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To: **Chair Jim Smith, and Members, Harbour East Community Council (HECC), HRM**

From: S. M. Mandaville Post-Grad Dip., Professional Lake Manage.
Chairman and Scientific Director
Date: January 09, 2006
Subject: **Russell and Morris Lakes: opinions have to be based on authentic limnology (chemical and biological limnology)!**

This communication is very informal unlike our other written submissions. Most aspects stated here may apply to other lakes as well (especially to shallow and/or dystrophic lakes).

The Table of Contents below gives you all a convenient overview on its own. There may be several typos here but the essence is accurate, and I can prove it at an independent science-based hearing! If this is any shorter, justice cannot be done!

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1. Tremendous amount of confusion about lake water quality among several, even among professional staff, perhaps since they are not practicing scientists in the specialized sub-discipline of APPLIED LIMNOLOGY!

1.1. The water quality of Russell Lake has not improved significantly although statements are being made to the contrary by even senior HRM's staff, alas:

Via two rapid submissions in November 2005 which were part of your December, 2005 agenda, I had summarized most, not all, historical archives on this lake.

While there has been some reduction in certain indicator values based on sporadic sampling by others, it has not been of significant proportions contrary to what your Councillor-rep had stated as recorded in the September-2005 minutes of the Dartmouth Lakes

Advisory Board (DLAB). Madame McCluskey was, ofcourse, repeating what some other non-limnologist stated.

Many biological parameters have not shown significant improvement. Other studies, not ours alone, have also arrived at the same conclusion. I had summarized some of them in our submission to you in November of 2005, perhaps even staff has not `digested' it fully!

To quote some of the top experts in North America in this discipline:-

"Chemical measurements are like taking snapshots of the ecosystem, whereas biological measurements are like making a videotape." …… Prof. David M. Rosenberg PhD, Univ. of Manitoba and the Freshwater Institute, DFO, Winnipeg, and lead author of the EMAN Protocol (*cf*. Bull. Entomol. Soc. Can. 1998. 30(4):144-152).

By the way, I am no small fish in that specialized sub-discipline either and I have been cited variously even in primary acknowledgements of a handful of recent textbooks as well as handbooks in Canada and abroad!

Via around five (5) voice messages to Dr. Tony Blouin of HRM during 2005 alone, I had left considerable info on this lake alone. I also answered his questions when we spoke by phone as always dating back to May of 1996 on this and many other lakes all over HRM (he is rarely around in office these days unlike in past years).

1.2. Some massive analytical errors in historical phosphorus data reported, and this has been acknowledged now:

While no one likes to be criticized, nevertheless, it has been acknowledged not only nationally but also internationally that a lot of historical water data relating to phosphorus has been vastly overstated, i.e., 2-3 times than what they are.

I was the one who reported the historical data from the NS Dept of Environment (NSEL) since they never formalized them; I had also

supplied same to the HRM as well as to leading scientists in Ontario who are involved in a 5-year, first ever, paleolimnology research in Nova Scotia (I have already included their findings on Russell Lake in the submissions we made to you in November 2005).

The data mostly accrued during the 1970s when a present associate of mine, Dr. John Underwood, was the only limnologist at the NSEL. John Underwood was never replaced when he quit NSEL in 1990!

John told me that the NSEL's 1970s data was analyzed at the provincial VG laboratories. It has now been determined that their analytical procedures were grossly inaccurate. This also applies to labs throughout Canada and I provide info below.

Even the VG Lab's recent phosphorus data has been erroneous, and they have been informed by the national accrediting agency, the CAEAL, to that effect during year 2004 or so. That is why they now subcontract to the New Brunswick provincial labs at Moncton. But phosphorus contamination can still occur in the field, in labs, in transport, giving erroneous results. Analyses by several independent but CAEAL accredited labs in Canada may be necessary to confirm which we had done with some of our data in the past!

I received the following email recently from one of our Scientific Directors, Prof. Dr. Pete Dillon FRSC of Trent University who is a leading chemical limnologist and is Scientist Emeritus with the Ontario Ministry of Environment. Indeed, it is his predictive TP models which are used extensively in Nova Scotia, and he used to know Dr. John Underwood, years ago (in the email insert below, I removed some personal stuff he wrote me):--

"From: Prof. Peter Dillon FRSC, Trent Univ., Ontario
Sent: Monday, November 14, 2005 11:00 AM
To: Shalom M. Mandaville

Cc: Prof. John Smol FRSC (PEARL-Queens Univ.); John K. Underwood PhD (former limnologist-NSEL); NSEL-Water Line
Subject: Phosphorus analytical inaccuracies

Hello Shalom
However, in the interim, I will try to clarify a few points, just to be sure that we are all on the same page. What I originally said was that P measurements reported by many labs in the '60's and '70's were often suspect. I know this for a fact as I conducted blind QA/QC tests on the Ont Min Envir in the mid-70's and, quite bluntly, our lab failed miserably. Results were too high most of the time, often 2 to 5x the real value. I also carried out some testing on other govt. labs with poor results. Detection limits in most labs were often 0.01 or 0.02 mg/L, i.e. 10 or 20 ug/L, which is of course useless if your study site has 5 ug/L. Part of the problem was that the focus before this was on waste effluents (our OME started as the Water Resources Commission and was responsible for sewage treatment in Ontario and did virtually nothing else - the OME only began in 1971 or 1972). Also, most good chemical work was being done on oceanography then and good results were achieved, but the oceans don't have a few ug/L TP as many lakes do, so those labs didn't have to push detection limits down.

By about 1977 or 78, OME was producing good TP results for my studies - we had set up a low-level P lab specifically for my work at Dorset and Sudbury. However, the rest of the Ministry was getting along with much poorer results than we were achieving - better than the early '70's but still not great. In the early '80's the Great Lakes group pushed for low level P analyses as we had done earlier, and finally the Ministry lab acceded and switched to comparable methods for the rest of the Ontario work.

I believe that similar situations existed in most labs. There are probably a few exceptions, but bear in mind that most govt. labs have large numbers of samples to analyze and low-level P was, at that time, very labour-intensive - this pre-dated standard use of auto-analyzers.

I'm sure that John Underwood would agree that P analyses in the '60's and much of the '70's were often inaccurate, often imprecise.

We all, of course, went through the same thing with SO4 analyses - the first of our data that I use are from 1980 - prior to that the data are quite useless unless the water had very low DOC, e.g. precipitation data are good, almost all lakes and streams are not.

There is a certain amount of art to P analyses. Unlike some trace elements, contamination is commonplace as P is ubiquitous in the environment, in the labs, etc. I still routinely see consultant's documents reporting P levels that I know are ridiculous. A few years ago, I was involved in a study with a group that was contesting a consultant's report (one of the biggest environmental consulting companies in the country) and it was obvious that the company's P analyses were nonsense. It was very simple to demonstrate this and their whole argument went out the window. As I'm sure you are aware, few consulting companies do their own analyse any more - its now, in a way, centralized in just a few companies or done for fees by govt. or academic labs.
If you have any other questions, I'd be glad to address them.
Sincerely
Peter Dillon
bcc'd to govt. offices, consultants. etc."

1.3. But if enhanced water quality is confirmed with more intense sampling than as being carried out presently by other parties, then it may have more to do with a combination of global warming, acid deposition on land and waters, and UV penetration which are additive in their effects:

This is heavy science, but a plethora of scientific literature is emerging these days. I have summarized many in several of our web pages. A considerable amount of the leading research in this domain is indeed being carried out by/under Canadian scientists from other parts of Canada, handful of whom being associated with us as Scientific Directors!

Several factors could account for declining lake water TP (total phosphorus), and these may apply locally as well to various degrees:-

i. lake and (or) watershed acidification processes that retain P within catchments or that increase the rate of P loss from lakes (e.g., the formation and enhanced precipitation of P-Al compounds).

   - For example, three of the lakes (Chub, Crosson, and Leech) with the largest diatom-inferred TP declines (9, 7, and 7 $\mu g.L^{-1}$, respectively) also had the greatest inferred pH declines, on the order of 0.4 to 1.0 pH units.
   - In all cases where inferred lake water pH declined significantly since before 1850, diatom-inferred TP never increased, suggesting at least some relationship between pH and TP trends within this lake set; and

ii. reductions in nutrient loading from watersheds as a result of reforestation. The mature old-growth forest that existed prior to European settlement may have supplied greater P loads to lakes than the younger (50 to 100 year old), logged, and aggrading forests that surround the lakes today.

However, many other anthropogenic changes have taken place that could also reduce lake water TP, including

i. reduction in forest fires,

ii. alterations in aquatic food-web structure as a result of increases in fish stocking, fish harvesting (angling), and other lake-management activities, and

iii. altered hydrology through dam construction.

1.4. The more reliable solution to monitor new and significant developments than being carried out now:

If one is really serious about the effects of new developments, then sampling has to be carried out at the end of any and all stormwater and other discharges, i.e., at the end of storm sewers, outflows of in-situ devices such as CDS (or Storm*ceptor* or Vortechnics), outflows of any constructed, i.e., manmade wetlands, and others.

Further, adhoc sampling will not suffice. Automatic samplers have to be installed and statistical models have to be used to interpret the data. Good genuine scientists can carry out such methodologies.

While sporadic lake sampling every season was required by staff of HRM, it is really not based on any knowledge of genuine limnology and lake management!

Especially in shallow lakes like Russell, many inlake mechanisms could lead to severe erroneous conclusions as already stated in scores of our lengthy emails and written submissions.

There is a plethora of scientific literature on numerous modifying factors in shallow and/or dystrophic lakes, and I summarized the prime features with leading references in our web page on shallow lakes; most genuine limnologists would be aware of the science (http://lakes.chebucto.org/shallow.html).

1.5. I had invited Dr. Tony Blouin of HRM and Dr. Don Gordon, now/formerly with the DLAB, several times to participate with us in carrying out intense scientific studies, but each had declined over the years; also applies to the massive Bedford Institute of Oceanography (BIO) in Dartmouth:

To keep the record straight, I had invited Tony several times to participate with us on a scientific research level, even at arms length, but he has begged off each time; he did that in the case of Maynard Lake as well, alas!

And further, I had invited a long term appointee of yours and of former Dartmouth City, BIO Oceanographer, Dr. Don Gordon, of the DLAB, throughout the 1990s as well, and he declined each time. I still have two of his emails though other times it was verbal.

But Dr. Gordon's present/former employer, the massive federal DFO, has liberally used a small part of our research in their publicly funded studies although their senior management has written me that freshwater quality was NOT within their mandate in Nova Scotia unless it affects catadramous species!

BIO does indeed carry out snapshot surveys every decade but that is only single surface sampling for chemistry (not biology), and their own formal reports clearly cautioned that one has to take that into consideration. In other words, do not jump at conclusions based on such `sketchy data'!

2. My intense co-operation with well paid bureaucrats, the public, and consultants of various educational backgrounds, the vast majority of whom do not appear to be genuine applied limnologists!

With specific focus on Russell as well as Morris Lakes, I have literally been bombarded with not only deep questioning emails but also by phone calls, especially on weekends and holidays.

They are not all from the same bureaucrat or entity, some are from individual lake stakeholders, and in other instances it was from students at local universities who are/were reporting to other entities.

Most, not all, of them are extremely courteous but to do justice to their queries, it takes hours and hours since unlike most politicians and bureaucrats, I do not send meaningless spin-doctoring responses!

I have cooperated as much as possible with extremely well paid staff not only at HRM but also with the provincial Environment Department.

I received approximately sixty (60) emails from various present and recent past senior staff at HRM and I still have some of them as I stated above.

The emails I referred to above from staff did NOT accrue as a result of any lengthy info emails I used to send (which I am stopping now since they don't understand anyway); any email responses to my statements are over and above. I hope I am clear now.

Even some of your well paid consultants have liberally borrowed from some of my work, and I have `proofs' of that. I had sent synoptic info to His Worship over the period 2003-2005 and always Cc'd to Tony Blouin and John Sheppard, but I am not totally confident the latter two really retain much info since many times I had to repeat the same over and over (they seem to have other priorities)!

Cc: His Worship, Peter Kelly MBA