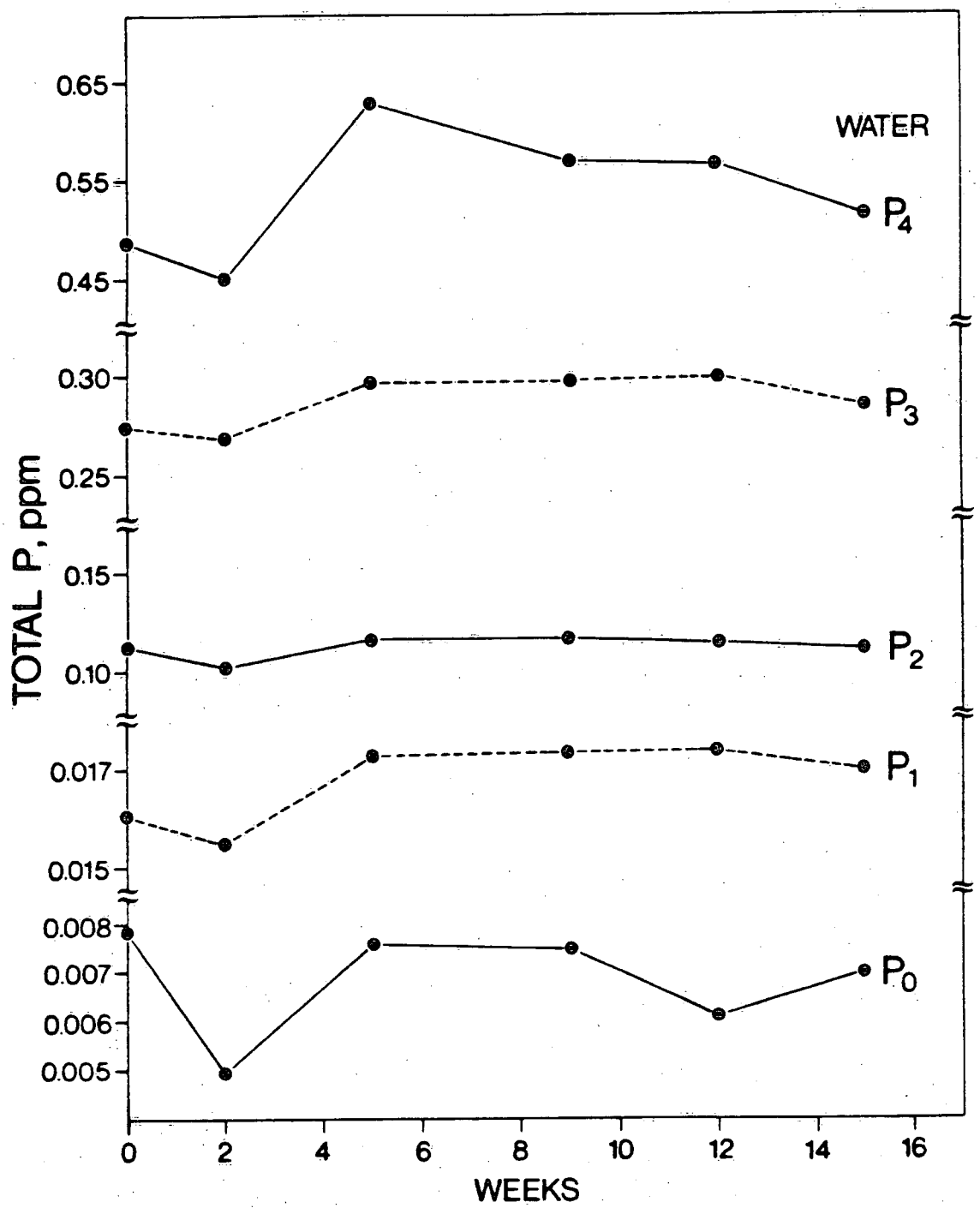


FIGURE 4. TOTAL P MONITORING (each point represents the average of 6 observations)

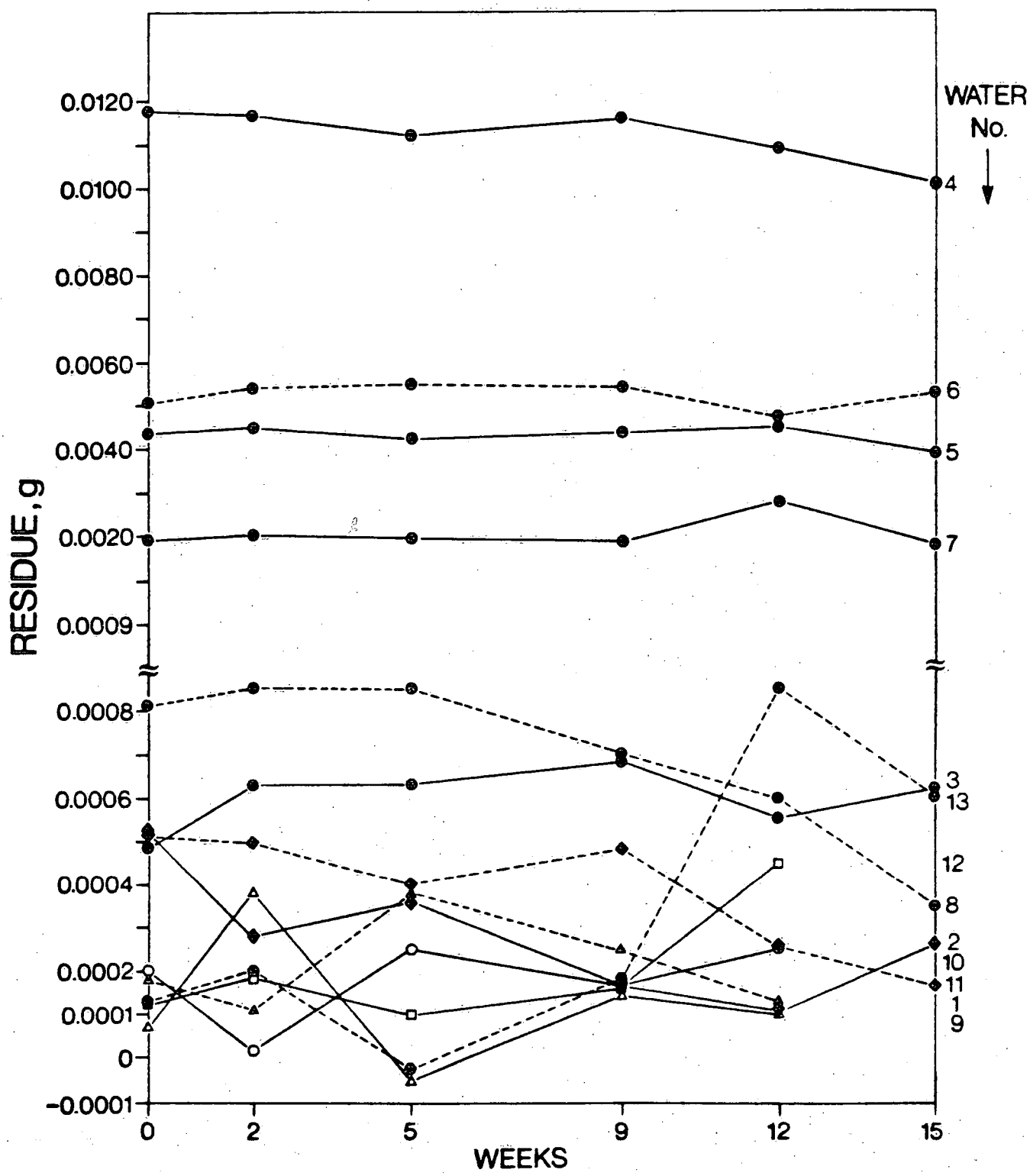


FIGURE 5. RESIDUE MONITORING (each point represents the average of 6 observations)

# APPENDIX

Tables of Raw Data

**Table A1. Raw data of nutrients and residue (week 0)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Pebbleloggitch | 0.340 | 0.063 | 0.227 | 0.023 | 0.363 | - | 6.20 | - | 0.0002 | - |
| | 0.390 | 0.054 | 0.336 | 0.019 | 0.409 | - | 6.40 | - | 0.0000 | - |
| | 0.368 | 0.057 | 0.311 | 0.020 | 0.388 | - | 10.90 | - | 0.0002 | - |
| | 0.360 | 0.058 | 0.302 | 0.018 | 0.398 | - | 10.90 | - | 0.0005 | - |
| | 0.380 | 0.048 | 0.332 | 0.017 | 0.398 | - | 10.80 | - | 0.0000 | - |
| | 0.367 | 0.053 | 0.314 | 0.015 | 0.382 | - | 10.90 | - | 0.0002 | - |
| Mercy River | 0.229 | 0.005 | 0.229 | <0.01 | 0.229 | - | 4.50 | - | 0.0004 | - |
| | 0.251 | 0.006 | 0.245 | <0.01 | 0.251 | - | 4.90 | - | 0.0006 | - |
| | 0.238 | 0.006 | 0.232 | <0.01 | 0.238 | - | 7.90 | - | 0.0007 | - |
| | 0.291 | 0.007 | 0.284 | <0.01 | 0.291 | - | 8.00 | - | 0.0003 | - |
| | 0.236 | 0.005 | 0.231 | <0.01 | 0.236 | - | 7.80 | - | 0.0009 | - |
| | 0.270 | 0.005 | 0.265 | <0.01 | 0.270 | - | 8.00 | - | 0.0002 | - |
| St. Lambert | 0.207 | <0.005 | 0.207 | 0.250 | 0.457 | 0.026 | 1.40 | 0.363 | 0.0005 | - |
| | 0.220 | <0.005 | 0.220 | 0.249 | 0.469 | 0.199 | 1.60 | 0.350 | 0.0009 | - |
| | 0.226 | <0.005 | 0.226 | 0.259 | 0.485 | 0.036 | 2.90 | 0.328 | 0.0002 | - |
| | 0.206 | <0.005 | 0.206 | 0.256 | 0.462 | 0.067 | 2.90 | 0.443 | 0.0004 | - |
| | 0.209 | <0.005 | 0.209 | 0.276 | 0.485 | 0.203 | 2.90 | 0.398 | 0.0008 | - |
| | 0.232 | <0.005 | 0.232 | 0.276 | 0.508 | 0.087 | 2.90 | 0.324 | 0.0001 | - |
| Red Deer | 0.399 | 0.026 | 0.373 | 0.159 | 0.558 | 0.341 | 2.50 | 4.25 | 0.0119 | 0.0103 |
| | 0.334 | 0.018 | 0.316 | 0.150 | 0.484 | 0.578 | 3.70 | 4.09 | 0.0116 | 0.0104 |
| | 0.376 | 0.005 | 0.371 | 0.159 | 0.535 | 2.80 | 3.90 | 3.95 | 0.0125 | 0.0109 |
| | 0.360 | 0.007 | 0.353 | 0.156 | 0.516 | 2.18 | 4.30 | 3.60 | 0.0122 | 0.0116 |
| | 0.388 | <0.005 | 0.388 | 0.170 | 0.558 | 0.606 | 4.00 | 4.57 | 0.0119 | 0.0109 |
| | 0.380 | <0.005 | 0.380 | 0.163 | 0.543 | 0.358 | 4.00 | 4.22 | 0.0109 | - |
| Qu'Appelle River | 1.04 | <0.005 | 1.04 | 3.36 | 4.40 | 0.169 | 3.40 | 1.03 | 0.0042 | 0.0036 |
| | 0.668 | <0.005 | 0.668 | 3.36 | 4.028 | 0.128 | 8.10 | 0.895 | 0.0043 | 0.0034 |
| | 0.999 | <0.005 | 0.999 | 3.41 | 4.359 | 0.147 | 8.20 | 1.14 | 0.0044 | 0.0037 |
| | 1.00 | <0.005 | 1.00 | 3.33 | 4.41 | 0.155 | 8.20 | 0.967 | 0.0043 | 0.0032 |
| | 1.06 | <0.005 | 1.06 | 3.32 | 4.39 | 0.192 | 8.10 | 0.893 | 0.0044 | 0.0035 |
| | 1.01 | <0.005 | 1.01 | 3.33 | 4.34 | 0.168 | 8.30 | 1.02 | 0.0046 | - |

**Table A1. Raw data of nutrients and residue (week 0) (cont'd.)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraser River | 0.655 | <0.005 | 0.655 | 2.43 | 3.085 | 0.264 | 3.70 | 2.70 | 0.0049 | 0.0037 |
| | 0.684 | <0.005 | 0.684 | 2.55 | 3.234 | 0.347 | 6.40 | 1.80 | 0.0052 | 0.0040 |
| | 0.784 | <0.005 | 0.748 | 2.54 | 3.288 | 0.279 | 6.50 | 2.52 | 0.0055 | 0.0040 |
| | 0.730 | <0.005 | 0.730 | 2.51 | 3.240 | 0.251 | 6.40 | 2.58 | 0.0051 | 0.0034 |
| | 0.683 | <0.005 | 0.683 | 2.48 | 3.163 | 1.13 | 6.50 | 2.52 | 0.0053 | 0.0039 |
| | 0.701 | <0.005 | 0.701 | 2.55 | 3.251 | 0.219 | 6.50 | 2.40 | 0.0044 | - |
| Sumas River | 0.168 | 0.037 | 0.131 | 0.011 | 0.179 | 0.039 | 0.20 | 0.354 | 0.0021 | 0.0021 |
| | 0.183 | 0.048 | 0.135 | 0.013 | 0.196 | 0.049 | 0.80 | 0.472 | 0.0017 | 0.0012 |
| | 0.170 | 0.042 | 0.128 | 0.013 | 0.183 | 0.286 | 0.90 | 0.362 | 0.0016 | 0.0016 |
| | 0.163 | 0.035 | 0.128 | 0.013 | 0.176 | 0.052 | 0.90 | 0.356 | 0.0020 | 0.0021 |
| | 0.154 | 0.051 | 0.119 | 0.012 | 0.166 | 0.042 | 0.90 | 0.338 | 0.0018 | 0.0020 |
| | 0.178 | 0.026 | 0.152 | 0.014 | 0.192 | - | 0.90 | - | 0.0022 | - |
| Hamilton Harbour | 0.629 | <0.005 | 0.627 | 3.25 | 3.877 | 0.154 | 1.50 | 1.29 | 0.0003 | 0.0000 |
| | 0.615 | <0.005 | 0.615 | 3.25 | 3.865 | 0.127 | 3.70 | 1.03 | 0.0009 | 0.0000 |
| | 0.629 | <0.005 | 0.629 | 3.28 | 3.909 | 0.128 | 3.70 | 1.08 | 0.0005 | 0.0002 |
| | 0.645 | <0.005 | 0.645 | 3.28 | 3.925 | 0.221 | 3.60 | 1.07 | 0.0011 | 0.0001 |
| | 0.681 | <0.005 | 0.681 | 3.24 | 3.921 | 0.272 | 3.70 | 1.02 | 0.0011 | 0.0000 |
| | 0.628 | <0.005 | 0.628 | 3.22 | 3.848 | 0.127 | 3.70 | 1.06 | 0.0010 | - |
| Waters Mixture | 0.061 | 0.066 | 0.061 | 0.262 | 0.323 | - | 0.60 | - | 0.0000 | - |
| | 0.099 | 0.059 | 0.099 | 0.266 | 0.365 | - | 0.70 | - | 0.0000 | - |
| | <0.01 | 0.058 | <0.01 | 0.274 | 0.274 | - | 1.40 | - | 0.0000 | - |
| | 0.068 | 0.060 | 0.068 | 0.274 | 0.342 | - | 1.40 | - | 0.0000 | - |
| | 0.068 | 0.060 | 0.068 | 0.271 | 0.339 | - | 1.30 | - | 0.0000 | - |
| | 0.059 | 0.056 | 0.059 | 0.293 | 0.352 | - | 1.40 | - | 0.0000 | - |
| RM-ANI-2 (ANI-1.2*DL) | 5.07 | 1.07 | 4.00 | 0.368 | 5.438 | - | 2.50 | - | 0.0002 | - |
| | 5.19 | 1.12 | 4.07 | 0.372 | 5.562 | - | 2.70 | - | 0.0001 | - |
| | 5.41 | 1.05 | 4.36 | 0.392 | 5.802 | - | 3.40 | - | 0.0003 | - |
| | 5.51 | 1.05 | 4.46 | 0.389 | 5.899 | - | 3.40 | - | 0.0001 | - |
| | 5.63 | 1.04 | 4.59 | 0.384 | 6.014 | - | 3.30 | - | 0.0002 | - |
| | 5.59 | 1.07 | 4.52 | 0.412 | 6.002 | - | 3.60 | - | 0.0003 | - |

**Table A1. Raw data of nutrients and residue (week 0) (cont'd.)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-ANI-3 | 0.438 | 0.066 | 0.372 | 0.906 | 1.344 | - | 0.70 | - | 0.0008 | - |
| (ANI-LOW-MED) | 0.443 | 0.059 | 0.384 | 0.914 | 1.357 | - | 0.90 | - | 0.0003 | - |
| | 0.430 | 0.058 | 0.372 | 0.948 | 1.378 | - | 1.90 | - | 0.0002 | - |
| | 0.426 | 0.060 | 0.366 | 0.942 | 1.368 | - | 1.90 | - | 0.0006 | - |
| | 0.448 | 0.060 | 0.388 | 0.912 | 1.360 | - | 1.80 | - | 0.0008 | - |
| | 0.438 | 0.056 | 0.382 | 1.00 | 1.438 | - | 1.90 | - | 0.0004 | - |
| (RM-ANI-5) | 0.921 | 0.295 | 0.626 | 1.68 | 2.601 | - | 17.5 | - | 0.0003 | 0.023 |
| (ANI-MED-HI) | 0.931 | 0.303 | 0.628 | 1.70 | 2.631 | - | 18.0 | - | 0.0000 | 0.019 |
| | 0.717 | 0.182 | 0.535 | 1.76 | 2.477 | - | 23.2 | - | 0.0001 | 0.020 |
| | 0.873 | 0.293 | 0.580 | 1.74 | 2.613 | - | 23.2 | - | 0.0002 | 0.018 |
| | 0.881 | 0.296 | 0.585 | 1.84 | 2.721 | - | 23.2 | - | 0.0000 | 0.017 |
| | 0.914 | 0.293 | 0.621 | 1.82 | 2.734 | - | 23.2 | - | 0.0002 | 0.015 |
| CRM-2 | 0.019 | <0.005 | 0.019 | 0.025 | 0.044 | - | 0.20 | - | 0.0000 | - |
| (Sample C) | 0.019 | <0.005 | 0.019 | 0.031 | 0.050 | - | 0.20 | - | 0.0002 | - |
| | 0.012 | <0.005 | 0.012 | 0.031 | 0.043 | - | 0.20 | - | 0.0002 | - |
| | 0.003 | <0.005 | 0.003 | 0.031 | 0.034 | - | 0.20 | - | 0.0002 | - |
| | 0.010 | <0.005 | 0.010 | 0.030 | 0.043 | - | 0.20 | - | 0.0002 | - |
| | 0.010 | <0.005 | 0.010 | 0.034 | 0.044 | - | 0.20 | - | 0.0000 | - |

**Table A2. Raw data of nutrients and residue (week 2)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Pebbleloggitch | 0.377 | 0.056 | 0.322 | 0.019 | 0.396 | - | 11.2 | - | 0.0000 | - |
| | 0.454 | 0.054 | 0.400 | 0.019 | 0.473 | - | 11.0 | - | 0.0003 | - |
| | 0.373 | 0.055 | 0.318 | 0.019 | 0.392 | - | 11.0 | - | 0.0006 | - |
| | 0.387 | 0.026 | 0.361 | 0.010 | 0.397 | - | 10.9 | - | -0.0004 | - |
| | 0.379 | 0.030 | 0.349 | 0.010 | 0.387 | - | 10.7 | - | -0.0002 | - |
| | 0.378 | 0.030 | 0.348 | 0.018 | 0.396 | - | 10.7 | - | 0.0004 | - |
| Mercy River | 0.248 | 0.007 | 0.241 | <0.01 | 0.248 | - | 8.0 | - | 0.0003 | - |
| | 0.234 | 0.006 | 0.228 | <0.01 | 0.234 | - | 8.0 | - | 0.0002 | - |
| | 0.211 | 0.006 | 0.205 | <0.01 | 0.211 | - | 7.60 | - | 0.0003 | - |
| | 0.248 | <0.005 | 0.248 | <0.01 | 0.248 | - | 7.80 | - | 0.0002 | - |
| | 0.246 | <0.005 | 0.246 | <0.01 | 0.246 | - | 7.80 | - | 0.0006 | - |
| | 0.232 | <0.005 | 0.232 | <0.01 | 0.232 | - | 7.60 | - | 0.0001 | - |
| St. Lambert | 0.206 | <0.005 | 0.206 | 0.267 | 0.473 | 0.107 | 2.80 | 0.306 | 0.0005 | - |
| | 0.233 | <0.0005 | 0.232 | 0.269 | 0.502 | 0.039 | 2.40 | 0.319 | 0.0003 | - |
| | 0.216 | <0.0005 | 0.216 | 0.285 | 0.501 | 0.263 | 2.70 | 0.301 | 0.0008 | - |
| | 0.205 | <0.0005 | 0.205 | 0.265 | 0.470 | 0.034 | 2.80 | 0.311 | 0.0005 | - |
| | 0.234 | <0.0005 | 0.234 | 0.261 | 0.495 | 0.046 | 2.80 | 0.360 | 0.0005 | - |
| | 0.217 | <0.0005 | 0.217 | 0.259 | 0.476 | 0.064 | 2.60 | 0.336 | 0.0012 | - |
| Red Deer | 0.436 | <0.005 | 0.436 | 0.166 | 0.602 | 1.56 | 3.80 | 4.01 | 0.0114 | 0.0102 |
| | 0.442 | 0.007 | 0.435 | 0.170 | 0.612 | 0.486 | 3.90 | 4.19 | 0.0121 | 0.0109 |
| | 0.387 | <0.005 | 0.387 | 0.169 | 0.556 | 2.90 | 3.80 | 3.93 | 0.0114 | 0.0099 |
| | 0.386 | 0.009 | 0.377 | 0.161 | 0.547 | 2.95 | 3.70 | 4.14 | 0.0122 | 0.0107 |
| | 0.399 | <0.005 | 0.399 | 0.165 | 0.564 | 0.789 | 3.80 | 4.46 | 0.0113 | 0.0109 |
| | 0.368 | 0.041 | 0.327 | 0.174 | 0.542 | 2.32 | 3.80 | 4.41 | 0.0115 | 0.0095 |
| Qu'Appelle River | 1.00 | <0.005 | 1.00 | 3.26 | 4.26 | 0.134 | 8.0 | 1.07 | 0.0044 | 0.0034 |
| | 0.995 | <0.005 | 0.995 | 3.15 | 4.145 | 0.142 | 8.1 | 1.09 | 0.0048 | 0.0036 |
| | 1.01 | <0.005 | 1.01 | 3.20 | 4.21 | 0.152 | 8.2 | 1.14 | 0.0046 | 0.0041 |
| | 1.01 | <0.005 | 1.01 | 3.26 | 4.27 | 0.144 | 8.0 | 1.14 | 0.0045 | 0.0036 |
| | 1.01 | <0.005 | 1.01 | 3.29 | 4.30 | 0.385 | 7.8 | 1.10 | 0.0048 | 0.0034 |
| | 1.01 | <0.005 | 1.01 | 3.32 | 4.33 | 0.264 | 7.7 | 1.18 | 0.0044 | 0.0036 |

Table A2. Raw data of nutrients monitoring (week 2) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraser River | 0.746 | <.005 | 0.746 | 2.52 | 3.266 | 0.375 | 6.30 | 2.71 | 0.0049 | 0.0037 |
| | 0.660 | <.005 | 0.660 | 2.55 | 3.210 | 0.294 | 6.50 | 2.64 | 0.0055 | 0.0039 |
| | 0.680 | <.005 | 0.680 | 2.55 | 3.230 | 0.252 | 6.30 | 2.59 | 0.0054 | 0.0039 |
| | 0.672 | <.005 | 0.672 | 2.60 | 3.272 | 0.497 | 6.20 | 2.78 | 0.0055 | 0.0041 |
| | 0.702 | <.005 | 0.702 | 2.56 | 3.262 | 0.254 | 6.20 | 2.76 | 0.0056 | 0.0045 |
| | 0.666 | <.005 | 0.666 | 2.57 | 3.230 | 0.272 | 6.20 | 2.70 | 0.0054 | 0.0038 |
| Sumas River | 0.187 | 0.049 | 0.138 | 0.015 | 0.202 | 0.044 | 0.60 | 3.22 | 0.0024 | 0.0019 |
| | 0.180 | 0.048 | 0.132 | 0.017 | 0.197 | 0.041 | 0.60 | 0.292 | 0.0020 | 0.0016 |
| | 0.368 | 0.052 | 0.316 | <.01 | 0.368 | 0.445 | 0.50 | 3.13 | 0.0019 | 0.0012 |
| | 1.01 | 0.036 | 0.974 | <.01 | 1.01 | 0.895 | 0.60 | 0.411 | 0.0023 | 0.0010 |
| | 0.131 | 0.033 | 0.098 | <.01 | 0.131 | 0.028 | 0.50 | 0.336 | 0.0018 | 0.0019 |
| | 0.622 | 0.033 | 0.590 | 0.014 | | 0.043 | 0.50 | 0.345 | 0.0019 | 0.0010 |
| Hamilton Harbour | 0.625 | <.005 | 0.625 | 3.17 | 3.795 | 0.133 | 3.50 | 1.12 | 0.0011 | 0.0002 |
| | 0.615 | <.005 | 0.615 | 3.18 | 3.795 | 0.135 | 7.20 | 1.18 | 0.0004 | -0.0001 |
| | 0.616 | <.005 | 0.616 | 3.29 | 3.906 | 0.124 | 3.50 | 1.00 | 0.0006 | -0.0002 |
| | 0.559 | <.005 | 0.559 | 3.22 | 3.779 | 0.089 | 3.50 | 1.01 | 0.0009 | 0.0005 |
| | 0.626 | <.005 | 0.626 | 3.07 | 3.696 | 0.369 | 3.50 | 1.12 | 0.0009 | 0.0003 |
| | 0.628 | <.005 | 0.628 | 3.20 | 3.828 | 0.132 | 3.50 | 1.22 | 0.0012 | 0.0005 |
| Waters Mixture | 0.040 | <.005 | 0.040 | 0.290 | 0.330 | - | 1.40 | - | 0.0004 | - |
| | 0.030 | .005 | 0.030 | 0.286 | 0.316 | - | 1.40 | - | 0.0003 | - |
| | 0.029 | <.005 | 0.029 | 0.286 | 0.315 | - | 1.40 | - | 0.0005 | - |
| | 0.022 | <.005 | 0.022 | 0.283 | 0.305 | - | 1.40 | - | 0.0005 | - |
| | 0.029 | <.005 | 0.029 | 0.283 | 0.312 | - | 1.40 | - | 0.0011 | - |
| | 0.299 | <.005 | 0.029 | 0.291 | 0.320 | - | 1.30 | - | 0.0002 | - |
| RM-ANI-2 (ANI-12*DL) | 4.91 | 1.19 | 3.72 | 0.410 | 5.32 | - | 3.30 | - | 0.0003 | - |
| | 5.50 | 1.21 | 4.29 | 0.406 | 5.906 | - | 3.40 | - | 0.0003 | - |
| | 5.43 | 1.14 | 4.29 | 0.404 | 5.834 | - | 3.40 | - | -0.0002 | - |
| | 5.53 | 1.21 | 4.32 | 0.408 | 5.938 | - | 3.40 | - | 0.0000 | - |
| | 5.27 | 1.21 | 4.06 | 0.404 | 5.674 | - | 3.30 | - | 0.0002 | - |
| | 5.33 | 1.22 | 4.11 | 0.411 | 5.741 | - | 3.30 | - | -0.0005 | - |

Table A2. Raw data of nutrients and residue (week 2) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-ANI-3 | 0.453 | 0.055 | 0.398 | 1.01 | 1.463 | - | 1.80 | - | 0.0004 | - |
| (ANI-LOW-MED) | 0.469 | 0.054 | 0.415 | 0.995 | 1.464 | - | 1.80 | - | 0.0003 | - |
| | 0.429 | 0.055 | 0.374 | 0.986 | 1.415 | - | 1.90 | - | 0.0005 | - |
| | 0.447 | 0.047 | 0.400 | 0.993 | 1.440 | - | 1.80 | - | 0.0005 | - |
| | 0.430 | 0.048 | 0.382 | 0.995 | 1.425 | - | 1.80 | - | 0.0011 | - |
| | 0.425 | 0.046 | 0.379 | 1.01 | 1.435 | - | 2.20 | - | 0.0002 | - |
| (RM-ANI-5) | 0.925 | 0.295 | 0.630 | 1.84 | 2.765 | - | 26.6 | - | 0.0005 | - |
| (ANI-MED-HI) | 0.923 | 0.297 | 0.626 | 1.81 | 2.733 | - | 26.6 | - | 0.0000 | - |
| | 0.900 | 0.290 | 0.610 | 1.81 | 2.710 | - | 26.6 | - | -0.0000 | - |
| | 0.885 | 0.309 | 0.576 | 1.78 | 2.665 | - | 26.6 | - | 0.0001 | - |
| | 0.895 | 0.314 | 0.578 | 1.79 | 2.682 | - | 26.6 | - | 0.0004 | - |
| | 0.866 | 0.327 | 0.566 | 1.81 | 2.673 | - | 26.6 | - | 0.0003 | - |
| CRM-2 | <.01 | <.005 | - | 0.027 | 0.027 | - | <.20 | - | -0.0002 | - |
| (Sample C) | <.01 | <.005 | - | 0.032 | 0.032 | - | 0.30 | - | 0.0003 | - |
| | <.01 | <.005 | - | 0.032 | 0.032 | - | 0.40 | - | 0.0006 | - |
| | <.01 | <.005 | - | 0.022 | 0.022 | - | 0.30 | - | 0.0001 | - |
| | <.01 | <.005 | - | 0.024 | 0.024 | - | 0.50 | - | 0.0007 | - |
| | <.01 | <.005 | - | 0.026 | 0.026 | - | 0.40 | - | -0.0001 | - |

**Table A3. Raw data of nutrients and residue (week 5)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Pebbleloggitch | 0.493 | 0.071 | 0.422 | 0.020 | 0.513 | - | 11.1 | - | 0.0002 | - |
| | 0.323 | 0.069 | 0.254 | 0.020 | 0.343 | - | 11.2 | - | 0.0005 | - |
| | 0.335 | 0.069 | 0.266 | 0.023 | 0.358 | - | 10.8 | - | 0.0005 | - |
| | 0.356 | 0.067 | 0.289 | 0.019 | 0.375 | - | 11.0 | - | 0.0005 | - |
| | 0.323 | 0.066 | 0.257 | 0.029 | 0.352 | - | 10.6 | - | 0.0003 | - |
| | 0.344 | 0.067 | 0.277 | 0.017 | 0.361 | - | 10.6 | - | 0.0003 | - |
| Mercy River | 0.255 | 0.017 | 0.238 | <0.01 | 0.255 | - | 8.0 | - | 0.0003 | - |
| | 0.249 | 0.015 | 0.234 | <0.01 | 0.249 | - | 8.0 | - | 0.0004 | - |
| | 0.288 | 0.018 | 0.270 | <0.01 | 0.288 | - | 7.8 | - | 0.0003 | - |
| | 0.303 | 0.017 | 0.288 | <0.01 | 0.303 | - | 7.6 | - | 0.0005 | - |
| | 0.279 | 0.014 | 0.265 | <0.01 | 0.279 | - | 7.7 | - | 0.0003 | - |
| | 0.229 | 0.013 | 0.216 | <0.01 | 0.229 | - | 7.8 | - | 0.0004 | - |
| St. Lambert | 0.172 | <0.005 | 0.172 | 0.286 | 0.458 | 0.051 | 3.0 | 0.404 | 0.0007 | - |
| | 0.169 | <0.005 | 0.169 | 0.276 | 0.445 | 0.045 | 2.7 | 0.374 | 0.0002 | - |
| | 0.162 | <0.005 | 0.162 | 0.288 | 0.450 | 0.230 | 3.1 | 0.359 | 0.0005 | - |
| | 0.164 | <0.005 | 0.164 | 0.284 | 0.448 | 0.099 | 2.8 | 0.330 | 0.0010 | - |
| | 0.197 | <0.005 | 0.197 | 0.278 | 0.475 | 0.034 | 2.9 | 0.327 | 0.0007 | - |
| | 0.210 | <0.005 | 0.210 | 0.282 | 0.492 | 0.031 | 2.8 | 0.322 | 0.0007 | - |
| Red Deer | 0.322 | 0.012 | 0.310 | 0.184 | 0.506 | 0.504 | 4.5 | 5.44 | 0.0119 | 0.0124 |
| | 0.240 | <0.005 | 0.240 | 0.167 | 0.407 | 0.376 | 4.2 | 5.82 | 0.0115 | 0.0106 |
| | 0.310 | <0.005 | 0.310 | 0.171 | 0.481 | 0.379 | 4.3 | 6.10 | 0.0121 | 0.0108 |
| | 0.310 | <0.005 | 0.310 | 0.175 | 0.485 | 0.427 | 4.1 | 5.55 | 0.0122 | 0.0105 |
| | 0.322 | <0.005 | 0.322 | 0.164 | 0.486 | 0.399 | 4.1 | 6.37 | 0.0118 | 0.0085 |
| | 0.296 | <0.005 | 0.296 | 0.166 | 0.462 | 0.332 | 4.2 | 5.87 | 0.0125 | 0.0111 |
| Qu'Appelle River | <0.01 | <0.005 | - | 3.33 | 3.33 | 0.162 | 8.0 | 1.17 | 0.0044 | 0.0043 |
| | 0.984 | <0.005 | 0.984 | 3.48 | 4.464 | 0.402 | 7.8 | 1.24 | 0.0044 | 0.0039 |
| | 0.839 | <0.005 | 0.839 | 3.48 | 4.319 | 0.493 | 8.0 | 1.15 | 0.0044 | 0.0031 |
| | 0.811 | <0.005 | 0.811 | 3.36 | 4.171 | 0.133 | 8.0 | 1.13 | 0.0041 | 0.0035 |
| | 0.889 | <0.005 | 0.889 | 3.34 | 4.229 | 0.147 | 7.9 | 1.22 | 0.0041 | 0.0025 |
| | 0.821 | <0.005 | 0.821 | 3.23 | 4.051 | 0.156 | 8.1 | 1.23 | 0.0043 | 0.0024 |

**Table A3. Raw data of nutrients and residue (week 5) (cont'd.)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraser River | 0.610 | <0.005 | 0.610 | 2.71 | 3.310 | 0.255 | 6.4 | 2.90 | 0.0054 | 0.0038 |
| | 0.607 | <0.005 | 0.607 | 2.67 | 3.277 | 0.347 | 6.2 | 2.83 | 0.0060 | 0.0040 |
| | 0.644 | <0.005 | 0.644 | 2.63 | 3.274 | 0.230 | 6.5 | 2.72 | 0.0053 | 0.0031 |
| | 0.467 | <0.005 | 0.467 | 2.50 | 2.967 | 0.247 | 4.3 | 2.74 | 0.0053 | 0.0027 |
| | 0.658 | <0.005 | 0.658 | 2.62 | 3.278 | 0.246 | 6.2 | 2.75 | 0.0054 | 0.0037 |
| | 0.567 | <0.005 | 0.567 | 2.54 | 3.107 | 0.243 | 6.3 | 2.71 | 0.0053 | 0.0043 |
| Sumas River | 0.196 | 0.056 | 0.140 | 0.014 | 0.210 | 0.315 | 0.9 | 0.370 | 0.0019 | 0.0013 |
| | 0.158 | 0.051 | 0.107 | 0.014 | 0.172 | 0.034 | 1.3 | 3.42 | 0.0017 | 0.0014 |
| | 0.191 | 0.051 | 0.140 | 0.015 | 0.206 | 0.037 | 0.9 | 0.347 | 0.0020 | 0.0016 |
| | 1.157 | 0.045 | 0.112 | 0.015 | 0.172 | 0.037 | 0.8 | 3.71 | 0.0022 | 0.0014 |
| | 0.166 | 0.047 | 0.119 | 0.012 | 0.178 | 0.037 | 0.8 | 0.355 | 0.0019 | 0.0011 |
| | 0.164 | 0.047 | 0.117 | 0.012 | 0.176 | 0.036 | 0.8 | 0.363 | 0.0020 | 0.0014 |
| Hamilton Harbour | 0.513 | <0.005 | 0.513 | 3.44 | 3.953 | 0.105 | 3.6 | 1.02 | 0.0008 | -0.0009 |
| | 0.460 | <0.005 | 0.460 | 3.47 | 3.930 | 0.109 | 3.5 | 1.06 | 0.0008 | 0.0003 |
| | 0.480 | <0.005 | 0.452 | 3.44 | 3.920 | 0.110 | 3.7 | 1.02 | 0.0004 | -0.0005 |
| | 0.452 | <0.005 | 0.477 | 3.30 | 3.752 | 0.103 | 3.5 | 0.971 | 0.0012 | -0.0005 |
| | 0.477 | <0.005 | 0.455 | 3.33 | 3.807 | 0.638 | 3.7 | 1.13 | 0.0011 | -0.0014 |
| | 0.455 | <0.005 | 0.480 | 3.32 | 3.775 | 0.775 | 3.6 | 1.07 | 0.0008 | -0.0006 |
| Waters Mixture | 0.026 | <0.005 | 0.026 | 0.292 | 0.318 | - | 1.3 | - | 0.0000 | - |
| | 0.251 | <0.005 | 0.251 | 0.290 | 0.541 | - | 1.4 | - | 0.0000 | - |
| | 0.040 | <0.005 | 0.040 | 0.285 | 0.225 | - | 1.4 | - | -0.0002 | - |
| | 0.045 | <0.005 | 0.045 | 0.295 | 0.338 | - | 1.5 | - | -0.0002 | - |
| | 0.171 | <0.005 | 0.171 | 0.291 | 0.462 | - | 1.2 | - | -0.0002 | - |
| | 0.086 | <0.045 | 0.086 | 0.297 | 0.383 | - | 1.2 | - | 0.0003 | - |
| RM-ANI-2 (ANI-12*DL) | 5.06 | 1.05 | 4.01 | 0.415 | 5.475 | - | 3.4 | - | 0.0003 | - |
| | 4.99 | 1.05 | 3.94 | 0.412 | 5.402 | - | 3.4 | - | 0.0006 | - |
| | 4.91 | 1.03 | 3.88 | 0.400 | 5.310 | - | 3.4 | - | 0.0000 | - |
| | 4.5 | 1.05 | 3.45 | 0.417 | 4.917 | - | 3.5 | - | -0.0002 | - |
| | 5.13 | 1.05 | 4.08 | 0.411 | 5.541 | - | 3.3 | - | 0.0005 | - |
| | 5.14 | 1.04 | 4.10 | 0.420 | 5.560 | - | 3.3 | - | 0.0003 | - |

Table A3. Raw data of nutrients and residue (week 5) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-ANI-3 | 0.368 | 0.063 | 0.305 | 1.01 | 1.378 | - | 1.8 | - | 0.0005 | - |
| (ANI-LOW-MED) | 0.371 | 0.061 | 0.310 | 0.997 | 1.368 | - | 1.9 | - | 0.0004 | - |
| | 0.357 | 0.063 | 0.294 | 0.976 | 1.333 | - | 1.9 | - | 0.0010 | - |
| | 0.359 | 0.062 | 0.297 | 1.01 | 1.369 | - | 2.1 | - | 0.0004 | - |
| | 0.337 | 0.063 | 0.274 | 1.00 | 1.337 | - | 1.7 | - | 0.0005 | - |
| | 0.345 | 0.061 | 0.284 | 1.02 | 1.365 | - | 1.8 | - | 0.0002 | - |
| (RM-ANI-5) | 0.759 | 0.287 | 0.472 | 1.86 | 2.619 | - | 26.6 | - | 0.0000 | - |
| (ANI-MED-HI) | 0.742 | 0.253 | 0.489 | 1.85 | 2.592 | - | 27.7 | - | -0.0001 | - |
| | 0.792 | 0.288 | 0.504 | 1.87 | 2.662 | - | 28.1 | - | 0.0002 | - |
| | 0.802 | 0.293 | 0.509 | 1.85 | 2.652 | - | 25.3 | - | 0.0003 | - |
| | 0.798 | 0.288 | 0.510 | 1.84 | 2.638 | - | 24.0 | - | 0.0002 | - |
| | 0.769 | 0.258 | 0.511 | 1.85 | 2.619 | - | 22.0 | - | 0.0000 | - |
| CRM-2 | <0.01 | <0.005 | 0.051 | 0.032 | 0.032 | - | <0.2 | - | 0.0000 | - |
| (Sample C) | <0.051 | <0.005 | 0.074 | 0.033 | 0.084 | - | <0.2 | - | 0.0003 | - |
| | <0.074 | <0.005 | 0.069 | 0.034 | 0.148 | - | 0.3 | - | 0.0000 | - |
| | <0.069 | <0.005 | 0.028 | 0.032 | 0.101 | - | 1.0 | - | 0.0004 | - |
| | <0.028 | <0.005 | 0.112 | 0.034 | 0.062 | - | <0.02 | - | -0.0004 | - |
| | <0.112 | <0.005 | - | 0.032 | 0.144 | - | <0.02 | - | -0.0005 | - |

**Table A4. Raw data of nutrients and residue (week 9)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Pebbleloggitch | 0.390 | 0.074 | 0.316 | 0.017 | 0.407 | - | 10.5 | - | 0.0007 | - |
| | 0.392 | 0.071 | 0.321 | 0.022 | 0.414 | - | 10.4 | - | 0.0004 | - |
| | 0.394 | 0.067 | 0.327 | <0.01 | 0.394 | - | 10.7 | - | -0.0003 | - |
| | 0.464 | 0.067 | 0.397 | 0.023 | 0.487 | - | 10.6 | - | 0.0002 | - |
| | 0.336 | 0.066 | 0.270 | 0.028 | 0.364 | - | 10.4 | - | 0.0002 | - |
| | 0.417 | 0.067 | 0.350 | 0.021 | 0.438 | - | 10.6 | - | 0.0003 | - |
| Mercy River | 0.273 | 0.018 | 0.255 | <0.01 | 0.273 | - | 7.6 | - | 0.0002 | - |
| | 0.289 | 0.015 | 0.274 | <0.01 | 0.289 | - | 7.7 | - | 0.0002 | - |
| | 0.334 | 0.014 | 0.320 | <0.01 | 0.334 | - | 7.9 | - | -0.0001 | - |
| | 0.282 | 0.014 | 0.268 | 0.01 | 0.292 | - | 7.6 | - | 0.0002 | - |
| | 0.276 | 0.015 | 0.261 | 0.016 | 0.292 | - | 7.7 | - | 0.0002 | - |
| | 0.298 | 0.014 | 0.284 | <0.01 | 0.298 | - | 8.0 | - | 0.0002 | - |
| St. Lambert | 0.244 | <0.005 | 0.244 | 0.297 | 0.541 | 0.042 | 2.8 | 0.333 | 0.0007 | - |
| | 0.249 | <0.005 | 0.249 | 0.296 | 0.545 | 0.033 | 3.0 | 0.372 | 0.0004 | - |
| | 0.246 | <0.005 | 0.246 | 0.300 | 0.546 | 0.030 | 3.3 | 0.292 | 0.0008 | - |
| | 0.237 | <0.005 | 0.237 | 0.299 | 0.536 | 0.033 | 3.2 | 0.291 | 0.0006 | - |
| | 0.239 | <0.005 | 0.239 | 0.296 | 0.535 | 0.217 | 3.4 | 0.285 | 0.0006 | - |
| | 0.230 | <0.005 | 0.230 | 0.292 | 0.522 | 0.134 | 3.6 | 0.277 | 0.0010 | - |
| Red Deer | 0.392 | 0.009 | 0.383 | 0.193 | 0.585 | 1.96 | 4.0 | 3.70 | 0.0123 | 0.0106 |
| | 0.383 | 0.012 | 0.371 | 0.217 | 0.600 | 0.408 | 4.2 | 3.83 | 0.0121 | 0.0104 |
| | 0.413 | <0.005 | 0.413 | 0.192 | 0.605 | 0.659 | 4.4 | 3.10 | 0.0111 | 0.0098 |
| | 0.421 | <0.005 | 0.421 | 0.179 | 0.600 | 0.315 | 4.3 | 3.25 | 0.0109 | 0.0095 |
| | 0.417 | 0.007 | 0.410 | 0.187 | 0.604 | 0.462 | 4.6 | 3.74 | 0.0117 | 0.0105 |
| | 0.442 | <0.005 | 0.442 | 0.184 | 0.626 | 0.587 | 4.7 | 3.41 | 0.0112 | 0.0102 |
| Qu'Appelle River | 0.994 | <0.005 | 0.994 | 3.43 | 4.424 | 0.601 | 8.0 | 1.11 | 0.0046 | 0.0036 |
| | 0.841 | <0.005 | 0.841 | 3.38 | 4.221 | 0.149 | 7.9 | 1.09 | 0.0042 | 0.0034 |
| | 0.955 | <0.005 | 0.955 | 3.36 | 4.315 | 0.286 | 8.1 | 1.01 | 0.0043 | 0.0037 |
| | 1.46 | <0.005 | 1.46 | 3.34 | 4.80 | 0.512 | 8.1 | 0.981 | 0.0038 | 0.0030 |
| | 0.893 | <0.005 | 0.893 | 3.34 | 4.233 | 0.244 | 8.1 | 1.02 | 0.0049 | 0.0033 |
| | 0.884 | <0.005 | 0.884 | 3.36 | 4.244 | 0.159 | 8.3 | 1.04 | 0.0045 | 0.0037 |

Table A4. Raw data of nutrients and residue (week 9) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraser River | 0.655 | <0.005 | 0.655 | 2.62 | 3.275 | 0.336 | 6.3 | 2.81 | 0.0053 | 0.0038 |
| | 0.931 | <0.005 | 0.931 | 2.64 | 3.571 | 1.05 | 6.1 | 2.46 | 0.0058 | 0.0042 |
| | 0.647 | <0.005 | 0.647 | 2.68 | 3.527 | 0.236 | 6.3 | 2.49 | 0.0052 | 0.0039 |
| | 0.765 | <0.005 | 0.765 | 2.63 | 2.395 | 0.242 | 6.3 | 2.53 | 0.0051 | 0.0037 |
| | 0.683 | <0.005 | 0.683 | 2.54 | 3.223 | 0.319 | 6.4 | 2.45 | 0.0057 | 0.0044 |
| | 0.626 | <0.005 | 0.626 | 2.56 | 3.186 | 0.235 | 6.5 | 2.51 | 0.0051 | 0.0037 |
| Sumas River | 0.229 | 0.103 | 0.126 | 0.018 | 0.247 | 0.037 | 0.80 | 0.293 | 0.0022 | 0.0018 |
| | 0.164 | 0.073 | 0.091 | 0.019 | 0.183 | 0.050 | 1.0 | 0.269 | 0.0015 | 0.0010 |
| | 0.187 | 0.076 | 0.111 | 0.020 | 0.207 | 0.053 | 1.0 | 0.274 | 0.0020 | 0.0018 |
| | 0.154 | 0.071 | 0.083 | 0.026 | 0.180 | 0.032 | 1.0 | 0.451 | 0.0016 | 0.0009 |
| | 0.168 | 0.071 | 0.097 | <0.01 | 0.168 | 0.036 | 1.3 | 0.346 | 0.0021 | 0.0013 |
| | 0.150 | 0.062 | 0.088 | 0.019 | 0.069 | 0.165 | 1.2 | 0.312 | 0.0018 | 0.0014 |
| Hamilton Harbour | 0.533 | <0.005 | 0.533 | 3.37 | 3.903 | 0.116 | 3.5 | 0.836 | 0.0007 | 0.0002 |
| | 0.513 | <0.005 | 0.513 | 3.39 | 3.903 | 0.098 | 3.5 | 0.859 | 0.0007 | 0.0002 |
| | 0.487 | <0.005 | 0.487 | 3.33 | 3.817 | 0.108 | 3.6 | 0.815 | 0.0006 | 0.0001 |
| | 0.723 | <0.005 | 0.723 | 3.34 | 4.053 | 0.410 | 3.7 | 0.859 | 0.0004 | 0.0002 |
| | 0.538 | <0.005 | 0.538 | 3.32 | 3.858 | 0.214 | 3.9 | 0.859 | 0.0008 | 0.0004 |
| | 0.503 | <0.045 | 0.503 | 3.40 | 3.903 | 0.093 | 3.5 | 0.809 | 0.0010 | 0.0004 |
| Waters Mixture | 0.117 | <0.005 | 0.117 | 0.299 | 0.416 | - | 1.3 | - | 0.0003 | - |
| | 0.103 | 0.006 | 0.097 | 0.294 | 0.397 | - | 1.3 | - | 0.0005 | - |
| | 0.107 | 0.007 | 0.100 | 0.293 | 0.400 | - | 1.4 | - | -0.0002 | - |
| | 0.095 | <0.005 | 0.095 | 0.294 | 0.389 | - | 1.9 | - | 0.0000 | - |
| | 0.110 | <0.005 | 0.110 | 0.298 | 0.408 | - | 1.5 | - | 0.0000 | - |
| | 0.101 | <0.005 | 0.101 | 0.299 | 0.400 | - | 2.1 | - | 0.0003 | - |
| RM-ANI-2 (ANI-12*DL) | 5.61 | 1.08 | 4.53 | 0.424 | 6.034 | - | 3.4 | - | 0.0002 | - |
| | 5.35 | 1.06 | 4.29 | 0.418 | 5.768 | - | 3.3 | - | 0.0001 | - |
| | 5.37 | 1.04 | 4.33 | 0.411 | 5.781 | - | 3.5 | - | 0.0001 | - |
| | 5.51 | 1.06 | 4.45 | 0.421 | 5.931 | - | 4.3 | - | 0.0010 | - |
| | 4.37 | 1.04 | 3.33 | 0.420 | 4.790 | - | 3.6 | - | 0.0002 | - |
| | 5.31 | 1.06 | 4.25 | 0.425 | 5.735 | - | 3.7 | - | 0.0002 | - |

**Table A4. Raw data of nutrients and residue (week 9) (cont'd.)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-ANI-3 | 0.409 | 0.066 | 0.343 | 1.02 | 1.429 | - | 1.8 | - | 0.0004 | - |
| (ANI-LOW-MED) | 0.472 | 0.064 | 0.408 | 1.00 | 1.472 | - | 1.8 | - | 0.0004 | - |
| | 0.477 | 0.067 | 0.410 | 0.99 | 1.467 | - | 1.8 | - | 0.0003 | - |
| | 0.418 | 0.065 | 0.353 | 0.998 | 1.410 | - | 1.7 | - | 0.0009 | - |
| | 0.354 | 0.061 | 0.293 | 1.00 | 1.354 | - | 1.7 | - | 0.0002 | - |
| | 0.438 | 0.062 | 0.376 | 1.02 | 1.458 | - | 2.0 | - | 0.0007 | - |
| (RM-ANI-5) | 0.855 | 0.293 | 0.562 | 1.82 | 2.675 | - | 26.9 | - | 0.0005 | - |
| (ANI-MED-HI) | 0.817 | 0.286 | 0.531 | 1.80 | 2.617 | - | 25.1 | - | 0.0001 | - |
| | 0.736 | 0.240 | 0.496 | 1.78 | 2.516 | - | 25.3 | - | 0.0001 | - |
| | 0.860 | 0.284 | 0.576 | 1.82 | 2.680 | - | 23.5 | - | 0.0001 | - |
| | 0.618 | 0.170 | 0.548 | 1.82 | 2.438 | - | 26.3 | - | 0.0002 | - |
| | 0.823 | 0.244 | 0.579 | 1.85 | 2.673 | - | 26.2 | - | 0.0002 | - |
| CRM-2 | 0.076 | <0.005 | 0.076 | 0.036 | 0.112 | - | 0.60 | - | 0.0006 | - |
| (Sample C) | 0.078 | <0.005 | 0.078 | 0.036 | 0.114 | - | 0.30 | - | 0.0001 | - |
| | 0.085 | 0.007 | 0.078 | 0.037 | 0.122 | - | 0.40 | - | 0.0003 | - |
| | 0.079 | <0.005 | 0.079 | 0.035 | 0.044 | - | 0.40 | - | 0.0003 | - |
| | 0.082 | <0.005 | 0.082 | 0.040 | 0.122 | - | 0.40 | - | 0.0000 | - |
| | 0.041 | <0.005 | 0.041 | 0.030 | 0.071 | - | 0.70 | - | 0.0000 | - |

**Table A5. Raw data of nutrients and residue (week 12)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Pebbleloggitch | 0.333 | 0.075 | 0.258 | 0.019 | 0.352 | - | 11.7 | - | - | - |
| | 0.390 | 0.073 | 0.317 | 0.018 | 0.408 | - | 10.7 | - | 0.0001 | - |
| | 0.368 | 0.064 | 0.304 | <0.01 | 0.368 | - | 10.7 | - | - | - |
| | 0.394 | 0.066 | 0.328 | 0.018 | 0.412 | - | 10.5 | - | 0.0001 | - |
| | 0.382 | 0.064 | 0.318 | 0.024 | 0.406 | - | 10.7 | - | - | - |
| | 0.382 | 0.062 | 0.320 | 0.028 | 0.410 | - | 10.5 | - | 0.0002 | - |
| Mercy River | 0.256 | 0.018 | 0.238 | <0.01 | 0.256 | - | 8.2 | - | - | - |
| | 0.262 | 0.018 | 0.244 | <0.01 | 0.262 | - | 7.9 | - | - | - |
| | 0.300 | 0.012 | 0.288 | <0.01 | 0.300 | - | 7.9 | - | 0.0002 | - |
| | 0.253 | 0.013 | 0.240 | <0.01 | 0.253 | - | 7.7 | - | 0.0001 | - |
| | 0.276 | 0.014 | 0.262 | <0.01 | 0.276 | - | 7.7 | - | 0.0001 | - |
| | 0.269 | 0.009 | 0.260 | <0.01 | 0.269 | - | 7.8 | - | 0.0000 | - |
| St. Lambert | 0.218 | <0.005 | 0.218 | 0.300 | 0.518 | 0.151 | 3.0 | 0.317 | 0.0006 | - |
| | 0.160 | <0.005 | 0.16 | 0.293 | 0.453 | 0.033 | 3.3 | 0.269 | 0.0006 | - |
| | 0.189 | <0.005 | 0.189 | 0.298 | 0.487 | 0.022 | 0.40 | 0.247 | 0.0008 | - |
| | 0.226 | <0.005 | 0.226 | 0.295 | 0.521 | 0.244 | 3.3 | 0.246 | 0.0005 | - |
| | 0.213 | <0.005 | 0.213 | 0.288 | 0.501 | 0.092 | 2.7 | 0.296 | 0.0003 | - |
| | 0.224 | <0.005 | 0.224 | 0.303 | 0.527 | 0.085 | 3.5 | 0.271 | 0.0005 | - |
| Red Deer | 0.416 | 0.013 | 0.403 | 0.178 | 0.594 | 2.50 | 4.2 | 3.67 | 0.0121 | 0.0109 |
| | 0.273 | 0.006 | 0.267 | 0.182 | 0.455 | 1.24 | 4.4 | 3.11 | 0.0096 | 0.0086 |
| | 0.409 | 0.014 | 0.423 | 0.173 | 0.582 | 0.400 | 4.0 | 3.39 | 0.0113 | 0.0104 |
| | 0.382 | <0.005 | 0.382 | 0.183 | 0.565 | 0.617 | 4.1 | 3.14 | 0.0107 | 0.0098 |
| | 0.377 | <0.005 | 0.377 | 0.178 | 0.555 | 2.03 | 4.3 | 3.77 | 0.0110 | 0.0099 |
| | 0.348 | <0.005 | 0.348 | 0.181 | 0.529 | 0.414 | 4.6 | 3.95 | 0.0111 | 0.0100 |
| Qu'Appelle River | 0.913 | <0.005 | 0.913 | 3.47 | 4.383 | 0.503 | 7.8 | 1.04 | 0.0045 | 0.0034 |
| | 0.806 | <0.005 | 0.806 | 3.34 | 4.146 | 0.465 | 8.0 | 0.965 | 0.0046 | 0.0036 |
| | 0.890 | <0.005 | 0.890 | 3.27 | 4.16 | 0.151 | 7.7 | 1.08 | 0.0047 | 0.0037 |
| | 0.919 | <0.005 | 0.919 | 3.41 | 4.329 | 0.135 | 7.8 | 1.07 | 0.0044 | 0.0037 |
| | 0.879 | <0.005 | 0.879 | 3.27 | 4.149 | 0.360 | 7.8 | 1.06 | 0.0047 | 0.0035 |
| | 1.03 | <0.005 | 1.03 | 3.09 | 4.12 | 0.148 | 8.0 | 1.09 | 0.0041 | 0.0036 |

**Table A5. Raw data of nutrients and residue (week 12) (cont'd.)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraser River | 0.708 | <0.005 | 0.708 | 2.63 | 3.338 | 0.744 | 6.1 | 2.24 | 0.0050 | 0.0038 |
| | 0.627 | <0.005 | 0.622 | 2.70 | 3.327 | 1.461 | 6.4 | 2.28 | 0.0051 | 0.0040 |
| | 0.670 | <0.005 | 0.670 | 2.67 | 3.34 | 0.223 | 6.2 | 2.39 | 0.0046 | 0.0029 |
| | 0.673 | <0.005 | 0.673 | 2.67 | 3.343 | 0.215 | 6.2 | 2.37 | 0.0054 | 0.0041 |
| | 0.630 | <0.005 | 0.630 | 2.54 | 3.17 | 0.349 | 6.3 | 2.73 | 0.0037 | 0.0020 |
| | 0.663 | <0.005 | 0.663 | 2.25 | 2.913 | 0.264 | 8.5 | 2.53 | 0.0048 | 0.0033 |
| Sumas River | 0.138 | 0.080 | 0.058 | <0.01 | 0.138 | 0.159 | 1.0 | 0.239 | 0.0017 | 0.0009 |
| | 0.213 | 0.071 | 0.142 | 0.013 | 0.226 | 0.036 | 1.2 | 0.274 | 0.0025 | 0.0013 |
| | 0.222 | 0.071 | 0.151 | 0.013 | 0.235 | 0.039 | 1.1 | 0.274 | 0.0040 | 0.0005 |
| | 0.164 | 0.065 | 0.099 | 0.015 | 0.179 | 0.030 | 1.1 | 0.315 | 0.0023 | 0.0021 |
| | 0.154 | 0.085 | 0.069 | <0.01 | 0.154 | 0.072 | 1.2 | 0.207 | 0.0035 | 0.0022 |
| | 0.145 | 0.062 | 0.083 | 0.018 | 0.163 | 0.222 | 1.5 | 0.312 | 0.0027 | 0.0007 |
| Hamilton Harbour | 0.503 | 0.005 | 0.498 | 3.42 | 3.923 | 0.096 | 3.6 | 0.755 | 0.0009 | 0.0003 |
| | 0.450 | <0.005 | 0.450 | 3.40 | 3.85 | 0.123 | 3.6 | 1.12 | 0.0007 | 0.0002 |
| | 0.514 | <0.005 | 0.514 | 3.34 | 3.854 | 0.105 | 3.3 | 0.803 | 0.0004 | - |
| | 0.527 | <0.005 | 0.527 | 3.34 | 3.867 | 0.087 | 3.5 | 0.833 | 0.0006 | - |
| | 0.460 | <0.005 | 0.460 | 3.31 | 3.77 | 0.378 | 3.7 | 0.827 | 0.0002 | - |
| | 0.496 | <0.005 | 0.496 | 3.20 | 3.696 | 0.120 | 3.7 | 0.845 | 0.0008 | 0.0004 |
| Waters Mixture | 0.115 | 0.006 | 0.109 | 0.297 | 0.412 | - | 2.0 | - | - | - |
| | 0.098 | 0.005 | 0.093 | 0.287 | 0.385 | - | 1.6 | - | - | - |
| | 0.121 | 0.005 | 0.116 | 0.276 | 0.397 | - | 1.7 | - | - | - |
| | 0.117 | <0.005 | 0.117 | 0.292 | 0.409 | - | 1.5 | - | - | - |
| | 0.110 | <0.005 | 0.110 | 0.283 | 0.393 | - | 1.5 | - | 0.001 | - |
| | 0.084 | <0.005 | 0.084 | 0.297 | 0.381 | - | 1.7 | - | - | - |
| RM-ANI-2 (ANI-12*DL) | 4.75 | 1.04 | 3.71 | 0.420 | 5.17 | - | 4.0 | - | - | - |
| | 5.51 | 1.06 | 4.45 | 0.406 | 5.916 | - | 3.4 | - | 0.0003 | - |
| | 5.37 | 1.06 | 4.31 | 0.397 | 5.767 | - | 3.5 | - | 0.0002 | - |
| | 4.11 | 1.03 | 3.08 | 0.415 | 4.525 | - | 3.3 | - | 0.0001 | - |
| | 5.47 | 1.02 | 4.45 | 0.408 | 5.878 | - | 3.4 | - | 0.0004 | - |
| | 5.35 | 1.00 | 4.35 | 0.430 | 5.78 | - | 3.6 | - | - | - |

Table A5. Raw data of nutrients and residue (week 12) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-ANI-3 | 0.359 | 0.066 | 0.293 | 1.01 | 1.369 | - | 2.6 | - | 0.0003 | - |
| (ANI-LOW-MED) | 0.410 | 0.067 | 0.343 | 0.975 | 1.385 | - | 1.8 | - | 0.0001 | - |
| | 0.387 | 0.070 | 0.317 | 0.965 | 1.352 | - | 1.9 | - | 0.0000 | - |
| | 0.393 | 0.061 | 0.332 | 1.01 | 1.403 | - | 1.6 | - | 0.0005 | - |
| | 0.429 | 0.059 | 0.370 | 0.988 | 1.417 | - | 1.7 | - | 0.0001 | - |
| | 0.429 | 0.054 | 0.375 | 1.03 | 1.459 | - | 1.9 | - | 0.0005 | - |
| (RM-ANI-5) | 0.810 | 0.299 | 0.511 | 1.83 | 2.64 | - | 24.4 | - | - | - |
| (ANI-MED-HI) | 0.862 | 0.311 | 0.551 | 1.77 | 2.632 | - | 25.3 | - | - | - |
| | 0.853 | 0.297 | 0.556 | 1.74 | 2.593 | - | 23.9 | - | - | - |
| | 0.924 | 0.290 | 0.634 | 1.85 | 2.774 | - | 24.2 | - | - | - |
| | 0.883 | 0.291 | 0.592 | 1.81 | 2.693 | - | 26.5 | - | 0.0003 | - |
| | 0.821 | 0.284 | 0.537 | 1.87 | 2.691 | - | 29.1 | - | 0.0006 | - |
| CRM-2 | 0.025 | <0.005 | 0.025 | 0.040 | 0.065 | - | 1.6 | - | 0.0015 | - |
| (Sample C) | 0.010 | <0.005 | 0.010 | 0.030 | 0.040 | - | 0.40 | - | - | - |
| | <0.01 | <0.005 | <0.01 | 0.029 | 0.029 | - | 0.40 | - | - | - |
| | <0.01 | <0.005 | <0.01 | 0.032 | 0.032 | - | 0.30 | - | 0.0002 | - |
| | 0.018 | <0.005 | 0.018 | 0.032 | 0.05 | - | 0.20 | - | - | - |
| | 0.027 | <0.005 | 0.027 | 0.029 | 0.056 | - | 0.40 | - | - | - |

**Table A6. Raw data of nutrients and residue (week 15)**

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Pebbleloggitch | 0.361 | 0.035 | 0.326 | 0.013 | 0.374 | - | 10.8 | - | - | - |
| | 0.340 | 0.041 | 0.299 | <0.01 | 0.340 | - | 10.7 | - | - | - |
| | 0.368 | 0.036 | 0.332 | <0.01 | 0.368 | - | 10.4 | - | - | - |
| | 0.378 | 0.043 | 0.335 | 0.014 | 0.392 | - | 10.3 | - | 0.0000 | - |
| | 0.399 | 0.041 | 0.358 | 0.023 | 0.422 | - | 10.3 | - | - | - |
| | 0.371 | 0.051 | 0.320 | 0.013 | 0.384 | - | 10.2 | - | - | - |
| Mercy River | 0.240 | 0.026 | 0.214 | 0.010 | 0.250 | - | 7.9 | - | 0.0000 | - |
| | 0.257 | 0.030 | 0.227 | <0.01 | 0.257 | - | 7.7 | - | 0.0004 | - |
| | 0.266 | 0.033 | 0.233 | <0.01 | 0.266 | - | 7.6 | - | - | - |
| | 0.245 | 0.028 | 0.217 | <0.01 | 0.245 | - | 7.6 | - | - | - |
| | 0.228 | 0.028 | 0.200 | <0.01 | 0.228 | - | 7.7 | - | 0.0001 | - |
| | 0.263 | 0.032 | 0.231 | <0.01 | 0.263 | - | 7.6 | - | - | - |
| St. Lambert | 0.208 | 0.022 | 0.186 | 0.219 | 0.427 | 0.048 | 3.4 | 0.319 | 0.0004 | - |
| | 0.205 | 0.025 | 0.180 | 0.288 | 0.493 | 0.033 | 3.5 | 0.279 | 0.0006 | - |
| | 0.226 | 0.027 | 0.199 | 0.261 | 0.487 | 0.049 | 3.0 | 0.339 | 0.0009 | - |
| | 0.206 | 0.024 | 0.182 | 0.253 | 0.459 | - | 3.2 | - | 0.0007 | - |
| | 0.203 | 0.028 | 0.175 | 0.302 | 0.505 | 0.036 | 3.0 | 0.295 | 0.0005 | - |
| | 0.196 | 0.028 | 0.168 | 0.229 | 0.425 | 0.180 | 3.0 | 0.304 | 0.0006 | - |
| Red Deer | 0.416 | 0.030 | 0.386 | 0.060 | 0.476 | 2.55 | 4.5 | 5.48 | 0.0000 | 0.0096 |
| | 0.422 | 0.036 | 0.386 | 0.080 | 0.502 | 1.80 | 4.5 | 5.12 | 0.0103 | 0.0101 |
| | 0.376 | 0.036 | 0.340 | 0.073 | 0.449 | 0.406 | 4.4 | 5.42 | 0.0107 | 0.0112 |
| | 0.457 | 0.036 | 0.421 | 0.074 | 0.531 | 2.18 | 4.3 | 3.68 | 0.0111 | 0.0085 |
| | 0.460 | 0.037 | 0.423 | 0.059 | 0.531 | 0.629 | 4.3 | 3.69 | 0.0090 | 0.0087 |
| | 0.511 | 0.037 | 0.474 | 0.048 | 0.559 | 0.730 | 4.1 | 3.62 | 0.0082 | 0.0074 |
| Qu'Appelle River | 0.964 | <0.005 | 0.964 | 3.51 | 4.474 | 0.148 | 7.9 | 3.16 | 0.0031 | 0.0028 |
| | 0.895 | <0.005 | 0.895 | 3.40 | 4.295 | 0.316 | 7.8 | 1.16 | 0.0038 | 0.0038 |
| | 0.892 | <0.005 | 0.892 | 3.31 | 4.202 | 0.184 | 7.7 | 1.09 | 0.0040 | 0.0026 |
| | 0.911 | <0.005 | 0.911 | 3.38 | 4.291 | 0.288 | 7.7 | 1.08 | 0.0040 | 0.0038 |
| | 0.908 | <0.005 | 0.908 | 3.51 | 4.418 | 0.404 | 7.9 | 1.04 | 0.0043 | 0.0029 |
| | 0.979 | <0.005 | 0.979 | 3.35 | 4.329 | 0.171 | 8.4 | 1.04 | 0.0043 | 0.0042 |

Table A6. Raw data of nutrients and residue (week 15) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraser River | 0.719 | 0.005 | 0.714 | 2.70 | 3.419 | 0.203 | 6.4 | 1.64 | 0.0050 | 0.0015 |
| | 0.661 | 0.007 | 0.654 | 2.78 | 3.441 | 1.933 | 6.4. | 2.58 | 0.0053 | 0.0027 |
| | 0.641 | 0.006 | 0.635 | 2.79 | 3.421 | 0.257 | 6.2 | 2.53 | 0.0050 | 0.0042 |
| | 0.729 | 0.006 | 0.723 | 2.73 | 3.459 | 0.691 | 6.3 | 2.47 | 0.0056 | 0.0035 |
| | 0.767 | 0.024 | 0.743 | 2.75 | 3.517 | 0.255 | 6.2 | 2.43 | 0.0058 | 0.0043 |
| | 0.737 | 0.018 | 0.719 | 2.70 | 3.437 | 0.285 | 5.9 | 2.63 | 0.0052 | 0.0024 |
| Sumas River | 0.101 | 0.016 | 0.085 | 0.018 | 0.119 | 0.377 | 1.2 | 0.273 | 0.0016 | 0.0002 |
| | 0.084 | 0.016 | 0.068 | 0.016 | 0.100 | 0.206 | 1.4 | 0.251 | 0.0020 | 0.0013 |
| | 0.114 | 0.021 | 0.093 | 0.017 | 0.131 | 0.076 | 1.0 | 0.311 | 0.0017 | 0.0009 |
| | 0.130 | 0.016 | 0.114 | 0.011 | 0.141 | 0.078 | 1.1 | 0.303 | 0.0017 | 0.0015 |
| | 0.144 | 0.015 | 0.129 | 0.012 | 0.156 | 0.042 | 1.0 | 0.289 | 0.0019 | 0.0013 |
| | 0.206 | 0.035 | 0.171 | 0.014 | 0.220 | 0.137 | 1.0 | 0.298 | 0.0022 | 0.0015 |
| Hamilton Harbour | 0.514 | <0.005 | 0.514 | 3.46 | 3.974 | 0.091 | 4.1 | 0.744 | 0.0003 | - |
| | 0.551 | <0.005 | 0.551 | 3.44 | 3.991 | 0.098 | 3.9. | 0.786 | 0.0001 | - |
| | 0.529 | <0.005 | 0.529 | 3.48 | 4.009 | 0.100 | 3.5 | 0.785 | 0.0004 | - |
| | 0.607 | <0.005 | 0.607 | 3.28 | 3.887 | 0.174 | 3.6 | 0.734 | 0.0000 | 0.0011 |
| | 0.529 | <0.005 | 0.529 | 3.38 | 3.909 | 0.315 | 3.6 | 0.771 | 0.0007 | - |
| | 0.554 | <0.005 | 0.554 | 3.40 | 3.954 | 0.108 | 3.4 | 0.774 | 0.0006 | 0.0003 |
| Waters Mixture | 0.117 | <0.005 | 0.117 | 0.333 | 0.45 | - | 2.4 | - | - | - |
| | 0.053 | <0.005 | 0.053 | 0.316 | 0.369 | - | 1.8 | - | - | - |
| | 0.067 | <0.005 | 0.067 | 0.316 | 0.383 | - | 1.6 | - | - | - |
| | 0.124 | <0.005 | 0.124 | 0.307 | 0.431 | - | 1.3 | - | - | - |
| | 0.055 | <0.005 | 0.055 | 0.305 | 0.360 | - | 1.2 | - | - | - |
| | 0.091 | <0.005 | 0.091 | 0.301 | 0.392 | - | 1.3 | - | - | - |
| RM-ANI-2 (ANI-12*DL) | 4.98 | 1.18 | 3.80 | 0.478 | 5.458 | - | 3.6 | - | - | - |
| | 5.08 | 1.22 | 3.86 | 0.451 | 5.531 | - | 3.8 | - | - | - |
| | 5.00 | 1.20 | 3.8 | 0.459 | 5.459 | - | 3.8 | - | - | - |
| | 6.13 | 1.19 | 4.94 | 0.436 | 4.566 | - | 3.4 | - | - | - |
| | 5.01 | 1.22 | 3.79 | 0.445 | 5.455 | - | 3.3 | - | - | - |
| | 6.07 | 1.18 | 4.89 | 0.428 | 6.498 | - | 3.4 | - | - | - |

Table A6. Raw data of nutrients and residue (week 15) (cont'd.)

| Water | TKN mg/L | $NH_3$ mg/L | Organic N mg/L | $NO_3$-$NO_2$-N mg/L | Total N mg/L | Part. Org. N mg/L | DOC mg/L | Part. Org. C mg/L | Residue g/200 ml | Ash g/200 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-ANI-3 | 0.392 | 0.076 | 0.316 | 1.07 | 1.462 | - | 2.2 | - | 0.0002 | - |
| (ANI-LOW-MED) | 0.455 | 0.071 | 0.384 | 1.08 | 1.535 | - | 2.1 | - | - | - |
| | 0.408 | 0.076 | 0.332 | 1.08 | 1.488 | - | 1.6 | - | 0.0002 | - |
| | 0.447 | 0.068 | 0.379 | 1.05 | 1.497 | - | 1.7 | - | 0.0001 | - |
| | 0.424 | 0.071 | 0.353 | 1.06 | 1.484 | - | 1.5 | - | - | - |
| | 0.443 | 0.076 | 0.367 | 1.03 | 1.473 | - | 1.6 | - | - | - |
| (RM-ANI-5) | 0.683 | 0.142 | 0.541 | 2.09 | 2.773 | - | 24.7 | - | - | - |
| (ANI-MED-HI) | 0.865 | 0.309 | 0.556 | 2.09 | 2.955 | - | 25.3 | - | 0.0000 | - |
| | 0.830 | 0.322 | 0.508 | 2.12 | 2.95 | - | 25.8 | - | - | - |
| | 0.838 | 0.303 | 0.535 | 2.07 | 2.908 | - | 25.1 | - | - | - |
| | 0.862 | 0.311 | 0.551 | 2.07 | 2.932 | - | 25.2 | - | - | - |
| | 0.649 | 0.113 | 0.536 | 2.06 | 2.709 | - | 25.7 | - | - | - |
| CRM-2 | 0.013 | 0.013 | 0.000 | 0.037 | 0.055 | - | 0.40 | - | - | - |
| (Sample C) | 0.025 | 0.011 | 0.014 | 0.033 | 0.058 | - | 0.70 | - | 0.0010 | - |
| | 0.023 | 0.014 | 0.009 | 0.032 | 0.055 | - | 0.90 | - | - | - |
| | 0.035 | 0.011 | 0.024 | 0.032 | 0.067 | - | <0.20 | - | 0.0007 | - |
| | 0.023 | 0.013 | 0.010 | 0.030 | 0.053 | - | 0.20 | - | - | - |
| | 0.042 | 0.012 | 0.03 | 0.029 | 0.071 | - | 0.20 | - | 0.0001 | - |

e A7. **Raw data of total P (ppm)**

| Water | Storage Time, Week | | | | | |
|---|---|---|---|---|---|---|
| | week 0 | week 2 | week 5 | week 9 | week 12 | week 15 |
| $P_0$ | .0072 | .0047 | .0051 | .0055 | .0048 | .003997 |
| | .0081 | .0049 | .0083 | .0077 | .0066 | .00743 |
| | .0080 | .0049 | .0079 | .0085 | .0061 | .006651 |
| | .0080 | .0049 | .0069 | .0079 | .0064 | .00657 |
| | .0080 | .0049 | .0076 | .0078 | .0068 | .007596 |
| | .0076 | .0048 | .0073 | .0077 | .0058 | .006593 |
| $P_1$ | .0161 | .0155 | .0161 | .0182 | .0169 | .016749 |
| | .0156 | .0154 | .0165 | .0174 | .0174 | .016869 |
| | .0161 | .0156 | .0182 | .0174 | .0177 | .016688 |
| | .0160 | .0155 | .0176 | .0170 | .0167 | .018317 |
| | .0160 | .0155 | .0179 | .0179 | .0176 | .017332 |
| | .0160 | .0153 | .0175 | .0167 | .0179 | .01603 |
| $P_2$ | .1098 | .102 | .1194 | .1149 | .1143 | .110618 |
| | .1119 | .103 | <.0002 | - | .1180 | .113069 |
| | .1127 | .103 | .1190 | .1183 | .1170 | .113635 |
| | .1127 | .103 | .1196 | .1214 | .1141 | .113257 |
| | .1137 | .130 | .1127 | .1198 | .1163 | .109489 |
| | .1137 | .103 | .1161 | .1187 | .1125 | .107989 |
| $P_3$ | .2761 | .260 | .2958 | .2951 | .2935 | .287765 |
| | .2744 | .286 | .3021 | - | .3124 | .300228 |
| | .2736 | .269 | .2924 | .2921 | .3144 | .279767 |
| | .2761 | .262 | .2859 | .2919 | .3034 | .286532 |
| | .2761 | .283 | .3009 | .2881 | .2982 | .283006 |
| | .2791 | .251 | .2974 | .2956 | .2945 | .278814 |
| $P_4$ | .4890 | .439 | .6173 | .5482 | .5195 | .521473 |
| | .4834 | .453 | .6150 | .5562 | .5595 | .535422 |
| | .4854 | .443 | .7265 | .6002 | .6708 | .520216 |
| | .4819 | .449 | .6570 | .5921 | - | .497973 |
| | .4829 | .449 | .573 | .5297 | .4951 | .504884 |
| | .4797 | .455 | .586 | .5989 | .5953 | .507775 |

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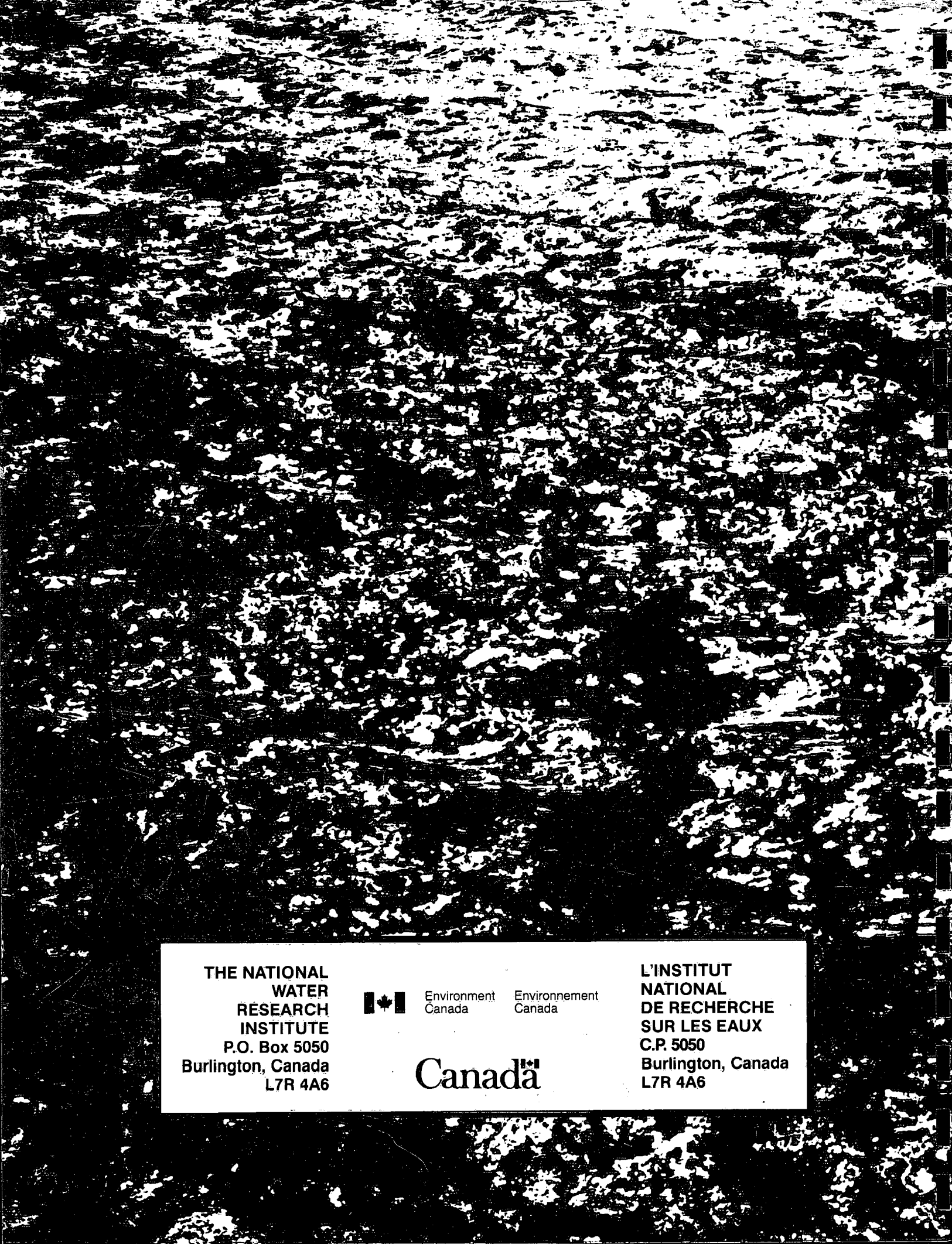


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